

This document was produced
by scanning the original publication.

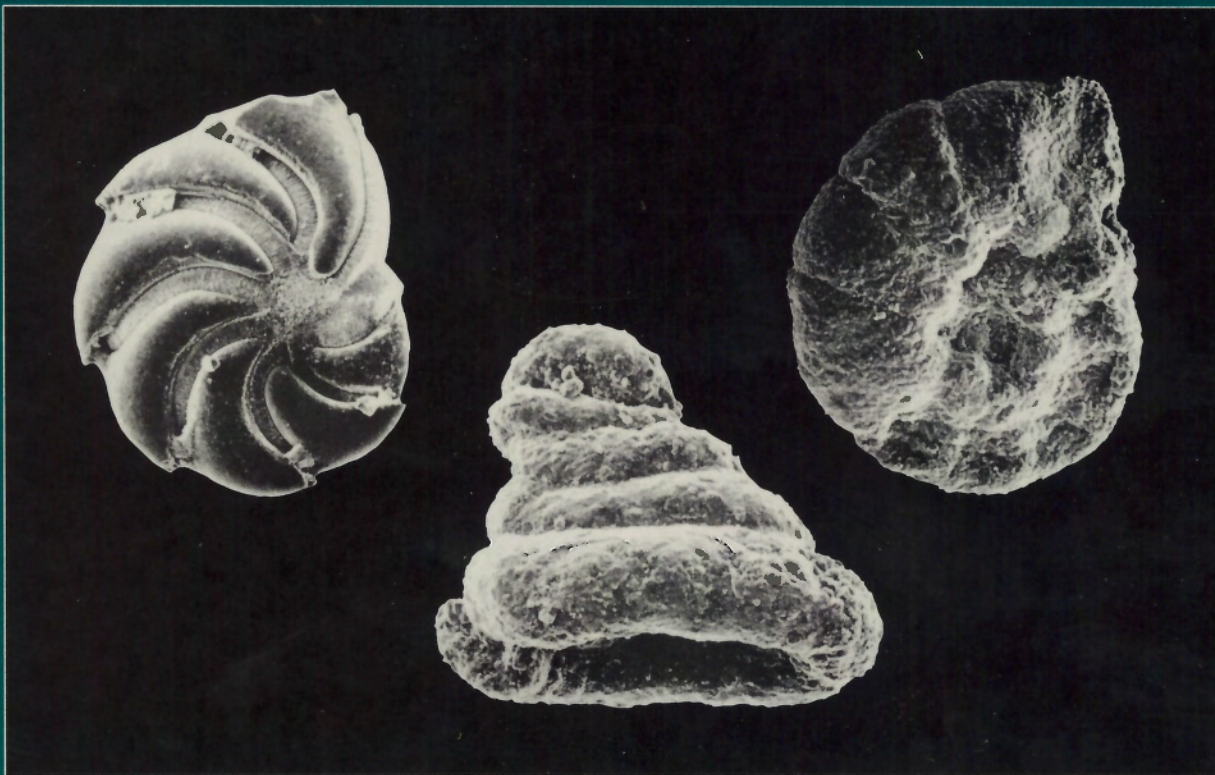
Ce document est le produit d'une
numérisation par balayage
de la publication originale.



GEOLOGICAL SURVEY OF CANADA
BULLETIN 439

**UPPER JURASSIC (OXFORDIAN-VOLGIAN)
FORAMINIFERA FROM THE HUSKY FORMATION,
AKLAVIK RANGE, DISTRICT OF MACKENZIE,
NORTHWEST TERRITORIES**

A.S. Hedinger



1993



Natural Resources
Canada

Ressources naturelles
Canada

Canada

GEOLOGICAL SURVEY OF CANADA
BULLETIN 439

**UPPER JURASSIC (OXFORDIAN-VOLGIAN) FORAMINIFERA
FROM THE HUSKY FORMATION, AKLAVIK RANGE,
DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES**

A.S. Hedinger

1993

©Minister of Supply and Services Canada 1993

Available in Canada through authorized
bookstore agents and other bookstores

or by mail from

Canada Communication Group – Publishing
Ottawa, Ontario Canada K1A 0S9

and from

Geological Survey of Canada offices:

601 Booth Street
Ottawa, Ontario K1A 0E8

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. M42-439E
ISBN 0-660-14560X

Price subject to change without notice

Cover description

Some of the Upper Jurassic specimens from the Aklavik Range. From left to right:
Labrospira sp. (x49), *Arenoturrspirillina* sp. (x56), and *Lenticulina* sp. (x80).

Critical readers

D.H. McNeil
J.H. Wall
P. Copestake

Editor

L. Reynolds

Typesetting and layout

H. King
P.L. Greener

Cartography

Institute of Sedimentary and Petroleum Geology

Author's address

A.S. Hedinger
1238 - 5th Avenue N.W.
Calgary, Alberta T2N 0R9

Manuscript submitted: 87.04.13

Resubmitted: 91.02.27

Approved for publication: 91.12.17

PREFACE

Little is known currently about Jurassic foraminiferal faunas from Arctic North America. This report documents the results of a detailed taxonomic and biostratigraphic study of Upper Jurassic microfaunas from the Aklavik Range, northern Richardson Mountains, District of Mackenzie, N.W.T. The outcrop section is adjacent to the Mackenzie River Delta, one of Canada's frontier hydrocarbon provinces. Biostratigraphic data derived from the study will aid in the future dating of nearby subsurface sediments.

Elkanah A. Babcock
Assistant Deputy Minister
Geological Survey of Canada

PRÉFACE

On sait actuellement peu de chose des faunes jurassiques de foraminifères provenant des régions arctiques de l'Amérique du Nord. Dans le présent rapport, on décrit les résultats d'une étude taxonomique et biostratigraphique détaillée des microfaunes du Jurassique supérieur provenant du chaînon Aklavik de la partie nord des monts Richardson, dans le district de Mackenzie (T.N.-O.). La portion affleurante jouxte le delta du Mackenzie, qui est l'une des provinces à hydrocarbures faisant partie des régions pionnières du Canada. Les données biostratigraphiques dérivées de l'étude aideront à dater les sédiments de subsurface avoisinants.

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

CONTENTS

1	Abstract/Résumé
2	Summary/Sommaire
4	Introduction
4	Previous work
4	Stratigraphic studies
4	Biostratigraphic studies
6	Jurassic stratigraphy of the Beaufort-Mackenzie Basin
6	Tectonic elements
7	Regional stratigraphy
7	Husky Formation
11	Martin Creek section
11	Foraminiferal studies
13	Faunal composition
13	Foraminiferal biostratigraphy
13	<i>Haplophragmoides tryssa</i> Zone
14	<i>Trochamminoides leskiwae</i> Zone
14	<i>Ammobaculites lunaris</i> - <i>Ammobaculoides mahadeoi</i> Zone
15	Calcareous faunule C-1
15	Calcareous faunule C-2
15	Regional affinities within the northern hemisphere
15	North slope of Alaska
15	Sverdrup Basin, Canadian Arctic Archipelago
19	Northeastern British Columbia
19	Fernie Basin, southeastern British Columbia
19	Western interior plains
20	Grand Banks area, Newfoundland
20	Northwestern Europe
20	Svalbard
20	Greenland
21	Western Siberia
21	Upper Jurassic foraminiferal biogeography
22	Systematic paleontology
22	Suborder Textulariina
22	Family Astrorhizidae
22	Subfamily Rhizammininae
22	Genus <i>Bathysiphon</i>
22	Family Saccamminidae
22	Subfamily Saccammininae
22	Genus <i>Saccamina</i>
25	Genus <i>Lagenammina</i>
25	Family Ammodiscidae
25	Subfamily Ammodiscinae
25	Genus <i>Ammodiscus</i>
29	Genus <i>Arenoturrspirillina</i>
30	Genus <i>Glomospira</i>
32	Genus <i>Turritellella</i>
33	Subfamily Tolypammininae
33	Genus <i>Lituotuba</i>
33	Genus <i>Saturnella</i> n. gen.
34	Family Hormosinidae
34	Subfamily Hormosininae
35	Genus <i>Reophax</i>

37	Genus <i>Scherochorella</i>
38	Family Lituolidae
38	Subfamily Haplophragmoidinae
38	Genus <i>Haplophragmoides</i>
40	Genus <i>Evolutinella</i>
41	Genus <i>Labrospira</i>
44	Genus <i>Trochamminoides</i>
45	Subfamily Recurvoidinae
45	Genus <i>Recurvoides</i>
51	Subfamily Lituolinae
51	Genus <i>Ammobaculites</i>
60	Genus <i>Ammobaculoides</i>
61	Genus <i>Bulbobaculites</i>
64	Family Textulariidae
64	Subfamily Spiroplectammininae
64	Genus <i>Spiroplectammina</i>
65	Subfamily Textulariinae
65	Genus <i>Textularia</i>
66	Subfamily Pseudobolivinae
66	Genus <i>Pseudobolivina</i>
66	Genus <i>Siphotextularia</i>
68	Family Trochamminidae
68	Subfamily Trochammininae
68	Genus <i>Trochammina</i>
76	Genus <i>Ammosphaeroidina</i>
77	Family Ataxophragmiidae
77	Subfamily Verneuilininae
77	Genus <i>Verneuilina</i>
78	Genus <i>Verneuilinoides</i>
79	Subfamily Globotextulariinae
79	Genus <i>Eomarssonella</i>
81	Genus <i>Orientalia</i>
82	Suborder Rotaliina
82	Family Nodosariidae
82	Subfamily Nodosariinae
82	Genus <i>Astacolus</i>
84	Genus <i>Citharina</i>
85	Genus <i>Dentalina</i>
87	Genus <i>Frondicularia</i>
88	Genus <i>Grillina</i>
88	Genus <i>Lenticulina</i>
91	Genus <i>Marginulina</i>
92	Genus <i>Marginulinopsis</i>
92	Genus <i>Nodosaria</i>
94	Genus <i>Planularia</i>
94	Genus <i>Pseudonodosaria</i>
96	Genus <i>Saracenaria</i>
98	Genus <i>Vaginulinopsis</i>
100	Family Polymorphinidae
100	Subfamily Polymorphininae
100	Genus <i>Eoguttulina</i>
100	Genus <i>Globulina</i>
101	Family Glandulinidae
101	Subfamily Glandulininae
101	Genus <i>Tristix</i>

101	Family Ceratobuliminidae
101	Subfamily Ceratobulimininae
101	Genus <i>Ceratocancris</i>
102	Genus <i>Conorboides</i>
103	Genus <i>Pseudolamarckina</i>
103	Family Spirillinidae
103	Subfamily Spirillininae
104	Genus <i>Spirillina</i>
104	Acknowledgments
105	References
112	Appendix 1 - Strip log of Martin Creek section
117	Appendix 2 - Macrofossil identifications (Dr. J.A. Jeletzky)

Figures

5	1. Location of study area
6	2. Table of formations, Arctic North America
7	3. Tectonic elements, Beaufort-Mackenzie Basin
8	4. Upper Jurassic lithofacies, Beaufort-Mackenzie Basin
9	5. Martin Creek, Aklavik Range; view to the southwest
9	6. One of the "mega-concretions" above the base of the lower member at Martin Creek
9	7. Martin Creek, Aklavik Range; view to the northeast
10	8. View of the lower member from the base of the cutbank in Figure 7
10	9. Outcrop of the lower member at a small confluent of Martin Creek
11	10. Upper Jurassic-Lower Cretaceous (Neocomian) biostratigraphic framework, Beaufort-Mackenzie Basin
12	11. Relationship between lithotype, foraminiferal number, generic diversity, and species diversity
in pocket	12. Distribution chart of agglutinated foraminiferal species
in pocket	13. Distribution chart of calcareous foraminiferal species
16	14. Locations of Upper Jurassic faunas discussed in text
17	15. Occurrences of selected agglutinated foraminiferal genera within the Upper Jurassic of the northern hemisphere
18	16. Occurrences of selected calcareous foraminiferal genera within the Upper Jurassic of the northern hemisphere
23	17. Morphological parameters of foraminifers measured in this study

Table

13	1. Total number of foraminifers recovered from selected Upper Jurassic localities in northwestern Europe
----	--

118	Plates 1-28
-----	-------------

**UPPER JURASSIC (OXFORDIAN-VOLGIAN) FORAMINIFERA
FROM THE HUSKY FORMATION, AKLAVIK RANGE,
DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES**

Abstract

The Husky Formation on the western margin of the Beaufort-Mackenzie Basin consists of a predominantly argillaceous clastic succession ranging in age from Late Jurassic (Oxfordian) to Early Cretaceous (basal Berriasian). A section of the lower member at Martin Creek in the Aklavik Range of the northern Richardson Mountains yielded an unusually rich and well preserved microfauna consisting of 143 species belonging to 49 genera (29 agglutinated and 20 calcareous) of foraminifers. Of these, 55 taxa are new or redefined. One new genus (*Saturnella*) is proposed.

The microfauna has a markedly Boreal aspect and is most closely comparable to coeval assemblages in the eastern Sverdrup Basin (Canadian Arctic Archipelago), western Siberia, and Svalbard.

Résumé

La Formation de Husky, située sur la marge ouest du bassin de Beaufort-Mackenzie, se compose d'une succession clastique argileuse qui s'échelonne du Jurassique tardif (Oxfordien) au Crétacé précoce (base du Berriasien). Une portion du Membre inférieur, située à Martin Creek dans le chaînon Aklavik de la partie nord des monts Richardson, contient une microfaune inhabituellement riche et bien conservée constituée de 143 espèces appartenant à 49 genres (29 agglutinés et 20 calcaires) de foraminifères. Parmi ceux-ci, 55 taxons sont nouveaux ou redéfinis. Un nouveau genre (*Saturnella*) est proposé.

La microfaune présente un aspect boréal marqué et s'apparente le plus aux assemblages contemporains que l'on trouve dans l'est du bassin de Sverdrup (archipel Arctique canadien), dans l'ouest de la Sibérie et dans le Svalbard.

Summary

The Beaufort–Mackenzie Basin contains a thick succession of Jurassic sediments that can be divided into the Lower and Middle Jurassic Bug Creek Group and the Upper Jurassic to basal Cretaceous Husky Formation. Although the macrofaunal succession in these sediments is well established, little is known about the microfaunal (foraminiferal) faunas. This study helps to define a “standard reference section” for part of the Husky Formation exposed in the Aklavik Range immediately west of the present day Mackenzie Delta. This will be of benefit in biostratigraphic studies of the subsurface.

At Martin Creek, the lower member of the Husky Formation consists of 200 m of predominantly shaly clastic rocks, which contain *Buchia* faunas of late Oxfordian to early Volgian age. This section yielded an unusually rich, diverse and well preserved microfauna consisting of 49 genera, predominantly of simple agglutinated taxa (29 genera). Calcareous forms (20 genera) are dominated (in decreasing order of abundance) by nodosariids, polymorphiniids and rotaliids. One hundred and forty-three species are described, of which 55 are new or redefined. Because of the large number of new taxa present, the focus of this study is taxonomic rather than biostratigraphic, based in part on the premise that adequate taxonomy is the foundation on which later biostratigraphic studies can be established.

The fauna consists of: *Bathysiphon* (1 species), *Saccamina* (3), *Lagenamina* (1), *Ammodiscus* (6), *Arenoturrspirillina* (2), *Glomospira* (3), *Turritellella* (2), *Lituotuba* (1), *Saturnella* n. genus (2), *Reophax* (5), *Scherochorella* (1), *Haplophragmoides* (2), *Labrospira* (3), *Evolutinella* (1), *Trochamminoides* (1), *Recurvoides* (10), *Ammobaculites* (13), *Ammobaculoides* (2), *Bulbobaculites* (4), *Spiroplectammina* (1), *Textularia* (2), *Pseudobolivina* (1), *Siphotextularia* (4), *Trochammina* (13), *?Ammosphaeroidina* (1), *Verneuilina* (2), *Verneuilinoides* (3), *Eomarssonella* (2), *Orientalia* (3), *Astacolus* (3), *Citharina* (2), *Dentalina* (7), *Frondicularia* (1), *Grillina* (1), *Lenticulina* (5), *Marginulina* (2), *Marginulinopsis* (1), *Nodosaria* (4), *Planularia* (1), *Pseudonodosarina* (5), *Saracenaria* (4), *Vaginulinopsis* (3), *Eoguttulina* (1), *Globulina* (1), *Tristix* (2), *Ceratocancris* (1), *Conorboides* (1), *Pseudolamarckina* (1), and *?Spirillina* (2).

The microfauna has pronounced Boreal affinities and compares well with coeval faunas in the eastern Sverdrup Basin (Canadian Arctic Archipelago), western Siberia, and Svalbard. It has little in common with the nodosariid dominated assemblages of the North American mid-continent (Williston Basin), although some faunal mixing appears to occur in northeastern British Columbia. The fauna is distinctly different from the warm water Tethyan faunas present in offshore eastern Canada.

Sommaire

Le bassin de Beaufort-Mackenzie contient une épaisse succession de sédiments jurassiques, qui se laisse subdiviser en deux: le Groupe de Bug Creek, du Jurassique inférieur et moyen, et la Formation de Husky, qui s'échelonne du Jurassique supérieur à la base du Crétacé. Bien que la succession macrofaunique de ces sédiments soit maintenant bien établie, on sait peu de chose des microfaunes (foraminifères). La présente étude aide à définir une «coupe stratigraphique de référence» pour la partie de la Formation de Husky affleurant dans le chaînon Aklavik immédiatement à l'ouest du présent delta du Mackenzie. Elle facilitera les études biostratigraphiques de la subsurface.

À Martin Creek, le Membre inférieur de la Formation de Husky se compose de 200 m de roches clastiques principalement schisteuses, contenant des faunes de *Buchia* qui s'échelonnent de la fin de l'Oxfordien au début du Volgien. Cette coupe contient une microfaune inhabituellement riche, variée et bien conservée composée de 49 genres, principalement de simples taxons de type agglutiné

(29 genres). Les formes calcaires (20 genres) sont surtout (selon un ordre d'abondance décroissante) des nodosariidés, des polymorphiniidés et des rotaliidés. On décrit cent quarante-trois espèces, dont 55 sont nouvelles ou redéfinies. En raison du grand nombre de nouveaux taxons présents, cette étude est davantage taxonomique que biostratigraphique, car on part du principe qu'une bonne taxonomie est la base sur laquelle peuvent être fondées les études biostratigraphiques ultérieures.

La faune se compose de: *Bathysiphon* (1 espèce), *Saccamina* (3), *Lagenamina* (1), *Ammodiscus* (6), *Arenoturrspirillina* (2), *Glomospira* (3), *Turritelletta* (2), *Lituotuba* (1), *Saturnella* n. genus (2), *Reophax* (5), *Scherochorella* (1), *Haplophragmoides* (2), *Labrospira* (3), *Evolutinella* (1), *Trochamminoides* (1), *Recurvoides* (10), *Ammobaculites* (13), *Ammobaculoides* (2), *Bulbobaculites* (4), *Spiroplectamina* (1), *Textularia* (2), *Pseudobolivina* (1), *Siphotextularia* (4), *Trochamina* (13), ?*Ammosphaeroidina* (1), *Verneuilina* (2), *Verneulinoides* (3), *Eomarssonella* (2), *Orientalia* (3), *Astacolus* (3), *Citharina* (2), *Dentalina* (7), *Frondicularia* (1), *Grillina* (1), *Lenticulina* (5), *Marginulina* (2), *Marginulinopsis* (1), *Nodosaria* (4), *Planularia* (1), *Pseudonodosarina* (5), *Saracenaria* (4), *Vaginulinopsis* (3), *Eoguttulina* (1), *Globulina* (1), *Tristix* (2), *Ceratocancris* (1), *Conorboides* (1), *Pseudolamarckina* (1) et ?*Spirillina* (2).

La microfaune présente des affinités boréales évidentes; elle est tout à fait comparable aux faunes contemporaines de l'est du bassin de Sverdrup (archipel Arctique canadien), de la Sibérie occidentale et du Svalbard. Elle a peu de traits communs avec les assemblages principalement composés de nodosariidés existant dans la portion médio-continentale de l'Amérique du Nord (bassin de Williston), même s'il y a apparemment eu brassage des faunes dans le nord-est de la Colombie-Britannique. La faune se différencie nettement des faunes des eaux chaudes de la mer Téthys que l'on rencontre dans les régions extracôtières de l'Est du Canada.

INTRODUCTION

The Jurassic foraminiferal faunas of Arctic North America are poorly known. As part of a larger program mounted by the Geological Survey of Canada, micropaleontological studies were undertaken on the Jurassic–Cretaceous succession exposed along the northern Richardson Mountains adjacent to the Mackenzie River Delta. In 1975, a section of the Husky Formation (Upper Jurassic to basal Cretaceous) was extensively sampled for foraminiferal and palynological analyses in order to serve as a standard reference section for the Beaufort–Mackenzie Basin area.

PREVIOUS WORK

Stratigraphic studies

Initial observations of the Mesozoic succession in the northern Richardson Mountains were made by McConnell (1891), Camsell (1906), Nauss (1944), and Garbrielse (1957). These workers established the presence of marine Upper Jurassic or Lower Cretaceous rocks at Mount Gifford and along the Willow (Donna) River, and of a thick succession of Lower Cretaceous rocks at Mount Goodenough (Fig. 1).

Detailed studies of the Mesozoic sediments in the northern Richardson Mountains were first carried out by Jeletzky (1958, 1960, 1961), who originally confined his work to the thick Jurassic–Cretaceous succession exposed along the Aklavik Range and immediately adjacent areas. Jeletzky (1967) formally subdivided the Jurassic succession into three formations: the predominantly arenaceous Bug Creek Group (Lower and Middle Jurassic), the overlying predominantly argillaceous Husky Formation (Upper Jurassic and basal Cretaceous), and the latter's coarse clastic equivalent, the North Branch Formation (Fig. 2).

In subsequent years, Jeletzky expanded his studies to embrace most of the Yukon north of the Kandik and Porcupine rivers (Jeletzky 1971, 1972, 1974). Within north-central Yukon he recognized the presence of an Upper Jurassic sandstone facies of the Husky Formation, which he termed the Porcupine River Formation (Jeletzky, 1977). This unit grades laterally into Husky shales to the east and Kingak shales to the west.

More recently, studies by Poulton and Callomon (1976), Frebold and Poulton (1977), Poulton (1978a,

1984), and Poulton et al. (1982) have greatly expanded the understanding of facies relationships within the Bug Creek succession.

The exploration for hydrocarbons in the subsurface of the adjacent Mackenzie River Delta has yielded much valuable information. Studies combining both surface and subsurface data were published by Young et al. (1976), Dixon (1982), and Braman (1985).

Biostratigraphic studies

Biostratigraphic studies within the Beaufort–Mackenzie Basin area can be subdivided into macrofossil and microfossil studies. Macrofossil studies of the Jurassic system in Arctic Canada were initially carried out by Frebold (1961, 1964) and Jeletzky (1958, 1966, 1973, 1984). The former concerned himself with ammonite faunas, whereas the latter embraced mainly Cretaceous faunas and the problems of delineating the Jurassic–Cretaceous boundary in the Boreal realm. Because of the acute scarcity of ammonites in the Upper Jurassic–Lower Cretaceous succession of the Beaufort–Mackenzie Basin, Jeletzky's zonal scheme, based on the pelecypod genus *Buchia*, has proven invaluable. Although these bivalves are abundant, they do not provide as refined a zonation as ammonites. Imlay (1959, 1961) and Imlay and Detterman (1973) carried out comparable studies in northern Alaska.

The number of studies of Jurassic Foraminifera in North America are few compared with those of Cretaceous and Tertiary faunas. Nowhere is this more evident than in Arctic North America. Tappan (1955) produced the only comprehensive study on the Arctic Jurassic when she described the microfaunas of the north slope of Alaska. This work was supplemented by Bergquist (1966).

Recently, Tappan's zonation has been questioned as a result of stratigraphic–biostratigraphic studies conducted in northeastern Alaska. Analysis of foraminiferal faunas recovered from a reference section of the Kingak Shale in the Ignek River valley of Alaska (Bergquist, *in* Detterman et al., 1975) revealed that:

“Despite the large assemblage, however, the Foraminifera in general are not particularly useful in delineating stages of the Jurassic because many are long-ranging or they appear in beds that are older or younger than those from which they are described. Most of the arenaceous forms range throughout the entire section,

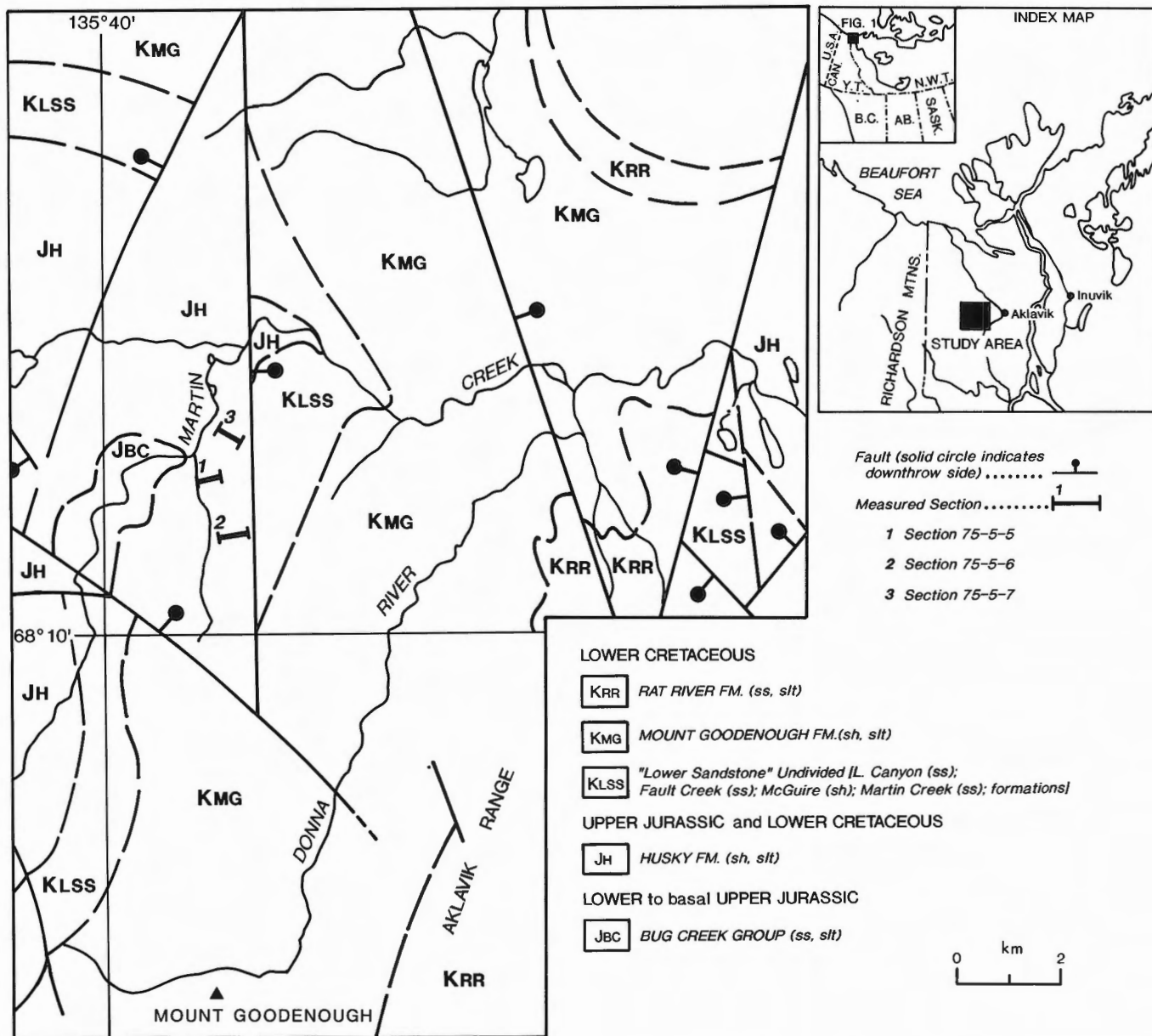


Figure 1. Location of study area. (Geology modified from Norris, 1981.)

although some were originally described from the Lower Jurassic (Toarcian to Pliensbachian) beds of northern Alaska and had been considered indicative of early Jurassic age and some species which were described from beds of late Jurassic age occur in older beds in this section. . . ."

Detterman et al. (op. cit.) succinctly described the problem when they stated:

"There is no ready explanation for the apparent unrestricted range of the Foraminifera in the Ignek Valley Section. . . . If it were only a matter of older forms occurring in younger beds it could

be explained by cannibalization and reworking of older into younger deposits; but the presence of presumed late Jurassic forms in Middle Jurassic beds cannot be explained as easily. Apparently a re-evaluation of the published age assignments of the Foraminifera for the Jurassic of northern Alaska is in order."

Canadian studies are much more preliminary than those south of the border. No detailed taxonomic studies comparable to that of Tappan (1955) are available. Chamney (1971) described a few biostratigraphically useful species from the Jurassic-Cretaceous boundary beds. Souaya (1976) and Wall (1983)

AGE	STAGE	NORTHEASTERN ALASKA (Detterman <i>et al.</i> , 1975)	NORTHERN YUKON (Jeletzky, 1962, 1977)	NORTHERN RICHARDSON MTS. (Poulton <i>et al.</i> , 1982; Jeletzky, 1967; Dixon, 1982)	MACKENZIE DELTA (subsurface) (Braman, 1985; Dixon, 1982)	CENTRAL AND EASTERN SVERDRUP BASIN (Embry, 1985)										
						ELLEFRINGNES I.	AXEL HEIBERG I.	ELLESMERE I.								
LOWER CRETACEOUS	NEOCOMIAN	KONGAKUT FORMATION	LOWER CANYON AND FAULT CREEK FORMATIONS	LOWER CANYON FORMATION	PARSONS GROUP	ISACHSEN FM.	Patterson Island Member	Patterson Island Member	Patterson Island Mbr.							
			McGUIRE FORMATION	FAULT CREEK FM.			McGUIRE FORMATION									
	MARTIN CREEK FORMATION		MARTIN CREEK FORMATION	MARTIN CREEK FM.												
	BERRIASIAN		HUSKY FORMATION	Upper member Red-weathering shale	Upper member											
JURASSIC	UPPER	KINGAK FORMATION	PORCUPINE RIVER FORMATION	HUSKY FORMATION	NORTH BRANCH FORMATION	MACKENZIE KING FORMATION	Deer Bay Member	DEER BAY FORMATION	Glacier Flord							
										Volgian	Arenaceous member					
	Lower		Lower member	Lower member												
	KIMMERIDGIAN		RINGNES FORMATION	RINGNES FM.	AWINGAK FORMATION		AWINGAK FORMATION	Ringnes Member	McConnell Island Member	McCONNELL ISLAND FORMATION	AWINGAK FORMATION					
	OXFORDIAN															
	MIDDLE		KINGAK FORMATION	KINGAK FORMATION	KINGAK FORMATION		BUG CREEK GROUP	BUG CREEK GROUP	HEIBERG FORMATION	Remus Member	Remus Member	Remus Member				
													Callovian	AKLAVIK FM.	AKLAVIK FM.	
													Bathonian	RICHARDSON MOUNTAINS FORMATION	RICHARDSON MOUNTAINS FM.	
	LOWER		KINGAK FORMATION	KINGAK FORMATION	KINGAK FORMATION		BUG CREEK GROUP	BUG CREEK GROUP	HEIBERG FORMATION	Fosheim Member	Fosheim Member	Fosheim Member				
Bajocian		MANUEL CREEK FORMATION				MANUEL CREEK FM.										
Toarcian		ALMSTROM CREEK FORMATION				ALMSTROM CREEK FM.										
Pliensbachian		MURRAY RIDGE FORMATION				MURRAY RIDGE FM.										
Sinemurian																
Hettangian																

Figure 2. Table of formations, Arctic North America.

provided illustrated catalogues of foraminifers from the Mesozoic of the Sverdrup Basin. Wall (*in* Balkwill *et al.*, 1977) published a checklist of the microfauna present within the Ringnes Formation. In addition, Yorath (1962) studied the microfauna of the Deer Bay Formation of the central Arctic Islands as part of a Master of Science dissertation at the University of Alberta.

JURASSIC STRATIGRAPHY OF THE BEAUFORT-MACKENZIE BASIN

Interpretations presented below have been drawn from Jeletzky (1967), Young *et al.* (1976), Dixon (1982), Poulton *et al.* (1982), and Braman (1985). Correlations

of the Jurassic system in the Arctic region are shown in Figure 2.

Tectonic elements

Tectonic elements affecting Jurassic sedimentation in the northern Yukon-Mackenzie Delta area are shown in Figure 3. The structural term encompassing the whole region is the "Beaufort-Mackenzie Basin" (Young *et al.*, 1976). The component basins and arches are, for the most part, Mesozoic elements, and do not necessarily reflect the present day (Laramide) trends. The Peel Landmass (Jeletzky, 1975) was a broad region of exposed northern interior platform during much of Jurassic time. Components of this landmass include Eagle Arch, Rat Uplift, and Eskimo Lakes Arch.

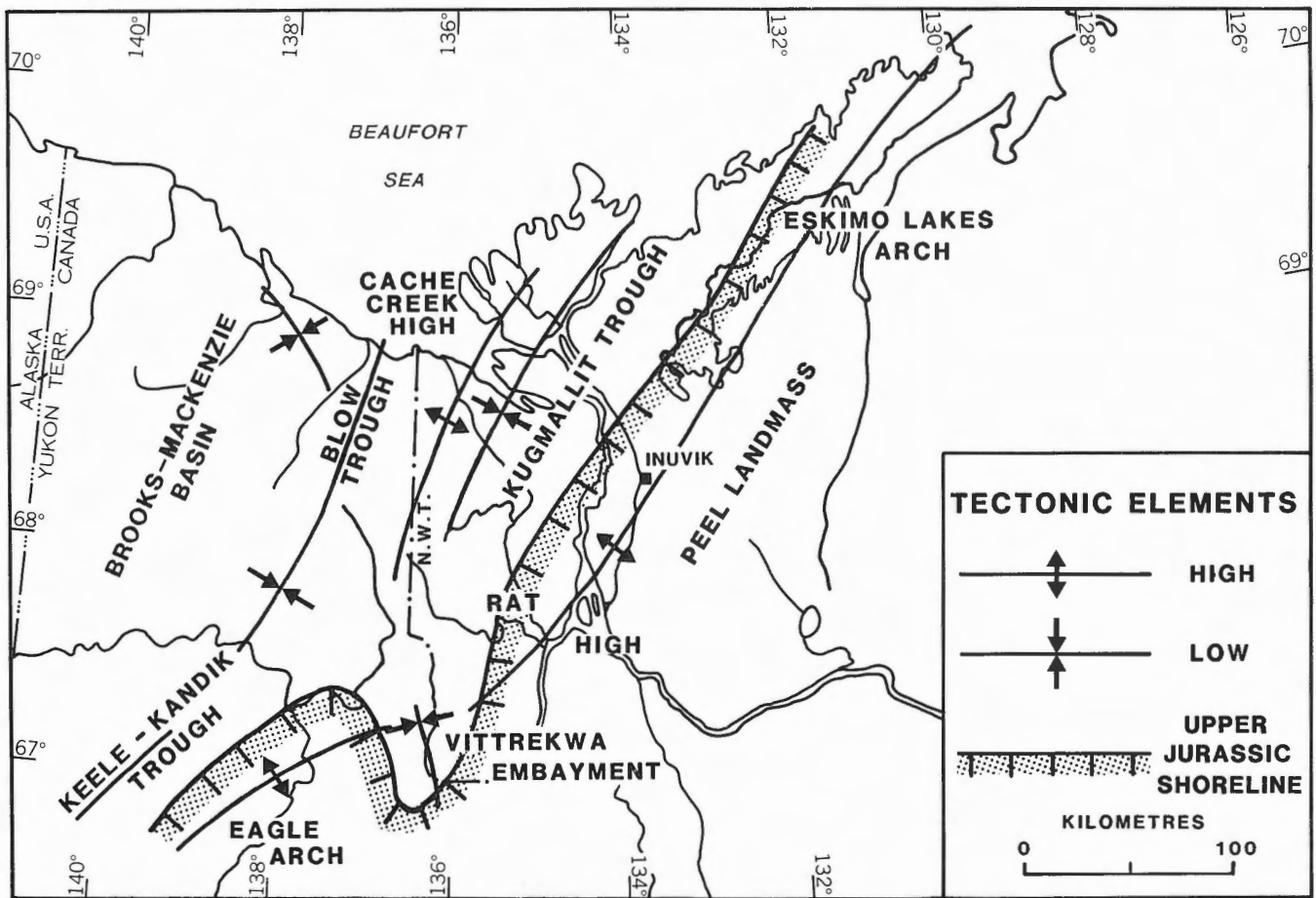


Figure 3. Tectonic elements, Beaufort-Mackenzie Basin. (Adapted from Young et al., 1976; Poulton et al., 1982.)

These elements, together with the Cache Creek High, constitute the so-called “Aklavik Arch Complex” (Jeletzky, 1975; Norris, 1974). The Vittrekwa Embayment represents a north-south trending re-entrant along the southern portion of the Peel Landmass.

Regional stratigraphy

In the western part of northern Yukon, the Jurassic is represented by dark grey and black weathering marine shale of the Kingak Formation (Detterman et al., 1975). Eastward from the Blow and Driftwood rivers, the Kingak progressively changes into siltstone and sandstone facies of the Lower and Middle Jurassic Bug Creek Group (Poulton et al., 1982). Silty equivalents of the Bug Creek sandstone are known to occur in the subsurface of the Mackenzie Delta and have been tentatively assigned to the Husky Formation (Young et al., 1976, p. 12).

Upper Jurassic sedimentation resulted in continued deposition of Kingak shale in the west, argillaceous Husky sediments in the east, and marine to nonmarine arenite of the Porcupine River Formation in the south and southwest. To the southeast, conglomeratic clastics of the North Branch Formation infilled the Vittrekwa Embayment. These facies relationships are illustrated in Figure 4.

Husky Formation

Jeletzky (1967) proposed the name Husky Formation for a thick succession of recessively weathering shale, siltstone, and minor sandstone that overlies quartz arenite of the Bug Creek Group in the northern Richardson Mountains. He designated the Aklavik Range-Martin Creek area as the region of “typical development” of the unit.

In outcrop, the Husky can be separated into four members:

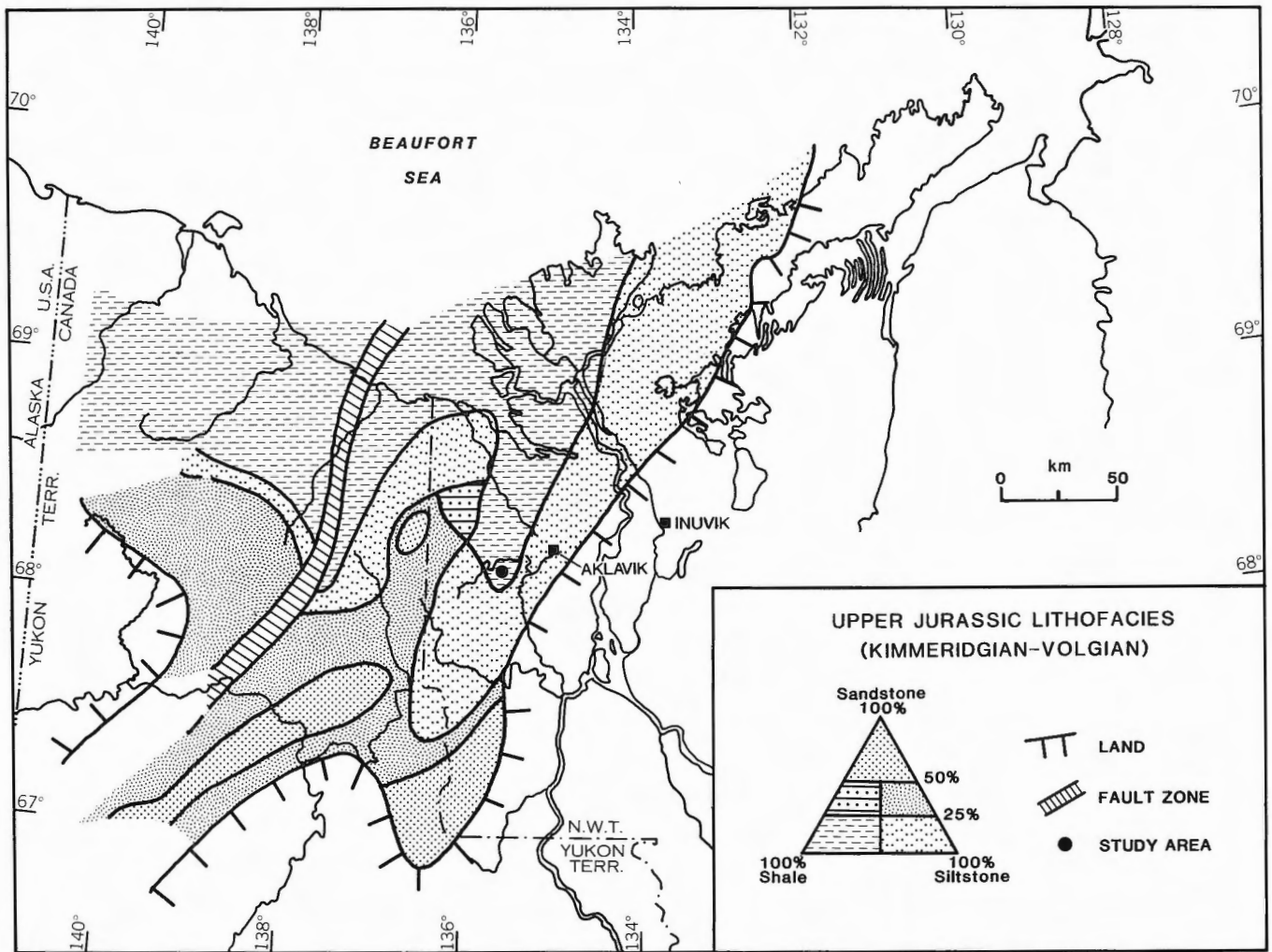


Figure 4. Upper Jurassic (Kimmeridgian-Volgian) lithofacies, Beaufort-Mackenzie Basin. (Adapted from Young et al., 1976.)

- Upper member (early to mid-Berriasian)
- Red weathering shale member (basal Berriasian)
- Arenaceous member (late Volgian)
- Lower member (late Oxfordian-mid-Volgian)

The Jurassic-Cretaceous boundary coincides with the base of the red weathering shale member (Jeletzky, 1967).

The lower member is the thickest of the four members, and ranges in thickness from 227 to 245 m in the Aklavik Range. The contact with the Middle Jurassic arenite of the Aklavik Formation (Bug Creek Group) is abrupt and probably disconformable. At Martin Creek (Figs. 1, 5), dark, recessive weathering shale of the lower member rests directly on tan weathering orthoquartzite of the Aklavik Formation. The contact is knife-sharp and indicates a period of

rapid marine transgression at the start of Husky deposition in this area. No evidence of a basal conglomerate or lag deposit of any kind was observed.

The basal third of the lower member contains some of the purest shale found in the Husky Formation. Along the east flank of Aklavik Range this interval contains numerous horizons of rust weathering, loaf-shaped, clay ironstone concretions, whereas at Martin Creek, concretions are rare. In both areas there is a zone of mega-concretions up to 5 m in diameter (Fig. 6; see also Jeletzky, 1967, p. 99, Pl. VIII, fig. 1). Similar mega-concretions are known to occur in the approximately coeval Ringnes Formation of the Sverdrup Basin (Balkwill et al., 1977).

The upper two thirds of the lower member are characterized by increasingly common interbeds of

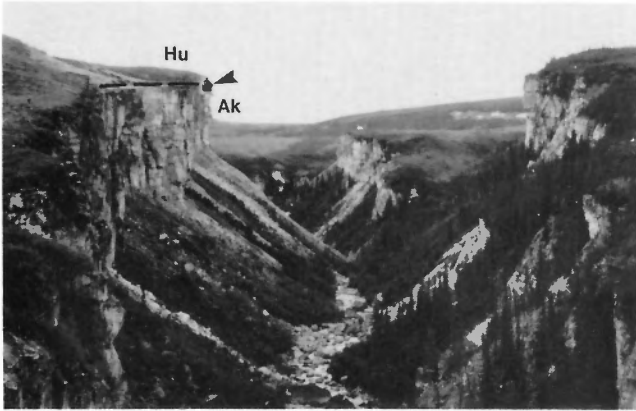


Figure 5. Martin Creek, Aklavik Range; view to the southwest. Canyon is incised into massive-weathering orthoquartzite of the Aklavik Formation (Ak), the uppermost unit of the Bug Creek Group. These sands are abruptly overlain by recessive-weathering marine shale of the Husky Formation (Hu).



Figure 6. One of the “mega-concretions” that occur about 36 m above the base of the lower member at Martin Creek. This particular concretion is not in situ. Note the two geologists for scale.

resistant-weathering, silty mudstone, siltstone, and fine grained quartz sandstone. Five such units are well developed at Martin Creek (Figs. 7-9) and form good local marker horizons. Most of these units consist of a single coarsening-upward cycle (shale-siltstone \pm sandstone). The sandstone is commonly fine grained, crossbedded, and/or bioturbated. Carbonaceous and coaly stringers are sometimes present. Nests and

coquinas of *Buchia* shells are common. Each of these cycles is abruptly terminated by a return to shale deposition. These coarser cycles were probably deposited as offshore bars or marine sand waves on a stable, shelf-like platform (Young et al., 1976; Dixon, 1982; Braman, 1985). In the adjacent subsurface, similar coarsening-upward cycles can be correlated for many kilometres (Dixon, 1982, Fig. 6).



Figure 7. Martin Creek, Aklavik Range; view to the northeast, showing typical weathering character of the lower member, Husky Formation. Units numbered 1-5 are coarsening-upward cycles, which form good local marker horizons.



Figure 8. View of the lower member from the base of the cutbank in Figure 7. Four coarsening-upward cycles (nos. 1-4) are clearly visible and occur 70.5-90 m above the base of the section (Appendix 1). Unit 5 is a 17 m thick succession of siltstone and fine grained sandstone originally thought to represent the arenaceous member, but now known to be a coarsening-upward cycle in the lower member.



Figure 9. Outcrop of the lower member at a small confluence of Martin Creek where Sections 75-5-5 and 75-5-6 were measured (Fig. 1, locs. 1, 2). The basal three coarsening-upward cycles (nos. 1-3) are shown in profile. Arrow at left indicates geologist for scale.

The arenaceous member consists of coarser clastic material than the underlying lower member and is capped by a distinctive, richly glauconitic sandstone. It is a particularly well developed coarsening-upward cycle and ranges in thickness from 12 to 35 m. The unit is only present in the Aklavik Range and the adjacent subsurface.

The red weathering shale member reaches a maximum thickness of about 30 m along the Aklavik Range and consists of very pure, recessive weathering, dark grey and rust coloured shale with numerous horizons of clay ironstone concretions. The contact with the underlying arenaceous member is abrupt (?disconformable).

The upper member ranges in thickness from 25 to 43 m and is comparable to one large coarsening-upward cycle, from shale at the base to sandstone at the top. It is gradationally overlain by arenite of the Martin Creek Formation.

The Husky Formation occurs throughout the subsurface of the adjacent Mackenzie Delta area immediately east of Aklavik Range. Dixon (1982) recognized that the fourfold subdivision of the Husky employed in outcrop was impractical for descriptions of the subsurface. He proposed a lower member (comprising the lower and arenaceous members) and an upper member (comprising the red weathering shale and upper members). This twofold subdivision can be readily mapped on mechanical well logs (Dixon, 1982; Braman, 1985).

The Husky Formation ranges in age from early Late Jurassic [(?)mid to late Oxfordian] to basal Cretaceous (mid-Berriasian). Due to a general lack of ammonites, the unit is dated on the basis of the vertical succession of the pelecypod *Buchia* (*Aucella*) (Fig. 10; see also Jeletzky, 1958, 1960, 1965, 1967). The Jurassic–Cretaceous boundary is placed at the base of the red weathering shale member, which carries the basal Berriasian *Buchia okensis* fauna.

Martin Creek section

The section selected for detailed study outcrops along Martin Creek (NTS 107 B, Aklavik at 68°12'N; 135°38'W; Fig. 1). Originally it was believed to represent the entire Husky Formation (Brideaux, 1976; Brideaux and Fisher, 1976). In total, 208 m of section were measured and sampled at intervals of 1.5 or 3.0 m (Appendix 1). Fourteen collections of macrofossils (Appendix 2) were made to provide calibration for the microfossil zonations (foraminiferal and palynological).

Subsequent identifications of the macrofauna by the late Dr. J.A. Jeletzky (Geological Survey of Canada) indicated that the original hypothesis of the stratigraphy was wrong. Only three *Buchia* zones were found within the sampled section (Figs. 11, 12). This evidence (Appendix 2) relegated the entire succession to

the lower member. The basal 160 m were placed in the *Buchia* (*Anaucella*) *concentrica* s. l.–*Buchia mosquensis* Zone (undifferentiated) of late Oxfordian to (?)early Volgian age. Diagnostic elements include: *Buchia* (*Anaucella*) *concentrica* (Sowerby) s. l., *Buchia* (*Anaucella*) *concentrica* (Sowerby) var. *erringtoni* (Gabb), *Buchia* sp. cf. *B. mosquensis* (von Buch), *Camptonectes* (*Boreionectes*) sp. cf. *B. praecinctus* Spath, *Cylindroteuthis* (*Cylindroteuthis*) sp. indet., “Turbo” ex. gr. “T.” *ferniensis* Frebold, and *Pleuromya* sp. indet.

The remaining 48 m of the section fall within the *Buchia piochii* s. l. Zone of early Volgian age. The fauna includes: *Buchia piochii* (Gabb) s. l. *Buchia* sp. cf. *B. blandfordiana* (Stoliczka), *Buchia* sp. cf. *B. fischeriana* (d’Orbigny), “*Aucellina*” ex. aff. “A.” *schmidti* Sokolov, 1912, and “*Aucellina*” (= *Meleagrinnella*) n. sp. aff. “A.” *schmidti* Sokolov.

From discussions with D.K. Norris (pers. comm., 1977) it became clear that the Martin Creek section was most probably abbreviated by faulting (Fig. 1), with the uppermost lower member, arenaceous member, and red weathering shale member being cut out by a north–south trending normal fault.

FORAMINIFERAL STUDIES

The original intent of the project was to generate a foraminiferal zonation for the entire Husky Formation and to describe all the microfaunal elements. As the project evolved, however, several factors contributed to the emphasis being changed from a biostratigraphic to a taxonomic one. These included the following:

1. Realization that the sampled section represented only part of the lower member of the Husky Formation and did not even include the Jurassic–Cretaceous boundary.
2. The time required to study the rich, diverse microfauna (143 species, of which almost one third were new or undescribed), which precluded the examination of additional surface or subsurface material from other parts of the Husky Formation.
3. The exceptional preservation of many of the agglutinated foraminifers, which greatly facilitated taxonomic study.
4. The erratic distribution of calcareous foraminifers, which made it difficult to assess their true biostratigraphic value.

		STAGE	FAUNAL ZONE	ROCK STRATIGRAPHIC UNITS
LOWER CRETACEOUS	VALANGINIAN		<i>Buchia keyserlingi</i>	McGUIRE FORMATION
			<i>Buchia volgensis</i>	MARTIN CREEK FORMATION
	BERRIASIAN		<i>Buchia uncioides</i>	Upper member
			<i>Buchia okensis</i>	Red-weathering shale member
UPPER JURASSIC	VOLGIAN	UPPER	<i>Buchia fischeriana</i>	Arenaceous member
		LOWER	<i>Buchia piochii</i>	Lower member
		<i>Buchia mosquensis</i>		
	KIMMERIDGIAN		<i>Buchia concentrica</i>	
	OXFORDIAN		<i>Cardioceras</i> ex gr. <i>cordatum</i>	BUG CREEK GROUP AKLAVIK FORMATION

Figure 10. Upper Jurassic–Lower Cretaceous (Neocomian) biostratigraphic framework, Beaufort–Mackenzie Basin. (From Jeletzky, 1958, 1967; Dixon, 1982.)

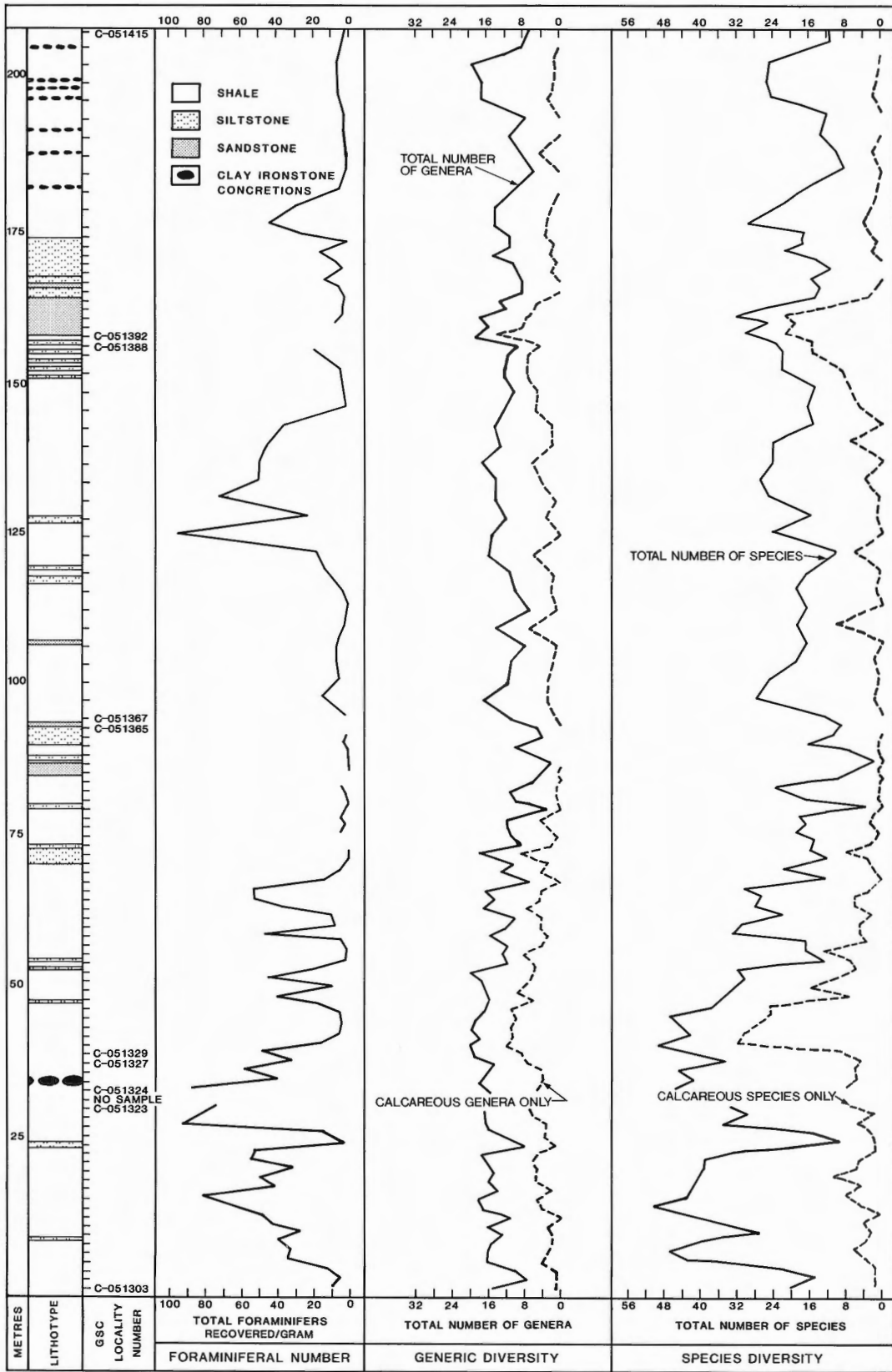


Figure 11. Relationship between lithotype, foraminiferal number, generic diversity, and species diversity.

This study is therefore mainly concerned with the systematic nomenclature and regional affinities of Upper Jurassic (upper Oxfordian–lower Volgian) foraminifers from part of the lower member of the Husky Formation exposed along Martin Creek in the Aklavik Range, northern Richardson Mountains, District of Mackenzie (Fig. 1). Palynological studies of the same sections have already been published by Brideaux (1976), Brideaux and Fisher (1976), and Fensome (1983, 1987).

Faunal composition

The foraminiferal microfauna recovered from the lower member of the Husky Formation is overwhelmingly dominated by simple arenaceous (agglutinated) foraminifers. It consists of 29 genera and 95 species: *Bathysiphon* (1 species), *Saccammina* (3), *Lagenammina* (1), *Ammodiscus* (6), *Arenoturrspirillina* (2), *Glomospira* (3), *Turritella* (2), *Lituotuba* (1), *Saturnella* (2), *Reophax* (5), *Scherochorella* (1), *Haplophragmoides* (2), *Labrospira* (3), *Evolutinella* (1), *Trochamminoides* (1), *Recurvoides* (10), *Ammobaculites* (13), *Bulbobaculites* (4), *Ammobaculoides* (2), *Spiroplectammina* (1), *Textularia* (2), *Pseudobolivina* (1), *Siphotextularia* (4), *Trochammina* (13), (?)*Ammosphaeroidina* (1), *Verneulina* (2), *Verneulinoides* (3), *Eomarssonella* (2) and *Orientalia* (3).

A diverse, but numerically very small, calcareous microfauna consisting of 20 genera and 46 species is also present, but is unpredictable (erratic) in occurrence. The fauna includes *Astacolus* (3 species), *Citharina* (2), *Dentalina* (7), *Grillina* (1), *Frondicularia* (1), *Lenticulina* (5), *Marginulina* (2), *Marginulinopsis* (1), *Nodosaria* (4), *Planularia* (1), *Pseudonodosaria* (5), *Saracenaria* (4), *Vaginulinopsis* (3), *Eoguttulina* (1), *Globulina* (1), *Tristix* (2), *Ceratocancris* (1), *Conorboides* (1), *Pseudolamarckina* (1) and (?)*Spirillina* (2). The vertical distribution (Fig. 13) may be related to the actual original occurrence, or some form of dissolution/preservation phenomena.

Another noteworthy feature of this boreal Upper Jurassic fauna is the large number of specimens recovered from the samples. The left-hand column of Figure 11 shows the estimated foraminiferal number (i.e., number of specimens recovered/gram of sample) for all the samples in the study. Some of the samples have more than 100 specimens/gram. These yields are particularly impressive when compared with total numbers recovered from coeval northwestern European assemblages (Table 1). They are several

orders of magnitude higher than their European counterparts.

TABLE 1

Total numbers of foraminifers recovered from selected Upper Jurassic localities in northwestern Europe

Unit	Aren. (TNS)*	Calc. (TNS)**	Reference
British Isles			
Oxford Clay	11 (1200)	—	Barnard et al. (1981)
Ampt Hill Clay	5 (124)	8 (411)	Gordon (1961)
Corallian Beds	13 (>1900)	17 (>2600)	Gordon (1965)
France			
Boulonnais	4 (>1000)	13 (>1200)	Barnard and Shipp (1981)

*Arenaceous genera (total number of specimens)

**Calcareous genera (total number of specimens)

Foraminiferal biostratigraphy

The proposed zonal scheme for that part of the lower member present at Martin Creek consists of three distinct assemblage zones and two faunules. Because the scheme is based on a single section, the effects of shifting paleoenvironmental parameters on vertical ranges cannot be taken into account. Until a broader study of Husky microfaunas is undertaken, the zonation presented below is provisional.

In the Boreal Jurassic–Lower Cretaceous (Neocomian) there appeared several foraminiferal species of quite remarkable longevity. These forms almost invariably constitute an important component of most of the samples, but are of little use for fine biostratigraphic work. Such successful species include *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp., *Labrospira freboldi* n. sp., and *Labrospira goodenoughensis* (Chamney).

Haplophragmoides tryssa Zone

The *Haplophragmoides tryssa* Zone ranges in age from (?)early Oxfordian to (?)late Kimmeridgian. The fauna is diverse and includes the following species:

Ammodiscus richardsonensis n. sp.
Glomospira glomerosa Eicher
G. tortuosa Eicher
Ammobaculites alaskensis Tappan subsp. *minor* n. subsp.
A. aklavikense n. sp.
A. trachyostrachos n. sp.
Bulbobaculites pokrovkaensis (Kosyрева)
B. willowensis n. sp.
Recurvoides sublustris Dain
R. huskyensis n. sp.
R. triangulus n. sp.
Trochammina omskensis Kosyрева
T. kosyrevae Levina
T. sp. cf. T. rostovzevi Levina
T. elevata Kosyрева subsp. *inflata* n. subsp.
T. elevata Kosyрева subsp. A
T. occidentalis n. sp.

Also present, reaching the acme of their occurrence, are the following species:

Haplophragmoides tryssa Loeblich and Tappan
Recurvoides decoris n. sp.
Trochammina elevata Kosyрева subsp. *elevata* n. subsp.
Verneuilinoides graciosus Kosyрева
V. postgraciosus Kommissarenko

Two epistominiids, *Ceratocancris ambitiosus* Dain and *Conorboides brauni* n. sp. also occur in this interval. *Recurvoides huskyensis* n. sp. is restricted to the basal few metres of the lower member. The species is equivalent to *Recurvoides gryci* (Tappan) from the mid to late Callovian of western Siberia (Dain et al., 1972).

Trochamminoides leskiwae Zone

The *Trochamminoides leskiwae* Zone ranges in age from (?)late Kimmeridgian to (?)early Volgian. Characteristic species in this interval are much fewer in number than in either the underlying or overlying assemblage zones, and include the following:

Trochamminoides leskiwae n. sp.
Eomarssonella paraconica Levina
Orientalia norrisi n. sp.

Other species first appearing at this level are *Saturnella brookeae* n. gen. and n. sp., *Trochammina scotti* n. sp., and *Verneuilina anglica* Cushman. Wall (1983) listed *Evolutinella* sp. (= *Trochamminoides leskiwae* n. sp.) and *Glomospirella* sp. 174 of Brooke

and Braun (1981) (= *Saturnella brookeae* n. gen. and n. sp.) as being diagnostic of the lower Volgian in the eastern part of the Sverdrup Basin.

Ammobaculites lunaris-*Ammobaculoides mahadeoi* Zone

The *Ammobaculites lunaris*-*Ammobaculoides mahadeoi* Zone is of (?)early to (?)middle Volgian age and represents the youngest fauna present within the lower member of the Husky Formation at the Martin Creek locality. It does not, however, represent the youngest fauna present within the lower member in the Beaufort-Mackenzie Basin. Studies of a section of the lower member at Mount Gifford (Fig. 1) indicate that this assemblage zone actually sits within the middle part of the lower member (unpublished data). Species characteristic of the *Ammobaculites lunaris*-*Ammobaculoides mahadeoi* Zone include the following:

“*Arenoturrispirillina intermedia*” Chamney
Recurvoides sp. A
Ammobaculites lunaris n. sp.
Ammobaculoides mahadeoi n. sp.
A. rickyouni n. sp.
Trochammina elevata Kosyрева subsp. *acutula* n. subsp.
T. walli n. sp.
T. postera n. sp.
Verneuilina krekei n. sp.
Verneuilinoides infrequens n. sp.
Eomarssonella pollocki n. sp.
Orientalia loucheuxi n. sp.

The vertical ranges of the two nominal index forms are apparently not concurrent, but until further data from the Mount Gifford section can be obtained, the forms are included within one assemblage zone.

Two calcareous faunules, both dominated by nodosariid foraminifers occur within the lower member at Martin Creek. They are designated as Faunules C-1 and C-2, respectively. Faunule C-1 comes from pure, dark grey shale within the upper part of the *Haplophragmoides tryssa* Zone, whereas faunule C-2 comes from friable siltstone and minor fine grained sandstone near the base of the *Ammobaculites lunaris*-*Ammobaculoides mahadeoi* Zone. One would suspect that the coarser clastics encasing the latter faunule would be the most susceptible to diagenetic leaching and dissolution of calcium carbonate test material, and yet some of the most pristine calcareous forms come from this level. The apparently erratic occurrence of

the calcareous foraminifers may thus reflect, at least in part, original assemblages, and not just diagenetic changes.

Calcareous faunule C-1 (Oxfordian–Kimmeridgian)

Astacolus sp. cf. *A. praesibirensis* Dain
Citharina callomoni n. sp.
C. sp. A
Lenticulina gerkei Dain
L. sp. cf. *L. audax* Loeblich and Tappan
L. sp. cf. *L. lauta* Dain
L. sp. A
Nodosaria orthostoecha Loeblich and Tappan
N. sp. cf. *N. amphigya* Loeblich and Tappan
N. sp. A
Saracenaria phaedra Tappan

Calcareous faunule C-2 (lower Volgian)

Astacolus sp. A
Lenticulina sp. B
Marginulinopsis rjavkinoensis (Kosyreva)
Planularia sp. cf. *P. fraasi* (Schwager)
Pseudolamarckina liapinensis Dain
Pseudonodosaria statuta n. sp.
Saracenaria sp. cf. *S. cypha* Loeblich and Tappan
S. minima n. sp.
Vaginulinopsis sp. cf. *V. enodis* Loeblich and Tappan
V. sp. A
V. sp. B

Regional affinities within the northern hemisphere

Direct comparison of the Husky microfauna with that from other regions within the northern hemisphere is restricted in part by the available literature, and, to a lesser extent by the quality of the available illustrations. Whenever possible, type specimens from the area in question were examined and compared directly with the Martin Creek material. In Figure 14, the areas with which comparisons were drawn are shown, and in Figures 15 and 16 the geographic distribution of selected genera with respect to each other are shown graphically.

North slope of Alaska

The only detailed taxonomic study of Jurassic microfaunas from the Arctic region of North America was completed by Tappan (1955) on material from the north slope of Alaska. The faunas were recovered from shale of the Kingak Formation, using both outcrop and

subsurface material. About two thirds of Tappan's forms were assigned Early or Middle Jurassic ages. Of these, the following also occur at Martin Creek:

Reophax metensis Franke
Textularia areoplecta Tappan
Marginulina sp. cf. *M. breviformis* (Terquem and Berthelin)
Rectoglandulina quinquecostata (Bornemann) [= *Pseudonodosaria* sp. cf. *P. quinquecostata* (Bornemann)]

Among Tappan's Upper Jurassic species, the following are tentatively equated to Husky forms:

Ammodiscus cheradospirus Loeblich and Tappan
A. orbis Lalicker
Haplophragmoides canui Cushman [= partim *Labrospira frebaldi* n. sp. and partim *L. goodenoughensis* (Chamney)]
Ammobaculites alaskensis Tappan [= partim *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp.]
Trochammina canningensis Tappan [= partim *Recurvoides canningensis* (Tappan)]
Saracenaria phaedra Tappan
Marginulina brevis Paalzow
Rectoglandulina brandi Tappan [= *Pseudonodosaria brandi* (Tappan)]
Fronicularia? sp. [= *Grillina praenodulosa* (Dain)]

Given the close geographic proximity of northern Alaska to the study area, the small number of species in common is surprising. Jurassic microfaunas from Siberia (Dain et al., 1972) and the Canadian Arctic Archipelago (Souaya, 1976; Wall, 1983) are nearly identical to those found at Martin Creek. It seems unlikely that the depositional environments of the Kingak and the Husky could have been so dissimilar, but it is conceivable that Tappan's assemblages came from a deeper marine biofacies. Examination of a few selected specimens from Tappan's type material (obtained on loan from the Smithsonian Institute) showed that she placed juvenile specimens of *Recurvoides* in the genus *Trochammina*. A restudy of Tappan's entire collections would be required to see if any other discrepancies exist.

Sverdrup Basin, Canadian Arctic Archipelago

Only two papers deal with the microfaunas of the vast region of the Canadian Arctic Archipelago. Souaya (1976) described the Mesozoic foraminifera from the Sun-Gulf-Global Linckens Island P-46 well, whereas

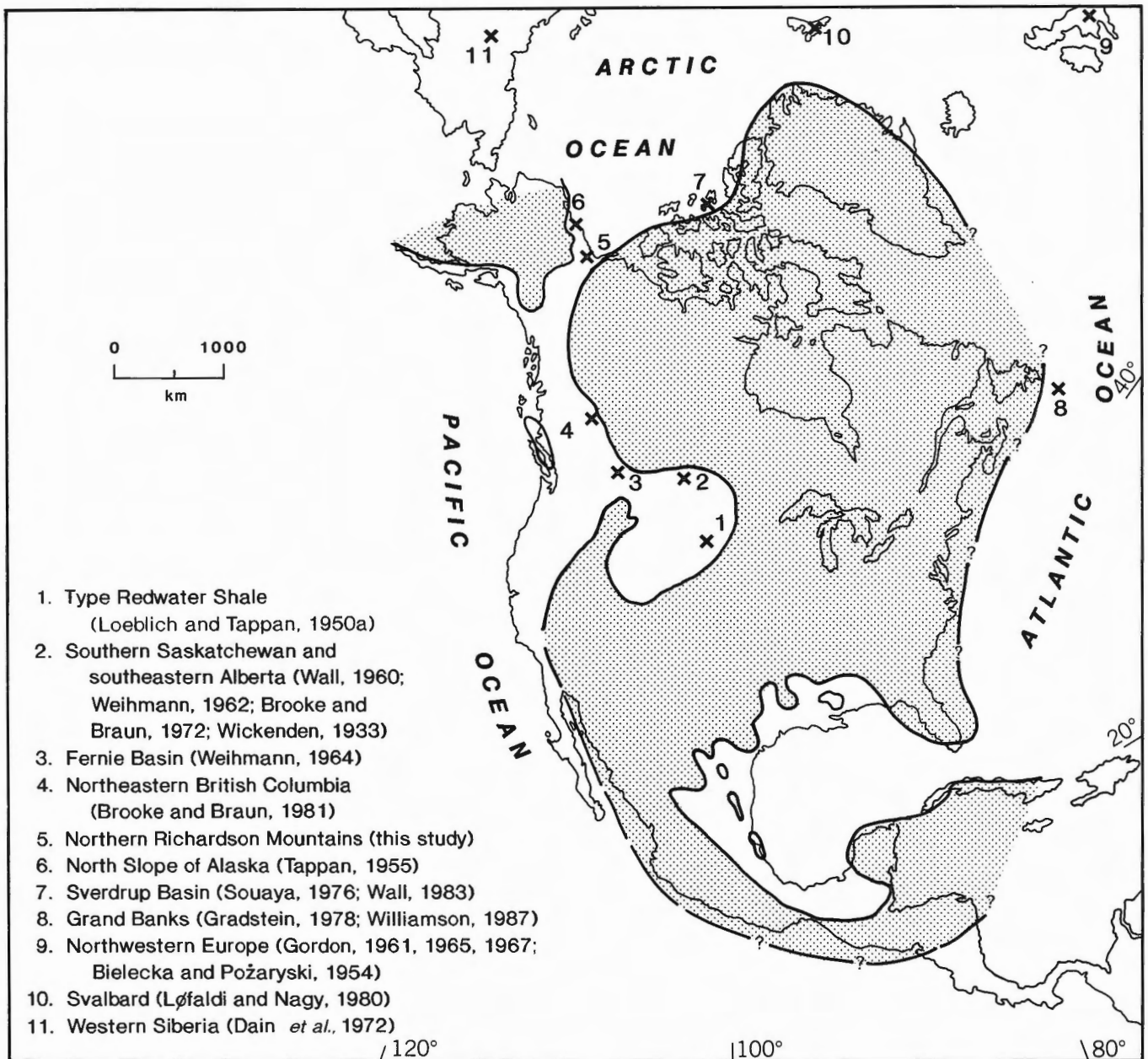


Figure 14. Locations of Upper Jurassic faunas discussed in text. Paleogeography is for middle Oxfordian time. (Adapted from Imlay, 1980.)

Wall (1983) illustrated diagnostic species from the Jurassic-Cretaceous succession in the eastern half of the Sverdrup Basin. I was able to examine the figured specimens from both studies. They are housed in the National Type Collection of Invertebrate and Plant Fossils of the Geological Survey of Canada, 601 Booth St., Ottawa.

Souaya (1976) divided the Upper Jurassic in the Linckens Island well into three zones and six subzones. None of these are readily recognizable at Martin Creek. In general terms, however, the microfaunas are

very similar. Of the 48 species recovered from the Upper Jurassic interval, 16 are conspecific with forms found at Martin Creek. These are as follows:

- Bathysiphon vitta* Nauss [= *Bathysiphon* sp. A]
- Saccammina lathrami* Tappan
- S.* sp. cf. *S. franconica* Ziegler [= *Saccammina* sp. B]
- Ammodiscus orbis* Lalicker
- A.* sp. cf. *A. cheradospirus* Loeblich and Tappan
- A.* sp. cf. *A. siliceus* Terquem [= *A. richardsonensis* n. sp.]

		Bathysiphon	Saccamina	Ammodiscus	Arenoturrispirulina	Glomospira	Glomospirella	Turrilella	Saturnella	Lituotuba	Reophax	Haplophragmoides	Evolufinella	Labrospira	Recurvoides	Triplasia	Ammomarginulina	Flabellamina	Trochammina	Ammosphaeroidina	Ammobaculites	Ammobaculoides	Bulbobaculites	Spiroplectammina	Textularia	Siphotextularia	Pseudobolivina	Gaudyina	Dorothyia	Verneuilina	Verneulinoides	Eomarrisonella	Orientalia	
NORTH AMERICA	BEAUFORT-MACKENZIE BASIN (this study)	●	●	●	●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●	●	●	●			●	●	●	●		
	ALASKA (NORTH SLOPE) Tappan, 1955	●	●	●		●					●	●		●	●				●		●							●						
	SVERDRUP BASIN	Souaya, 1976	●	●	●	●	●					●	●		●	●		●	●	●	●	●	●	●	●	●			●	●			●	
		Wall, 1983		●	●	●				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				●	●	●	●	●
	NORTHEASTERN BRITISH COLUMBIA Brooke and Braun, 1981	●	●	●		●	●		●		●	●		●	●	●		●	●	●	●	●	●	●	●				●	●				
	WESTERN INTERIOR PLAINS	SASKATCHEWAN Wall, 1960; Welhmann, 1962; Brooke and Braun, 1972	●	●	●		●		●		●	●	●				●	●	●	●	●	●	●	●	●					●	●			
		UNITED STATES Loeblich and Tappan, 1950a, b			●							●	●						●	●	●	●	●	●	●	●					●	●		
	GRAND BANKS, NFLD. Gradstein, 1977, 1978; Williamson, 1987											●							●	●	●	●	●	●	●				●	●				
	NORTHWESTERN EUROPE	GREAT BRITAIN Gordon, 1961, 1965, 1967		●								●	●		●	●		●	●	●	●	●	●	●	●	●	●		●	●				
		SVALBARD Løfdahl and Nagy, 1980, 1983			●		●						●		●	●		●	●	●	●	●	●	●	●	●				●	●			
POLAND Bielecka and Pożaryski, 1954; Bielecka, 1975												●	●	●	●	●		●	●	●	●	●	●	●	●									
WESTERN SIBERIA Dain et al., 1972				●	●				●		●	●	●	●	●	●				●	●	●	●	●	●						●	●	●	●

STIPPLED = (?) CHARACTERISTIC BOREAL GENUS

Figure 15. Occurrences of selected agglutinated foraminiferal genera within the Upper Jurassic of the northern hemisphere.

Arenoturrispirulina *intermedia* Chamney
Reophax suevicus Franke [= ?*Reophax* sp. cf. *R. densa* Tappan]
R. metensis Franke
Haplophragmoides sp. cf. *H. tryssa* Loeblich and Tappan [= *Labrospira miranda* (Dain)]
Recurvoides disputabilis Dain [both subspecies]
Ammobaculites alaskensis Tappan [= *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp.]
Trochammina topagorukensis Tappan [= *Trochammina elevata* Kosyreva subsp. *elevata* n. subsp.]
Verneuilina anglica Cushman
Verneulinoides sp. cf. *V. georgiae* (Terquem) [= *Eomarrisonella pollocki* n. sp.]

In addition, the following species were also found to occur in the Husky Formation:

Reophax sp. B [= *Scherchorella minuta* (Tappan)]

Ammobaculites sp. B [= *Ammobaculites magnus* n. sp.]
Haplophragmoides goodenoughensis Chamney [= *Labrospira goodenoughensis* (Chamney)]
Trochammina globigeriniformis (Parker and Jones) [= *Trochammina elevata* Kosyreva subsp. *inflata* n. subsp.]
T. sp. cf. *T. exigua* Cushman and Applin [= *Trochammina walli* n. sp.]
Fronicularia tumida (Terquem) [= *Grillina praenodulosa* (Dain)]
Lingulina sp. cf. *L. hybrida* Frenzen [= *Grillina praenodulosa* (Dain)]
Lenticulina sp. cf. *L. audax* Loeblich and Tappan
Marginulina sp. cf. *M. breviformis* (Terquem and Berthelin)
Pseudonodosaria brandi (Tappan)

Wall (1983) published the first comprehensive foraminiferal zonation of the Jurassic-Cretaceous succession of the Sverdrup Basin. Where possible, he used macrofossil data to calibrate the foraminiferal

		Spirillina	Ophthalmitulum	Quinqueloculina	Astacolus	Citharina	Citharinella	Dentalina	Falsopalmula	Fondicularia	Griffina	Lenticulina	Lingulina	Margulinula	Margulinopsis	Nodosaria	Palmula	Pseudonodosaria	Saracenaria	Tristix	Vaginulina	Vaginulinopsis	Lagena	Eoguttulina	Globulina	Guttulina	Pseudoguttulina	Conicospirillina	Trocholina	Trochospirillina	Turrispirillina	Ceratobulimina	Ceratocancris	Conarbolides	Hoeglundina	Pseudolamarckina	Epistamina	Pseudocyclammima	Voorhuysenia							
NORTH AMERICA	BEAUFORT-MACKENZIE BASIN (this study)	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●																				
	ALASKA (NORTH SLOPE) Tappan, 1955							●	●	●	?	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
	SVERDRUP BASIN	Souaya, 1976										●	●																																	
		Wall, 1983				●			●			●	●																																	
	NORTHEASTERN BRITISH COLUMBIA Brooke and Braun, 1981					●						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	WESTERN INTERIOR PLAINS	SASKATCHEWAN Wall, 1960; Wehmann, 1962; Brooke and Braun, 1972	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
UNITED STATES Loeblich and Tappan, 1950a, b		●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
GRAND BANKS, N.F.L.D. Gradstein, 1977, 1978; Williamson, 1987		●	●									●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
NORTHWESTERN EUROPE	GREAT BRITAIN Gordon, 1961, 1965, 1967	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	SVALBARD Lefaldli and Nagy, 1980, 1983				●			●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	POLAND Bielecka and Pożaryski, 1954; Bielecka, 1975	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
	WESTERN SIBERIA Dain et al., 1972				●						●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		

STIPPLED = (?) CHARACTERISTIC BOREAL GENUS

Figure 16. Occurrences of selected calcareous foraminiferal genera within the Upper Jurassic of the northern hemisphere.

zones. Due to the preliminary nature of the work, no taxonomic studies were included. Species found to be conspecific with Martin Creek material include the following:

- Bathysiphon* sp. 1 [= *Bathysiphon* sp. A]
- Ammodiscus cheradospirus* Loeblich and Tappan
- A.* sp. cf. *A. orbis* Lalicker [= *Ammodiscus orbis* Lalicker]
- Glomospirella* sp. 174 of Brooke and Braun, 1981 [= *Saturnella brookeae* n. gen. and n. sp.]
- Reophax* sp. 5 [= *Reophax* sp. cf. *R. adaptatus* Dain]
- Haplophragmoides* sp. cf. *H. tryssa* Loeblich and Tappan [= *Haplophragmoides tryssa* Loeblich and Tappan]
- H.* sp. 2 [= large variant of *Labrospira freboldi* n. sp.]
- H.* sp. cf. *H. canui* Cushman [= *Labrospira freboldi* n. sp.]
- Cribrostomoides goodenoughensis* (Chamney) [= *Labrospira goodenoughensis* (Chamney)]
- Haplophragmoides* sp. 3 [= *Labrospira goodenoughensis* (Chamney)]
- Cribrostomoides* sp. 1 [= *Labrospira freboldi* n. sp.]

- Evolutinella* sp. [= *Trochamminoides leskiwae* n. sp.]
- Ammobaculites* sp. 3 [= *Ammobaculites trachyostrachos* n. sp.]
- A.* sp. cf. *A. suprajurassicum* (Schwager) [= *Ammobaculites alaskensis* Tappan subsp. *minor* n. subsp.]
- A.* sp. 6 [= *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp.]
- A.* sp. 7 [= *Ammobaculites alaskensis* Tappan subsp. *calculosus* n. subsp.]
- Haplophragmium pokrovkaensis* Dain [= *Bulbobaculites pokrovkaensis* (Dain)]
- Trochammina canningensis* Tappan [= ?*Ammosphaeroidina stelcki* n. sp.]
- T.* sp. cf. *T. rosacea* Zasyelova [= *Trochammina walli* n. sp.]
- Verneuilina anglica* Cushman
- Verneuilinioides graciosus* Kosyreva
- Arenobulimina* sp. 1 [= *Orientalia norrisi* n. sp.]
- Orientalia* sp. 2 [= *Orientalia loucheuxi* n. sp.]
- Globulina* sp. cf. *G. alexandrae* Dain
- Geinitzinita* sp. cf. *G. nodulosa* Fursenko and Polenova [= *Grillina praenodulosa* (Dain)]

Northeastern British Columbia

Brooke and Braun (1981) described a fairly extensive (though poorly preserved) microfauna from the Fernie Formation of the Foothills of northeastern British Columbia. This assemblage is of special interest in that it appears to be markedly Boreal in aspect and has little in common with the partly coeval assemblages found in the adjacent western interior plains (see Western interior plains, below). Examination of Brooke and Braun's type material revealed the following conspecific forms:

- Saccamina* sp. cf. *S. lathrami* Tappan [= *Saccamina lathrami* Tappan]
Ammodiscus sp. cf. *A. cheradospirus* Loeblich and Tappan
Glomospirella sp. 174 [= *Saturnella brookeae* n. gen. and n. sp.]
Haplophragmoides sp. cf. *H. canui* Cushman [= *Labrospira freholdi* n. sp.]
H. sp. cf. *H. topagorukensis* Tappan [= *Evolutinella infirma* n. sp.]
H. sp. 143 [= *Labrospira goodenoughensis* (Chamney)]
?*Recurvoides* sp. cf. *R. disputabilis* Dain [= *Recurvoides disputabilis* Dain]
?*Recurvoides* sp. 149 [= *Recurvoides triangulus* n. sp.]
Ammobaculites sp. cf. *A. alaskensis* Tappan [= partim *Ammobaculites lunaris* n. sp.]
A. sp. 152 [= *Ammobaculites* sp. cf. *A. multiformis* Dain]
Spiroplectammina sp. cf. *S. tobolskensis* Beljaevskaja and Kommissarenko [= partim *Ammobaculoides mahadeoi* n. sp.]
Trochammina sp. cf. *T. canningensis* Tappan [= partim *Recurvoides canningensis* (Tappan)]
Trochammina? sp. cf. *T. gatesensis* Stelck and Wall [= partim *Trochammina walli* n. sp.]
T. gryci Tappan [= *Recurvoides huskyensis* n. sp.]
Geinitzinita sp. cf. *G. praenodulosa* Dain [= *Grillina praenodulosa* (Dain)]
Planularia sp. cf. *P. fraasi* (Schwager)
Saracenaria sp. 176 [= *Saracenaria minima* n. sp.]
Globulina sp. cf. *G. alexandrae* Dain

Fernie Basin, southeastern British Columbia

Weihmann (1962, 1964) illustrated a sparse, very poorly preserved microfauna from the Fernie Formation within the Fernie Basin of British Columbia. She compared the fauna to that recovered

by Wall (1960) from the Oxfordian of southern Saskatchewan. I examined her type material and confirmed the poor preservation evident in her illustrations. I also discovered a single, beautifully preserved (but not described or illustrated) species of *Recurvoides*. This indicates that some Boreal migrants penetrated as far south as the 49th Parallel in Oxfordian time.

Western interior plains

The western interior plains of North America contain the best studied Jurassic microfaunas. Taxonomic and biostratigraphic studies have been carried out by Sandridge (1933), Wickenden (1933), Lalicker (1950), Loeblich and Tappan (1950a, b), Wall (1960), and Brooke and Braun (1972).

Western interior microfaunas are characteristically dominated by a diverse group of benthonic, calcareous-walled species dominated by nodosariids and polymorphiniids. The simple agglutinated faunas are much less diverse, but usually account for most of the population in a given assemblage. Lalicker (1950) obtained a microfauna of 39 species, of which all but two were calcareous, from the Ellis Group of Montana. Loeblich and Tappan (1950a) recovered 56 species from the Redwater Shale of South Dakota. Of these, only nine were agglutinated.

Microfaunas from the type Redwater Shale (Oxfordian) (Loeblich and Tappan, 1950a) and the middle and upper Vanguard Formation (upper Oxfordian to lower Kimmeridgian) of southern Alberta and Saskatchewan (Wall, 1960; Weihmann, 1962; Brooke and Braun, 1972) contain the following species that are comparable to Husky forms:

- Ammodiscus francisi* (Wall)
A. orbis Lalicker
A. sp. cf. *A. orbis* Lalicker
A. cheradospirus Loeblich and Tappan
Bulbobaculites sp. [= *Turritellella parva* n. sp.]
Haplophragmoides tryssa Loeblich and Tappan
Dentalina ejuncida Loeblich and Tappan
Lenticulina audax Loeblich and Tappan
Nodosaria orthostoecha Loeblich and Tappan
N. amphigya Loeblich and Tappan
Saracenaria cypha Loeblich and Tappan
Tristix inornata (Loeblich and Tappan)
Vaginulinopsis enodis Loeblich and Tappan

The assemblage from the western interior plains is quite different from the Boreal ones found in the

Arctic regions of Canada and as far south as northeastern British Columbia. Characteristic Boreal genera such as *Recurvoides*, *Saturnella*, and *Arenoturrisspirillina* are missing, as are the large and robust representatives of the genus *Labrospira* [i.e., *Labrospira goodenoughensis* (Chamney) and *L. frebaldi* n. sp.]. The western interior microfauna appears to have much closer ties to assemblages in northwestern Europe (see Northwestern Europe, below) than it does to the geographically closer area of northeastern British Columbia. Brooke and Braun (1981, p. 8–10) discussed this curious phenomenon at some length without coming to any firm conclusion as to its probable cause. Certainly no physical barrier was present between these two adjacent areas that might have hampered comingling of the faunas.

Grand Banks (eastern coast of Newfoundland)

In recent years, the search for hydrocarbons along Canada's eastern seaboard has brought to light much valuable data on the Mesozoic microfaunas of this previously inaccessible area. Gradstein et al. (1975) compiled the first comprehensive microfaunal zonation of the Jurassic in the Grand Banks area. Gradstein (1977, 1978), Williamson (1987), and Williamson and Stam (1988) provided more detailed information on the Jurassic foraminiferal faunas and biogeography. The Jurassic Grand Banks microfaunas are of Tethyan affinity (see Gordon, 1970). Gradstein (1977, p. 562, 563) noted that:

“... Middle and Upper Jurassic assemblages from Alaska [Tappan, 1955; Bergquist, 1966] and the western interior [Loeblich and Tappan, 1950a, 1950b; Wall, 1960; Brooke and Braun, 1972; Gordon, 1970] bear little resemblance to the coeval Grand Banks assemblages . . . Nodosariids, many probably different from the Grand Banks ones and simple arenaceous taxa predominate; epistominiids, “Globigerina” and larger Foraminifera, often so abundant in the Grand Banks are missing.”

Northwestern Europe

The Jurassic foraminiferal microfaunas of northwestern Europe are probably the best known and most studied in the world. Upper Jurassic faunas from Great Britain (Lloyd, 1959, 1962; Gordon, 1961, 1965; Cordey, 1962; Barnard et al., 1981), France (Bizon, 1958, 1960; Barnard and Shipp, 1981), Germany (Bartenstein and Brand, 1937; Lutze, 1960), Poland

(Bielecka and Pozaryski, 1954; Bielecka, 1975), Denmark (Norvang, 1957), and Sweden (Norling, 1972) bear little resemblance to their counterparts from the Boreal regions of North America. An indication of this problem was noted by Bielecka and Pozaryski (1954, p. 152), who were trying to correlate the Upper Malm of Poland with the Volga series of the Soviet Union. They noted that although the microfaunas were broadly similar, the species were often different.

The northwest European faunas are strongly dominated by benthonic, calcareous-walled foraminifers belonging to the nodosariids, polymorphiniids, and rotaliids. Arenaceous foraminifers are scarcer, the most common representatives being *Ammodiscus*, *Reophax*, *Ammobaculites*, *Haplophragmoides*, *Triplasia*, *Bigenerina*, *Trochammina*, *Textularia*, and *Gaudryina*. These microfaunas seem to be closely allied with the western interior plains of North America (see Western interior plains, above; Wall, 1960, p. 47). Bielecka (1975) feels that the Polish (and perhaps, by analogy, also the western interior) microfaunas may best belong to a sub-Boreal faunal province, as they are neither typically Boreal nor are they typically Tethyan.

Svalbard

Løfaldli and Nagy (1980) described an assemblage dominated by simple agglutinated foraminifers from the Middle to Upper Jurassic (Callovian to basal Kimmeridgian) from the island of Svalbard. Characteristic boreal genera such as *Recurvoides* and *Grillina* are present, and a number of the species are comparable to those found at Martin Creek. These include:

- Psammospaera? metensis* (Terquem) [= *Saccamina lathrami* Tappan]
- Ammodiscus cheraspirus* Loeblich and Tappan
- Haplophragmoides canuiformis* Dain [= *Labrospira goodenoughensis* (Chamney)]
- Ammobaculites suprajurassicum* (Schwager) [= *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp.]
- A. sp. aff. A. alaskensis* Tappan [= *A. alaskensis* Tappan subsp. *alaskensis* n. subsp.]
- Lingulina praenodulosa* (Dain) [= *Grillina praenodulosa* (Dain)]

Greenland

Despite yielding some of the world's richest and most prolific ammonite and pelecypod faunas, the

foraminiferal faunas of the Jurassic of Greenland remain virtually unstudied. Presumably they would have strongly Boreal affinities.

Western Siberia

The Upper Jurassic foraminiferal faunas of western Siberia have been thoroughly studied by Dain et al. (1972) and Dain and Kuznetsova (1976). These microfaunas bear very close resemblance to those recovered from Martin Creek, notwithstanding their large geographic separation. Direct comparisons are also greatly facilitated by the excellent camera lucida illustrations provided by the Russian workers. In many cases these accurate drawings are far superior for illustrating agglutinated foraminiferal tests than are the more sophisticated photographs obtained using a scanning electron microscope. Western Siberian species comparable to those found at Martin Creek include:

- Glomospira pattoni* Tappan [= *Glomospira glomerosa* Eicher]
- Ammodiscus uglicus* Ehremeeva [= *Ammodiscus* sp. cf. *A. orbis* Lalicker]
- Reophax adaptatus* Dain [= ?*Reophax* sp. cf. *R. adaptatus* Dain]
- Cribrostomoides canui* (Cushman) [= *Labrospira frebaldi* n. sp.]
- C. mirandus* Dain [= *Labrospira miranda* (Dain)]
- Haplophragmoides? canuiformis* Dain [= *Labrospira goodenoughensis* (Chamney)]
- Recurvoides gryci* (Tappan) [= *Recurvoides huskyensis* n. sp.]
- R. disputabilis* Dain [both subspecies]
- R. scherkalyensis* Levina [= ?*R.* sp. cf. *R. scherkalyensis* Dain]
- R. sublustris* Dain
- Ammobaculites multiformis* Dain [= ?*A.* sp. cf. *A. multiformis* Dain]
- Haplophragmium pokrovkaensis* Dain [= *Bulbobaculites pokrovkaensis* (Dain)]
- Trochammina elevata* Kosyрева [= *Trochammina elevata* Kosyрева subsp. *elevata* n. subsp.]
- T. kosyrevae* Levina
- T. omskensis* Kosyрева
- T. rostovzevi* Levina [= *T.* sp. cf. *T. rostovzevi* Levina]
- T. ex. gr. canningensis*(?) Tappan [= partim ?*Ammosphaeroidina stelcki* n. sp.]
- Verneuilinoides graciosus* Kosyрева
- V. postgraciosus* Kommissarenko
- Eomarssonella paraconica* Levina
- Astacolus praesibirensis* Kosyрева [= *A.* sp. cf. *A. praesibirensis* Dain]

- Lenticulina gerkei* Dain
- Geinitzinita praenodulosa* Dain [= *Grillina praenodulosa* (Dain)]
- Pseudonodosaria brandi* (Tappan)
- Vaginulinopsis rjavkinoensis* Kosyрева [= *Marginulinopsis rjavkinoensis* (Kosyрева) + var.]
- Globulina alexandrae* Dain
- Ceratocancris ambitiosus* Dain
- Pseudolamarckina liapinensis* Dain

Upper Jurassic foraminiferal biogeography

Gordon (1970) discussed the global biogeography of Jurassic foraminiferal microfaunas. He concluded that, unlike other fossil groups (i.e., ammonites, belemnites), foraminifers did not show any marked provinciality in the Upper Jurassic. Gordon defined instead two broad assemblages, which he termed shelf and Tethyan. He demonstrated (1970, Fig. 3-C) that the former occurred both north and south of the latter. Shelf assemblages were characterized by three subgroups, which are as follows: 1) nodosariid and nodosariid-mixed assemblages (nodosariids not less than 20 per cent of all specimens, no other calcareous species conspicuous); 2) dominantly simple arenaceous assemblages (at least 80 per cent arenaceous specimens present); 3) conspicuous calcareous benthos present other than nodosariids.

“Tethyan” assemblages were characterized by two sub-groups: 1) complex arenaceous foraminifers; 2) planktonic foraminifers.

The database was heavily influenced by the then available literature, in that 75 per cent of the studies came from northwestern Europe, and the remaining 25 per cent spanned the rest of the globe. Except for those of Tappan (1955) and Bergquist (1966), no studies were available from the high latitudes of the northern hemisphere.

Analysis of more recent studies from western Siberia (Dain et al., 1972), Svalbard (Løfaldli and Nagy, 1980), the Sverdrup Basin (Chamney, 1971; Souaya, 1976; Wall, 1983) and the northern mainland (Brooke and Braun, 1981; this study) shows that there is an apparent provincialism even among the simple agglutinated genera between high latitude and middle latitude shelf assemblages north of the Tethys Belt. The high latitude or boreal microfaunas carry ?endemic genera such as *Saturnella* n. gen., *Arenoturrispirillina*, *Recurvoides*, and *Eomarssonella*. These do not seem to occur in the middle latitude or

sub-Boreal regions. Sub-Boreal faunas are typical of northwestern Europe and the western interior plains of North America.

SYSTEMATIC PALEONTOLOGY

All type specimens (both illustrated and not illustrated), as well as all picked residues are housed in the National Type Collection of Invertebrate and Plant Fossils, Geological Survey of Canada, 601 Booth St., Ottawa, Ontario.

The morphological parameters measured in this study are shown in Figure 17.

Order FORAMINIFERIDA Eichwald, 1830

Suborder TEXTULARIINA Delage and Herouard, 1896

Superfamily AMMODISCACEA Reuss, 1862

Family ASTORRHIZIDAE Brady, 1881

Subfamily RHIZAMMININAE Rhumbler, 1895

Genus *Bathysiphon* Sars in G.D. Sars, 1872

Type species. *Bathysiphon filiformis* (original description).

Diagnosis. Test free, large, elongate, narrow, fairly flexible tube, which may have annular constrictions; wall agglutinated; aperture at one of open ends.

Bathysiphon sp. A

Plate 1, figures 1, 2

1976 *Bathysiphon vitta* Nauss; Souaya, p. 263, Pl. 3, fig. 16.

1983 *Bathysiphon* sp. 1 of Wall, Pl. 2, fig. 1.

Material. Uncommon, generally well preserved; figured specimen GSC 57083 from GSC loc. C-051415, 208 m above base of lower member; figured specimen GSC 57084 from GSC loc. C-051379, 131 m above base, specimen GSC 57085 from GSC loc. C-051409, 191 m above base.

Description. Test medium sized, elongate, tubular, open at both ends, flattened, usually represented by

only short fragments; test may possess irregular constrictions or swellings; wall very finely agglutinated with much siliceous cement; aperture at open ends of tube.

Dimensions (mm).

GSC Specimen No.	Length	Width
57083*	>0.98	0.20
57084*	>1.11	0.36
57085*	>0.60	0.25

*Broken specimen.

Remarks. *Bathysiphon* sp. A resembles *B. anomalocoelia* Tappan from the Lower Jurassic of northern Alaska, but differs in being somewhat smaller and possessing constrictions and swellings along the test.

Occurrence. *Bathysiphon* sp. A occurs rarely in the upper third of the lower member.

Family SACCAMMINIDAE Brady, 1884

Subfamily SACCAMMININAE Brady, 1884

Genus *Saccammina* M. Sars in Carpenter, 1889

Type species. *Saccammina sphaerica* Brady, 1871.

Diagnosis. Test free, single globular chamber, wall with pseudochitinous base and outer agglutinated layer, firmly cemented; aperture rounded, may be produced on short neck.

Saccammina lathrami Tappan

Plate 1, figures 7–10

1960 *Saccammina lathrami* Tappan, p. 289, Pl. 1, figs. 1, 2; Pl. 29, figs. 9–12.

1972 *Saccammina* sp. cf. *S. lathrami* Tappan; Sutherland and Stelck, p. 559, Pl. 1, fig. 5.

1976 *Saccammina lathrami* Tappan; Souaya, p. 264, Pl. 4, fig. 4.

1980 *Saccammina lathrami* Tappan; Haig, p. 96, Pl. 2, figs. 1, 2.

?1980 *Psammospaera metensis* (Terquem); Løfaldli and Nagy, p. 74, Pl. 1, fig. 13.

1981 *Saccammina* sp. cf. *S. lathrami* Tappan; Brooke and Braun, p. 11, Pl. 1, figs. 2–5.

1983 *Saccammina lathrami* Tappan; Wall, Pl. 6, fig. 2.

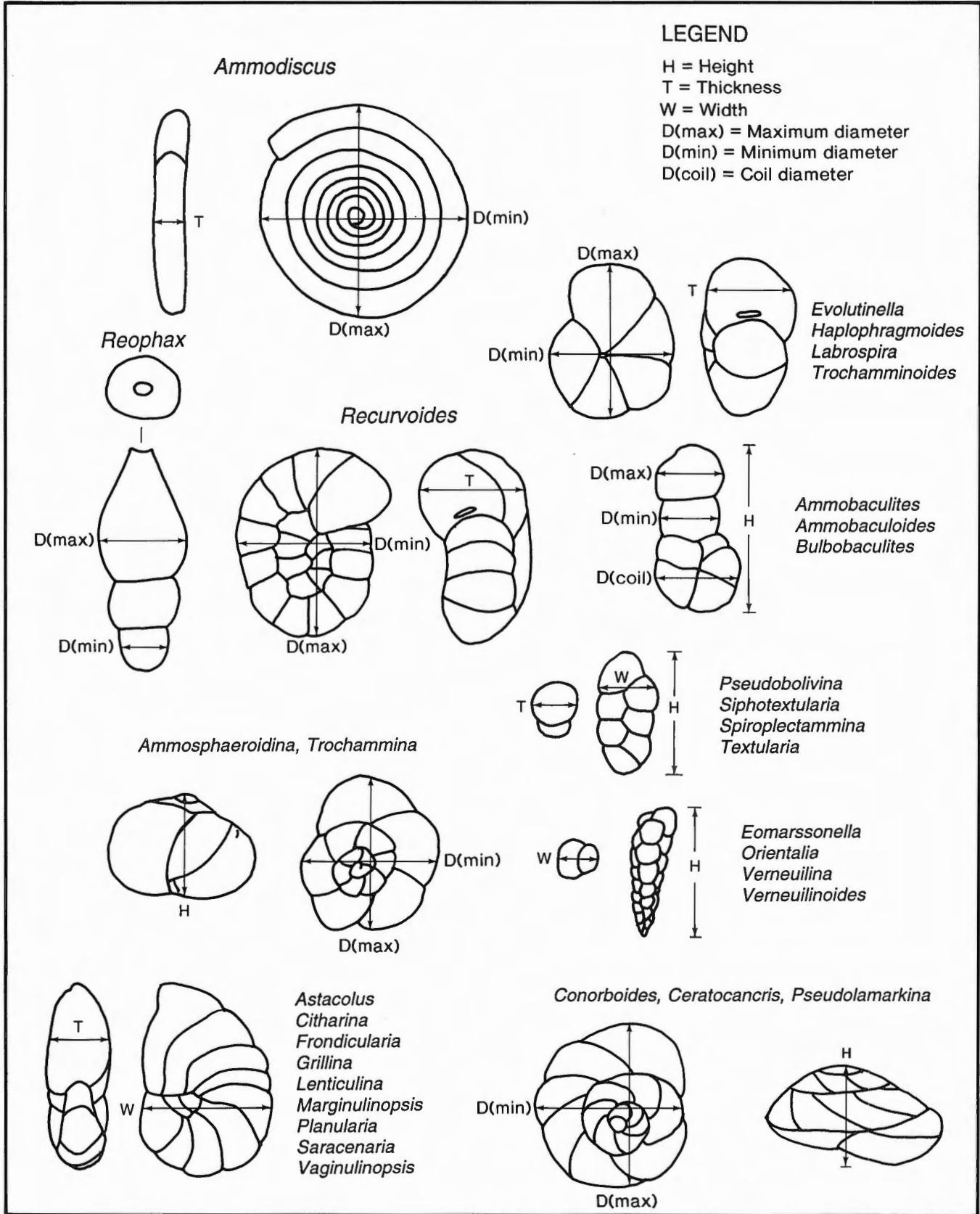


Figure 17. Morphological parameters of foraminifers measured in this study.

Material. Fairly common, generally poorly preserved; figured hypotype GSC 57087 from GSC loc. C-051398, 167 m above base of lower member; figured hypotype GSC 57088 and unfigured hypotypes GSC 57089, 57090 from GSC loc. C-051376, 110 m above base.

Description. Test medium sized, ovate, strongly to moderately compressed; consisting of single, undivided chamber; wall very finely arenaceous with much cement, smoothly finished, whitish grey in colour; test very susceptible to deformation; aperture simple, terminal, commonly obscured due to poor preservation.

Dimensions (mm).

GSC Specimen No.	Length	Width	Thickness	WT
Hypotype 57087	>0.75	0.58	0.20	0.06
Hypotype 57088	0.43	0.38	0.08	—
Hypotype 57089	0.63	0.55	0.20	—
Hypotype 57090	—	0.53	0.38	—

WT, wall thickness.

Remarks. The Husky specimens closely resemble *Saccammina lathrami*, but are generally less well preserved. The way in which the tests are distorted and (commonly) ruptured suggests that the wall is partly pseudochitinous in composition and does not have the same structural strength as the other Husky species assigned to this genus. Brooke and Braun (1981) recovered similar, probably conspecific forms from the Upper Jurassic Fernie Formation of northeastern British Columbia.

Occurrence. *Saccammina lathrami* occurs erratically throughout the upper two thirds of the lower member at Martin Creek.

Saccammina sp. A

Plate 1, figures 5, 6

Material. Rare, generally well preserved; figured specimen GSC 57091 from GSC loc. C-051308, 7.5 m above base of lower member; unfigured specimen GSC 57092 and figured specimen GSC 57093 from GSC loc. C-051317, 21 m above base.

Description. Test medium sized, rounded to slightly ovate, moderately inflated, periphery rounded; consisting of a single undivided chamber, commonly somewhat laterally compressed, may show a central depression; wall finely arenaceous with much cement, fairly smoothly finished; aperture simple, terminal, an elongate slit, commonly produced on a slight neck.

Dimensions (mm).

GSC Specimen No.	Length	Width	Thickness
57091	0.79	0.71	0.38
57092	0.65	0.48	0.33
57093	0.50	0.41	0.16

Remarks. The species differs from *Saccammina lathrami* Tappan in possessing a more strongly inflated test than the latter (despite crushing), suggesting a more truly agglutinated rather than pseudochitinous wall structure. The texture of the wall is also more coarsely agglutinated.

Occurrence. *Saccammina* sp. A occurs in small numbers throughout the lower member.

Saccammina sp. B

Plate 1, figure 11

1976 *Saccammina* sp. cf. *S. franconica* Ziegler; Souaya, p. 264, Pl. 7, fig. 6.

Material. Single specimen; figured specimen GSC 57094 from GSC loc. C-051401, 171.5 m above the base of the lower member.

Description. Test large, globose, strongly centrally inflated, periphery rounded; consisting of single globular chamber; wall coarsely arenaceous, consisting of unsorted quartz grains set in considerable cement, roughly finished; aperture obscure.

Dimensions (mm).

GSC Specimen No.	Length	Width	Thickness
57094	0.75	0.70	0.60

Remarks. *Saccammina* sp. B is readily distinguished by its large, globose, coarsely agglutinated test.

Occurrence. *Saccamina* sp. B was found in a single sample in the upper part of the lower member.

Genus *Lagenamma* Rhumbler, 1911

Type species. *Lagenamma laguncula* (original description).

Diagnosis. Test single, flask-shaped chamber; wall with pseudochitinous inner layer, densely covered with agglutinated material; aperture terminal, produced on neck.

Lagenamma sp. A

Plate 1, figures 3, 4

Material. Single specimen; figured specimen GSC 57086 from GSC loc. C-051398, 167 m above base of lower member.

Description. Test medium sized, compressed, flask-shaped, consisting of single undivided chamber, narrow at base, then flaring through 75 per cent of test, tapering markedly toward aperture; wall very finely arenaceous with much cement, smoothly finished, whitish to pale grey; aperture simple, terminal, rounded, at end of pronounced neck.

Dimensions (mm).

GSC Specimen No.	Length	Width	Thickness
57086	0.90	0.35	0.23

Remarks. This species has been tentatively assigned to *Lagenamma* as it does not adequately satisfy the definition of *Saccamina*. The wall may be partly pseudochitinous, as it is very susceptible to deformation. Badly distorted and/or ruptured specimens currently assigned to *Saccamina lathrami* Tappan may actually be specimens of *Lagenamma*.

Occurrence. *Lagenamma* sp. occurs in a single sample in the upper part of the lower member.

Family AMMODISCIDAE Reuss, 1862

Subfamily AMMODISCINAE Reuss, 1862

Genus *Ammodiscus* Reuss, 1862

Type species. *Ammodiscus infimus* Bornemann, 1874.

Diagnosis. Test free, discoidal, proloculus followed by undivided, planispirally coiled tubular chamber, which may show transverse growth constrictions but no internal partitions; wall agglutinated, aperture at open end of tube.

Ammodiscus cheradospirus Loeblich and Tappan

Plate 2, figures 1-4

1950 *Ammodiscus cheradospirus* Loeblich and Tappan, p. 6, Pl. 1, figs. 1, 2.

1955 *Involutina cheradospira* (Loeblich and Tappan); Tappan, p. 38, Pl. 8, fig. 9.

?1960 *Involutina cheradospira* (Loeblich and Tappan); Wall, p. 44, Pl. 2, figs. 1-3.

1962 *Ammodiscus cheradospirus* Loeblich and Tappan; Weihmann, Pl. 9, fig. 13.

?1972 *Ammodiscus cheradospirus* Loeblich and Tappan; Brooke and Braun, Pl. 8, figs. 4-7.

1976 *Ammodiscus* sp. cf. *cheradospirus* Loeblich and Tappan; Souaya, p. 264, Pl. 5, fig. 9; Pl. 6, fig. 19.

1980 *Ammodiscus cheradospirus* Loeblich and Tappan; Løfaldli and Nagy, p. 75, Pl. 1, figs. 1-3.

1981 *Ammodiscus cheradospirus* Loeblich and Tappan; Brooke and Braun, p. 11, Pl. 1, figs. 6-9.

1982 *Ammodiscus* sp. cf. *cheradospirus* Loeblich and Tappan; Leskiw in Poulton et al., Pl. 5, fig. 3.

1983 *Ammodiscus* sp. cf. *cheradospirus* Loeblich and Tappan; Wall, Pl. 2, fig. 6.

Material. About 50 well preserved specimens; unfigured hypotype GSC 57107 and figured hypotypes GSC 57108, 57109 from GSC loc. C-051317, 21 m above base of lower member; unfigured hypotypes GSC 57110, 57111 from GSC loc. C-051318, 22.5 m above base.

Description. Test medium sized, planispirally coiled, compressed, periphery generally rounded; consisting of proloculus and long, undivided, tubular second chamber, which increases in diameter fairly rapidly with each succeeding volution; about five to seven whorls in adult specimens; spiral suture distinct, very slightly depressed; wall finely arenaceous (with a few coarser grains) with considerable cement, fairly smoothly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 57107	0.85	0.13	0.95
Hypotype 57108	0.83	0.18	1.05
Hypotype 57109	1.10	0.20	1.58
Hypotype 57110	0.78	0.13	0.90
Hypotype 57111	0.60	0.11	0.65

Remarks. Specimens from the lower member exhibit considerable variation in size, ranging from 0.65 to 1.50 mm in maximum diameter. *Ammodiscus cheradospirus* differs from *A. richardsonensis* n. sp. in possessing a smaller, more compressed, and thinner-walled test.

Two somewhat divergent interpretations of *Ammodiscus cheradospirus* have emerged in the North American literature. As interpreted by Wall (1960) and Brooke and Braun (1972), *A. cheradospirus* possesses a rather coarsely agglutinated wall bound with a small amount of cement. This results in a roughened exterior finish. In addition, these authors have included in the taxon specimens ranging up to two millimetres in diameter. Loeblich and Tappan (1950b), Tappan (1955), Souaya (1976), Løfaldli and Nagy (1980), Brooke and Braun (1981), Leskiw (*in Poulton et al.*, 1982), and Wall (1983) show a somewhat different form, in which the wall is finely agglutinated and fairly smoothly finished. Both variants of *A. cheradospirus* coexist within the lower member at Martin Creek. The "rough-walled" variants are assigned to *A. sp. cf. A. cheradospirus*.

Occurrence. *Ammodiscus cheradospirus* occurs in small numbers in the lower half of the lower member at Martin Creek.

Ammodiscus orbis Lalicker

Plate 1, figures 25–30

- 1950 *Ammodiscus orbis* Lalicker, p. 11, Pl. 1, fig. 2.
 1955 *Involutina orbis* (Lalicker); Tappan, p. 39, Pl. 8, fig. 14.

- 1972 *Ammodiscus uglicus uglicus* Ehremeeva *in* Dain et al., p. 35, Pl. V, figs. 1–5.
 1972 *Ammodiscus uglicus ehremeevae* Dain *in* Dain et al., p. 34, Pl. V, figs. 6–8, 10, 11.
 ?1976 *Ammodiscus orbis* Lalicker; Souaya, p. 264, Pl. 7, fig. 3.
 1981 *Ammodiscus cf. A. orbis* Lalicker; Brooke and Braun, p. 12, Pl. 1, figs. 10, 11.
 1982 *Ammodiscus sp. cf. A. orbis* Lalicker; Leskiw *in* Poulton et al., Pl. 5, fig. 6.
 1983 *Ammodiscus sp. cf. A. orbis* Lalicker; Wall, Pl. 4, fig. 1.

Material. Fairly common, generally well preserved; figured hypotype GSC 57095 from GSC loc. C-051337, 51 m above base of lower member; figured hypotypes 57096, 57097 and unfigured hypotypes GSC 57098, 57099 from GSC loc. C-051342, 58.5 m above base of lower member.

Description. Test medium sized, discoidal, planispirally coiled, rounded in outline, flattened; consisting of proloculus followed by long, undivided tubular second chamber that increases very gradually in diameter with each succeeding volution; about five to seven whorls in adult specimens; sutures distinct, slightly thickened, slightly to not depressed; wall very finely arenaceous, composed of fairly equant, microgranular quartz grains with abundant cement, fairly smoothly finished; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter	Thickness
Hypotype 57095	0.50	0.075
Hypotype 57096	0.60	0.075
Hypotype 57097	0.58	0.100
Hypotype 57098	0.50	0.063
Hypotype 57099	0.38	0.075

Remarks. The Husky specimens of *Ammodiscus orbis* are slightly larger than those figured by Lalicker and possess one to one and a half volutions more in the adult stage. *Ammodiscus uglicus uglicus* Ehremeeva and *A. uglicus ehremeevae* Dain are both very similar in size and design to *A. orbis*, and are herein considered junior synonyms of *A. orbis*.

Occurrence. *Ammodiscus orbis* occurs in small numbers in the basal part of the lower member.

Ammodiscus sp. cf. *A. cheradospirus*
Loeblich and Tappan

Plate 2, figures 5-7

?1950 *Ammodiscus cheradospirus* Loeblich and Tappan, p. 6, Pl. 1, figs. 1, 2.

1960 *Involutina cheradospira* (Loeblich and Tappan); Wall, p. 44, Pl. 2, figs. 1-3.

1972 *Ammodiscus cheradospirus* Loeblich and Tappan; Brooke and Braun, Pl. 8, figs. 4-7.

Material. Rare; unfigured specimen GSC 57112 and figured specimen GSC 57113 from GSC loc. C-051409, 191 m above base of lower member; figured specimen GSC 57114 from GSC loc. C-051410, 194 m above base.

Description. Test large, planispirally coiled, compressed, periphery generally rounded; consisting of proloculus followed by long, undivided tubular second chamber that increases in diameter fairly gradually with each successive volution, about five whorls in the adult form; spiral suture distinct, slightly depressed; wall fairly coarsely agglutinated, composed of medium to coarse silt-sized quartz grains with considerable cement, roughly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height	WT
57112	0.55	0.130	0.78	0.050
57113	0.55	0.088	0.55	0.063
57114	1.23	0.230	1.38	0.063

WT, wall thickness.

Remarks. The Husky forms of *Ammodiscus* sp. cf. *A. cheradospirus* are more coarsely agglutinated than comparable material from the Jurassic of Saskatchewan (Wall, 1960; Brooke and Braun, 1972), but are too few in number for a new taxon to be established.

Occurrence. *Ammodiscus* sp. cf. *A. cheradospirus* occurs in small numbers near the top of the lower member at Martin Creek.

Ammodiscus sp. cf. *A. francisi* (Wall)

Plate 1, figures 12-18

?1960 *Involutina francisi* Wall, p. 45, Pl. 1, figs. 1, 2.

?1972 *Ammodiscus francisi* (Wall); Brooke and Braun, Pl. 8, figs. 8-10.

Material. Common, generally well preserved; figured specimens GSC 57115, 57116, 57118, 57120 and unfigured specimens 57117, 57119 from GSC loc. C-051326, 36 m above base of lower member.

Description. Test small, discoidal, flattened; rounded to slightly ovate in outline, consisting of proloculus (megalospheric proloculus is ovate in outline, up to 0.05 mm in diameter, and may occupy up to 35% of test) and long, planispirally coiled tubular second chamber of five to six volutions (microspheric) or three to five volutions (megalospheric); tube increases rapidly in diameter with growth, such that in the ultimate whorl the tube may be twice as thick as in the initial whorl; test initially closely coiled but with coiling becoming somewhat irregular by the ultimate whorl and commonly deviating from the plane of coiling; spiral suture distinct, slightly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter	Thickness
57115	0.22	0.050
57116	0.18	0.050
57117	0.20	0.028
57118	0.20	0.038
57119	0.18	0.043
57120	0.18	0.038

Remarks. *Ammodiscus francisi* (Wall) was first described from the Middle Jurassic (Bathonian and Bajocian) of southern Saskatchewan. *Ammodiscus* sp. cf. *A. francisi* is of comparable size and general shape to the latter but possesses more whorls (five to six compared to four to five) and somewhat more irregular coiling in the ultimate whorl. One microspheric and two megalospheric variants have been recognized. The former outnumber the latter by approximately 2:1.

Occurrence. *Ammodiscus* sp. cf. *A. francisi* occurs commonly in the basal 50 m of the lower member.

Ammodiscus sp. cf. *A. orbis* Lalicker

Plate 1, figures 19-24

?1950 *Ammodiscus orbis* Lalicker, p. 11, Pl. 1, fig. 2.

1960 *Involutina* sp. cf. *I. orbis* (Lalicker); Wall, p. 46, Pl. 1, figs. 3-6.

1972 *Ammodiscus* cf. *orbis* Lalicker; Brooke and Braun, Pl. 8, figs. 11-13.

Material. Abundant, several hundred generally well preserved tests; unfigured specimen GSC 57100 and figured specimens GSC 57101-57104 from GSC loc. C-051309, 7.5 m above base of lower member; unfigured specimens GSC 57105, 57106 from GSC loc. C-051324, 33 m above base.

Description. Test small, discoidal, flattened, planispirally coiled, rounded to slightly ovate in outline; consisting of proloculus (spherical if megalospheric) and long, tubular second chamber; test consists of six to seven volutions in adult specimens; tube increases very slowly and regularly in diameter throughout growth of test; sutures distinct, spiral, not depressed; wall very finely arenaceous with much cement, smoothly finished; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter	Thickness
57100	0.19	0.039
57101	0.23	0.028
57102	0.21	0.043
57103	0.19	0.032
57104	0.19	0.043
57105	0.17	0.043
57106 (j)	0.13	0.028

j, juvenile.

Remarks. *Ammodiscus* sp. cf. *A. orbis* differs from *A. orbis* sensu stricto in being about one third of the size of the latter. It is identical in size and test design to the form illustrated by Wall (1960) from the Callovian (Middle Jurassic) of southern Saskatchewan.

Occurrence. *Ammodiscus* sp. cf. *A. orbis* occurs throughout the lower member at Martin Creek.

Ammodiscus richardsonensis n. sp.

Plate 2, figures 8-12; Plate 3, figure 1

?1953 *Involutina silicea* (Terquem); Loeblich and Tappan, p. 310, fig. 2.

non 1955 *Involutina silicea* (Terquem); Tappan, p. 39, Pl. 9, figs. 1-4.

1976 *Ammodiscus* sp. cf. *A. siliceus* Terquem; Souaya, p. 264, Pl. 5, fig. 15; non Pl. 12, fig. 13.

Material. About 50 specimens in adequate state of preservation, although the tests are commonly fragmented and moderately to strongly deformed. Holotype GSC 57122, paratype GSC 57123, and unfigured paratype GSC 57124 from GSC loc. C-051311, 12 m above base of lower member; unfigured paratype GSC 57125 from GSC loc. C-051312, 13.5 m above base; paratype GSC 57126 and unfigured paratype GSC 57127 from GSC loc. C-029106, 0.0-1.5 m above base.

Description. Test large, robust, discoidal, planispirally coiled, periphery rounded, test slightly biconcave; consisting of proloculus (commonly obscured) followed by long, undivided tubular second chamber that increases rather rapidly in diameter with each succeeding volution, such that the diameter of the tube in the ultimate whorl may be three to four times that in the initial whorl; commonly six to seven whorls in the adult test; some specimens exhibit irregular constrictions of the tube at (?) random intervals, but no septa are present; spiral suture distinct, strongly depressed; wall very finely agglutinated with much cement, very smoothly finished, such that some tests appear almost porcelaneous; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Thickness	Height	TD ¹	TD ²	WT
Holotype 57122	0.63	3.52	—	—	—
Paratype 57123	0.30	2.38	0.075	0.313	0.063
Paratype 57124	0.28	2.50	0.150	0.350	0.063
Paratype 57125	0.29	2.63	0.063	0.325	0.075
Paratype 57126	0.28	1.73	—	—	—
Paratype 57127	0.33	1.38	—	—	—

TD¹, tube thickness in initial whorl; TD², tube thickness in ultimate whorl; WT, wall thickness.

Remarks. *Ammodiscus richardsonensis* n. sp. was originally referred to *A. siliceus* Terquem as figured by Tappan (1955) from the early Jurassic of the North Slope of Alaska. Examination of some of Tappan's

type material (hypotype P158 illustrated in Pl. 9, figs. 1a, b and hypotype P162 illustrated in Pl. 9, fig. 3) showed that her forms are, in reality, much smaller and more coarsely agglutinated than the Husky species. The sutures are flush and quite indistinct, and the tube increases in diameter much more slowly. Comparison of the Husky material with *A. siliceous* Terquem as figured by Bizon (1960) from the Lias of the Paris Basin (Terquem's type material) and by Barnard (1959) from the Lias of England shows that the Husky form is much larger and more finely agglutinated.

Ammodiscus richardsonensis n. sp. differs from *A. cherospirus* Loeblich and Tappan in being much larger, possessing a more rapidly expanding tube and having a much finer, more siliceous wall. *Ammodiscus thomsi* Chamney, although of a comparable or even larger size is thinner and has a more gradually expanding tube. *Ammodiscus veteranus* Kosyрева from the Volgian of western Siberia has a similar overall appearance but is considerably smaller.

The deformation that commonly affects all the specimens is probably a result of their large size and wall composition, which could be partly pseudo-chitinous.

Etymology. Named after the Richardson Mountains of northern Yukon and northwestern District of Mackenzie, Northwest Territories.

Occurrence. *Ammodiscus richardsonensis* n. sp. occurs in small numbers in the basal 20 m of the lower member.

Genus *Arenoturrspirillina* Tairov, 1956

Type species. *Arenoturrspirillina aptica* Tairov and Kuznetsova.

Diagnosis. Test conical, similar in plan to *Ammodiscus*, but with regular trochospiral coil, as in the early stage of *Ammodiscoides*, evolute and not close-coiled or high-spired as in *Turritellella*; aperture at open end of tube.

Remarks. This genus appears to have been restricted to the Boreal faunal realm during the Late Jurassic–Early Cretaceous.

Arenoturrspirillina waltoni Chamney

Plate 3, figures 2–6

1971 *Arenoturrspirillina waltoni* Chamney, p. 104, Pl. 17, fig. 7; Pl. 18, fig. 1.
 non 1976 *Arenoturrspirillina waltoni?* Chamney; Souaya, p. 265, Pl. 7, fig. 5.

Material. About 15 specimens in fair to adequate state of preservation. Figured hypotype GSC 57128 from GSC loc. C-051336, 49.5 m above base of lower member; figured hypotype GSC 57129 from GSC loc. C-051337, 51 m above base; figured hypotype GSC 57130 and unfigured hypotype GSC 57131 from GSC loc. C-051338, 52.5 m above base.

Description. Test medium sized, conical, similar in plan view to *Ammodiscus* but with regular trochospiral coiling, periphery rounded; consisting of proloculus followed by long, tubular second chamber, which increases gradually in diameter with growth, about five whorls in adult specimens, the initial three of which are sharply conical, the remaining two coils much less so; sutures indistinct, slightly depressed; wall very finely arenaceous with considerable cement, smoothly finished and quite translucent; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Hypotype 57128	1.40	1.08	0.63
Hypotype 57129*	1.13	0.89	0.48
Hypotype 57130*	1.80	—	1.13
Hypotype 57131	0.93	0.63	0.55

*crushed specimen.

Remarks. *Arenoturrspirillina waltoni* Chamney is the only representative of this genus *sensu stricto* found in the lower member at Martin Creek.

Occurrence. *Arenoturrspirillina waltoni* occurs rarely in the Oxfordian part of the lower member.

“*Arenoturrspirillina*” *intermedia* Chamney

Plate 3, figures 7–10

1971 *Arenoturrspirillina intermedia* Chamney, p. 105, Pl. 18, figs. 3, 5, non fig. 4.

Material. Rare; figured hypotypes GSC 57133, 57134 from GSC loc. C-051413, 203 m above base of lower member; unfigured hypotypes GSC 57135, 57136 from GSC loc. C-057411, 197 m above base.

Description. Test free in mature stage; medium sized, conical in shape, periphery rounded, consisting of proloculus attached to an isolated detrital grain, followed by long, undivided tubular second chamber arranged in a regular trochospiral coil; five to six whorls in adult specimens, whorls not strongly overlapping; tube increases very gradually in size with growth; sutures indistinct, not depressed; wall very finely arenaceous with much cement, smoothly finished; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height	TD
Hypotype 57133	1.05	0.84	0.48	0.10
Hypotype 57134	1.05	—	0.55	0.14
Hypotype 57135	0.58	0.45	0.43	0.14
Hypotype 57136	1.00	0.63	0.63	0.11

TD, tube diameter.

Remarks. “*Arenoturrspirillina*” *intermedia* differs from the genus *Arenoturrspirillina sensu stricto* in having the proloculus attached to a detrital sand grain. Chamney (1971) in remarking on certain specimens of *A. intermedia* noted that the species had a “secondary quartz grain” obscuring the proloculus. Yet his illustrations (ibid., Pl. 18A, B, figs. 5a–c) clearly indicate that the initial whorls of the tube wrap around the sand grain such that it is impossible for the quartz grain to be “secondary”. Thus, although these forms are *Arenoturrspirillina*-like in general test architecture, the juveniles are quite different. The relationship is akin to that of *Tolypamma* and *Saturnella* described below. The quality of the material recovered from the lower member precludes the erection of a new genus at present.

Occurrence. “*Arenoturrspirillina*” *intermedia* occurs rarely in the uppermost 20 m of the lower member at Martin Creek.

Genus *Glomospira* Rzehak, 1885

Type species. *Trochammina squamata* Jones and Parker var. *gordialis* Jones and Parker, 1860.

Diagnosis. Test similar to *Ammodiscus*, but coiling is streptospiral or irregular; aperture at end of open tube.

Glomospira glomerosa Eicher

Plate 4, figures 1–6

1960 *Glomospira glomerosa* Eicher, p. 56, Pl. 3, fig. 6.

1976 *Glomospira regularis* Scherp *hemisphaerica?* Scherp; Souaya, p. 265, Pl. 11, fig. 2.

Material. Several hundred well preserved specimens; figured hypotypes GSC 57137, 57139, and 57143 and unfigured hypotypes GSC 57138, 57140–57142 from GSC loc. C-051307, 6 m above base of lower member.

Description. Test tiny, equidimensional; consisting of proloculus (not observed) followed by irregularly, spirally wound, slowly expanding tubular second chamber; initial two to three whorls tightly coiled in one plane with remaining coils wandering randomly over entire test; suture distinct, slightly depressed; wall very finely agglutinated with much cement, smoothly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Length	Width	Height	TD
Hypotype 57137	0.15	0.13	0.08	0.025
Hypotype 57138	0.11	0.11	0.08	0.025
Hypotype 57139	0.10	0.10	0.08	0.018
Hypotype 57140	0.16	0.15	0.11	0.031
Hypotype 57141	0.13	0.10	0.08	0.031
Hypotype 57142	0.13	0.13	0.10	0.037
Hypotype 57143	0.10	0.10	0.08	0.018

TD, tube diameter.

Remarks. Eicher (1960) first described *Glomospira glomerosa* from the Shell Creek Shale (upper Albian) of Wyoming. The Husky specimens are of (?early to mid-Oxfordian age, and no similar forms have been

recorded in the literature that bridge the intervening time gap. *Glomospira glomerosa* coexists in assemblages that also contain *G. tortuosa* Eicher, another form also known from the upper Albian of Wyoming. It is possible that the Husky forms are homeomorphs of the Shell Creek forms, and evolved under similar environmental conditions.

Glomospira glomerosa closely resembles (in its initial stages) *G. pattoni* Tappan, but is much smaller, being 25 to 50 per cent of the size of the latter, and with more irregular coiling in the later portion. *Glomospira perplexa* Franke (see Tappan, 1955) also closely resembles the early stages of *G. glomerosa*, but is much larger. *Glomospira glomerosa* differs from *G. tortuosa* Eicher in possessing a more regularly coiled early portion, and a more gradually expanding tube.

Occurrence. *Glomospira glomerosa* is common in the basal 25 m of the lower member.

Glomospira tortuosa Eicher

Plate 4, figures 9-14

1960 *Glomospira tortuosa* Eicher, p. 57, Pl. 3, fig. 8.

Material. Common, generally well preserved; figured hypotypes GSC 57144, 57146, and 57149 and unfigured hypotypes GSC 57145, 57147, 57148, and 57150 from GSC loc. C-051307, 6 m above base of lower member.

Description. Test tiny, globular to ovoid in outline, periphery rounded; consisting of proloculus (not observed) and irregularly wound tubular second chamber that increases in diameter rather rapidly with growth of test; sutures distinct, moderately depressed; wall very finely arenaceous with much cement, smoothly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Length	Width	Height	TD
Hypotype 57144	0.16	0.13	0.15	0.063
Hypotype 57145	0.18	0.16	0.13	0.043
Hypotype 57146	0.15	0.13	0.11	0.050
Hypotype 57147	0.13	0.11	0.11	0.050

Hypotype 57148	0.15	0.10	0.13	0.038
Hypotype 57149	0.15	0.13	0.14	0.043

TD, tube diameter.

Remarks. Eicher (1960) first described *Glomospira tortuosa* from the upper Lower Cretaceous (upper Albian) of the Bighorn Basin of Wyoming. The form differs from all other illustrated species of *Glomospira* by virtue of its tiny size and highly irregular mode of coiling.

Occurrence. *Glomospira tortuosa* shares the same vertical range within the lower member as *G. glomerosa* Eicher.

Glomospira? sp. A

Plate 4, figures 21-23

Material. Rare; figured specimens GSC 57151, 57154 and unfigured specimens GSC 57152, 57153 from GSC loc. C-051413, 203 m above base of lower member.

Description. Test small, consisting of spherical proloculus followed by long, undivided tubular second chamber that expands slowly with growth of test; initially loosely planispirally coiled (three to four whorls), later tube tends to wander at random over surface of test; sutures distinct, fine, strongly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture formed by open end of tube.

Dimensions (mm).

GSC Specimen No.	Length	Width	Height	TD
57151	0.28	0.25	0.11	0.075
57152	0.23	0.20	0.18	0.075
57153	0.25	0.20	0.16	0.050
57154	0.38	0.34	0.14	0.075

TD, tube diameter.

Remarks. *Glomospira?* sp. A includes a wide variety of morphologies varying between *Glomospira sensu stricto* and *Ammodiscus* (figured specimen GSC 57154). All the forms are characterized by irregularity in coiling in the final few whorls of the test.

Occurrence. *Glomospira?* sp. A occurs rarely in a single sample near the top of the lower member.

Genus *Turritellella* Rhumbler, 1904

Type species. *Trochammina shoneana* Siddall, 1878.

Diagnosis. Test free, elongate, high spired; proloculus followed by long, undivided tubular, close-coiled second chamber, wall finely agglutinated, aperture at open end of tube.

Turritellella giffordi n. sp.

Plate 4, figures 19, 20

Material. Rare; holotype GSC 57159, paratype GSC 57161 and unfigured paratypes GSC 57158, 57160 from GSC loc. C-051326, 36 m above base of lower member.

Description. Test tiny, elongate, high spired; consisting of proloculus followed by undivided, close-coiled, tubular second chamber, peripheral margins of test slightly to moderately lobate; spiral suture distinct, fine, rather strongly depressed, running obliquely (20°–30°) to the horizontal; wall very finely arenaceous with much cement, smoothly finished; aperture formed by open end of tube, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Height	Width	TD
Holotype 57158*	>0.28	0.08	0.04
Paratype 57159*	>0.28	0.06	0.04
Paratype 57160*	>0.23	0.06	0.04
Paratype 57161*	>0.18	0.05	0.03

TD, tube diameter; *broken specimen.

Remarks. *Turritellella giffordi* n. sp. differs from *T. parva* in possessing a thicker tube that coils at a more oblique angle to the horizontal.

Etymology. Named after Mount Gifford, a peak in the Aklavik Range of northern Richardson Mountains, Northwest Territories.

Occurrence. *Turritellella giffordi* n. sp. occurs in small numbers in a single sample 36 m above the base of the lower member.

Turritellella parva n. sp.

Plate 4, figures 17, 18

1960 *Bulbobaculites*(?) sp. Wall, p. 56, Pl. 17, fig. 10.

Material. Rare, four specimens in adequate state of preservation; holotype GSC 57155 and figured paratype GSC 57157, and unfigured paratype GSC 57156 from GSC loc. C-051322, 28.5 m above base of lower member.

Description. Test tiny, elongate, high spired; consisting of proloculus followed by undivided, close-coiled tubular second chamber; margins of test are slightly lobate; spiral suture distinct, slightly depressed, running slightly oblique to the horizontal; wall very finely arenaceous with much cement, smoothly finished; aperture at open end of tube, commonly obscure due to poor preservation.

Dimensions (mm).

GSC Specimen No.	Length	Width	TD
Holotype 57155	0.29	0.08	0.021–0.029
Paratype 57156	0.24	0.06	—
Paratype 57157	0.20	0.06	—

TD, tube diameter.

Remarks. *Turritellella parva* n. sp. closely resembles the form that Wall (1960) described as *Bulbobaculites*(?) sp. from the Upper member of the Vanguard Formation in Saskatchewan. None of the Husky specimens exhibit the trochospirally coiled initial portion that is characteristic of the genus *Bulbobaculites*. Wall noted, however, that his species was only tentatively assigned to the genus *Bulbobaculites* because some of his forms "...show no evidence of divisions into chambers in the early portion, which would suggest possible closer affinity to the genus *Turritellella* Rhumbler." It is possible that the two forms are conspecific.

Etymology. From the Latin, *parvus*, meaning rather small.

Occurrence. *Turritellella parva* n. sp. occurs in small numbers in a single sample located 28.5 m above the base of the lower member.

Subfamily TOLYPAMMININAE Cushman, 1928

Genus *Lituotuba* Rhumbler, 1895

Type species. *Serpula filum* Schmid, 1867.

Diagnosis. Test free or attached, early stage irregularly coiling undivided tube as in *Glomospira*; later stage uncoiling, becoming rectilinear; aperture at open end of tube.

Lituotuba? sp.

Plate 4, figures 7, 8, 15, 16

?1955 *Lituotuba irregularis* Tappan, p. 41, Pl. 9, fig. 8, non figs. 5-7, 9.

1976 *Ammovertella?* sp. A Souaya, p. 256, Pl. 11, fig. 5.

Material. Rare; figured specimens GSC 57158, 57179 and unfigured specimen GSC 57177 from GSC loc. C-051306, 4.5 m above base of lower member; unfigured specimens GSC 57174-57176 from GSC loc. C-051307, 6 m above base.

Description. Test tiny, consisting of proloculus and long, undivided, tubular second chamber that coils in an irregular manner around the test, very rarely in latter stages of growth the tube detaches from the test proper and trends toward rectilinearity; sutures distinct, depressed; wall very finely arenaceous with much cement, smoothly finished; aperture at open end of tube, commonly obscured.

Dimensions (mm).

GSC Specimen	Length	Width	Thickness	TD
57174	0.18	0.15	0.09	0.05
57175	0.18	0.14	0.11	0.04
57176	0.15	0.11	0.09	0.03
57177	0.18	0.13	0.09	0.05
57178	0.13	0.13	0.10	0.04
57179	0.18	0.14	0.08	0.03

TD, tube diameter.

Remarks. This species cannot be assigned with certainty to the genus *Lituotuba* as it lacks the well developed rectilinear portion that is diagnostic of the latter. *Lituotuba?* sp. closely resembles at least some of the specimens Tappan assigned to *L. irregularis* from the north slope of Alaska.

Occurrence. *Lituotuba?* sp. occurs in modest numbers in the basal beds of the lower member.

Genus *Saturnella* n. gen.

Type species. *Saturnella brookeae* n. sp.

Diagnosis. Test attached to free or isolated detrital particle (sand grain or another foraminiferal test), medium sized, consisting of proloculus followed by undivided tubular second chamber; initial few whorls coil irregularly on attachment surface; later portion becoming planispiral as in *Ammodiscus*; aperture at open end of tube.

Remarks. *Saturnella* n. gen. differs from *Tolypammina sensu stricto* in being attached to a free detrital grain rather than to a stable surface. The genus may be most closely compared to *Tolypammina sensu* Kosyreva (in Dain et al., 1972). However, in Kosyreva's species the tube trends irregularly over the face of the detrital grain and never attains the distinctive planispiral mode of coiling present in *Saturnella*. A similar pairing of genera occurs within Husky representatives of the genus *Arenoturrispirillina* Tairov, where the proloculus of certain species is clearly attached to a mobile detrital grain.

Etymology. The genus is named for its close resemblance to the planet Saturn.

Range. Late Jurassic, northern Northwest Territories (District of Mackenzie), northeastern British Columbia and the Canadian Arctic Archipelago.

Saturnella brookeae n. gen. and sp.

Plate 4, figures 24-31, 34-38

non 1981 *Glomospirella* sp. 174 Brooke and Braun; p. 13, Pl. 1, figs. 22-27.

1983 *Glomospirella* sp. 174 Brooke and Braun; Wall, Pl. 3, figs. 27-29.

Material. Abundant, several hundred well preserved tests; holotype GSC 57162, figured paratypes GSC 57165, 57168 and unfigured paratypes GSC 57163, 57164, 57166, 57167 from GSC loc. C-051337, 125 m above base of lower member; paratypes GSC 58504, 58505 from GSC loc. C-051311, 12 m above base.

Description. Test initially attached to free detrital particle (usually quartz grain, less commonly another foraminiferal test), medium sized; consisting of proloculus followed by long, undivided tubular second chamber, in first few whorls the tube may wander over the surface of attachment in irregular fashion, but after one or two volutions assumes a planispiral or nearly planispiral mode of coiling as in *Ammodiscus*; sutures distinct, slightly depressed; wall very finely arenaceous with considerable cement, fairly smoothly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	TD	WT
Holotype 57162	0.57	0.11	—
Paratype 57163	0.66	0.13	—
Paratype 57164	0.91	0.12	—
Paratype 57165	0.51	0.12	—
Paratype 57166	0.80	0.12	0.03
Paratype 57167	0.65	0.12	—
Paratype 57168 (j)	0.42	0.08	—
Paratype 58504	0.67	0.18	—
Paratype 58505 (j)	0.57	0.13	—

TD, tube diameter; WT, wall thickness; j, juvenile specimen.

Remarks. The preferred surface of attachment is almost invariably a detrital quartz grain in the medium-sized sand range (average diameter from 125 measurements is 0.25 mm). The grains are subangular to subrounded. Note that paratype GSC 58505 (Pl. 4, figs. 34–36) is attached to a foraminiferal test belonging to the genus *Labrospira*. *Saturnella brookeae* differs from *Glomospirella* sp. 174 of Brooke and Braun (1981) in that the initial attached portion has fewer whorls wrapped around the surface of attachment. It is conspecific with Wall's (1983) interpretation of *Glomospirella* sp. 174 Brooke and Braun.

Etymology. The patronym honours Dr. Margaret Brooke for her contributions to Jurassic foraminiferal biostratigraphy.

Occurrence. *Saturnella brookeae* occurs most commonly in the middle (Kimmeridgian) part of the lower member at Martin Creek, although a few specimens have also been recovered from mid-Oxfordian beds.

Saturnella sp. A

Plate 4, figures 32, 33, 39–43

Material. Twenty specimens in adequate state of preservation; figured specimens GSC 57169, 57172, 57173 and unfigured specimens GSC 57170, 57171 from GSC loc. C-051409, 191 m above base of lower member.

Description. Test attached to a detrital grain in juvenile portion; medium sized; initial portion irregularly coiled on surface of attachment, becoming planispirally coiled in later portion, periphery rounded to somewhat ovate; consisting of proloculus and long, undivided tubular second chamber that enlarges in diameter fairly rapidly with growth; about three to four whorls present in adult specimens; sutures distinct, moderately depressed; wall very finely arenaceous with much cement, smoothly finished; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	TD
57169	1.05	0.68	0.14–0.15
57170	0.70	0.60	0.13
57171	0.80	0.73	0.10–0.11
57172	0.70	0.58	0.10
57173 (j)	0.43	0.43	0.08–0.09

TD, tube diameter; j, juvenile specimen.

Remarks. *Saturnella* sp. A differs from *S. brookeae* n. sp. in having a much thicker tube for a comparable test diameter, having fewer whorls in the adult form, and possessing finer, more strongly impressed sutures.

Occurrence. *Saturnella* sp. A occurs in small numbers in the upper beds of the lower member.

Superfamily LITUOLACEA de Blainville, 1825

Family HORMOSINIDAE Haeckel, 1894

Subfamily HORMOSININAE Haeckel, 1894

Genus *Reophax* Montfort, 1808

Type species. Reophax scorpiurus Montfort, 1808.

Diagnosis. Test free, elongate, nearly straight or arcuate; chambers few, increasing in size as added; sutures nearly horizontal, obscure to moderately constricted; wall agglutinated with comparatively little cement; surface rough; aperture terminal, rounded, at end of distinct tubular neck.

Reophax metensis Franke

Plate 5, figures 4-7

1936 *Reophax metensis* Franke, p. 19, Pl. 1, figs. 17a, b.

1937 *Reophax metensis* Franke; Bartenstein and Brand, p. 133, Pl. 10, fig. 8; Pl. 13, figs. 1a, b, 4.

1955 *Reophax metensis* Franke; Tappan, p. 36, Pl. 7, figs. 11-14.

non 1976 *Reophax metensis* Franke; Souaya, p. 266, Pl. 5, fig. 4.

1989 *Reophax metensis* Franke; Nagy and Johansen, p. 343, figs. 5A-C, 6A-H; Pl. 1, figs. 1-25; Pl. 2, figs. 1-15.

Material. Abundant; hypotypes GSC 57184, 57185 from GSC loc. C-051326, 36 m above base of lower member; hypotype GSC 57186 and unfigured hypotypes 57187, 57188 from GSC loc. C-051325, 34.5 m above base; unfigured hypotype GSC 57189 from GSC loc. C-051309, 9 m above base.

Description. Test large, elongate; consisting of two to three large, rounded chambers in a straight to slightly curved uniserial arrangement; chambers strongly centrally inflated, increasing rapidly in size as added, ultimate chamber globular to pyriform in shape, wider at base than at top, occupies 50 to 67 per cent of entire test; sutures distinct, strongly constricted; wall composed of coarse quartz grains set within and surrounded by finer matrix and siliceous cement, with a few grains sticking out of the matrix; aperture terminal, central or slightly eccentric, rounded, commonly produced on elongate neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Hypotype 57184	0.65	0.33	1.05

Hypotype 57185	0.53	0.28	0.88
Hypotype 57186	0.43	0.23	0.85
Hypotype 57187	0.40	0.25	0.68
Hypotype 57188	0.30	0.20	0.63
Hypotype 57189	0.63	0.38	1.00

Remarks. *Reophax metensis* from the lower member of the Husky Formation closely resembles the forms described by Tappan (1955) from the north slope of Alaska. It is also possible that Tappan's (op. cit.) *R. liassica* Franke may be a microspheric heteromorph of *R. metensis*.

Reophax metensis differs from *R. sp. A* in having a wall composed of essentially equant quartz grains set within the cement and matrix, whereas the latter has a wall composed of medium to coarse grains lightly imbedded in the cement. The ultimate chamber of *R. metensis* is also much more inflated and the neck is more elongate.

Occurrence. *Reophax metensis* occurs erratically throughout the studied section.

Reophax sp. cf. R. adaptatus Dain

Plate 5, figures 8-12

?1972 *Reophax adaptatus* Dain et al., p. 43, Pl. VI, figs. 3-5, non figs. 6, 7.

1976 *Reophax sp. cf. R. metensis* Franke; Souaya, p. 266, Pl. 5, fig. 4.

1983 *Reophax sp.* 5 Wall, Pl. 3, fig. 1.

Material. Common; figured specimens GSC 57190, 57191, and unfigured specimens GSC 57192-57194 from GSC loc. C-051412, 200 m above base of lower member; unfigured specimen GSC 57195 and figured specimen GSC 57196 from GSC loc. C-051413, 203 m above base.

Description. Test large, elongate, consisting of two or, less commonly, three chambers in a straight or slightly curved uniserial arrangement; chambers robust, rounded, strongly inflated, increasing rapidly in size as added; ultimate chamber commonly pyriform, much wider at base than at top, occupies 50 to 75 per cent of test; wall composed of subangular to subrounded quartz grains (mainly in the fine sand fraction)

partially set in matrix (cement) giving a rough and uneven surface finish; sutures indistinct, depressed, straight; aperture simple, terminal, may be produced on a slight neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
57190	1.28	0.75	1.78
57191	0.78	0.45	1.38
57192	0.70	0.43	1.35
57193	0.68	0.30	1.13
57194	0.48	0.30	0.83
57195	1.20	0.53	1.58
57196	0.68	0.33	1.03

Remarks. *Reophax* sp. cf. *R. adaptatus* is similar in most aspects to *R. adaptatus*, but the Husky forms are somewhat larger. It is also similar in overall geometry and size to *R. metensis* Franke but differs in the construction of the wall, which is more coarsely agglutinated and held together with less cement.

Occurrence. *Reophax* sp. cf. *R. adaptatus* occurs sporadically throughout the section at Martin Creek.

Reophax sp. cf. *R. densa* Tappan

Plate 6, figures 1-3

?1955 *Reophax densa* Tappan, p. 36, Pl. 8, figs. 1-6.

Material. Fairly common; figured specimens GSC 57210, 57211 and unfigured specimens GSC 57212, 57213 from GSC loc. C-051312, 13.5 m above base of lower member.

Description. Test large, elongate, very gently tapering to nearly parallel-sided; consisting of five or six chambers in uniserial arrangement; proloculus commonly missing; chambers initially broader than tall, later equant, moderately inflated; sutures distinct, fine, horizontal, strongly constricted; wall coarsely arenaceous, consisting of subrounded quartz grains set in considerable siliceous cement; roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (init.)	Diameter (ult.)	Height
57210	0.59	0.65	>1.95

57211	0.65	0.60	>1.89
57212	0.71	0.70	>1.80
57213	0.58	0.55	>1.95

(init.), diameter of initial chamber; (ult.), diameter of ultimate chamber.

Remarks. *Reophax* sp. cf. *R. densa* closely resembles megalospheric heteromorphs of *R. densa* from the Lower Jurassic of Alaska. It differs from *R. suevica* Franke in possessing more closely appressed, equant chambers and a straight rather than curved test. Because the initial part of the test is commonly missing, the form has been tentatively placed in *Reophax*, although it could be broken specimens of *Ammobaculites* or *Bulbobaculites*.

Occurrence. *Reophax* sp. cf. *R. densa* Tappan occurs in the basal beds of the lower member.

Reophax sp. A

Plate 5, figures 1-3

?1976 *Reophax suevicus* Franke; Souaya, p. 267, Pl. 5, fig. 2.

Material. Fairly common; figured specimens GSC 57197, 57198, and unfigured specimen GSC 57199 from GSC loc. C-051312, 13.5 m above base of lower member; figured specimen GSC 57200 and unfigured specimens GSC 57201, 57202 from GSC loc. C-051309, 9 m above base.

Description. Test large, elongate; consisting of three or four chambers in a straight uniserial arrangement; chambers robust, slightly inflated, increasing fairly rapidly in size as added; ultimate chamber slightly pyriform in shape, taller than broad, tapered; occupying 33 to 50 per cent of test; wall coarsely agglutinated, composed of subrounded quartz grains set in small amount of siliceous cement, very roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
57197	0.83	0.63	1.75
57198	0.85	0.53	1.88
57199	0.78	0.58	1.63
57200	0.83	0.60	1.60
57201	0.78	0.65	1.75
57202	0.65	0.48	1.15

Remarks. *Reophax* sp. A bears close resemblance to *R. suevicus* Franke as illustrated by Souaya (1976), although it is difficult to determine how many chambers are present in Souaya's form. It differs from *R. metensis* Franke in lacking the strongly inflated, pyriform ultimate chamber and in possessing a much more coarsely agglutinated wall. It differs from *R. adaptatus* Dain in possessing a less acutely tapering test and in lacking the large, pyriform ultimate chamber.

Occurrence. *Reophax* sp. A occurs abundantly in the basal 15 m of the lower member.

Reophax sp. B

Plate 5, figures 13, 14

Material. Common; figured specimens GSC 57203, 57206 and unfigured specimens GSC 57204, 57205, and 57207 from GSC loc. C-051326, 36 m above base of lower member; unfigured specimens GSC 57208, 57209 from GSC loc. C-051329, 39 m above base.

Description. Test small, stubby, uniserial; consisting of two or three chambers that increase rapidly in size as added; chambers inflated, rounded in section; ultimate chamber pyriform, widest at base and tapering to a distinct neck, commonly occupies 50 to 75 per cent of test; sutures distinct, straight, horizontal, slightly constricted; wall finely arenaceous with much cement, roughly finished; aperture simple, terminal, rounded, produced on the end of a distinct neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Height
57203	0.45	0.21
57204	0.43	0.20
57205	0.31	0.20
57206	0.48	0.20
57207	0.38	0.21
57208	0.50	0.28
57209	0.44	0.18

Remarks. *Reophax* sp. B closely resembles *R. liassica* as figured by Tappan (1955) from the Lower Jurassic of Alaska, but differs in being 50 to 67 per cent smaller and possessing fewer chambers. It is much smaller and more finely agglutinated than either *R. sp. cf. R. adaptatus* Dain or *R. metensis* Franke.

Occurrence. *Reophax* sp. B occurs throughout the studied section.

Genus *Scherochorella* Loeblich and Tappan 1984

Type species. *Reophax minuta* Tappan, 1940.

Diagnosis. Test free, tiny, subglobular proloculus followed by relatively broad and low, closely appressed chambers, gradually increasing in breadth as added and arranged in a rectilinear to slightly curved series; sutures distinct, depressed, horizontal; wall agglutinated, thin; aperture simple, terminal, rounded, not produced on a neck.

Remarks. *Scherochorella* differs from *Reophax* in having broad, low, and more regularly expanding chambers and in lacking a distinct neck.

Scherochorella minuta (Tappan)

Plate 5, figures 15, 16

- 1940 *Reophax minuta* Tappan, p. 94, Pl. 14, figs. 4a, b.
- 1943 *Reophax minuta* Tappan; Tappan, p. 480, Pl. 77, figs. 4a, b.
- 1954 *Reophax minuta* Tappan; Frizzell, p. 57, Pl. 1, figs. 11a, b.
- 1962 *Reophax minuta* Tappan; Tappan, p. 132, Pl. 30, fig. 10.
- 1962 *Reophax pepperensis* Loeblich; Tappan, p. 133, Pl. 30, fig. 14.
- 1975 *Reophax minuta* Tappan; Stelck, Pl. I, fig. 24.
- 1976 *Reophax* sp. B. Souaya, p. 266, Pl. 10, fig. 9; Pl. 12, fig. 3.

Material. Common, generally well preserved; hypotypes GSC 57180, 57181 from GSC loc. C-051324, 33 m above base of lower member; unfigured hypotypes GSC 57182, 57183 from GSC loc. C-051326, 36 m above base.

Description. Test tiny, elongate, parallel-sided, periphery rounded; chambers numerous (up to eight in adult specimens), uniserially arranged; chambers equant to slightly elongate, slightly inflated, increasing gradually in size as added, rounded in section; sutures distinct, straight, slightly depressed; wall finely agglutinated with much cement, fairly smoothly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 57180*	0.09	>0.40

Hypotype 57181*	0.09	>0.33
Hypotype 57182	0.05	0.30
Hypotype 57183	0.07	0.30

*broken specimen.

Remarks. *Scherochorella minuta* was originally described from the Lower Cretaceous (Upper Albian) Grayson Formation of northern Texas. It was subsequently reported from Albian strata in Oklahoma (Frizzell, 1954) and Alaska (Tappan, 1962). The forms present in the lower member of the Husky Formation are indistinguishable from those figured by Tappan (ibid.) from the Albian of Alaska. Souaya (1976) described nearly identical forms from the Rhaetic (Upper Triassic) of the Canadian Arctic Archipelago. From the above it is evident that *S. minuta* is long ranging and of little biostratigraphic value.

Scherochorella pepperensis (Loeblich) was originally distinguished from *S. minuta* by its smaller size (0.25 mm for the former versus 0.50 mm for the latter) and slightly tapering test. It is not clear how Tappan (1962) distinguishes the two species, as her *S. pepperensis* ranges up to 0.50 mm in size and appears to be parallel sided rather than tapering. Tappan's Alaskan forms of *S. pepperensis* (Loeblich) have been placed in synonymy with *S. minuta*.

In many of the specimens recovered from the lower member, the initial part of the test has broken off. Chamber dimensions appear to be quite variable, ranging from broader than high to equant. The ultimate chamber sometimes tapers and can become quite pyriform. It is possible that more than one species is present, but available material precludes further differentiation.

Occurrence. *Scherochorella minuta* occurs sporadically throughout the studied section.

Family LITUOLIDAE de Blainville, 1825

Subfamily HAPLOPHRAGMOIDINAE
Maync, 1952

Genus *Haplophragmoides* Cushman, 1910

Type species. *Nonionina canariensis* d'Orbigny, 1839.

Diagnosis. Test free, planispirally coiled, involute; wall agglutinated; aperture an equatorial, interior-marginal slit.

Remarks. Most North American workers on Boreal Jurassic to Lower Cretaceous (Neocomian) micro-

faunas have assigned all planispirally coiled, involute to slightly evolute foraminifers to the genus *Haplophragmoides* Cushman (e.g., Tappan 1955, 1962; Chamney, 1969; Brooke and Braun, 1981; Leskiw in Poulton et al., 1982). Soviet workers (Dain et al., 1972) were the first to point out that many of these forms had areal rather than interior-marginal apertures, and that the aperture was slit-like and carried a bordering lip. They reassigned these species to the genus *Cribochromoides* Cushman.

Thin section and scanning electron microscope study of excellently preserved material from the lower member of the Husky Formation has corroborated the Soviet observations. Most of the large, robust (and numerically commonest) forms have areal, slit-like to ovate apertures with a bordering lip. Of eight species belonging to the Subfamily Haplophragmoidinae, only two can be assigned with certainty to the genus *Haplophragmoides*.

Haplophragmoides tryssa Loeblich and Tappan

Plate 6, figures 4–17

- 1950 *Haplophragmoides tryssa* Loeblich and Tappan, p. 41, Pl. 11, figs. 2a, b.
 non 1960 *Haplophragmoides tryssa* Loeblich and Tappan; Wall, p. 50, Pl. 14, figs. 18, 19.
 1972 *Haplophragmoides tryssa* Loeblich and Tappan; Brooke and Braun, Pl. 8, figs. 37–39.
 non 1976 *Haplophragmoides* sp. cf. *H. tryssa* Loeblich and Tappan; Souaya, p. 267, Pl. 6, fig. 14.
 1983 *Haplophragmoides* sp. cf. *H. tryssa* Loeblich and Tappan; Wall, Pl. 2, figs. 14–16.

Material. Abundant, generally in excellent state of preservation; hypotypes GSC 57214, 57216, 57221, and unfigured hypotypes GSC 57215, 57217, 57220 from GSC loc. C-051312, 13.5 m above base of lower member; unfigured hypotypes GSC 57218, 57219 from GSC loc. C-051311, 12 m above base; unfigured hypotypes GSC 57222–57225 from GSC loc. C-051313, 15 m above base; hypotypes GSC 57226, 57227 and unfigured hypotypes GSC 57228, 57229 from GSC loc. C-051326, 36 m above base; unfigured hypotype GSC 57230 from GSC loc. C-051315, 18 m above base.

Description. Test small, planispirally coiled, slightly compressed, completely involute to semievolute, rounded in outline, periphery slightly lobulate;

commonly consisting of four to five chambers, and rarely five to six and a half chambers (visible) in the ultimate whorl; chambers slightly inflated, increasing very gradually in size as added; sutures distinct, fine, very slightly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture an elongate slit, centrally located at the base of the ultimate chamber, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 57214	0.20	0.13	0.23
Hypotype 57215	0.23	0.10	0.21
Hypotype 57216	0.19	0.10	0.18
Hypotype 57217	0.23	0.10	0.23
Hypotype 57218	0.20	0.10	0.18
Hypotype 57219	0.21	0.10	0.21
Hypotype 57220	0.26	0.13	0.29
Hypotype 57221	0.26	0.11	0.28
Hypotype 57222	0.19	0.10	0.25
Hypotype 57223	0.19	0.10	0.25
Hypotype 57224	0.20	0.08	0.24
Hypotype 57225	0.19	0.10	0.24
Hypotype 57226	0.21	0.11	0.23
Hypotype 57227	0.25	0.13	0.23
Hypotype 57228	0.24	0.13	0.26
Hypotype 57229	0.25	0.13	0.28
Hypotype 57230	0.25	0.13	0.28

Remarks. *Haplophragmoides tryssa* was first described from the Redwater Shale (Oxfordian) of South Dakota. It was subsequently recorded from southern and central Saskatchewan (?Wall, 1960; Brooke and Braun, 1972) and the eastern Canadian Arctic

Archipelago (Wall, 1983). It appears to be one of the very few species to have thrived in both the western interior and Boreal faunal provinces during Late Jurassic time.

The forms recovered from the lower member of the Husky Formation agree well with the types described by Loeblich and Tappan (1950a). They possess somewhat more regularly (?rigidly) formed chambers of a near constant size in the ultimate whorl. The sutures meet the umbilicus nearly at right angles to one another. A distortion of the planispiral coiling arrangement occurs in specimens with five or six chambers in the ultimate whorl. The test is then semi-evolute and the coiling “pseudotrochospiral”, wherein one side appears involute, the other semi-evolute (hypotype GSC 57226, Pl. 6, figs. 10, 11). This form of *H. tryssa* probably represents the megalospheric generation. Here, the proloculus appears to be so large (relative to the overall size of the test) that it cannot be accommodated in the normal test design. Thus, it occurs on one side of the test, creating a semi-evolute appearance on that side. Specimens that are strongly “asymmetric” can resemble juvenile *Recurvoides*. The large population of *H. tryssa* combined with generally excellent preservation shows that all of these heteromorphs clearly belong to one species.

Loeblich and Tappan (1950a) noted the close relationship between *H. Tryssa* and *H. kirki* Wickenden from the Upper Cretaceous of Alberta and Saskatchewan, but recognized that the chambers of *H. kirki* were much more inflated.

Occurrence. *Haplophragmoides tryssa* occurs commonly in the basal 35 m of the lower member.

Haplophragmoides sp. A

Plate 6, figures 18–21

Material. Rare; 10 specimens in adequate state of preservation; unfigured specimens GSC 57231, 57232, and figured specimens GSC 57233, 57234 from GSC loc. C-051363, 90 m above base of lower member.

Description. Test small, planispirally coiled, evolute, laterally compressed, umbilical areas slightly depressed, peripheral margin rounded to very slightly lobulate; chambers few, slightly inflated, increasing gradually in size as added, about six in ultimate whorl; sutures distinct, fine, straight, slightly depressed; wall agglutinated, of medium sized quartz grains, fairly

roughly finished; aperture a low slit at the base of the septal face, centrally located.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
57231	0.35	0.28	0.15
57232	0.28	0.24	0.14
57233	0.38	0.28	0.15
57334	0.31	0.28	0.14

Remarks. *Haplophragmoides* sp. A differs from *H. tryssa* Loeblich and Tappan in being considerably larger, possessing more chambers in the ultimate whorl, and being more coarsely agglutinated.

Occurrence. *Haplophragmoides* sp. A occurs in small numbers in a single sample located 90 m above the base of the lower member.

Genus *Evolutinella* Myatliuk, 1971

Type species. *Evolutinella subevoluta* Nikitina and Myatliuk in Myatliuk, 1971.

Diagnosis. Test free, practically to entirely evolute, consisting of several weakly overlapping whorls; wall finely agglutinated; aperture areal, simple.

Evolutinella infirma n. sp.

Plate 8, figures 10–12; 15–17; 21–23

1981 *Haplophragmoides* cf. *H. topagorukensis* Tappan; Brooke and Braun, p. 15, Pl. 2, figs. 31–34; non figs. 35, 36.

Material. Abundant, generally well preserved; holotype GSC 57254, paratypes GSC 57255, 57256, and unfigured paratypes GSC 57257–57259 from GSC loc. C-051326, 36 m above base of lower member.

Description. Test medium sized, moderately compressed, planispirally coiled (may show a slight tendency to mild streptospiral coiling in the initial whorls), almost totally evolute, biumbilicate, periphery rounded, umbilical areas depressed; consisting of three to four whorls with 13 to 14 chambers in the ultimate whorl; chambers rounded triangular in cross-section (almost crescentic), not inflated, expanding very gradually in size as added; sutures straight, radiate,

moderately thickened, very slightly depressed or flush, in some specimens a ring of umbilical nodes weakly developed around the umbilical depression; wall very finely arenaceous with much cement, smoothly finished; aperture areal, simple, a crescentic slit raised slightly above the base of the septum, sometimes with a bordering lip, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57254	0.65	0.54	0.24
Paratype 57255	0.86	0.70	0.34
Paratype 57256	0.63	0.60	0.28
Paratype 57257	0.63	0.61	0.25
Paratype 57258	0.59	0.50	0.24
Paratype 57259	0.50	0.48	0.18

Remarks. This species is tentatively placed in *Evolutinella* Myatliuk rather than *Trochamminoides* Cushman because of the nature and position of the aperture: areal with a bordering lip rather than basal. Study of well preserved specimens under water through transmitted light shows that some individuals show a slight tendency toward streptospiral coiling in the initial whorls. Where this tendency becomes pronounced, the forms are assigned to *Recurvoides myhri* n. sp. From the large populations recovered from the lower member of the Husky Formation it is possible to demonstrate a complete range of intermediate stages, from *Evolutinella* to *Recurvoides*.

Evolutinella infirma n. sp. is similar in appearance to *Labrospira goodenoughensis* (Chamney) but differs from the latter in being much more evolute, having a somewhat smaller and more strongly compressed test, and possessing more numerous chambers in the ultimate whorl. It seems probable that with a large enough population, intergradations might be found among all three species (and genera) mentioned above.

Some of the forms included by Brooke and Braun (1981) in *Haplophragmoides* sp. cf. *H. topagorukensis* Tappan are clearly conspecific with *E. infirma* n. sp. in all aspects, including even the weakly developed “umbilical ring”.

Etymology. From the Latin, *infirmus*, reflecting the somewhat unstable nature of the coiling in the initial whorls of the species.

Occurrence. *Evolutinella infirma* n. sp. occurs commonly in the basal third of the lower member.

Genus *Labrospira* Hoeglund, 1947

Type species. *Haplophragmium crassimargo* Norman, 1892.

Diagnosis. Test free, large, discoid, planispirally enrolled and partially evolute; wall thick, coarsely agglutinated and firmly cemented with organic material; aperture an oval to slit-like areal opening slightly above the base of the apertural face with well developed bordering lip.

Remarks. The relationship of *Haplophragmoides* to *Labrospira* is similar to the relationship of *Thalmanamina* to *Recurvoides* — the same basic test design but with apertures in different positions. *Labrospira* was placed in synonymy with *Cribrostomoides* by Loeblich and Tappan (1964), but was recently amended to a separate genus again (Loeblich and Tappan, 1988).

Soviet workers (Dain et al., 1972) first recognized that the Boreal Upper Jurassic forms assigned by other workers to the genus *Haplophragmoides* had areal rather than interior-marginal apertures. They placed these forms into *Cribrostomoides*. However, the adult form of this genus clearly does not possess a simple aperture, and it is unlikely that — within the Husky — we are dealing with a population consisting solely of juveniles. The more appropriate taxon for these forms is the genus *Labrospira* Hoeglund.

Labrospira freboldi n. sp.

Plate 8, figures 1-9, 13, 14

- 1955 *Haplophragmoides canui* Cushman; Tappan, p. 42, Pl. 9, figs. 11, 12, 14; *non* figs. 13, 15.
 1972 *Cribrostomoides canui* (Cushman); Dain et al., Pl. VII, figs. 3, 4.
non 1976 *Haplophragmoides canui* Cushman; Ascoli, Pl. 6, figs. 9a-c.
 1976 *Cribrostomoides canui* Cushman; Souaya, p. 267, Pl. 2, figs. 2a, b.

- 1981 *Haplophragmoides* sp. cf. *H. canui* Cushman; Brooke and Braun, p. 14, Pl. 2, figs. 9-21.
 1982 *Haplophragmoides* sp. cf. *H. canui* Cushman; Leskiw in Poulton et al., Pl. 4, figs. 1, 2.
 1983 *Haplophragmoides canui* Cushman; Løfaldli and Nagy, p. 100, Pl. 1, figs. 1, 2.
 1983 *Haplophragmoides* sp. cf. *H. canui* Cushman; Wall, Pl. 4, figs. 32, 33.
 1983 *Cribrostomoides* sp. 1 Wall, Pl. 4, fig. 38.
 1983 *Haplophragmoides* sp. 2 Wall, Pl. 3, figs. 25, 26.

Material. Abundant, several thousand specimens, variable preservation; holotype GSC 57235 and paratypes GSC 57236, 57237, 57240, 57367, and unfigured paratypes GSC 57238, 57239 from GSC loc. C-051308, 7.5 m above base of lower member.

Description. Test large, robust, planispirally coiled, involute, biumbilicate, periphery rounded, with eight or nine chambers in the ultimate whorl; chambers moderately inflated, increasing very gradually in size as added; sutures thickened, straight, radiate, very slightly to not depressed, wall very finely agglutinated with much siliceous cement, smoothly finished; aperture areal, centrally located, raised above base of the apertural face, ovate to slightly crescentic in shape, commonly with a bordering lip, which is often obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57235	0.80	0.65	0.45
Paratype 57236	1.23	1.10	0.75
Paratype 57237	0.78	0.68	0.43
Paratype 57238	0.70	0.54	0.38
Paratype 57239	1.70	1.50	0.75
Paratype 57240	0.94	—	0.50
Paratype 57367	0.93	0.75	0.38

Remarks. *Labrospira canui* (Cushman) sensu Tappan (1955) has been used frequently, but incorrectly in numerous boreal Upper Jurassic studies. Examination

of hypotype material of *H. canui* from the Corallian Beds of Dorset, England (from the Nothe Clay, Berkshire Oolite Series; see Gordon, 1965) reveals that the form is smaller, has much finer, more delicate sutures and a thinner wall that is composed of fine quartz silt set within — but not engulfed by — the cement. The wall finish is thus slightly roughened, not smooth. The taxon *Labrospira freboldi* is proposed to accommodate this markedly different Boreal species. Partial thin section study of exceptionally preserved specimens clearly indicates that the aperture is areal, and usually possesses a noticeable bordering lip.

Forms referable to *L. freboldi* (including some very large variants) are the single most dominant element in many of the assemblages recovered from the lower member of the Husky Formation.

Etymology. The patronym honours Dr. Hans Frebold, Jurassic paleontologist and biostratigrapher with the Geological Survey of Canada.

Occurrence. *Labrospira freboldi* occurs in large numbers throughout the lower member.

Labrospira goodenoughensis (Chamney)

Plate 7, figures 1–12

- 1955 *Haplophragmoides canui* Cushman; Tappan, p. 42, Pl. 9, fig. 13, ?15a, b, *non* figs. 11, 12, 14a, b.
- 1969 *Haplophragmoides goodenoughensis* Chamney, p. 23, Pl. IV, figs. 5, 6.
- 1969 *Haplophragmoides coronis* Chamney, p. 25, Pl. V, figs. 4, 5.
- 1972 *Haplophragmoides(?) canuiformis* Dain in Dain et al., p. 48, Pl. VIII, figs. 2a–d, *non* figs. 3a–c.
- 1976 *Haplophragmoides topagorukensis* Tappan; Souaya, p. 267, Pl. 1, fig. 2.
- non* 1976 *Haplophragmoides goodenoughensis* Chamney; Souaya, p. 267, Pl. 2, figs. 6a, b.
- 1980 *Haplophragmoides(?) canuiformis* Dain; Løfaldli and Nagy, p. 77, Pl. 2, figs. 1, 2.
- 1981 *Haplophragmoides* sp. 143 Brooke and Braun, p. 15, Pl. 3, figs. 1–3.
- 1983 *Cribrostomoides goodenoughensis* (Chamney); Wall, Pl. 4, figs. 34, 35.
- 1983 *Haplophragmoides* sp. 3 Wall, Pl. 4, figs. 36, 37.

Material. Abundant, several hundred excellently preserved specimens; unfigured hypotype GSC 57241

and hypotypes GSC 57242–57245 from GSC loc. C-051329, 39 m above base of lower member; hypotype GSC 57246 and unfigured hypotype 57247 from GSC loc. C-051326, 36 m above base.

Description. Test large, planispirally coiled, slightly compressed, semi-evolute, biumbilicate; periphery rounded to moderately lobate; proloculus commonly megalospheric, rarely microspheric, consisting of two and a half to three whorls with nine to thirteen chambers in the ultimate whorl; chambers roughly triangular in cross-section with rounded angles, somewhat inflated, increasing very gradually in size as added, raised near umbilicus, thus forming an “umbilical ring”; sutures straight, radiate, thickened, becoming depressed near the umbilical area, then rising near the umbilicus to form “nodes”, these nodes commonly form a prominent ring around the markedly depressed umbilical area itself; wall finely arenaceous with much cement, smoothly finished; aperture areal, ovate to slightly oblong in shape, raised slightly above the base of the septum, commonly with a pronounced bordering lip.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Hypotype 57241	0.83	0.70	0.38
Hypotype 57242	0.80	0.70	0.35
Hypotype 57243	0.78	0.75	0.40
Hypotype 57244	0.70	0.58	0.35
Hypotype 57245	—	—	—
Hypotype 57246	0.54	0.50	0.30
Hypotype 57247	0.58	0.48	0.30

Remarks. *Labrospira goodenoughensis* was originally described on the basis of poorly preserved (highly siliceous and crushed) material from the Lower Cretaceous (basal Barremian) of Aklavik Range, Northwest Territories (Chamney, 1969, p. 24). Abundant, beautifully preserved specimens of this species occur throughout the lower member of the Husky Formation. Detailed study of this material indicates that the species belongs to the genus *Labrospira* rather than to *Haplophragmoides*.

Examination by transmitted light of well preserved (commonly pyrite-filled) tests of "*Haplophragmoides*" *goodenoughensis* Chamney immersed in water clearly indicates that the position of the aperture is areal rather than basal. Partial thin sections of selected specimens confirm this and show that the aperture is surrounded by a distinctive bordering lip (Pl. 7, figs. 1, 2, 11). The shape of the aperture varies from oval to slightly elongate.

About 75 per cent of the specimens studied in partial thin section possess a megalospheric proloculus of fairly large size. These same forms also possess well developed "septal nodes" and the "umbilical ring" referred to by Chamney (1969, p. 23, 25). The presence of a large proloculus suggests an explanation for the formation of the septal nodes when the general shape of the chambers is taken into account. The chambers of *L. goodenoughensis* are roughly triangular (almost crescentic) in cross-section, and strongly overlap the preceding whorls. When a megalospheric proloculus is present, the tapering basal portions of each chamber are forced to rise as they approach the umbilicus. This causes a small node to form at the apex of the chamber where the thickened septa meet. Stacking of successive chambers (caused by the strong overlap of the whorls) further accentuates the node. Because *L. goodenoughensis* is semi-evolute and the chambers do not overlap completely, the node tends to migrate away from the umbilical depression as new whorls are added.

The septa of *L. goodenoughensis* are strongly thickened (limbate) and less susceptible to deformation than the chamber walls. Because all septa meet around the umbilical plug, this serves to accentuate further the umbilical ring. Crushing of the test makes the umbilical ring (of septal nodes) even more obvious.

Microspheric forms studied by the partial thin section method seem to possess a less well developed umbilical ring, although the feature is still present. Possibly the meeting of the limbate septa around the umbilicus is enough to generate the septal nodes. It is generally not possible to distinguish microspheric from megalospheric heteromorphs without first making thin sections of the specimens.

Chamney (1969) separated *L. goodenoughensis* from *Haplophragmoides coronis* Chamney on the basis of somewhat smaller dimensions and fewer chambers in the ultimate whorl of the latter. In all other aspects, the two species are identical. Observation of numerous specimens from the lower member of the Husky

Formation suggests that *H. coronis* Chamney is probably a juvenile form of *L. goodenoughensis*.

The form identified by Souaya (1976) as *Haplophragmoides goodenoughensis* Chamney is not conspecific with the Husky specimens. However, examination of Souaya's types of *H. topagorukensis* Tappan suggests that they almost certainly belong to *L. goodenoughensis*.

Brooke and Braun (1981) differentiated their *Haplophragmoides* sp. 143 from *L. goodenoughensis* on the basis of what constituted "true" septal nodes and how these were formed. They correctly sensed that the "umbilical ring" was caused by the inner tips of partially collapsed chambers, yet they felt that the "septal nodes" (which in effect form the umbilical ring) must be caused by a different process. Examination of Chamney's type material reveals that the "septal nodes" are a direct result of the crushing of the collapsed chambers (and septa), so that *H. sp. 143* is conspecific with *L. goodenoughensis*.

Chamney (1969) noted that forms similar to *L. goodenoughensis* occurred throughout the Deer Bay Formation (Upper Jurassic to middle Lower Cretaceous) in the Canadian Arctic Archipelago. This gives the species a very broad stratigraphic range.

Occurrence. *Labrospira goodenoughensis* occurs abundantly throughout the lower member.

Labrospira miranda (Dain)

Plate 8, figures 18-20; 24-26

1972 *Cribrostomoides mirandus* Dain in Dain et al., p. 51, Pl. VIII, figs. 4, 5.

1976 *Haplophragmoides* sp. cf. *H. tryssa* Loeblich and Tappan; Souaya, p. 267, Pl. 6, fig. 14.

Material. Abundant, generally well preserved; hypotypes GSC 57248, 57249, and unfigured hypotype GSC 57250 from GSC loc. C-051329, 39 m above base of lower member; unfigured hypotypes GSC 57251-57253 from GSC loc. C-051326, 36 m above base.

Description. Test medium sized, robust, planispirally coiled; completely involute, biumbilicate, periphery rounded, with 5 to 6 chambers in the ultimate whorl; chambers inflated, increasing very gradually in size as added; sutures straight, radiate, very slightly

thickened, only slightly depressed; wall very finely arenaceous with moderate amount of cement, smoothly finished; aperture areal, ovate to slightly crescentic, raised about one third above the base of the apertural face, commonly obscured due to poor preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Hypotype 57248	0.54	0.50	0.35
Hypotype 57249	0.53	0.45	0.30
Hypotype 57250	0.49	0.43	0.28
Hypotype 57251	0.56	0.49	0.35
Hypotype 57252	0.48	0.40	0.30
Hypotype 57253	0.38	0.33	0.28

Remarks. *Labrospira miranda* is similar in size and general appearance to *Haplophragmoides kingakensis* Tappan and *H. duoinflatus* Chamney. From the former it differs in having a more rounded periphery, less depressed sutures and a more finely arenaceous wall. From the latter it differs only in being slightly larger, so it may be a junior synonym. *Labrospira miranda* also bears some resemblance to *Cribrostomoides dolininae* Bulynnikova, although it appears from illustrations of the latter (Dain et al., 1972, Pl. VIII, figs. 1, 2) that this form is actually a species of *Recurvoides* as both the holotype and paratype exhibit a streptospiral mode of coiling.

Occurrence. *Labrospira miranda* occurs through the basal two thirds of the lower member.

Genus *Trochamminoides* Cushman, 1910

Type species. *Trochammina proteus* Karrer, 1886.

Diagnosis. Similar to *Haplophragmoides* but coiling evolute, aperture large, interior-marginal, with slightly thickened lip.

Trochamminoides leskiwae n. sp.

Plate 6, figures 22–26

1983 *Evolutinella* sp. Wall, Pl. 3, figs. 18–20.

Material. About 40 specimens in adequate state of preservation; holotype GSC 57260, paratypes GSC 57262, 57263, and unfigured paratype GSC 57261 from GSC loc. C-051379, 131 m above base of lower member; unfigured paratypes GSC 57264–57266 from GSC loc. C-051381, 137 m above base.

Description. Test small, discoidal, strongly compressed, periphery somewhat lobulate; coiling planispiral, completely evolute; consisting of spherical proloculus (0.012 to 0.018 mm in diameter) followed by three to three and a half whorls; three or four chambers in initial whorl increasing to six or seven in ultimate whorl; chambers roughly rectangular with rounded corners, strongly compressed; sutures distinct, very slightly depressed to flush, arched obliquely backward; wall very finely arenaceous with much cement, smoothly finished; aperture a low arch at the base of the ultimate chamber, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57260	0.36	0.30	0.10
Holotype 57261	0.33	0.28	0.09
Holotype 57262	0.28	0.26	0.05
Holotype 57263	0.29	0.28	0.05
Holotype 57264	0.33	0.29	0.08
Holotype 57265	0.30	0.21	0.08
Holotype 57266	0.31	0.26	0.10

Remarks. *Trochamminoides leskiwae* n. sp. differs from *Haplophragmoides barrowensis* Tappan in being 50 per cent smaller and having far fewer chambers in the ultimate whorl. Due to its compressed, wafer-like test it is very susceptible to crushing and distortion.

Etymology. The patronym honours Kay Leskiw, formerly a micropaleontologist with Shell Canada Resources Ltd., Calgary.

Occurrence. *Trochamminoides leskiwae* n. sp. occurs in small numbers in beds located 125 to 143 m above base of lower member.

Subfamily RECURVOIDINAE
Alekseitchuk-Mitskevich, 1973

Genus *Recurvoides* Earland, 1934

Type species. Recurvoides contortus Earland, 1934.

Diagnosis. Test free, subglobular; streptospirally coiled with few chambers in each whorl, later whorls in differing planes so the exterior somewhat resembles *Trochammina*, although early periphery and not all early whorls are visible from the spiral side; wall agglutinated, thin; aperture small, areal, with distinct bordering lip (coiling may vary from distinctly streptospiral to nearly planispiral with an abrupt change of 90° in the plane of coiling during development).

Remarks. The genus *Recurvoides* appears to be characteristic of Boreal realm microfaunas in the Upper Jurassic and lower Lower Cretaceous (Neocomian). It has been described from the Canadian Arctic Archipelago (Souaya, 1976; Wall, 1983), northeastern British Columbia (Brooke and Braun, 1981), and the Fernie Basin (Weihmann, 1964). Ten species can be distinguished in the present study, from the northern Richardson Mountains, Northwest Territories. It is thus somewhat surprising that Tappan (1955) failed to recognize any *Recurvoides* in her material from northern Alaska. Examination of some of her types of *Trochammina canningensis* Tappan (paratypes P287 and P293, and unfigured paratype P776) shows that all are juvenile forms of some species of *Recurvoides*. A restudy of all of her types would be required to determine which should be reclassified as *Recurvoides*. *Recurvoides* specimens have also been recovered from Siberia (Dain et al., 1972), Svalbard (Løfaldli and Nagy, 1980), and Spitsbergen (Løfaldli and Nagy, 1983).

Recurvoides canningensis (Tappan)

Plate 9, figures 7–20

- 1955 *Trochammina canningensis* Tappan, p. 29, Pl. 14, figs. 15, 17–19; *non* fig. 16.
1972 *Trochammina*(?) ex. gr. *canningensis* Tappan; Dain et al., Pl. XIII, figs. 1a–c; *non* figs. 2a–c.
?1976 *Trochammina canningensis* Tappan; Souaya, p. 274, Pl. 2, figs. 2a–c.
?1976 *Trochammina globigeriniformis* (Brady); Souaya, p. 274, Pl. 3, figs. 11a–c.

1981 *Trochammina* cf. *T. canningensis* Tappan; Brooke and Braun, p. 22, Pl. 5, figs. 15–18; *non* figs. 19–25.

non 1982 *Trochammina* sp. cf. *canningensis* Tappan; Leskiw in Poulton et al., Pl. 3, figs. 4–6.

non 1983 *Trochammina canningensis* Tappan; Wall, Pl. 1, figs. 4–6.

Material. Abundant, several hundred well preserved specimens; hypotypes GSC 57267–57269 from GSC loc. C-051326, 36 m above base of lower member; hypotype GSC 57270 from GSC loc. C-051324, 33 m above base; unfigured hypotype GSC 57271 and hypotype GSC 57272 from GSC loc. C-051312, 13.5 m above base.

Description. Test small to medium sized, robust, globular; streptospiral coiling; consisting of six to fourteen chambers arranged in one and a half to two and a half strongly overlapping whorls; chambers globular, strongly inflated, expanding rapidly in size as added; sutures distinct, somewhat thickened, strongly depressed, wall arenaceous, of fine to medium sized quartz grains with considerable cement, somewhat roughly finished; aperture obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Hypotype 57267	0.34	0.33	0.30
Hypotype 57268	0.34	0.31	0.30
Hypotype 57269	0.33	0.33	0.28
Hypotype 57270	0.63	0.55	0.45
Hypotype 57271	0.48	0.42	0.40
Hypotype 57272	0.48	0.43	0.38

Remarks. Examination of some of Tappan's type material of "*Trochammina*" *canningensis* Tappan (i.e., paratype P287, Pl. 14, fig. 15; paratype P293, Pl. 14, fig. 17; and unfigured paratype P776) shows that all the forms are clearly juvenile stages of one or more species of *Recurvoides*, but not the same "species concept" as those present in the lower member of the Husky Formation. Restudy of the entire collection of types would be necessary before Tappan's species could be adequately redefined. Pending further study,

the Husky forms are tentatively included within *R. canningensis*.

Positive generic identification of this species is difficult due to the closely overlapping, rapidly expanding chamber arrangement, which obscures (i.e., covers up) the coiling in the early whorls. Close study of exceptionally preserved specimens suggests, however, that the coiling is distinctly streptospiral rather than trochospiral.

Recurvoides canningensis differs from *Trochammina*(?) ex. gr. *canningensis* Tappan from Western Siberia in being about twice as large, possessing more numerous and more greatly inflated chambers, and having a greater number of whorls in the mature test.

Trochammina sp. cf. *T. canningensis* of Brooke and Braun (1981) appears to be composed of two different species. Those illustrated in Pl. 5, figs. 15–18 are conspecific with the Husky forms, whereas those depicted in figs. 19–25 appear to belong to some other species (perhaps a juvenile stage) of *Recurvoides*. Brooke and Braun (op. cit., p. 22) noted that the coiling of this species was not trochospiral, but still opted to place the form within the genus *Trochammina*.

The forms referred to by Leskiw (*in* Poulton et al., 1982) as *Trochammina* sp. cf. *T. canningensis* apparently belong to several genera. The first (Pl. 1, fig. 4) appears to be a true *Trochammina*, the second (fig. 5) is a juvenile *Recurvoides*, but not *R. canningensis*, and the third (fig. 6) appears to be a juvenile *Ammobaculites*.

Occurrence. *Recurvoides canningensis* occurs commonly through the basal two thirds of the lower member.

Recurvoides decoris n. sp.

Plate 9, figures 23, 34

Material. Abundant, several hundred excellently preserved specimens; holotype GSC 57321 from GSC loc. C-051312, 13.5 m above base of lower member; paratype 57322 and unfigured paratypes 57323–57325 from GSC loc. C-051313, 15 m above base; paratypes GSC 57326, 57327 from GSC loc. C-051326, 36 m above base.

Description. Test small, compressed, peripheral margin rounded; streptospirally coiled in the initial portion,

later trending toward planispiral; chambers numerous, slightly inflated, expanding gradually as added, 12 to 14 in the ultimate whorl; wall agglutinated, consisting of microgranular quartz grains set in much siliceous cement, smoothly finished; sutures distinct, straight and radiate, slightly thickened, slightly depressed; aperture simple, areal, commonly impossible to distinguish due to small size of specimens and preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57321	0.30	0.30	0.075
Paratype 57322	0.28	0.23	0.063
Paratype 57323	0.26	0.23	0.075
Paratype 57324	0.23	0.23	0.075
Paratype 57325	0.26	0.25	0.075
Paratype 57326	0.23	0.16	0.063
Paratype 57327	0.20	0.18	0.063

Remarks. *Recurvoides decoris* n. sp. differs from all other species of *Recurvoides* within the lower member by virtue of its small size, highly compressed test and larger number of chambers per whorl.

Etymology. From the Latin, *decoris*, meaning elegant.

Occurrence. *Recurvoides decoris* n. sp. occurs commonly through the basal two thirds of the lower member.

Recurvoides disputabilis Dain

Plate 10, figures 1–7

- 1972 *Recurvoides disputabilis* Dain *in* Dain et al., p. 55, Pl. X, figs. 6, 7.
- 1972 *Recurvoides disputabilis disputabilis* Dain *in* Dain et al., p. 55, Pl. XI, figs. 1–4.
- 1972 *Recurvoides disputabilis plana* Dain *in* Dain et al., p. 56, Pl. XI, figs. 5, 6; Pl. XII, figs. 1, 2.
- non 1976 *Recurvoides* sp. cf. *R. disputabilis plana* Dain; Souaya, p. 267, Pl. 6, figs. 4a–c.

- non 1976 *Recurvoides* sp. cf. *R. disputabilis disputabilis* Dain; Souaya, p. 267, Pl. 7, figs. 4a-c.
 ?1980 *Recurvoides disputabilis* Dain; Løfaldli and Nagy, p. 77, Pl. 2, figs. 10, 11.
 1981 *Recurvoides?* cf. *R. disputabilis* Dain; Brooke and Braun, p. 19, Pl. 3, figs. 21-32.
 1983 ?*Recurvoides disputabilis disputabilis* Dain; Wall, Pl. 2, figs. 17-19.

Material. Fairly common, generally well preserved; hypotype GSC 57287 and unfigured hypotypes GSC 57288, 57289 from GSC loc. C-051367, 95 m above base of lower member; hypotype GSC 57290 from GSC loc. C-051369, 101 m above base; unfigured hypotype GSC 57291 from GSC loc. C-051370, 104 m above base; unfigured hypotype GSC 57292 from GSC loc. C-051411, 197 m above base; hypotype GSC 57293 from GSC loc. C-051412, 200 m above base.

Description. Test medium sized, rounded; streptospirally coiled; consisting of one and a half to two and a half whorls, ultimate part of penultimate whorl visible on the "dorsal" side, the latter sometimes forming a distinct, knob-like projection; only ultimate whorl visible on the "ventral" side; plane of coiling shifts abruptly (45° to 60°) in each successive volution; about six to eight chambers in the ultimate whorl; chambers slightly inflated; quadrangular in early whorls with tendency to become "wedge-shaped" in later whorls, increasing very gradually in size as added; sutures distinct, straight and radiate, flush with surface of test; wall composed of fine to medium sized grains with much cement giving a fairly smooth finish; aperture simple, areal, ovate, raised slightly above base of septum, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Hypotype 57287	0.55	0.53	0.35
Hypotype 57288	0.35	0.30	0.25
Hypotype 57289	0.43	0.35	0.25
Hypotype 57290	0.48	0.48	0.33
Hypotype 57291	0.45	0.43	0.28
Hypotype 57292	0.45	0.40	0.35

Hypotype 57293	0.48	0.40	0.35
----------------	------	------	------

Remarks. Dain's reasons for erecting two subspecies of *Recurvoides disputabilis* are not clear. Apparently the sole distinguishing criterion is that *R. disputabilis plana* has a "slightly more symmetrical test". The two forms apparently also succeed one another stratigraphically: *R. disputabilis disputabilis* is upper Oxfordian, whereas *R. disputabilis plana* is lower Kimmeridgian. In the lower member of the Husky Formation, forms referable to both subspecies coexist in the same assemblages. For this reason, no attempt has been made to separate the subspecies.

Forms referable to this species have a wide distribution in the Boreal realm, having been reported from Spitsbergen (Løfaldli and Nagy, 1980), western Siberia (Dain et al., 1972), the Canadian Arctic Archipelago (Wall, 1983), and northeastern British Columbia (Brooke and Braun, 1981).

Occurrence. *Recurvoides disputabilis* occurs in small numbers throughout the upper half of the lower member.

Recurvoides huskyensis n. sp.

Plate 10, figures 22-30

- 1972 *Recurvoides gryci* (Tappan); Dain in Dain et al., Pl. IX, figs. 1-7.
 1981 *Trochammina gryci* Tappan; Brooke and Braun, p. 23, Pl. 5, figs 36-48.
 non 1983 *Trochammina gryci* Tappan; Wall, Pl. 4, figs. 21-39.
 ?1983 *Trochammina gryci* Tappan; Løfaldli and Nagy, p. 101, Pl. 2, figs. 5, 6.

Material. Rare, about 15 specimens in adequate state of preservation; holotype GSC 57300, paratypes 57301, 57303 and unfigured paratypes 57302, 57304 from GSC loc. C-051306, 4.5 m above base of lower member; unfigured paratypes GSC 57305, 57306 from GSC loc. C-051305, 3.0 m above base.

Description. Test large, "globular", peripheral margin rounded; consisting of three to four whorls in gentle streptospiral coil such that coiling arrangement appears almost *Trochammina*-like; chambers numerous, rounded-triangular in cross-section, not inflated, increasing very gradually in size as added; eight to eleven in ultimate whorl; almost all of the whorls visible "dorsally", only the chambers of the ultimate

whorl visible "ventrally"; sutures thickened, straight and radiate, flush with surface of test; wall agglutinated, very finely arenaceous with much cement, smoothly finished; aperture simple, areal, ovate, commonly with a bordering lip, usually obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57300	0.93	0.80	0.43
Paratype 57301	0.60	0.55	0.45
Paratype 57302	0.55	0.48	0.40
Paratype 57303	0.88	0.85	0.40
Paratype 57304	0.78	0.60	0.45
Paratype 57305	0.85	0.70	0.40
Paratype 57306	0.65	0.60	0.43

Remarks. Examination of the original type material of *Trochammina gryci* Tappan by Wall (per. comm., 1983) confirmed that Tappan's species is indeed a species of *Trochammina*. The form illustrated by Dain (in Dain et al., 1972) is clearly a species of a *Recurvoides*. It is not clear, however, why Dain's species was associated with Tappan's *Trochammina* species. *Recurvoides huskyensis* is a large, very distinctive form that appears to be restricted to lowest Oxfordian strata. Both microspheric and megalospheric heteromorphs have been documented.

The forms illustrated by Brooke and Braun (1981) as *Trochammina gryci* appear identical in basic test geometry to the Husky species, except that they are a little smaller.

Etymology. Named after the Husky Channel of the Mackenzie River Delta, District of Mackenzie, Northwest Territories, Canada.

Occurrence. *Recurvoides huskyensis* n. sp. occurs in small numbers in the basal 5 m of the lower member, in beds of (?)early Oxfordian age. This agrees well with their Siberian counterparts, which occur in strata of mid to late Callovian age (Dain et al., 1972).

Recurvoides myhri n. sp.

Plate 9, figures 1-6

Material. About 100 specimens in adequate state of preservation; holotype GSC 57313 and unfigured paratypes GSC 57314, 57315 from GSC loc. C-051312, 13.5 m above base of lower member; paratype GSC 57316 and unfigured paratypes 57317, 57318 from GSC loc. C-051329, 39 m above base; unfigured paratypes GSC 57319, 57320 from GSC loc. C-051353, 75 m above base.

Description. Test medium to large, compressed, peripheral margin rounded; gently streptospirally coiled such that the plane of coiling appears to shift less than 15° with each succeeding volution, producing a decidedly "planispiral" (*Labrospira*-like) geometry; consisting of three to three and a half whorls, with all whorls nearly visible on either side of test; chambers numerous, semicircular in cross-section, increasing very gradually in size as added, commonly 12 to 17 in ultimate whorl; sutures distinct, thickened, straight, and radiate, flush with wall of test; wall very finely agglutinated with much cement, smoothly finished; aperture simple, areal, ovate, with a distinct bordering lip.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57313	0.78	0.73	0.23
Paratype 57314	0.60	0.53	0.20
Paratype 57315	0.80	0.71	0.35
Paratype 57316	0.65	0.65	0.20
Paratype 57317	0.73	0.55	0.25
Paratype 57318	0.63	0.55	0.26
Paratype 57319	0.50	0.45	0.18
Paratype 57320	0.53	0.45	0.18

Remarks. *Recurvoides myhri* n. sp. is closely related to *Evolutinella infirma* n. sp. and the two commonly coexist in the same samples. The form differs from other species of *Recurvoides* in possessing a very shallow streptospiral mode of coiling, which gives it a

nearly planispiral appearance, and in having more numerous chambers in the ultimate whorl.

Within certain assemblages in the lower member, it is possible to trace a continuous spectrum of coiling geometry (belonging to the same "species group") from *Recurvoides* to *Evolutinella*. This demonstrates one of the problems inherent in the current "rigorous" taxonomy. What causes this range in coiling geometry is not wholly understood, but may be a response to the presence/absence of a megalospheric proloculus. Partial thin section studies of well preserved specimens show that those forms with a streptospiral mode of coiling possess a megalospheric proloculus. This may reflect an attempt by the foraminiferal animal to accommodate the large proloculus. If this is the case, then it would suggest that *Evolutinella infirma* n. sp. is the agamont form and *Recurvoides myhri* n. sp. is the gamont form of the same species group.

Etymology. Patronym honours D.W. Myhr, currently geologist with Ascentex Resources Ltd., formerly with the Geological Survey of Canada.

Occurrence. *Recurvoides myhri* n. sp. is common in the basal 75 m of the lower member.

Recurvoides sublustris Dain

Plate 10, figures 19–21

1972 *Recurvoides sublustris* Dain in Dain et al., p. 57, Pl. XII, figs. 3–6.

1983 *Recurvoides sublustris* Dain; Løfaldli and Nagy, p. 101, Pl. 2, figs. 3, 4.

Material. Quite common, generally well preserved; unfigured hypotype GSC 57273 from GSC loc. C-051324, 33 m above base of lower member; unfigured hypotype 57274 from GSC loc. C-051326, 36 m above base; hypotype GSC 57275 and unfigured hypotype GSC 57276 from GSC loc. C-051329, 39 m above base.

Description. Test medium sized, compressed, ovate in outline, periphery rounded; streptospirally coiled; consisting of approximately two to three whorls, about two visible on the "dorsal" side, only the ultimate whorl visible on the "ventral" side; plane of coiling shifts approximately 30° to 45° in each succeeding volution; chambers numerous, not inflated, initially quadrate, later becoming more "wedge-shaped" (i.e., tapering from the peripheral margin inward), increasing gradually in size as added, about seven to

ten in ultimate whorl; sutures distinct, thickened, straight, radial and flush; wall finely agglutinated with much cement, smoothly finished; aperture simple, ovate, areal, raised above base of terminal face, with a distinct bordering lip, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Hypotype 57273	0.50	0.38	0.30
Hypotype 57274	0.58	0.43	0.25
Hypotype 57275	0.55	0.43	0.25
Hypotype 57276	0.60	0.45	0.25

Remarks. The specimens of *Recurvoides sublustris* recovered from the lower member of the Husky Formation agree well with Dain's material from the upper Oxfordian to basal Kimmeridgian of western Siberia, although Husky specimens have somewhat fewer chambers in the ultimate whorl.

Occurrence. *Recurvoides sublustris* occurs in beds of late Oxfordian to (?)middle Kimmeridgian age in the lower member.

Recurvoides triangulus n. sp.

Plate 10, figures 31–38

?1981 *Recurvoides?* sp. 149 Brooke and Braun, p. 20, Pl. 3, figs. 21–32.

Material. About 25 well preserved specimens; holotype GSC 57307, paratype GSC 57308, and unfigured paratype GSC 57309 from GSC loc. C-051312, 13.5 m above base of lower member; paratype GSC 57310 from GSC loc. C-051311, 12 m above base; unfigured paratypes 57311, 57312 from GSC loc. C-051324, 33 m above base.

Description. Test medium sized, ovate, elongate, peripheral margin rounded, generally compressed, rounded-triangular in cross-section; streptospirally coiled, plane of coiling shifts abruptly (45° to 60°) after initial volution, later much less so; consisting of two and a half to three whorls, with eight to ten chambers in the ultimate whorl; chambers not inflated,

somewhat longer than broad, expanding very gradually in size as added; sutures distinct, straight and radiate, flush with wall of test, may be somewhat thickened; wall very finely agglutinated with much cement, smoothly finished; aperture simple, areal, ovate, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
Holotype 57307	0.73	0.44	0.35
Paratype 57308	0.73	0.40	0.35
Paratype 57309	0.65	0.40	0.33
Paratype 57310	0.69	0.44	0.33
Paratype 57311	0.53	0.35	0.23
Paratype 57312	0.53	0.35	0.25

Remarks. *Recurvoides triangulus* n. sp. is distinctly different from other species of *Recurvoides* found in the Husky Formation by virtue of its length to width ratio and its rounded-triangular cross-sectional profile. The form figured by Brooke and Braun (1981) as *Recurvoides?* sp. 149 is quite similar, but about half the size of the Husky form. It also appears to lack the rounded-triangular cross-sectional profile of the latter.

Etymology. From the Latin, "triangulus", referring to the cross-sectional profile of the species.

Occurrence. *Recurvoides triangulus* n. sp. occurs in small numbers in the basal 35 m of the lower member.

Recurvoides sp. cf. *R. scherkalyensis* Levina

Plate 10, figures 8–11; 14–17

?1972 *Recurvoides scherkalyensis* Levina in Dain et al., Pl. IX, figs. 8a–c; Pl. X, figs. 1a–c.

Material. Fairly common, generally well preserved; figured specimens GSC 57294, 57295 from GSC loc. C-051313, 15 m above base of lower member; figured specimen GSC 57296 and unfigured specimen GSC 57297 from GSC loc. C-051315, 18 m above base; unfigured specimen GSC 57298 from GSC loc.

C-051321, 27 m above base; unfigured specimen GSC 57299 from GSC loc. C-051343, 60 m above base.

Description. Test large, broadly rounded, peripheral margin rounded; streptospirally coiled; consisting of two to two and a half whorls; approximately two whorls visible on "dorsal" side, only ultimate whorl visible on "ventral" side, about nine or ten chambers in the ultimate whorl; chambers subquadrate, slightly tapering inward from the periphery, increasing gradually in size as added; sutures distinct, thickened, straight, and radiate, flush with side of test; wall agglutinated, composed of finely granular quartz with much cement, fairly smoothly finished; aperture simple, areal, ovate, raised slightly above base of terminal septum, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
57294	0.80	0.60	0.40
57295	0.68	0.60	0.25
57296	0.65	0.55	0.25
57297	0.57	0.50	0.28
57298	0.63	0.53	0.25
57299	0.73	0.60	0.33

Remarks. *Recurvoides* sp. cf. *R. scherkalyensis* broadly resembles the west Siberian species, but the Husky forms are somewhat larger and more robust.

Occurrence. *Recurvoides* sp. cf. *R. scherkalyensis* occurs in the basal 30 m of the lower member.

Recurvoides sp. cf. *R. sublustris* Dain

Plate 10, figures 12, 13, 18

?1972 *Recurvoides sublustris* Dain in Dain et al., p. 57, Pl. XII, figs. 3–6.

Material. Fairly common, generally well preserved; figured specimens GSC 57277, 57279, and unfigured specimens GSC 57278, 57280 from GSC loc. C-051307, 6 m above base of lower member; unfigured specimens GSC 57281–57286 from GSC loc. C-029107, 1.5 to 6.1 m above base.

Description. Test large, compressed, stoutly ovate in outline, peripheral margin rounded; streptospirally coiled; consisting of approximately two and a half to

four whorls; about two to three whorls visible on “dorsal” side, one to two whorls visible on “ventral” side; plane of coiling appears to shift less than 30° in each succeeding volution; chambers numerous, eight to ten in ultimate whorl (?megalospheric) or ten to fourteen in ultimate whorl (?microspheric); chambers moderately inflated, initially quadrate, in later whorls becoming more “wedge-shaped” (tapering from the peripheral margin inward), increasing gradually in size as added; sutures distinct, thickened, straight and radiate, flush; wall finely agglutinated with much cement, smoothly finished; aperture simple, ovate, areal, raised above the base of the terminal septum, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
57277	0.83	0.63	0.33
57278	0.80	0.58	0.30
57279	0.75	0.58	0.28
57280	0.65	0.50	0.23
57281	0.60	0.45	0.23
57282	0.50	0.40	0.23
57283	0.65	0.48	0.18
57284	0.38	0.40	0.19
57285	0.48	0.38	0.20
57286	0.50	0.38	0.18

Remarks. *Recurvoides* sp. cf. *R. sublustris* has a more gently streptospiral mode of coiling and more chambers in the ultimate whorl than *R. sublustris*. The Husky specimens show a fair degree of variation in test size, ranging from 0.40 to 0.80 mm. The presence of microspheric and megalospheric generations is inferred from the number of chambers in the ultimate whorl.

Occurrence. *Recurvoides* sp. cf. *R. sublustris* occurs commonly in the basal third of the lower member.

Recurvoides sp. A

Plate 9, figures 21, 22

Material. Rare, about 25 well preserved specimens; figured specimen GSC 57328 and unfigured types GSC 57329–57331 from GSC loc. C-051414, 206 m above base of lower member.

Description. Test medium sized, globular in juvenile forms, becoming somewhat elongate in adults,

peripheral margin rounded; loosely streptospirally coiled, consisting of one and a half to two and a half whorls; normally all whorls visible on “dorsal” side, only the ultimate whorl visible on “ventral” side; plane of coiling shifts gently (less than 30°) in each successive volution, about five to eight chambers in the ultimate whorl; chambers quadrate, slightly inflated, increasing gradually in size as added; sutures distinct, straight, radiate, flush with test wall; wall arenaceous, fine to medium-sized quartz grains set in considerable cement, somewhat roughly finished; aperture simple, areal, ovate, centrally located, commonly obscure due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Thickness
57328	0.40	0.35	0.33
57329	0.56	0.50	0.35
57330	0.48	0.38	0.30
57331 (j)	0.38	0.30	0.33

j, megalospheric juvenile.

Remarks. *Recurvoides* sp. A closely resembles *R. eotrochus* Dain but is larger and lacks the open umbilical area of the latter. It differs from *R. disputabilis* Dain in having a trochospiral-like mode of coiling.

Occurrence. *Recurvoides* sp. A occurs sporadically in the uppermost 10 m of the lower member at Martin Creek.

Subfamily LITUOLINAE de Blainville, 1825

Genus *Ammobaculites* Cushman, 1910

Type species. *Spirolina agglutinans* d’Orbigny, 1846.

Diagnosis. Test free, early portion close coiled, later uncoiled and rectilinear, rounded in section; wall agglutinated, interior simple; aperture simple, terminal, rounded.

Ammobaculites aklavikensis n. sp.

Plate 13, figures 1–10

Material. Common, holotype GSC 57376, paratypes GSC 57377, 58502 and unfigured paratypes GSC 57378–57380, 58501 from GSC loc. C-051315, 18 m

above base of lower member; paratype GSC 57382 and unfigured paratype GSC 57381 from GSC loc. C-051314, 16.5 m above base.

Description. Test large, robust; early portion planispirally coiled, rounded to slightly lobulate in outline, of four or five rounded to moderately inflated chambers that increase very gradually in size as added, coil diameter generally 33 to 50 per cent greater than maximum diameter of uniserial portion, coil comprises 25 to 33 per cent of adult test; uniserial portion rectilinear, nearly parallel-sided, consisting of four or five chambers, which are robust, centrally inflated, and rounded in section, broader than high (height:width ratio 1:1.5 to 1:2), ultimate chamber pyriform; sutures distinct, straight, strongly constricted, horizontal in uniserial portion; wall fairly coarsely agglutinated, consisting of quartz grains with much siliceous cement, surface rough-finished; aperture simple, terminal, rounded, produced on a distinct neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57376	0.31	0.23	0.33	0.85
Paratype 57377	0.26	0.23	0.32	0.85
Paratype 57378	0.26	0.23	0.33	1.03
Paratype 57379	0.25	0.18	0.38	0.91
Paratype 57380	0.20	0.19	0.30	0.55
Paratype 57381	0.28	0.20	0.29	0.75
Paratype 57382 (j)	0.28	—	0.38	0.60
Paratype 58501	0.38	0.38	0.58	1.13
Paratype 58502	0.40	—	0.55	>0.75

j, juvenile.

Remarks. *Ammobaculites aklavikensis* n. sp. resembles certain forms figured by Tappan (1955) as *A. alaskensis* Tappan (Pl. 12, figs. 2, 3, 6, 7) but is generally smaller, possesses fewer chambers in the uniserial portion, and has a more strongly pyriform ultimate chamber with a distinctive neck.

As in other species of *Ammobaculites* from the lower member of the Husky Formation, *A.*

aklavikensis n. sp. can exhibit some variability in the coiled portion of the test. Two such aberrant individuals are paratype GSC 58502 (Pl. 13, figs. 9, 10) and unfigured paratype GSC 58501. When preservation is good, and sample size large enough, a whole spectrum of intermediate forms can be seen to exist between *A. aklavikensis* n. sp. and *Bulbobaculites gilberti* n. sp. This could indicate that the two forms belong to the same species groups, and instability in coiling could be related to megalospheric generations.

Etymology. The name is derived from the Aklavik Range of the northern Richardson Mountains, District of Mackenzie, Northwest Territories.

Occurrence. *Ammobaculites aklavikensis* n. sp. occurs abundantly in the Oxfordian part of the lower member, in samples 15 to 30 m above base.

Ammobaculites alaskensis Tappan subsp. *alaskensis* n. subsp.

Plate 11, figures 1–4, 7–10

- 1955 *Ammobaculites alaskensis* Tappan, p. 45, Pl. 12, figs. 1, 4, 5, 8, 9; *non* figs. 2, 3, 6, 7, 10.
- non* 1976 *Ammobaculites alaskensis* Tappan; Souaya, p. 268, Pl. 5, fig. 3.
- 1980 *Ammobaculites* aff. *alaskensis* Tappan; Løfaldli and Nagy, p. 78, Pl. 4, figs. 13, 14.
- 1980 *Ammobaculites suprajurassicum* (Schwager); Løfaldli and Nagy, p. 77, Pl. 2, figs. 12, 13; Pl. 3, figs. 3, 4.
- non* 1981 *Ammobaculites* cf. *A. alaskensis* Tappan; Brooke and Braun, p. 16, Pl. 4, figs. 1–16.
- non* 1982 *Ammobaculites* sp. cf. *alaskensis* Tappan; Leskiw *in* Poulton et al., Pl. 2, figs. 1, 2.
- 1983 *Ammobaculites* sp. 6 Wall, Pl. 3, figs. 30, 31.

Material. Abundant, several thousand specimens; holotype GSC 57332 and unfigured paratypes GSC 57333, 57334 from GSC loc. C-051325, 34.5 m above base of lower member; paratype GSC 57335 and unfigured paratype GSC 57336 from GSC loc. C-051326, 36 m above base; unfigured paratype GSC 57337 and paratypes GSC 57338, 57339 from GSC loc. C-051411, 197 m above base.

Description. Test large, robust, early portion planispirally coiled, consisting of (visible) one to one and a half whorls with four to six chambers in the

ultimate whorl, chambers strongly inflated, somewhat triangular in outline, increasing gradually in size as added, coil diameter generally 25 to 50 per cent greater than diameter of uniserial portion; later portion uniserial, straight and rectilinear, parallel-sided or nearly so, consisting of two to four chambers; chambers centrally inflated, broader than high (height to width ratio 1:1.5), rounded in cross-section, increasing very slowly in size as added; ultimate chamber generally equant, rounded to very slightly pyriform in outline; sutures distinct, thickened, moderately constricted; straight and radial in coiled portion, and horizontal in uniserial portion; wall moderately to coarsely agglutinated, composed mainly of unsorted quartz grains bound with much siliceous cement, giving a fairly smooth to quite rough overall texture; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57332	0.35	0.35	0.50	1.03
Paratype 57333	0.38	0.31	0.45	1.05
Paratype 57334	0.39	0.39	0.53	0.65
Paratype 57335	0.40	0.38	0.55	1.00
Paratype 57336	0.35	0.35	0.45	0.73
Paratype 57337	0.35	0.33	0.53	1.18
Paratype 57338	0.41	0.33	0.50	1.33
Paratype 57339	0.50	0.40	0.55	1.48

Remarks. *Ammobaculites alaskensis* as originally defined by Tappan (1955) contains a diverse group of forms clearly belonging to at least two (if not three) species. It is proposed herein to restrict the definition of *A. alaskensis* to forms that possess a rather large (initial) coiled portion followed by a uniserial portion composed of two to four (and rarely five) chambers. The sutures are thickened, the wall grain size rather coarse, and the terminal chamber rounded to very slightly pyriform. Even within these stricter guidelines, *A. alaskensis alaskensis* n. subsp. shows a great deal of variation, particularly in height and grain size.

Ammobaculites alaskensis alaskensis n. subsp. differs from *A. barrowensis* Tappan in being one

quarter to one half the size and having a more rounded ultimate chamber. It bears some resemblance to *A. validus* Beljaevskaja, but the diagnosis of the latter form is too vague to make an adequate comparison.

The forms illustrated by Løfaldli and Nagy (1980) as *A. suprajurassicum* (Schwager) are identical to *A. alaskensis alaskensis*, whereas the form that they assigned to *A. sp. aff. A. alaskensis* Tappan is identical to that illustrated by Tappan (1955, Plate 12, figure 8). This specimen, with the rather large coiled initial portion is also included in the redefined *A. alaskensis alaskensis*.

Forms referred to *A. alaskensis* by Brooke and Braun (1981) are not comparable to the revised definition of the species. Although their species concept is similar (“...large, robust, coarsely agglutinated forms with coil diameter about 50% greater than uniserial portion...”), their species is 50 to 67 per cent larger, and the uniserial portion contains only one to two chambers.

Included within the redefined *A. alaskensis* group are two new subspecies, *Ammobaculites alaskensis calculosus* n. subsp. and *A. alaskensis minor* n. subsp. The *A. lunaris* n. sp. variant is a short-lived offshoot of this group, which has nearly identical test geometry, except that the coiled portion is somewhat lenticular in profile, and possesses crescentic sutures.

Occurrence. *Ammobaculites alaskensis alaskensis* n. subsp. occurs throughout the lower member.

Ammobaculites alaskensis Tappan subsp. *calculosus* n. subsp.

Plate 12, figures 1–6

1983 *Ammobaculites* sp. 7 Wall, Pl. 4, fig. 3.

Material. Common, generally well preserved; holotype GSC 57410, paratype GSC 57411, and unfigured paratypes GSC 57412–57414 from GSC loc. C-051401, 171.5 m above base of lower member; unfigured paratype GSC 57415 and paratype GSC 57416 from GSC loc. C-051402, 173 m above base.

Description. Test large, robust, initial portion planispirally coiled, consisting of three to five chambers, chambers not inflated, increasing very gradually in size as added, diameter of coil usually

equal to or slightly larger than diameter of uniserial portion; later portion uniserial, straight and rectilinear, consisting of three to five chambers; chambers centrally inflated, generally broader than high (height:width ratio about 1:2), ultimate chamber about equant but slightly pyriform, widest just above base; sutures obscured by coarse grains, moderately constricted, straight and nearly radial in coiled portion, straight and horizontal in uniserial portion; wall very coarsely agglutinated, composed of unsorted fine to medium sized quartz grains (0.125 to 0.500 mm range) imbedded in siliceous cement, very roughly finished; aperture simple, terminal, rounded, often produced on a slight rim or collar.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57410	0.63	0.46	0.65	1.96
Paratype 57411	0.65	0.45	0.63	2.18
Paratype 57412	0.73	0.50	0.60	1.73
Paratype 57413	0.85	0.68	0.75	1.68
Paratype 57414 (j)	0.43	0.43	0.58	0.83
Paratype 57415	0.88	0.50	0.65	1.95
Paratype 57416 (j)	0.48	0.38	0.58	1.05

j, juvenile specimen.

Remarks. *Ammobaculites alaskensis calculosus* n. subsp. most closely resembles *A. multiformis* Dain from the Oxfordian–Kimmeridgian boundary beds of western Siberia, but differs in being three times as large and in having more chambers in the uniserial portion. It differs from *A. alaskensis alaskensis* n. subsp. in being larger and more coarsely agglutinated. It differs from the equally coarse grained *A. trachyostrachos* n. sp. in possessing a larger coil and much broader chambers. Wall's (1983) *A. sp. 7* appears to be conspecific with the Husky form.

Etymology. From the Latin, *calculosus*, pebbly or, gravelly, referring to the appearance of the test.

Occurrence. *Ammobaculites alaskensis calculosus* n. subsp. occurs abundantly in the upper 25 m of the lower member.

Ammobaculites alaskensis Tappan subsp. *minor* n. subsp.

Plate 11, figures 5, 6, 11–14

1983 *Ammobaculites* sp. cf. *A. suprajurassicum* (Schwager); Wall, Pl. 3, fig. 8.

Material. Common, generally well preserved; holotype GSC 57340, paratypes GSC 57343, 57344 and unfigured paratypes GSC 57341, 57342, 57345 from GSC loc. C-051307, 6 m above base of lower member.

Description. Test large, robust, early portion loosely planispirally coiled, consisting of six or seven chambers, umbilical areas depressed, chambers moderately inflated, increasing gradually in size as added, coil diameter about 50 to 75 per cent greater than that of later portion; coil comprises about 50 to 67 per cent of entire test height; later portion uniserial, straight, rectilinear, consisting of one or two chambers; chambers centrally inflated, almost equant to slightly broader than high, increasing slowly in size as added, ultimate chamber pyriform; sutures distinct, moderately constricted, radial in coiled portion, straight and horizontal in uniserial portion; wall agglutinated, composed of unsorted quartz grains with considerable cement, fairly smoothly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57340	0.25	0.50	0.65
Paratype 57341	0.25	0.48	0.48
Paratype 57342	0.28	0.43	0.53
Paratype 57343	0.25	0.38	0.55
Paratype 57344	0.28	0.45	0.70
Paratype 57345	0.33	0.53	0.60

Remarks. *Ammobaculites alaskensis minor* n. subsp. is very similar in general design to *A. alaskensis alaskensis* n. subsp., but differs in having a proportionately larger, less inflated coil with a depressed umbilical area and a poorly developed uniserial portion.

Etymology. From the Latin, *minor*, lesser.

Occurrence. *Ammobaculites alaskensis minor* n. subsp. occurs in the basal 10 m of the lower member.

Ammobaculites canoensis n. sp.

Plate 14, figures 16-19

Material. About 100 well preserved specimens; holotype GSC 57390, paratype GSC 57391, and unfigured paratypes GSC 57392-57395 from GSC loc. C-051415, 208 m above base of lower member.

Description. Test medium sized; planispiral coil consisting of one to one and a half closely embracing whorls, with four to six slightly inflated chambers in the ultimate whorl, diameter of coil generally greater than maximum width of later portion, comprises 25 to 33 per cent of entire test; uniserial portion straight, parallel-sided, four to six chambers that are usually broader than high (height:width ratio about 1:2), not inflated, expanding very gradually in size as added, ultimate chamber may be slightly pyriform; sutures distinct, slightly constricted; wall coarsely agglutinated with much cement, roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57390	0.29	0.30	0.88
Paratype 57391	0.25	0.31	0.90
Paratype 57392	0.33	0.35	1.00
Paratype 57393	0.25	0.40	1.00
Paratype 57394	0.20	0.30	0.88
Paratype 57395	0.23	0.35	0.83

Etymology. From Canoe Lake, in the northern Richardson Mountains, District of Mackenzie, Northwest Territories.

Occurrence. *Ammobaculites canoensis* n. sp. occurs abundantly in the uppermost 20 m of the lower member.

Ammobaculites lunaris n. sp.

Plate 11, figures 15-26

1981 *Ammobaculites* cf. *A. alaskensis* Tappan; Brooke and Braun, p. 16, Pl. 4, figs. 9-11; *non* figs. 1-8, 12-16.

Material. Abundant, generally well preserved; holotype GSC 57403 and paratypes GSC 57404, 57369 from GSC loc. C-051398, 167 m above base of lower member; paratype GSC 57405 and unfigured paratype GSC 57406 from GSC loc. C-051397, 165.5 m above base; paratypes GSC 57407-57409, 57368 from GSC loc. C-051403, 174.5 m above base.

Description. Test large, robust; initial portion tight planispiral coil, completely involute, coil tends to be rounded lenticular in cross-section, about 50 per cent wider than uniserial portion and comprises about 33 per cent of the test; six or seven chambers in coil, chambers centrally inflated, wedge-shaped, increasing very gradually in size as added; later portion uniserial, straight and rectilinear, rounded in cross-section, consisting of three (rarely four) chambers, which are centrally inflated and broader than high (height:width ratio about 1:2), ultimate chamber equant, rounded; sutures distinct, thickened, moderately depressed, arcuate (crescentic) in coiled portion, straight and horizontal in uniserial portion; wall fairly coarsely agglutinated, consisting of quartz grains with abundant cement, fairly roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57403	0.30	0.50	0.89
Paratype 57404	0.35	0.50	0.73
Paratype 57405 (j)	0.30	0.46	0.68
Paratype 57406 (j)	0.35	0.46	0.65
Paratype 57407 (j)	0.28	0.43	0.46
Paratype 57408 (j)	0.25	0.38	0.45
Paratype 57409	0.48	0.73	1.00
Paratype 57368	0.33	0.50	0.80

Paratype 57369	0.45	0.55	1.23
-------------------	------	------	------

j, juvenile specimen.

Remarks. *Ammobaculites lunaris* n. sp. appears to be an offshoot of the *A. alaskensis alaskensis* n. subsp. group and bears many morphological similarities to the forms in the latter. It differs in possessing a unique, lenticular-shaped coil, in which the chambers are “umbilically” inflated, and separated by distinctive, arcuate sutures.

Etymology. From the Latin, *lunaris* (crescent-shaped), referring to the distinctive curved sutures found in the planispirally coiled portion of the test.

Occurrence. *Ammobaculites lunaris* n. sp. is restricted in occurrence to an interval 167 to 175 m above the base of the lower member.

Ammobaculites magnus n. sp.

Plate 13, figures 17–20

1976 *Ammobaculites* sp. A Souaya, p. 269, Pl. 7, fig. 7; Pl. 12, fig. 10.

Material. Fairly common, generally poorly preserved; holotype GSC 57396, paratype GSC 57398, and unfigured paratypes GSC 57397, 57399, and 57400 from GSC loc. C-051338, 52.5 m above base of lower member; paratype GSC 57402 and unfigured paratype GSC 57401 from GSC loc. C-051337, 51 m above base.

Description. Test large, robust, tapering; early portion planispirally coiled with five or six chambers in coil, chambers not inflated, increasing gradually in size as added, coil diameter generally less than 50 per cent of maximum diameter of later uniserial portion; uniserial chambers rectilinear, six or seven in number, centrally inflated, much broader than high (height:width ratio greater than 1:3), increasing fairly rapidly in size as added; sutures indistinct, slightly depressed, straight and horizontal in uniserial portion, nearly radial in coiled portion; wall fairly coarsely agglutinated with much cement, quite smoothly finished; aperture simple, terminal, rounded, sometimes produced on collar or rim.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57396*	1.00	0.68	0.60	1.90

Paratype 57397	0.93	0.68	0.63	1.95
Paratype 57398*	1.08	0.53	—	>2.38
Paratype 57399*	1.10	0.58	—	>1.88
Paratype 57400	0.90	0.58	0.50	1.50
Paratype 57401*	0.98	0.65	0.53	1.95
Paratype 57402*	0.98	—	—	—

*damaged, crushed, or partial specimen.

Remarks. *Ammobaculites magnus* n. sp. is identical with Souaya’s (1976) *A.* sp. A from the Callovian of the Sverdrup Basin. It differs from all other large species of the genus *Ammobaculites* present in the lower member in being more finely agglutinated and possessing the acutely tapering uniserial portion.

Ammobaculites sp. 4 of Wall (1983) is comparable in size and general chamber design (low and very broad) to *A. magnus* n. sp., but differs from the latter in having a much more coarsely agglutinated wall.

Etymology. From the Latin, *magnus* or great, referring to the very large size of the species.

Occurrence. *Ammobaculites magnus* n. sp. occurs sporadically throughout the lower member.

Ammobaculites toughenoughensis n. sp.

Plate 13, figures 11–16

1976 *Ammobaculites* sp. cf. *A. “directa-decora”* Scherp; Souaya, p. 268, Pl. 10, fig. 11.

Material. Abundant; holotype GSC 57383, paratypes GSC 57384, 57385 and unfigured paratypes GSC 57386–57389 from GSC loc. C-051333, 45 m above base of lower member.

Description. Test large, robust; planispiral coil of four or five chambers, chambers slightly inflated, rounded, increasing very gradually in size as added, coil diameter less than or equal to maximum diameter of test, makes up about 20 per cent of entire test; later portion uniserial, straight, margins rounded, nearly parallel, consisting of four to six centrally inflated chambers, much broader than high (height:width ratio 1:1.5 to 1:2), rounded in cross-section and increasing very slowly in size as added; ultimate (and commonly

penultimate) chamber almost equant, commonly slightly to strongly pyriform, sutures distinct, slightly limbate, straight and horizontal in uniserial portion; wall coarsely arenaceous, composed of quartz grains with abundant siliceous cement, fairly roughly finished; aperture simple, terminal, rounded, with a bordering lip.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57383	0.40	0.26	0.28	1.05
Paratype 57384	0.53	0.30	0.33	1.68
Paratype 57385	0.36	0.31	0.28	1.03
Paratype 57386	0.33	0.25	0.30	0.93
Paratype 57387	0.43	0.28	0.29	1.15
Paratype 57388	0.48	0.28	0.34	1.08
Paratype 57389	0.40	0.33	0.40	0.93

Remarks. *Ammobaculites toughenoughensis* n. sp. differs from *A. alaskensis alaskensis* n. subsp. in having a smaller coiled portion, more chambers in the uniserial portion, and a more pyriform ultimate chamber. It differs from *A. imlayi* Loeblich and Tappan in being twice as large, having a more inflated coil, and a more coarsely agglutinated wall. The form assigned by Souaya (1976) to *Ammobaculites* sp. cf. *A. "directa-decora"* Scherp from the latest Triassic of the Canadian Arctic Archipelago appears to be synonymous with the Husky species.

Ammobaculites toughenoughensis n. sp. appears to be the planispiral analogue of *Bulbobaculites willowensis* n. sp. The two forms probably belong to the same species group, and good preservation is required to distinguish the genus that the form actually belongs to.

Etymology. The species is named after Mount Toughenough, a peak in the Aklavik Range of the northern Richardson Mountains, District of Mackenzie, Northwest Territories.

Occurrence. *Ammobaculites toughenoughensis* n. sp. occurs throughout the lower member.

Ammobaculites trachyostrachos n. sp.

Plate 14, figures 1-6

1983 *Ammobaculites* sp. 3 Wall, Pl. 2, fig. 8; Pl. 3, fig. 7.

Material. Common, generally well preserved; holotype GSC 57370, paratypes GSC 57373, 57374 and unfigured paratypes GSC 57371, 57372, and 57375 from GSC loc. C-051311, 12 m above base of lower member.

Description. Test large, robust; planispiral coil of four or five slightly inflated chambers, increasing very gradually in size as added, coil diameter less than or equal to maximum diameter of uniserial portion; uniserial portion straight to very gently tapering, of four to six centrally inflated chambers that are broader than high, ultimate chamber rounded to somewhat pyriform; sutures distinct to almost unrecognizable (depending on grain size of wall), moderately constricted, obscured in coiled portion, straight and horizontal in uniserial portion; wall very coarsely agglutinated, of unsorted quartz grains imbedded in small amount of siliceous cement, very roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57370	0.58	0.35	0.43	2.00
Paratype 57371	0.56	0.40	0.40	1.90
Paratype 57372	0.55	0.38	0.33	1.85
Paratype 57373	0.43	0.40	0.35	1.45
Paratype 57374	0.40	0.40	0.40	1.55
Paratype 57375	0.50	0.35	0.28	1.55

Remarks. *Ammobaculites trachyostrachos* n. sp. differs from other representatives of *Ammobaculites* in the lower member by its large size, rather tiny coil, and coarsely agglutinated wall. Because the coil is so small, it can sometimes be obscured due to preservation, and the species could be mistaken for a *Reophax* or *Bulbobaculites mutabilis* n. sp. In several specimens the coil is finely agglutinated, whereas the uniserial portion is very coarsely agglutinated. *Ammobaculites*

sp. 3 of Wall (1983) from the Oxfordian of the eastern Sverdrup Basin appears to be conspecific with the Husky form. *Ammobaculites trachyostrachos* n. sp. differs from *A. alaskensis calculosus* n. subsp. in being larger, more coarsely agglutinated, and possessing a much smaller and indistinct coiled portion.

Etymology. From the Greek, *trachyostrachos*, rough-shelled or rough-walled, an apt description of the wall texture.

Occurrence. *Ammobaculites trachyostrachos* n. sp. occurs commonly in the basal 15 m of the lower member.

Ammobaculites sp. cf. *A. multiformis* Dain

Plate 12, figures 7-20

?1972 *Ammobaculites multiformis* Dain in Dain et al., p. 63, Pl. XVI, figs. 5-8.

1981 *Ammobaculites* sp. 152 Brooke and Braun, p. 18, Pl. 4, figs. 27-36.

Material. Common, generally well preserved; figured specimens GSC 57346, 57348, and unfigured type GSC 57347 from GSC loc. C-051325, 33 m above base of lower member; figured specimens GSC 57349-57352 from GSC loc. C-051379, 131 m above base.

Description. Test medium sized, robust; earlier portion loosely planispirally coiled, completely evolute, umbilical areas slightly depressed, consisting of five to seven chambers, chambers equant to triangular in shape, moderately to strongly inflated, increasing gradually in size as added, coiled portion normally equal to or slightly larger than maximum diameter of uniserial portion, makes up 33 to 50 per cent of test; later portion uniserial, axis straight to slightly inclined, consisting of one or two (very rarely three) chambers, ultimate chamber strongly inflated, distinctly pyriform in shape; sutures distinct, slightly thickened, strongly constricted; wall moderately to very coarsely agglutinated, composed of unsorted quartz grains with considerable cement, fairly smoothly to somewhat roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
57346	0.30	0.36	0.64
57347	0.24	0.38	0.54

57348	0.21	0.38	0.79
57349	0.33	0.43	0.65
57350	0.29	0.35	0.85
57351	0.55	0.35	1.25
57352	0.34	0.50	0.65

Remarks. *Ammobaculites* sp. cf. *A. multiformis* is a highly variable species, as the trivial name implies. Variation in the grain size of the wall is quite pronounced, with some forms having a finely agglutinated, smoothly finished surface, whereas others are built of very coarse grains that obscure and distort the sutures. Several specimens have fine grains in the coiled portion and progressively coarser grains in the uniserial portion. The shape of the chambers of the coil is quite variable, ranging from globular to teardrop-shaped to triangular.

Ammobaculites sp. cf. *A. multiformis* differs from *A. multiformis* in having fewer chambers in the uniserial portion.

Occurrence. *Ammobaculites* sp. cf. *A. multiformis* occurs in small numbers through all but the basal 30 m of the lower member.

Ammobaculites sp. cf. *A. multiformis* Dain morphotype A

Plate 12, figures 21-25

?1972 *Ammobaculites multiformis* Dain in Dain et al., p. 63, Pl. XVI, figs. 5-8.

Material. Common, figured specimens GSC 57358-57360 from GSC loc. C-051379, 131 m above base of lower member.

Description. Test large, early portion planispirally coiled, consisting of three to five chambers, chambers slightly inflated, increasing gradually in size as added, coiled portion about same diameter or up to 33 per cent greater than maximum diameter of uniserial portion, makes up 33 per cent of entire test; later portion uniserial, consisting of two or three chambers, which are centrally inflated, slightly broader than high, ultimate chamber distinctly pyriform; sutures distinct, straight, horizontal, strongly constricted; wall coarsely arenaceous, of unsorted quartz grains with small amount of siliceous cement, roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
57358	0.30	0.38	0.80
57359	0.31	0.33	0.93
57360	0.38	0.45	0.93

Remarks. *Ammobaculites* sp. cf. *A. multiformis* morphotype A differs from *A. sp. cf. A. multiformis* in possessing (on average) more chambers in the uniserial portion, which are arranged along a straight rather than inclined axis.

Occurrence. *Ammobaculites* sp. cf. *A. multiformis* morphotype A occurs rarely 125 to 143 m above the base of the lower member.

Ammobaculites sp. cf. *A. venustus* Loeblich and Tappan

Plate 16, figures 1-6

?1950 *Ammobaculites venustus* Loeblich and Tappan, p. 42, Pl. 11, figs. 7, 8.

1960 *Ammobaculites venustus* Loeblich and Tappan; Wall, p. 52, Pl. 8, figs. 8, 9; Pl. 17, figs. 6, 7.

1972 *Ammobaculites venustus* Loeblich and Tappan; Brooke and Braun, Pl. 8, figs. 58, 59.

non 1976 *Ammobaculites venustus* Loeblich and Tappan; Souaya, p. 269, Pl. 6, figs. 16, 17.

Material. Common, figured specimens GSC 57361, 57363, 57364 and unfigured types GSC 57362, 57365 from GSC loc. C-051337, 51 m above base of lower member; unfigured type GSC 57366 from GSC loc. C-051332, 43.5 m above base.

Description. Test small; initial portion planispirally coiled, consisting of one and a half to two closely embracing whorls, proloculus followed by five or six rapidly expanding chambers in initial whorl, decreasing to three or four in outer whorl; coiled portion occupies 25 to 33 per cent of entire test; later portion uniserial, straight, consisting of two to four chambers, chambers about equant, centrally inflated, expanding very gradually in size as added, ultimate chamber pyriform; sutures distinct, straight, strongly constricted, horizontal in uniserial portion; wall finely agglutinated with considerable cement, roughly finished; aperture simple, terminal, rounded, produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
57361	0.13	0.15	0.33
57362	0.13	0.18	0.23
57363	0.18	0.18	0.40
57364	0.15	0.15	0.45
57365	0.14	0.18	0.40
57366	0.14	0.15	0.40

Remarks. *Ammobaculites* sp. cf. *A. venustus* differs from *A. venustus* in having a more inflated — rather than compressed — test, fewer chambers in the coiled portion (three or four compared to five or six) and in possessing a more pyriform ultimate chamber. The nature of the coiling in *A. sp. cf. A. venustus* is quite variable, with some of the (?) megalospheric heteromorphs showing a tendency to a streptospiral or (?) slightly trochospiral arrangement.

Occurrence. *Ammobaculites* sp. cf. *A. venustus* occurs abundantly 44 to 55 m above the base of the lower member.

Ammobaculites sp. A

Plate 15, figures 7-10

?1981 *Ammobaculites* cf. *A. wenonahae* Tappan; Brooke and Braun, p. 17, Pl. 4, figs. 22-26.

Material. About 50 specimens in variable states of preservation; figured specimen GSC 57353 from GSC loc. C-051368, 98 m above base of lower member; unfigured type GSC 57354 from GSC loc. C-051369, 101 m above base; unfigured type GSC 57355 from GSC loc. C-051379, 131 m above base; figured specimens GSC 57356, 57357 from GSC loc. C-051381, 137 m above base.

Description. Test large, robust; initial portion planispirally coiled, biumbilicate, umbilical areas slightly to moderately depressed, consisting of seven to ten chambers, chambers elongate-triangular in shape, much broader than high, increasing rapidly in size as added, slightly inflated, coil diameter 50 to 67 per cent greater than maximum diameter of uniserial portion, coiled portion occupies 50 to 75 per cent of height of test; uniserial portion poorly developed, usually a single chamber that is strongly inflated and rounded to pyriform in shape; sutures distinct, slightly thickened, moderately constricted, straight; wall moderately to

coarsely agglutinated, composed of mostly equant quartz grains with abundant cement, roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
57353	0.63	0.85	1.08
57354	0.63	0.89	1.00
57355	0.43	0.68	0.70
57356	0.55	0.78	1.18
57357	0.58	0.89	1.08

Remarks. *Ammobaculites* sp. A resembles *A.* sp. cf. *A. multiformis* Dain, but is about twice the size of the latter. It may be conspecific with the form described by Brooke and Braun (1981) as *A.* sp. cf. *A. wenonahae* Tappan.

Occurrence. *Ammobaculites* sp. A occurs rarely throughout the upper two thirds of the lower member.

Genus *Ammobaculoides* Plummer, 1932

Type species. *Ammobaculoides navarroensis* Plummer, 1932.

Diagnosis. Test free, elongate, ovate to rounded in section; early chambers arranged in planispiral coil, later biserially arranged and finally uniserial; wall agglutinated; aperture at base of final chamber of early portion, becoming terminal in adult.

Ammobaculoides mahadeoi n. sp.

Plate 16, figures 7–12

1981 *Spiroplectamina* cf. *S. tobolskensis* Beljaevskaja and Kommissarenko in Dain et al.; Brooke and Braun, p. 22, Pl. 5, figs. 10–12; *non* figs. 13, 14.

Material. About 30 specimens in adequate state of preservation; holotype GSC 57444 and unfigured paratypes GSC 57445, 57446 from GSC loc. C-051409, 191 m above base of lower member; paratypes GSC 57447, 57449 and unfigured paratype GSC 57448 from GSC loc. C-051415, 208 m above base.

Description. Test medium sized; early portion planispirally coiled, evolute, consisting of about two whorls, with three to five chambers in the first and

seven or eight chambers in the second whorl, respectively, chambers not inflated, increasing very gradually in size as added, coil makes up 25 to 33 per cent of adult test; later portion initially biserially arranged (again about 33 per cent of adult test), with two or three pairs of equant chambers, which are not inflated and increase very gradually in size as added; last portion uniserial, consisting of two or three chambers; sutures distinct, thickened, flush; wall fairly coarsely agglutinated with considerable cement, roughly finished with rare, larger grains present; aperture (adult specimens) simple, terminal, rounded to slightly ovate.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Diameter (coil)	Height
Holotype 57444	0.20	0.15	0.25	0.53
Paratype 57445	0.19	0.14	0.23	0.46
Paratype 57446	0.20	0.15	0.20	0.43
Paratype 57447	0.23	0.18	0.28	0.75
Paratype 57448	0.20	0.19	0.25	0.84
Paratype 57449	0.23	0.18	0.28	0.68

Remarks. *Ammobaculoides mahadeoi* n. sp. most closely resembles *A. phallus* Lalicker, but differs in being twice as large, possessing a more parallel-sided later portion, and having fewer pairs of chambers in the biserial portion. Brooke and Braun (1981) included within their *Spiroplectamina* sp. cf. *S. tobolskensis* Beljaevskaja and Kommissarenko specimens that possess a distinctly uniserial ultimate portion, which makes the forms assignable to *Ammobaculoides*. Their figured specimens (op. cit., Pl. 5, figs. 10–12) agree closely with the Husky forms.

Etymology. The patronym honours Mr. Clarence B. Mahadeo, micropaleontologist formerly with Amoco Canada Petroleum Company Limited.

Occurrence. *Ammobaculoides mahadeoi* n. sp. occurs in small numbers in the uppermost beds of the lower member.

Ammobaculoides rickyouni n. sp.

Plate 16, figures 13–18

Material. Fairly common, generally well preserved; holotype GSC 57437, paratypes GSC 57440, 57443 and unfigured paratypes GSC 57438, 57439, 57441, 57442 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, compressed; early portion planispirally coiled, consisting of one to one and a half whorls, about seven chambers per whorl, expanding rapidly in size as added, coil is followed by one to two pairs of loosely biserial chambers, in most individuals trending from biserial to almost uniserial; sutures distinct, slightly depressed, slightly curved backward in the coiled portion, oblique to almost horizontal in the later portion; wall finely arenaceous with much cement, smoothly finished; aperture simple, rounded, terminal in uncoiled portion.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57437	0.13	0.17	0.34
Paratype 57438	0.11	0.19	0.37
Paratype 57439	0.11	0.19	0.33
Paratype 57440	0.14	0.20	0.31
Paratype 57441	0.14	0.19	0.34
Paratype 57442	0.12	0.21	0.33
Paratype 57443	0.14	0.19	0.27

Remarks. This species is tentatively assigned to the genus *Ammobaculoides* due to the apparent trend toward uniseriality in the later portion of the test. The terminal position of the aperture also supports this argument. In general, *Ammobaculoides rickyouni* n. sp. resembles some specimens of *Spiroplectammina* sp. as figured by Tappan (1955) from the north slope of Alaska. It is readily distinguished from the latter by its smaller size and lack of "regularity" in the uncoiled portion of the test.

Etymology. The patronym honours Dr. F.G. (Rick) Young, geologist with Home Oil Company Limited.

Occurrence. *Ammobaculoides rickyouni* n. sp. occurs abundantly in a single sample situated 176 m above the base of the lower member.

Genus *Bulbobaculites* Maync, 1952

Type species. *Ammobaculites leucki* Cushman and Hedberg, 1941.

Diagnosis. Test free, streptospirally coiled in the initial portion, later rectilinear; transverse section rounded; wall agglutinated, simple; aperture simple, terminal, rounded.

Remarks. *Bulbobaculites* differs from *Bulbophragmium* Maync in having a simple rather than a cribrate aperture. It differs from the genus *Haplophragmium* Reuss in having a simple rather than alveolar wall structure.

Bulbobaculites gilberti n. sp.

Plate 15, figures 11-17

Material. Common, generally well preserved; holotype GSC 57430, paratypes GSC 57432, 57436 and unfigured paratype GSC 57431, 57433-57435 from GSC loc. C-051315, 18 m above base of lower member.

Description. Test large; early portion loosely streptospirally coiled, consisting of five to seven rounded chambers that increase rapidly in size as added; coiled portion makes up 25 to 33 per cent of entire test; later portion uniserial, straight, consisting of three to five chambers that are slightly inflated, rounded in cross-section, about twice as broad as high, ultimate chamber nearly equant, strongly pyriform; sutures distinct, slightly thickened, strongly constricted; wall finely agglutinated with much siliceous cement, smoothly finished; aperture simple, terminal, rounded, may be produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57430	0.33	0.25	0.96
Paratype 57431	0.29	0.30	0.75
Paratype 57432	0.25	0.38	0.63
Paratype 57433	0.28	0.36	0.66
Paratype 57434	0.28	0.31	0.75
Paratype 57435	0.23	0.26	0.65

Paratype 0.25 0.35 0.38

57436 (j)

j, juvenile specimen.

Remarks. *Bulbobaculites gilberti* n. sp. is the streptospirally coiled analogue (?heteromorph) of *Ammobaculites aklavikensis* n. sp. The forms share a common vertical range and occur together in the same samples. Good preservation is a prerequisite for distinguishing the two genera.

Etymology. From Mount Davies-Gilbert, a peak in the northern Richardson Mountains.

Occurrence. *Bulbobaculites gilberti* n. sp. occurs commonly 17 to 21 m above the base of the lower member.

Bulbobaculites pokrovkaensis (Kosyreva)

Plate 15, figures 18–24

- 1972 *Haplophragmium pokrovkaensis* Kosyreva in Dain et al., p. 68, Pl. XVIII, figs. 1–5.
 non 1981 *Ammobaculites* sp. cf. *pokrovkaensis* (Kosyreva); Brooke and Braun, p. 17, Pl. 4, figs. 17–21.
 non 1982 *Ammobaculites pokrovkaensis* (Kosyreva); Leskiw in Poulton et al., Pl. 2, figs. 4, 5.
 non 1983 *Ammobaculites pokrovkaensis* (Kosyreva); Løfaldli and Nagy, p. 101, Pl. 1, fig. 6.
 1983 *Haplophragmium* sp. cf. *H. pokrovkaensis* Kosyreva; Wall, Pl. 4, figs. 12–14.

Material. Common; hypotypes GSC 57417, 57418, 57420 and unfigured hypotypes GSC 57419, 57421, and 57422 from GSC loc. C-051321, 27 m above base of lower member.

Description. Test small, initial portion streptospirally coiled, consisting of two or three chambers (megalospheric), three or four chambers (microspheric); chambers globular, inflated, increasing fairly rapidly in size as added; coiled portion constitutes 25 to 33 per cent of entire test; later portion uniserial, straight, consisting of two or three chambers that are centrally inflated, about as broad as they are high, ultimate chamber slightly to distinctly pyriform; sutures distinct, moderately constricted; wall finely agglutinated with much cement, fairly smoothly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Hypotype 57417	0.14	0.16	0.45
Hypotype 57418	0.14	0.18	0.34
Hypotype 57419	0.16	0.18	0.38
Hypotype 57420	0.16	0.15	0.39
Hypotype 57421	0.18	0.13	0.48
Hypotype 57422	0.14	0.14	0.38

Remarks. The Husky forms of *Bulbobaculites pokrovkaensis* agree well with Russian representatives from the Lower Kimmeridgian of western Siberia, although our forms are probably slightly older (Upper Oxfordian). Wall (1983) recovered similar material from the Upper Volgian of the eastern Sverdrup Basin, so it appears that the species is long ranging. The forms assigned by Brooke and Braun (1981) to *Ammobaculites* sp. cf. *A. pokrovkaensis* clearly have a planispiral coil. Examination of Kosyreva's forms (in Dain et al., 1972), however, shows a streptospiral coil. So, although the two species have the same general morphology, they belong to different genera.

Occurrence. *Bulbobaculites pokrovkaensis* occurs in the basal 30 m of the lower member.

Bulbobaculites willowensis n. sp.

Plate 15, figures 1–6

Material. Common, generally well preserved; holotype GSC 57423, paratype GSC 57424 and unfigured paratype GSC 57425 from GSC loc. C-051314, 16.5 m above base of lower member; paratype GSC 57427 and unfigured paratypes GSC 57426, 57428, and 57429 from GSC loc. C-051315, 18 m above base.

Description. Test large, robust; early portion tightly streptospirally coiled, consisting of four to seven chambers, diameter of initial portion usually less than that of uniserial portion, constitutes 15 to 20 per cent of adult test; later portion uniserial, straight, consisting of four to six chambers that are inflated and rounded in cross-section, about twice as broad as high, ultimate chamber globular to slightly pyriform; sutures distinct,

slightly thickened, constricted; wall composed of medium-sized quartz grains with considerable cement, quite smoothly finished; aperture simple, terminal, rounded, sometimes produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 57423	0.45	0.35	1.68
Paratype 57424	0.46	0.25	1.19
Paratype 57425	0.48	0.30	1.38
Paratype 57426	0.43	0.28	1.63
Paratype 57427	0.38	0.30	1.00
Paratype 57428 (j)	0.33	0.25	0.80
Paratype 57429 (j)	0.36	0.30	0.70

j, juvenile specimen.

Remarks. *Bulbobaculites willowensis* n. sp. differs from *B. pokrovkaensis* (Kosyreva) in being much larger and having more chambers in the uniserial portion. It differs from *B. gilberti* n. sp. in possessing a smaller coiled portion with more accentuated streptospiral coiling. *Bulbobaculites willowensis* n. sp. is one of three species of *Bulbobaculites* found within the lower member that appear to have planispirally coiled heteromorphs that are, by definition, placed within the genus *Ammobaculites* Cushman. Based on preliminary studies of large, well preserved populations, it appears that *B. willowensis* n. sp. and *Ammobaculites toughenoughensis* n. sp. belong to the same species group. Other species group pairs are: *Bulbobaculites gilberti* n. sp./*Ammobaculites aklavikensis* n. sp., and *Bulbobaculites mutabilis* n. sp./*Ammobaculites trachyostrachos* n. sp.

Not enough work has been done to determine the reasons for this. Aberrations in coiling could be due to the presence of a megalospheric proloculus, which might induce streptospiral coiling because of its large size, such as apparently occur in slightly streptospiral forms of *Haplophragmoides tryssa* Loeblich and Tappan. This explanation, though attractive, may not be the only one. Stelck and Hedinger (1976) demonstrated that both megalospheric and microspheric heteromorphs existed within *Bulbobaculites swareni* (Stelck and Hedinger). The present "rigorous"

taxonomy does not allow both streptospiral and planispiral heteromorphs to be placed within the same genus. The unsatisfactory solution of creating separate taxa for forms that probably belong to the same species is proposed until further, more detailed studies can be undertaken.

Etymology. The species is named after the Willow River, which flows through the Aklavik Range, northern Richardson Mountains, Northwest Territories.

Occurrence. *Bulbobaculites willowensis* n. sp. occurs commonly in beds 17 to 39 m above the base of the lower member.

Bulbobaculites? mutabilis n. sp.

Plate 14, figures 7-15

Material. Common, generally well preserved; holotype GSC 58491, paratypes GSC 58492, 58493, 58495 and unfigured paratypes GSC 58494, 58496 from GSC loc. C-051311, 12 m above base of lower member.

Description. Test large, robust, early portion clearly to indistinctly streptospirally coiled, consisting of three to five rather slowly expanding chambers; coil diameter usually considerably less than maximum diameter of test, occupying 15 to 20 per cent of adult specimen; later portion uniserial, straight, gently tapering to nearly parallel-sized, consisting of four to six chambers that are centrally inflated and rounded in cross-section, rather broader than they are high, ultimate chamber more equant; sutures distinct to nearly unrecognizable (depending on coarseness of wall) moderately constricted, straight and horizontal in uniserial portion; wall composition variable: medium to very coarsely agglutinated, consisting of unsorted quartz grains in siliceous cement, smoothly to very roughly finished; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (coil)	Height
Holotype 58491	0.44	0.28	1.65
Paratype 58492	0.60	0.28	1.83
Paratype 58493	0.50	0.25	1.58
Paratype 58494	0.55	0.35	1.68

Paratype 58495	0.48	0.26	1.60
Paratype 58496	0.58	0.28	1.75

Remarks. The species is tentatively placed in the genus *Bulbobaculites*, because in many cases the nature of the coiling is difficult to ascertain, though it is not obviously planispiral. As in *Ammobaculites trachyostrachos* n. sp., the selection of grains (more particularly grain size) throughout the life of any one individual is puzzling. Holotype GSC 58491 (Pl. 14, figs. 11, 12) and paratype GSC 58493 (Pl. 14, figs. 7, 8) have very coarse grained walls throughout the entire test, whereas others, like paratype GSC 58492 and 58495 (Pl. 14, figs. 9, 10, 13–15) appear to favour alternately fine and/or coarse particles from one chamber to the next. This may reflect seasonal sediment supply to the area, or simply be a specific characteristic of this form.

Etymology. From the Latin, *mutabilis*, meaning changeable or inconstant, referring to the variable grain size used in wall construction.

Occurrence. *Bulbobaculites? mutabilis* n. sp. occurs commonly in the basal 15 m of the lower member.

Family TEXTULARIIDAE Ehrenberg, 1838

Remarks. Textulariidae have only rarely been recorded in Boreal Upper Jurassic microfaunas, and in previous studies have never been cited as major constituents of any assemblages. In marked contrast, the lower member of the Husky Formation contains a rich and diverse (though numerically small) fauna including *Textularia* spp., *Spiroplectammina* sp., *Pseudobolivina* spp., and *Siphotextularia* spp. These genera occur throughout the lower member, but never constitute more than 2 per cent of any given assemblage. The species are invariably quite small (restricted to the 200 mesh size fraction); this could explain the scarcity of Textulariidae reported from other areas.

Subfamily SPIROPLECTAMMININAE Cushman, 1927

Genus *Spiroplectammina* Cushman, 1927

Type species. *Textularia agglutinans* d'Orbigny variety *biformis* Parker and Jones, 1865.

Diagnosis. Test free, elongate, early portion in planispiral coil of few chambers, later chambers

biserially arranged; wall agglutinated; aperture a lower arch at the inner margin of the ultimate chamber.

Remarks. *Spiroplectammina* differs from *Textularia* in having an initial coil.

Spiroplectammina cuneata n. sp.

Plate 17, figures 1–4.

Material. Uncommon; holotype GSC 57450 from GSC loc. C-051324, 33 m above base of lower member; paratype GSC 57451 from GSC loc. C-051325, 34.5 m above base; unfigured paratypes GSC 57452–57455 from GSC loc. C-051326, 36 m above base.

Description. Test small, elongate, compressed; early portion planispiral coil of about 5 equant chambers; later portion biserially arranged, consisting of six to eight pairs of chambers that increase gradually in size as added so that the margins of the test flare slightly; sutures distinct, very slightly to not depressed, slightly curved backward in coil, oblique in later portion, at about 30° from the horizontal; wall finely arenaceous with considerable cement, smoothly finished; aperture a low arch at the inner margin of the ultimate chamber, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Holotype 57450	0.08	0.06	0.28
Paratype 57451	0.08	0.06	0.25
Paratype 57452	0.08	0.05	0.23
Paratype 57453	0.08	0.05	0.22
Paratype 57454	0.08	0.05	0.23
Paratype 57455	0.09	0.05	0.24

Remarks. The genus *Spiroplectammina* seems to occur only rarely in Jurassic and Cretaceous assemblages in Canadian Arctic regions. *Spiroplectammina cuneata* n. sp. differs from *S. tobolskensis* Beljaevskaja and Kommisarenko (*in* Dain et al., 1972) in being smaller, having fewer whorls and chambers in the coiled portion and more numerous, regularly shaped chambers in the biserial portion. It differs from *S.*

suprajurassica Kosyreva (in Dain et al., 1972), in being smaller, possessing a smaller coil with fewer chambers and having more chambers in the biserial portion. It differs from both *S. vicinalis* Dain (in Dain et al., 1972) and *S. paravicinalis* Dain in being much smaller, having fewer chambers and whorls in the coiled portion, and possessing a much more finely agglutinated wall.

Spiroplectamina cuneata n. sp. occurs rarely in the lower member and shares the same vertical range as *Textularia areoplecta* Tappan. Specimens with the early portion broken off are hard to distinguish from the latter.

Etymology. From the Latin, *cuneatus*, meaning wedge-shaped.

Occurrence. *Spiroplectamina cuneata* n. sp. occurs rarely in the basal two thirds of the lower member.

Subfamily TEXTULARIINAE Ehrenberg, 1838

Genus *Textularia* DeFrance in de Blainville, 1824

Type species. *Textularia sagittula* DeFrance in de Blainville, 1824.

Diagnosis. Test free, elongate, biserial, generally more or less compressed in plane of biseriality, or, less commonly, ovate to rounded in cross-section; chambers numerous, generally closely appressed; wall agglutinated, simple; aperture a single low arch at base of last chamber.

Textularia areoplecta Tappan

Plate 17, figures 5-9

1955 *Textularia areoplecta* Tappan, p. 47, Pl. 13, figs. 13-16.

Material. Uncommon, about 25 specimens in adequate state of preservation; hypotypes GSC 57456, 57457 from GSC loc. C-051323, 30 m above base of lower member; unfigured hypotypes GSC 57458, 57459 and hypotypes GSC 57460, 57461 from GSC loc. C-051326, 36 m above base.

Description. Test small, strongly compressed, elongate, biserial throughout, gently tapering to nearly parallel-sided, consisting of tiny, spherical proloculus followed by six to eight pairs of chambers, which are not inflated and are broader than high, increasing very

gradually in size as added; sutures distinct, very slightly depressed, slightly oblique; wall very finely arenaceous with much cement, smoothly finished, aperture a high arch at base of ultimate chamber.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 57456	0.10	0.06	0.23
Hypotype 57457	0.09	0.05	0.25
Hypotype 57458*	0.09	0.05	>0.25
Hypotype 57459	0.09	0.04	0.20
Hypotype 57460	0.10	0.06	0.23
Hypotype 57461	0.08	0.04	0.24

*broken specimen.

Remarks. The Husky specimens agree well with the forms figured by Tappan, although her forms all come from the Lower Jurassic of northern Alaska.

Occurrence. *Textularia areoplecta* Tappan occurs in small numbers throughout the lower member.

Textularia sp. A

Material. Rare; unfigured types GSC 57462, 57463 from GSC loc. C-051322, 28.5 m above base of lower member.

Description. Test small, elongate, compressed, gently tapering, biserially arranged throughout; consisting of spherical proloculus followed by four to six pairs of chambers that are broader than high and increase very gradually in size as added; sutures distinct, fine, flush, moderately oblique; wall very finely arenaceous with much cement, smoothly finished; aperture a low arch at base of ultimate chamber.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
57462	0.15	0.10	0.35
57463*	0.18	0.06	0.36

*crushed specimen.

Remarks. *Textularia* sp. A differs from *T. areoplecta* Tappan in being larger and possessing a more robust test with fewer chambers.

Occurrence. *Textularia* sp. A occurs rarely in the basal 30 m of the lower member.

Subfamily PSEDOBOLIVININAE Weisner, 1931

Genus *Pseudobolivina* Weisner, 1931

Type species. *Pseudobolivina antarctica* Weisner, 1931.

Diagnosis. Test biserial, tending to become uniserial, axis slightly twisted; aperture a high narrow slit, interior-marginal in early biserial stage, becoming nearly terminal in later stage.

Pseudobolivina laxa n. sp.

Plate 17, figures 21–25

Material. Uncommon; holotype GSC 57464 and paratype GSC 57465 from GSC loc. C-051329, 39 m above base of lower member; paratypes GSC 57466, 57467 and unfigured paratypes GSC 57468, 57469 from GSC loc. C-029107, 1.5 to 6.1 m above base.

Description. Test tiny, elongate, narrow, nearly parallel-sided; initially biserial, with a tendency to become uniserial or nearly so, axis of test may become twisted up to 45° during growth; spherical proloculus followed by six or seven chambers of which only four or five are in a strictly biserial arrangement; chambers generally equant (biserial portion), slightly inflated, increasing gradually in size as added; sutures distinct, fine, moderately to strongly constricted; wall very finely arenaceous with much cement, smoothly finished; aperture simple, terminal, rounded, produced on a distinct neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Holotype 57464	0.06	0.06	0.24
Paratype 57465	0.06	0.05	0.23
Paratype 57466	0.10	0.08	0.28

Paratype 57467	0.08	0.08	0.25
Paratype 57468	0.08	0.06	0.23
Paratype 57469	0.08	0.08	0.25

Remarks. *Pseudobolivina laxa* n. sp. strongly resembles *P. variana* (Eicher) from the Albian of Wyoming in the mode of coiling of the test. *Pseudobolivina laxa* n. sp. differs from the latter in being smaller and possessing an aperture that is rounded and produced on a neck.

Etymology. Latin, *laxus*, meaning loose, a reflection of the mode in which the chambers are arranged.

Occurrence. *Pseudobolivina laxa* n. sp. occurs in small numbers in the basal 40 m of the lower member.

Genus *Siphotextularia* Finlay, 1931

Type species. *Siphotextularia wairoana* Finlay, 1931.

Diagnosis. Test free, quadrangular in section, chambers biserially arranged throughout; aperture nearly terminal, rounded, in face of final chamber and produced on a short neck.

Siphotextularia martinensis n. sp.

Plate 17, figures 10, 11

Material. Rare; holotype GSC 57484, paratype GSC 57485, and unfigured paratype GSC 57486 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test tiny, strongly compressed, squat, sharply tapering, biserial throughout; ovate proloculus followed by two or three pairs of rapidly enlarging chambers; sutures distinct, fine, slightly depressed, oblique; wall finely arenaceous with much cement, smoothly finished; aperture simple, terminal, rounded, produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Length
Holotype 57484	0.13	0.08	0.19

Paratype 57485	0.13	0.08	0.20
Paratype 57486	0.13	0.08	0.18

Remarks. *Siphotextularia martinensis* n. sp. is similar in design to *S. sp. B*, but is smaller, more strongly compressed, and the adult form possesses fewer pairs of chambers.

Etymology. From Martin Creek in the Aklavik Range, northern Richardson Mountains, District of Mackenzie, Northwest Territories.

Occurrence. *Siphotextularia martinensis* n. sp. was recovered from a single sample 176 m above base of lower member.

Siphotextularia torquens n. sp.

Plate 17, figures 12–16

Material. Uncommon; holotype GSC 57473, paratypes GSC 57474, 57475 and unfigured paratype GSC 57476 from GSC loc. C-051306, 4.5 m above base of lower member; unfigured paratypes GSC 57477, 57478 from GSC loc. C-029110, 18.5 to 24 m above base.

Description. Test small, elongate, slightly to moderately tapering, axis of test may be twisted 90° to 180° during growth; biserial throughout; spherical proloculus followed by four or five pairs of chambers, chambers increasing moderately in size as added, becoming quite inflated in last two pairs of chambers; sutures distinct, fine, slightly depressed, slightly oblique; wall very finely arenaceous with much cement, smoothly finished; aperture simple, terminal, rounded, produced on a distinct, short neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Holotype 57473	0.14	0.09	0.29
Paratype 57474	0.15	0.13	0.28
Paratype 57475	0.13	0.10	0.29
Paratype 57476	0.13	0.08	0.26
Paratype 57477	0.13	0.08	0.29

Paratype 57478	0.15	0.10	0.33
-------------------	------	------	------

Remarks. *Siphotextularia torquens* n. sp. is unusual because the axis of the test is loosely twisted during ontogeny up to a maximum of 180°. As the species shows no tendency to uniseriality, it is provisionally placed in *Siphotextularia* rather than *Pseudobolivina*. The twisted test coupled with its slim, elongate nature are sufficient to distinguish *S. torquens* n. sp. from other species of the same genus present in the lower member.

Etymology. From the Latin, *torquens*, meaning twisted, referring to the twisted nature of the adult test.

Occurrence. *Siphotextularia torquens* n. sp. occurs in small numbers in the basal 30 m of the lower member.

Siphotextularia sp. A

Plate 17, figures 17–20

Material. Uncommon; figured specimens GSC 57479, 57480 and unfigured types GSC 57481–57483 from GSC loc. C-051307, 6 m above base of lower member.

Description. Test small, elongate, slightly compressed, gently tapering, biserial throughout; spherical proloculus followed by three or four pairs of chambers; chambers initially low, later somewhat ovate, slightly to noninflated, increasing gradually in size as added; sutures distinct, fine, very slightly depressed, oblique; wall very finely arenaceous with much cement, smoothly finished; aperture simple, terminal, rounded, produced on short, distinct neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
57479	0.13	0.08	0.28
57480	0.10	0.08	0.26
57481	0.11	0.08	0.23
57482*	0.13	—	0.33
57483*	0.10	—	0.30

*crushed specimen.

Remarks. *Siphotextularia sp. A* is more elongated than *S. sp. B* and is neither as broad (for a given height), nor as inflated as the latter.

Occurrence. *Siphotextularia* sp. A occurs sporadically in the basal 30 m of the lower member.

Siphotextularia sp. B

Plate 17, figures 26–29

?1976 *Siphotextularia?* *rayi* Tappan; Souaya, p. 274, Pl. 3, figs. 9a, b.

Material. Uncommon; figured specimens GSC 57487–57489 from GSC loc. C-051312, 13.5 m above base of lower member; unfigured types GSC 57490, 57491 from GSC loc. C-051313, 15 m above base.

Description. Test tiny, robust, squat, rather strongly tapering, quadrangular in profile with rounded angles, biserial throughout; spherical proloculus followed by three or four pairs of chambers; chambers low, slightly inflated, increasing fairly rapidly in size as added; sutures distinct, slightly depressed, slightly oblique; wall finely agglutinated with much cement, fairly smoothly finished; aperture simple, terminal, rounded, sometimes produced on short neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
57487	0.16	0.10	0.25
57488	0.16	0.10	0.25
57489	0.14	0.10	0.20
57490	0.14	0.09	0.25
57491 (j)	0.13	0.08	0.25

j, juvenile specimen.

Remarks. The generic assignment of *Siphotextularia* sp. B is uncertain, because not all of the specimens possess an aperture that is raised on a distinct neck. The form is similar overall to *S. martinensis* n. sp., but is larger and more robust.

Occurrence. *Siphotextularia* sp. B occurs in small numbers in the basal 60 m of the lower member.

Family TROCHAMMINIDAE Schwager, 1877

Subfamily TROCHAMMININAE Schwager, 1877

Genus *Trochammina* Parker and Jones, 1859

Type species. *Nautilus inflatus* Montagu, 1808.

Diagnosis. Test free, trochospiral; globular to ovate chambers increasing gradually in size; wall agglutinated; aperture low, interior-marginal, extraumbilical to umbilical arch, which may have a narrow bordering lip.

Remarks. The genus *Trochammina* is represented in the lower member of the Husky Formation by ten species, two subspecies, and one variety. The large number of identifiable species is attributable to the exceptional preservation, which allows speciation of the sub-80 mesh forms, and particularly those (like *Trochammina walli* n. sp.) that occur only in the 200 mesh size fraction.

Trochammina aquilonaris n. sp.

Plate 19, figures 42–49

Material. Common, generally well preserved; holotype GSC 58030, paratypes GSC 58031, 58033 and unfigured paratype 58032 from GSC loc. C-051329, 39 m above base of lower member; unfigured paratypes GSC 58034–58036 from GSC loc. C-051324, 33 m above base.

Description. Test small, trochoid, flattened, very low spired, rounded in outline; consisting of two to two and a half whorls; chambers numerous, moderately compressed, expanding gradually in size as added, with seven or eight chambers in ultimate whorl; all whorls visible dorsally, only chambers of the ultimate whorl visible ventrally; sutures distinct, slightly depressed, slightly curved; wall very finely agglutinated with much cement, smoothly finished; aperture at inner margin of ultimate chamber, opening into umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58030	0.30	0.34	0.09
Paratype 58031	0.21	0.19	0.06
Paratype 58032	0.20	0.20	0.07
Paratype 58033	0.21	0.19	0.06
Paratype 58034	0.21	0.20	0.06

Paratype 58035	0.21	0.16	0.06
Paratype 58036	0.19	0.18	0.07

Remarks. *Trochammina aquilonaris* n. sp. is similar to *T. phialodes* n. sp. in general morphology and size, but differs in having a much lower spire.

Etymology. From the Latin, *aquilonaris*, meaning northern.

Occurrence. *Trochammina aquilonaris* n. sp. is common in the basal 80 m of the lower member.

Trochammina elevata Kosyрева subsp.
acutila n. subsp.

Plate 18, figures 1-3; 5-7; 9-11

Material. Over 100 specimens in a good state of preservation; holotype GSC 58049 and unfigured paratypes GSC 58050, 58051 from GSC loc. C-051411, 197 m above base of lower member; paratypes GSC 58052, 58054 and unfigured paratype GSC 58053 from GSC loc. C-051412, 200 m above base.

Description. Test small, trochoid, high to very high-spired, lobulate in outline; consisting of three to four whorls; chambers globular, strongly inflated, increasing very rapidly in size as added, three or four in initial whorl with four in each succeeding whorl; all chambers visible dorsally, only the chambers of the ultimate whorl visible ventrally; sutures distinct, straight, radiate, slightly to moderately depressed; wall finely arenaceous with much cement, smoothly finished; aperture at base of ultimate chamber, opening into the umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58049	0.33	0.29	0.28
Paratype 58050	0.30	0.26	0.23
Paratype 58051	0.34	0.30	0.29

Paratype 58052	0.25	0.23	0.25
Paratype 58053	0.33	0.29	0.23
Paratype 58054	0.29	0.25	0.24

Remarks. *Trochammina elevata acutila* n. subsp. closely resembles *T. elevata elevata* n. subsp. in general test morphology, but differs in being more high-spired, and possessing more greatly inflated, less closely appressed, chambers.

Etymology. From the Latin, *acutalis*, pointed, referring to the high spired morphology.

Occurrence. *Trochammina elevata acutila* occurs in the uppermost beds of the lower member.

Trochammina elevata Kosyрева subsp.
elevata n. subsp.

Plate 17, figures 30-41

1972 *Trochammina elevata* Kosyрева in Dain et al., p. 88, Pl. XXIII, figs. 8-11, 13.

1976 *Trochammina topagorukensis* Tappan; Souaya, p. 293, Pl. 6, figs. 2a, b.

1982 *Trochammina* sp. 4965 Leskiw in Poulton et al., Pl. 5, figs. 4, 5.

non 1983 *Trochammina* sp. cf. *T. elevata* Kosyрева; Wall, Pl. 4, figs. 26-28.

Material. Several hundred specimens in excellent state of preservation; holotype GSC 57504, paratypes GSC 57505, 57506, 58002 and unfigured paratypes GSC 57507, 57508, and 58001 from GSC loc. C-051325, 34.5 m above base of lower member.

Description. Test small, trochoid, moderate to high spired, lobulate in outline; consisting of three to three and half whorls; chambers globular, expanding very rapidly in size as added, four in initial microspheric whorl, fewer in megalospheric, with four chambers in each whorl thereafter; all chambers visible dorsally, only the chambers of the ultimate whorl visible ventrally; sutures distinct, radiate, straight, slightly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture at base of ultimate chamber, opening into the umbilicus.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 57504	0.27	0.21	0.19
Paratype 57505	0.31	0.24	0.21
Paratype 57506	0.26	0.26	0.18
Paratype 57507	0.24	0.20	0.16
Paratype 57508	0.21	0.19	0.14
Paratype 58001	0.23	0.20	0.13
Paratype 58002	0.24	0.23	0.14

Remarks. Husky forms of *Trochammina elevata elevata* n. subsp. are slightly larger and more high-spired than their Siberian relatives. The species occurs throughout the lower member along with three closely allied subspecies: *T. elevata acutila* n. subsp., *T. elevata inflata* n. subsp., and *T. elevata* subsp. A. *Trochammina elevata elevata* n. subsp. differs from *T. topagorukensis* Tappan in being entirely quadriserial, whereas the latter has more than four chambers in the intermediate whorls and only four in the ultimate whorl.

Souaya (1976) identified identical forms from the Sverdrup Basin in the Canadian Arctic Archipelago. *Trochammina* sp. cf. *T. elevata* of Wall (1983) differs from the Husky forms in lacking the broad and more inflated chamber design in the ultimate whorl. The Husky forms have a broadly tapering profile, whereas Wall's species is nearly straight-sided.

Leskiw (*in* Poulton et al., 1982) recovered forms conspecific with *T. elevata elevata* n. subsp. from the Lower Jurassic (Upper Sinemurian) Murray Ridge Formation (Bug Creek Group) of northern Yukon Territory. Her forms appear to be megalospheric juveniles of *T. elevata elevata* n. subsp. This considerably extends the range of the species and limits its biostratigraphic value.

Occurrence. *Trochammina elevata elevata* n. subsp. occurs sporadically throughout the lower member, suggesting it is environmentally sensitive.

Trochammina elevata Kosyreva subsp.
inflata n. subsp.

Plate 18, figures 13–18

Material. Common, generally well preserved; holotype GSC 58003, paratypes GSC 58005, 58006, and unfigured paratypes GSC 58004, 58007–58009 from GSC loc. C-051325, 34.5 m above base of lower member.

Description. Test medium sized, trochoid, lobulate in outline; consisting of three to four whorls, spire moderate to very low; chambers globular, expanding very rapidly as added, size of chambers in ultimate whorl double or triple that of preceding whorls, four chambers in each whorl; all chambers visible dorsally, only the chambers of ultimate whorl visible ventrally; sutures distinct, straight and radiate, strongly depressed; wall finely arenaceous with much cement, smoothly finished; aperture a slit at base of ultimate chamber, opening into umbilicus.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58003	0.39	0.37	0.33
Paratype 58004	0.41	0.36	0.30
Paratype 58005	0.36	0.29	0.26
Paratype 58006	0.39	0.33	0.29
Paratype 58007	0.43	0.36	0.31
Paratype 58008	0.37	0.34	0.23
Paratype 58009	0.47	0.40	0.33

Remarks. *Trochammina elevata inflata* n. subsp. is similar in test design to *T. elevata elevata* n. subsp. but differs in having greatly inflated chambers in the ultimate whorl. Only (?) microspheric individuals have so far been recognized.

Etymology. From the Latin, *inflatus*, inflated, referring to the design of the chambers in the ultimate whorl.

Occurrence. *Trochammina elevata inflata* n. subsp. occurs in small numbers 32 to 39 m above the base of the lower member.

Trochammina elevata Kosyрева subsp. A

Plate 18, figures 4, 8, 12

Material. About 20 specimens in adequate state of preservation; figured specimen GSC 58061 and unfigured specimens GSC 58062–58065 from GSC loc. C-029109, 12.3 to 18.5 m above base of lower member.

Description. Test medium sized, robust, trochoid with high to very high spire, strongly tapering, periphery slightly lobulate; consisting of four to four and a half whorls; chambers globular, inflated, increasing rapidly in size as added; four or five in initial whorl (microspheric); two or three in initial whorl (megalospheric) with four chambers in each whorl thereafter; sutures distinct, strongly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture at base of ultimate chamber, opening into the umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
58061	0.34	0.31	0.33
58062	0.34	0.33	0.26
58063	0.30	0.30	0.28
58064	0.38	0.31	0.30
58065	0.36	0.34	0.29

Remarks. The generic assignment of *Trochammina elevata* Kosyрева subsp. A is questionable because of its extremely high-spined coiling. If intermediates grading into lower-spined varieties were not present, the species could easily be placed in either *Gravellina* or *Orientalia*. Sutherland and Stelck (1972) noted similar problems with the generic assignment of the upper upper Albian *T. rutherfordi mellariolum* Eicher. In that case, the species could have been assigned to the genus *Eggerella* if intermediates had not been present.

Trochammina elevata Kosyрева subsp. A differs from *T. elevata elevata* n. subsp. in possessing a much higher, more strongly tapering spire and in having a greater number of whorls. It differs from *T. elevata*

acutila n. subsp. in having a much more strongly tapering spire.

Occurrence. *Trochammina elevata* Kosyрева subsp. A occurs rarely 12 to 18 m above the base of the lower member.

Trochammina kosyrevae Levina

Plate 19, figures 10–17

1972 *Trochammina kosyrevae* Levina in Dain et al., p. 83, Pl. XXII, figs. 5–9.

?1976 *Trochammina* sp. cf. *T. gryci* Tappan; Souaya, p. 274, Pl. 4, figs. 1a–c.

non 1983 *Trochammina* sp. cf. *T. kosyrevae* Levina; Wall, Pl. 3, figs. 15–17.

Material. Fairly common, generally well preserved; hypotype GSC 57492 from GSC loc. C-029109, 12.3 to 18.5 m above base of lower member; hypotype GSC 57493 and unfigured hypotypes GSC 57494–57496 from GSC loc. C-051312, 13.5 m above base; hypotype GSC 57497 from GSC loc. C-051311, 12 m above base.

Description. Test medium sized, robust, periphery rounded to slightly lobate, flattened both ventrally and dorsally; spire trochoid, very low, consisting of two to two and a half whorls; chambers slightly inflated, rounded, increasing fairly rapidly in size as added, six or seven in initial whorl, decreasing to approximately six in ultimate whorl; all chambers visible dorsally, only chamber of ultimate whorl visible ventrally, umbilicus deeply impressed; sutures distinct, moderately depressed, dorsally inclined against direction of coiling and slightly curved, ventrally straight and radiate; wall very finely agglutinated with much cement, smoothly finished; aperture slit-like, at base of ultimate chamber, opening into umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Hypotype 57492	0.34	0.30	0.20
Hypotype 57493	0.38	0.35	0.24
Hypotype 57494	0.38	0.30	0.20
Hypotype 57495	0.29	0.26	0.15

Hypotype 57496	0.28	0.24	0.15
Hypotype 57497	0.38	0.33	0.25

Remarks. The Husky specimens of *Trochammina kosyrevae* Levina resemble their Siberian counterparts in all aspects, and share the same stratigraphic range. Their scarcity precludes study of microspheric and megalospheric generations. Dextrally and sinistrally coiled heteromorphs exist in about equal numbers.

Occurrence. *Trochammina kosyrevae* Levina occurs rarely in the basal 20 m of the lower member.

Trochammina occidentalis n. sp.

Plate 19, figures 30–41

Material. About 100 specimens in excellent state of preservation; holotype GSC 58016, paratype GSC 58018, and unfigured paratype GSC 58017 from GSC loc. C-051315, 18 m above base of lower member; paratype GSC 58019 and unfigured paratype GSC 58020 from GSC loc. C-051312, 13.5 m above base; paratype GSC 58021 and unfigured paratype 58022 from GSC loc. C-051309, 9 m above base.

Description. Test small, trochoid, robust; spire low to moderate, periphery lobulate, consisting of three to four whorls; chambers numerous, moderately inflated, increasing rapidly in size as added, three to five in initial whorl, increasing to five or six in whorls thereafter, with five in the ultimate whorl; all chambers visible dorsally, only chambers of the ultimate whorl visible ventrally; umbilicus broad, deeply depressed; sutures distinct, fine, moderately depressed, slightly oblique dorsally, straight and radiate ventrally; wall finely agglutinated with considerable siliceous cement, fairly smoothly finished; aperture slit-like, at base of ultimate chamber, opening into umbilicus.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58016	0.28	0.25	0.15
Paratype 58017	0.23	0.20	0.15
Paratype 58018	0.28	0.23	0.18

Paratype 58019	0.25	0.23	0.13
Paratype 58020	0.29	0.25	0.18
Paratype 58021	0.23	0.23	0.13
Paratype 58022	0.29	0.24	0.18

Remarks. *Trochammina occidentalis* n. sp. bears some resemblance in size and number of chambers per whorl to *T. phialodes* n. sp., but differs in being slightly larger and possessing fewer, more greatly inflated, chambers per whorl. It differs from *T. postera* n. sp. in possessing a lower spire, and in lacking the greatly expanded ultimate whorl.

Etymology. From the Latin, *occidentalis*, meaning west or western.

Occurrence. *Trochammina occidentalis* n. sp. occurs commonly in the basal 30 m of the lower member, in beds of Early Oxfordian age.

Trochammina omskensis Kosyrev

Plate 19, figures 18–29

1972 *Trochammina omskensis* Kosyrev in Dain et al., p. 84, Pl. XXIII, figs. 1–7.

Material. About 50 specimens in adequate state of preservation; hypotypes GSC 57498–57500 and unfigured hypotype GSC 57501 from GSC loc. C-051310, 10.5 m above base of lower member; hypotype GSC 57502 from GSC loc. C-051308, 7.5 m above base; unfigured hypotype GSC 57503 from GSC loc. C-051306, 4.5 m above base.

Description. Test small, trochoid, plano-convex in cross-section, spire low to very low, peripheral margin lobulate; consisting of three to three and a half whorls; chambers in initial whorl rounded, later becoming trapezoidal, slightly inflated, increasing gradually in size as added, about seven or eight in initial whorl with about the same number in succeeding whorls, all chambers visible dorsally, only chambers of the ultimate whorl visible ventrally, umbilical region rather strongly depressed; sutures distinct, fine, slightly depressed, curved back against direction of coiling dorsally, straight and radiate ventrally; wall very finely arenaceous with much cement, smoothly finished; aperture a low arch at the base of the ultimate chamber, opening into the umbilicus.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Hypotype 57498	0.21	0.19	0.11
Hypotype 57499	0.20	0.18	0.10
Hypotype 57500	0.16	0.14	0.08
Hypotype 57501	0.19	0.18	0.08
Hypotype 57502	0.21	0.19	0.10
Hypotype 57503	0.20	0.19	0.09

Remarks. The Husky specimens of *Trochammina omskensis* agree well with the microspheric generation illustrated by Kosyreva (*in* Dain et al., 1972) from the Upper Oxfordian of western Siberia. The species differs from *T. walli* n. sp. in being larger, less plano-convex in cross-section, and having a smaller height:width ratio.

Occurrence. *Trochammina omskensis* occurs in the basal 20 m of the lower member.

Trochammina phialodes n. sp.

Plate 20, figures 1-9, 16-18

Material. Abundant, generally well preserved; holotype GSC 58023 from GSC loc. C-051326, 36 m above base of lower member; paratypes GSC 58024, 58025 and unfigured paratype GSC 58026 from GSC loc. C-051324, 33 m above base; unfigured paratypes GSC 58027, 58028 from GSC loc. C-029113, 30.3 to 36.4 m above base; paratype GSC 58029 from GSC loc. C-051328, 39 m above base.

Description. Test small, trochoid, distinctly concavo-convex, rounded in outline; consisting of three to three and a half whorls; chambers numerous, not inflated, expanding gradually in size as added, seven or eight in ultimate whorl; all whorls visible dorsally, early whorls partially concealed ventrally; spire moderate to low; sutures straight, slightly depressed; wall finely arenaceous with much cement, smoothly finished; aperture on inner margin of ultimate chamber, opening into umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58023	0.23	0.21	0.15
Paratype 58024	0.23	0.21	0.12
Paratype 58025	0.23	0.19	0.10
Paratype 58026	0.24	0.23	0.12
Paratype 58027	0.24	0.23	0.10
Paratype 58028	0.23	0.21	0.20
Paratype 58029	0.24	0.23	0.14

Remarks. *Trochammina phialodes* n. sp. can be readily distinguished from other species of *Trochammina* in the lower member by its distinctive concavo-convex test design. Both sinistrally and dextrally coiled heteromorphs exist in about equal numbers.

Etymology. From the Greek, *phialodes*, meaning bowl-shaped, referring to the concavo-convex design of the test.

Occurrence. *Trochammina phialodes* n. sp. occurs commonly throughout the Oxfordian to Kimmeridgian portions of the lower member.

Trochammina postera n. sp.

Plate 20, figures 31-39

Material. About 250 specimens in various states of preservation; holotype GSC 58055, paratypes GSC 58057, 58058, and unfigured paratypes GSC 58056, 58059, and 58060 from GSC loc. C-051412, 200 m above base of lower member.

Description. Test small, trochoid; periphery rounded to somewhat lobulate; moderate to high spired; consisting of three and a half to four whorls; chambers initially equant, later becoming longer than wide, slightly inflated, increasing gradually in size as added; eight or nine in initial whorl (microspheric), six to eight in initial whorl (megalospheric), reducing to five or six in ultimate whorl; all chambers visible dorsally, only those of ultimate whorl visible ventrally; umbilicus slightly to moderately depressed; sutures fine, distinct,

slightly depressed, curved against direction of coiling on dorsal side, straight and radiate on ventral side; wall very finely arenaceous with much cement, smoothly finished; aperture at base of ultimate chamber, opening to umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58055	0.29	0.28	0.16
Paratype 58056	0.33	0.26	0.13
Paratype 58057	0.26	0.25	0.18
Paratype 58058	0.26	0.23	0.13
Paratype 58059*	0.30	0.31	>0.20
Paratype 58060	0.25	0.24	0.13

*slightly crushed specimen.

Remarks. The height of the spire in *Trochammina postera* n. sp. is variable, and ranges from low to quite high. It differs from *T. phialodes* n. sp. in lacking the distinctive concavo-convex test design and in having a higher spire. From *T. elevata acutila* n. subsp. it differs in having a somewhat lower spire, and five or six chambers in the ultimate whorl.

Etymology. From the Latin, *postera*, meaning later, referring to its late appearance in the Martin Creek section.

Occurrence. *Trochammina postera* n. sp. shares a common vertical range with *T. elevata acutila* n. subsp. and *Ammobaculooides mahadeoi* n. sp., occurring in the uppermost beds of the lower member.

Trochammina scotti n. sp.

Plate 20, figures 22–30

Material. Over 100 specimens in adequate state of preservation; holotype GSC 58044, paratypes GSC 58045, 58046 and unfigured paratypes 58047, 58048 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, trochoid, rounded to slightly lobulate in outline, discoidal, low-spired; consisting of two and half to three whorls; chambers numerous, not inflated, increasing gradually in size as added, eight to ten in initial whorl, decreasing to about eight in ultimate whorl; sutures distinct, slightly depressed, oblique on dorsal side, nearly radiate on ventral side; wall very finely arenaceous with much cement, smoothly finished; aperture at base of ultimate chamber, opening into the umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58044	0.29	0.24	0.12
Paratype 58045	0.24	0.20	0.10
Paratype 58046	0.30	0.24	0.10
Paratype 58047	0.23	0.20	0.10
Paratype 58048	0.17	0.16	0.08

Remarks. *Trochammina scotti* n. sp. has both dextrally and sinistrally coiled heteromorphs, which coexist in about equal numbers. In general appearance the species most closely resembles *T. phialodes* n. sp., but differs in having oblique rather than radial sutures, a much lower spire, and in lacking the distinctive concavo-convex shape of the latter.

Etymology. The patronym honours the late Bill Scott, geologist with Hudson's Bay Oil and Gas Ltd. who died as a result of injuries sustained in a helicopter crash in August, 1978.

Occurrence. *Trochammina scotti* n. sp. occurs commonly in the upper 40 m of the lower member.

Trochammina walli n. sp.

Plate 20, figures 10–15; 19–21

1976 *Trochammina* sp. cf. *T. exigua* Cushman and Applin; Souaya, p. 287, Pl. 3, fig. 6.

1981 *Trochammina?* cf. *T. gatesensis* Stelck and Wall; Brooke and Braun, p. 22, Pl. 5, figs. 30–35; non figs. 26–29.

1983 *Trochammina* sp. cf. *T. rosacea* Zasyelova;
Wall, Pl. 5, figs. 18–20.

Material. Over 100 specimens in excellent state of preservation; holotype GSC 58037, paratypes GSC 58038, 58039, and unfigured paratypes GSC 58040–58043 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test tiny, trochoid, closely resembling the genus *Gyroidina* in external morphology, spire very low, periphery slightly lobulate; consisting of three to three and a half whorls; chambers angular-conical, expanding gradually in size as added, seven or eight in initial whorl, about seven in each whorl thereafter; all chambers visible dorsally, only those of the ultimate whorl visible ventrally; sutures distinct, fine, slightly depressed, slightly curved against direction of coiling dorsally, straight and radiate ventrally; wall very finely agglutinated with much cement, smoothly finished; aperture at base of ultimate chamber, opening into umbilicus, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58037	0.19	0.16	0.09
Paratype 58038	0.16	0.14	0.09
Paratype 58039	0.16	0.16	0.11
Paratype 58040	0.16	0.14	0.09
Paratype 58041	0.14	0.13	0.08
Paratype 58042	0.16	0.13	0.11
Paratype 58043 (j)	0.10	0.10	0.06

j, juvenile specimen.

Remarks. *Trochammina walli* n. sp. bears a strong resemblance to *T. gyroidinaeformis* Krasheninnikov from the Upper Cretaceous abyssal plain deposits of the Indian Ocean. The wall textures are different however, as Krasheninnikov (1974) described the wall of his form as being “. . . thin, homogeneous, fine grained and smooth to slightly roughened.” Examination of his plates suggest that the wall of *T. gyroidinaeformis* is very thin compared to the Husky forms. Only examination of Krasheninnikov’s type

material could resolve whether *T. walli* n. sp. is a separate species or a junior synonym of *T. gyroidinaeformis*.

Examination of Souaya’s (1976) type material confirms that the form identified as *T. sp. cf. T. exigua* Cushman and Applin is conspecific with *T. walli* n. sp. Some of the forms assigned by Brooke and Braun (1981) to *Trochammina?* sp. cf. *T. gatesensis* Stelck and Wall are clearly conspecific with *T. walli* n. sp., but the remainder belong to a different species.

Trochammina minutissima Dain is similar in general size and morphology to *T. walli* n. sp., but lacks the distinctive *Gyroidina*-like chamber shape.

Etymology. The patronym honours Dr. J.H. Wall for his contributions to foraminiferal studies of the Jurassic and Cretaceous in Western Canada.

Occurrence. *Trochammina walli* n. sp. occurs commonly 176 to 182 m above the base of the lower member, in beds of probable early Volgian age.

Trochammina sp. cf. *T. rostovzevi* Levina

Plate 19, figures 1–9

?1972 *Trochammina rostovzevi* Levina in Dain et al., p. 82, Pl. XXII, figs. 1–3.

Material. Rare, figured specimen GSC 58012 and unfigured specimens GSC 58010, 58011 from GSC loc. C-051306, 4.5 m above base of lower member; figured specimen GSC 58013 from GSC loc. C-051312, 13.5 m above base; figured specimen GSC 58014 and unfigured type GSC 58015 from GSC loc. C-029109, 12.3 to 18.5 m above base.

Description. Test medium sized, trochoid with moderate spire, robust, periphery rounded to somewhat lobulate; consisting of two and a half to three whorls; chambers inflated, rounded, increasing rapidly in size as added, six or seven in initial whorl, decreasing to five or six in ultimate whorl; all chambers visible dorsally, only chambers of ultimate whorl visible ventrally; sutures distinct, slightly thickened, slightly depressed, oblique on dorsal side and inclined against direction of coiling; straight and radiate on ventral side; wall finely agglutinated with much cement; smoothly finished; aperture slit-like, at base of ultimate chamber, opening into umbilicus.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
58010	0.40	0.38	0.25
58011	0.40	0.38	0.25
58012	0.38	0.34	0.30
58013	0.39	0.38	0.23
58014	0.43	0.35	0.28
58015	0.38	0.30	0.21

Remarks. The Husky specimens closely resemble *Trochammina rostovzevi*, except that they have one to two more chambers in the ultimate whorl. The western Siberian forms occur in the Callovian, whereas the Canadian material is of (?)early Oxfordian age.

Occurrence. *Trochammina* sp. cf. *T. rostovzevi* Levina occurs rarely in the basal 20 m of the lower member, and shares a common vertical range with *T. kosyreva* Levina.

Genus *Ammosphaeroidina* Cushman, 1910

Type species. *Haplophragmium sphaeroidiniformis* Brady, 1884.

Diagnosis. Test free, globose, streptospirally coiled with few embracing chambers, only three of final whorls visible at exterior; wall agglutinated, aperture a low, interior-marginal arch.

Ammosphaeroidina? stelcki n. sp.

Plate 16, figures 19–24

- 1972 *Trochammina*(?) ex. gr. *canningensis* Tappan; Dain in Dain et al., Pl. XIII, fig. 1, non fig. 2.
 1983 *Trochammina canningensis* Tappan; Wall, Pl. 1, figs. 4–6.

Material. Common, several hundred well preserved specimens; holotype GSC 58066, paratype GSC 58067, and unfigured paratypes GSC 58068–58072 from GSC loc. C-051324, 33 m above base of lower member.

Description. Test small, globular, (?)trochospirally coiled, consisting of one to one and a half visible whorls; (?)spherical proloculus followed by three or four chambers; chambers inflated, globular, expanding rapidly in size as added and strongly overlapping;

sutures distinct, straight, fine, strongly depressed; wall very finely arenaceous with much cement, fairly smoothly finished; aperture obscured by preservation.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58066	0.25	0.21	0.16
Paratype 58067	0.23	0.19	0.18
Paratype 58068	0.26	0.21	0.19
Paratype 58069	0.23	0.23	0.18
Paratype 58070	0.24	0.23	0.18
Paratype 58071	0.21	0.20	0.15
Paratype 58072	0.18	0.18	0.13

Remarks. *Ammosphaeroidina? stelcki* n. sp. differs from *Trochammina canningensis* Tappan in being somewhat smaller, and possessing fewer, more closely overlapping chambers. Dain (in Dain et al., 1972) also made this differentiation, as she assigned material very similar to the Husky species to *Trochammina*(?) ex. gr. *canningensis* Tappan. Wall illustrated forms conspecific with *A.? stelcki* n. sp. from the Toarcian (Lower Jurassic) of the eastern Sverdrup Basin, thus establishing its range from late Lower Jurassic to Upper Jurassic.

The generic assignment of *A.? stelcki* n. sp. is difficult to assess. By definition, this species is assignable to the subfamily Trochammininae, though it is of unorthodox design. Three genera, two modern (*Ammosphaeroidina* Cushman and *Cystammina* Neumayr) and one Upper Cretaceous (*Praecystammina* Krashennikov) bear a close resemblance.

The genus *Cystammina* Neumayr differs from *Ammosphaeroidina* Cushman in possessing a trochospiral coil and a raised, slit-like aperture, whereas the latter is streptospirally coiled with the aperture in the form of an interior-marginal arch. The nature of the coiling in the Husky species is difficult to ascertain without thin section study: it could be either trochospiral or streptospiral. However, in the holotype GSC 58066 and in paratypes GSC 58067 and 58071 there are hints that the aperture may be a low, interior-marginal arch, suggesting the genus *Ammosphaeroidina*.

Krashenninikov (1973) described *Praecystamina* from the Upper Cretaceous (Santonian–Campanian) of the northwest Pacific. The genus is similar to both *Cystamina* and *Ammosphaeroidina*, but possesses a raised, ovate, lipped aperture. The Husky species is very similar in overall test morphology, size, and apparent nature of coiling to the forms illustrated by Krashenninikov (op. cit.), but differs in having a thicker, more coarse grained wall, and possessing what is probably an interior-marginal aperture. It is important to note that wall thickness and composition may be a reflection of water depth and available sediment supply, as Krashenninikov's forms were recovered from bathyal facies, whereas the Husky forms are from shelf facies.

Etymology. The patronym honours Dr. C.R. Stelck, pioneer micropaleontologist and Professor Emeritus of Geology at the University of Alberta.

Occurrence. *Ammosphaeroidina? stelcki* n. sp. occurs commonly in the basal 65 m of the lower member, and sporadically throughout the rest of the lower member.

Family ATAXOPHRAGMIIDAE Schwager, 1877

Subfamily VERNEUILININAE Cushman, 1911

Genus *Verneuilina* d'Orbigny in de la Sagra, 1839

Type species. *Verneuilina tricarinata* d'Orbigny, 1840.

Diagnosis. Test free, elongate, triangular, with angles of test sharp, nearly carinate, chambers triserially arranged throughout; wall agglutinated with much calcareous cement; aperture a low arch at the inner margin of the final chamber.

Verneuilina anglica Cushman

Plate 21, figures 19–21

1936 *Verneuilina anglica* Cushman, p. 1, Pl. 1, figs. 1a, b.

1976 *Verneuilina anglica* Cushman; Souaya, p. 293, Pl. 6, fig. 9.

1983 *Verneuilina anglica* Cushman; Wall, Pl. 4, fig. 9.

Material. Common, generally well preserved; hypotype GSC 58074 and unfigured hypotypes GSC 58073, 58075, and 58079 from GSC loc. C-051381, 137 m above base of lower member; hypotypes GSC 58077,

58082, and unfigured hypotypes GSC 58076, 58078, 58080, and 58081 from GSC loc. C-051383, 147 m above base.

Description. Test small, elongate, pyramidal, triangular in cross-section, angles sharp and prominent, sides strongly concave, axis of test may be slightly twisted; test triserial throughout with six or seven tiers of chambers, which are flat-sided, slightly inflated and of roughly uniform shape, increasing fairly gradually in size as added; sutures distinct, slightly depressed, oblique; wall very finely arenaceous with much cement, somewhat roughly finished; aperture simple, a low arch at inner margin of ultimate chamber, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58073	0.18	0.35
Hypotype 58074	0.18	0.34
Hypotype 58075	0.18	0.33
Hypotype 58076	0.18	0.36
Hypotype 58077	0.15	0.33
Hypotype 58078	0.16	0.28
Hypotype 58079	0.18	0.25
Hypotype 58080	0.18	0.20
Hypotype 58081	0.14	0.19
Hypotype 58082	0.15	0.25

Remarks. The Husky forms of *Verneuilina anglica* agree well with those figured by both Souaya (1976) and Wall (1983) from the Sverdrup Basin of the Canadian Arctic Archipelago.

Occurrence. *Verneuilina anglica* occurs commonly in the upper 120 m of the lower member.

Verneuilina krekei n. sp.

Plate 21, figures 22–26

Material. Uncommon; holotype GSC 58083, paratypes GSC 58084 and 58086, and unfigured paratypes GSC 58085, 58087, and 58088 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, elongate, pyramidal; triangular in cross-section, angles prominent but slightly rounded, sides moderately concave, periphery (i.e., angles) slightly lobulate; test triserial with six to eight tiers of three chambers each, chambers of

uniform shape, slightly inflated, increasing gradually in size as added; sutures distinct, slightly depressed, oblique; wall finely arenaceous with much cement, smoothly finished; aperture a high arch at inner margin of ultimate chamber.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58083	0.14	0.31
Paratype 58084	0.13	0.30
Paratype 58085	0.15	0.30
Paratype 58086	0.10	0.25
Paratype 58087	0.13	0.28
Paratype 58088	0.13	0.30

Remarks. *Verneuilina krekei* n. sp. differs from *V. anglica* Cushman in having more moderately concave test sides, slightly more rounded angles along the periphery of which the chambers appear more lobulate, and in being more slender.

Etymology. The patronym honours Joe Kreke, a pilot with Kenting Helicopters, who worked with the Geological Survey of Canada surface party in the Aklavik Range during the summer of 1975. He was killed in a helicopter accident in 1979.

Occurrence. *Verneuilina krekei* n. sp. occurs in small numbers in beds 176 to 179 m above the base of the lower member.

Genus *Verneuilinoides* Loeblich and Tappan, 1949

Type species. *Verneuilina schizea* Cushman and Alexander, 1930.

Diagnosis. Test free, elongate, triserial throughout, with rounded angles; loosely appressed chambers increasing in size toward apertural end; sutures generally distinct and depressed; wall arenaceous; aperture an arch at the base of the final chamber.

Verneuilinoides graciosus Kosyрева

Plate 21, figures 1-9

1972 *Verneuilinoides graciosus* Kosyрева in Dain et al., p. 98, Pl. XXX, figs. 2-4.

1983 *Verneuilinoides graciosus* Kosyрева; Wall, Pl. 3, figs. 9, 10.

Material. Common, generally well preserved; hypotypes GSC 58089, 58090, 58093 and unfigured hypotypes GSC 58091, 58092 from GSC loc. C-051309, 9 m above base of lower member; hypotypes GSC 58094, 58095 and unfigured hypotype GSC 58096 from GSC loc. C-051321, 27 m above base; hypotypes GSC 58099, 58100, and unfigured hypotypes GSC 58097, 58098, and 58103 from GSC loc. C-051326, 36 m above base; hypotype GSC 58101 and unfigured hypotypes GSC 58102, 58104-58106 from GSC loc. C-051328, 39 m above base.

Description. Test small, elongate, robust, gently to rather strongly tapering; triserial throughout, rounded in cross-section; consisting of tiny proloculus followed by five or six tiers of three chambers each; chambers subglobular, increasing rapidly in size as added and attaining largest size in ultimate whorl; sutures distinct, strongly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture simple, a low rounded arch at inner margin of ultimate chamber, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58089	0.15	0.34
Hypotype 58090	0.14	0.33
Hypotype 58091	0.16	0.38
Hypotype 58092	0.15	0.35
Hypotype 58093	0.13	0.30
Hypotype 58094	0.13	0.20
Hypotype 58095	0.13	0.18
Hypotype 58096	0.13	0.23
Hypotype 58097	0.15	0.23
Hypotype 58098	0.14	0.28
Hypotype 58099	0.15	0.26
Hypotype 58100	0.13	0.28
Hypotype 58101	0.16	0.35
Hypotype 58102	0.16	0.29
Hypotype 58103	0.15	0.30
Hypotype 58104	0.15	0.25
Hypotype 58105	0.11	0.29
Hypotype 58106	0.15	0.35

Remarks. Excellent preservation in the section at Martin Creek allows for the discrimination of several varieties of *Verneuilinoides graciosus*; hence the large number of hypotypes that have been assigned. The

species differs from *V. tryphera* Loeblich and Tappan in being much smaller and more highly tapered.

Occurrence. *Verneuilinoides graciosus* occurs commonly in the basal 55 m of the lower member.

Verneuilinoides infrequens n. sp.

Plate 21, figures 13–18

Material. Fairly common; holotype GSC 58112, paratypes GSC 58113, 58114 and unfigured paratypes GSC 58115, 58116 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, elongate, tapering, triangular in cross-section with rounded angles; triserial, axis of test may be twisted either dextrally or sinistrally up to 180° during ontogeny; consisting of tiny spherical proloculus followed by seven to nine whorls of three chambers each; chambers initially subglobular, increasing gradually in size as added, becoming somewhat pyriform in last two or three whorls; sutures distinct, slightly depressed; wall finely agglutinated with much cement, smoothly finished; aperture a high arch at inner margin of ultimate chamber.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58112	0.14	0.40
Paratype 58113	0.10	0.31
Paratype 58114	0.13	0.35
Paratype 58115	0.13	0.33
Paratype 58116	0.13	0.28

Remarks. *Verneuilinoides infrequens* n. sp. bears some resemblance to *V. borealis* Tappan from the Albian of northern Alaska, but differs in being smaller and more slender. It differs from the *V. graciosus* Kosyreva–*V. postgraciosus* Kommissarenko group in being larger and having a noticeably twisted test.

Etymology. From the Latin, *infrequens*, meaning rare.

Occurrence. *Verneuilinoides infrequens* n. sp. occurs rarely in the upper 20 m of the lower member.

Verneuilinoides postgraciosus Kommissarenko

Plate 21, figures 10–12

1972 *Verneuilinoides postgraciosus* Kommissarenko in Dain et al., p. 99, Pl. XXX, fig. 5.

Material. Fairly common; hypotypes GSC 58107–58109 and unfigured hypotypes GSC 58110, 58111 from GSC loc. C-051327, 37.5 m above base of lower member.

Description. Test small, elongate, tapering, pointed at the beginning and expanding rather slowly (small apical angle); triserial, triangular in cross-section with rounded angles; consisting of five to eight whorls; chambers rounded, moderately inflated, expanding gradually in size as added; sutures distinct, slightly depressed; wall finely arenaceous with much cement, smoothly finished; aperture a low arch at inner margin of ultimate chamber.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58107	0.12	0.38
Hypotype 58108	0.13	0.39
Hypotype 58109	0.11	0.33
Hypotype 58110	0.11	0.28
Hypotype 58111	0.13	0.31

Remarks. *Verneuilinoides postgraciosus* was described from upper Kimmeridgian to Volgian strata of western Siberia. The species is similar in general test architecture to *V. graciosus* Kosyreva described from the basal Kimmeridgian of the same area. Within the lower member of the Husky Formation, forms referable to both species occur in beds of Oxfordian to Kimmeridgian age. *Verneuilinoides postgraciosus* differs from *V. graciosus* in being more slender (having a smaller apical angle), possessing a greater number of whorls (five to eight compared to five to six) and having chambers that are less inflated and more gradually expanding. *Verneuilinoides tryphera* Loeblich and Tappan is much smaller, has fewer whorls, and possesses more greatly inflated, subglobular chambers.

Occurrence. *Verneuilinoides postgraciosus* Kommissarenko occurs rarely in the basal 55 m of the lower member.

Subfamily GLOBOTEXTULARIINAE
Cushman, 1927

Genus *Eomarssonella* Levina, 1972

Type species. *Eomarssonella paraconica* Levina, 1972.

Diagnosis. Test as in *Eggerella* Cushman but with non-inflated chambers; apertural face flat or slightly depressed; wall finely agglutinated with much siliceous cement, smoothly finished; aperture a low interior marginal slit at the base of the terminal chamber.

Range. Upper Jurassic, Siberia, Arctic North America.

Eomarssonella paraconica Levina

Plate 22, figures 1-5

1972 *Eomarssonella paraconica* Levina in Dain et al., p. 102, Pl. XXXII, figs. 1-11.

Material. Common, generally well preserved; hypotypes GSC 58117-58119 from GSC loc. C-051383, 143 m above base of lower member.

Description. Test small, trochospirally coiled, conical in shape, increasing rather uniformly with growth; rather stout, gently tapering to a blunt apex, rounded in cross-section; consisting of about five to six whorls, initially with about five chambers per whorl, decreasing to four and finally to three in ultimate whorl; chambers rhomboidal in shape in lateral view, increasing gradually in size as added; sutures distinct, straight, slightly depressed, slanted against direction of coiling; wall very finely arenaceous with much cement, smoothly finished; aperture an arched interior-marginal slit at base of terminal chamber, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58117	0.20	0.34
Hypotype 58118	0.23	0.31
Hypotype 58119	0.20	0.33

Remarks. Not all the adult specimens of *Eomarssonella paraconica* recovered from the lower member possess the flared ultimate chambers of the Siberian examples. This could be explained in terms of microspheric as opposed to megalospheric heteromorphs. The genus appears to have been restricted to the Boreal faunal realm during Late Jurassic time.

Occurrence. *Eomarssonella paraconica* occurs in large numbers 125 to 145 m above the base of the lower member.

Eomarssonella pollocki n. sp.

Plate 21, figures 27-30

1976 *Verneuulinoides* sp. cf. *V. georgiae* (Terquem); Souaya, p. 263, Pl. 6, figs. 10a, b.

Material. About 50 specimens in adequate state of preservation; holotype GSC 58120, paratype GSC 58121, and unfigured paratypes GSC 58122-58124 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, elongate, expanding slowly from sharply pointed apex, rounded in cross-section, except for the ultimate whorl, which may be slightly lobulate; trochospirally coiled, commonly consisting of four to seven whorls; initial portion (one to three whorls) with five or six chambers per whorl, decreasing in latter portion to quadriserial and finally triserial arrangement; chambers rhomboidal in shape on the outside, increasing very gradually in size as added, with exception of ultimate whorl wherein chambers become moderately inflated to nearly subglobular; sutures distinct, slightly depressed, straight; wall finely arenaceous with much cement, fairly smoothly finished; aperture an arched interior-marginal slit at base of terminal chamber, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58120	0.20	0.30
Paratype 58121	0.20	0.20
Paratype 58122	0.19	0.23
Paratype 58123	0.18	0.20
Paratype 58124	0.18	0.27

Remarks. *Eomarssonella pollocki* n. sp. differs from *E. paraconica* Levina in having a more slender, sharply pointed test, which possesses more greatly inflated chambers in the ultimate whorl. The form figured by Souaya (1976) as *V. sp. cf. V. georgiae* (Terquem) is conspecific with the Husky form, as the initial portion of the test is clearly multiserial rather than triserial.

Etymology. The patronym honours Dr. C. Pollock, formerly a micropaleontologist with Amoco Canada Petroleum Company Limited.

Occurrence. *Eomarssonella pollocki* n. sp. occurs in beds 176 m above the base of the lower member.

Genus *Orientalia* N.K. Bykova, 1947

Type species. *Orientalia exilis* Bykova, 1947.

Diagnosis. Test elongate, early stage trochospiral with six or seven chambers per whorl; later reduced to quadriserial with four chambers in vertical rows; wall finely agglutinated with large amount of cement; aperture an interior-marginal slit.

Remarks. *Eomarssonella* and *Orientalia* appear to be closely related genera. For example, Levina (in Dain et al., 1972, p. 102–104) noted that rare adult specimens of *Eomarssonella paraconica* Levina possessed four chambers in their ultimate whorl, which technically would place these forms in *Orientalia*. Levina (ibid.) argued that these four chambered forms represented megalospheric heteromorphs of *Eomarssonella*, when in fact, the opposite would be expected; i.e., megalospheric heteromorphs should have fewer and not more chambers. A detailed study of large populations of these genera would be required to determine whether *Eomarssonella* is a valid genus or a junior synonym of *Orientalia*.

Orientalia loucheuxi n. sp.

Plate 21, figures 31–35

1983 *Orientalia* sp. 2 Wall, Pl. 4, figs. 12–14.

Material. Fairly common, generally well preserved; holotype GSC 58145, paratypes GSC 58146–58149 and unfigured paratypes GSC 58150, 58151 from GSC loc. C-051404, 176 m above base of lower member.

Description. Test small, elongate, slightly to moderately flared from sharply pointed apex; trochospirally coiled; early portion (two to three whorls) with five or six chambers per whorl, later portion (three to four whorls) quadriserial; test closely-coiled, periphery rounded, except in ultimate whorl where it can be slightly lobulate; chambers rhomboidal in outline (externally), increasing very gradually in size as added, may be slightly inflated in ultimate whorl; sutures distinct, slightly depressed; wall very finely arenaceous with much cement, smoothly finished; aperture an arched interior-marginal slit at base of ultimate chamber, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58145	0.24	0.33
Paratype 58146	0.20	0.28
Paratype 58147	0.19	0.28
Paratype 58148	0.23	0.28
Paratype 58149	0.16	0.25
Paratype 58150	0.15	0.21
Paratype 58151	0.21	0.24

Remarks. *Orientalia loucheuxi* n. sp. differs from *O. norrisi* n. sp. in having a more elongate and tapering test, the apex of which is sharply pointed. It differs from *Eomarssonella pollocki* n. sp. in having four, rather than three, chambers in the ultimate whorl.

Etymology. The species is named after the Loucheux Indian Tribe, which inhabits the northern Richardson Mountains area.

Occurrence. *Orientalia loucheuxi* n. sp. occurs in a single sample 176 m above the base of the lower member.

Orientalia norrisi n. sp.

Plate 22, figures 6–9

?1972 *Eomarssonella paraconica* Levina in Dain et al., p. 102, Pl. XXXII, fig. 2; non figs. 1, 3–11.

1983 *Arenobulimina* sp. 1 Wall, Pl. 3, figs. 21, 22.

Material. Abundant; holotype GSC 58125, paratypes GSC 58126, 58139, 58140, and unfigured paratypes GSC 58127–58130, 58138 from GSC loc. C-051383, 143 m above base of lower member; unfigured paratypes GSC 58141–58144 from GSC loc. C-051377, 125 m above base.

Description. Test small to medium sized, trochospirally coiled, increasing uniformly with growth, conical in shape with blunt apex, rounded in cross-section, consisting of five to six whorls; initial two or three whorls of five chambers each, decreasing to four chambers per whorl in later portion; chambers externally rhomboidal in shape, slightly inflated, increasing gradually in size as added; sutures distinct, slightly depressed, straight, slanted against the direction of coiling; wall very finely agglutinated with

considerable cement, smoothly finished; aperture simple, arched interior-marginal slit at base of ultimate chambers, commonly obscured due to preservation.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58125	0.19	0.31
Paratype 58126	0.23	0.35
Paratype 58127	0.23	0.30
Paratype 58128	0.23	0.30
Paratype 58129	0.20	0.26
Paratype 58130	0.20	0.28
Paratype 58138	0.20	0.20
Paratype 58139	0.21	0.23
Paratype 58140	0.21	0.25
Paratype 58141	0.18	0.23
Paratype 58142	0.19	0.18
Paratype 58143	0.16	0.15
Paratype 58144	0.15	0.18

Remarks. *Orientalia norrisi* n. sp. is very similar in overall test architecture to *Eomarssonella paraconica* Levina and differs solely in having four chambers in the ultimate whorl of the test, whereas the latter has two and a half to three. *Orientalia norrisi* n. sp. differs from *O. loucheuxi* n. sp. in possessing a stouter, more gently tapering test, and in having a blunt apex.

Etymology. The patronym honours Dr. D.K. Norris, Geological Survey of Canada (retired), head of Operation Porcupine, a large-scale mapping project initially launched in 1962 to map northern Yukon Territory from latitude 65°N to the Arctic Coast, between longitudes 132°W and 141°W.

Occurrence. *Orientalia norrisi* n. sp. occurs commonly in strata 125 to 143 m above the base of the lower member.

Orientalia sp. cf. *O. norrisi* n. sp.

Plate 22, figures 10–12

Material. About 40 specimens in good state of preservation; figured specimens GSC 58131, 58133 and unfigured specimens GSC 58132, 58134 from GSC loc. C-051379, 131 m above the base of the lower member; unfigured specimen GSC 58135 from GSC loc. C-051377, 125 m above base; unfigured types GSC 58136, 58137 from GSC loc. C-051383, 143 m above base.

Description. Test medium sized, robust, rather strongly flaring; trochospirally coiled, rounded in cross-section except for the ultimate whorl where the periphery becomes lobulate; consisting of about five or six whorls, about five chambers in initial whorl decreasing to four in ultimate whorl; chambers initially rhomboidal in shape (externally), increasing gradually in size as added; in ultimate (and rarely in penultimate) whorl, chambers become strongly inflated and globular, and may distort whorl shape; sutures distinct, slightly to moderately depressed; wall finely arenaceous with much cement, fairly smoothly finished; aperture an arched interior-marginal slit at the base of the ultimate chamber, commonly obscured.

Dimensions (mm).

GSC Specimen No.	Width	Height
58131	0.35	0.43
58132	0.35	0.39
58133	0.36	0.35
58134	0.31	0.40
58135	0.35	0.44
58136	0.35	0.40
58137	0.34	0.43

Remarks. *Orientalia* sp. cf. *O. norrisi* n. sp. is distinguished by having an ultimate whorl with more greatly inflated, rather globular chambers than those found in the ultimate whorl of *O. norrisi* n. sp. Some specimens are clearly transitional to *Eomarssonella paraconica* Levina. In such cases it is difficult to make a clear-cut generic assignment. *Orientalia* sp. cf. *O. norrisi* n. sp. is similar in size and general design to *Arenobulimina paynei* Tappan as illustrated by Souaya (1976), but differs in having less inflated, more closely coiled chambers in the initial portion of the test.

Occurrence. *Orientalia* sp. cf. *O. norrisi* n. sp. occurs in beds of late Kimmeridgian age in the lower member.

Suborder ROTALIINA Delage and Herouard, 1896

Superfamily NODOSARIACEA Ehrenberg, 1838

Family NODOSARIIDAE Ehrenberg, 1838

Subfamily NODOSARIINAE Ehrenberg, 1838

Genus *Astacolus* de Montfort, 1808

Type species. *Astacolus crepidulatus* de Montfort, 1808.

Diagnosis. Test free, elongate, arcuate, compressed, chambers numerous, low, broad, added along slightly curved axis; sutures oblique, highest at outer margin, curved, straight, or sinuate; aperture radiate, terminal, at peripheral angle.

Astacolus sp. cf. *A. praesibirensis* Kosyreva

Plate 22, figures 22–26

?1972 *Astacolus praesibirensis* Kosyreva in Dain et al., p. 125, Pl. XLI, figs. 1–4.

Material. Ten well preserved specimens; figured specimens GSC 58152, 58154 and unfigured specimens GSC 58153, 58155 from GSC loc. C-051339, 54 m above base of lower member.

Description. Test large, robust, strongly compressed, arcuate; planispirally coiled in early portion with a tendency to uncoil in later portion, although all chambers reach back to the coil; periphery with distinct keel; chambers numerous, up to 14, low and broad, increasing rapidly in breadth but only slowly in height as added; sutures distinct, thickened, flush, oblique, moderately arcuate; wall calcareous, smooth; aperture at end of peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58152	0.70	0.28	1.08
58153*	0.85	0.38	>1.30
58154*	0.65	0.29	>0.95
58155*	0.83	0.38	>1.18

*broken specimen.

Remarks. *Astacolus* sp. cf. *A. praesibirensis* is similar in most respects to its Siberian namesake, but possesses a more conspicuous, thicker keel. It differs from *A. arietis* (Terquem) in being larger and more strongly compressed.

Occurrence. *Astacolus* sp. cf. *A. praesibirensis* occurs in a single sample 54 m above the base of the lower member.

Astacolus sp. A

Plate 23, figures 1–6

Material. About 40 well preserved specimens; figured specimens GSC 58156–58158 and unfigured specimen

GSC 58159 from GSC loc. C-051382, 140 m above base of lower member; unfigured specimen GSC 58160 from GSC loc. C-051386, 152 m above base; unfigured specimen GSC 58161 from GSC loc. C-051390, 159.5 m above base.

Description. Test medium sized, strongly compressed, slightly arcuate; planispirally coiled in early portion, with a tendency to uncoil in later portion; chambers numerous, nine to eleven visible, low and broad, increasing rapidly in breadth but only slowly in height as added; sutures distinct, somewhat thickened, flush, oblique; wall calcareous, smooth; aperture at end of peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58156	0.68	0.25	0.99
58157	0.65	0.28	1.30
58158	0.48	0.18	0.73
58159	0.41	0.15	0.60
58160	0.53	0.24	0.93
58161	0.44	0.20	0.70

Remarks. *Astacolus* sp. A is broadly similar to the *A. sibirensis* Kosyreva–*A. praesibirensis* Kosyreva group of forms from the Upper Jurassic of western Siberia, but is somewhat smaller and possesses fewer chambers. It differs from *A. sp. cf. A. praesibirensis* Kosyreva found in the lower member in being smaller, having fewer chambers and lacking the pronounced keel of the latter.

Occurrence. *Astacolus* sp. A occurs rarely throughout the mid portion of the lower member.

Astacolus sp. B

Plate 23, figures 7–10

Material. Rare; figured specimen GSC 58162 from GSC loc. C-051334, 46.5 m above base of lower member; figured specimen GSC 58163 from GSC loc. C-051331, 42 m above base.

Description. Test medium sized, moderately compressed, lenticular in cross-section, arcuate; planispirally coiled in early stage with tendency to uncoil later on; periphery with fully to moderately developed keel; chambers numerous, about nine in adults, low and broad; sutures distinct, thickened,

flush, arcuate; wall calcareous, smooth, very finely perforate; aperture at end of peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58162	0.55	0.28	0.96
58163	0.50	0.25	0.85

Remarks. *Astacolus* sp. B differs from *A. sp. cf. A. praesibirensis* Kosyreva in being much smaller, possessing fewer chambers and having a lenticular cross-section. It differs from *A. sp. A* in being smaller and having a lenticular cross-section.

Occurrence. *Astacolus* sp. B occurs rarely in beds 40 to 50 m above the base of the lower member.

Genus *Citharina* d'Orbigny in de la Sagra, 1839

Type species. *Vaginulina (Citharina) strigillata* Reuss, 1846.

Diagnosis. Test flattened, subtriangular in outline, may be keeled; chambers numerous, extending nearly to base at inner margin; wall smooth, striate or costate; aperture radiate at outer margin.

Citharina callomoni n. sp.

Plate 24, figures 17–23

Material. About 20 specimens in reasonable state of preservation, though most are fragments; holotype GSC 58164 and paratypes GSC 58165, 58166 from GSC loc. C-051331, 42 m above base of lower member; unfigured paratypes GSC 58167, 58168 from GSC loc. C-051334, 46.5 m above base.

Description. Test large, flattened, subtriangular in outline, peripheral margin varies from straight to slightly convex; chambers numerous, probably about 10 to 12 in adults (estimated), increasing gradually in breadth as added, so that the chambers are quite broad and low; sutures fairly distinct, thickened, slightly depressed; wall calcareous, smooth, ornamented with low, fine, longitudinal costae, about 12 to 14 per side in adults, running continuously from base of test to near median point on ventral face, not branching; aperture radiate, produced on short, neck-like extension of the peripheral angle.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Holotype 58164 (j)	0.36	0.15	0.88
Paratype 58165*	0.60	0.21	>1.20
Paratype 58166*	0.50	0.18	>0.93
Paratype 58167*	0.63	0.20	>1.13
Paratype 58168*	0.63	0.15	>0.70

j, juvenile specimen; *broken specimen.

Remarks. *Citharina callomoni* n. sp. resembles *C. entypomatus* Loeblich and Tappan from the Oxfordian of the western interior plains of the United States, but differs in being about twice as large and possessing fewer chambers. The fragmentary preservation of these fragile forms makes them difficult to compare with other described species.

Etymology. The patronym honours Dr. J.H. Callomon, Professor of Geology and Chemistry at University College, London.

Occurrence. *Citharina callomoni* n. sp. occurs rarely 40 to 50 m above the base of the lower member.

Citharina sp. A

Plate 24, figures 24–29

Material. About 10 poorly preserved and fragmentary tests; figured specimen GSC 58169 from GSC loc. C-051334, 46.5 m above base of lower member; figured specimens GSC 58170, 58171 and unfigured specimens GSC 58172, 58173 from GSC loc. C-051330, 40.5 m above base.

Description. Test small, strongly compressed, rounded triangular in outline, peripheral margin slightly convex; chambers numerous, nine or ten in adults, increasing very rapidly in breadth but only slightly in height as added; sutures distinct, moderately depressed, strongly oblique; wall calcareous, finely perforate, smooth; aperture at the peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58169	0.28	0.06	0.38
58170	0.14	0.04	0.28
58171	0.16	0.05	0.25
58172*	0.18	0.05	>0.30
58173*	0.33	0.05	>0.40

*denotes broken specimen.

Remarks. The test of *Citharina* sp. A is very delicate. Except for figured specimen GSC 58169, most of the material consists of fragmented tests or loose chambers. *Citharina* sp. A resembles *C. latissima* Loeblich and Tappan in outline, but differs in being much smaller and lacking ornamentation.

Occurrence. *Citharina* sp. A occurs rarely 40 to 50 m above the base of the lower member.

Genus *Dentalina* Risso, 1826

Type species. *Nodosaria (Dentalina) curvieri* d'Orbigny, 1826.

Diagnosis. Test elongate, arcuate, uniserial; sutures commonly oblique; aperture radiate, terminal, may be eccentric or nearly central.

Remarks. Although the lower member of the Husky Formation at Martin Creek yielded seven species of *Dentalina*, most are very rare in occurrence (five specimens or less) and are currently of little use biostratigraphically.

Dentalina vulgata n. sp.

Plate 26, figures 24–29

Material. About 35 specimens, of which 10 are well preserved; holotype GSC 58183 from GSC loc. C-051334, 46.5 m above base of lower member; paratype GSC 58184 and unfigured paratypes GSC 58185, 58186 from GSC loc. C-051333, 45 m above base; paratype GSC 58187 from GSC loc. C-051330, 40.5 m above base; unfigured paratype GSC 58188 from GSC loc. C-051393, 159.5 m above base.

Description. Test medium sized, elongate, but stubby at both ends, axis straight to slightly arcuate, uniserial; consisting of three or four chambers, proloculus

stubby, with distinct small apical horn; chambers inflated, of approximately constant width, with height increasing gradually, ultimate chamber about 50 per cent higher than broad, chambers rounded to slightly ovate in section; sutures distinct, fine, flush, transverse to very slightly oblique; wall calcareous, smooth; aperture terminal, radiate, slightly eccentric.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58183	0.23	0.80
Paratype 58184	0.23	0.60
Paratype 58185	0.23	0.55
Paratype 58186	0.20	0.55
Paratype 58187	0.23	0.78
Paratype 58188	0.23	0.69

Etymology. From the Latin, *vulgatus*, ordinary.

Occurrence. *Dentalina vulgata* n. sp. occurs rarely throughout the lower member.

Dentalina sp. cf. *D. ejuncida*
Loeblich and Tappan

Plate 26, figures 13, 32

?1950 *Dentalina ejuncida* Loeblich and Tappan, p. 48, Pl. 13, figs. 9–11.

Material. Rare; figured specimen GSC 58174 and unfigured type GSC 58175 from GSC loc. C-051333, 45 m above base of lower member; figured specimen GSC 58176 from GSC loc. C-051330, 40.5 m above base.

Description. Test small, elongate, slightly arcuate, tapering; uniserial throughout; consisting of six or seven chambers (adult), chambers slightly inflated, generally higher than broad, not overlapping, expanding gradually in size as added; sutures fine, distinct, slightly constricted and strongly oblique; wall calcareous, smooth, very finely perforate; aperture terminal, radiate, eccentric.

Dimensions (mm).

GSC Specimen No.	Width	Height
58174	0.13	0.55

58175*	0.08	>0.45
58176 (j)	0.13	0.38

*broken specimen; j, juvenile specimen.

Remarks. *Dentalina* sp. cf. *D. ejuncida* Loeblich and Tappan differs from *D. ejuncida* in having fewer chambers in the adult test.

Occurrence. *Dentalina* sp. cf. *D. ejuncida* Loeblich and Tappan occurs rarely, 40 to 50 m above the base of the lower member.

Dentalina sp. A

Plate 26, figures 14–16

Material. Rare, poor, fragmentary preservation; figured specimens GSC 58177, 58178 from GSC loc. C-051330, 40.5 m above base of lower member.

Description. Test large, elongate, axis slightly arcuate; uniserial throughout; consisting of seven (?or more) chambers; proloculus spherical with single apical horn, chambers initially closely appressed, wider than high; in later portion gradually becoming equidimensional, ultimate chamber higher than wide, chambers slightly inflated, rounded in section; sutures distinct, fine, slightly depressed, somewhat oblique; wall calcareous, smooth, very finely perforate; aperture terminal, radiate, eccentric.

Dimensions (mm).

GSC Specimen No.	Width	Height
58177	0.25	1.05
58178*	0.29	>1.00

*broken specimen.

Remarks. *Dentalina* sp. A is similar in size and general appearance to *D. ejuncida* Loeblich and Tappan, but the latter lacks an apical horn and has more oblique sutures. *Dentalina tortilis* Franke is similar in appearance, but is smaller.

Occurrence. *Dentalina* sp. A occurs in a single sample 40 m above the base of the lower member.

Dentalina sp. B

Plate 26, figures 20, 21

Material. About 30 specimens in various states of preservation; figured specimens GSC 58179, 58180 and unfigured type GSC 58181 from GSC loc. C-051330, 40.5 m above base of lower member; unfigured type GSC 58182 from GSC loc. C-051334, 46.5 m above base.

Description. Test small, elongate, slender, straight to slightly arcuate, rounded in cross-section; proloculus spherical, may possess single apical horn; chambers initially about twice as broad as high, later becoming equant or nearly so, slightly inflated; sutures distinct, flush, slightly to moderately oblique; wall calcareous, smooth; aperture terminal, eccentric, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58179*	0.16	>0.63
58180*	0.16	>0.70
58181*	0.15	>0.53
58182*	0.15	>0.58

*broken specimen.

Occurrence. *Dentalina* sp. B occurs sparsely 40 to 50 m above the base of the lower member.

Dentalina sp. C

Plate 26, figures 17, 18

Material. Single specimen; figured specimen GSC 58506 from GSC loc. C-051332, 43.5 m above base of lower member.

Description. Test large, robust, elongate, slightly arcuate, uniserial; consisting of rounded proloculus followed by two rapidly expanding chambers that are higher than broad and rounded in cross-section; ultimate chamber slightly inflated, occupies 50 per cent of test; sutures distinct, fine, very slightly depressed, horizontal; wall calcareous, smooth; aperture terminal, radiate, slightly eccentric.

Dimensions (mm).

GSC Specimen No.	Width	Height
58506	0.35	0.90

Occurrence. *Dentalina* sp. C was recovered from 43.5 m above the base of the lower member.

Dentalina sp. D

Plate 26, figure 19

Material. Three specimens; figured specimen GSC 58509 and unfigured specimen GSC 58510 from GSC loc. C-051394, 161 m above base of lower member.

Description. Test medium sized, elongate, axis slightly arcuate, uniserial; consisting of four or five chambers that expand slowly as added; chambers not inflated, higher than broad, rounded in cross-section; sutures distinct, fine, slightly depressed, oblique; wall calcareous, smooth; aperture terminal, radiate, eccentric.

Dimensions (mm).

GSC Specimen No.	Width	Height
58509	0.26	0.80
58510	0.23	0.74

Occurrence. *Dentalina* sp. D was recovered from a sample 161 m above base of the lower member.

Dentalina sp. E

Plate 26, figures 22, 23

Material. Rare and poorly preserved; figured specimen GSC 58189 and unfigured type GSC 58190 from GSC loc. C-051334, 46.5 m above base of lower member.

Description. Test small, slender, elongate, axis straight, uniserial; proloculus bluntly rounded followed by five or six slightly inflated chambers, chambers maintain constant width through ontogeny, but height increases gradually so that later chambers are equidimensional; sutures distinct, very slightly constricted, transverse to slightly oblique; wall calcareous, smooth; aperture terminal, radiate, eccentric, produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Width	Height
58189	0.16	0.64

58190* 0.19 >0.64
*damaged specimen.

Remarks. *Dentalina* sp. E is similar in size and appearance to *D.* sp. B but differs in being parallel sided rather than tapering, possessing transverse rather than oblique sutures, and lacking an apical horn.

Occurrence. *Dentalina* sp. E occurs 42 to 48 m above base of lower member.

Genus *Frondicularia* DeFrance
in d'Orbigny, 1826

Type species. *Renulina complanata* DeFrance, 1824.

Diagnosis. Test free, elongate or palmate, flattened, chambers low, broad and equitant; sutures strongly arched or angled at centre of test; aperture terminal, radiate, may be produced on short neck.

Frondicularia? sp.

Plate 27, figures 12, 13

Material. Two well preserved specimens; figured specimen GSC 58195 from GSC loc. C-029131, 131 to 137 m above base of lower member.

Description. Test medium sized, robust, sharply tapering (teardrop-shaped), lateral sides convex with conspicuous medial depression along axis of test, uniserial; chambers bisymmetrical, about five in number, broader than high, increasing rapidly in size as added; ultimate chamber occupies 35 per cent of adult test, sutures distinct, fine, flush, chevron-shaped, wall calcareous, finely perforate, smooth, ornamented with six strong, distinct longitudinal costae, running continuously from apex of test to the ultimate chamber, aperture terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58195	0.53	0.38	0.75

Remarks. *Frondicularia?* sp. is broadly similar to *Ichthyolaria tjumenika* Tylkina (*in* Dain et al., 1972), but differs in being proportionately much broader and in lacking auxiliary costae.

Occurrence. *Frondicularia?* sp. occurs 131 to 137 m above base of lower member.

Genus *Grillina* Kristan-Tollman, 1964

Type species. *Grillina grilli* Kristan-Tollman, 1964.

Diagnosis. Test free, elongate, flaring slightly, sides flattened to concave, elongate, hexagonal in section with angles weak to costate, chambers uniserial and rectilinear, arched centrally, broad and low; wall calcareous, smooth to costate at test angles; aperture terminal; slit elongate, straight to curved (or slightly ovate).

Remarks. Loeblich and Tappan (1988) considered the genus *Geinitzinita* Sellier de Civreaux and Dessauvagine to be a junior synonym of *Grillina*.

Grillina praenodulosa (Dain)

Plate 27, figures 14–16

- 1955 *Frondicularia* sp. Tappan, p. 82, Pl. 27, fig. 10.
1972 *Geinitzinita praenodulosa* Dain in Dain et al., p. 108, Pl. XXXIII, figs. 1–5.
1976 *Lingulina* sp. cf. *L. hybrida* Frentzen; Souaya, p. 280, Pl. 3, figs. 4a, b.
1976 *Frondicularia tumida?* Terquem; Souaya, p. 278, Pl. 4, figs. 2a, b.
1980 *Lingulina praenodulosa* (Dain); Løfaldli and Nagy, p. 80, Pl. 6, figs. 1–6.
1981 *Geinitzinita* cf. *G. praenodulosa* Dain; Brooke and Braun, p. 25, Pl. 7, figs. 3–5.
1982 *Geinitzinita* sp. cf. *G. praenodulosa* Dain; Leskiw in Poulton et al., Pl. 1, fig. 8.
1983 *Geinitzinita* sp. cf. *G. nodulosa* (Fursenko and Polenova); Wall, Pl. 4, fig. 45.

Material. Fairly common, about 25 tests in adequate state of preservation; hypotypes GSC 58191, 58192 from GSC loc. C-051330, 40.5 m above base of lower member; unfigured hypotypes GSC 58193, 58194 from GSC loc. C-051331, 42 m above base.

Description. Test medium sized, gently tapering; uniserial and rectilinear throughout; spherical proloculus followed by four to six low, rather rapidly expanding chambers, chambers broadly ovate in outline, convex at periphery and concave at median point; medial depression occupies up to 50 per cent of chamber width, more deeply impressed at base of

chamber, disappearing toward aperture; borders of medial depression outlined by translucent, ridge-like swellings; sutures distinct, fairly wide, slightly depressed, and chevron-shaped; wall calcareous, smooth, finely perforate; aperture simple, terminal, ovate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 58191	0.24	0.19	0.53
Hypotype 58192	0.21	0.16	0.49
Hypotype 58193	0.28	0.20	0.58
Hypotype 58194	0.21	0.15	0.41

Remarks. *Grillina praenodulosa* (Dain) occurs commonly throughout the Boreal faunal realm in Late Jurassic time in northern Europe, Siberia, and in the Canadian Arctic. It is the only nodosariid recognized to date that can be called a characteristic boreal form.

Occurrence. *Grillina praenodulosa* occurs rarely throughout the lower member.

Genus *Lenticulina* Lamarck, 1804

Type species. *Lenticulina rotulata* Lamarck, 1804.

Diagnosis. Test free, planispiral or rarely trochospiral, lenticular, biumbonate, periphery angled or keeled; chambers increasing gradually in size, in general of greater breadth than height; sutures radial, straight or curved and depressed, flush or elevated; surface may be variously ornamented with thickened, elevated sutures, bosses, or sutural nodes; aperture radial, at peripheral angle.

Lenticulina gerkei Dain

Plate 25, figures 1–5

- 1972 *Lenticulina gerkei* Dain in Dain et al., p. 117, Pl. XXXVI, figs. 7a, b.

Material. Over 50 specimens in excellent state of preservation; hypotype GSC 58198 and unfigured hypotypes GSC 58196, 58197, 58199 from GSC loc.

C-051330, 40.5 m above base of lower member; hypotypes GSC 58201, 58202 and unfigured hypotype GSC 58200 from GSC loc. C-051334, 46.5 m above base.

Description. Test medium sized, planispirally coiled, lenticular (biconvex) in cross-section, periphery subacute, biumbilicate, umbilical areas may be slightly depressed; chambers numerous, increasing gradually in size as added; ultimate and penultimate chambers commonly moderately inflated along inner lower flanks; eight or nine chambers in ultimate whorl, face of ultimate chamber rounded triangular in outline, slightly convex; sutures distinct, fine, radial, curved rather strongly against direction of coiling, flush; wall calcareous, hyaline, finely perforate, smooth; aperture at peripheral angle, radiate, may be elevated on slight neck.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 58196	0.40	0.23	0.51
Hypotype 58197	0.43	0.21	0.48
Hypotype 58198	0.44	0.26	0.50
Hypotype 58199	0.38	0.23	0.48
Hypotype 58200	0.33	0.21	0.45
Hypotype 58201	0.28	0.19	0.41
Hypotype 58202	0.30	0.21	0.40

Remarks. Some specimens of *Lenticulina gerkei* from the lower member exhibit a slightly trochospiral (*Darbyella*-like) mode of coiling. The inflation of the umbilical portions of the ultimate and penultimate chambers is also quite variable.

Occurrence. *Lenticulina gerkei* Dain occurs commonly 40 to 50 m above the base of the lower member.

Lenticulina sp. cf. *L. audax*
Loeblich and Tappan

Plate 25, figures 6–8

?1950 *Lenticulina audax* Loeblich and Tappan, p. 43, Pl. 11, figs. 18–21.

Material. About 40 specimens; figured specimens GSC 58203, 58204, and unfigured types GSC 58205–58208 from GSC loc. C-051331, 42 m above base of lower member.

Description. Test medium to large, planispirally coiled; involute, usually biumbonate; periphery subacute, peripheral margin keeled; chambers numerous, about nine or ten in adult specimens; terminal face rounded triangular in section, with fairly sharp angles on sides, not inflated; sutures distinct, radial, thickened, flush, generally curved against direction of coiling; wall calcareous, hyaline, finely perforate, smooth; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58203	0.70	0.43	0.80
58204	0.65	0.38	0.73
58205	0.75	0.50	0.88
58206	0.65	0.50	0.85
58207	0.85	0.50	1.00
58208	0.80	0.60	0.95

Remarks. *Lenticulina* sp. cf. *L. audax* differs from *L. audax* in having fewer chambers in the ultimate whorl and being proportionately wider.

Occurrence. *Lenticulina* sp. cf. *L. audax* occurs rarely in the middle portion of the lower member.

Lenticulina sp. cf. *L. lauta* Dain

Plate 25, figures 20–23

?1972 *Lenticulina lauta* Dain in Dain et al., p. 122, Pl. XXXVII, fig. 1.

Material. Fifty specimens; figured specimens GSC 58209, 58211, 58213 and unfigured types GSC 58210, 58212, 58214 from GSC loc. C-051331, 42 m above base of lower member.

Description. Test large, planispirally coiled, involute, periphery subacute, peripheral margin strongly keeled; chambers numerous, about nine to eleven in ultimate whorl, expanding gradually in size as added, apertural face sharply triangular with slightly rounded lateral sides; sutures distinct, radial, slightly thickened, flush, curved backward against direction of coiling; wall

calcareous, hyaline, finely perforate, smooth; aperture located at peripheral angle, slightly projected, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58209	0.93	0.55	1.18
58210	0.74	0.41	0.85
58211	0.64	0.33	0.78
58212	0.88	0.48	0.95
58213	0.55	0.38	0.63
58214	0.58	0.28	0.78

Remarks. *Lenticulina* sp. cf. *L. lauta* is similar in size and test design to *L. audax* Loeblich and Tappan, but differs in being wholly involute, possessing fewer chambers in the ultimate whorl and lacking the prominent, clear umbos of the latter. It is similar in most respects to *L. lauta* Dain from the Kimmeridgian of western Siberia, but cannot be assigned with total certainty because Dain neglects to mention whether her form has a keel.

Occurrence. *Lenticulina* sp. cf. *L. lauta* Dain occurs rarely 40 to 50 m above the base of the lower member.

Lenticulina sp. A

Plate 25, figures 9–14

Material. Uncommon; figured specimen GSC 58218 and unfigured types GSC 58215–58217, 58219, 58220 from GSC loc. C-051334, 46.5 m above base of lower member; figured specimen GSC 58221 and unfigured specimen GSC 58222 from GSC loc. C-051331, 42 m above base.

Description. Test medium sized, lenticular, planispirally coiled, and involute; later portion may be uncoiled; periphery sharply angular, peripheral margin has thin, distinctive keel; chambers numerous, 11 to 12 in ultimate whorl, expanding gradually in size as added, terminal face sharply triangular with only slightly to not rounded lateral sides, may appear flat to slightly concave; sutures distinct, radial, limbate, flush, moderately curved against direction of coiling with maximum inflection occurring close to the umbilicus; wall calcareous, hyaline, finely perforate, smooth; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58215	0.53	0.29	0.65
58216	0.50	0.28	0.65
58217	0.35	0.23	0.48
58218	0.48	0.26	0.65
58219	0.36	0.29	0.49
58220	0.36	0.24	0.58
58221	0.52	0.35	0.83
58222	0.40	0.23	0.50

Remarks. Specimens of *Lenticulina* sp. A that are wholly planispiral have a sharp and flat terminal face. In forms that exhibit a tendency to uncoil (Pl. 25, figs. 13, 14), the apertural face becomes rounded triangular in outline, with the lateral sides becoming moderately inflated.

Lenticulina sp. A differs from *L. gerkei* Dain in having a sharper, more acute peripheral margin, possessing a keel and lacking the inflated ultimate chamber of the latter. It bears some resemblance to *L. undosa* Beljaevskaja (in Dain et al., 1972), but is larger and possesses more chambers in the ultimate whorl.

Occurrence. *Lenticulina* sp. A occurs rarely 40 to 50 m above the base of the lower member.

Lenticulina sp. B

Plate 25, figures 15–19

Material. About 50 specimens in adequate state of preservation; figured specimens GSC 58223, 58224 and unfigured specimens GSC 58225, 58226, 58363, 58364 from GSC loc. C-051394, 161 m above base of lower member.

Description. Test large, lenticular, planispirally coiled and wholly involute, periphery subacute; chambers numerous, expanding gradually in size as added, about 10 to 11 in ultimate whorl; apertural face triangular with rounded angles, slightly inflated, sutures rather indistinct, radial, limbate, flush, strongly curved back against direction of coiling; wall calcareous, hyaline, finely perforate, smooth; aperture located at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58223	0.76	0.52	1.08
58224	0.80	0.46	1.28
58225	0.75	0.38	0.98
58226	0.58	0.38	0.80
58363	0.68	0.46	0.96
58364	0.80	0.50	1.15

Remarks. *Lenticulina* sp. B closely resembles *L. splendida* Beljaevskaja (in Dain et al., 1972) from the lower Kimmeridgian of western Siberia, but lacks the keel of the latter species.

Occurrence. *Lenticulina* sp. B occurs rarely 158 to 165 m above the base of the lower member.

Genus *Marginulina* d'Orbigny, 1826

Type species. *Marginulina raphanus* d'Orbigny, 1826.

Diagnosis. Early portion slightly coiled, but not completely enrolled as in *Marginulinopsis*, later portion rectilinear; sutures oblique, especially in early portion; aperture on dorsal angle, somewhat produced.

Marginulina brevis Paalzow

Plate 27, figures 4-6

1922 *Marginulina brevis* Paalzow, p. 21, Pl. 2, fig. 18.

1955 *Marginulina brevis* Paalzow; Tappan, p. 58, Pl. 18, fig. 14.

Material. Three specimens; hypotype GSC 58365 from GSC loc. C-051331, 42 m above base of lower member; hypotype GSC 58366 and unfigured hypotype GSC 58367 from GSC loc. C-051332, 43.5 m above base.

Description. Test small, subovate in outline, subtriangular in cross-section, narrower at outer margin and wider at inner margin, margins rounded; chambers few, five in mature specimens, low and broad, increasing fairly slowly in size as added, except for ultimate chamber, which makes up 33 to 50 per cent of entire test; sutures distinct, fine, flush to slightly depressed, oblique; wall calcareous, finely perforate; aperture at dorsal angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
Hypotype 58365	0.25	0.20	0.55
Hypotype 58366	0.20	0.15	0.39
Hypotype 58367*	0.20	0.18	>0.33

*broken specimen.

Remarks. Tappan (1955) obtained two specimens of *Marginulina brevis* from a core of Kingak Shale (Upper Jurassic) from northern Alaska. Including the holotype and the Husky material, a total of only six specimens of this rare species has been recovered.

Occurrence. *Marginulina brevis* Paalzow occurs rarely 40 to 45 m above the base of the lower member.

Marginulina sp. cf. *M. breviformis*
(Terquem and Berthelin)

Plate 26, figures 30, 31

?1955 *Marginulina breviformis* (Terquem and Berthelin); Tappan, p. 58, Pl. 18, figs. 2, 3.

Material. Rare; figured specimens GSC 58368, 58369 from GSC loc. C-051334, 46.5 m above base of lower member; unfigured type GSC 58370 from GSC loc. C-051330, 40.5 m above base.

Description. Test medium sized, robust, stout, rounded in cross-section; about five to six chambers in mature individuals, early chambers tiny, broader than high, increasing more rapidly in breadth than in height, ultimate chamber occupies 33 to 50 per cent of test; sutures distinct, slightly depressed, only moderately oblique; wall calcareous, finely perforate, smooth; aperture located at dorsal angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58368	0.30	0.63
58369*	0.45	>0.70
58370	0.26	0.45

*broken specimen.

Remarks. The Husky specimens of *Marginulina* sp. cf. *M. breviformis* differ from Tappan's in possessing only slightly depressed, less oblique sutures and somewhat greatly inflated chambers.

Occurrence. *Marginulina* sp. cf. *M. breviformis* occurs rarely 40 to 50 m above the base of the lower member.

Genus *Marginulinopsis* Silvestri, 1904

Type species. *Marginulinopsis densicostata* Thalmann, 1937.

Diagnosis. Test with early stage as in *Lenticulina*, later uncoiling and rectilinear as in *Marginulina*; aperture terminal, radiate.

Marginulinopsis rjavkinoensis (Kosyreva)

Plate 26, figures 33–40

- 1972 *Vaginulinopsis rjavkinoensis* Kosyreva in Dain et al., p. 134, Pl. XXXIX, figs. 5–9.
 ?1980 *Marginulina* aff. *caelata* Loeblich and Tappan; Løfaldli and Nagy, p. 79, Pl. 4, figs. 9–12.

Material. About 50 specimens; hypotype GSC 58371 and unfigured hypotypes GSC 58372, 58373 from GSC loc. C-051387, 155 m above base of lower member; unfigured hypotypes GSC 58374, 58375 from GSC loc. C-051388, 156.5 m above base; hypotype GSC 58376 and unfigured hypotype GSC 58377 from GSC loc. C-051390, 159.5 m above base; hypotype GSC 58378 and unfigured hypotypes GSC 58379, 58383, 58384 from GSC loc. C-051392, 158 m above base; hypotypes GSC 58380, 58381 and unfigured hypotype GSC 58382 from GSC loc. C-051394, 161 m above base.

Description. Test medium sized, elongate, initial portion close coiled, evolute, consisting of five or six chambers that increase in size slowly as added, later portion uniserial, straight and rectilinear, consisting of three or four chambers; chambers broader than high, slightly inflated, rounded to ovate in section, ultimate chamber may be more inflated than previous ones; sutures distinct, highest on dorsal side, slightly thickened, depressed, arched against direction of coiling in initial portion, slightly oblique in uniserial portion; wall calcareous, hyaline, finely perforate, ornamented with up to 22 low (often indistinct), fine, longitudinal costae that run uninterrupted across the sutures, and may occasionally bifurcate or coalesce; aperture at dorsal angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58371	0.21	0.55
Hypotype 58372	0.24	0.50
Hypotype 58373	0.21	0.53
Hypotype 58374	0.23	0.45
Hypotype 58375	0.24	0.46
Hypotype 58376	0.23	0.63
Hypotype 58377	0.23	0.53
Hypotype 58378	0.23	0.50
Hypotype 58379	0.23	0.48
Hypotype 58380	0.23	0.68
Hypotype 58381	0.18	0.66
Hypotype 58382	0.26	0.68
Hypotype 58383	0.23	0.46
Hypotype 58384	0.20	0.41

Remarks. *Marginulinopsis rjavkinoensis* differs from *M. phragmites* Loeblich and Tappan in being somewhat smaller and possessing more numerous, lower and more indistinct costae. It bears close resemblance to *M. jonesi* (Reuss), but its costae appear to be more dense.

A few very poorly preserved specimens possibly assignable to *Marginulinopsis* occur in older beds within the lower member, at 40 to 50 m above the base, but are not described formally.

Occurrence. *Marginulinopsis rjavkinoensis* occurs commonly 155 to 165 m above the base of the lower member.

Genus *Nodosaria* Lamarck, 1812

Type species. *Nautilus radícula* Linne, 1758.

Diagnosis. Test free, multilocular, rectilinear, rounded in section; sutures distinct and commonly perpendicular to axis of test; surface smooth; costate, striate, hispid or tuberculate; aperture central, terminal, radiate, may be produced on neck.

Nodosaria orthostoecha Loeblich and Tappan

Plate 27, figures 21, 22

- ?1933 *Nodosaria* cf. *corallina* (Gümbel); Wickenden, p. 165, Pl. 2, fig. 11.

- 1950 *Nodosaria orthostoecha* Loeblich and Tappan, p. 11, Pl. 1, figs. 33a, b.
 1960 *Nodosaria orthostoecha* Loeblich and Tappan; Wall, p. 89, Pl. 13, fig. 19.
 1972 *Nodosaria orthostoecha* Loeblich and Tappan; Brooke and Braun, Pl. 11, figs. 44-46.
 ?1976 *Nodosaria lirulata* Loeblich and Tappan; Souaya, p. 277, Pl. 8, fig. 24.

Material. Rare, poorly preserved and often fragmentary; hypotypes GSC 58390, 58391 and unfigured hypotype GSC 58392 from GSC loc. C-051330, 40.5 m above base of lower member; unfigured hypotype GSC 58393 from GSC loc. C-051331, 42 m above base.

Description. Test small, uniserial, rectilinear, consisting of up to five chambers; chambers subglobular, strongly centrally inflated, expanding gradually in size as added; sutures distinct, fine, strongly constricted, transverse; wall calcareous, finely perforate, surface ornamented by a maximum of 13 to 14 coarse longitudinal costae; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58390	0.16	0.48
Hypotype 58391*	0.18	>0.25
Hypotype 58392*	0.18	>0.15
Hypotype 58393*	0.14	>0.23

*broken specimen.

Remarks. *Nodosaria orthostoecha* is very similar to *N. lirulata* Loeblich and Tappan, but differs in possessing chambers that are smaller with slightly less constricted sutures. Although much of the Husky material is fragmentary, the species is distinctive and easy to recognize.

Occurrence. *Nodosaria orthostoecha* occurs rarely in the basal half of the lower member.

Nodosaria sp. cf. *N. amphigya*
 Loeblich and Tappan

Plate 27, figure 23

- ?1950 *Nodosaria amphigya* Loeblich and Tappan, p. 48, Pl. 13, figs. 15, 16.

Material. Rare, poorly preserved; figured specimen GSC 58394 from GSC loc. C-051336, 49.5 m above base of lower member; unfigured specimen GSC 58395 from GSC loc. C-051331, 42 m above base.

Description. Test small, elliptical, rounded in section; consisting of single chamber that is twice as high as broad, slightly tapered at both ends; wall calcareous, finely perforate; ornamented with a maximum of eight to ten fairly fine, longitudinal costae; aperture simple, terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Height
58394*	0.18	>0.36
58395*	0.13	>0.23

*broken specimen.

Remarks. The Husky form is probably conspecific with *Nodosaria amphigya*, but poor preservation does not allow a direct comparison to be made.

Occurrence. *Nodosaria* sp. cf. *N. amphigya* occurs rarely in the lower half of the lower member.

Nodosaria sp. A

Plate 26, figures 7, 8

Material. Three poorly preserved specimens; figured specimen GSC 58396 and unfigured type GSC 58397 from GSC loc. C-051330, 40.5 m above base of lower member; figured specimen GSC 58398 from GSC loc. C-051331, 42 m above base.

Description. Test medium sized, elongate, uniserial, chambers disarticulated during preservation, chambers globular, strongly inflated; sutures not observed but likely transverse and strongly constricted; wall calcareous, very finely perforate; aperture simple, terminal, at end of narrow apertural neck.

Dimensions (mm).

GSC Specimen No.	Width	Height
58396*	0.23	>0.30
58397*	0.24	>0.30
58398*	0.23	>0.35

*broken specimen.

Occurrence. *Nodosaria* sp. A occurs rarely between 40.5 and 42 m above the base of the lower member.

Nodosaria sp. B

Plate 27, figure 17

Material. Single specimen; figured specimen GSC 58399 from GSC loc. C-051336, 49.5 m above the base of the lower member.

Description. Test small, uniserial, rectilinear, consisting of three chambers; chambers closely appressed, slightly inflated and broader than high, ultimate chamber equidimensional; sutures distinct, transverse, slightly depressed; wall calcareous, ornamented with 12 longitudinal costae, of which six are distinct and sharp (primary costae), and six distinct and low (secondary costae); aperture simple, terminal, rounded, produced on slight neck.

Dimensions (mm).

GSC Specimen No.	Width	Height
58399*	0.28	>0.40

*broken specimen.

Occurrence. *Nodosaria* sp. B occurs 49.5 m above the base of the lower member.

Genus *Planularia* DeFrance, 1824

Type species. *Peneroplis auris* DeFrance in de Blainville, 1826.

Diagnosis. Similar to *Astacolus* but with compressed sides and carinate margins.

Planularia sp. cf. *P. fraasi* (Schwager)

Plate 24, figures 12-16

?1961 *Planularia fraasi* (Schwager); Gordon, p. 529, Textfig. 2 (7a, b).

?1965 *Planularia fraasi* (Schwager); Gordon, p. 841, Pl. 6, figs. 11, 12.

1981 *Planularia* cf. *P. fraasi* (Schwager); Brooke and Braun, p. 30, Pl. 7, figs. 50-53.

Material. About 50 specimens; figured specimens GSC 58402-58404 and unfigured types GSC 58400, 58401

from GSC loc. C-051394, 161 m above base of lower member; figured specimen GSC 58405 from GSC loc. C-051387, 155 m above base.

Description. Test small, strongly compressed, very slightly arcuate, partially planispirally coiled in initial stage, tending to uncoil later, though all chambers reach back to the coil; chambers broad and low, increasing very rapidly in breadth but very slowly in height as added, about eight to nine in adult forms; sutures distinct, slightly thickened, not depressed, slightly arcuate; wall calcareous, smooth; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58400	0.30	0.15	0.58
58401	0.33	0.13	0.65
58402	0.31	0.15	0.65
58403	0.39	0.15	0.59
58404	0.31	0.13	0.46
58405	0.30	0.14	0.80

Remarks. *Planularia* sp. cf. *P. fraasi* agrees well with the specimens illustrated by Brooke and Braun (1981) from the Fernie Formation of northeastern British Columbia. It differs from *P. lidigrigia* Kosyrev (in Dain et al., 1972) in being smaller, having fewer chambers and possessing a vestigial coil.

Occurrence. *Planularia* sp. cf. *P. fraasi* occurs commonly 155 to 165 m above the base of the lower member.

Genus *Pseudonodosaria* Boomgaard, 1949

Type species. *Glandulina discreta* Reuss, 1850.

Diagnosis. Test free, uniserial and rectilinear throughout; chambers embracing strongly, at least in the early portion, later chambers may be inflated and less strongly embracing; sutures horizontal; aperture terminal, radiate.

Pseudonodosaria brandi (Tappan)

Plate 26, figures 9, 10

1955 *Rectoglandulina brandi* Tappan, p. 74, Pl. 26, fig. 12.

- 1972 *Pseudonodosaria brandi* (Tappan); Dain in Dain et al., Pl. XXXIV, figs. 1-4, 6.
 1976 *Pseudonodosaria brandi* (Tappan); Souaya, p. 280, Pl. 8, fig. 16.
 1979 *Pseudonodosaria humilis* (Roemer); Løfaldli and Thusu, Pl. 47, fig. 4.
 1981 *Pseudonodosaria humilis* (Roemer); Brooke and Braun, p. 27, Pl. 7, figs. 8, 9.

Material. Fairly common, generally well preserved; hypotypes GSC 58406, 58407 and unfigured hypotype GSC 58408 from GSC loc. C-051333, 45 m above base of lower member; unfigured hypotype GSC 58409 from GSC loc. C-051331, 42 m above base; unfigured hypotypes GSC 58410, 58411 from GSC loc. C-051330, 40.5 m above base.

Description. Test medium sized, robust, uniserial and rectilinear throughout; broadly rounded at base, early chambers closely appressed, ultimate chamber rounded, occupies 33 to 50 per cent of entire test, three or four chambers in adult specimens; sutures indistinct, transverse, flush; wall calcareous, smooth; aperture terminal, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58406	0.28	0.45
Hypotype 58407	0.30	0.51
Hypotype 58408	0.29	0.55
Hypotype 58409	0.26	0.43
Hypotype 58410	0.21	0.36
Hypotype 58411	0.20	0.31

Remarks. *Pseudonodosaria brandi* is a common species in the Boreal Upper Jurassic, having been reported from such widespread areas as Arctic North America, Scandinavia, and western Siberia.

Occurrence. *Pseudonodosaria brandi* occurs rarely in the lower part of the lower member.

Pseudonodosaria statuta n. sp.

Plate 26, figures 1-6

Material. Fairly common, generally well preserved; holotype GSC 58417 and paratypes GSC 58418, 58419 from GSC loc. C-051392, 158 m above base of lower member; paratype GSC 58422 and unfigured paratypes GSC 58420, 58421 from GSC loc. C-051394, 161 m above base.

Description. Test large, robust, gently tapering, uniserial and rectilinear throughout, periphery smoothly rounded in transverse section; test broadly rounded at base, consisting of six to nine chambers; initial four or five chambers closely appressed, about twice as broad as high, later chambers becoming more equant and rather rounded; sutures distinct, fine, flush to very slightly constricted, transverse; wall calcareous, smooth; aperture terminal, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58417	0.31	0.90
Paratype 58418	0.30	0.71
Paratype 58419	0.29	0.70
Paratype 58420	0.30	0.74
Paratype 58421	0.29	0.75
Paratype 58422	0.26	0.75

Remarks. *Pseudonodosaria statuta* n. sp. differs from *P. brandi* (Tappan) in being twice as large and possessing more chambers.

Occurrence. *Pseudonodosaria statuta* n. sp. occurs commonly 155 to 165 m above the base of the lower member.

Pseudonodosaria sp. cf. *P. quinquecostata* (Bornemann)

Plate 27, figures 10, 11

?1955 *Rectoglandulina quinquecostata* (Bornemann); Tappan, p. 75, Pl. 26, figs. 17, 18.

Material. Single specimen; figured specimen GSC 58412 from GSC loc. C-051334, 46.5 m above base of lower member.

Description. Test small, compressed, uniserial, tapering; consisting of five strongly appressed chambers, chambers much broader than high, expanding rapidly in size as added, generally ovate in transverse section; sutures indistinct, strongly arched between costae (inverted V-shaped), slightly depressed; wall calcareous, hyaline, finely perforate, ornamented with six large longitudinal costae that run nearly full length of test; aperture terminal, ovate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58412	0.25	0.14	0.43

Remarks. The identification of this species is based on Tappan's work on material from the north slope of Alaska.

Occurrence. *Pseudonodosaria* sp. cf. *P. quinquecostata* occurs in a single sample situated 46.5 m above the base of the lower member.

Pseudonodosaria sp. A

Plate 27, figures 18-20

Material. Rare; figured specimens GSC 58413, 58414 from GSC loc. C-051330, 40.5 m above base of lower member.

Description. Test small, short, sharply tapering; consisting of three to five chambers in uniserial arrangement; proloculus has single, fine, apical spine; ultimate chamber about twice as high as preceding one; sutures indistinct, flush, moderately arched between costae; wall calcareous, finely perforate, surface ornamented with six or seven longitudinal costae that extend the length of the test to the apical spine; aperture simple, terminal, rounded, produced on short neck.

Dimensions (mm).

GSC Specimen No.	Width	Height
58413	0.38	0.61
58414	0.28	0.48

Occurrence. *Pseudonodosaria* sp. A occurs rarely 40 to 42 m above the base of the lower member.

Pseudonodosaria sp. B

Plate 26, figures 11, 12

Material. Rare, five specimens in adequate state of preservation; figured specimen GSC 58415 from GSC loc. C-051390, 159.5 m above base of lower member; figured specimen GSC 58416 from GSC loc. C-051330, 40.5 m above base.

Description. Test free, large, elongate, rounded in cross-section, uniserial and rectilinear throughout, consisting of seven or eight chambers that initially are closely embracing, later much less so; proloculus (shaped like a blunt cone) followed by four or five closely appressed chambers, which are about twice as broad as they are high, last two or three chambers are subrounded, centrally inflated, equant; sutures distinct, fine, slightly depressed, transverse; wall calcareous, smooth; aperture simple, terminal, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58415	0.24	0.93
58416	0.28	1.08

Remarks. *Pseudonodosaria* sp. B differs from *P. statuta* n. sp. in being somewhat smaller, lacking a tapering test, and possessing ultimate chambers that are not as closely appressed. It differs from *Nodosaria detruncata* Schwager in being twice as large and possessing more numerous chambers.

Occurrence. *Pseudonodosaria* sp. B occurs rarely throughout the lower member.

**Genus *Saracenaria* DeFrance in
de Blainville, 1824**

Type species. *Saracenaria italica* DeFrance, 1824.

Diagnosis. Test free, planispiral in early stage, later with tendency to uncoil; triangular in section with broad, flat apertural face, outer margin and two angles of face may be acute and keeled to somewhat rounded; aperture at peripheral angle, radiate.

Saracenaria phaedra Tappan

Plate 24, figures 10, 11

1955 *Saracenaria phaedra* Tappan, p. 64, Pl. 26, fig. 2.

1967 *Saracenaria phaedra* Tappan; Gordon, p. 452, Pl. 2, figs. 17, 18.

Material. Twenty-five specimens in various states of preservation; unfigured hypotypes GSC 58423, 58424 from GSC loc. C-051331, 42 m above base of lower

member; hypotype GSC 58427 and unfigured hypotypes GSC 58425, 58426 from GSC loc. C-051334, 46.5 m above base.

Description. Test small, elongate, early portion faintly coiled, later becoming uniserial with chambers highest at dorsal margin and triangular in transverse section, margins very slightly to noncarinate; chambers low and broad, expanding gradually in size as added, about eight to ten in adults (including three to five in coil); terminal face rounded-triangular in section, slightly convex; sutures somewhat limbate, flush, gently curved back against direction of coiling in initial portion, later nearly straight; wall calcareous, hyaline, finely perforate, smooth; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
Hypotype 58423	0.23	0.58
Hypotype 58424	0.20	0.44
Hypotype 58425	0.18	0.40
Hypotype 58426	0.19	0.34
Hypotype 58427	0.18	0.33

Remarks. *Saracenaria phaedra* was defined on the basis of a single specimen recovered from the Upper Jurassic part of the Kingak Shale of northern Alaska. Tappan's holotype shows rather well developed keels along the margins of the test. These are much less pronounced in the Husky forms.

Occurrence. *Saracenaria phaedra* occurs 40 to 50 m above the base of the lower member.

Saracenaria minima n. sp.

Plate 23, figures 24-27

1981 *Saracenaria* sp. 176 Brooke and Braun, p. 31, Pl. 7, figs. 54-69.

Material. About 25 specimens in good state of preservation; holotype GSC 58440 and unfigured paratypes GSC 58441, 58442 from GSC loc. C-051394, 161 m above base of lower member; paratypes GSC 58443, 58444 and unfigured paratype GSC 58445 from GSC loc. C-051393, 159.5 m above base.

Description. Test small to medium sized, squat, early portion planispirally coiled, later portion tending to be

slightly uncoiled with chambers highest at dorsal margin and subtriangular in cross-section; chambers low and broad, expanding gradually in size as added, rounded and slightly inflated in later portion; about seven or eight chambers in adult forms, including four or five in the coil; sutures distinct, slightly thickened, flush, curved back against direction of coiling; wall calcareous, smooth; aperture located at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
Holotype 58440	0.30	0.49
Paratype 58441	0.25	0.51
Paratype 58442	0.28	0.46
Paratype 58443	0.23	0.40
Paratype 58444	0.28	0.41
Paratype 58445	0.25	0.46

Remarks. On initial inspection, specimens of *Saracenaria minima* n. sp. were thought to be juvenile forms of *S. sp. cf. S. cypha* Loeblich and Tappan. However, when the uniserial portions of the two forms were compared (at an equal stage of development), the former was nearly always squat, whereas the latter exhibited early tendencies to become elongate and uncoiled.

The forms described by Brooke and Braun (1981) from the Fernie Formation in northeastern British Columbia compare favourably with this small Husky species.

Etymology. From the Latin, *minima*, meaning smallest.

Occurrence. *Saracenaria minima* n. sp. occurs commonly 152 to 162 m above the base of the lower member.

Saracenaria sp. cf. *S. cypha* Loeblich and Tappan

Plate 24, figures 1-9

?1950 *Saracenaria cypha* Loeblich and Tappan, p. 54, Pl. 14, figs. 9-12.

Material. About 70 specimens in adequate state of preservation; figured specimens GSC 58429-58431,

58433 and unfigured specimens GSC 58428, 58432, 58437 from GSC loc. C-051392, 158 m above base of lower member; figured specimens GSC 58434, 58435 from GSC loc. C-051386, 152 m above base; unfigured specimen GSC 58436 from GSC loc. C-051390, 159.5 m above base; unfigured specimens GSC 58438, 58439 from GSC loc. C-051394, 161 m above base.

Description. Test medium sized, elongate, early portion planispirally coiled, involute, later portion becoming uniserial with chambers highest at dorsal margin and subtriangular in transverse section (i.e., with rounded angles), chambers low and broad, expanding gradually in size as added, about eight to twelve in adult specimens with four to six in coiled portion and remainder in uniserial portion; sutures distinct, slightly thickened, flush, gently curved back against direction of coiling; wall calcareous, finely perforate; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58428	0.40	0.88
58429	0.35	0.68
58430	0.31	0.60
58431	0.34	0.70
58432	0.39	0.68
58433	0.30	0.54
58434	0.30	0.78
58435	0.30	0.74
58436*	0.26	>0.63
58437*	0.26	>0.65
58438	0.28	0.78
58439*	0.28	0.78

*broken specimen.

Remarks. *Saracenaria* sp. cf. *S. cypha* differs from *S. cypha* in being somewhat larger and lacking depressed sutures. Superficially, the Husky form resembles a large version of *S. phaedra* Tappan, but the chambers are much more rounded in section and the form lacks marginal keels.

Occurrence. *Saracenaria* sp. cf. *S. cypha* occurs quite commonly 152 to 162 m above the base of the lower member.

Saracenaria sp.

Material. Rare, unfigured specimens GSC 58446–58449 from GSC loc. C-051330, 40.5 m above base of lower member.

Description. Test small, elongate, early portion faintly coiled, later becoming uniserial, with chambers rounded triangular in transverse section; chambers low and broad, expanding gradually as added in the coiled portion, but more rapidly in uniserial portion, chambers in uniserial portion moderately to strongly inflated such that angles appear rounded to even slightly deformed; about seven to eight chambers in mature test with two to three in coiled portion; sutures distinct, fine, usually flush but may be slightly depressed, gently curved back against direction of coiling; wall calcareous, finely perforate, smooth; aperture at peripheral angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58446	0.30	0.64
58447	0.23	0.50
58448	0.20	0.45
58449	0.21	0.45

Remarks. *Saracenaria* sp. differs from *S. phaedra* Tappan in having fewer, more greatly inflated chambers in the uniserial portion and in lacking marginal keels.

Occurrence. *Saracenaria* sp. occurs rarely 40 to 50 m above the base of the lower member.

Genus *Vaginulinopsis* Silvestri, 1904

Type species. *Vaginulina soluta* Silvestri var. *carinata* Silvestri, 1898.

Diagnosis. Test close coiled as in *Lenticulina* in early portion, later uncoiling, slightly compressed as in *Vaginulina*; aperture at dorsal angle, radiate.

Vaginulinopsis sp. cf. *V. enodis*
Loeblich and Tappan

Plate 23, figures 19–23

?1950 *Vaginulinopsis enodis* Loeblich and Tappan, p. 46, Pl. 12, figs. 11–16.

1976 *Vaginulinopsis* sp. cf. *V. enodis* Loeblich and Tappan; Souaya, p. 280, Pl. 7, fig. 12.

Material. Ten well preserved specimens; figured specimens GSC 58452–58454 from GSC loc. C-051394,

161 m above base of lower member; unfigured specimen GSC 58455 from GSC loc. C-051392, 158 m above base.

Description. Test medium sized, elongate, ovate in cross-section, early portion planispirally coiled, consisting of five to six chambers, later portion uncoiled, straight to slightly arcuate, moderately compressed, consisting of three to four chambers; chambers low and broad, increasing rapidly in size as added, very slightly to not inflated, although ultimate chamber may be quite inflated; sutures distinct, very slightly thickened, flush to slightly depressed, strongly arcuate in coiled portion, less so in uniserial portion; wall calcareous, hyaline, smooth; aperture at dorsal angle, oval, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58452	0.30	0.69
58453	0.40	0.88
58454	0.30	0.55
58455	0.34	0.63

Remarks. *Vaginulinopsis* sp. cf. *V. enodis* closely resembles *V. enodis* in size and general test design, but has fewer chambers. It agrees well with the species figured by Souaya (1976) from the Sverdrup Basin of the Canadian Arctic Archipelago.

Occurrence. *Vaginulinopsis* sp. cf. *V. enodis* occurs rarely in beds 158 to 161 m above the base of the lower member.

Vaginulinopsis sp. A

Plate 23, figures 15–18

Material. About 25 mostly incomplete (broken) tests; figured specimens GSC 58456, 58457 and unfigured specimens GSC 58458, 58459 from GSC loc. C-051376, 122 m above base of lower member; unfigured specimen GSC 58460 from GSC loc. C-051386, 152 m above base; unfigured specimen GSC 58461 from GSC loc. C-051387, 155 m above base.

Description. Test large, robust, ovate in transverse section; early portion planispirally coiled with about nine to twelve chambers in coil, later portion straight and rectilinear, moderately compressed, of four to six chambers; chambers low and broad, increasing quite rapidly in size as added; sutures distinct, thickened,

flush, strongly arcuate in coiled portion, less so in uniserial portion; wall calcareous, smooth; aperture at dorsal angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
58456*	0.60	0.43	>1.75
58457*	0.55	0.38	>1.28
58458*	0.60	0.41	>1.25
58459*	0.38	0.28	>0.96
58460*	0.60	0.38	>1.30
58461*	0.53	0.33	>0.98

*broken specimen.

Remarks. The very poor state of preservation of the majority of the test of *Vaginulinopsis* sp. A precludes the naming of a new species for this otherwise large and distinctive form.

Occurrence. *Vaginulinopsis* sp. A occurs sporadically 120 to 160 m above the base of the lower member.

Vaginulinopsis sp. B

Plate 23, figures 11–14

Material. Four specimens; figured specimens GSC 58462, 58463 and unfigured specimen GSC 58464 from GSC loc. C-051394, 161 m above base of lower member; unfigured specimen GSC 58465 from GSC loc. C-051392, 158 m above base.

Description. Test medium sized, elongate, moderately compressed, ovate in section; initial portion close coiled, evolute, consisting of three or four chambers that expand gradually in size as added; later portion uniserial, rectilinear, consisting of four or five chambers that are broader than high and expand gradually in size as added, ultimate chamber may be slightly inflated; sutures distinct, flush, radial in coiled portion, becoming limbate in later portion, slightly arched and moderately oblique; wall calcareous, hyaline, finely perforate, smooth; aperture at dorsal angle, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
58462	0.28	0.74

58463	0.25	0.70
58464	0.21	0.55
58465	0.23	0.58

Remarks. *Vaginulinopsis* sp. B differs from *V.* sp. cf. *V. enodis* Loeblich and Tappan in being much slimmer and possessing more chambers in the uniserial portion. It differs from *V. epicharis* Loeblich and Tappan in possessing much less arcuate sutures that do not reach back to the umbilicus. It strongly resembles *V. thomasi* Wall from the Upper Vanguard Formation (Oxfordian) of southern Saskatchewan.

Occurrence. *Vaginulinopsis* sp. B occurs rarely 158 to 161 m above the base of the lower member.

Family POLYMORPHINIDAE d'Orbigny, 1839

Subfamily POLYMORPHININAE d'Orbigny, 1839

Genus *Eoguttulina* Cushman and Ozawa, 1930

Type species. *Eoguttulina anglica*.

Diagnosis. Test free, with chambers added in elongate spiral series in planes less than 90° apart, each succeeding chamber farther from the base.

Eoguttulina sp. A

Plate 22, figures 13-17

Material. Common though generally poorly preserved; figured specimens GSC 97948-97951 from GSC loc. C-051394, 161 m above base of lower member; unfigured specimens GSC 97952, 97953 from GSC loc. C-051330, 40.5 m above base.

Description. Test medium sized, fusiform; chambers biserially arranged, slightly inflated, increasing rapidly in size as added and rather strongly overlapping, final pair occupy about 50 per cent of test; sutures distinct, very strongly oblique, flush to very slightly depressed, wall calcareous, smooth; aperture terminal, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Thickness	Height
97948	0.34	0.25	0.58
97949	0.34	0.28	0.53
97950	0.25	0.25	0.53

97951	0.25	0.25	0.48
97952	0.34	0.30	0.70
97953	0.33	0.25	0.54

Remarks. *Eoguttulina* sp. A bears close resemblance to the form figured by Dain (*in* Dain et al., 1972, Pl. XLVI, figs. 3, 4) as *E. ex. gr. invroclaviensis* (Bielecka and Pozaryski), but is nearly twice as large. It differs from *E. liassica* (Strickland) in possessing more chambers in the adult form.

Occurrence. *Eoguttulina* sp. A occurs erratically throughout the lower member, though the most frequent form of preservation is a steinkern.

Genus *Globulina* d'Orbigny *in* de la Sagra, 1839

Type species. *Polymorphina (Globulina) gibba* d'Orbigny, 1826.

Diagnosis. Test globular to ovate, chambers strongly overlapping, added in planes about 144° apart; sutures flush, not depressed; aperture radiate.

Globulina sp. cf. *G. alexandrae* Dain

Plate 22, figures 18-21

?1972 *Globulina alexandrae* Dain *in* Dain et al., p. 148, Pl. XLIV, figs. 7, 8.

1981 *Globulina* cf. *G. alexandrae* Dain; Brooke and Braun, p. 32, Pl. 8, figs. 7-18.

1983 *Globulina* sp. cf. *G. alexandrae* Dain; Wall, Pl. 2, figs. 23-26.

Material. Common, generally poorly preserved; figured specimens GSC 97954-97957 from GSC loc. C-051331, 42 m above base of lower member.

Description. Test small, teardrop shaped, chambers in globuline arrangement, normally two or three visible, inflated and strongly overlapping, last chamber occupies 75 to 90 per cent of test; sutures indistinct, flush, strongly oblique; wall calcareous, smooth; aperture terminal, radiate.

Dimensions (mm).

GSC Specimen No.	Width	Height
97954	0.30	0.44
97955	0.28	0.40

97956	0.29	0.41
97957	0.26	0.38

Remarks. *Globulina* sp. cf. *G. alexandrae* is the most common calcareous foraminifer found in the lower member. However, preservation is so poor (mostly steinkerns or pyrite casts) that a more definitive identification has not been attempted.

Occurrence. *Globulina* sp. cf. *G. alexandrae* occurs throughout the lower member.

Family GLANDULINIDAE Reuss, 1860

Subfamily GLANDULININAE Reuss, 1860

Genus *Tristix* MacFayden, 1951

Type species. *Rhabdogonium liassicum* Berthelin, 1879.

Diagnosis. Test free, uniserial, generally triangular in section but also rarely quadrate; wall calcareous, hyaline, aperture terminal, radiate.

Tristix sp. cf. *T. inornata* (Loeblich and Tappan)

Plate 27, figure 9

?1950 *Quadratina inornata* Loeblich and Tappan, p. 54, Pl. 14, fig. 7.

Material. Single specimen, figured specimen GSC 58466, from GSC loc. C-051392, 155 m above base of lower member.

Description. Test small, elongate, quadrate in section, sides subparallel, tapering very slightly to base, faces moderately excavated, angles subacute, rounded; six chambers increasing gradually in size as added; sutures distinct, slightly depressed, chevron shaped; wall calcareous, finely perforate; aperture terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Height
58466	0.15	0.30

Remarks. *Tristix* sp. cf. *T. inornata* varies from *T. inornata* in being about 50 per cent smaller and possessing more strongly arched sutures.

Occurrence. *Tristix* sp. cf. *T. inornata* was recovered from a sample located 155 m above the base of the lower member.

Tristix? sp.

Plate 27, figures 7, 8

Material. Two well preserved specimens; figured specimen GSC 58467 from GSC loc. C-051386, 152 m above base of lower member; figured specimen GSC 58468 from GSC loc. C-051393, 159.5 m above base.

Description. Test small, elongate, tapering, pentagonal in transverse section, with rounded angles, angles subacute, faces strongly excavated; uniserially arranged, spherical proloculus followed by six or seven gradually increasing chambers; sutures distinct, fine, very slightly depressed, strongly arched centrally but curving downward at angle of chambers; wall calcareous, very finely perforate, smooth; aperture terminal, rounded.

Dimensions (mm).

GSC Specimen No.	Width	Height
58467	0.24	0.54
58468	0.21	0.36

Occurrence. *Tristix?* sp. occurs rarely 150 to 160 m above the base of the lower member.

Superfamily ROBERTINACEA Reuss, 1850

Family CERATOBULIMINIDAE Cushman, 1927

Subfamily CERATOBULIMININAE Cushman, 1927

General comments. Apart from the nodosariids and polymorphiniids, the only other significant group of calcareous foraminifers in the lower member are the ceratobuliminids. Their tests are almost invariably poorly preserved (either severely recrystallized, or, less commonly, pyritized), such that the nature of the aperture — an important diagnostic feature at the generic level — is often difficult to determine. Generic assignments have been based on gross morphological similarity rather than apertural character.

Genus *Ceratocancris* Finlay, 1939

Type species. *Ceratobulimina (Ceratocancris) clifdenensis* Finlay, 1939.

Diagnosis. Similar to *Ceratobulimina* but with low, slit-like basal aperture, extraumbilical-umbilical in position, ending at small notch near periphery and at similar notch in umbilical margin; internal partition not attached to spiral wall, and with low accessory internal partition attached to surface of previous whorl just inside aperture.

Ceratocancris ambitiosus Dain

Plate 28, figures 9-16

1972 *Ceratocancris ambitiosus* Dain in Dain et al., p. 176, Pl. LVI, figs. 1, 2.

Material. Over 50 specimens in various states of preservation; hypotypes GSC 58469, 58470 from GSC loc. C-051327, 37.5 m above base of lower member; unfigured hypotype GSC 58471 from GSC loc. C-051330, 40.5 m above base; hypotype GSC 58473 and unfigured hypotypes GSC 58472, 58474 from GSC loc. C-051331, 42 m above base; unfigured hypotypes GSC 58475, 58476 from GSC loc. C-051333, 45 m above base.

Description. Test small, trochoid, low-spined, dorsal side gently convex, ventral side planar to slightly depressed, peripheral margin rounded to slightly lobulate; consisting of one and a half to two whorls, spherical proloculus followed by seven or eight rapidly expanding chambers, with five or six in ultimate whorl; chambers trapezoidal in shape, wider on outer and narrower on inner margins, moderately inflated, each succeeding chamber about double the size of the preceding; sutures distinct, oblique on dorsal and radiate on ventral sides, moderately to quite strongly depressed; wall calcareous, finely perforate, smooth; aperture umbilical, slit-like at base of flap produced by ultimate chamber, normally obscured by poor preservation.

Dimensions (mm).

GSC Specimen No.	Diameter	Height
58469	0.28	0.13
58470	0.28	0.13
58471	0.29	0.12
58472	0.24	0.13
58473	0.25	0.11
58474	0.23	0.10
58475	0.25	0.12
58476	0.25	0.10

Remarks. This species is very similar in all aspects to the one illustrated by Dain (*in* Dain et al., 1972) from the lower Kimmeridgian of western Siberia.

Occurrence. *Ceratocancris ambitiosus* occurs rarely 30 to 45 m above the base of the lower member.

Genus Conorboides Hofker *in* Thalmann, 1952

Type species. *Conorboides mitra* Hofker, 1951.

Diagnosis. Test free, low trochospiral, plano-convex, umbilicate, periphery subacute to rounded, few chambers per whorl, sutures oblique on spiral side, radiate on umbilical side; wall calcareous (aragonite); aperture a low interior-marginal umbilical arch with short, broad flap that may have fimbriate margin; apertures of early chambers of final whorl may remain open along suture beneath flaps; internal pillar extending from aperture, parallel to axis of coiling, to opposite chamber wall.

Conorboides brauni n. sp.

Plate 28, figures 17-24

Material. Common, variably preserved; holotype GSC 58477, paratypes GSC 58478, 58479 and unfigured paratypes GSC 58480, 58481 from GSC loc. C-051331, 42 m above base of lower member; unfigured paratypes GSC 58482-58484 from GSC loc. C-051327, 37.5 m above base.

Description. Test small, trochospirally coiled with moderate to high spire, planoconvex to slightly concavoconvex in design, peripheral margin rounded; consisting of tiny spherical proloculus followed by three and a half to four whorls, five or six chambers in initial whorl, to about four in ultimate whorl; chambers slightly inflated, increasing gradually in size as added; all chambers visible dorsally, only chambers of ultimate whorl visible ventrally; sutures distinct, limbate, strongly oblique dorsally, fine, radiate and slightly impressed ventrally; wall calcareous, finely perforate, smooth; aperture umbilical, where preserved appears to be low interior-marginal arch with notch developed midway along chamber face.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
Holotype 58477	0.25	0.18	0.18

Paratype 58478	0.30	0.28	0.20
Paratype 58479	0.19	0.19	0.15
Paratype 58480	0.25	0.25	0.18
Paratype 58481	0.20	0.19	0.19
Paratype 58482	0.28	0.25	0.18
Paratype 58483	0.25	0.24	0.23
Paratype 58484	0.19	0.19	0.15

Remarks. *Conorboides brauni* n. sp. is tentatively assigned to *Conorboides* because of the high trochospiral coil, although the nature of the aperture cannot be determined with certainty. Both high spired and moderate to low spired varieties occur.

Etymology. The patronym honours Dr. W.K. Braun, micropaleontologist and Professor of Geology at the University of Saskatchewan.

Occurrence. *Conorboides brauni* n. sp. occurs in greatest numbers 30 to 45 m above the base of the lower member.

**Genus *Pseudolamarckina* Myatliuk in
Rauzer-Chernousova and Fursenko, 1959**

Type species. *Pulvinulina rjasanensis* Uhlig, 1883.

Diagnosis. Test free, trochospiral, planoconvex; umbilicus closed; sutures oblique and thickened on spiral side, depressed and radial on umbilical side; wall calcareous, thin, finely perforate; aperture interior-marginal with extension up face of ultimate chamber; internal partition parallel to plane of coiling.

Pseudolamarckina liapinensis Dain

Plate 28, figures 1-8

1972 *Pseudolamarckina liapinensis* Dain in Dain et al., p. 169, Pl. LII, figs. 1-6; Pl. LIII, figs. 1, 2; Pl. LV, figs. 1, 9.

Material. Ten specimens, mostly pyritized; hypotypes GSC 57485, 57486 and unfigured hypotype GSC 57487

from GSC loc. C-051391, 158 m above base of lower member; hypotype GSC 57488 and unfigured hypotypes GSC 57489, 57490 from GSC loc. C-051394, 161 m above base.

Description. Test small, trochospirally coiled, spire low to moderate, planoconvex in design, peripheral margin rounded to slightly lobulate; consisting of two to two and a half whorls, spherical proloculus followed by a total of 12 to 15 chambers, with about five in ultimate whorl, chambers moderately inflated, increasing gradually in size as added; sutures distinct, limbate, highly oblique on dorsal side, slightly depressed; on ventral side radial; wall calcareous, smooth; aperture an interior-marginal slit adjacent to umbilicus, loop-shaped though normally concealed by plate; remnant apertures on previous chambers may appear as small, elongate loops parallel to the direction of coiling.

Dimensions (mm).

GSC Specimen No.	Diameter (max.)	Diameter (min.)	Height
58485	0.30	0.26	0.10
58486	0.30	0.26	0.09
58487	0.28	0.23	0.15
58488	0.26	0.24	0.09
58489	0.25	0.23	0.09
58490	0.28	0.25	0.13

Remarks. Dain (in Dain et al., 1972) recognized three species of *Pseudolamarckina* in the Upper Jurassic of western Siberia, which are: *P. liapinensis* Dain (Upper Kimmeridgian), *P. lopsiensis* Dain (Upper Kimmeridgian), and *P. voliaensis* Dain (Lower Volgian). The basis for distinguishing was stated to be the “. . . nature of the apertural tooth-plate and the composition of the test wall” (op. cit., p. 169). Given the state of preservation of the Husky material, reliance must be placed on the external morphology rather than the above criteria. Therefore, the Husky species is tentatively compared to *P. liapinensis* Dain.

Occurrence. *Pseudolamarckina liapinensis* occurs rarely 158 to 161 m above the base of the lower member.

Superfamily SPIRILLINACEA Reuss, 1862

Family SPIRILLINIDAE Reuss, 1862

Subfamily SPIRILLININAE Reuss, 1862

Genus *Spirillina* Ehrenberg, 1843

Type species. Spirillina vivipara Ehrenberg, 1843.

Diagnosis. Test free, planispiral or with one side slightly concave, proloculus followed by closely appressed, spirally wound, undivided tubular second chamber; wall calcareous, hyaline, composed of single crystal of calcite deposited over pseudochitinous membrane, finely to coarsely perforate; aperture at open end of tube.

Spirillina? sp. A

Plate 27, figure 1

Material. Single specimen; figured specimen GSC 58497 from GSC loc. C-051382, 140 m above base of lower member.

Description. Test large, robust, planispirally coiled, consisting of spherical proloculus followed by long, undivided tubular second chamber, tube expands gradually in initial three or four volutions, thereafter rapidly in remaining four volutions; spiral suture distinct, slightly depressed; wall calcareous, appears to be (?)imperforate; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter	Thickness
58497	1.33	0.23

Remarks. *Spirillina?* sp. A differs from *S.?* sp. B in being twice as large and possessing more volutions in the coil.

Occurrence. *Spirillina?* sp. A was recovered from a sample 140 m above the base of the lower member.

Spirillina? sp. B

Plate 27, figures 2, 3

Material. Three specimens, two preserved as pyrite casts; figured specimen GSC 58498 from GSC loc. C-051391, 161 m above base of lower member; figured specimen GSC 58499 from GSC loc. C-051389, 158 m above base; unfigured specimen GSC 58500 from GSC loc. C-051382, 140 m above base.

Description. Test medium sized, planispirally coiled, spherical proloculus followed by close-coiled, tubular, and undivided second chamber that increases fairly rapidly in diameter with each added volution, about six to eight coils in adult forms; spiral suture distinct, fine, flush in early whorls, becoming rather strongly depressed in later whorls; wall calcareous, hyaline; aperture at open end of tube.

Dimensions (mm).

GSC Specimen No.	Diameter	Thickness
58498	0.48	0.14
58499	0.46	0.13
58500	0.46	0.10

Occurrence. *Spirillina?* sp. B occurs rarely 140 to 160 m above the base of the lower member.

ACKNOWLEDGMENTS

This study formed the basis of a Master of Science degree undertaken at the University of Alberta, Edmonton, Alberta (1975-1979), supervised by Dr. C.R. Stelck. Special thanks are extended to Dr. Stelck, Dr. J.H. Wall (Institute of Sedimentary and Petroleum Geology, Calgary, Alberta) and Mr. Paul F. Johnston (Chevron Canada Resources Limited), who assisted and encouraged me during my studies.

Field support during the 1975 field season was provided by a Geological Survey of Canada surface party led by Dr. F.G. Young. Dr. W.W. Brideaux (Amoco Canada Petroleum Company Limited) assisted with fieldwork and sample collection. Financial assistance was provided by an Energy, Mines and Resources grant to Dr. C.R. Stelck. Drs. J.H. Wall and D.H. McNeil (Institute of Sedimentary and Petroleum Geology, Calgary) kindly allowed the author access to pertinent material from the Geological Survey of Canada type collections and helped to obtain type specimens from the Smithsonian Institute, Washington.

The manuscript benefited from careful critical reading by Drs. D.H. McNeil and P. Copestake (Britoil PLC, Glasgow, Scotland).

REFERENCES

Alekseitchuk-Mitskevich, L.S.

1973: Classification of foraminifers of the Family Haplophragmiidae. Transactions of the All-Union Petroleum Scientific Research Institute (VNIGRI), no. 43, p. 12-44. (In Russian.)

Ascoli, P.

1976: Foraminiferal and ostracod biostratigraphy of the Mesozoic-Cenozoic; Scotian Shelf, Atlantic Canada; in First International Symposium on Benthonic Foraminifera of Continental Margins, Part B, Paleoecology and Biostratigraphy, C.T. Schafer and B.R. Pelletier (eds.); Maritime Sediments, Special Publication no. 1, p. 653-773.

Balkwill, H.R., Wilson, D.G., and Wall, J.H.

1977: Ringnes Formation, Upper Jurassic, Sverdrup Basin, Canadian Arctic Archipelago. Bulletin of Canadian Petroleum Geology, v. 25, p. 1115-1144.

Barnard, T.

1952: Foraminifera from the Upper Oxford Clay (Jurassic) of Warboys, Huntingdonshire. Proceedings of the Geological Association, v. 63, p. 336-349.

1953: Foraminifera from the Upper Jurassic Oxford Clay of Redcliffe Point near Weymouth, England. Proceedings of the Geological Society, v. 106, p. 183-197.

1959: Some arenaceous Foraminifera from the Lias of England. Contributions of the Cushman Foundation for Foraminiferal Research, v. X, pt. 4, p. 132-136.

Barnard, T., Cordey, W.G., and Shipp, D.J.

1981: Foraminifera from the Oxford Clay (Callovian-Oxfordian) of England. Revista Española de Micropaleontología, v. 13, p. 383-462.

Barnard, T. and Shipp, D.J.

1981: Kimmeridgian Foraminifera from the Boulonnais. Revue de Micropaléontologie, v. 24, p. 3-26.

Bartenstein, H.

1952: Taxonomische Bemerkungen zu den *Ammobaculites*, *Haplophragmium*, *Lituola*

und Verwandten Gattungen (For.). Senckenbergiana, v. 33, p. 312-342. (In German.)

Bartenstein, H. and Brand, E.

1937: Mikropaläontologische Untersuchungen zur Stratigraphie des nord-westdeutschen Lias und Dogger. Senckenbergische naturforschende Gesellschaft, Abhandlungen 439, 224 p. (In German.)

Bergquist, H.R.

1966: Micropaleontology of the Mesozoic rocks of northern Alaska. United States Geological Survey, Professional Paper 302-D, p. 93-227.

Bielecka, W.

1975: Foraminifera and brackish Ostracoda from the Portlandian of the Polish Lowlands. Acta Palaeontologica Polonica, v. XX, p. 295-393.

Bielecka, W. and Pożaryski, W.

1954: Micropaleontological stratigraphy of the Upper Malm in central Poland; instytut Geologiczny, Prace, tom 12, 306 p. (In Polish, English and Russian.)

Bizon, J.J.

1958: Foraminifères et Ostracodes de l'Oxfordien de Villers-sur-Mer (Calvados). Revue de l'Institut Français du Pétrole 13, 145 p.

1960: Revision de quelques Espèces-Type de Foraminifères du Lias du Bassin Parisienne de la collection Terquem. Revue de Micropaléontologie, v. 3, p. 3-18.

Braman, D.R.

1985: The sedimentology and stratigraphy of the Husky Formation in the subsurface of the District of Mackenzie, N.W.T. Geological Survey of Canada, Paper 83-14, 24 p.

Brideaux, W.W.

1976: Berriasian dinoflagellate assemblage, Martin Creek, northwest District of Mackenzie; in Report of Activities, Part C, Geological Survey of Canada, Paper 76-1C, p. 115-130.

Brideaux, W.W. and Fisher, M.J.

1976: Upper Jurassic-Lower Cretaceous dinoflagellate assemblages from Arctic Canada. Geological Survey of Canada, Bulletin 259, 53 p.

- Brooke, M.M. and Braun, W.K.**
 1972: Biostratigraphy and microfaunas of the Jurassic System of Saskatchewan. Saskatchewan Department of Mineral Resources, Report 161, 83 p.
- 1981: Jurassic microfaunas and biostratigraphy of northeastern British Columbia and adjacent Alberta. Geological Survey of Canada, Bulletin 283, 69 p.
- Camsell, C.**
 1906: Report on the Peel River and tributaries, Yukon and Mackenzie; *in* Geological Survey of Canada, Summary Report 1904, p. 1c-49c.
- Chamney, T.P.**
 1969: Barremian Textulariina, Foraminiferida from Lower Cretaceous beds, Mount Goodenough section, Aklavik Range, District of Mackenzie. Geological Survey of Canada, Bulletin 185, 41 p.
- 1971: New species of Foraminifera, Cretaceous-Jurassic boundary, Arctic America. Geological Survey of Canada, Bulletin 192, p. 95-109.
- Cordey, W.G.**
 1962: Foraminifera from the Oxford Clay of Staffin Bay, Isle of Skye, Scotland. *Senckenbergiana Lethaia*, v. 43, p. 375-409.
- Cushman, J.A.**
 1930: Notes sur quelques foraminifères jurassiques d'Auberville (Calvados). *Société Linnean de Normandie*, Bulletin ser. 8, v. 2, p. 132-135. (In French.)
- 1936: New genera and species of the families Verneulinidae and Valvulinidae and of the Subfamily Virgulininae. Cushman Laboratory for Foraminiferal Research, Contributions, Special Publication 6, 26 p.
- Cushman, J.A. and Glazevski, K.**
 1949: Upper Jurassic Foraminifera from the Nizniow Limestone of Podole, Poland. Contributions from the Cushman Laboratory for Foraminiferal Research, v. 25, p. 1-11.
- Dain, L.G., Bulynnikova, S.P., Kosyreva, V.F., Kommisarenko, V.K., Levina, V.I., and Tylkina, K.E.**
 1972: Foraminifera of the Upper Jurassic deposits of western Siberia, L.G. Dain (ed.); All-Union Scientific Research Geological Prospecting Institute (VNIGRI), Transactions (Trudy), no. 317, 273 p. (In Russian.)
- Dain, L.G. and Kuznetsova, K.I.**
 1976: Zonal subdivision of the stratotype section of the Volgian based on Foraminifera. *Voprosty Mikropalaeontologie* 14, p. 103-124.
- Detterman, R.L., Reiser, H.N., Brosge, W.P., and Dutro, J.T.**
 1975: Post-Carboniferous stratigraphy of north-eastern Alaska. United States Geological Survey, Professional Paper 886, 46 p.
- Dixon, J.**
 1982: Jurassic and Cretaceous subsurface stratigraphy of the Mackenzie Delta-Tuktoyaktuk Peninsula, N.W.T. Geological Survey of Canada, Bulletin 349, 52 p.
- Eicher, D.L.**
 1960: Stratigraphy and micropaleontology of the Thermopolis Shale. Peabody Museum of Natural History, Bulletin 15, 126 p.
- Fensome, R.A.**
 1983: Miospores from the Jurassic-Cretaceous boundary beds, Aklavik Range, Northwest Territories, Canada. Ph.D. thesis, University of Saskatchewan, xix + 762 p.
- 1987: Taxonomy and biostratigraphy of schizalean spores from the Jurassic-Cretaceous boundary beds of the Aklavik Range, District of Mackenzie. *Palaeontographica Canadiana* 4, 49 p.
- Franke, A.**
 1936: Die Foraminiferen des Deutschen Lias. *Preussische Geologische Landesanstalt Abhandlungen, Neues Folge, Heft 169*, 138 p. (In German.)
- Frebold, H.**
 1960: The Jurassic faunas of the Canadian Arctic, Lower Jurassic and lowermost Middle Jurassic ammonites. Geological Survey of Canada, Bulletin 59, 33 p.
- 1961: The Jurassic faunas of the Canadian Arctic, Middle and Upper Jurassic ammonites. Geological Survey of Canada, Bulletin 74, 43 p.

- 1964: Illustrations of Canadian fossils: Jurassic of Western and Arctic Canada. Geological Survey of Canada, Paper 63-4, 107 p.
- Frebold, H. and Poulton, T.P.**
1977: Hettangian (Lower Jurassic) rocks and faunas, northern Yukon Territory. Canadian Journal of Earth Sciences, v. 14, p. 89-101.
- Frizzell, D.L.**
1954: Handbook of Cretaceous foraminifers of Texas. Texas Bureau of Economic Geology Investigations, Report 22, 232 p.
- Gabrielse, H.**
1957: Geological reconnaissance in the northern Richardson Mountains, Yukon and Northwest Territories. Geological Survey of Canada, Paper 56-6, 11 p.
- Gordon, W.A.**
1961: Some Foraminifera from the Ampthill Clay, Upper Jurassic of Cambridgeshire. Palaeontology, v. 4, p. 520-537.
1965: Foraminifera from the Corallian Beds, Upper Jurassic of Dorset, England. Journal of Paleontology, v. 39, p. 828-863.
1967: Foraminifera from the Callovian (Middle Jurassic) of Brora, Scotland. Micropaleontology, v. 13, p. 445-464.
1970: Biogeography of Jurassic Foraminifera. Geological Society of America, Bulletin, v. 81, p. 1689-1704.
- Gradstein, F.M.**
1977: Biostratigraphy and biogeography of Jurassic Grand Banks Foraminifera. Benthonics 75, Proceedings, Part B, p. 557-584.
1978: Jurassic Grand Banks Foraminifera. Journal of Foraminiferal Research, v. 8, p. 97-109.
- Gradstein, F.M., Williams, G.M., Jenkins, W.A.M., and Ascoli, P.**
1975: Mesozoic and Cenozoic stratigraphy of the Atlantic continental margin, eastern Canada. Canadian Society of Petroleum Geologists, Memoir 4, p. 103-131.
- Haig, D.W.**
1980: Early Cretaceous textularine foraminiferids from Queensland. Paleontographica, Abt. A, v. 170, p. 87-138.
- Imlay, R.W.**
1959: Succession and speciation of the pelecypod *Aucella*. United States Geological Survey, Professional Paper 314-G, p. 155-169.
1961: Characteristic Jurassic molluscs from northern Alaska. United States Geological Survey, Professional Paper 271-D, p. 69-96.
1980: Jurassic paleobiogeography of the conterminous United States in its continental setting. United States Geological Survey, Professional Paper 1062, 134 p.
- Imlay, R.W. and Detterman, R.L.**
1973: Jurassic paleobiogeography of Alaska. United States Geological Survey, Professional Paper 801, 34 p.
- Jeletzky, J.A.**
1958: Uppermost Jurassic and Cretaceous rocks of the Aklavik Range, northeastern Richardson Mountains, Northwest Territories. Geological Survey of Canada, Paper 58-5, 84 p.
1960: Uppermost Jurassic and Cretaceous rocks, east flank of the Richardson Mountains between Stoney Creek and lower Donna River. Geological Survey of Canada, Paper 59-14, 31 p.
1961: Upper Jurassic and Cretaceous rocks, west flank of the Richardson Mountains between the headwaters of the Blow and the Bell Rivers, Yukon Territory. Geological Survey of Canada, Paper 61-9, 42 p.
1965: Late Upper Jurassic and early Lower Cretaceous fossil zones of the Canadian western Cordillera. Geological Survey of Canada, Bulletin 103, 70 p., 22 pls.
1966: Upper Volgian (latest Jurassic) ammonites and buchias of Arctic Canada. Geological Survey of Canada, Bulletin 128, 51 p.
1967: Jurassic and (?)Triassic rocks of the eastern slope of the Richardson Mountains and northwest District of Mackenzie. Geological Survey of Canada, Paper 66-50, 171 p.

- 1971: Stratigraphy, facies and paleogeography of Mesozoic rocks of northern and west-central Yukon; *in* Report of Activities, Part A, Geological Survey of Canada, Paper 71-1A, p. 203-221.
- 1972: Stratigraphy, facies and paleogeography of Mesozoic and Tertiary rocks of northern Yukon and northwest District of Mackenzie; *in* Report of Activities, Part A, Geological Survey of Canada, Paper 72-1A, p. 212-215.
- 1973: Biochronology of the marine boreal latest Jurassic, Berriasian and Valanginian in Canada; *in* The Boreal Lower Cretaceous, R. Casey and P. Rawson (eds.); Geological Journal, Special Paper 5, p. 41-80.
- 1974: Contribution to the Jurassic and Cretaceous geology of northern Yukon and District of Mackenzie. Geological Survey of Canada, Paper 74-10, 23 p.
- 1975: Jurassic and Lower Cretaceous paleogeography and depositional tectonics of the Porcupine Plateau, adjacent areas of Yukon and those of Mackenzie District. Geological Survey of Canada, Paper 74-16, 52 p.
- 1977: Porcupine River Formation: a new Upper Jurassic sandstone unit, northern Yukon Territory. Geological Survey of Canada, Paper 77-21, 52 p.
- 1984: Jurassic-Cretaceous boundary beds of Western and Arctic Canada and the problem of the Tithonian-Berriasian Stages in the Boreal Realm; *in* Jurassic-Cretaceous Biochronology of North America, G.E.G. Westermann (ed.); Geological Association of Canada, Special Paper 27, p. 175-255.
- Krasheninnikov, V.A.**
- 1973: Cretaceous benthonic Foraminifera, Leg 20, Deep Sea Drilling Project; *in* Initial Reports, Deep Sea Drilling Project, Leg 20, Natural Science Foundation, v. 20, p. 205-219.
- 1974: Upper Cretaceous benthonic agglutinated Foraminifera, Deep Sea Drilling Project, Leg 27; *in* Initial Reports, Deep Sea Drilling Project, Leg 27, Natural Science Foundation, v. 27, p. 631-661.
- Lalicker, C.G.**
- 1950: Foraminifera of the Ellis Group (Jurassic) at the type locality. Kansas University Paleontological Contributions no. 5 (Protozoa Article 2), p. 3-20.
- Lindenberg, H.**
- 1967: Die Arten von *Haplophragmium* und *Triplasia* eine Bearbeitung auf biometrischer und paläoökologischer Grundlage. Senckenbergische naturforschende Gesellschaft Abhandlungen no. 514, 74 p.
- Lloyd, A.G.**
- 1959: Arenaceous Foraminifera from the type Kimmeridgian (Upper Jurassic). Palaeontology, v. 1, p. 298-320.
- 1962: Polymorphinid, miliolid and rotalid Foraminifera from the type Kimmeridge. Micropaleontology, v. 8, p. 369-383.
- Loeblich, A.R., Jr. and Tappan, H.**
- 1950a: North American Jurassic Foraminifera I: The Type Redwater Shale (Oxfordian) of South Dakota. Journal of Paleontology, v. 24, p. 39-60.
- 1950b: North America Jurassic Foraminifera 2: Characteristic Western Interior Callovian Species. Washington Academy of Sciences Journal, v. 40, p. 4-19.
- 1953: Studies of Arctic Foraminifera. Smithsonian Institute Miscellaneous Collections, v. 121, no. 7, 150 p.
- 1964: Sarcodina, chiefly "Thecamoebians" and Foraminiferida; *in* Treatise on Invertebrate Paleontology; Part C, Protista 2, R.C. Moore (ed.); Geological Society of America, v. 1-2, 900 p.
- 1984: Some new proteinaceous and agglutinated genera of Foraminiferida. Journal of Paleontology, v. 58, p. 1158-1163.
- 1988: Foraminiferal Genera and their Classification. Van Nostrand, Reinhold and Company, New York, 970 p.
- Løfaldli, M. and Nagy, J.**
- 1980: Foraminiferal stratigraphy of Jurassic deposits of Kongsoya, Svalbard. Norsk Polarinstitut Skrifter, no. 172, p. 63-95.

- 1983: Agglutinating Foraminifera in Jurassic and Cretaceous dark shales in southern Spitzbergen; *in* Proceedings of the First Arenaceous Foram Workshop, Instituttet for Kontinentalsokkelundersøkelser, Publication 108, p. 91-107.
- Løfaldli, M. and Thusu, B.**
1979: Micropaleontological studies of Upper Jurassic and Lower Cretaceous of Andoya, Norway. *Palaeontology*, v. 22, p. 413-425.
- Lutze, G.F.**
1960: Zur Stratigraphie und Paläontologie des Callovian und Oxfordian in Nordwestdeutschland. *Geologisches Jahrbuch* 77, p. 391-532.
- McConnell, R.G.**
1891: Report on an exploration in the Yukon and Mackenzie basins, Northwest Territories. Geological Survey of Canada, Annual Report (n. ser.), v. IV, p. 6D-163D.
- Myatliuk, E.V.**
1939: Foraminifera from the Jurassic of the Nordiik Oil District; *in* Geology and Mineral Resources of the Yenesei-Lena regions, Part 1, N.N. Mutafi (ed.); Arctic Institute (Komissiya po Severu) Transactions, v. 126, 276 p. (In Russian.)
- Nagy, J. and Johansen, H.O.**
1989: Preservation and distribution pattern of *Reophax metensis* (Foraminifera) in the Jurassic of the North Sea. *Journal of Foraminiferal Research*, v. 19, p. 337-348.
- Nagy, J. and Løfaldli, M.**
1981: Agglutinating Foraminifera in Jurassic dark shales in Svalbard; *in* Microfossils from Recent and Ancient Shelf Seas, J.W. Neale and M.D. Brasier (eds.); Ellis Horwood, Chichester, p. 113-121.
- Nauss, A.W.**
1944: Final report on the lower Mackenzie River area, Northwest Territories. Imperial Oil Limited, Canol Report, Assignment 32.
- Norling, E.**
1972: Jurassic stratigraphy and Foraminifera of western Scania, southern Sweden. *Sveriges Geologiska Undersökning*, Ser. C. 47, 120 p.
- Norris, D.K.**
1974: Structural geometry and geological history of the northern Canadian Cordillera; *in* Proceedings of the 1973 National Convention, A.E. Wren and R.B. Cruz (eds.); Canadian Society of Exploration Geophysicists, p. 18-45.
- 1981: Geology, Aklavik map area (NTS 107/B). Geological Survey of Canada, Map 1577A.
- Nørvang, A.**
1957: The Foraminifera of the Lias Series in Jutland, Denmark. *Meddelelser Dansk Geologisk Forening* 13, p. 279-413.
- Paalzow, R.**
1922: Die Foraminiferen der Parkinsoni-Mergel von Heidenheim am Hahnenkahn. *Naturforschende Gesellschaft in Nürnberg Abhandlungen*, Band. 22, Heft 1, 35 p. (In German.)
- Poulton, T.P.**
1978a: Internal correlations and thickness trends, Jurassic Bug Creek Formation, northeastern Yukon and adjacent District of Mackenzie; *in* Current Research, Part B, Geological Survey of Canada, Paper 78-1B, p. 27-30.
- 1978b: Pre-late Oxfordian Jurassic biostratigraphy of northern Yukon and adjacent District of Mackenzie; *in* P.S. Warren Memorial Symposium, C.R. Stelck and B.D.E. Chatterton (eds.); Geological Association of Canada, Special Paper 18, p. 445-471.
- 1984: The Jurassic of the Canadian Western Interior from 49° latitude to the Beaufort Sea; *in* The Mesozoic of Middle North America, D.F. Stott and D.J. Glass (eds.); Canadian Society of Petroleum Geologists, Memoir 9, p. 12-41.
- Poulton, T.P. and Callomon, J.H.**
1976: Major features of the Lower and Middle Jurassic stratigraphy of the northern Richardson Mountains, northeastern Yukon Territory and northwestern District of Mackenzie; *in* Report of Activities, Part B, Geological Survey of Canada, Paper 76-1B, p. 345-352.
- Poulton, T.P., Leskiw, K., and Audretsch, A.**
1982: Stratigraphy and microfossils of the Jurassic Bug Creek Group of northern Richardson

Mountains, northern Yukon and adjacent Northwest Territories. Geological Survey of Canada, Bulletin 325, 137 p.

Sandridge, J.

1933: Foraminifera from the Jurassic in Montana. American Midland Naturalist, v. 14, p. 174-185.

Souaya, F.J.

1976: Foraminifera from the Sun-Gulf-Global Linckens Island P-46 well, Arctic Archipelago, Canada. Micropaleontology, v. 22, p. 249-306.

Stelck, C.R.

1975: The Upper Albian *Miliammina manitobensis* Zone in northeastern British Columbia; in The Cretaceous System in the Western Interior of North America, W.G.E. Caldwell (ed.); Geological Association of Canada, Special Paper 13, p. 253-275.

Stelck, C.R. and Hedinger, A.S.

1976: Secondary cribration in *Haplophragmium* (Foraminifera). Journal of Foraminiferal Research, v. 6, p. 134-141.

Sutherland, G.D. and Stelck, C.R.

1972: Foraminifera from the Cretaceous *Neogastropilites* Zone, Moberly Lake, British Columbia. Bulletin of Canadian Petroleum Geology, v. 20, p. 549-582.

Tappan, H.

1940: Foraminifera from the Grayson Formation of northern Texas. Journal of Paleontology, v. 14, p. 93-126.

1943: Foraminifera from the Duck Creek Formation of Oklahoma and Texas. Journal of Palaeontology, v. 17, p. 476-517.

1955: Foraminifera from the Arctic slope of Alaska: Part B, Jurassic Foraminifera. United States Geological Survey, Professional Paper 236-B, p. 21-90.

1960: Cretaceous biostratigraphy of northern Alaska. American Association of Petroleum Geologists, Bulletin, v. 44, p. 273-297.

1962: Foraminifera from the Arctic slope of Alaska: Part 3, Cretaceous Foraminifera. United

States Geological Survey, Professional Paper 236-C, p. 91-209.

Wall, J.H.

1960: Jurassic microfaunas of Saskatchewan. Saskatchewan Department of Mineral Resources Report no. 53, 129 p.

1983: Jurassic and Cretaceous foraminiferal biostratigraphy in the eastern Sverdrup Basin, Canadian Arctic Archipelago. Bulletin of Canadian Petroleum Geology, v. 31, p. 246-281.

Weihmann, I.

1962: Jurassic microfossils from southern Alberta, Canada. Hermann-Aldinger Festschrift, p. 191-198, Stuttgart.

1964: Stratigraphy and microfauna of the Jurassic Fernie Group, Fernie Basin, southeastern British Columbia. Bulletin of Canadian Petroleum Geology, v. 12, Flathead Valley Guidebook Issue, p. 587-599.

Wickenden, R.T.D.

1932: New species of Upper Cretaceous Foraminifera from the prairie provinces. Royal Society of Canada, Proceedings and Transactions, ser. 3, v. 26, sec. IV, p. 85-91.

1933: Jurassic Foraminifera from wells in Alberta and Saskatchewan. Royal Society of Canada, Transactions, ser. 3, v. 27, sec. IV, p. 151-170.

Williamson, M.A.

1987: A quantitative foraminiferal biozonation of the Late Jurassic-Early Cretaceous of the East Newfoundland Basin. Micropaleontology, v. 33, p. 37-65.

Williamson, M.A. and Stam, B.

1988: Jurassic/Cretaceous Epistominidae from Canada and Europe. Micropaleontology, v. 34, p. 136-158.

Yakovleva, S.P.

1979: Systematics of Jurassic Lituolinae. Paleontologicheskii Zhurnal, v. 1. p. 12-21.

Yorath, C.J.

1962: Micropaleontology of the Deer Bay Formation, Arctic Archipelago, Canada. M.Sc. thesis, University of Alberta, 94 p.

Young, F.G.

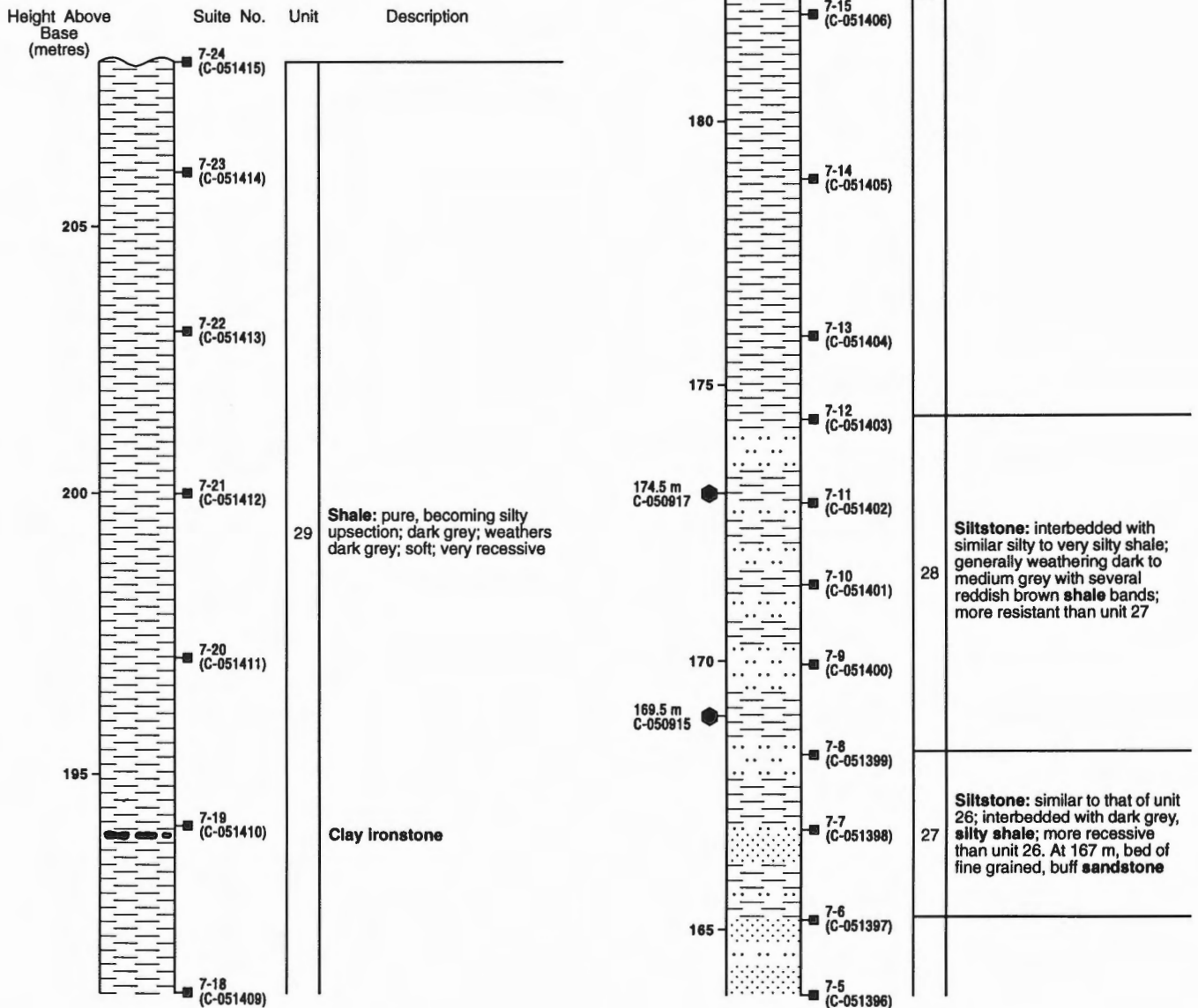
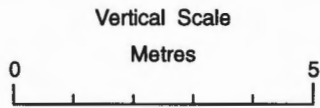
1975: Stratigraphic and sedimentologic studies in northeastern Eagle Plain, Yukon Territory; *in* Report of Activities, Part B, Geological Survey of Canada, Paper 75-1B, p. 309-323.

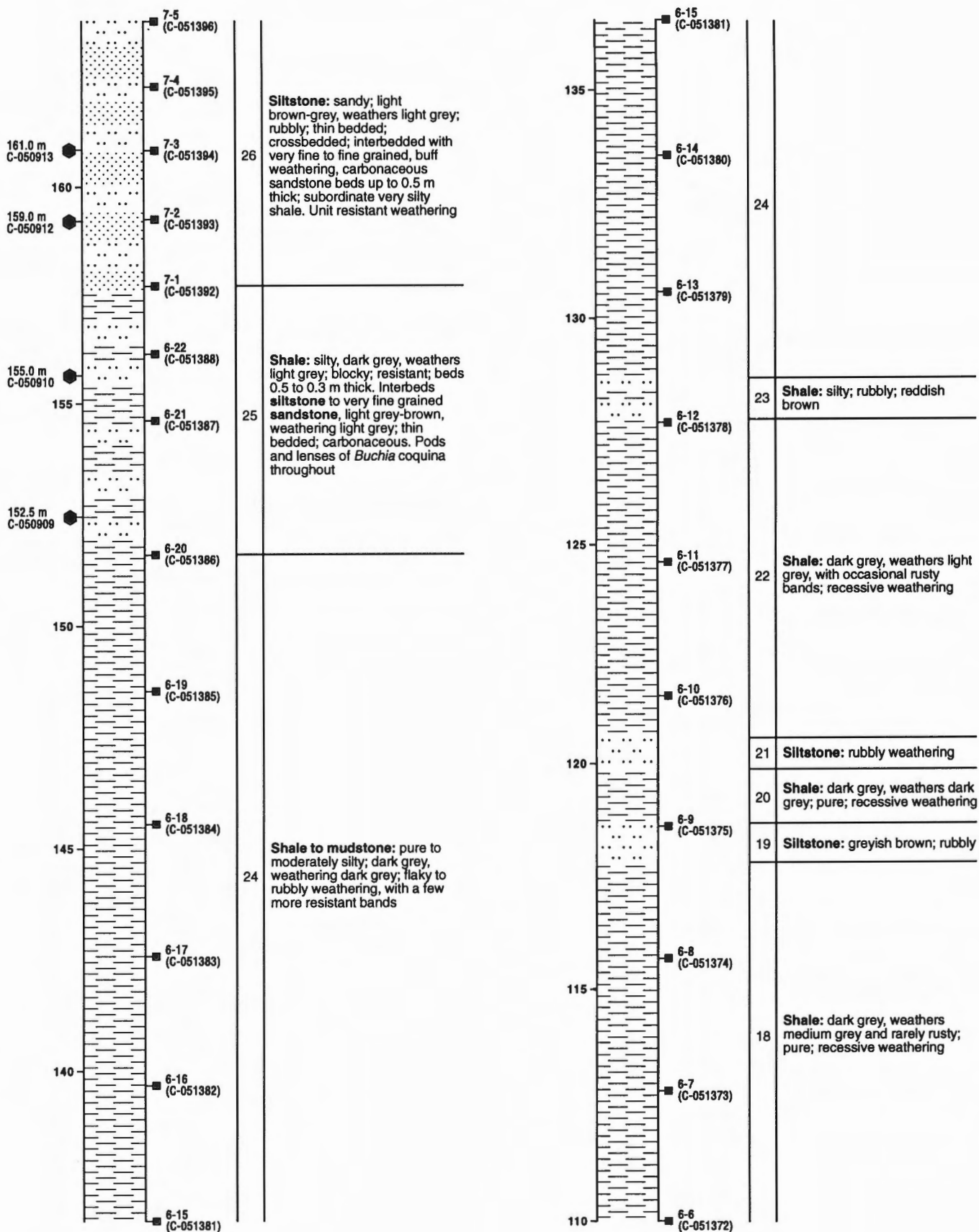
Young, F.G., Myhr, D.W., and Yorath, C.J.

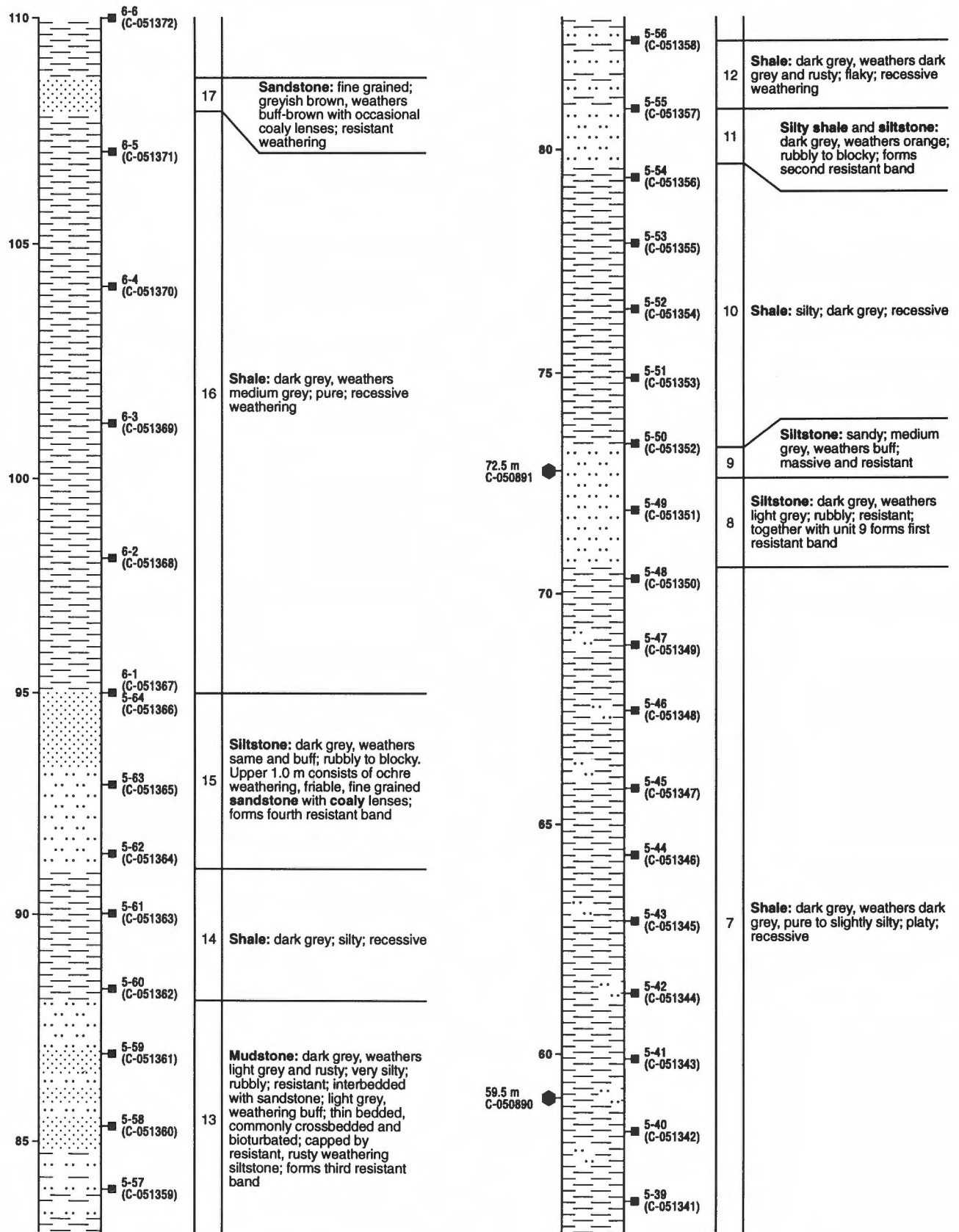
1976: The Geology of the Beaufort-Mackenzie Basin. Geological Survey of Canada, Paper 76-11, 65 p.

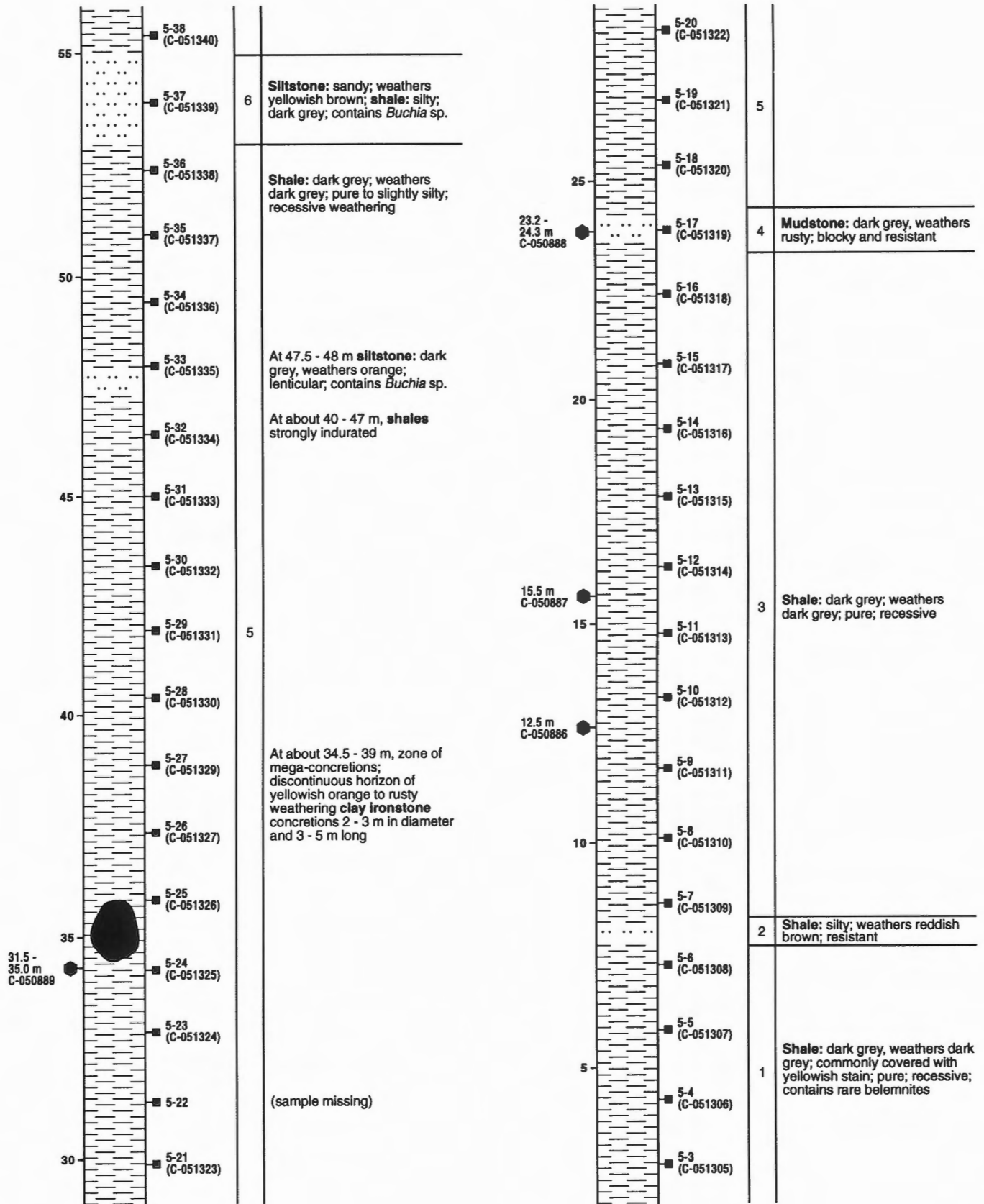
APPENDIX 1

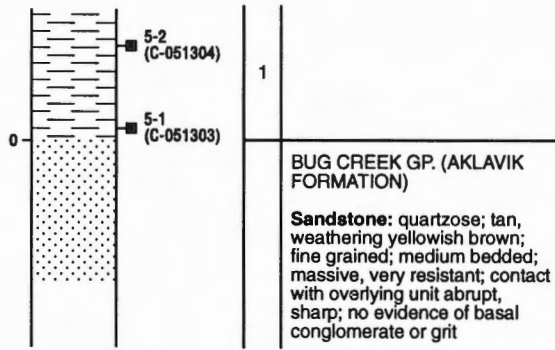
SAMPLED SECTIONS OF HUSKY FORMATION AT MARTIN CREEK, AKLAVIK RANGE, DISTRICT OF MACKENZIE (GSC SECTIONS 75-5-5, 5-6 AND 5-7)











Sandstone: quartzose; tan, weathering yellowish brown; fine grained; medium bedded; massive, very resistant; contact with overlying unit abrupt, sharp; no evidence of basal conglomerate or grit



Sandstone



Siltstone



Shale



Concretionary layer

GSC Macrofossil locality ●

GSC Microfossil locality ■

Field number 5-1

Catalogue number C-051303

Note: C-051366 is the same height above base as C-051367

APPENDIX 2

MACROFOSSIL IDENTIFICATIONS

The following macrofossil identifications are from Geological Survey of Canada Internal Report No. Km-3-1977-JAJ, and were made by Dr. J.A. Jeletzky.

GSC loc. C-050886

Height above base. 12.5 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby)
early form *Camptonectes* (*Boreionectes*) sp.
cf. *C. (B.) praecinctus* Spath
Camptonectes (s.l.) sp. indet.

Age. Late Oxfordian

GSC loc. C-050887

Height above base. 15.5 m

Fauna. Phylloceratid ammonite, gen. et sp. indet.
Pleuromya sp. indet.
Camptonectes (*Boreionectes*) sp. indet.
gastropods, gen. et sp. indet.
Dentalium (s.l.) sp. indet.

Age. Late Jurassic to Valanginian (no diagnostic Fauna)

GSC loc. C-050888

Height above base. 23.2–24.3 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
Camptonectes (*Boreionectes*) sp. cf. *C. (B.) praecinctus* Spath

Age. Oxfordian

GSC loc. C-050889

Height above base. 31.5–35.0 m

Fauna. *Buchia* sp. aff. *B. (Anaucella) concentrica* (Sowerby)
Buchia sp. cf. *B. mosquensis* (von Buch) s.l.
Cylindroteuthis (*Cylindroteuthis*) sp. indet.
"Turbo" sp. ex. aff. *T. ferniensis* Frebold

Age. Late Oxfordian to Early Kimmeridgian

GSC loc. C-050890

Height above base. 59.5 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
indeterminate pelecypods

Age. Late Oxfordian

GSC loc. C-050891

Height above base. 72.5 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
Age. Late Oxfordian

GSC loc. C-050909

Height above base. 152.5 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
Age. Late Oxfordian

GSC loc. C-050910

Height above base. 155.0 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
indeterminate pelecypods
Age. Late Oxfordian

GSC loc. C-050912

Height above base. 159.0 m

Fauna. *Buchia* (*Anaucella*) *concentrica* (Sowerby) s.l.
and var. *erringtoni* (Gabb)
Buchia sp. cf. *B. mosquensis* (von Buch)
Age. Early Kimmeridgian

GSC loc. C-050913

Height above base. 161.0 m

Fauna. *Buchia piochii* (Gabb) s.l.
Buchia sp. cf. *B. blandfordiana* (Stoliczka)
indeterminate pelecypods
Age. Mid to Late Portlandian

GSC loc. C-050915

Height above base. 169.5 m

Fauna. *Buchia* sp. cf. *B. fischeriana* (d'Orbigny) s.l.
Buchia sp. cf. *B. piochii* (Gabb) s.l.
"Aucellina" sp. ex. aff. "A" *schmidti*
Sokolov, 1912
indeterminate pelecypods
Age. Mid to Late Portlandian or Upper Tithonian
(unlikely)

GSC loc. C-050917

Height above base. 174.5 m

Fauna. *Buchia* sp. cf. *B. fischeriana* (d'Orbigny) s.l.
Buchia sp. cf. *B. piochii* (Gabb) s.l.
"Aucellina" (actually *Meleagrinnella*) n. sp. ex.
aff. "A." *schmidti* Sokolov, 1912
Age. Mid to Late Portlandian or Upper Tithonian
(unlikely)

PLATE 1

Figures 1, 2. *Bathysiphon* sp. A

1. Side view, x40, figured specimen GSC 57083, GSC loc. C-051415.
2. Side view, x40, figured specimen GSC 57084, GSC loc. C-051379.

Figures 3, 4. *Lagenammina* sp. A

- Opposite side views, x40, figured specimen GSC 57086, GSC loc. C-051398.

Figures 5, 6. *Saccammina* sp. A

5. Side view, x40, figured specimen GSC 57091, GSC loc. C-051308.
6. Side view, x40, figured specimen GSC 57093, GSC loc. C-051317.

Figures 7–10. *Saccammina lathrami* Tappan

- 7, 8. Opposite side views, x40, hypotype GSC 57088, GSC loc. C-051376.
- 9, 10. Opposite side views of a ruptured specimen, x40, hypotype GSC 57087, GSC loc. C-051398.

Figure 11. *Saccammina* sp. B

- Side view, x40, figured specimen GSC 57094, GSC loc. C-051401.

Figures 12–18. *Ammodiscus* sp. cf. *A. francisi* (Wall)

12. Side view, x120, figured specimen GSC 57118, GSC loc. C-051326.
- 13, 14. Apertural and side views, x120, figured specimen GSC 57115, GSC loc. C-051326.
- 15, 16. Apertural and side views, x120, figured specimen GSC 57116, GSC loc. C-051326.
- 17, 18. Opposite side views of a juvenile megalospheric heteromorph, x120, figured specimen GSC 57120, GSC loc. C-051326.

Figures 19–24. *Ammodiscus* sp. cf. *A. orbis* Lalicker

- 19–21. Opposite side views, x120, figured specimen GSC 57104, GSC loc. C-051309. Figure 20 in transmitted light.
22. Side view, x120, figured specimen GSC 57102, GSC loc. C-051309.
23. Side view, x120, figured specimen GSC 57103, GSC loc. C-051309.
24. Side view, x120, figured specimen GSC 57101, GSC loc. C-051309.

Figures 25–30. *Ammodiscus orbis* Lalicker

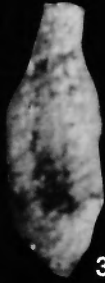
- 25, 26. Opposite side views, x40, hypotype GSC 57096, GSC loc. C-051342.
- 27–29. Opposite side and peripheral views, x40, hypotype GSC 57095, GSC loc. C-051337.
30. Side view, x120, hypotype GSC 57097, GSC loc. C-051342.



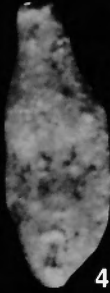
1



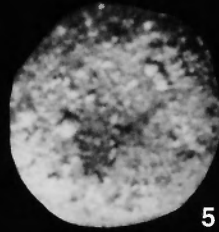
2



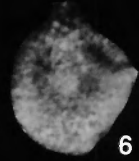
3



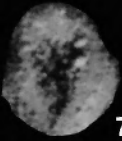
4



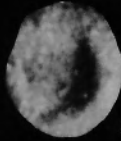
5



6



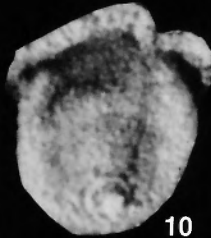
7



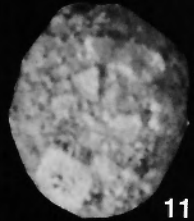
8



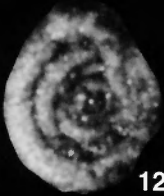
9



10



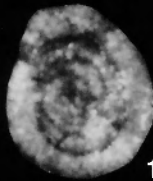
11



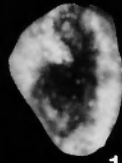
12



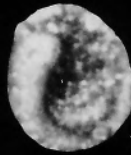
13



14



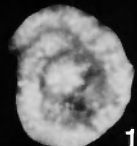
15



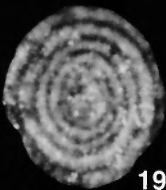
16



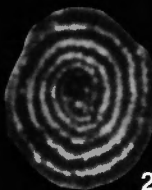
17



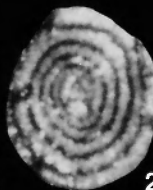
18



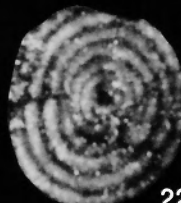
19



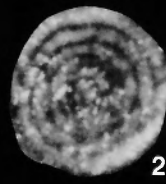
20



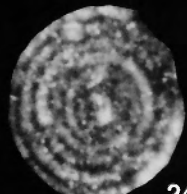
21



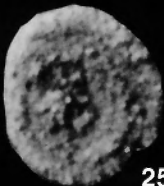
22



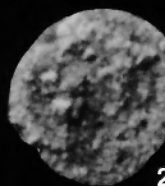
23



24



25



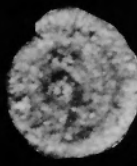
26



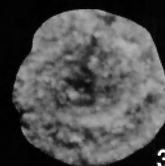
27



28



29



30

PLATE 2

Figures 1-4. *Ammodiscus cheradospirus* Loeblich and Tappan

1, 2. Side and peripheral views, x40, hypotype GSC 57109, GSC loc. C-051317.

3, 4. Opposite side views, x40, hypotype GSC 57108, GSC loc. C-051317.

Figures 5-7. *Ammodiscus* sp. cf. *A. cheradospirus* Loeblich and Tappan

5. Side view, x40, figured specimen GSC 57114, GSC loc. C-051410.

6, 7. Opposite side views, x40, figured specimen GSC 57113, GSC loc. C-051409.

Figures 8-12. *Ammodiscus richardsonensis* n. sp.

8, 9. Peripheral and side views of broken specimen, x40, paratype GSC 57123, GSC loc. C-051311.

10-12. Opposite side and peripheral views, x40, paratype GSC 57126, GSC loc. C-029106.
Note smooth finish of test wall.

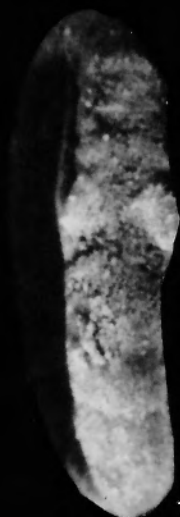
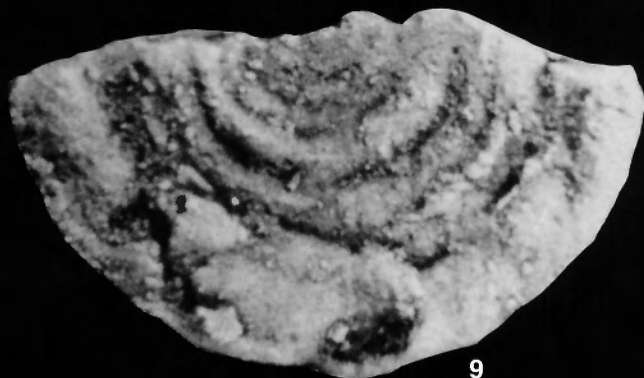
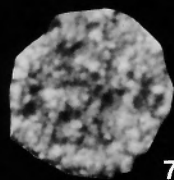
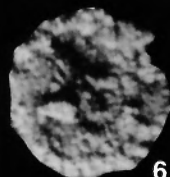
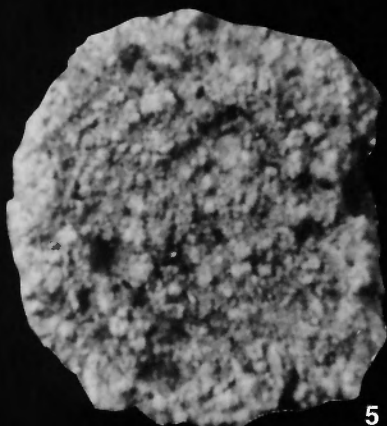
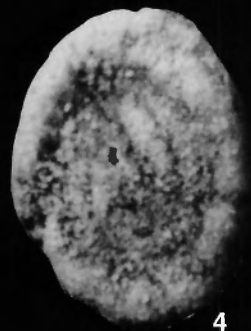
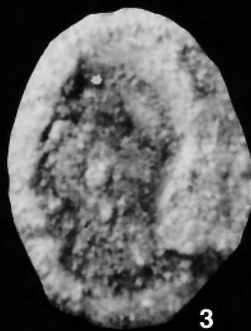


PLATE 3

Figure 1. *Ammodiscus richardsonensis* n. sp.

Side view of partially crushed specimen, x40, holotype GSC 57122, GSC loc. C-051311.

Figures 2-6. *Arenoturrspirillina waltoni* Chamney

2, 3. Ventral and dorsal views, x40, hypotype GSC 57128, GSC loc. C-051336.

4. Side view of strongly crushed specimen, x40, hypotype GSC 57130, GSC loc. C-051338.

5, 6. Ventral and dorsal views, x40, hypotype GSC 57129, GSC loc. C-051337.

Figures 7-10. "*Arenoturrspirillina*" *intermedia* Chamney

7, 8. Dorsal and side views of laterally crushed adult specimen, x40, figured specimen GSC 57134, GSC loc. C-051413.

9, 10. Dorsal and ventral views, x40, figured specimen GSC 57133, GSC loc. C-051413.

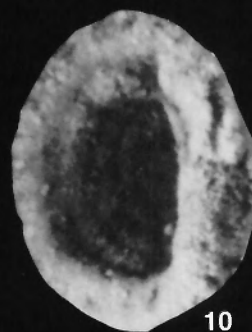
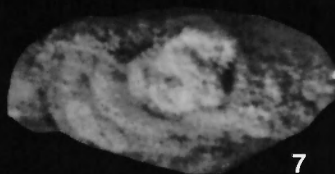
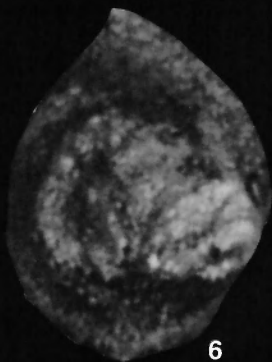
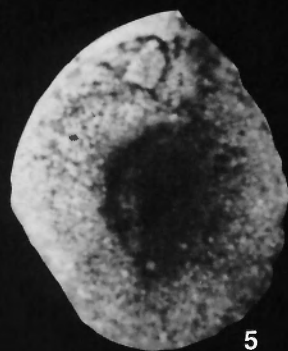
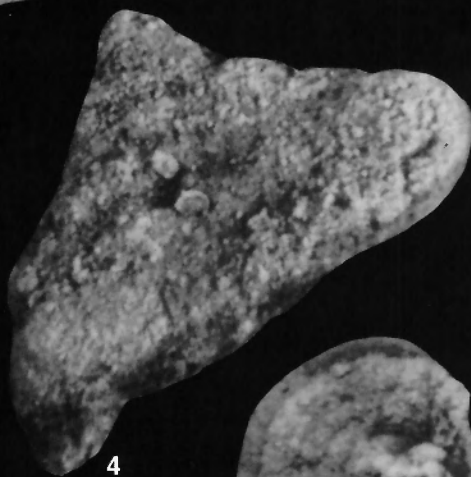
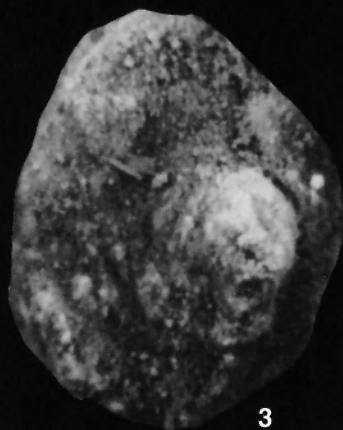
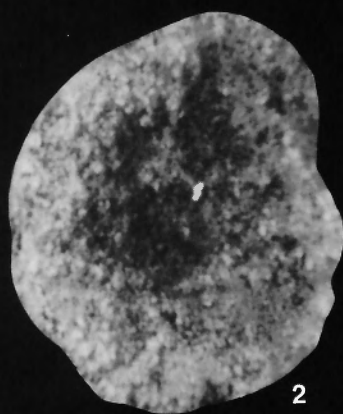


PLATE 4

Figures 1–6. *Glomospira glomerosa* Eicher

- 1, 2. Opposite side views, x120, hypotype GSC 57137, GSC loc. C-051307.
- 3, 4. Opposite side views, x120, hypotype GSC 57143, GSC loc. C-051307.
- 5, 6. Opposite side views of juvenile specimen, x120, hypotype GSC 57139, GSC loc. C-051307.

Figures 7, 8, 15, 16. *Lituotuba?* sp.

- 7, 8. Opposite side views, x120, figured specimen GSC 57179, GSC loc. C-051306.
- 15, 16. Opposite side views, x120, figured specimen GSC 57178, GSC loc. C-051306. (“a” = aperture).

Figures 9–14. *Glomospira tortuosa* Eicher

- 9, 10. Two side views, x120, hypotype GSC 57144, GSC loc. C-051307.
- 11, 12. Two different side views, x120, hypotype GSC 57149, GSC loc. C-051307.
- 13, 14. Two different side views of juvenile specimen, x120, hypotype GSC 57146, GSC loc. C-051307.

Figures 17, 18. *Turritellella parva* n. sp.

17. Side view, x120, holotype GSC 57155, GSC loc. C-051322.
18. Side view, x120, paratype GSC 57157, GSC loc. C-051322.

Figures 19, 20. *Turritellella giffordi* n. sp.

19. Side view, x120, holotype GSC 57159, GSC loc. C-051326.
20. Side view, x120, paratype GSC 57161, GSC loc. C-051326.

Figures 21–23. *Glomospira?* sp. A

21. Side view, x40, figured specimen GSC 57154, GSC loc. C-051413.
- 22, 23. Opposite side views, x40, figured specimen GSC 57151, GSC loc. C-051413.

Figures 24–31, 34–38. *Saturnella brookeae* n. gen. and n. sp.

- 24, 25. Peripheral and side views of juvenile specimen, x40, paratype GSC 57165, GSC loc. C-051337.
- 26–28. Opposite side and peripheral views of adult specimen, x40, holotype GSC 57162, GSC loc. C-051337.
- 29–31. Opposite side and peripheral views, x40, paratype GSC 58504, GSC loc. C-051311.
- 34–36. Opposite side and peripheral views of juvenile specimen attached to test of *Labrospira* sp., x40, paratype GSC 58505, GSC loc. C-051311.
- 37, 38. Top and side views of juvenile specimen, x40, paratype GSC 57168, GSC loc. C-051337.

Figures 32, 33, 39–43. *Saturnella* sp. A

- 32, 33. Opposite side views of adult specimen, x40, figured specimen GSC 57169, GSC loc. C-051409.
- 39, 40. Opposite side views of juvenile specimen, x40, figured specimen GSC 57173, GSC loc. C-051409.
- 41–43. Opposite side and peripheral views, x40, figured specimen GSC 57172, GSC loc. C-051409.



PLATE 5

Figures 1-3. *Reophax* sp. A

1. Side view, x40, figured specimen GSC 57197, GSC loc. C-051312.
2. Side view, x40, figured specimen GSC 57198, GSC loc. C-051312.
3. Side view, x40, figured specimen GSC 57200, GSC loc. C-051309.

Figures 4-7. *Reophax metensis* Franke

- 4, 5. Apertural and side views, x40, hypotype GSC 57184, GSC loc. C-051326.
6. Side view, x40, hypotype GSC 57185, GSC loc. C-051326.
7. Side view, x40, hypotype GSC 57186, GSC loc. C-051325.

Figures 8-12. *Reophax* sp. cf. *R. adaptatus* Dain

- 8, 9. Opposite side views of slightly crushed adult specimen, x40, figured specimen GSC 57190, GSC loc. C-051412.
10. Side view, x40, figured specimen GSC 57191, GSC loc. C-051412.
- 11, 12. Side view, x40, figured specimen GSC 57196, GSC loc. C-051413.

Figures 13, 14. *Reophax* sp. B

13. Side view, x120, figured specimen GSC 57203, GSC loc. C-051326.
14. Side view, x120, figured specimen GSC 57206, GSC loc. C-051326.

Figures 15, 16. *Scherochorella minuta* (Tappan)

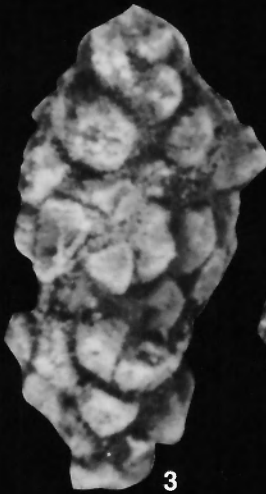
15. Side view, x120, hypotype GSC 57180, GSC loc. C-051324.
16. Side view, x120, hypotype GSC 57181, GSC loc. C-051324.



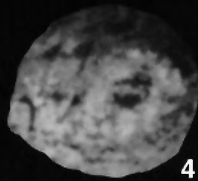
1



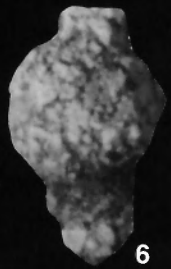
2



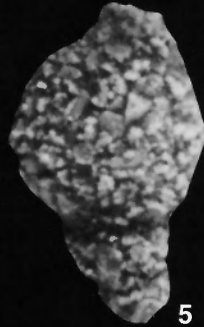
3



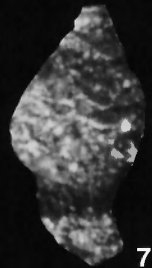
4



6



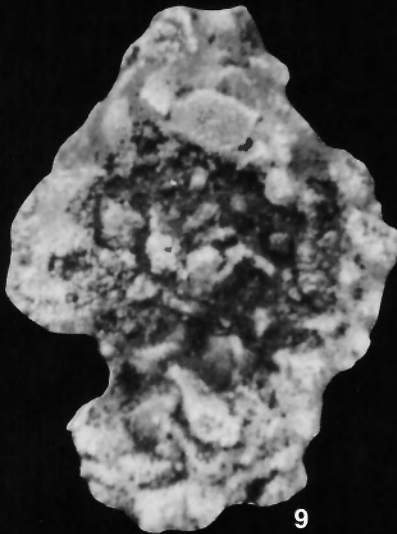
5



7



8



9



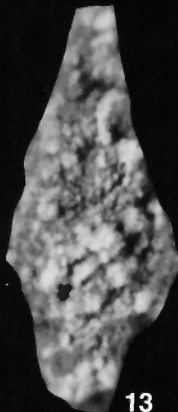
10



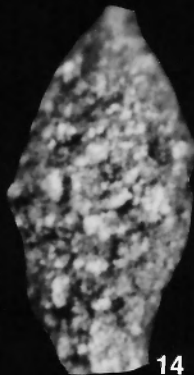
11



12



13



14



15



16

PLATE 6

Figures 1-3. *Reophax* sp. cf. *R. densa* Tappan

1. Side view, x40, figured specimen GSC 57211, GSC loc. C-051312.
2. Opposite side views, x40, figured specimen GSC 57210, GSC loc. C-051312.

Figures 4-17. *Haplophragmoides tryssa* Loeblich and Tappan

- 4-6. Opposite side and apertural views of typical adult specimen, x120, hypotype GSC 57214, GSC loc. C-051312.
- 7-9. Opposite side and apertural views, x120, hypotype GSC 57216, GSC loc. C-051312.
- 10, 11. Opposite side views of ?megalospheric adult variety, x120, hypotype GSC 57226, GSC loc. C-051326.
- 12-14. Opposite side and apertural views, x120, hypotype GSC 57221, GSC loc. C-051312.
- 15-17. Opposite side and apertural views, x120, hypotype GSC 57227, GSC loc. C-051326.

Figures 18-21. *Haplophragmoides* sp. A

- 18-20. Opposite side and apertural views, x120, figured specimen GSC 57233, GSC loc. C-051363.
21. Side view, x120, figured specimen GSC 57234, GSC loc. C-051363.

Figures 22-26. *Trochamminoides leskiwae* n. sp.

22. Side view, x120, holotype GSC 57260, GSC loc. C-051379.
- 23, 24. Same side views in reflected and transmitted light; note basal position of aperture, x120, paratype GSC 57263, GSC loc. C-051379.
- 25, 26. Apertural and side view of well preserved adult specimen, x120, paratype GSC 57262, GSC loc. C-051379.

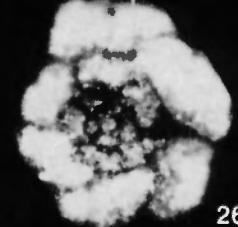
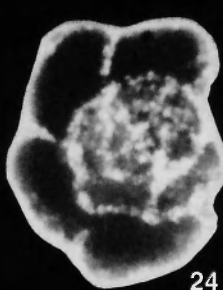
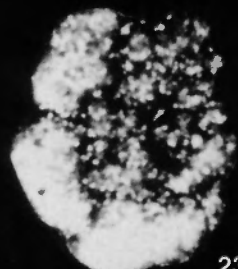
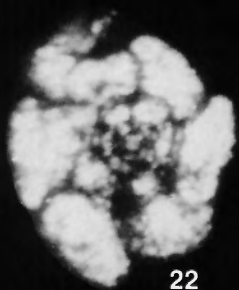
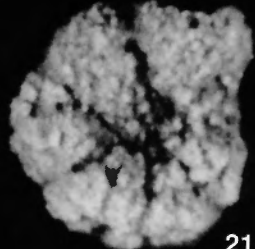
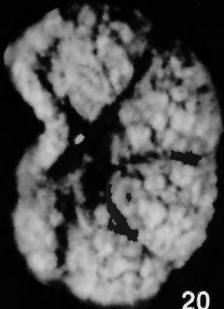
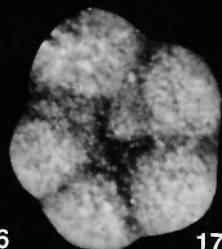
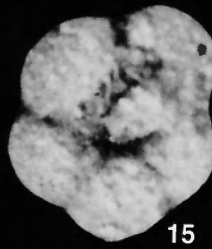
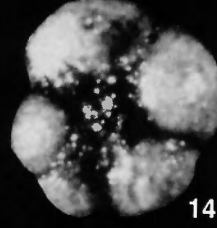
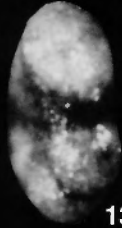
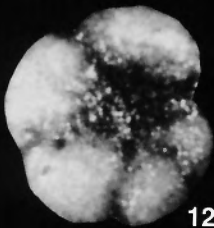
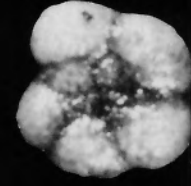
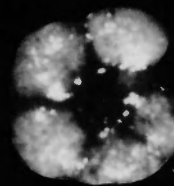
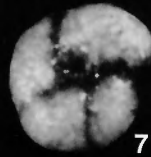
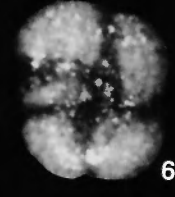
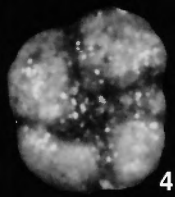
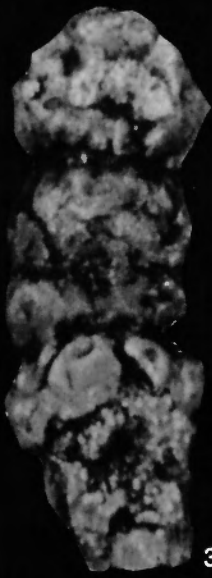
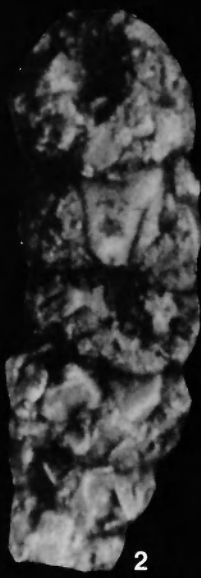
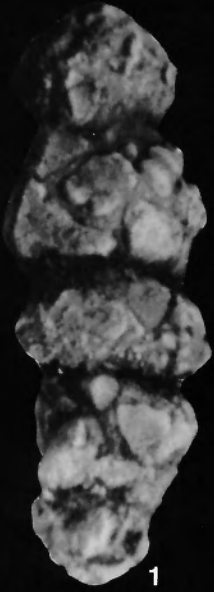


PLATE 7

Figures 1-12. *Labrospira goodenoughensis* (Chamney)

1. S.E.M. photomicrograph, x175, of an enlarged portion of figure 2 (chambers 4-7) showing the position and nature of the aperture on four successive septal faces, hypotype GSC 57244, GSC loc. C-051329. Note the aperture is clearly areal and possesses a distinct bordering lip.
2. S.E.M. photomicrograph, x80, of partially thin sectioned adult specimen (oblique view), hypotype GSC 57244, GSC loc. C-051329.
- 3-5. Opposite side and peripheral views of juvenile specimen, x40, hypotype GSC 57246, GSC loc. C-051326.
- 6-8. Opposite side and peripheral views of typical adult specimen, x40, hypotype GSC 57242, GSC loc. C-051329.
- 9, 10. Opposite side views, x40, hypotype GSC 57245, GSC loc. C-051329.
- 11, 12. Opposite side views of partially thin sectioned adult specimen, x80, hypotype GSC 57243, GSC loc. C-051329. The chambers are infilled with secondary pyrite. Figure 11 (S.E.M. photomicrograph) clearly shows the position of the aperture (represented by the break in the septal wall) as being areal rather than basal.

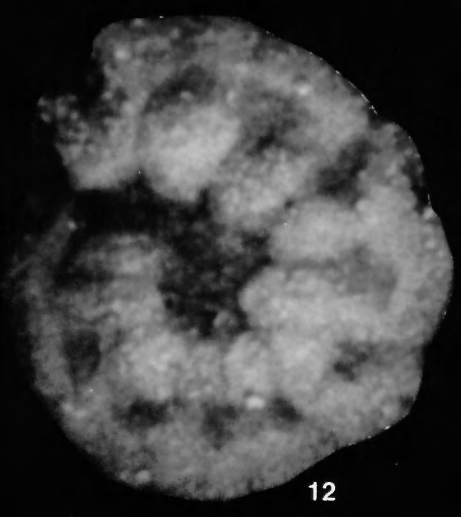
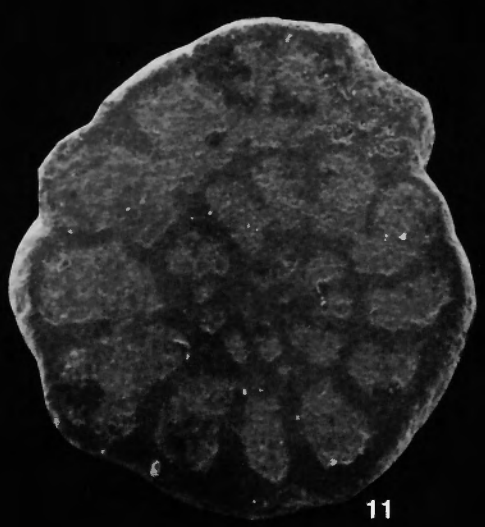
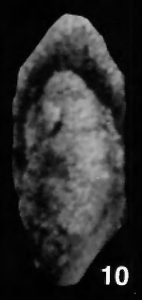
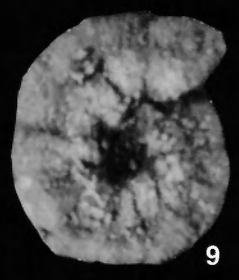
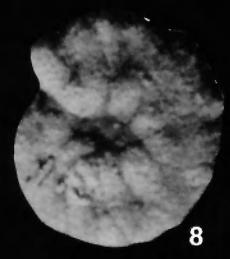
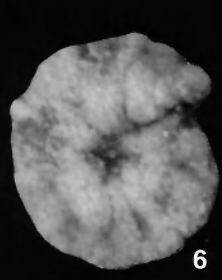
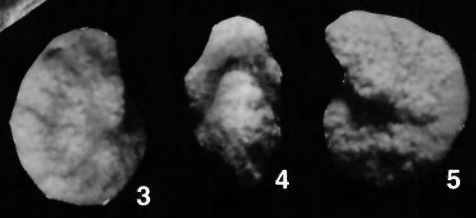
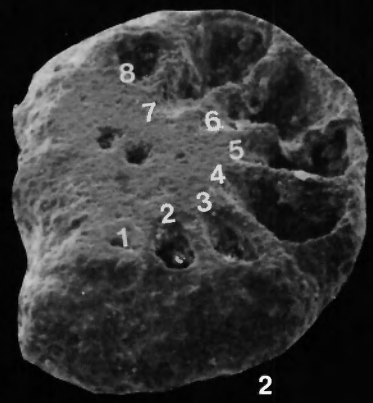
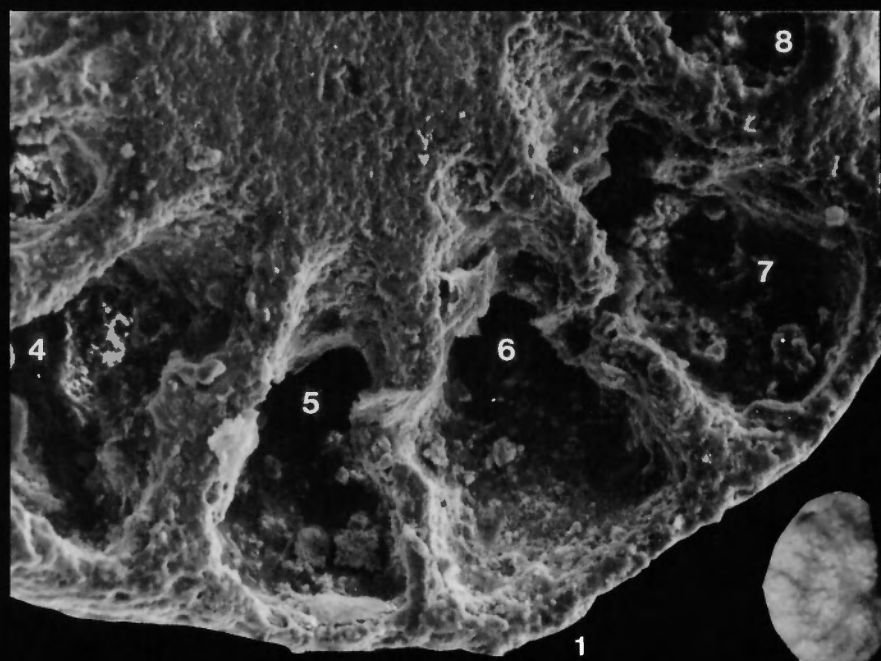


PLATE 8

Figures 1-9, 13, 14. *Labrospira freboldi* n. sp.

- 1-3. Opposite side and peripheral views, x40, holotype GSC 57235, GSC loc. C-051308.
- 4-6. Opposite side and peripheral views, x40, paratype GSC 57237, GSC loc. C-051308.
- 7. S.E.M. photomicrograph, x80, peripheral view showing areal nature of aperture, paratype GSC 57240, GSC loc. C-051308.
- 8, 9. Opposite side views of unusually large adult specimen, x40, paratype GSC 57236, GSC loc. C-051308.
- 13, 14. Peripheral and side views, x40, paratype GSC 57367, GSC loc. C-051308.

Figures 10-12, 15-17, 21-23. *Evolutinella infirma* n. sp.

- 10-12. Opposite side and peripheral views of large adult specimen, x40, paratype GSC 57255, GSC loc. C-051326.
- 15-17. Opposite side and peripheral views, x40, paratype GSC 57256, GSC loc. C-051326.
- 21-23. Opposite side and peripheral views, x40, holotype GSC 57254, GSC loc. C-051326.

Figures 18-20, 24-26. *Labrospira miranda* (Dain)

- 18-20. Opposite side and peripheral views of typical adult specimen, x40, hypotype GSC 57248, GSC loc. C-051329.
- 24-26. Opposite side and peripheral views, x40, hypotype GSC 57249, GSC loc. C-051329.

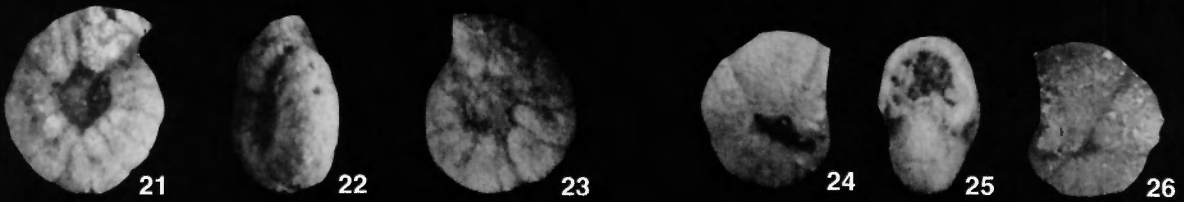
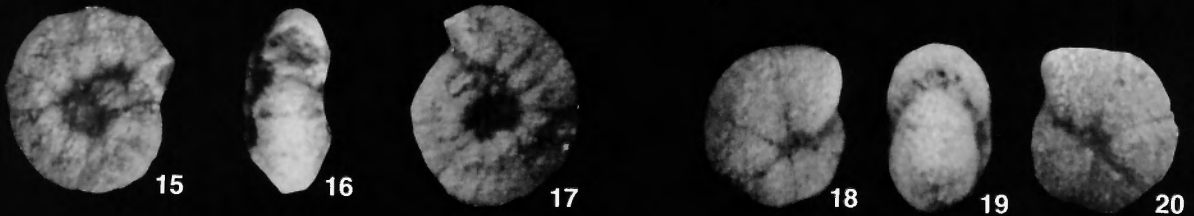
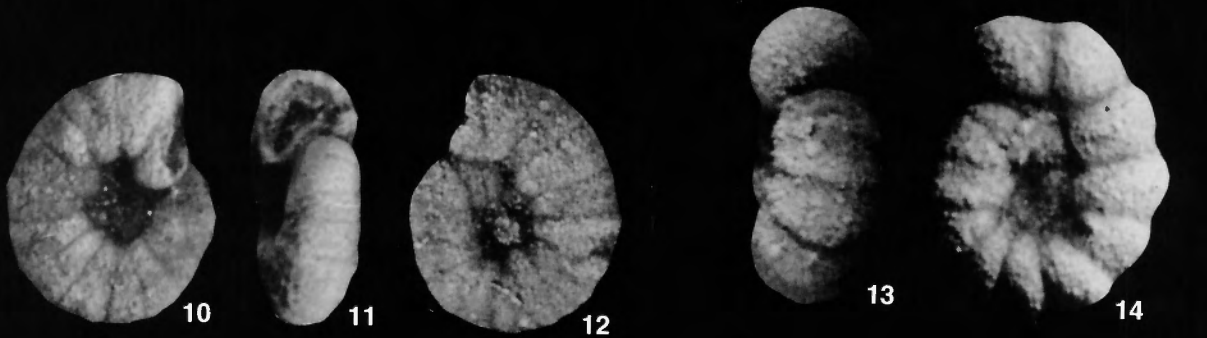
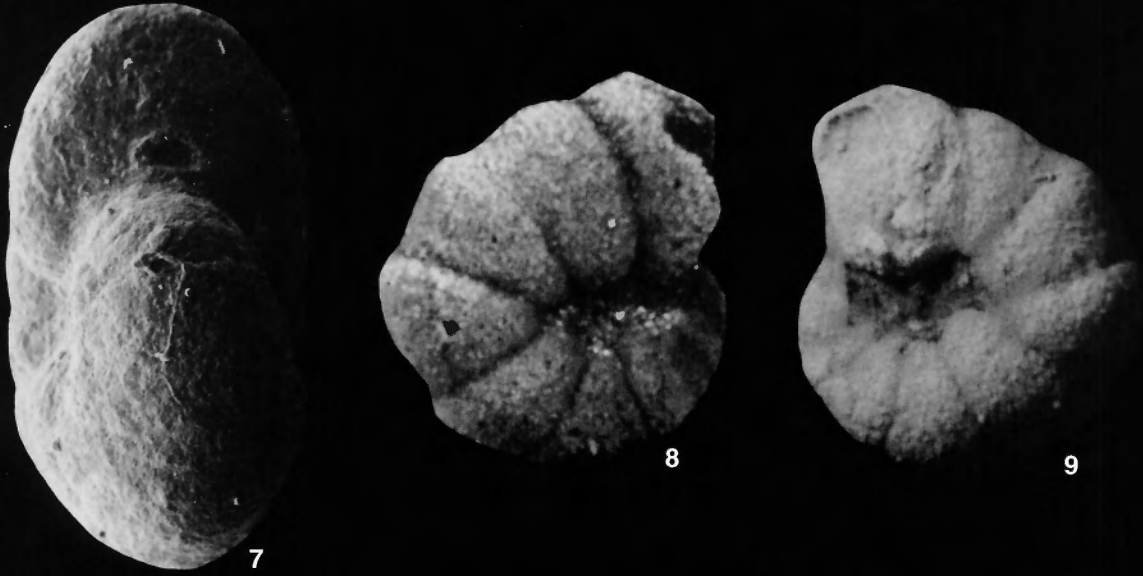
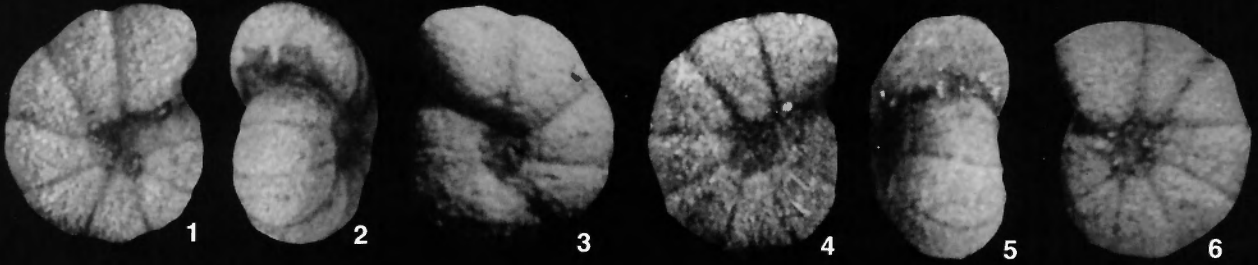


PLATE 9

Figures 1–6. *Recurvoides myhri* n. sp.

1–3. Opposite side and peripheral views of typical adult specimen, x40, holotype GSC 57313, GSC loc. C-051312.

4–6. Opposite side and peripheral views, x40, paratype GSC 57316, GSC loc. C-051329.

Figures 7–20. *Recurvoides canningensis* (Tappan)

7–9. Three opposing views of typical adult specimen, x40, hypotype GSC 57267, GSC loc. C-051326.

10–12. Three opposing views, x40, hypotype GSC 57269, GSC loc. C-051326.

13, 14. Two opposing views, x40, hypotype GSC 57268, GSC loc. C-051326.

15–17. Three opposing views, x40, hypotype GSC 57272, GSC loc. C-051312.

18–20. Three opposing views of a coarse grained variety, x40, hypotype GSC 57270, GSC loc. C-051324.

Figures 21, 22. *Recurvoides* sp. A

Side and peripheral views of typical adult specimen, x120, figured specimen GSC 57328, GSC loc. C-051414.

Figures 23–34. *Recurvoides decoris* n. sp.

23, 24. Opposite side views of juvenile specimen, x120, paratype GSC 57326, GSC loc. C-051326. Figure 24 transmitted light.

25–28. Opposite side and peripheral views of robust adult specimen, x120, holotype GSC 57321, GSC loc. C-051312. Figure 28 transmitted light.

29–32. Opposite side and peripheral views, x120, paratype GSC 57322, GSC loc. C-051313. Figure 32 transmitted light.

33, 34. Opposite side views of juvenile specimen, x120, paratype GSC 57327, GSC loc. C-051326. Figure 34 transmitted light.

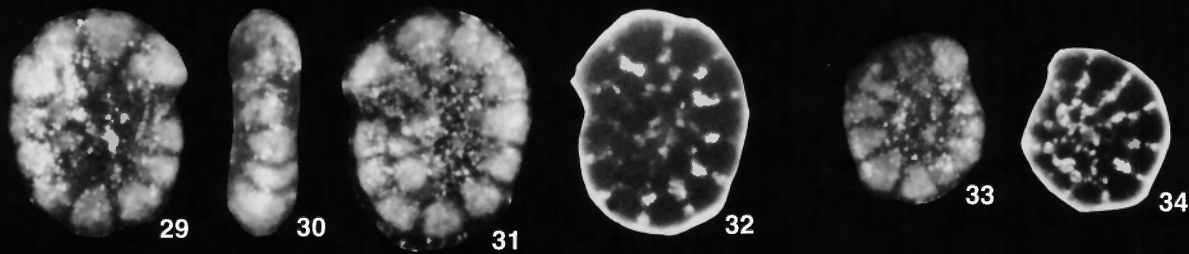
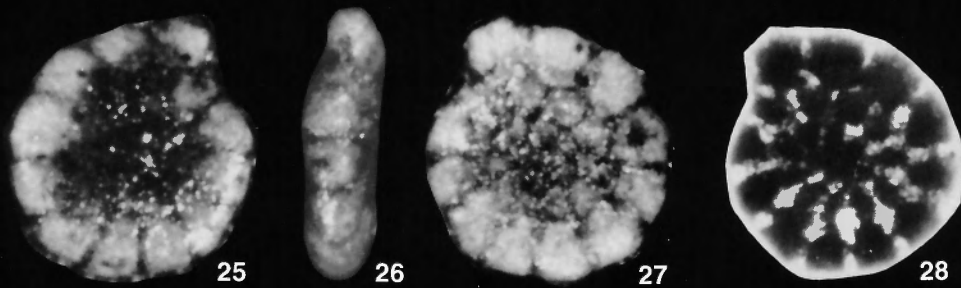
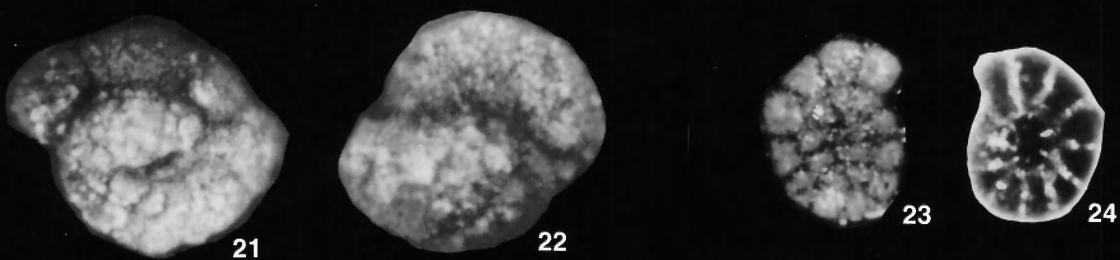
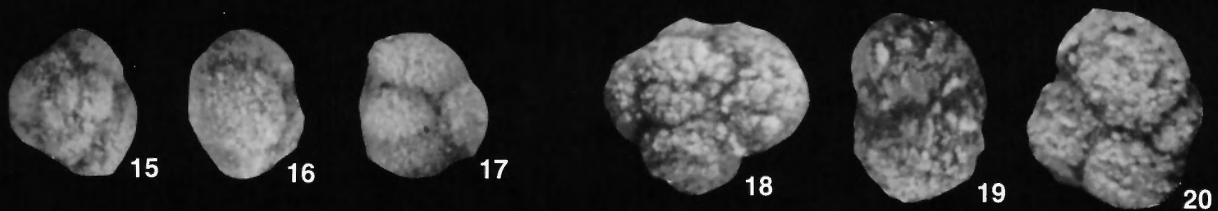
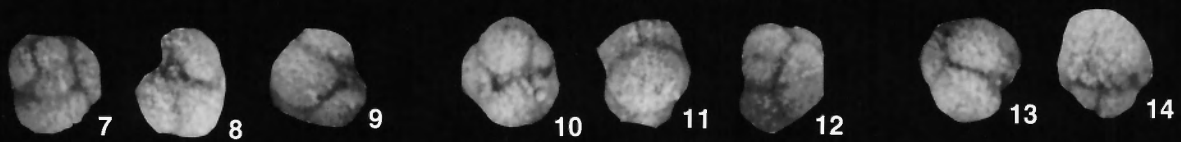
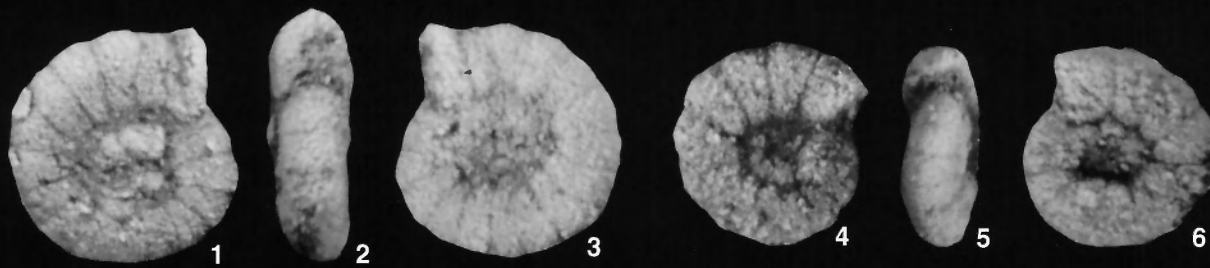


PLATE 10

Figures 1-7. *Recurvoides disputabilis* Dain

- 1-3. Opposite side and peripheral views, x40, hypotype GSC 57287, GSC loc. C-051367.
- 4, 5. Opposite side views, x40, hypotype GSC 57290, GSC loc. C-051369.
- 6, 7. Opposite side views, x40, hypotype GSC 57293, GSC loc. C-051412.

Figures 8-11, 14-17. *Recurvoides* sp. cf. *R. scherkalyensis* Levina

- 8-10. Opposite side and peripheral views, x40, figured specimen GSC 57295, GSC loc. C-051313.
- 11, 17. Opposite side views, x40, figured specimen GSC 57294, GSC loc. C-051313.
- 14-16. Opposite side and peripheral views, x40, figured specimen GSC 57296, GSC loc. C-051315.

Figures 12, 13, 18. *Recurvoides* sp. cf. *R. sublustris* Dain

- 12, 13. Opposite side views, x40, figured specimen GSC 57279, GSC loc. C-051307.
- 18. Side view, x40, figured specimen GSC 57277, GSC loc. C-051307.

Figures 19-21. *Recurvoides sublustris* Dain

- 19-21. Opposite side and peripheral views of typical adult specimen, x40, hypotype GSC 57275, GSC loc. C-051329. Note areal nature of aperture clearly visible in figure 20.

Figures 22-30. *Recurvoides huskyensis* n. sp.

- 22-24. Dorsal, side and ventral views, x40, paratype GSC 57301, GSC loc. C-051306. Note "pseudo-trochospiral" (actually streptospiral) mode of coiling, which is well displayed in this specimen.
- 25-27. Dorsal, side and ventral views of a large, slightly crushed specimen, x40, holotype GSC 57300, GSC loc. C-051306.
- 28-30. Dorsal, side and ventral views, x40, paratype GSC 57303, GSC loc. C-051306.

Figures 31-38. *Recurvoides triangulus* n. sp.

- 31-33. "Ventral", side, and "dorsal" views, x40, paratype GSC 57308, GSC loc. C-051312.
- 34-36. "Dorsal", side, and "ventral" views, x40, holotype GSC 57307, GSC loc. C-051312.
- 37, 38. "Dorsal" and "ventral" views, x40, paratype GSC 57310, GSC loc. C-051311.

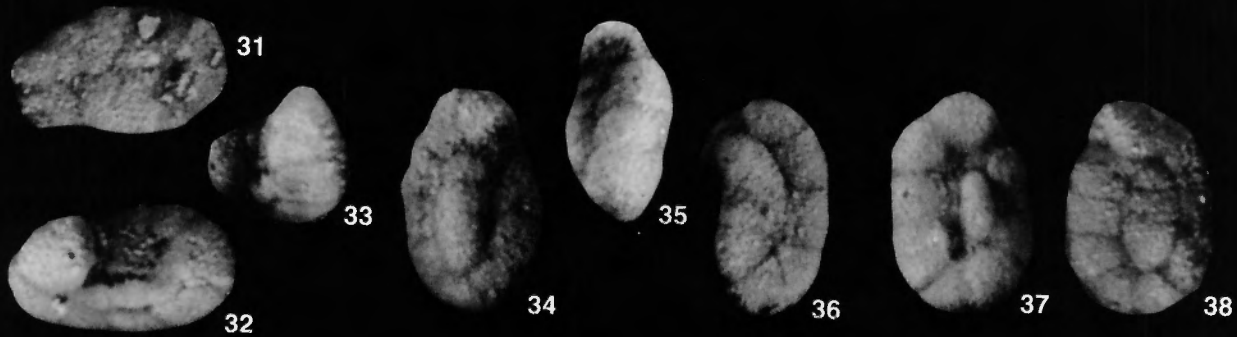
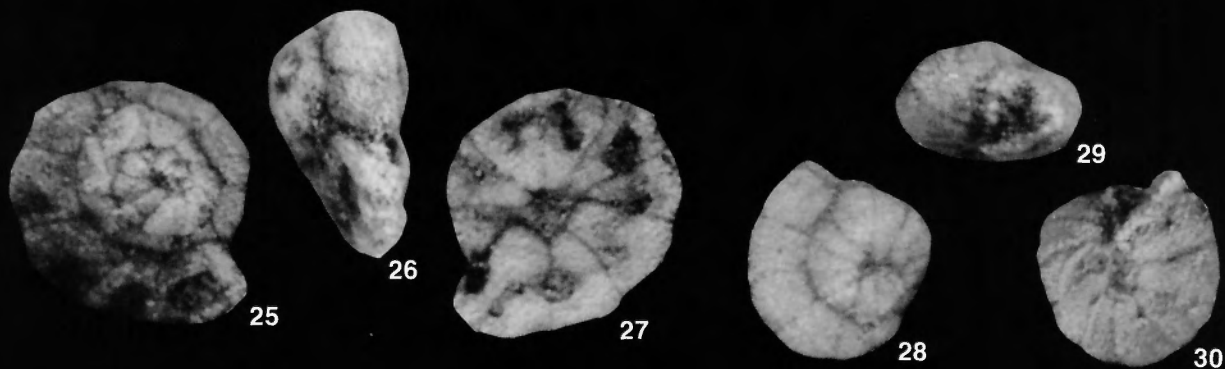
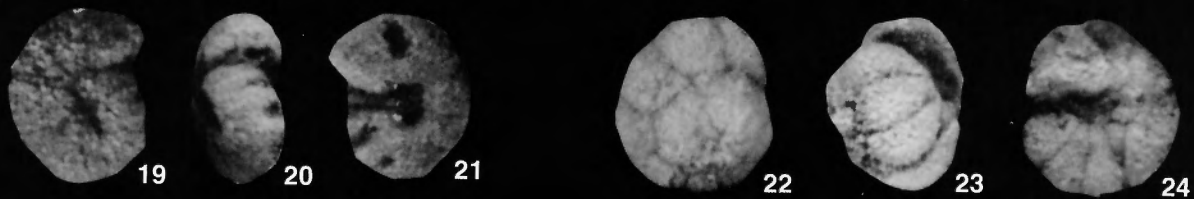
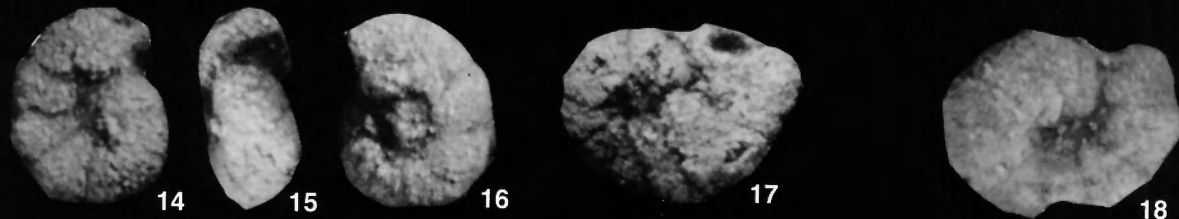
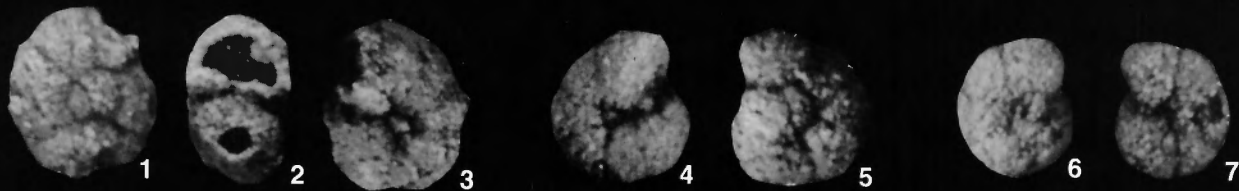


PLATE 11

Figures 1-4, 7-10. *Ammobaculites alaskensis* Tappan subsp. *alaskensis* n. subsp.

- 1, 2. Opposite side views of typical adult specimen, x40, holotype GSC 57332, GSC loc. C-051325.
- 3, 4. Opposite side views, x40, paratype GSC 57335, GSC loc. C-051326.
- 7, 8. Opposite side views of a coarse grained variant, x40, paratype GSC 57338, GSC loc. C-051411.
- 9, 10. Opposite side views of coarse grained variant, x40, paratype GSC 57339, GSC loc. C-051411.

Figures 5, 6, 11-14. *Ammobaculites alaskensis* Tappan subsp. *minor* n. subsp.

- 5, 6. Opposite side views of typical adult specimen, x40, holotype GSC 57340, GSC loc. C-051307.
- 11, 12. Opposite side views, x40, paratype GSC 57343, GSC loc. C-051307.
- 13, 14. Opposite side views, x40, paratype GSC 57344, GSC loc. C-051307.

Figures 15-26. *Ammobaculites lunaris* n. sp.

15. Side view, x40, paratype GSC 57368, GSC loc. C-051403.
- 16, 17. Opposite side views of typical adult specimen, x40, holotype GSC 57403, GSC loc. C-051398.
18. Side view, x40, paratype GSC 57404, GSC loc. C-051398.
- 19, 20. Opposite side views of juvenile specimen, x40, paratype GSC 57405, GSC loc. C-051397.
- 21, 22. Opposite side views of robust adult specimen, x40, paratype GSC 57369, GSC loc. C-051398.
- 23, 24. Opposite side views of large variant with atypically depressed umbilical area, x40, paratype GSC 57409, GSC loc. C-051403.
25. Side view of uncoated juvenile specimen showing arcuate sutures in the coiled portion, x40, paratype GSC 57407, GSC loc. C-051403.
26. Side view of juvenile specimen, x40, paratype GSC 57408, GSC loc. C-051403.

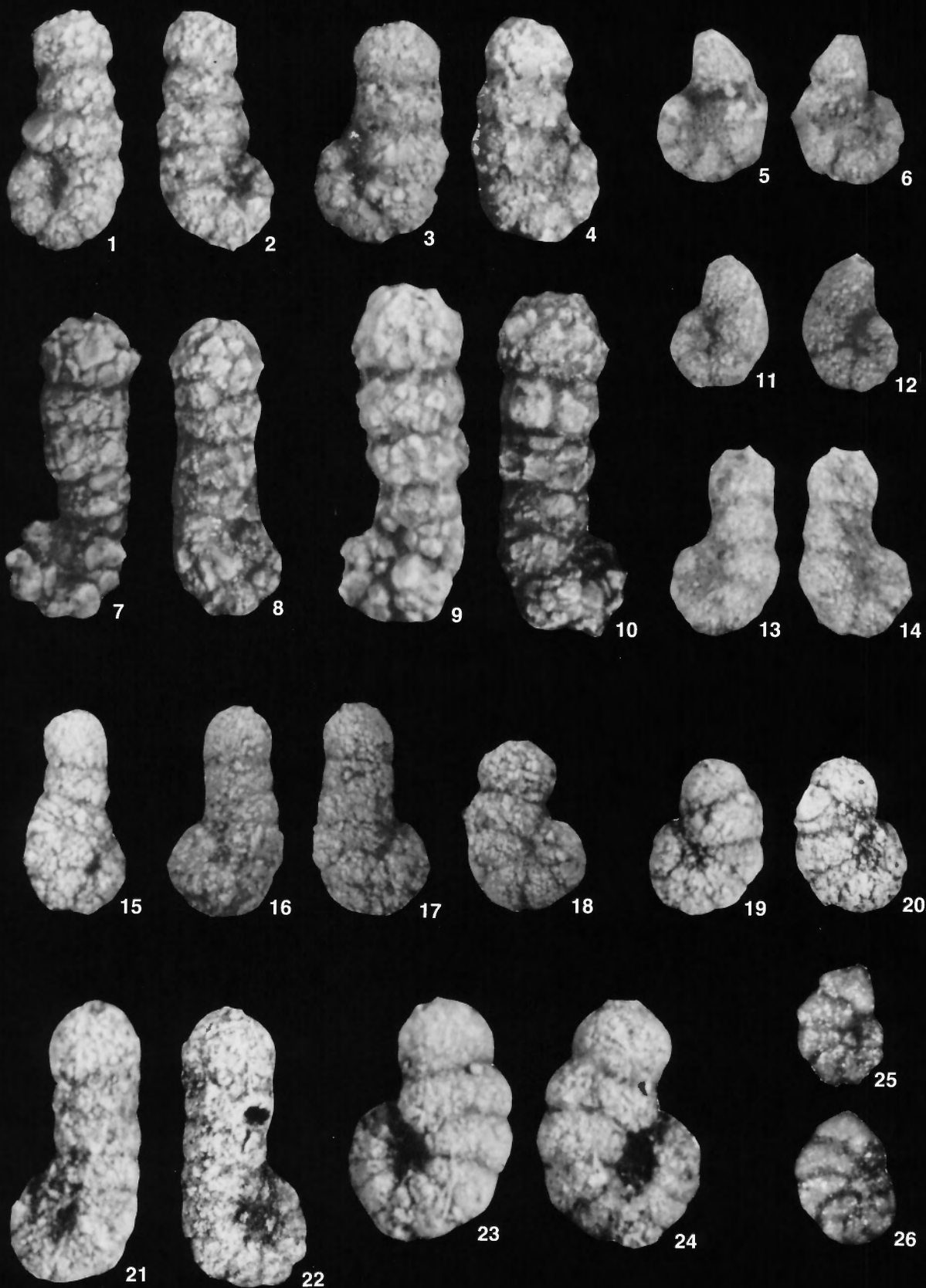


PLATE 12

Figures 1-6. *Ammobaculites alaskensis* Tappan subsp. *calculosus* n. subsp.

- 1, 2. Opposite side views of typical adult specimen, x40, paratype GSC 57411, GSC loc. C-051401.
- 3, 4. Opposite side views, x40, holotype GSC 57410, GSC loc. C-051401.
- 5, 6. Opposite side views of juvenile specimen, x40, paratype GSC 57416, GSC loc. C-051402.

Figures 7-20. *Ammobaculites* sp. cf. *A. multiformis* Dain

- 7, 8. Opposite side views of a typical adult specimen, x40, figured specimen GSC 57346, GSC loc. C-051325.
- 9, 10. Opposite side views, x40, figured specimen GSC 57349, GSC loc. C-051379.
- 13, 14. Opposite side views, x40, figured specimen GSC 57350, GSC loc. C-051379.
- 15, 16. Opposite side views, x40, figured specimen GSC 57348, GSC loc. C-051325.
- 11, 17, 18. Apertural and opposite side views of an unusually large specimen with finely agglutinated coil and coarsely agglutinated uniserial portion, x40, figured specimen GSC 57351, GSC loc. C-051379.
- 12, 19, 20. Apertural and opposite side views of "deviant" juvenile specimen with ornate "flanged" chambers in coiled portion, x40, figured specimen GSC 57352, GSC loc. C-051379.

Figures 21-25. *Ammobaculites* sp. cf. *A. multiformis* Dain var. A

- 21, 22. Opposite side views, x40, figured specimen GSC 57358, GSC loc. C-051379.
- 23, 24. Opposite side views, x40, figured specimen GSC 57359, GSC loc. C-051379.
25. Side view, x40, figured specimen GSC 57360, GSC loc. C-051379.

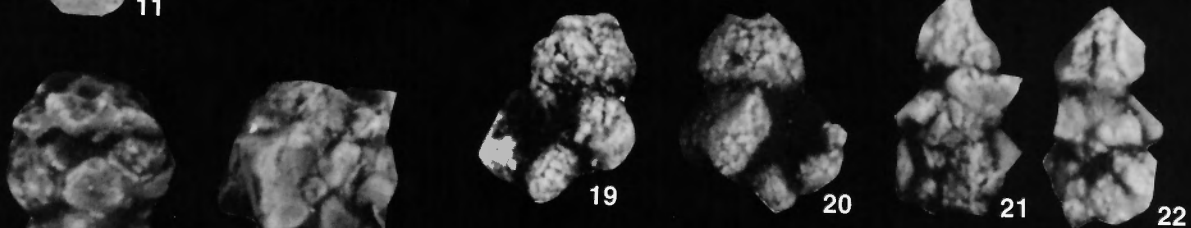
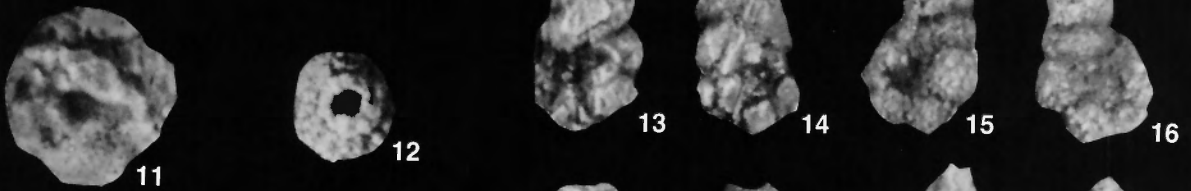
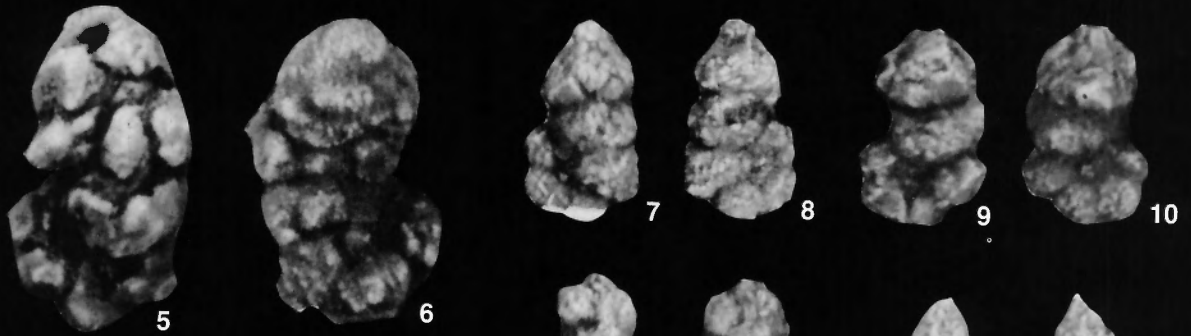


PLATE 13

Figures 1-10. *Ammobaculites aklavikensis* n. sp.

- 1-3. Opposite side and peripheral views of typical adult specimen, x40, holotype GSC 57376, GSC loc. C-051315.
- 4, 5. Opposite side views, x40, paratype GSC 57377, GSC loc. C-051315.
- 6-8. Opposite side and peripheral views of juvenile specimen, x40, paratype GSC 57382, GSC loc. C-051314.
- 9, 10. Opposite side views of a large damaged specimen with a 90° twist in direction from midportion of uniserial section (i.e., two chambers above coiled portion), x40, paratype GSC 58502, GSC loc. C-051315.

Figures 11-16. *Ammobaculites toughenoughensis* n. sp.

- 11, 12. Side and peripheral views of large, adult specimen, x40, paratype GSC 57384, GSC loc. C-051333. Note small diameter of coiled portion relative to that of uniserial portion.
13. Side view, x40, holotype GSC 57383, GSC loc. C-051333.
- 14-16. Opposite side and peripheral views, x40, paratype GSC 57385, GSC loc. C-051333.

Figures 17-20. *Ammobaculites magnus* n. sp.

17. Side view of strongly crushed adult specimen with missing initial (coiled) portion, x40, paratype GSC 57398, GSC loc. C-051338.
- 18, 19. Opposite side views of slightly crushed adult specimen, x40, holotype GSC 57396, GSC loc. C-051338.
20. Apertural view, x40, paratype GSC 57402, GSC loc. C-051337.



PLATE 14

Figures 1-6. *Ammobaculites trachyostrachos* n. sp.

- 1, 2. Opposite side views of typical adult specimen, x40, holotype GSC 57370, GSC loc. C-051311.
- 3, 4. Opposite side views, x40, paratype GSC 57373, GSC loc. C-051311. Note that coil and initial chamber of uniserial portion are very coarsely agglutinated, whereas the remainder is not.
- 5, 6. Opposite side views, x40, paratype GSC 57374, GSC loc. C-051311.

Figures 7-15. *Bulbobaculites? mutabilis* n. sp.

- 7, 8. Opposite side views, x40, paratype GSC 58493, GSC loc. C-051311.
- 9, 10. Opposite side views, x40, paratype GSC 58492, GSC loc. C-051311.
- 11, 12. Opposite side views, x40, holotype GSC 58491, GSC loc. C-051311.
- 13-15. Opposite side and peripheral views, x40, paratype GSC 58495, GSC loc. C-051311. Note abrupt shift in direction of uniserial portion.

Figures 16-19. *Ammobaculites canoensis* n. sp.

- 16, 17. Opposite side views, x40, holotype GSC 57394, GSC loc. C-051415.
- 18, 19. Opposite side views, x40, paratype GSC 57391, GSC loc. C-051415.

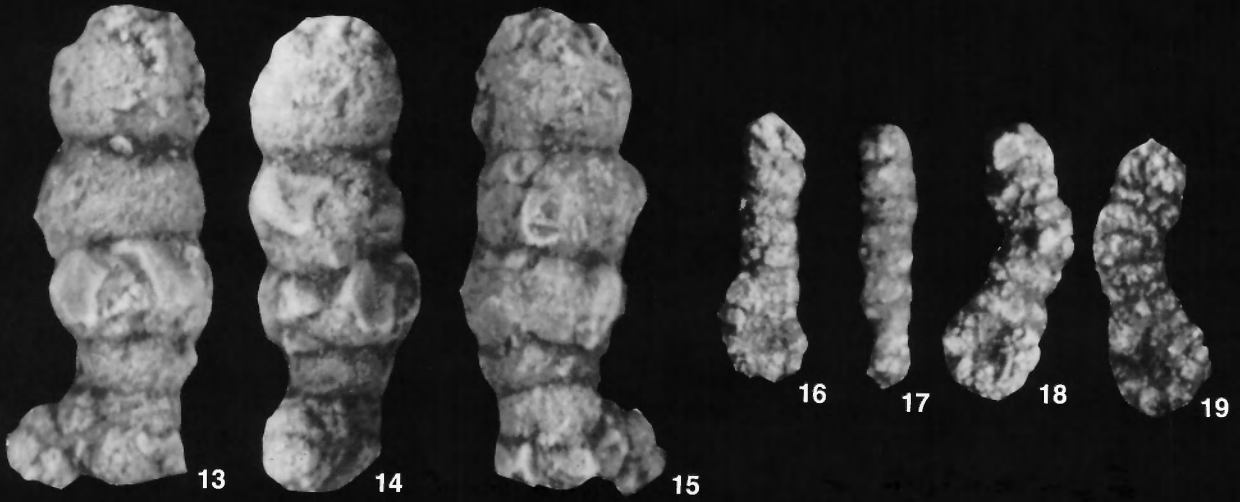
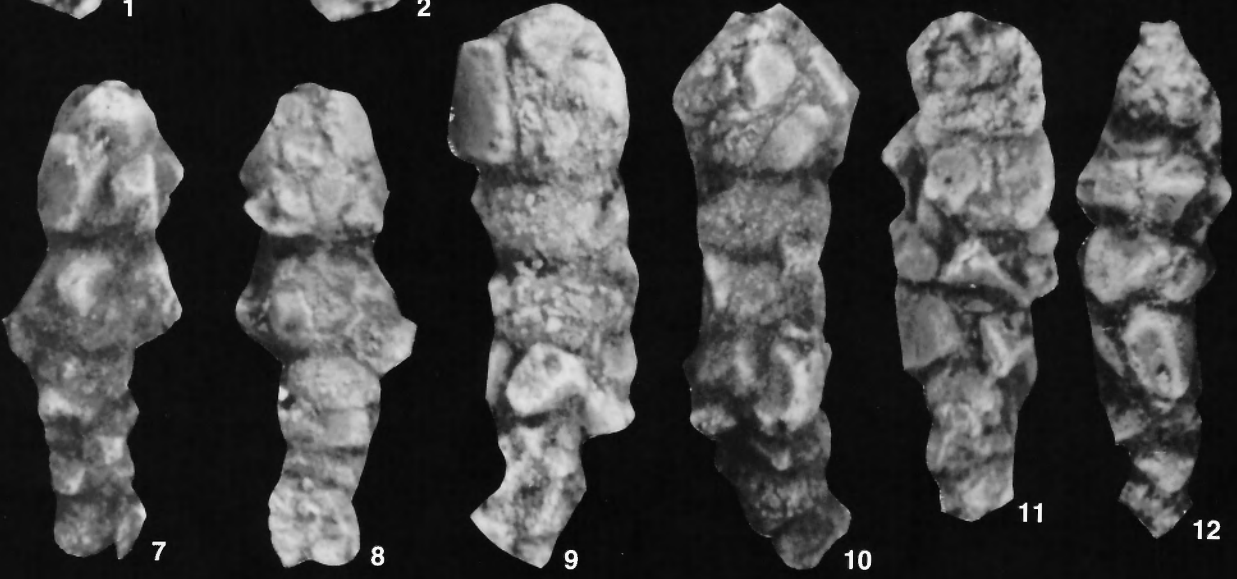
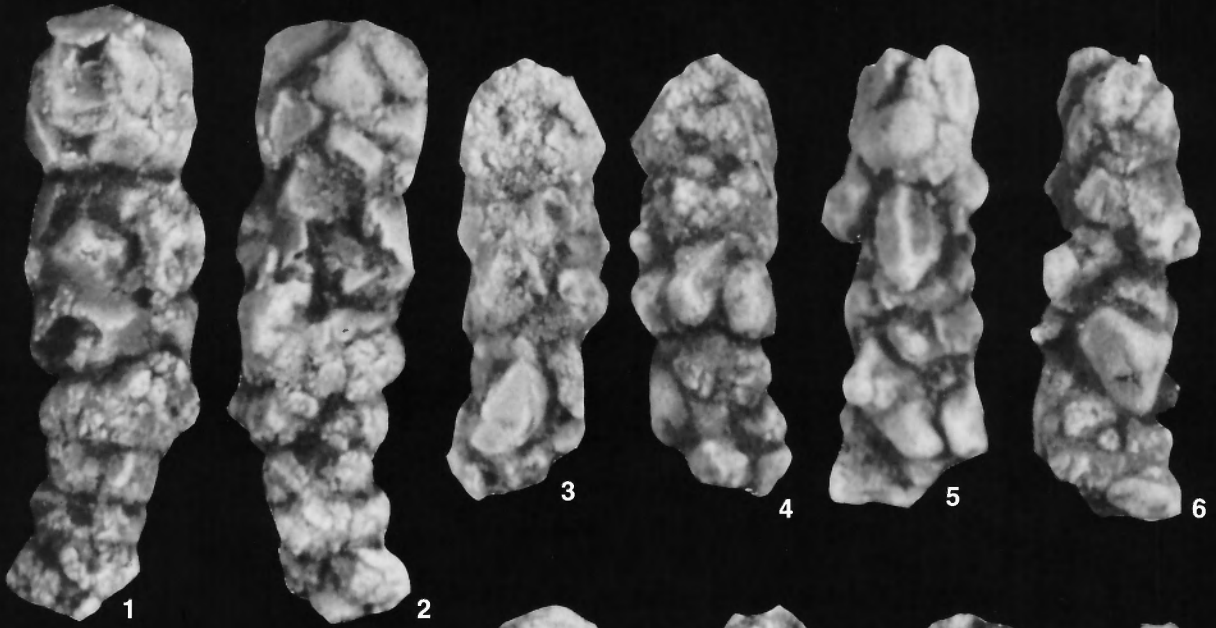


PLATE 15

Figures 1–6. *Bulbobaculites willowensis* n. sp.

- 1, 2. Opposite side views of robust adult specimen, x40, holotype GSC 57423, GSC loc. C-051314.
- 3, 4. Opposite side views, x40, paratype GSC 57424, GSC loc. C-051314.
- 5, 6. Opposite side views, x40, paratype GSC 57427, GSC loc. C-051315.

Figures 7–10. *Ammobaculites* sp. A

7. Side view, x40, figured specimen GSC 57353, GSC loc. C-051368.
- 8, 9. Opposite side views, x40, figured specimen GSC 57357, GSC loc. C-051381.
10. Side view, x40, figured specimen GSC 57356, GSC loc. C-051381.

Figures 11–17. *Bulbobaculites gilberti* n. sp.

- 11, 12. Opposite side views, x40, holotype GSC 57430, GSC loc. C-051315.
- 13–15. Opposite side and peripheral views, x40, paratype GSC 57432, GSC loc. C-051315.
- 16, 17. Opposite side views of juvenile specimen, x40, paratype GSC 57436, GSC loc. C-051315.

Figures 18–24. *Bulbobaculites pokrovkaensis* (Kosyreva)

- 18–20. Opposite side and peripheral views, x120, hypotype GSC 57417, GSC loc. C-051321.
- 21, 22. Opposite side views, x120, hypotype GSC 57420, GSC loc. C-051321.
- 23, 24. Opposite side views, x120, hypotype GSC 57418, GSC loc. C-051321.



PLATE 16

Figures 1–6. *Ammobaculites* sp. cf. *A. venustus* Loeblich and Tappan

- 1, 2. Side and peripheral views, x120, figured specimen GSC 57364, GSC loc. C-051337.
- 3, 4. Peripheral and side views, x120, figured specimen GSC 57363, GSC loc. C-051337.
- 5, 6. Side and peripheral views of juvenile specimen, x120, figured specimen GSC 57361, GSC loc. C-051337.

Figures 7–12. *Ammobaculoides mahadeoi* n. sp.

- 7, 8. Opposite side views of adult specimen illustrating planispiral coil, initial biserial portion, and later, uniserial portion, x80, paratype GSC 57447, GSC loc. C-051415.
- 9, 10. Opposite side views, x80, paratype GSC 57449, GSC loc. C-051415.
- 11, 12. Opposite side views, x80, holotype GSC 57444, GSC loc. C-051409.

Figures 13–18. *Ammobaculoides rickyouni* n. sp.

- 13, 15. Opposite side views, x120, holotype GSC 57437, GSC loc. C-051404.
14. Side view in transmitted light showing chamber arrangement, x120, holotype GSC 57437, GSC loc. C-051404.
- 16, 17. Side views, x120, paratype GSC 57440, GSC loc. C-051404.
18. Side view, x120, paratype GSC 57443, GSC loc. C-051404.

Figures 19–24. *Ammosphaeroidina? stelcki* n. sp.

- 19–21. Opposite side and peripheral views, x120, holotype GSC 58066, GSC loc. C-051324.
- 22–24. Opposite side views, x120, paratype GSC 58067, GSC loc. C-051324.



1



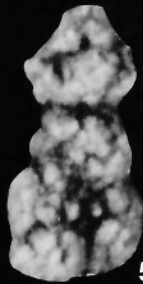
2



3



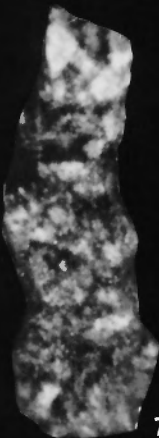
4



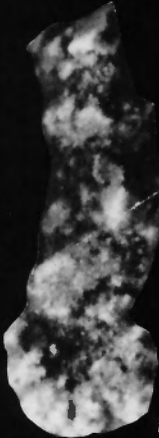
5



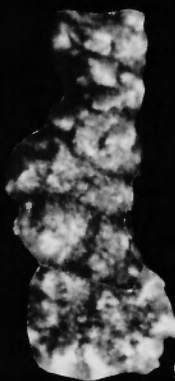
6



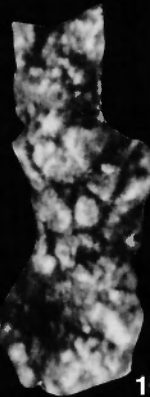
7



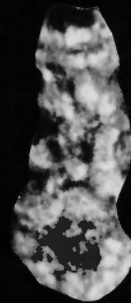
8



9



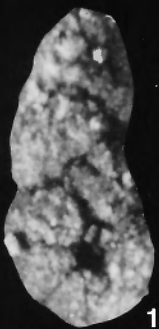
10



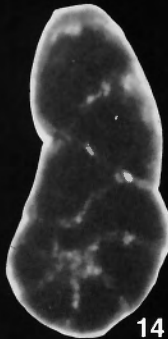
11



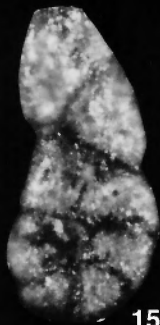
12



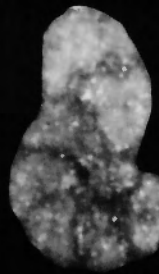
13



14



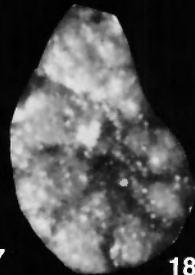
15



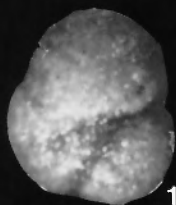
16



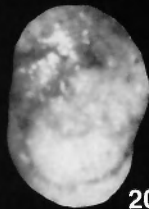
17



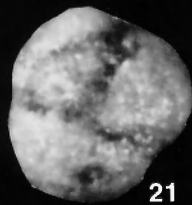
18



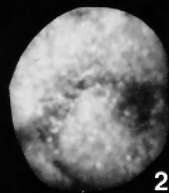
19



20



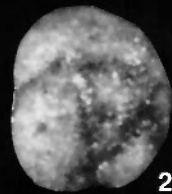
21



22



23



24

PLATE 17

Figures 1–4. *Spiroplectammina cuneata* n. sp.

- 1, 2. Peripheral and side views, x120, holotype GSC 57450, GSC loc. C-051324.
- 3, 4. Opposite side views, x120, paratype GSC 57451, GSC loc. C-051325.

Figures 5–9. *Textularia areoplecta* Tappan

- 5, 6. Peripheral and side views, x120, hypotype GSC 57456, GSC loc. C-051323. Note well preserved basal aperture in figure 5.
7. Side view, x120, hypotype GSC 57457, GSC loc. C-051323.
8. Side view, x120, hypotype GSC 57460, GSC loc. C-051326.
9. Side view, x120, hypotype GSC 57461, GSC loc. C-051326.

Figures 10, 11. *Siphotextularia martinensis* n. sp.

10. Side view, x120, holotype GSC 57484, GSC loc. C-051404. Note the well defined “siphon” or tube on which the aperture is projected passing from the penultimate to the ultimate chamber.
11. Side view, x120, paratype GSC 57485, GSC loc. C-051404.

Figures 12–16. *Siphotextularia torquens* n. sp.

12. Side view clearly showing the nearly 90° twist in the axis of the test, x120, holotype GSC 57473, GSC loc. C-051306.
- 13, 14. Opposite side views, x120, paratype GSC 57474, GSC loc. C-051306.
- 15, 16. Opposite side views, x120, paratype GSC 57475, GSC loc. C-051306.

Figures 17–20. *Siphotextularia* sp. A

- 17, 18. Side and peripheral views, x120, figured specimen GSC 57479, GSC loc. C-051307.
- 19, 20. Side and peripheral views, x120, figured specimen GSC 57480, GSC loc. C-051307.

Figures 21–25. *Pseudobolivina laxa* n. sp.

- 21, 22. Side and peripheral views of a rather slim specimen, x120, holotype GSC 57464, GSC loc. C-051329.
23. Side view, x120, paratype GSC 57465, GSC loc. C-051329.
24. Side view, x120, paratype GSC 57466, GSC loc. C-029107.
25. Side view, x120, paratype GSC 57467, GSC loc. C-029107.

Figures 26–29. *Siphotextularia* sp. B

- 26, 27. Side and peripheral views of typical adult specimen, x120, figured specimen GSC 57487, GSC loc. C-051312.
28. Side view, x120, figured specimen GSC 57488, GSC loc. C-051312.
29. Side view, x120, figured specimen GSC 57489, GSC loc. C-051312.

Figures 30–41. *Trochammina elevata* Kosyрева subsp. *elevata* n. subsp.

- 30–32. Dorsal, side, and ventral views of a microspheric heteromorph, x120, holotype GSC 57504, GSC loc. C-051325.
- 33–35. Dorsal, side, and ventral views of a microspheric heteromorph, x120, paratype GSC 57506, GSC loc. C-051325.
- 36–38. Dorsal, side, and ventral views of a microspheric heteromorph, x120, paratype GSC 57505, GSC loc. C-051325. The aperture is visible as a high, semicircular arch at the base of the ultimate chamber in figure 38.
- 39–41. Dorsal, side, and ventral views of a megalospheric heteromorph, x120, paratype GSC 58002, GSC loc. C-051325.

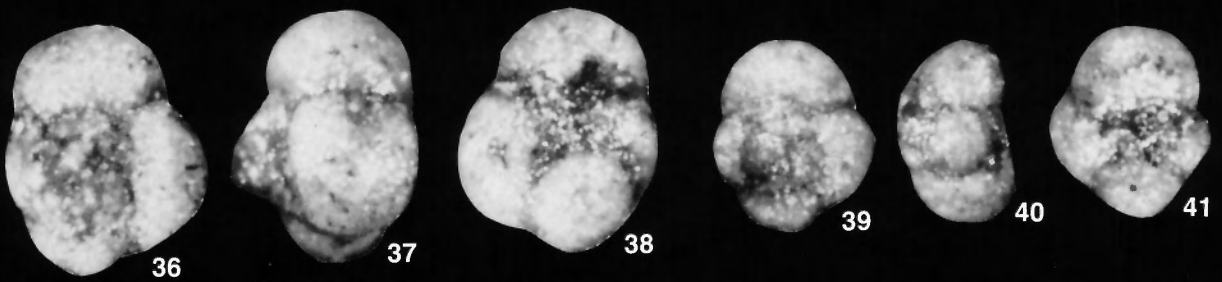
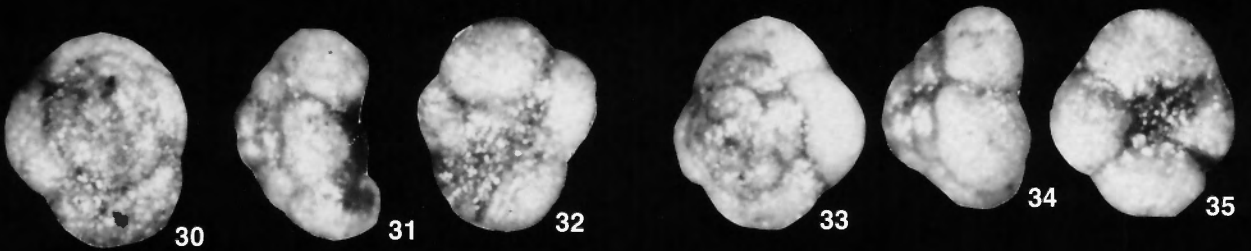
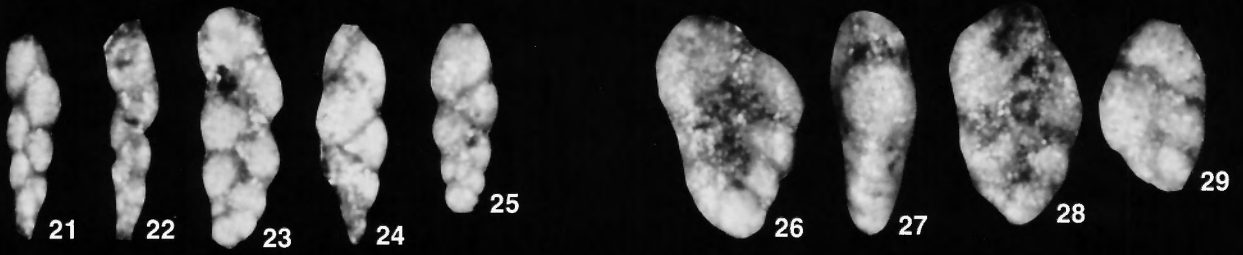
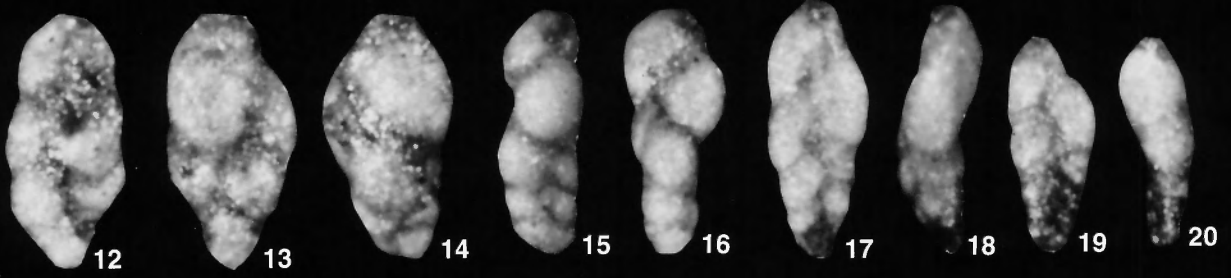
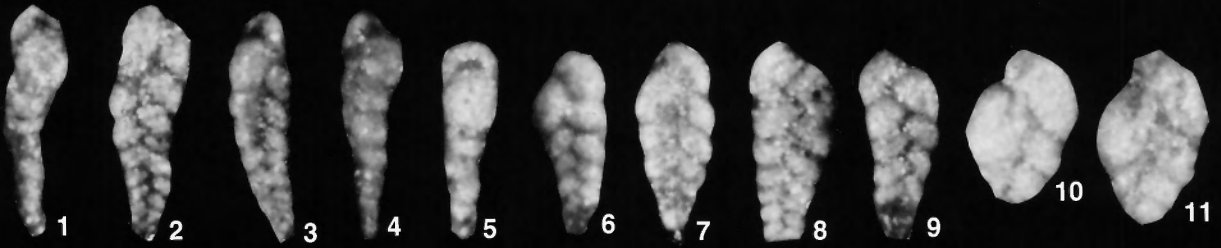


PLATE 18

Figures 1-3, 5-7, 9-11. *Trochammina elevata* Kosyreva subsp. *acutila* n. subsp.

1-3. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, holotype GSC 58049, GSC loc. C-051411.

5-7. Dorsal, side, and ventral views of sinistrally coiled, megalospheric heteromorph, x120, paratype GSC 58052, GSC loc. C-051412.

9-11. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58054, GSC loc. C-051412.

Figures 4, 8, 12. *Trochammina elevata* Kosyreva subsp. A

Dorsal, side, and ventral views of (?)dextrally coiled, microspheric heteromorph, x120, figured specimen GSC 58061, GSC loc. C-029109. Note very high nature of coil.

Figures 13-18. *Trochammina elevata* Kosyreva subsp. *inflata* n. subsp.

13, 14. Dorsal and ventral views of partially damaged adult specimen, x120, paratype GSC 58006, GSC loc. C-051325.

15, 18. Dorsal and ventral views, x120, holotype GSC 58003, GSC loc. C-051325.

16, 17. Dorsal and ventral views, x120, paratype GSC 58005, GSC loc. C-051325.

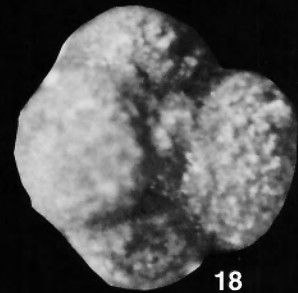
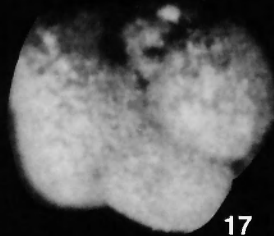
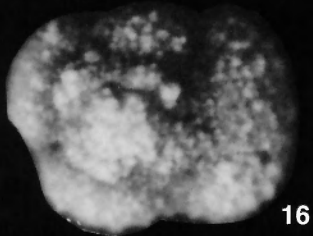
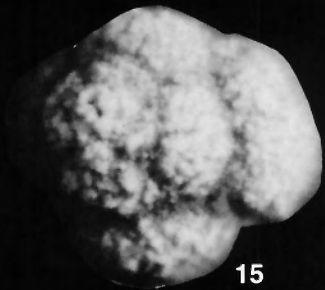
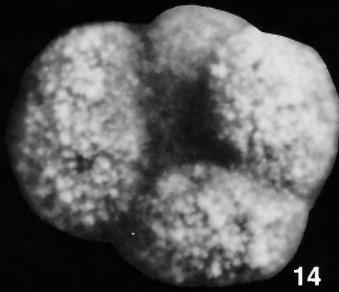
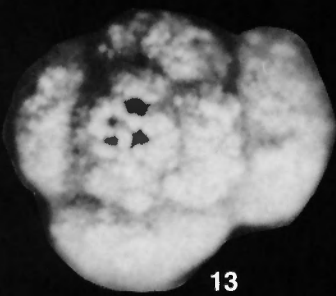
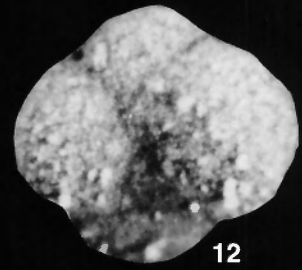
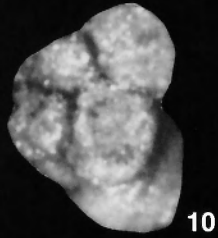
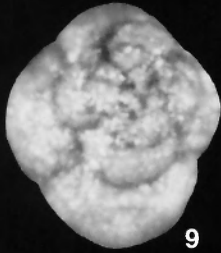
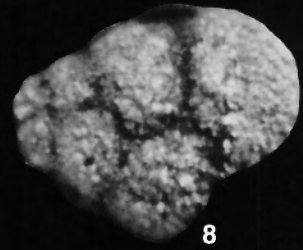
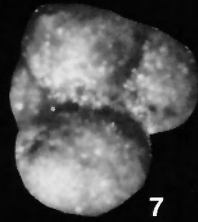
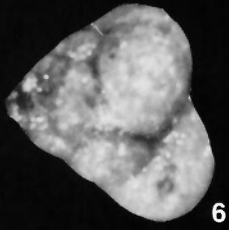
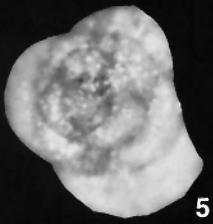
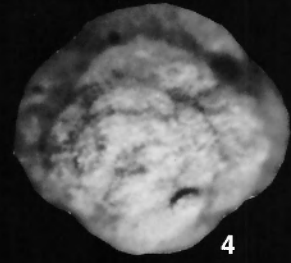
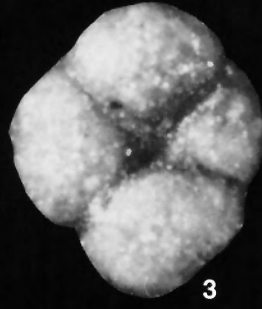
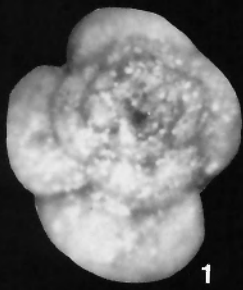


PLATE 19

Figures 1–9. *Trochammina* sp. cf. *T. rostovzevi* Levina

- 1–3. Dorsal, side, and ventral views of dextrally coiled heteromorph, x40, figured specimen GSC 58013, GSC loc. C-051312.
- 4–6. Dorsal, side, and ventral views of dextrally coiled heteromorph, x40, figured specimen GSC 58014, GSC loc. C-029109.
- 7–9. Dorsal, side, and ventral views of sinistrally coiled heteromorph, x40, figured specimen GSC 58012, GSC loc. C-051306.

Figures 10–17. *Trochammina kosyrevae* Levina

- 10–12. Dorsal, side, and ventral views of dextrally coiled heteromorph, x40, hypotype GSC 57492, GSC loc. C-029109.
- 13–15. Dorsal, side, and ventral views of dextrally coiled heteromorph, x40, hypotype GSC 57493, GSC loc. C-051312.
- 16, 17. Dorsal and ventral views of sinistrally coiled heteromorph, x40, hypotype GSC 57497, GSC loc. C-051311.

Figures 18–29. *Trochammina omskensis* Kosyreva

- 18–20. Dorsal, side and ventral views of dextrally coiled, microspheric heteromorph, x120, hypotype GSC 57502, GSC loc. C-051308. Note low spire and marked umbilical depression.
- 21–23. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, hypotype GSC 57498, GSC loc. C-051310.
- 24–26. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, hypotype GSC 57499, GSC loc. C-051310.
- 27–29. Dorsal, side, and ventral views of dextrally coiled, microspheric juvenile, x120, hypotype GSC 57500, GSC loc. C-051310.

Figures 30–41. *Trochammina occidentalis* n. sp.

- 30–32. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, holotype GSC 58016, GSC loc. C-051315.
- 33–35. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58019, GSC loc. C-051312.
- 36–38. Dorsal, side, and ventral views of sinistrally coiled, megalospheric heteromorph, x120, paratype GSC 58018, GSC loc. C-051315.
- 39–41. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58021, GSC loc. C-051309.

Figures 42–49. *Trochammina aquilonaris* n. sp.

- 42–44. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, holotype GSC 58030, GSC loc. C-051329. Note very low nature of spire.
- 45–47. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58033, GSC loc. C-051329.
- 48, 49. Dorsal and side views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58031, GSC loc. C-051329.

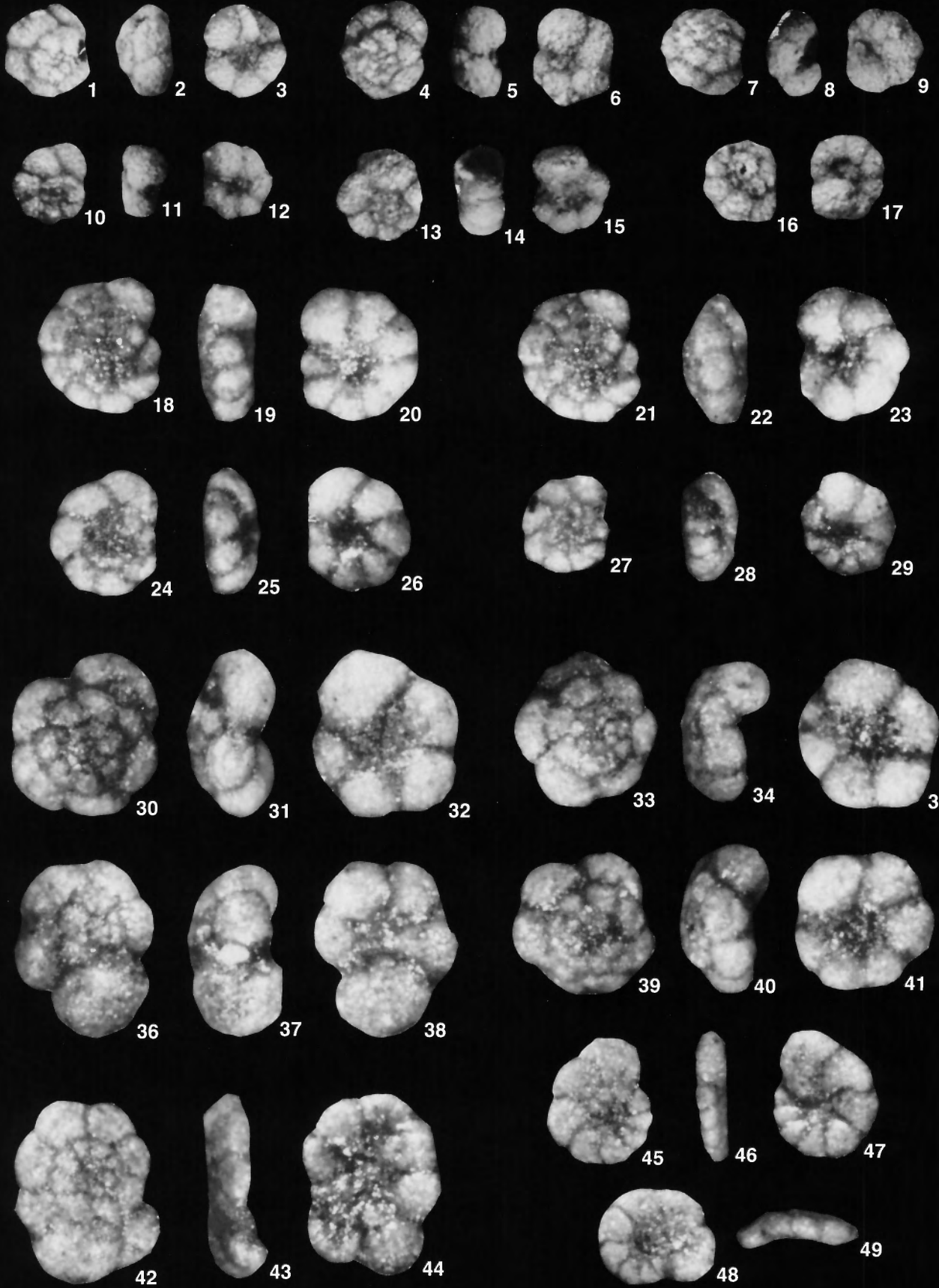


PLATE 20

Figures 1-9, 16-18. *Trochammina phialodes* n. sp.

- 1-3. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58024, GSC loc. C-051324.
- 4-6. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, holotype GSC 58023, GSC loc. C-051326. Note deep ventral depression and overall concavo-convex test shape.
- 7-9. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58029, GSC loc. C-051328.
- 16-18. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, paratype GSC 58025, GSC loc. C-051324.

Figures 10-15, 19-21. *Trochammina walli* n. sp.

- 10-12. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, holotype GSC 58037, GSC loc. C-051404. Note overall *Gyroidina*-like appearance of test.
- 13-15. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58038, GSC loc. C-051404.
- 19-21. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, paratype GSC 58039, GSC loc. C-051404.

Figures 22-30. *Trochammina scotti* n. sp.

- 22-24. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, holotype GSC 58044, GSC loc. C-051404.
- 25-27. Dorsal, side, and ventral views of sinistrally coiled, microspheric juvenile, x120, paratype GSC 58046, GSC loc. C-051404.
- 28-30. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58045, GSC loc. C-051404.

Figures 31-39. *Trochammina postera* n. sp.

- 31-33. Dorsal, side, and ventral views of dextrally coiled, microspheric heteromorph, x120, paratype GSC 58057, GSC loc. C-051412.
- 34-36. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, paratype GSC 58058, GSC loc. C-051412.
- 37-39. Dorsal, side, and ventral views of sinistrally coiled, microspheric heteromorph, x120, holotype GSC 58055, GSC loc. C-051412.

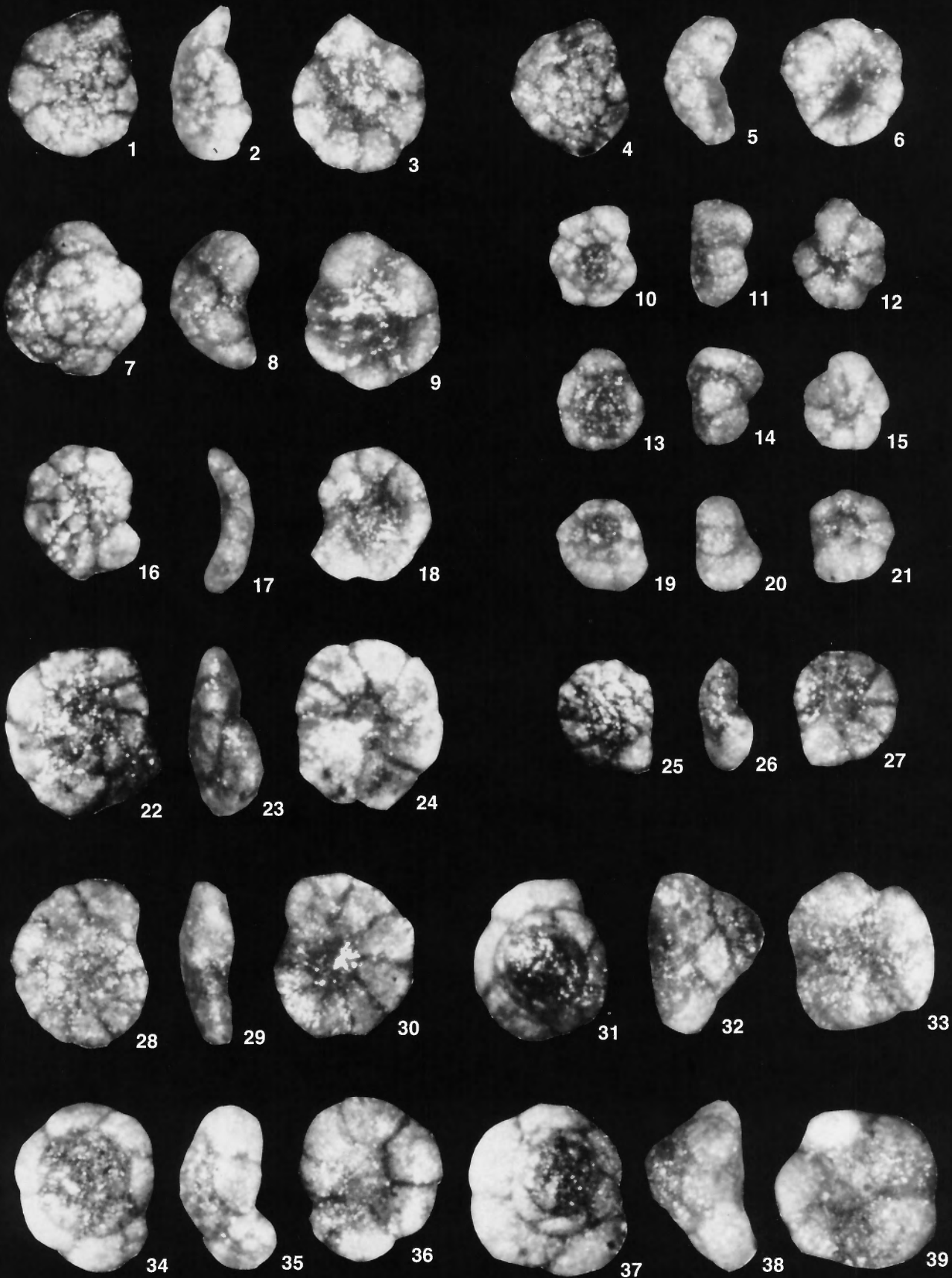


PLATE 21

Figures 1–9. *Verneuilinoides graciosus* Kosyreva

1. Side view, x120, hypotype GSC 58090, GSC loc. C-051309.
2. Side view, x120, hypotype GSC 58089, GSC loc. C-051309.
3. Side view, x120, hypotype GSC 58101, GSC loc. C-051328.
- 4, 5. Side views, x120, hypotype GSC 58099, GSC loc. C-051326.
6. Side view, x120, hypotype GSC 58100, GSC loc. C-051326.
7. Side view, x120, hypotype GSC 58093, GSC loc. C-051309.
8. Side view, x120, hypotype GSC 58094, GSC loc. C-051321.
9. Side view, x120, hypotype GSC 58095, GSC loc. C-051321.

Figures 10–12. *Verneuilinoides postgraciosus* Kommisarenko

10. Side view, x120, hypotype GSC 58109, GSC loc. C-051327.
11. Side view, x120, hypotype GSC 58108, GSC loc. C-051327.
12. Side view, x120, hypotype GSC 58107, GSC loc. C-051327.

Figures 13–18. *Verneuilinoides infrequens* n. sp.

- 13, 14. Side views, x120, holotype GSC 58112, GSC loc. C-051404.
- 15, 16. Side views, x120, paratype GSC 58113, GSC loc. C-051404.
- 17, 18. Side views, x120, paratype GSC 58114, GSC loc. C-051404.

Figures 19–21. *Verneuilina anglica* Cushman

19. Side view, x120, hypotype GSC 58074, GSC loc. C-051381.
20. Side view, x120, hypotype GSC 58077, GSC loc. C-051383.
21. Side view, x120, hypotype GSC 58082, GSC loc. C-051383.

Figures 22–26. *Verneuilina krekei* n. sp.

22. Side view, x120, holotype GSC 58083, GSC loc. C-051404.
- 23, 24. Side views, x120, paratype GSC 58084, GSC loc. C-051404.
- 25, 26. Side views, x120, paratype GSC 58086, GSC loc. C-051404.

Figures 27–30. *Eomarssonella pollocki* n. sp.

- 27, 28. Side views of uncoated and coated adult specimen, x120, holotype GSC 58120, GSC loc. C-051404. Note the triserial chamber arrangement in the ultimate whorl and the sharply pointed apex of the test.
- 29, 30. Side views of juvenile specimen, x120, paratype GSC 58121, GSC loc. C-051404.

Figures 31–35. *Orientalia loucheuxi* n. sp.

31. Side view, x120, holotype GSC 58145, GSC loc. C-051404. Note overall similarity in test design to *Eomarssonella pollocki* n. sp. (figs. 27–30, above) except for the quadriserial arrangement of the ultimate whorl.
32. Side view, x120, paratype GSC 58149, GSC loc. C-051404.
33. Side view, x120, paratype GSC 58147, GSC loc. C-051404.
34. Side view, x120, paratype GSC 58146, GSC loc. C-051404.
35. Side view, x120, paratype GSC 58148, GSC loc. C-051404.

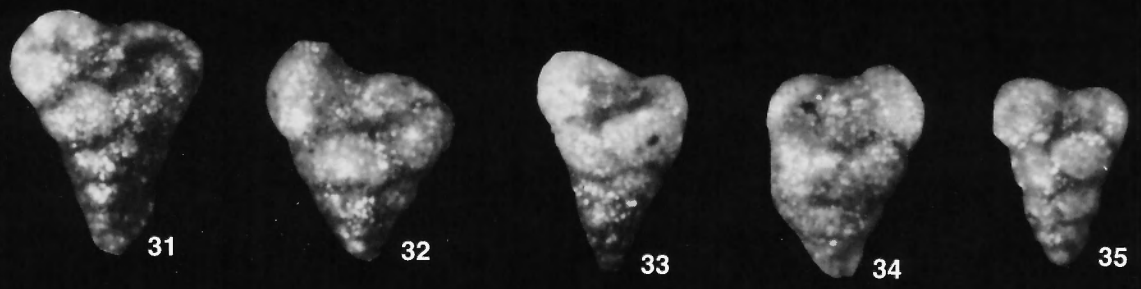
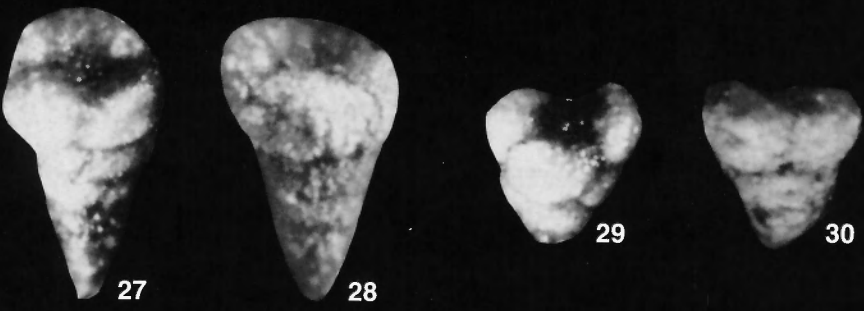
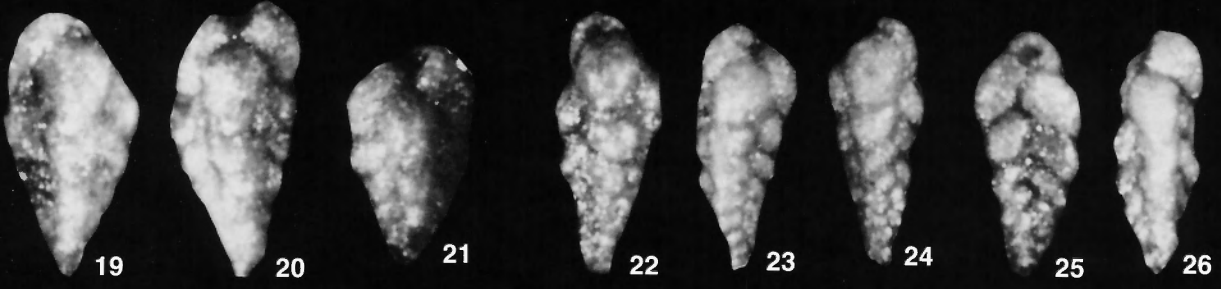
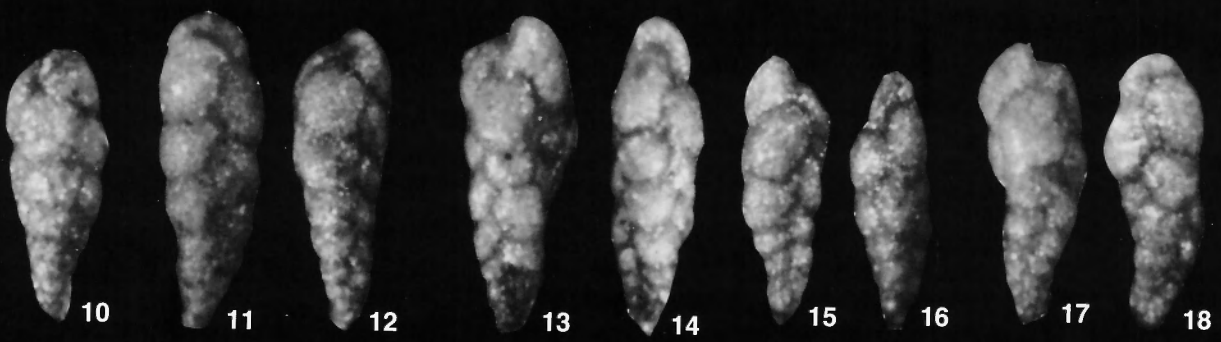
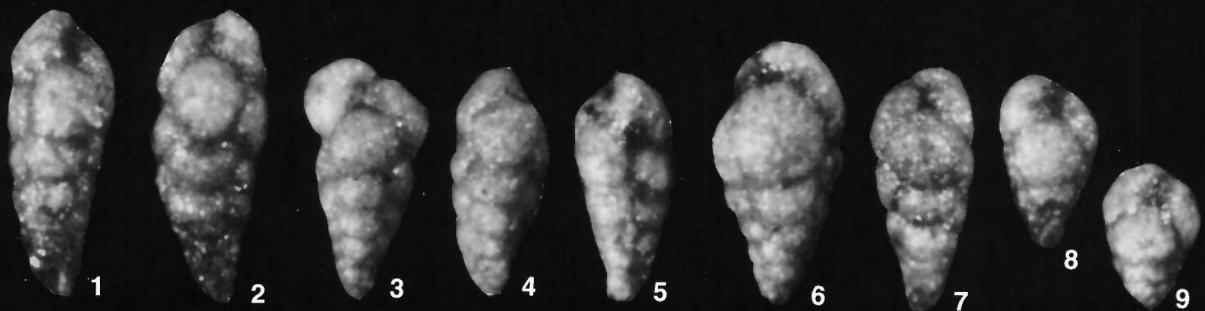


PLATE 22

Figures 1-5. *Eomarssonella paraconica* Levina

- 1, 2. Side views of adult specimen, x120, hypotype GSC 58117, GSC loc. C-051383.
3. Side view, x120, hypotype GSC 58119, GSC loc. C-051383.
- 4, 5. Side views, x120, hypotype GSC 58118, GSC loc. C-051383.

Figures 6-9. *Orientalia norrisi* n. sp.

6. Side view, x120, holotype GSC 58125, GSC loc. C-051383.
7. Side view, x120, paratype GSC 58126, GSC loc. C-051383.
8. Side view, x120, paratype GSC 58139, GSC loc. C-051383.
9. Side view, x120, paratype GSC 58140, GSC loc. C-051383.

Figures 10-12. *Orientalia* sp. cf. *O. norrisi* n. sp.

10. Side view, x120, figured specimen GSC 58131, GSC loc. C-051379.
- 11, 12. Side views, x120 figured specimen GSC 58133, GSC loc. C-051379.

Figures 13-17. *Eoguttulina* sp.

13. Side view, x40, figured specimen GSC 97948, GSC loc. C-051394.
- 14, 15. Side and peripheral views, x40, figured specimen GSC 97949, GSC loc. C-051394.
16. Side view, x40, figured specimen GSC 97950, GSC loc. C-051394.
17. Side view, x40, figured specimen GSC 97951, GSC loc. C-051394.

Figures 18-21. *Globulina* sp. cf. *G. alexandrae* Dain

18. Side view, x40, figured specimen GSC 97954, GSC loc. C-051331.
19. Side view, x40, figured specimen GSC 97955, GSC loc. C-051331.
20. Side view, x40, figured specimen GSC 97956, GSC loc. C-051331.
21. Side view, x40, figured specimen GSC 97957, GSC loc. C-051331.

Figures 22-26. *Astacolus* sp. cf. *A. praesibirensis* Kosyрева

- 22-24. Opposite side views, x40, figured specimen GSC 58152, GSC loc. C-051339.
- 25, 26. Opposite side views, x40, figured specimen GSC 58154, GSC loc. C-051339.

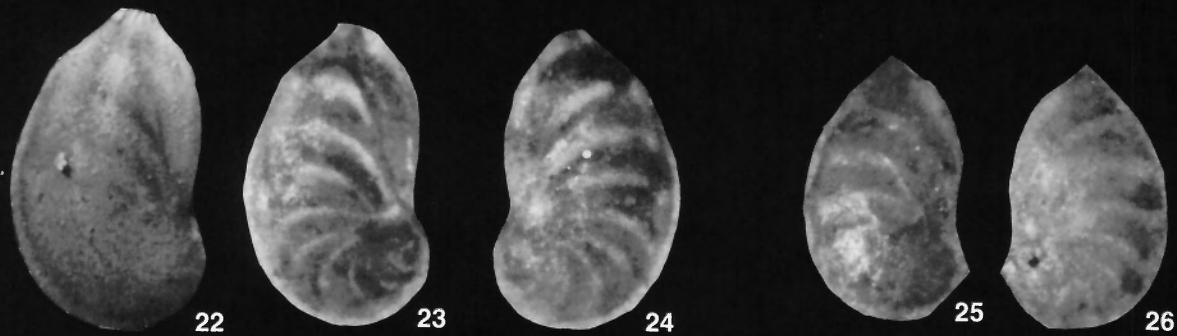
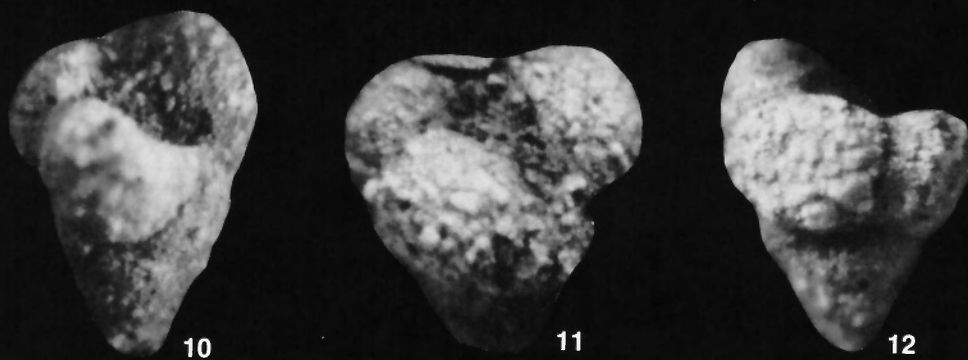
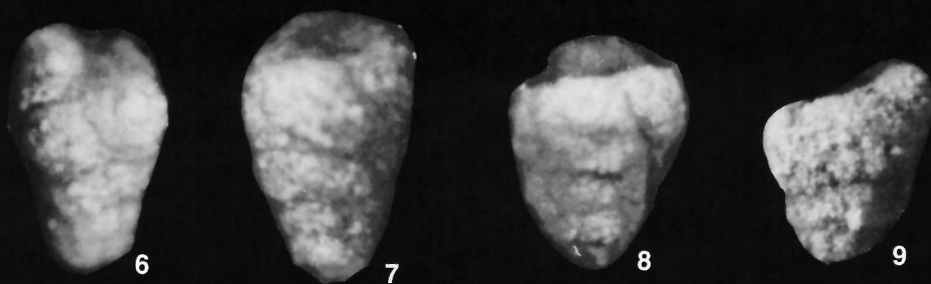


PLATE 23

Figures 1–6. *Astacolus* sp. A

- 1, 2. Side views in plane and transmitted light, x40, figured specimen GSC 58157, GSC loc. C-051382.
- 3, 4. Side views in plane and transmitted light, x40, figured specimen GSC 58156, GSC loc. C-051382.
- 5, 6. Opposite side views in plane and transmitted light, x40, figured specimen GSC 58158, GSC loc. C-051382.

Figures 7–10. *Astacolus* sp. B

- 7, 8. Side views in plane and transmitted light, x40, figured specimen GSC 58162, GSC loc. C-051334.
- 9, 10. Side views in plane and transmitted light, x40, figured specimen GSC 58163, GSC loc. C-051331.

Figures 11–14. *Vaginulinopsis* sp. B

- 11, 12. Opposite side views, x40, figured specimen GSC 58462, GSC loc. C-051394.
- 13, 14. Opposite side views, x40, figured specimen GSC 58463, GSC loc. C-051394.

Figures 15–18. *Vaginulinopsis* sp. A

- 15, 16. Opposite side views of (incomplete) adult specimen, x40, figured specimen GSC 58456, GSC loc. C-051376.
- 17, 18. Opposite side views of (incomplete) adult specimen, x40, GSC 58457, GSC loc. C-051376.

Figures 19–23. *Vaginulinopsis* sp. cf. *V. enodis* Loeblich and Tappan

- 19, 20. Side views, x40, figured specimen GSC 58453, GSC loc. C-051394.
- 21, 22. Opposite side views, x40, figured specimen GSC 58452, GSC loc. C-051394.
23. Side view, x40, figured specimen GSC 58454, GSC loc. C-051394.

Figures 24–27. *Saracenaria minima* n. sp.

- 24, 25. Side and peripheral views of typical adult specimen, x40, holotype GSC 58440, GSC loc. C-051394.
26. Side view, x40, paratype GSC 58443, GSC loc. C-051393.
27. Side view, x40, paratype GSC 58444, GSC loc. C-051393.

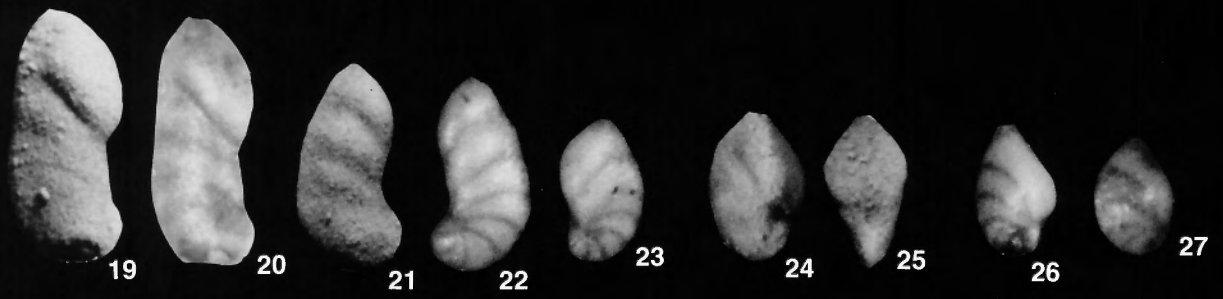
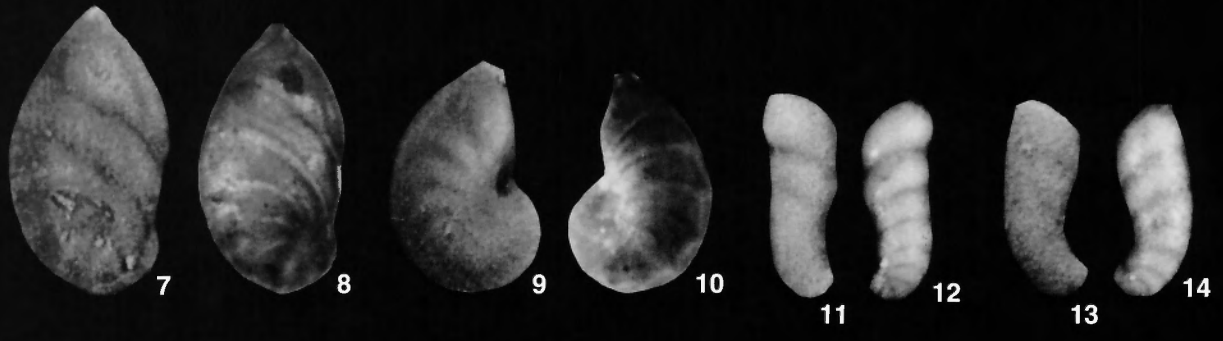


PLATE 24

Figures 1-9. *Saracenaria* sp. cf. *S. cypha* Loeblich and Tappan

- 1, 2. Side and peripheral views, x40, figured specimen GSC 58431, GSC loc. C-051392.
3. Side view, x40, figured specimen GSC 58429, GSC loc. C-051392.
4. Side view, x40, figured specimen GSC 58430, GSC loc. C-051392.
5. Side view, x40, figured specimen GSC 58433, GSC loc. C-051392.
- 6, 7. Side and peripheral views, x40, figured specimen GSC 58434, GSC loc. C-051386.
- 8, 9. Side and peripheral views, x40, figured specimen GSC 58435, GSC loc. C-051386.

Figures 10, 11. *Saracenaria phaedra* Tappan

- Opposite side views, x120, hypotype GSC 58427, GSC loc. C-051334.

Figures 12-16. *Planularia* sp. cf. *P. fraasi* (Schwager)

- 12, 13. Opposite side views of a large variant in which the penultimate and ultimate chambers do not reach back to the coiled portion, x40, figured specimen GSC 58405, GSC loc. C-051387.
14. Side view, x40, figured specimen GSC 58402, GSC loc. C-051394.
15. Side view, x40, figured specimen GSC 58403, GSC loc. C-051394.
16. Side view, x40, figured specimen GSC 58404, GSC loc. C-051394.

Figures 17-23. *Citharina callomoni* n. sp.

- 17-19. Opposite side and peripheral views of complete juvenile specimen, x40, holotype GSC 58164, GSC loc. C-051331.
- 20, 21. Opposite side views of broken adult specimen, x40, paratype GSC 58165, GSC loc. C-051331.
- 22, 23. Opposite side views of broken adult specimen, x40, paratype GSC 58166, GSC loc. C-051331.

Figures 24-29. *Citharina* sp. A

- 24, 25. Opposite side views, x120, figured specimen GSC 58169, GSC loc. C-051334.
- 26, 27. Opposite side views of juvenile specimen, x120, figured specimen GSC 58170, GSC loc. C-051330.
- 28, 29. Opposite side views of juvenile specimen, x120, figured specimen GSC 58171, GSC loc. C-051330.

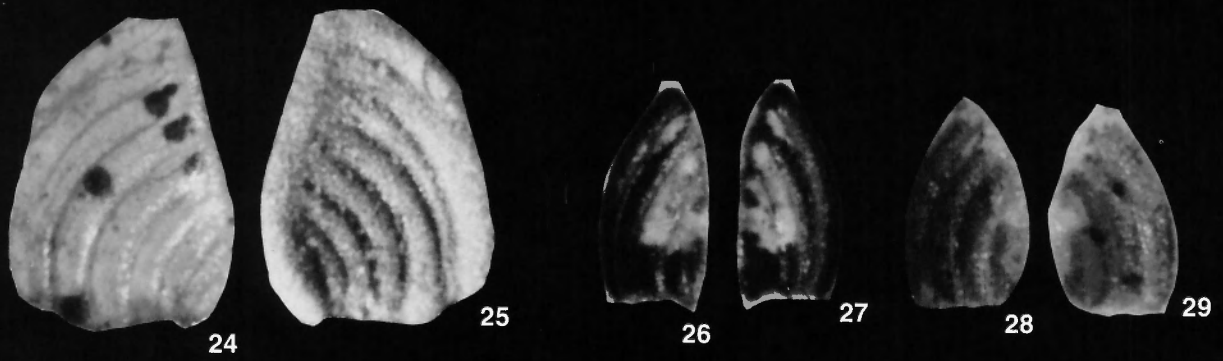
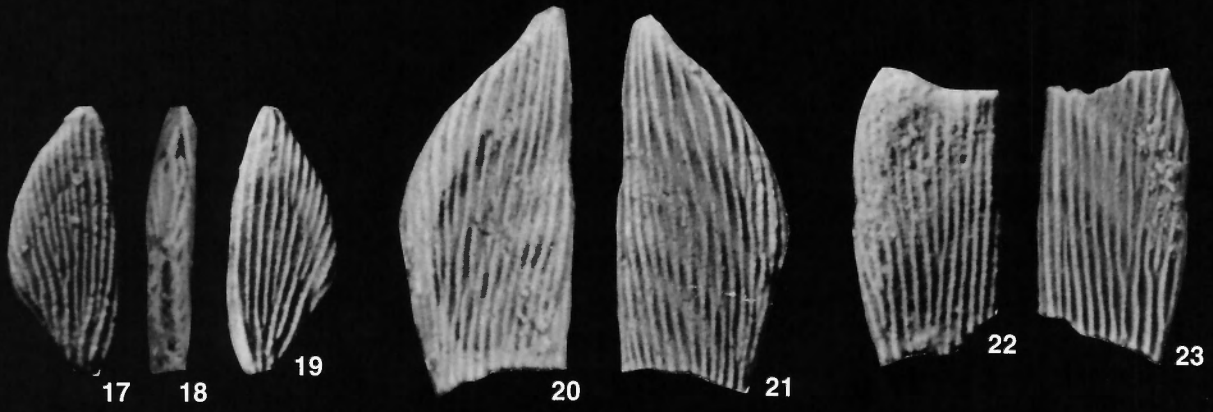
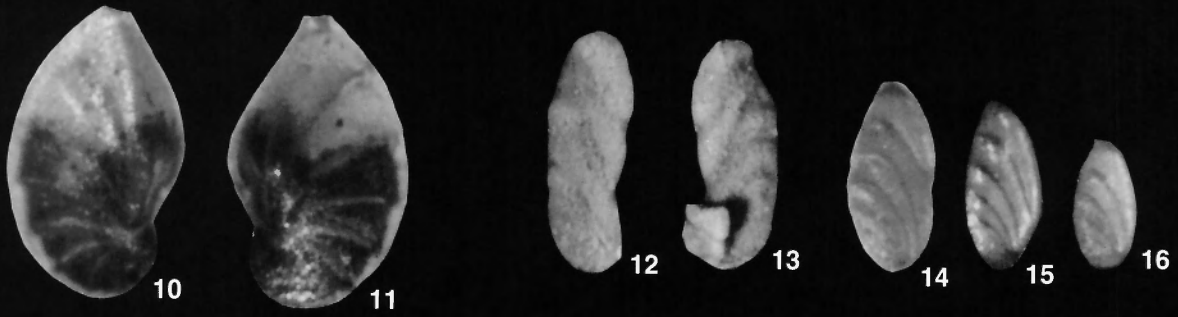
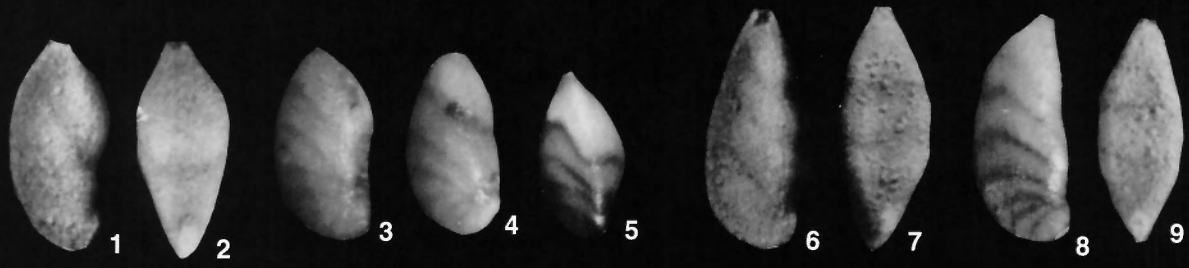


PLATE 25

Figures 1-5. *Lenticulina gerkei* Dain

- 1, 2. Side views in reflected light showing the marked inflation of the ultimate chamber, which is characteristic of this species, x120, hypotype GSC 58201, GSC loc. C-051334.
- 3, 4. Opposite side views of variant with *Darbyella*-like mode of coiling, x40, hypotype GSC 58198, GSC loc. C-051330.
5. Side view, x40, hypotype GSC 58202, GSC loc. C-051334.

Figures 6-8. *Lenticulina* sp. cf. *L. audax* Loeblich and Tappan

- 6, 7. Opposite side views, x40, figured specimen GSC 58203, GSC loc. C-051331.
8. Side view, x40, figured specimen GSC 58204, GSC loc. C-051331.

Figures 9-14. *Lenticulina* sp. A

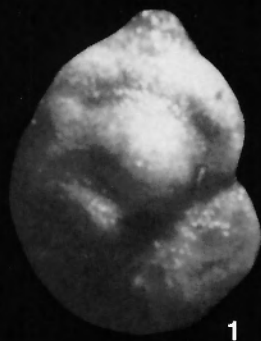
- 9-12. Opposite side and peripheral views, x40, figured specimen GSC 58218, GSC loc. C-051334.
- 13, 14. Opposite side views of uncoiling variant, x40, figured specimen GSC 58221, GSC loc. C-051331.

Figures 15-19. *Lenticulina* sp. B

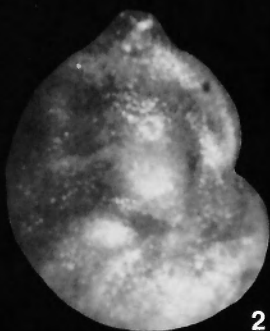
- 15-17. Opposite side and peripheral views of slightly crushed specimen, x40, figured specimen GSC 58224, GSC loc. C-051394.
- 18, 19. Side and peripheral views, x40, figured specimen GSC 58223, GSC loc. C-051394.

Figures 20-23. *Lenticulina* sp. cf. *L. lauta* Dain

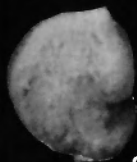
- 20, 21. Opposite side views of fragmentary specimen, x40, figured specimen GSC 58213, GSC loc. C-051331.
22. Side view, x40, figured specimen GSC 58211, GSC loc. C-051331.
23. Side view, x40, figured specimen GSC 58209, GSC loc. C-051331.



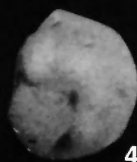
1



2



3



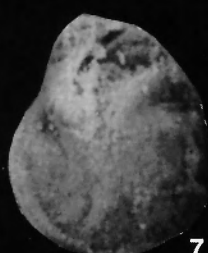
4



5



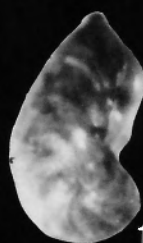
6



7



8



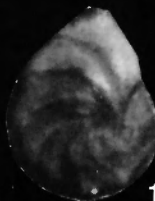
13



14



9



10



11



12



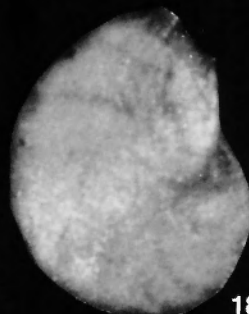
15



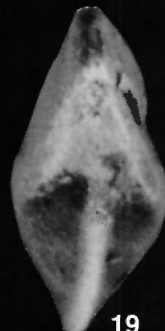
16



17



18



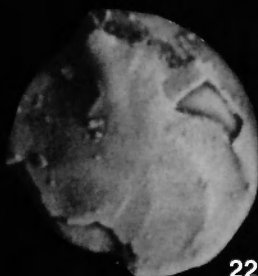
19



20



21



22



23

PLATE 26

Figures 1–6. *Pseudonodosaria statuta* n. sp.

- 1, 2. Side views of an unusually large adult specimen, x40, paratype GSC 58422, GSC loc. C-051394.
- 3, 4. Side views, x40, holotype GSC 58417, GSC loc. C-051392.
5. Side view, x40, paratype GSC 58418, GSC loc. C-051392.
6. Side view, x40, paratype GSC 58419, GSC loc. C-051392.

Figures 7, 8. *Nodosaria* sp. A

7. Side view, x40, figured specimen GSC 58398, GSC loc. C-051331.
8. Side view, x40, figured specimen GSC 58396, GSC loc. C-051330.

Figures 9, 10. *Pseudonodosaria brandi* (Tappan)

9. Side view, x40, hypotype GSC 58406, GSC loc. C-051333.
10. Side view, x40, hypotype GSC 58407, GSC loc. C-051333.

Figures 11, 12. *Pseudonodosaria* sp. B

11. Side view, x40, figured specimen GSC 58416, GSC loc. C-051330.
12. Side view, x40, figured specimen GSC 58415, GSC loc. C-051390.

Figures 13, 32. *Dentalina* sp. cf. *D. ejuncida* Loeblich and Tappan

13. Side view, x120, figured specimen GSC 58176, GSC loc. C-051330.
32. Side view, x120, figured specimen GSC 58174, GSC loc. C-051333.

Figures 14–16. *Dentalina* sp. A

- 14, 15. Side and peripheral views, x40, figured specimen GSC 58177, GSC loc. C-051330.
16. Side view, x40, figured specimen GSC 58178, GSC loc. C-051330.

Figures 17, 18. *Dentalina* sp. C

Side views, x40, figured specimen GSC 58506, GSC loc. C-051332.

Figure 19. *Dentalina* sp. D

Side view, x40, figured specimen GSC 58509, GSC loc. C-051394.

Figures 20, 21. *Dentalina* sp. B

20. Side view, x40, figured specimen GSC 58179, GSC loc. C-051330.
21. Side view, x40, figured specimen GSC 58180, GSC loc. C-051330.

Figures 22, 23. *Dentalina* sp. E

Side and peripheral views, x40, figured specimen GSC 58189, GSC loc. C-051334.

Figures 24–29. *Dentalina vulgata* n. sp.

- 24, 25. Side views, x40, holotype GSC 58183, GSC loc. C-051334.
26. Side view, x40, paratype GSC 58187, GSC loc. C-051330.
- 27–29. Opposite side and peripheral views of a juvenile specimen, x40, paratype GSC 58184, GSC loc. C-051333.

Figures 30, 31. *Marginulina* sp. cf. *M. breviformis* (Terquem and Berthelin)

30. Side view, x40, figured specimen GSC 58368, GSC loc. C-051334.
31. Side view, x40, figured specimen GSC 58369, GSC loc. C-051334.

Figures 33–40. *Marginulinopsis rjavkinoensis* (Kosyрева)

- 33, 34. Opposite side views, x40, hypotype GSC 58381, GSC loc. C-051394.
35. Side view, x40, hypotype GSC 58380, GSC loc. C-051394.
36. Side view, x40, hypotype GSC 58376, GSC loc. C-051390.
- 37, 38. Opposite side views, x40, hypotype GSC 58371, GSC loc. C-051387.
- 39, 40. Opposite side views, x40, hypotype GSC 58378, GSC loc. C-051392.

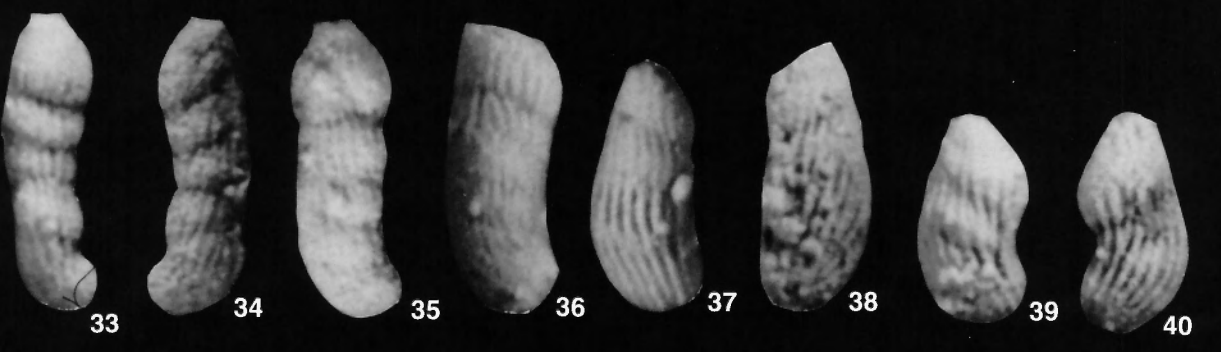
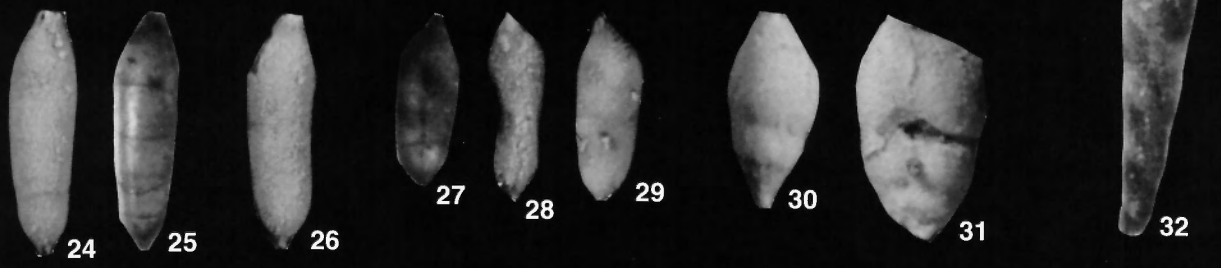
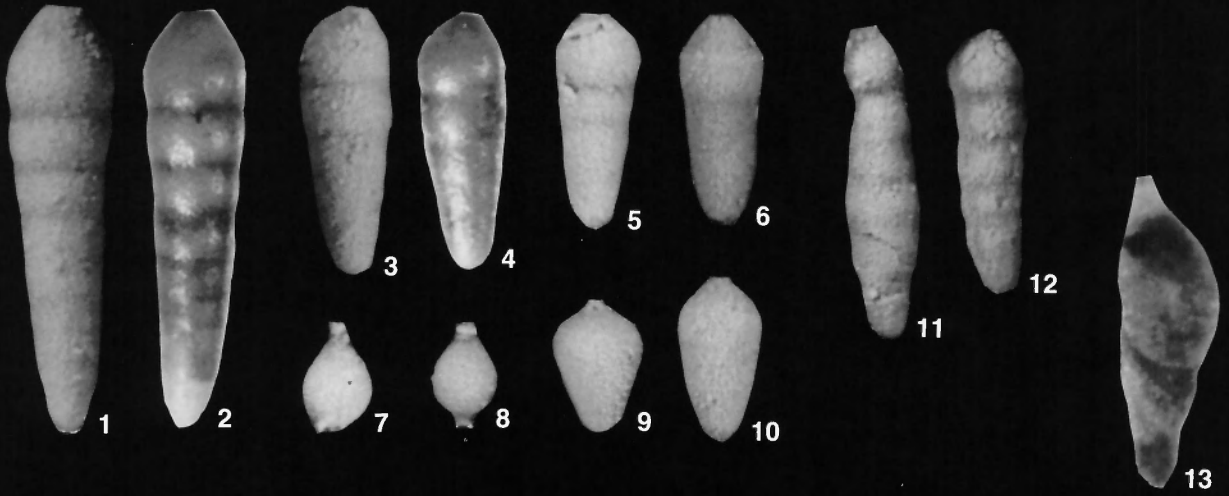


PLATE 27

Figure 1. *Spirillina?* sp. A

Side view, x40, figured specimen GSC 58497, GSC loc. C-051382.

Figures 2, 3. *Spirillina?* sp. B

2. Side view of pyrite cast, x40, figured specimen GSC 58498, GSC loc. C-051391.

3. Side view of pyrite cast, x40, figured specimen GSC 58499, GSC loc. C-051389.

Figures 4–6. *Marginulina brevis* Paalzow

4, 5. Opposite side views, x120, hypotype GSC 58365, GSC loc. C-051331.

6. Side view, x120, hypotype GSC 58366, GSC loc. C-051332.

Figures 7, 8. *Tristix?* sp.

7. Side view of adult specimen, x120, figured specimen GSC 58467, GSC loc. C-051386.

8. Side view of juvenile specimen, x120, figured specimen GSC 58468, GSC loc. C-051393.

Figure 9. *Tristix* sp. cf. *T. inornata* Loeblich and Tappan

Side view, x120, figured specimen GSC 58466, GSC loc. C-051392.

Figures 10, 11. *Pseudonodosaria* sp. cf. *P. quinquecostata* Bornemann

Side and peripheral views, x120, figured specimen GSC 58412, GSC loc. C-051334.

Figures 12, 13. *Frondicularia?* sp.

Side and peripheral views, x120, figured specimen GSC 58195, GSC loc. C-029131.

Figures 14–16. *Grillina praenodulosa* (Dain)

14, 15. Apertural and side views of small adult specimen, x40, hypotype GSC 58191, GSC loc. C-051330.

16. Side view, x40, hypotype GSC 58192, GSC loc. C-051330.

Figure 17. *Nodosaria* sp. B

Side view of incomplete (?) adult specimen, x40, figured specimen GSC 58399, GSC loc. C-051336.

Figures 18–20. *Pseudonodosaria* sp. A

18, 20. Apertural and side views, x40, figured specimen GSC 58413, GSC loc. C-051330.

19. Side view, x40, figured specimen GSC 58414, GSC loc. C-051330.

Figures 21, 22. *Nodosaria orthostoecha* Loeblich and Tappan

21. Side view, x120, hypotype GSC 58390, GSC loc. C-051330.

22. Side view of juvenile specimen, x120, hypotype GSC 58391, GSC loc. C-051330.

Figure 23. *Nodosaria* sp. cf. *N. amphigya* Loeblich and Tappan

Side view, x120, figured specimen GSC 58394, GSC loc. C-051336.

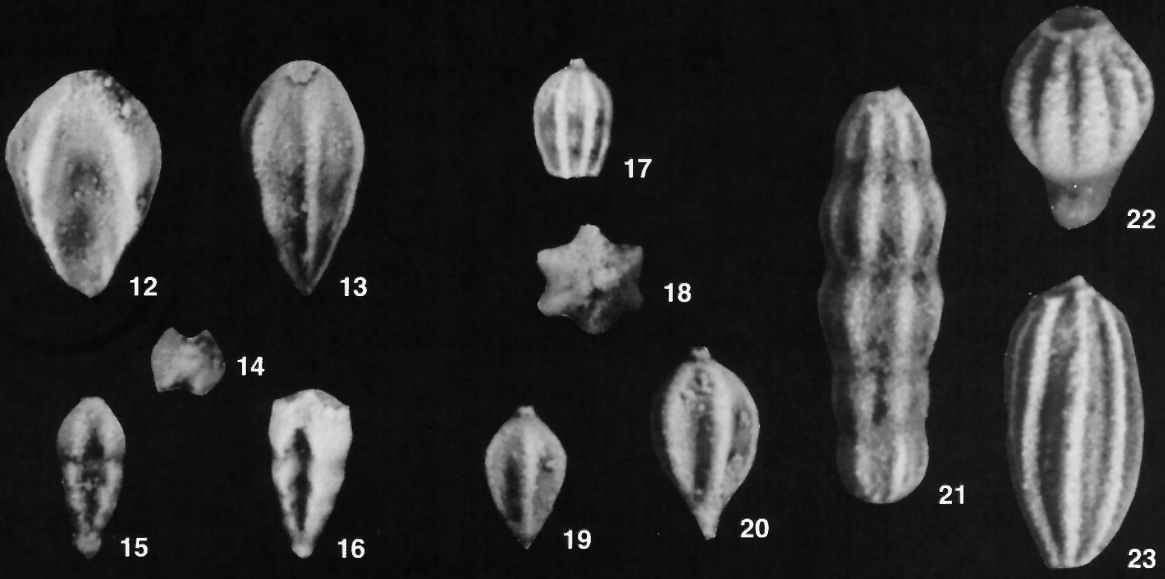


PLATE 28

Figures 1-8. *Pseudolamarckina liapinensis* Dain

- 1-3. Dorsal, side, and ventral views of completely pyritized adult specimen, x120, hypotype GSC 58485, GSC loc. C-051391.
- 4-6. Dorsal, side, and ventral views of completely pyritized, slightly damaged specimen, x120, hypotype GSC 58486, GSC loc. C-051391.
- 7, 8. Dorsal and ventral views of completely pyritized specimen, x120, hypotype GSC 58488, GSC loc. C-051394.

Figures 9-16. *Ceratocancris ambitiosus* Dain

- 9-11. Dorsal, side, and ventral views of adult specimen, x120, hypotype GSC 58469, GSC loc. C-051327.
- 12-14. Dorsal, side, and ventral views, x120, hypotype GSC 58473, GSC loc. C-051331.
- 15, 16. Dorsal and ventral views, x120, hypotype GSC 58470, GSC loc. C-051327.

Figures 17-24. *Conorboides brauni* n. sp.

- 17, 21. Dorsal and side views, x120, holotype GSC 58477, GSC loc. C-051331.
- 18-20. Dorsal, side, and ventral views, x120, paratype GSC 58478, GSC loc. C-051331.
- 22-24. Dorsal, side, and ventral views, x120, paratype GSC 58479, GSC loc. C-051331.

