GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA

MC82
.8C21d
255c4

This document was produced
by scanning the original publication.

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

BULLETIN 255

AN ATLAS OF MICROFACIES IN CARBONIFEROUS CARBONATES OF THE CANADIAN CORDILLERA

LIBRARY / BIBLIOTHÈQUE
FEB 13 1979
GEOLOGICAL SURVEY
COMMISSION GÉOLOGIQUE

Bernard L. Mamet

BIBLIOTHÈQUE
PUBLICATIONS DU QUÉBEC
12 JAN 1977
UNIVERSITÉ LAVAL

1976

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

AN ATLAS OF MICROFACIES IN CARBONIFEROUS CARBONATES OF THE CANADIAN CORDILLERA



GEOLOGICAL SURVEY
BULLETIN 255

AN ATLAS OF MICROFACIES IN CARBONIFEROUS CARBONATES OF THE CANADIAN CORDILLERA

Bernard L. Mamet



© Crown Copyrights reserved

Available by mail from Information Canada, Ottawa,
from Geological Survey of Canada,
601 Booth St., Ottawa,

and at the following Canadian Government bookshops:

HALIFAX
1683 Barrington Street

MONTREAL
640 St. Catherine Street West

OTTAWA
171 Slater Street

TORONTO
221 Yonge Street

WINNIPEG
393 Portage Avenue

VANCOUVER
800 Granville Street

or through your bookseller

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

Price $10.00 Catalogue No. 42/255

Price subject to change without notice

Information Canada
Ottawa, 1975

Technical Editor
E. J. W. IRISH

Critical Readers
E. W. BAMBER
R. W. MACQUEEN

Editor
MARGUERITE RAFUSE

Text printed on Georgian offset smooth (brilliant white)
Set in Times Roman with
captions in News Gothic by
SOUTHAM • MURRAY

Artwork by CARTOGRAPHIC UNIT,
GSC, ISPG, CALGARY

Preface

The carbonate rocks of the Carboniferous of western Canada include a variety of facies, most of which are characterized by particular foraminiferal and algal assemblages. The study identifies and describes these assemblages and uses them to outline the biostratigraphic zonation and paleoenvironments of the Tournaisian to Moscovian (Mississippian to mid-Pennsylvanian) interval.

The depositional history of the Carboniferous rocks that today include a number of reservoirs of oil and gas is a matter of considerable importance in the search for natural resources in Canada. The present study provides a tool to assist in this important task.

D. J. McLAREN,
Director-General,
Geological Survey of Canada

OTTAWA, May 1975

Contents

	Page
Introduction	1
Acknowledgments	1
Locality index and distribution of plates and figures by locality	1
Locations of collecting localities	3
Stratigraphic Correlations	4
Southwestern Alberta	4
Northeastern British Columbia	4
Northwest Territories and northeastern British Columbia	4
Northwestern British Columbia	4
North-central British Columbia	4
West-central Yukon Territory	4
Northern Yukon Territory	6
List of figured formations	6
Environments	7
Basinal, euxinic environment	7
Basin margin environment	7
Toe of slope and foreslope environment	7
Pelmatozoan "bank" environment	7
Pelmatozoan and bryozoan "bank" environment	7
Fore-front of "banks"; open-shelf environment	7
Oolitic and algal bank environments; skeletal sands on edge of platform	7
Restricted shelf and lagoonal environment	7
Intertidal and supratidal environments	7
List of figured environments	8
Foraminiferal Realms	8
Phylogenetic development of foraminiferal families	8
List of figured families	9
Outline of a Zonation for the Carboniferous of the Canadian Cordillera	10
Distribution of illustrations by zones	11
Taxonomy	11
List of figured taxa	12
References	16

Illustrations

Plates 1–95. Microfossil and microfacies slides deposited in the type collection of the Geological Survey of Canada, Ottawa 19–131

Textfigure 1. Index map showing location of described localities 2

2. Stratigraphic correlation chart. Correlations with the Eurasian and North American standards 5

3. Phylogenic development of the families 9

AN ATLAS OF MICROFACIES IN CARBONIFEROUS CARBONATES OF THE CANADIAN CORDILLERA

Abstract

Ninety-five plates of typical foraminiferal and algal assemblages are presented for the "Exshaw," Banff, Pekisko, Shunda, Turner Valley, Livingstone, Mount Head, Etherington, Debolt, Peratrovich?, Nizi, Prophet, Besa River, Flett, Hart River, Ettrain, Alapah, and Wahoo Formations of the Canadian Cordillera (Alberta, British Columbia, Yukon Territory). Nineteen assemblage zones ranging from Tournaisian to Moscovian, and nine major carbonate-platform environments with twelve biotic assemblages are described and illustrated.

Résumé

Des assemblages les plus caractéristiques de Foraminifères et d'Algues sont réunis en quatre-vingt quinze planches décrivant les Formations "Exshaw," Banff, Pekisko, Shunda, Turner Valley, Livingstone, Mount Head, Etherington, Debolt, Peratrovich?, Nizi, Prophet, Besa River, Flett, Hart River, Ettrain, Alapah et Wahoo dans les Cordillères canadiennes (Alberta, Colombie-Britannique, Territoire du Yukon). Dix-neuf zones d'assemblage allant du Tournaisien au Moscovien, neuf environnements de plate-forme et douze assemblages de faciès sont reconnus et illustrés.

Introduction

This atlas illustrates the most characteristic microfacies of the lower part of the Carboniferous in the Canadian Cordillera. Integration of data derived from foraminifers, algae, calcispheres, and carbonate petrology permits recognition of a biostratigraphic zonal scheme and of nine major carbonate platform environments, both valid for the entire Cordillera. This study of Paleozoic sediments confirms that the separation of lithostratigraphy from biostratigraphy is an artificial approach, and that integration of information derived from paleontology and from sedimentology is necessary for correct reconstruction of past environments.

The 495 photographs reproduced in this atlas were selected from a collection of about 6,000. They are not quantitatively representative of the Carboniferous succession. Foraminiferal-algal coarse grainstones are more rewarding to the photographer than barren spiculites; hence, an over-representation of the first. Moreover it is tempting to illustrate the unusual or the uncommon; the extraordinary and unique assemblages of the Peratrovich fauna are more appealing than the dull, monotonous bryozoan-crinoidal limestones of the Livingstone Formation. However, the Peratrovich Formation is known only in scattered, small outcrops, whereas the Livingstone forms mountain chains. Such hindrances are inherent to all photographic atlases and should be kept in mind.

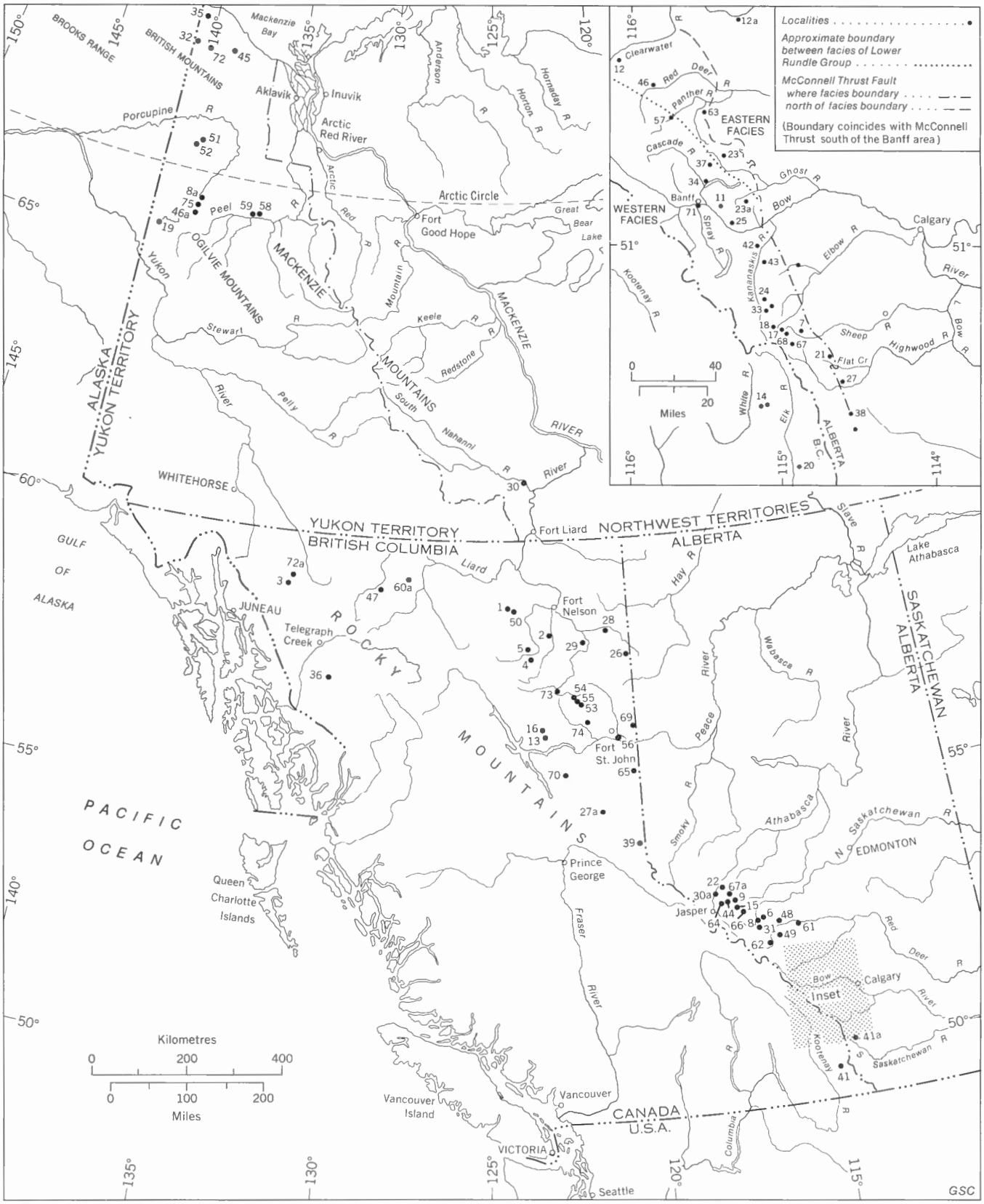
Acknowledgments

This report is based on the study of about 8,500 thin sections cut from 4,600 samples from about 200 carefully measured sections or cored wells. Many of the samples were collected initially for lithological studies or for macrofauna, but most of them yielded excellent microfauna. To gather such a wealth of information would have been impossible for a single geologist, as most outcrops are located in poorly accessible regions. Thus, the help and generosity of my Canadian colleagues E. W. Bamber, H. Gabrielse, R. W. Macqueen, D. Mason, J. W. H. Monger, S. J. Nelson, D. H. Oswald, A. A. Petryk, and R. M. Procter are gratefully acknowledged. The Geological Survey of Canada, Shell Canada Limited, Imperial Oil Limited, and Chevron Standard Limited loaned material. Joint work with A. K. Armstrong, J. T. Dutro, M. Gordon, W. J. Sando, B. Skipp, and D. Toomey enabled the establishment of a unified stratigraphic Carboniferous scheme for the entire American Cordillera.

Original MS. received: June 26, 1973
Approved for publication: May 1975

Locality Index and Distribution of Plates and Figures by Locality

1)	Alaska Highway, mile 380, B.C.	*see* North Tetsa River
2)	Altair *et al.* Tenaka d-82-L/94-J-2, B.C.	66/1, 72/2
3)	Atlin map-area, Nakina Lake, B.C.	80/1–4, 81/1–18
4)	Bat Creek waterfall, B.C.	82/2–4, 83/1, 85/6, 8, 9
5)	Besa River, B.C.	83/4
6)	Blackstone Gap, Alta.	7/4, 7
7)	Boulder Creek, Alta.	20/1–4, 24/1, 2, 40/1–4, 41/1, 2, 45/4
	Boundary Lake, B.C.	*see* Texaco NFA Boundary Lake
8)	Brazeau River, Alta.	9/1, 2, 14/5, 7, 8, 10, 11
8a)	Brown Anticline (= Cathedral Anticline), Yukon Territory	89/7
	Bush Mountain	*see* Triad BP Bush Mountain
9)	Cadomin, Alta.	15/4
10)	Canyon Creek, Alta.	9/4, 10/1, 2
11)	Carrot Creek, Alta.	18/1
12)	Clearwater River, Alta.	2/4, 5/2–4, 7/2, 5, 6, 13/3
12a)	Lower Clearwater River, Alta.	4/2
13)	Clearwater River (Nabesche River), B.C.	83/2, 3, 85/11–13
14)	Connor Lakes, B.C.	1/1–4, 19/2–4, 25/1–4, 26/1–4, 27/1–4, 28/1, 2, 37/1–4, 42/3, 5, 7, 43/1–3, 5, 44/1, 2, 7, 45/3, 6, 46/1, 2, 47/1–4, 48/1–3, 52/1, 2, 4
15)	Deception Creek, Alta.	6/3, 4, 12/4
16)	Ducette, B.C. (Nabesche River area)	72/1
17)	Elbow Lake, Alta.	29/1–4, 42/1, 48/4
18)	Elpoca Creek, Alta.	18/2, 3, 34/2–4, 35/1, 39/3, 42/2, 6, 8, 43/4, 7, 8, 45/5, 7–9, 52/3
19)	Ettrain and Jungle Creek, Yukon Territory	87/2, 3
20)	Ewin Creek, B.C.	38/2
21)	Flat Creek, Alta.	3/3, 44/5
22)	Folding Mountain, Alta.	13/1, 14/2, 4, 6, 9
	Fort St. John	*see* Pacific Fort St. John
23)	Ghost River, Alta.	12/2
23a)	Ghost River, south fork, Alta.	30/4, 38/1, 46/3, 4, 52/8
24)	Grizzly Creek, Alta.	23/1–4, 42/4, 43/9–11
25)	Grotto Creek, Alta.	21/3, 4, 22/1, 30/3
	Halfway	*see* West Nat. *et al.* Halfway
26)	H.B.-Imperial-Union Paddy (1) a-49-B/94-H-16	53/2, 62/1–4, 71/3
27)	Highwood Valley, Alta.	28/3, 4, 45/1
27a)	Hook Creek, B.C.	55/1–4
28)	Imperial Kahntah (1) b-29-C/94-I-7, B.C.	53/1, 56/1, 2, 61/1, 71/1, 2



TEXTFIGURE 1. Index map showing location of described localities

29)	Imperial Sikanni Chief (1) b-92-D/94-I-4, B.C.	58/1–4, 60/1–5, 11, 61/2–4
30)	Jackfish Gap, Yohin Ridge, District of Mackenzie	84/1–4, 85/1–5, 7, 10
30a)	Jasper Lake, Alta.	16/1–4, 17/1–7
31)	Job Creek, Alta.	8/4, 11/4, 12/1
32)	Joe Creek, Yukon Territory	95/3
	Kahntah	*see* Imperial Kahntah (1)
33)	King Creek, Alta.	31/1–4, 44/3, 6, 45/2, 49/1–4, 52/6
34)	Lake Minnewanka, Alta.	3/4, 18/4, 22/4
	Lily Lake	*see* West Canadian Lily Lake
35)	Malcolm River, Yukon Territory	94/4
36)	Mess Creek, B.C.	73/1–4, 74/1–8
37)	Mount Aylmer, Alta.	22/3, 38/4
38)	Mount Burke, Alta.	21/1
39)	Mount Hanington, B.C.	14/1, 3, 53/3, 4, 54/1–4, 59/1–4
40)	Mount Hood, Alta.	33/1
41)	Mount Hosmer, B.C.	50/4, 51/1, 2, 52/5
41a)	Mount Livingstone, Alta.	44/4
42)	Mount Lorette, Alta.	3/1, 2, 19/1, 24/3, 39/1, 2
43)	Mount McDougall, Alta.	32/1–4, 41/3, 4, 44/8, 52/7
44)	Mount Merlin, Alta.	9/3
45)	Mount Sedgwick, Yukon Territory	90/1–4, 91/1–4, 92/1, 2, 95/1, 2, 4, 5, 6, 9, 11, 12
46)	Mount Tyrrell, Alta.	4/1, 8/1, 2, 3, 11/2, 3, 12/3 15/2
	Nabesche River	*see* Clearwater River, locality 13
46a)	Nahoni Range, Ogilvie Mountains, Yukon Territory	89/1–6, 9
47)	Nizi Creek, B.C.	75/1–4, 76/1–4, 77/1–4, 79/1, 2, 4, 5
48)	Nordegg, Alta.	5/1, 6/2, 7/8
49)	North Ram Gap, Alta.	13/4
50)	North Tetsa River, B.C.	86/3, 88/5–17
51)	Old Crow, Yukon Territory	94/1–3
52)	Old Crow Lake, Yukon Territory	93/1–4, 95/7, 8, 10
53)	Pacific Highway (1) b-25-I/94-B-16, B.C.	64/1–4, 65/1–4, 72/6
54)	Pacific Highway (3) a-69-I/94-B-16, B.C.	63/1–4, 67/3, 4, 68/1
55)	Pacific Highway (2) a-47-I/94-B-16, B.C.	68/2, 3, 4, 71/4–6, 72/3, 4
56)	Pacific Fort St. John 43-8-20-83-18W6, B.C.	70/3
	Paddy	*see* Imperial–Union Paddy
57)	Panther River, Alta.	6/1, 39/4
58)	Peel River section 116 H I B, Yukon Territory	86/1, 2, 87/4, 88/20
59)	Peel River section 116 H I A and T 3, Yukon Territory	88/1–4, 18, 19, 21, 22, 89/8
	Phillips Ancona No. 1 8-27-39-11W5	*see* Red Deer, Alta.
60)	Plateau Mountain, Alta.	21/2
60a)	Rabbit River, McDame map-area, B.C.	82/1
61)	Red Deer, Alta. (Phillips Ancona No. 1 8-27-39-11W5)	2/1–3
62)	Sentinel Mountain, Alta.	13/2
63)	Sheep Creek, Alta.	15/1
	Sikanni Chief	*see* Imperial Sikanni Chief
64)	Sirdar Mountain, Alta.	10/3, 4, 11/1
65)	Sohio-Un. Prod. *et al.* Tupper Creek c-70-B/93-P-9, B.C.	56/3, 60/6–8, 10, 12–14, 16–19
66)	Southesk-Cairn, Alta.	15/3
67)	South Misty Range, Alta.	22/2, 24/4, 35/2–4, 36/1–4, 43/6, 50/1–3, 51/3, 4
67a)	Sphinx Creek, Nikanassin Range, Alta.	4/3, 4, 7/1, 3
68)	Storm Creek, Alta.	30/1, 2
	Tenaka	*see* Altair *et al.* Tenaka
69)	Texaco NFA Boundary Lake (1) 6-6-86-13W6, B.C.	56/4, 57/1–4, 60/9, 15, 70/4
70)	Triad BP Bush Mountain a-15-A/93-0-10, B.C.	66/2
71)	Tunnel Mountain, Alta.	33/2–4, 34/1, 38/3
72)	Trout Lake, Yukon Territory	92/3, 4
72a)	Tulsequah map-area, B.C.	78/1–4, 79/3, 6–8
	Tupper Creek	*see* Sohio-Un. Prod. *et al.* Tupper Creek
73)	West Canadian Lily Lake c-81-F/94-G-2, B.C.	66/3, 4, 67/1, 2, 69/3, 4, 72/8
74)	West Nat. *et al.* Halfway (3) 8-11-87-25W6, B.C.	69/1, 2, 70/1, 2, 72/5, 7
75)	Whitestone River, Yukon Territory	86/4, 87/1

Locations of Collecting Localities

Locality		Locality	
1	58°40′N; 124°23′W	30	61°06′N; 123°55′W
2	58°14′N; 122°53′W	30a	53°05′N; 118°02′W
3	59°04′N; 132°36′W	31	52°23′N; 116°43′W
4	57°47′N; 123°37′30″W	32	68°54′N; 140°52′W
5	57°56′30″N; 123°43′W	33	50°43′N; 115°06′W
6	52°36′N; 116°35′W	34	51°15′N; 115°28′W
7	50°37′N; 114°52′W	35	69°23′N; 140°35′W
8	52°32′N; 116°51′30″W	36	57°19′N; 130°49′W
8a	66°01′N; 138°50′W	37	51°20′N; 115°28′W
9	52°59′N; 117°20′W	38	50°17′N; 114°32′W
10	50°54′N; 114°53′W	39	54°10′30″N; 120°15′W
11	51°10′N; 115°23′W	40	50°44′N; 115°04′W
12	51°47′N; 116°04′W	41	49°38′N; 114°59′W
12a	51°58′N; 115°15′W	41a	≃50°08′30″N; 114°23′W
13	56°20′N; 123°15′W	42	50°59′N; 115°08′W
14	50°19′N; 115°05′W	43	50°55′N; 115°05′W
15	52°51′N; 117°21′W	44	52°57′N; 117°43′W
16	56°22′30″N; 123°15′W	45	68°51′N; 138°58′W
17	50°38′N; 115°00′W	46	51°40′N; 115°50′W
18	50°39′N; 115°04′W	46a	65°45′N; 139°03′30″W
19	65°23′N; 140°40′W	47	59°04′N; 129°02′W
20	50°04′N; 114°43′30″W	48	52°29′N; 116°04′W
21	50°30′N; 114°40′W	49	52°11′N; 116°12′W
22	53°14′30″N; 117°45′30″W	50	58°39′30″N; 124°22′W
23	51°22′N; 115°23′W	51	67°07′N; 139°10′W
23a	51°11′N; 115°14′W	52	66°59′N; 139°38′W
24	50°46′N; 115°07′W	53	56°56′N; 122°03′W
25	51°06′N; 115°19′W	54	56°58′N; 122°06′W
26	57°57′N; 120°13′30″W	55	55°57′N; 122°04′W
27	50°24′N; 114°37′W	56	56°13′N; 120°46′W
27a	54°48′N; 121°19′W	57	51°34′N; 115°43′W
28	58°16′N; 120°52′W	58	65°53′N; 136°07′W
29	58°05′N; 121°53′W		

continued

Locality		Locality	
59	65°53′N; 136°07′W	67a	53°04′30″N; 117°31′30″W
60	50°12′N; 114°32′W	68	50°37′N; 114°59′W
60a	59°11′N; 128°00′W	69	56°26′N; 120°01′W
61	52°24′N; 115°30′W	70	55°31′N; 122°34′W
62	52°05′N; 116°26′W	71	51°10′N; 115°33′W
63	51°35′N; 115°29′W	72	68°50′N; 140°00′W
64	52°54′N; 117°48′W	72a	58°59′45″N; 132°26′45″W
65	55°33′30″N; 120°15′W	73	57°09′N; 122°46′W
66	52°43′N; 117°12′W	74	56°31′30″N; 121°53′W
67	50°34′N; 114°56′W	75	65°49′N; 138°55′W

Stratigraphic Correlations

Southwestern Alberta
(Columns 1–4, Textfig. 2)

The Canadian Cordillera between Jasper and Crowsnest Pass (*see* Macauley *et al.*, 1964) is particularly well suited to biostratigraphic and lithostratigraphic investigations because of its continuous exposures for a distance of approximately 300 miles (483 km). Since the work of Douglas (1958), Moore (1958), and Nelson (1960, 1961), the region has become a standard reference area for Carboniferous stratigraphy (for a complete bibliography *see* Macqueen and Bamber, 1968a, 1968b). However, a slight diachronism in several stratigraphic units is observed from northwest to southeast, and facies changes render correlations difficult in some areas.

The microfauna at the top of the Banff Formation is very scarce throughout the region (Petryk *et al.*, 1970). The Pekisko Formation in the Moose Mountain and Banff–Clearwater River areas falls within the upper part of Zone 7 but, because of the appearance of a new oolitic unit at its top, it grades into Zone 8 to the northwest. The Shunda Formation at its type locality (Stearn, 1956) is of Late Tournaisian age (Oswald, 1968), as is the Shunda Formation of the Fort St. John region. The Shunda–Turner Valley contact is slightly diachronous near the Tournaisian–Viséan boundary. Because of dolomitization and recrystallization of the unit, the Turner Valley microfauna is poorly known. The Pekisko, Shunda, and Turner Valley Formations grade laterally into the poorly stratified pelmatozoan–bryozoan Livingstone bank facies. The Mount Head rhythmic sequence (Baril, Wileman, Salter, Loomis, Marston, and Carnarvon Members of Douglas, 1958) is well developed only in the southeast (Highwood Pass) and grades laterally toward the west into a pseudo-"Livingstone" sequence of mid-Viséan age (Macqueen and Bamber, 1968b). The Upper Viséan–Lower Namurian sequence (lower to upper Etherington Formation) appears to be isochronous and the Carnarvon/Etherington contact is at the $15/16_i$ boundary over the whole region (Mamet, 1968). This entire platform sequence grades to the west into a very thick miogeosynclinal sequence (Textfig. 1, loc. 14) which can be correlated roughly with the succession in the type area of the Livingstone and Mount Head Formations (Textfig. 1, locs. 21, 27; Mamet and Mason, 1968).

Northeastern British Columbia (Subsurface)
(Column 5, Textfig. 2)

The subsurface Carboniferous succession of the Fort St. John region is particularly well suited to foraminiferal correlations, which can be extended over more than 200 miles (322 km) from the northern part of the area [H.B.–Imperial–Union Paddy (1) 1-49-B/94-H-16, Imperial Kahntah (1) b-29-C/94-I-7, Altair *et al.* Tenaka d-82-L/94-J-2] to the south (Texaco NFA Boundary Lake (1) 6-6-86-13W6, Pacific Imperial Parkland 6-29-81-15W6). The Pekisko, Shunda, and Debolt Formations (Irish, 1963; Procter and Macauley, 1968) show little diachronism; the Pekisko Formation is consistently Middle Tournaisian, the Shunda Formation Late Tournaisian, the Lower Debolt Early to early Middle Viséan, and the Upper Debolt late Middle to early Late Viséan. Triassic, Permian, or Carboniferous sediments rest on the eroded Viséan succession. Reworked Viséan cherts of Zone 14 often are incorporated in these upper Paleozoic sediments.

Northwest Territories and Northeastern British Columbia
(Columns 6 and 7, Textfig. 2)

The Prophet Formation at its type locality (Sutherland, 1958) exhibits a lithostratigraphic and biostratigraphic succession similar to that observed in the Flett Formation; upper Osage to St. Louis age equivalents have been encountered. The underlying Besa River radiolarite (Sutherland, 1958; Kidd, 1963) yields no foraminiferal microfauna.

Northwestern British Columbia (Atlin Map-Area)
(Column 8, Textfig. 2)

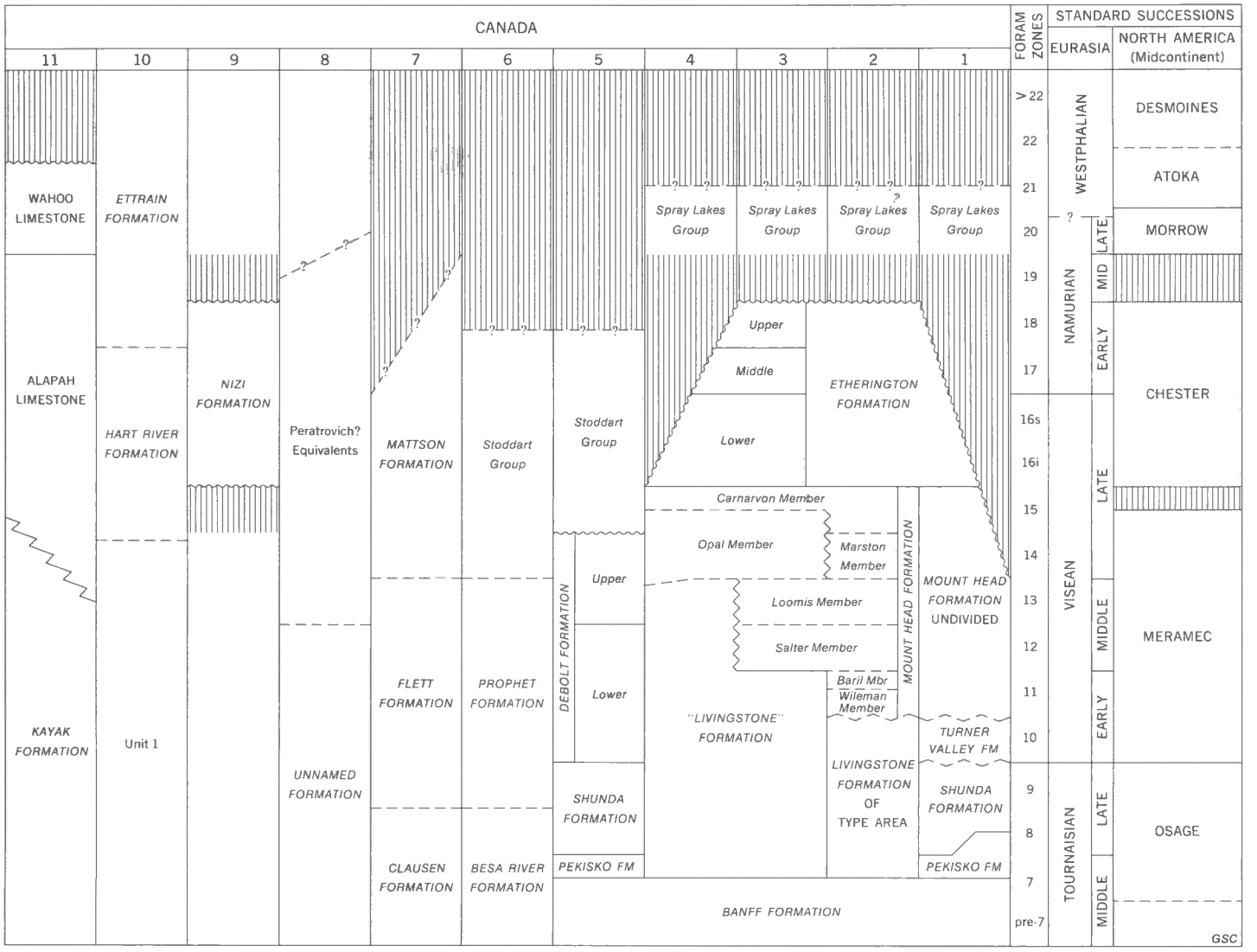
Scattered, discontinuous outcrops of Tournaisian, Viséan, and Namurian carbonates are known in the Atlin map-area. The fauna and facies are similar to those observed in the Peratrovich Formation of southern Alaska and contain abundant "American" elements accompanied by Tethyan taxa.

North–Central British Columbia
(Column 9, Textfig. 2)

The impure bryozoan–pelmatozoan packstone, wackestone, and mudstone of the Nizi Formation (Gabrielse, 1963) rest unconformably on Devonian strata and are of Late Viséan – Early Namurian age (Zones 16 to 18). This 1,600-foot (488 m) succession is similar in age to the Etherington Formation of southwestern Alberta (Mamet and Gabrielse, 1969).

West–Central Yukon Territory
(Column 10, Textfig. 2)

The Late Viséan – Early Namurian Hart River Formation generally has very unfavourable facies for foraminifers and algae (some *Neoarchaediscus* in Zone 16 and *Asteroarchaediscus* in Zone 17). The Ettrain microfacies are much richer and yield Zones 18, 19, 20, 21, 22, and >22 (Mamet and Ross *in* Bamber and Waterhouse, 1971).



TEXTFIGURE 2. Stratigraphic correlation chart. Correlations of Canadian successions with Eurasian and North American standards.

1–4) *Southwestern Alberta*

1) Banff-Jasper area, Alberta Rocky Mountains and Foothills (Banff, Pekisko, Shunda, Turner Valley Formations from the "eastern facies" of Macqueen and Bamber, 1968a).
2) Type area of Mount Head Formation and Front Ranges, Crowsnest Pass to Bow Valley (Banff Formation and lower Rundle Group columns 2, 3, and 4, belong to the "western facies" of Macqueen and Bamber, 1968a).
3) Western Front Ranges of Rocky Mountains, south and southwest of Banff (the "Livingstone" Formation includes equivalents of the lower two members of the Mount Head Formation in its type area).
4) Rocky Mountain Main Ranges and westernmost Front Ranges, area south and southeast of Banff ("Livingstone" Formation includes equivalents of the lower four members of the Mount Head Formation in its type area).

5) *Subsurface of northeastern British Columbia* (Fort St. John – Fort Nelson region).

6) *Cordilleran outcrops of northeastern British Columbia* (Peace River – Muskwa River region).

7) *Northwest Territories* (Jackfish River – Kotaneelee River region).

8) *Northwestern British Columbia* (Atlin map-area).

9) *North-central British Columbia* (Telegraph Creek map-area).

10) *West-central Yukon Territory* (Ogilvie Mountains and Peel River).

11) *Northern Yukon Territory* (British and Buckland Mountains).

Northern Yukon Territory
(Column 11, Textfig. 2)

Carbonates of Meramec to Atoka age, containing a rich foraminiferal fauna are known in the British and Buckland Mountains where they represent the lateral equivalents of the Endicott and Lisburne Groups of Alaska (Armstrong, Mamet, and Dutro, 1970; Armstrong and Mamet, 1970; Mamet and Armstrong, 1972). The microfacies of the Kayak Shale and the Alapah and Wahoo Limestones have been described in the Trout Lake – Trail River region by Mamet and Mason (1970) and at Joe Creek by Mamet and Ross (*in* Bamber and Waterhouse, 1971).

List of Figured Formations

Southwestern Alberta

Plate 1 "Exshaw" and Banff Formations
Plate 2 Banff Formation
Plate 3 Banff Formation
Plate 4 Lower Pekisko Formation
Plate 5 Upper Pekisko Formation
Plate 6 Upper Pekisko Formation
Plate 7 Pekisko microbiota
Plate 8 Lower Shunda Formation
Plate 9 Upper Shunda Formation
Plate 10 Upper Shunda Formation
Plate 11 Upper Shunda Formation
Plate 12 Upper Shunda Formation
Plate 13 Upper Shunda Formation
Plate 14 Shunda microbiota
Plate 15 Turner Valley Formation
Plate 16 Turner Valley Formation
Plate 17 Turner Valley microbiota
Plate 18 Livingstone Formation
Plate 19 Livingstone Formation
Plate 20 Mount Head Formation; Wileman and Baril Members
Plate 21 Mount Head Formation; Baril and Salter Members
Plate 22 Mount Head Formation; Salter Member
Plate 23 Mount Head Formation; Salter Member
Plate 24 Mount Head Formation; Loomis Member
Plate 25 Middle Mount Head Formation (undifferentiated)
Plate 26 Middle Mount Head Formation (undifferentiated)
Plate 27 Middle Mount Head Formation (undifferentiated)
Plate 28 Middle Mount Head Formation (undifferentiated)
Plate 29 Mount Head Formation; Opal Member
Plate 30 Mount Head Formation; Opal Member
Plate 31 Mount Head Formation; Opal Member
Plate 32 Mount Head Formation; Marston Member
Plate 33 Mount Head Formation; Opal Member
Plate 34 Mount Head Formation; Opal Member
Plate 35 Mount Head Formation; Opal Member
Plate 36 Mount Head Formation; Opal Member
Plate 37 Mount Head Formation; Carnarvon Member
Plate 38 Mount Head Formation; Carnarvon Member
Plate 39 Mount Head Formation; Carnarvon Member
Plate 40 Mount Head Formation; Carnarvon Member
Plate 41 Mount Head Formation; Carnarvon Member
Plate 42 Mount Head microbiota
Plate 43 Mount Head microbiota
Plate 44 Mount Head microbiota
Plate 45 Mount Head microbiota
Plate 46 Etherington Formation (boundary beds)
Plate 47 Lower Etherington Formation
Plate 48 Lower Etherington Formation
Plate 49 Lower Etherington Formation
Plate 50 Lower and Middle Etherington Formation
Plate 51 Upper Etherington Formation
Plate 52 Etherington microbiota

Northeastern British Columbia

Plate 53 Banff Formation
Plate 54 Banff Formation
Plate 55 Banff Formation
Plate 56 Shunda Formation
Plate 57 Shunda Formation
Plate 58 Shunda Formation
Plate 59 Shunda Formation
Plate 60 Shunda microbiota
Plate 61 Lower Debolt Formation
Plate 62 Lower Debolt Formation
Plate 63 Lower Debolt Formation
Plate 64 Lower Debolt Formation
Plate 65 Lower Debolt Formation
Plate 66 Upper Debolt Formation
Plate 67 Upper Debolt Formation
Plate 68 Upper Debolt Formation
Plate 69 Upper Debolt Formation
Plate 70 Upper Debolt Formation
Plate 71 Debolt microbiota
Plate 72 Debolt microbiota

Northwestern and north–central British Columbia

Plate 73 Peratrovich? Formation
Plate 74 Peratrovich? microbiota
Plate 75 Nizi Formation
Plate 76 Nizi Formation
Plate 77 Nizi Formation
Plate 78 Unnamed formation, Atlin map-area
Plate 79 Nizi and unnamed formation (Atlin map-area) microbiota
Plate 80 Peratrovich? Formation
Plate 81 Peratrovich? microbiota

Northeastern British Columbia and Northwest Territories

Plate 82 Prophet Formation
Plate 83 Prophet and Besa River Formations
Plate 84 Flett Formation
Plate 85 Flett and Prophet microbiota

West-central Yukon Territory

Plate 86 Hart River and Ettrain Formations
Plate 87 Ettrain Formation
Plate 88 Unnamed formation and Ettrain microbiota
Plate 89 Ettrain microbiota

Northern Yukon Territory

Plate 90 Alapah Limestone
Plate 91 Alapah Limestone
Plate 92 Alapah Limestone
Plate 93 Ettrain Formation (Wahoo Limestone equivalent)
Plate 94 Ettrain Formation and Wahoo Limestone
Plate 95 Alapah and Ettrain microbiota

Environments

Nine major marine environments can be recognized in Lower Carboniferous carbonate sediments of the Canadian Cordillera and adjacent Interior Platform. The environments are described briefly here in approximate order of decreasing bathymetry. Owing to the complexity of sedimentary environments, rocks representing the nine environments given below do not necessarily occur in complete, orderly succession either laterally or vertically.

Basinal, Euxinic Environment

This environment is represented by silicified lime–mudstone and lime–wackestone (Dunham, 1962) as well as by thin-bedded phosphatic units, associated with dark grey to black, organic-rich pyritic shale and chert. The colour is commonly dark brown to black; bedding is thin; lamination is common. Burrowing is poorly developed, but many organic markings occur on bedding planes. Fauna is dominantly of pelagic origin, and consists of radiolarians, rare sponge spicules, and ammonoids; ostracodes also are present.

Basin Margin Environment

The dominant lithology of this environment consists of silicified, thin- to medium-bedded, medium to dark grey or brown lime–mudstone and lime–wackestone with minor shale and siltstone. Layered chert is common and nodular carbonate first occurs in the upper part of this sequence. Burrowing is rare to common; sponge spicules are very common; radiolarians are less common than in the basinal environment. Ammonoids and ostracodes also are present.

Toe of Slope and Foreslope Environment

The lithological succession in this environment is highly variable, comprising sedimentary breccias, exotic blocks, lime–packstone and lime–grainstone, all derived from the shelf edge upslope, and consisting of echinoderm skeletal sands. The first occurrence of algal pellets is found in this environment. The strata are medium grey or brown, and thin to thick bedded. *In situ* fossils include the first pelmatozoans, mainly crinoid and blastoid ossicles, and very rare echinoids. Sponge spicules are rare.

Pelmatozoan "Bank" Environment

This environment is represented by very thick bedded pelmatozoan lime–packstone and lime–grainstone. Beds are indistinct, light grey, and massive. Terrigenous clastics do not occur in the succession. *In situ* accumulation of pelmatozoan detritus is characteristic; pelmatozoan plates and ossicles show little or no signs of abrasion, mudcoating, or pitting. Sponge spicules are present only in nodular cherts. Brachiopods occur in pods or lenses.

Pelmatozoan and Bryozoan "Bank" Environment

Pelmatozoan–bryozoan lime–wackestone, packstone, and grainstone dominate this succession. They are very thick bedded, light grey, massive and resistant. Terrigenous clastics are lacking. Poorly developed crossbedding is present locally. Bryozoan fronds (mainly fenestellid) are mixed with pelmatozoan ossicles. Brachiopods occur in pods or lenses. Rare monocular foraminifers and Earlandiidae are first encountered in this facies.

Fore-Front of "Banks"; Open-Shelf Environment

This environment is characterized by a diversity of well-bedded to very well bedded, thin-bedded, light to dark grey or brown lime–mudstone, wackestone, packstone, and grainstone. Graded bedding and crossbedding are present. Evidence of burrowing is widespread. The following three faunal assemblages can be distinguished: (a) a pelmatozoan–bryozoan–brachiopod–gastropod assemblage with rare foraminifers (Earlandiidae and Endothyridae) and rare calcareous algae (Rhodophycophyta, Chlorophycophyta); (b) a pelmatozoan–bryozoan–brachiopod–gastropod assemblage with rare foraminifers (Earlandiidae and Endothyridae), associated with non-skeletal pellets, lumps and botryoidal, coated grains; (c) a pelmatozoan–bryozoan-brachiopod–gastropod–foraminifer–calcareous alga assemblage, associated with abundant non-skeletal pellets, lumps, and botryoidal, coated grains (algae are mostly Dasycladaceae).

Oolitic and Algal "Bank" Environments; Skeletal Sands on Edge of Platform

Poorly bedded, light to medium grey algal lime–boundstone, grading into oolitic lime–grainstone characterize this environment, which grades laterally into the fore-front bank or open-shelf environment. Crossbedding is common. Fossils are abundant; pelmatozoan, bryozoan, brachiopod, foraminifer, and dasyclad detritus is dominant. It is reworked, abraded, coated with micrite envelopes, mud-filled in part, and in part oolitized. Dasyclads and kamaenid algae form boundstones. Non-skeletal grains include lumps, oolites, and botryoidal coated grains.

Restricted Shelf and Lagoonal Environment

This environment is represented by lime-mudstone, wackestone, packstone, and their well-bedded, finely crystalline dolomite equivalents. Pelletoidal grains, oncolites, and algal birdseyes are present. Pelmatozoan detritus, kamaenid algae, gastropods, and calcispheres are abundant. Plurilocular foraminifers are rare and progressively less abundant in rocks representing environments with progressively more restricted circulation. Mats composed of blue-green algae (non-calcareous) and stromatolites are present near the intertidal zone, but rarely are encountered. Pods of spicular chert are present and should not be confused with basin margin spiculites.

Intertidal and Supratidal Environments

The dominant lithology in these environments consists of irregularly laminated microcrystalline dolomite and well-bedded dolomitic lime–mudstone. These are light grey or brown, and display well-developed sedimentary cycles. Chert and calcite pseudomorphs after anhydrite and/or gypsum also occur. Mats composed of blue-green algae, and stroma-

tolites are present as well as evaporite solution breccia; mud cracks and flat-pebble conglomerates are widespread. Fossils are very rare to absent; algae, calcispheres, ostracodes, and gastropods occur locally.

List of Figured Environments
(numbers indicate plates and figures)

Basinal, euxinic
1/1, 2, 82/2.

Basin margin
1/3, 4, 82/1, 83/4, 84/1.

Foreslope of pelmatozoan and bryozoan "banks"
3/1, 2, 4?, 19/2, 3, 53/1, 86/1, 2.

Pelmatozoan "banks"
3/3, 4/1, 18/2, 4.

Pelmatozoan and bryozoan "banks"
8/2, 18/1, 3.

Open shelf
2/1–4, 4/2, 3, 4, 6/1, 11/3, 12/3, 13/1–4, 15/1, 19/1?, 20/1–4, 21/1, 2, 22/1–4, 23/1–4, 24/1, 3, 4, 25/1, 26/2–4, 27/1–4, 28/1–3, 29/1–4, 30/1, 2, 4, 31/3, 32/1, 2, 33/1–4, 34/2, 35/1, 2, 37/1–4, 46/2–4, 47/1, 2, 48/1, 49/3, 4, 53/2, 3, 4, 54/1–4, 56/2, 57/1, 3, 4, 61/1–4, 62/1–4, 63/1–4, 64/1–4?, 65/1–2?, 66/1, 2, 68/2–4, 69/1–3, 73/1–4, 75/1–4, 76/1–4, 77/1–4, 78/1–4, 79/1–4, 88/1, 84/2–4, 87/1, 2, 3, 90/1–4?, 91/1–4?, 92/1–2?, 3, 4, 93/2, 94/1–3.

Oolitic and algal "banks"; skeletal sands on edge of platform
5/1–4, 19/1?, 4, 24/2, 25/2, 3, 4, 26/1, 32/3, 4, 34/1, 3, 4, 35/4, 36/1–4, 47/3, 48/2, 49/1, 50/1, 2, 3, 51/1, 2, 58/1–4, 64/1–4?, 66/4?, 67/1–4, 68/1, 90/1–4?, 91/1–4?, 92/1–2?, 93/1, 3, 4.

Restricted shelf and lagoonal
6/2, 3, 4?, 8/4, 9/1–4, 10/2, 11/2, 12/1, 2, 4, 21/3, 4, 28/4, 35/3, 38/1–4, 39/1–4, 40/1–4, 41/1–4, 46/1 (lagoonal spiculite, not tidal shelf spiculite) 48/3, 4, 49/2, 50/4, 51/3, 55/1–4, 56/1, 3, 4, 57/2, 59/1–4, 65/3, 4, 66/3, 68/2–4, 70/1, 2, 4, 83/2–4, 86/3, 4, 87/4.

Intertidal and supratidal
8/1, 3, 10/1, 3, 4, 11/1, 4, 51/4?.

Foraminiferal Realms

The foraminiferal assemblages illustrated in this report belong to a single faunal "province" in which faunal exchanges have been continuous and widespread; hence the same phylogenetic scheme and zonation can be recognized for all of the formations investigated (Mamet and Skipp, 1970b).

The existence of provincialism would be indicated if faunal exchanges were interrupted or at least greatly reduced, thus leading the biostratigrapher to recognize a number of different biostratigraphic schemes based on faunas evolving independently. This certainly is not true of Carboniferous calcareous foraminifers. Some faunal differences are conspicuous, however, and in the northern hemisphere one can distinguish three realms: a Tethyan realm, characterized by a very rich fauna, high to very high specific diversity, and complete phylogenies; a Kuznets and North American realm, with a rich fauna, lower specific diversity, and incomplete phylogenies; and a Taimyr–Alaska realm, with poorer assemblages, low specific diversity, and incomplete phylogenies.

No typical representatives of the Tethyan realm are known in Canada and most of the illustrated microfauna belongs to the North American realm (e.g., Banff, Pekisko, Shunda, Turner Valley, Debolt, Mount Head, and Etherington Formations). The Hart River Formation and Alapah Limestone belong to the Taimyr–Alaska realm.

Of particular paleogeographic importance are the faunas found on the islands of southern Alaska bordering the Pacific Coast (Prince of Wales, Toti, Madre de Dios, Shelikof, and Peratrovich Islands) and in scattered outcrops of northwestern British Columbia (Atlin map-area) which contain an association of "American" and Tethyan elements. For instance, this "Peratrovich facies" yields abundant Tournaisian, Viséan, and early Namurian *Eotextularia*, *Mediocris*, *Howchinia*, *Omphalotis*, *Janischewskina*, *Bradyina*, and evolved Endothyranopsidae, which are unique in North America. Such assemblages indicate an island arc or oceanic island "mixed fauna."

Phylogenetic Development of Foraminiferal Families

Although the phylogenetic development of the foraminiferal families is not as clear in the North American Cordillera as it is in the Eurasiatic succession, it generally follows a similar pattern (Mamet, 1965; Petryk *et al.*, 1970).

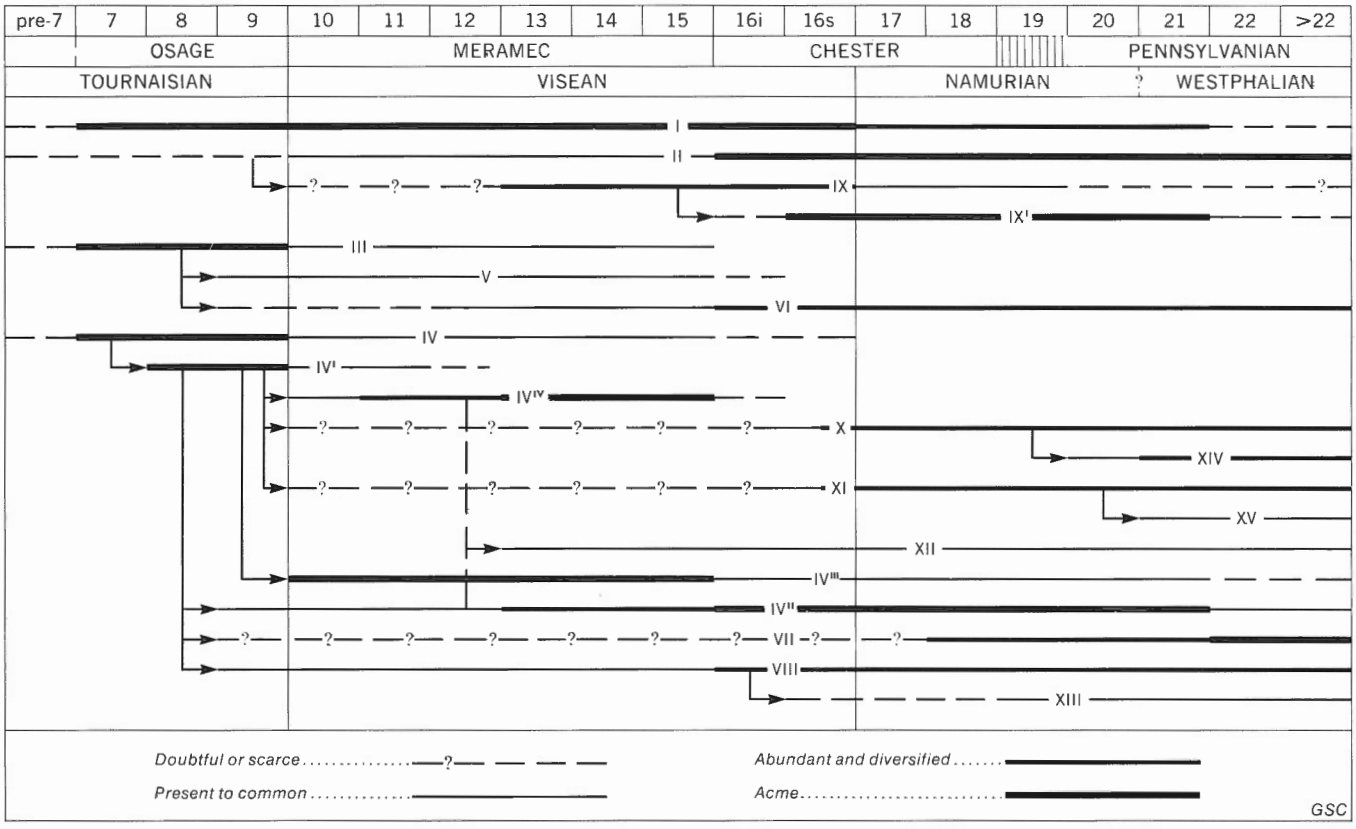
The root stock of the Earlandiidae (I), Pseudoammodiscidae (II), Tournayellidae (III), and primitive Endothyridae (IV) is of Late Devonian age and is not discussed here. The first identifiable Tournaisian assemblage, zone "pre-7", is composed exclusively of these four families (Textfig. 3). The Earlandiidae (I) and Pseudoammodiscidae (II) have little stratigraphic value at the scale used in this report but, in contrast, the Tournayellidae (III) reached their acme in Middle and Late Tournaisian time. Among the Endothyridae, the *Tuberendothyra–Spinoendothyra* assemblage (IV^{I}) was abundant in the Late Tournaisian, *Endothyra* sensu stricto (IV^{II}) appears at the same level and developed in Late Viséan – early Namurian, while *Globoendothyra* (IV^{III}) and *Eoendothyranopsis* (IV^{IV}) appeared in the Early Viséan.

The Forschiidae (V) were derived from the gigantic Late Tournaisian tournayeliids by incipient agglutination of the wall; the family is poorly developed in North America, and the widespread Eurasiatic *Lituotubella*, *Forschia*, and *Forschiella* are rare or absent.

The root stock of the Palaeotextulariidae (VI) is imperfectly known in North America, *Eotextularia* having been encountered only in isolated outcrops of British Columbia. In Cordilleran strata of Late Viséan and Namurian ages, the family is well represented by *Palaeotextularia*, *Koskinobigenerina*, *Cribrostomum*, *Climacammina*, and *Deckerella?*

The Biseriamminidae (VII) and Tetrataxidae (VIII) were derived from the same endothyroid stock of Late Tournaisian age; both are poorly represented in North America, the former by the Namurian *Biseriella parva* and the latter mainly by *Tetrataxis*.

The Archaediscidae with open lumen (*Archaediscus*, *Propermodiscus*, *Planoarchaediscus*) (IX) were derived from



TEXTFIGURE 3. Phylogenic development of the families (*see* list of families)

the Pseudoammodiscidae in Viséan time; Archaediscidae with coalescent lumen (*Neoarchaediscus*, *Asteroarchaediscus*) (IX¹) appeared in the Late Viséan and became one of the most widespread groups of Namurian Foraminifera.

Eostaffellidae and Pseudoendothyridae (X and XI) were derived in the Viséan from the Endothyridae, but both families were numerically insignificant until Late Viséan time when they developed at the expense of *Eoendothyranopsis*. Primitive Bradyinidae (XII) appeared in the mid-Viséan; in areas other than Alaska, the family is poorly represented in Lower Carboniferous strata of North America.

Primitive "Lasiodiscidae" (XIII) were derived from the Tetrataxidae in the latest Viséan; they did not become conspicuous elements of the fauna until late Namurian time.

Finally, fusulines (*Millerella*) are observed for the first time at the base of the Pennsylvanian, and Ozawainellidae (XIV) and Schubertellidae (XV) are common from the Atoka to the Desmoines age equivalents.

List of Figured Families

For illustration of the most common and widespread representatives of these families, *see* "List of figured taxa" (p. 12).

I Earlandiidae
- *Earlandia* sp.
- *Earlandinella* sp.

II Pseudoammodiscidae
- *Brunsia* sp.
- *Pseudoammodiscus* sp.
- *Pseudoglomospira* sp.

III Tournayellidae
- *Brunsiina* sp.
- *Chernyshinella* sp.
- *Glomospiranella* sp.
- *Palaeospiroplectammina* sp.
- *Rectoseptaglomospiranella* sp.

IV Endothyridae (sensu lato)
- Primitive forms.
  - *Latiendothyra* sp.
- Spinose forms.
  - *Spinoendothyra* sp.
  - *Tuberendothyra* sp.
- Tri-layered forms (Endothyridae sensu stricto)
  - *Endothyra* sp.
  - *Endothyranella* sp.
  - *Priscella* sp.
- Forms with diaphanotheca (globoendothyrids)
  - *Dainella* sp.
  - *Globoendothyra* sp.
- Forms with porous tectum (endothyranopsids)
  - *Banffella* sp.
  - *Endothyranopsis* sp.
  - *Eoendothyranopsis* sp.
  - *Skippella* sp.
  - *Spinothyra* sp.

V Forschiidae
Eoforschia sp.

VI Palaeotextulariidae
Climacammina sp.
Cribrostomum sp.
Eotextularia sp.
Palaeotextularia sp.

VII Biseriamminidae
Biseriella sp.
Globivalvulina sp.

VIII Tetrataxidae
Monotaxinoides sp.
Tetrataxis sp.

IX Archaediscidae with open lumen (Archaediscinae)
Archaediscus sp.
Propermodiscus sp.

IX Archaediscidae with closed lumen (Asteroarchaediscinae)
Asteroarchaediscus sp.
Neoarchaediscus sp.
Planospirodiscus sp.

X Eostaffellidae
Eostaffella sp.
Mediocris sp.
Zellerina? sp.

XI Pseudoendothyridae
Eoparastaffella sp.
Pseudoendothyra sp.

XII Primitive Bradyinidae and Bradyinidae
Bradyina sp.

XIII Primitive "Lasiodiscidae"
Eolasiodiscus sp.

XIV Ozawainellidae
Millerella sp.

XV Schubertellidae
Eoschubertella sp.

Outline of a Zonation for the Carboniferous of the Canadian Cordillera

The Eurasiatic *Quasiendothyra* zonation is not applicable in the Canadian Cordillera because of the lack of microfaunas in this interval; hence, the exact equivalents of Zones 4, 5, and 6 are unknown (Mamet and Playford, 1968). Moreover, because of a generally unfavourable microfacies at the base of the Tournaisian (radiolarites, radiolarite-spiculite cherts, spiculite siltstones, bryozoan–pelmatozoan packstones), "pre-7" foraminiferal assemblages are very poor, and usually are restricted to monocular, unsegmented Foraminifera or incertae sedis. *Septaglomospiranella granulosa* (Zeller), *Septabrunsiina*, and *Latiendothyra* also are present.

The Middle Tournaisian Zone 7 is characterized by the acme of *Septaglomospiranella primaeva* (Chernysheva) and abundant *Latiendothyra* and *Rectoseptaglomospiranella*.

The lower Upper Tournaisian Zone 8 is recognized on the acme of *Tuberendothyra* [*T. tuberculata* (Lipina)], and *Septabrunsiina parakrainica* (Skipp, Holcomb and Gutschick), while *Chernyshinella* and *Rectoseptaglomospiranella* are progressively eliminated. The acme of *Spinoendothyra* [*S. spinosa* (Chernysheva), *S. bellicosta* (Malakhova), *S. paracostifera* (Lipina)], accompanied by spinose tournayellids (*Carbonella*), is characteristic of Zone 9. The first appearance of *Eoforschia*, *Tetrataxis*, *Priscella*, and *Pseudotaxis* also is characteristic of this uppermost Tournaisian zone. *Inflatoendothyra* and *Paradainella* are common.

The lowest Viséan Zone 10 is characterized by the proliferation of *Globoendothyra* [notably *G. baileyi* (Hall)], accompanied by residual spinoendothyrids. *Dainella* occurs for the first time in the zone, and rare *Eoendothyranopsis* appear at this level. The proliferation of *Eoendothyranopsis spiroides* (Zeller) accompanied by *Stacheia-Stacheoides* is characteristic of Zone 11. *Koninckopora* and *Palaeotextularia* are conspicuous elements of the microfacies of Zone 12, whereas the last Tournaisian endothyroids and tournayellids usually are scarce above this level.

The boundary between Zones 12 and 13 is well marked by the concurrent assemblage of the last *Eoendothyranopsis* of the group *E. spiroides* (Zeller) and the first *Eoendothyranopsis* of the group *E. pressa* (Grozdilova *in* Lebedeva).

The upper Middle Viséan Zone 13 is recognized by the proliferation of Archaediscidae (*Archaediscus* of the group *A. krestovnikovi* Rauser, last *Propermodiscus* sp.) and the first appearance of *Endothyranopsis* (*E. compressa* Rauser and Reitlinger) and *Eoendothyranopsis* of the group *E. pressa* (Grozdilova *in* Lebedeva).

The lower Upper Viséan Zone 14 is recognized by the acme of *Eoendothyranopsis* of the group *E. ermakiensis* (Grozdilova *in* Lebedeva), *Eoendothyranopsis macra* (Zeller), *Eoendothyranopsis utahensis* (Zeller), and the first appearance of *Banffella banffensis* (McKay and Green).

Zone 15, of middle Late Viséan age, is recognized by the first appearance of *Endothyranopsis crassa*, of bilayered Palaeotextulariidae and of gigantic Archaediscidae; the zone coincides with the acme of *Eoendothyranopsis* [*E. robusta* (McKay and Green)] and of *Globoendothyra* (*G. globulus* d'Eichwald).

In the northern part of the Cordillera, Zones 14 and 15 often are marked by floods of *Brunsia* (*B. lenensis* Bogush and Yuferev).

Zone 16_i in North America is marked by the elimination of many early and mid-Viséan forms such as *Eoendothyranopsis* and *Eoforschia* and the concurrent proliferation of *Endothyra* sensu stricto and *Zellerina discoidea* (Girty). Wall coalescence is observed for the first time in *Neoarchaediscus*.

The uppermost Viséan Zone 16_s is characterized by the acme of *Neoarchaediscus*, by the presence of *Planospirodiscus*, and by gigantic *Pseudoendothyra* [*P.* of the group *P. kremenskensis* Rozovskaia, and *P.* of the group *P. circuli* (Thompson)].

The lowest Namurian Zone 17, which also contains faunal elements of Zone 16_s, is recognizable by the proliferation of *Asteroarchaediscus*, whereas the overlying lower Namurian Zone 18 has *Biseriella parva* (Chernysheva) in addition and rare *Eostaffelina* at its top.

Zone 19 is characterized by the elimination of most Archaediscidae sensu stricto and the brief acme of "*Eosigmoilina*". The zone corresponds in part to the Namurian *Homoceras* Zone.

Zone 20 is identifiable by the first occurrence of *Lipinella*

and *Millerella* sensu stricto and could be partly equivalent to the Bashkirian strata of the Russian Platform. Should this hypothesis be correct, the zone straddles the Namurian–Westphalian boundary (Gordon, 1964). However, the upper part of the upper Bashkirian contains *Profusulinella*, whereas this fusulinid is known for the first time in Zone 22 of the American Cordillera. It is to be noted that, outside Alaska, the primitive forms of *Pseudostaffella* (*P. antiqua*) are not known in the Cordillera and that "Bashkirian" equivalents are identified there mainly by non-fusulinid foraminifers.

Zone 21 is based on the appearance of *Eoschubertella–Pseudostaffella* and Zone 22 by the first occurrence of *Profusulinella*. Younger Moscovian zones (Zone >22) have not been formally divided as they are poorly represented by facies rich in sessile foraminifers.

Distribution of Illustrations by Zones
(numbers indicate plates and figures)

Lower Middle Tournaisian (Zones pre-7 to 7)
3/1–3, 53/1, 2.

Middle Tournaisian (Zone 7)
2/1–4, 3/4, 4/1, 2, 7/4, 53/3, 4, 54/1–4, 55/1–4.

Middle Upper Tournaisian boundary (Zones 7/8 boundary)
4/3, 4, 7/1, 3.

Lower Upper Tournaisian (Zone 8)
5/1–4, 6/1–4, 7/2, 5–8, 8/1–4, 14/1, 3, 18/1, 56/1, 2.

Uppermost Tournaisian (Zone 9)
9/3, 4, 10/1–4, 11/1–4, 12/1, 2, 4, 13/1–4, 14/2, 4, 6, 9, 56/3, 4, 57/1–4, 58/1–4, 59/1–4, 60/1–19, 78/?1–4, 79/3?, ?6–8, 85/5.

Tournaisian–Viséan boundary (Zones 9/10 boundary)
9/1, 2, 12/3, 14/5, 7, 8, 10, 11.

Lowermost Viséan (Zone 10)
15/1, 2, 61/1, 71/1, 2, 84/2, 85/4.

Upper Lower Viséan (Zone 11)
16/1–4, 17/1–4, 19/3?, 20/1, 2, 3?, 4?, 21/1, 2?, 61/2–4, 62/1–4, 71/3, 82/3?, 4?.

Undetermined Lower Viséan (Zone 10 or 11)
15/3, 4, 18/2, 19/2.

Lower Middle Viséan (Zone 12)
21/3, 4, 22/1–4, 83/1.

Middle Middle Viséan (Zones 12/13 boundary)
23/1–4, 24/1, 42/4, 43/9–11, 63/1–4, 64/1–4, 65/1–4, 72/6, 84/3, 4, 85/1–3.

Upper Middle Viséan (Zone 13)
24/2–4, 25/1–4, 26/1, 42/3, 5, 43/1, 6, 44/5, 7, 66/1–4, 67/1–4, 68/1–4, 69/1, 2, 71/4–6, 72/1?, 3–5, 7, 8, 85/6, 8–10, 90/1–4, 91/1–4, 92/1, 2, 95/1–6, 11, 12.

Lower Upper Viséan (Zone 14)
26/2–4, 27/1–4, 28/1–4, 29/1–4, 30/1–4, 31/1, 2, 32/1–4, 33/1, 34/2–4, 35/2–4, 36/1–4, 42/1, 2, 6, 7, 8?, 43/2–5, 7, 8, 44/1, 2, 3?, 6, 8, 45/2, 3, 6–9, 69/3, 4, 70/4, 72/2, 83/2, 3, 85/11–14.

Zones 14/15 boundary
31/3, 4, 33/2–4, 34/1, 35/1, 39/3, 70/1–2.

Middle Upper Viséan (Zone 15)
37/1–4, 38/1–4, 39/1, 2, 4, 40/1–4, 41/1–4, 44/4, 45/1, 4, 5?.

Zones 15/16$_{inf}$ boundary
46/1–4, 52/3, 8.

Upper Viséan (Zone 16$_{inf}$)
47/1–4, 48/1, 2, 4, 49/1–4, 50/1–3, 52/1, 2, 4–7.

Uppermost Viséan (Zone 16$_{sup}$)
48/3.

Lowermost Namurian (Zone 17)
50/4, 73/1, 2, 74/4, 6–8, 75/1–4, 79/1.

Upper Lower Namurian (Zone 18)
51/1–4, 73/3, 4?, 74/1–3, 5, 76/1–4, 77/1–4, 79/2, 4, 5, 86/3, 88/5–17, 92/3, 4.

Upper Lower Namurian or slightly lower (≥Zone 18)
80/1–4, 81/1–18.

Uppermost Namurian (Zone 20)
89/7, 95/7, 10.

Westphalian (Zone 21) (Atokan age equivalents)
86/4, 87/1, 89/3, 93/1–4, 94/1–4.

Westphalian (Zone 22)
87/2, 89/4, 5.

Undetermined post-mid-Moscovian Zone
87/3, 4, 88/1–4, 18, 19, 21, 22, 89/1, 2, 6, 8, 9.

Taxonomy

Systematic paleontology is well beyond the scope of this paper. The systematic treatment of most of the illustrated foraminiferal taxa can be found in Armstrong and Mamet (in press), and a complete taxonomic revision of the algal flora is to be found in Mamet and Rudloff (1972) and in Petryk and Mamet (1972).

Only two taxa are reported here for the first time; their description follows.

Phylum **PROTOZOA**
Order FORAMINIFERIDA
Family ENDOTHYRANOPSIDAE Reitlinger 1959

Genus ***Spinothyra*** gen. nov.

Plate 80, figure 4; Plate 81, figures 1–4

Endothyra Rauser–Tschernoussova, 1948, p. 176 (part).
(*?*)*Endothyra* Durkina, 1959, p. 278 (part).
Endothyra Skipp, 1969, p. 204 (part).
Endothyra Solovieva, 1969, p. 11, 12 (part).

Diagnosis. Test free, discoidal, as in *Endothyranopsis*, *Cribrospira*, or *Janishewskina*, with rounded periphery, well-defined sutures and marked umbilici. Proloculum followed by a rather regularly coiled, rapidly expanding spirotheca. Two to three volutions in adult specimens. Four to five chambers in the last whorl, nine to twelve in the whole shell. Enlarged endothyranopsid septa, at 75° from the spirotheca. Secondary deposits as anteriorly curved, long projections, present in each chamber. Wall calcareous, secreted, a porous tectum. Aperture a low slit at the base of the apertural face.

Remarks. Endothyranopsidae usually have poorly developed secondary deposits, and often no basal deposits at all. The Middle Viséan–Early Namurian *Spinothyra* plays the same

role in the phylogeny of the Endothyranopsidae as the spinose Late Tournaisian–Early Viséan *Spinoendothyra* plays among the Endothyridae.

Type of genus (here designated). *Endothyra pauciseptata* Rauser–Tschernoussova, 1948, p. 176, Pl. 5, figs. 1–4, 6 (holotype, fig. 4). The genus is monotypic.

Stratigraphic range and distribution. Scarce in Eurasia and in North America. First well-documented occurrence in the Middle Viséan (Meramec age equivalent) Horseshoe Mesa Member of the Redwall Limestone in the Grand Canyon region (Skipp, 1969). Original material from Rauser–Tschernoussova is from the Upper Viséan–Lower Namurian Oka Group of the Moscovian Syncline. Highest known occurrence is in Lower Namurian (Serpukov equivalent) strata of Novaya Zemlya and of British Columbia (this report).

Spinothyra pauciseptata (Rauser–Tschernoussova, 1948)
Plate 80, figure 4; Plate 81, figures 1–4

Endothyra pauciseptata Rauser–Tschernoussova, 1948, p. 176, Pl. 5, figs. 1–4, 6.
(not) *Endothyra pauciseptata* Grozdilova and Lebedeva, 1954, p. 109, 110, Pl. 12, fig. 7.
(?)*Endothyra* ex gr. *E. pauciseptata* Durkina, 1959, p. 278.
(not) *Plectogyra pauciseptata* Omara and Conil, 1965, p. 242, Pl. 3, figs. 19, 20.
Endothyra aff. *E. pauciseptata* Skipp, 1969, p. 204, Pl. 28, figs. 24, 25, 28.
Endothyra pauciseptata Solovieva, 1969, p. 11, Pl. I, fig. 9.
Endothyra ex gr. *E. pauciseptata* Solovieva, 1969, p. 12, Pl. I, fig. 29.

Diagnosis. Test free, discoidal, 400 to 750 μ in diameter. Diameter/thickness ratio; 0.70 to 0.90. Proloculum important, followed by a rapidly expanding coil. Two and one-half to three volutions in adult specimens. Four chambers in the last whorl, eleven to twelve in all. Septa endothyranopsid-like, up to three times the thickness of the wall; no intraseptal pore visible. Secondary deposits as prominent, anteriorly curved hooks. Wall calcareous-secreted, a porous tectum, 10–14 μ in thickness. Aperture a low slit at the base of the apertural face.

Remarks. The only apparent difference between the Atlin forms and the original Russian material is a slightly more pronounced curvature of the secondary spines. Although Rauser–Tschernoussova claimed that the species had only two whorls with a total of six to eight chambers, her illustrated figure 4, the only one published from a well-oriented mature form, shows three whorls and eleven to twelve chambers.

Stratigraphic range and distribution. Tethys, Siberia–Alaska realm, North American realm; Middle Viséan to Lower Namurian.

Family PALAEOTEXTULARIIDAE

Genus ***Eotextularia*** Mamet *in* Mamet, Mikhailov and Mortelmans, 1970

Eotextularia mongeri sp. nov.

Plate 78, figures 1–4; Plate 79, figure 7

Diagnosis. Test free, composed of two morphological stages; an initial streptospiral coil, followed by a gently tapering biserial part. Diameter of the septate glomospiral spire about 170–200 μ for five chambers. Length of the biserial part 450–500 μ for four chambers. Width of the biserial part 370–430 μ. Septa long, curved, slightly thickened, with rounded tips. Wall thick, calcareous-secreted, with about 5 per cent of agglutinated carbonates, up to 30–35 μ thick. Aperture a high slit at the base of the apertural face.

Comparison. The new species is readily distinguishable from the two known Late Tournaisian–Early Viséan species of *Eotextularia: E. diversa* (Chernysheva, 1948) is stouter and much more rapidly tapering; and *E. breviscula* (Conil and Lys, 1965) is also much bigger, with a more prominent tectum.

Holotype (here designated). Plate 79, figure 7, GCS loc. 79403, GSC type no. 39597.

Derivatio nominis

Dedicated to Dr. J. W. H. Monger, who kindly supplied the material.

Stratigraphic range and distribution. This is the first recorded occurrence of *Eotextularia* in North America. *Eotextularia* is known only from the Late Tournaisian or slightly younger "unnamed formation" of the Atlin map-area, British Columbia.

List of Figured Taxa
(numbers indicate plates and figures)

Ammovertella sp.	51/2
Anatolipora sp.	34/1
Aoujgalia sp.	27/4
Aoujgalia variabilis Termier and Termier	45/3
Archaediscus krestovnikovi Rauser-Tschernoussova	76/3, 4
Archaediscus of the group *A. krestovnikovi* Rauser-Tschernoussova	36/1–4, 46/2, 52/7, 76/2, 77/1
Archaeolithophyllum? sp.	22/2
Asphaltina cordillerensis Mamet and Rudloff	87/2
Asteroarchaediscus baschkiricus (Krestovnikov and Teodorovitch)	95/7
Atractyliopsis sp.	73/1, 2
Atractyliopsis cumberlandensis Rich	45/1
Banffella sp.	36/1–4, 39/4
Banffella banffensis (McKay and Green)	35/1, 44/8
Biseriella sp.	81/12, 13
Biseriella of the group *B. parva* (Chernysheva)	76/1, 3, 4, 80/1, 92/4
Bisphaera sp.	53/3, 4, 55/2
Bradyina sp.	73/4
Bradyina cribrostomata Rauser-Tschernoussova and Reitlinger	87/1, 89/2
Bradyina magna Roth and Skinner	89/1
Brunsia sp.	25/3, 36/1–4, 85/13
Brunsia of the group *B. irregularis* (von Möller)	69/3, 83/3
Brunsia lenesis Bogush and Yuferev	28/2, 42/5, 7, 43/2, 3, 69/3, 83/2, 3, 85/11, 12
Brunsiina sp.	3/4

Calcisphaera sp. 2/1, 2, 9/1, 2, 4, 37/4, 40/4, 41/3, 4, 57/1, 59/4, 65/1, 2, 68/2–4, 77/2, 3, 80/1, 3, 90/1, 2, 94/1–3, 95/12

Calcisphaera laevis Williamson 12/4, 14/11, 23/1–4, 27/2, 29/1, 39/3, 41/1, 47/2, 55/4, 57/3, 4, 69/1, 2, 70/4, 84/2, 91/1, 2

Calcisphaera pachysphaerica (Pronina) 23/1–4, 26/2, 32/3, 4, 33/2–4, 36/1–4, 41/1, 47/2, 91/1–4, 95/11

Chernyshinella disputabilis Dain 2/4

Chernyshinella glomiformis maxima (Lipina) 54/1–4

Chernyshinella aff. *C. paucicamerata* Lipina 54/1–4

Climacammina sp. 76/1, 3, 4

Climacammina of the group *C. moelleri* Reitlinger 89/9

Cribrospira? sp. 73/1?, 2?

Cribrostomum bradyi (von Möller) 75/2, 3

Dainella sp. 16/3

Diplosphaerina sp. 81/14

Diplosphaerina inaequalis (Derville) 45/6

Earlandia sp. 2/1, 36/1–4, 57/2, 61/1, 62/1, 2, 69/3, 70/4, 75/3, 4, 76/2, 77/2, 3, 80/3, 83/3, 90/1, 2

"*Earlandia*" *consternatio* (Conkin) 14/4

Earlandia of the group *E. clavatula* (Howchin) 13/4, 24/1, 26/2, 46/3, 4, 49/2, 3, 65/3, 4, 70/1, 2

Earlandia of the group *E. elegans* (Rauser-Tschernoussova) 3/1, 2, 55/1–3, 66/2, 68/2–4, 70/1, 2

Earlandia of the group *E. moderata* (Malakhova) 3/3, 12/3, 19/3, 55/1–3, 57/1

Earlandia of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger) 19/3, 24/1, 4, 27/2, 46/3, 4, 47/3, 49/2, 3, 61/2, 3, 65/3, 4, 66/2, 70/1, 2, 76/3, 4, 84/2–4

Earlandinella sp. 36/1–4, 92/1, 2, 95/9

Endothyra sp. 29/1, 3, 4, 30/4, 31/1, 32/3, 4, 34/1, 36/1–4, 39/1, 2, 40/4, 49/4, 50/3, 61/2, 3, 62/1, 2, 64/4, 68/1–4, 69/1, 2, 75/1, 83/1, 90/1, 2, 92/1, 2

Endothyra bowmani Phillips emend Brady 46/3, 4, 49/2, 3, 72/2, 75/3

Endothyra of the group *E. bowmani* Phillips emend Brady 33/2–4, 44/7, 46/2–4, 49/2, 3, 52/5, 6, 68/2–4, 72/1, 2, 79/5, 84/3, 4

Endothyra excentralis Cooper 46/2–4, 49/2, 3, 52/5

Endothyra aff. *E. obsoleta* Rauser-Tschernoussova 68/2–4

Endothyra phrissa (Zeller) 52/8

Endothyra pseudobradyi Brazhnikova 72/1, 84/3, 4

Endothyra of the group *E. similis* Rauser-Tschernoussova and Reitlinger 25/3, 49/1

Endothyranella sp. 84/3, 4

Endothyranella recta (Brady) 64/4, 65/3, 4

Endothyranopsis sp. 33/2–4, 34/1, 37/1, 39/1, 2, 4, 40/1–3, 73/1?, 2?, 90/1?, 2?, 92/1, 2

Endothyranopsis compressa (Rauser-Tschernoussova and Reitlinger) 36/1–4, 44/4

Endothyranopsis of the group *E. compressa* (Rauser-Tschernoussova and Reitlinger) 39/3, 44/4, 5

Endothyranopsis convexa (Rauser-Tschernoussova) 44/5

Endothyranopsis of the group *E. sphaerica* (Rauser-Tschernoussova and Reitlinger) 74/1, 2

Eoendothyranopsis sp. 20/1, 2, 25/4, 26/4, 27/2, 3, 30/3, 31/3, 4, 32/3, 4, 33/1, 34/1?, 35/2, 3, 37/1, 38/1, 3, 4, 39/1–4, 62/1, 2, 63/4, 67/1, 2, 84/3, 4, 90/1, 2

Eoendothyranopsis donica typica Brazhnikova and Rostovceva 44/6

Eoendothyranopsis ermakiensis (Lebedeva) 34/4, 71/4, 6

Eoendothyranopsis of the group *E. ermakiensis* (Lebedeva) 24/2, 29/3, 4, 31/2, 33/2–4, 34/1, 36/1–4, 37/2, 3, 40/1–3, 44/6, 67/3, 4, 70/1, 2, 4, 92/1, 2, 95/3

Eoendothyranopsis hinduensis (Skipp *in* McKee and Gutschick) 63/1–3, 64/1–3, 65/1–4, 72/6

Eoendothyranopsis macra (Zeller) 29/1, 34/4, 69/1, 2, 91/3?, 4?, 95/6

Eoendothyranopsis prodigiosa (Armstrong) 25/2, 43/7?, 68/2–4, 95/5?

Eoendothyranopsis of the group *E. rara* (Grozdilova *in* Lebedeva) 23/1–4, 25/1, 26/1, 32/3, 4, 35/1, 36/1–4, 37/2–4, 39/1, 2, 64/1–4, 91/1, 2

Eoendothyranopsis robusta (McKay and Green) 31/3, 4, 33/2–4, 34/1, 37/2, 3, 40/1–3, 70/1, 2

Eoendothyranopsis scitula (Toomey) 24/4, 27/2, 30/2, 4, 32/1, 37/2, 3, 43/4–6, 8, 10, 66/1, 3, 67/3, 4, 68/2–4, 70/1, 2, 71/5, 72/7, 8, 91/1–4, 92/1, 2, 95/1, 4

Eoendothyranopsis spiroides (Zeller) 23/1–4, 43/9, 11, 61/2, 3, 62/1–4, 64/1–4

Eoendothyranopsis of the group *E. spiroides* (Zeller) 21/4, 23/1–4, 61/2, 3, 64/1–3, 65/1, 2, 72/6, 84/3, 4

Eoendothyranopsis thompsoni (Anisgard and Campau) 44/1, 3, 63/1–3, 64/1–3?, 68/1, 85/1–3, 7

Eoforschia sp. 16/3, 24/2, 27/2, 29/1, 3–4, 30/4, 32/1, 33/1, 35/1, 2, 39/4, 67/1, 68/1, 83/1

Eoforschia minoris (Lipina) 23/1–4, 32/3, 4, 61/1, 66/4

Eoforschia moelleri (Malakhova *in* Dain) 32/3, 4, 66/4, 67/3, 4, 68/2–4, 69/4

Eoforschia of the group *E. moelleri* (Malakhova *in* Dain)	23/1–4, 25/1, 4, 26/4, 32/3, 4, 33/2–4, 36/1–4, 39/1, 2, 40/1–3, 42/1, 2, 4, 6, 8, 61/1, 62/1, 2, 63/1–3, 64/1–3, 65/1–4, 66/4, 67/1, 2, 70/4
"*Eoparastaffella*" of the group "*E.*" *ovalis* Vdovenko	71/1–3
Eoschubertella sp.	89/4, 5, 94/?1–3
Eoschubertella? yukonensis (Ross)	93/1
Eostaffella sp.	75/1, 76/2–4, 77/1, 94/1–3
Eostaffella of the group *E. radiata* (Brady)	73/3, 79/4
Eostaffella oregonensis Sada and Danner	80/3
Eotextularia mongeri sp. nov.	78/1–4, 79/7
Eotuberitina sp.	31/2, 41/1, 56/1, 3, 68/2–4, 76/3, 4, 80/1
Eotuberitina grandis (Golubsov)	60/14
Eotuberitina reitlingerae (Mikluko-Maklai)	45/5
Eovolutina sp.	57/2–4
Eovolutina tujmasensis Lipina	14/6
Epistacheoides connorensis Mamet and Rudloff	27/4, 48/3
Epistacheoides nephroformis Petryk and Mamet	38/2, 49/2, 3
Exvotarisella index (Ehrenberg sensu von Möller)	15/2?, 59/2, 3
Girvanella sp.	2/3
Globivalvulina sp.	93/1
Globivalvulina of the group *G. bulloides* (Brady)	94/1–3, 95/8
Globoendothyra sp.	16/1–3, 22/3, 4, 24/4, 26/1, 27/2, 29/3, 4, 31/1, 3, 4, 32/1, 3–4, 33/2–4, 34/1, 4, 35/1, 40/1–3, 46/2–4, 48/1, 49/4, 50/3, 61/2, 3, 63/4, 64/1–4, 65/1, 2, 68/2–4, 69/1, 2, 76/2–4, 91/1, 2
Globoendothyra of the group *G. baileyi* (Hall)	15/1, 17/7, 20/4, 61/4, 62/1–4
Globoendothyra of the group *G. globulus* (d'Eichwald sensu von Möller)	37/1, 49/2, 3
Globoendothyra paula (Vissarionova)	25/3, 26/3, 4, 29/2, 33/2–4, 34/2, 3, 36/1–4, 44/2, 52/3, 66/2, 67/1–4, 85/6, 90/1, 2, 91/3, 4, 92/1, 2
Globoendothyra of the group *G. tomiliensis* (Lebedeva)	25/4, 28/1, 37/4, 44/2, 52/3, 63/1–3, 66/2
"*Globoendothyra*"(*?*) *trachida* (Zeller)	12/3, 15/1, 16/4, 17/3–5, 6, 62/1, 2
Glomospiranella sp.	13/1
Glomospiranella of the group *C. subglobosa* Malakhova	14/9
Inflatoendothyra inflata (Lipina) OBJ	12/3, 13/4, 57/1
Kamaena sp.	5/2–3, 9/1–3, 26/2, 35/3, 38/4, 41/3, 4
Kamaena delicata (Antropov)	5/1
Kamaena maclareni Mamet and Rudloff	5/1
Komia sp.	87/3?
Koninckopora sp.	25/2, 27/1, 28/2, 38/1
Koninckopora inflata (de Koninck)	24/4, 28/1, 33/2–4, 34/2, 3, 36/1–4
Koninckopora tenuiramosa Wood	28/3, 30/3, 31/3, 4, 45/2, 90/1, 2, 95/2
Latiendothyra sp.	2/4, 13/1, 54/1–4, 55/1–4, 57/1, 3, 4, 61/1
Latiendothyra latispiralis (Lipina)	58/1–4, 61/2, 3
Latiendothyra parakosvensis (Lipina)	13/1, 14/1, 53/2
Latiendothyra of the group *L. parakosvensis* (Lipina)	2/2, 3, 14/1, 56/2
Latiendothyra rjausakensis (Lipina)	54/1–4
Mediocris sp.	80/1, 4
Mediocris aff. *M. breviscula* (Ganelina)	81/18
Mediocris mediocris (Vissarionova)	81/15–17
Millerella of the group *M. marblensis* Thompson emend	89/3
Millerella pressa Thompson	95/10
Monotaxinoides multivolutus (Reitlinger)	86/4, 87/4, 88/1–4
Neoarchaediscus sp.	77/1
Neoarchaediscus grandis (Reitlinger)	74/3, 5, 89/7
Omphalotis of the group *O. circumplicata* (Howchin)	81/11
Orthriosiphon sp.	67/3, 4
Orthriosiphon saskatchewanensis Johnson and Konishi	16/1, 2, 17/1, 2, 21/1, 24/3
Orthriosiphonoides sp.	21/3, 31/1
Orthriosiphonoides salterensis Petryk *in* Petryk and Mamet	22/1
Palaeoberesella sp.	38/4, 40/4
Palaeoberesella lahuseni (von Möller)	6/2, 56/3, 59/2, 3
Palaeoberesella cf. *P. lahuseni* (von Möller)	10/2, 59/4
Palaeocancellus sp.	12/4, 40/4
Palaeocancellus aff. *P. cancellatus* (Williamson)	60/16
Palaeospiroplectammina of the group *P. chernyshinensis* (Lipina)	4/3, 4, 7/1, 3
Palaeotextularia asper Cooper	51/1
Palaeotextularia of the group *P. consobrina* Lipina	49/4, 51/1
Paracalligelloides sp.	2/1, 2, 26/4, 30/1, 4, 32/3, 4, 34/2, 3, 40/1–3, 45/7–9, 47/2, 63/1–3, 70/1, 2
Paradainella sp.	14/10
Parathurammina sp.	2/4, 33/2–4, 35/1, 37/4, 38/4, 39/1, 2, 4, 40/4, 41/3, 4, 55/1–4, 56/1, 61/1, 62/1, 2, 63/1–3, 64/4, 68/2–4, 70/4, 76/3, 4, 92/1, 2

Parathurammina of the group *P. dagmarae* Suleimanov 60/13

Parathurammina of the group *P. paracushmani* Reitlinger 60/15

Parathurammina of the group *P. spinosa* (Williamson) 14/8, 34/1, 60/5–12

Parathurammina aff. *P. subvasta* (Bykova) 60/13

Parathurammina of the group *P. suleimanovi* Lipina 4/3, 4, 8/4, 12/4, 13/4, 23/1–4, 41/1, 56/3, 4, 57/1–4, 61/2, 3

Planoendothyra sp. 65/1?, 2?, 90/1, 2, 93/1

Planospirodiscus taimyricus Sossipatrova 86/3, 88/5–17, 92/3

"*Plectogyra trachida*" Zeller 6/3

Priscella sp. 70/4, 80/1, 3

Priscella of the group *P. prisca* (Rauser-Tschernoussova and Reitlinger) 81/10, 85/4

Priscella prisca (Rauser-Tschernoussova and Reitlinger) 81/5–9

Proninella sp. 9/1–3, 11/2, 40/4, 41/1, 3, 4, 59/2–4, 65/3, 4

Pseudoammodiscus sp. 43/1

Pseudoendothyra sp. 47/4, 48/2, 51/3, 93/1, 94/1–4

Pseudoendothyra ampla (Thompson) 48/2, 52/1, 4

Pseudoendothyra aff. *P. bona* Rozovskaia 47/1

Pseudoendothyra composita (Dutkevich) 50/4, 73/1–2

Pseudoendothyra of the group *P. kremenskensis* Rozovskaia 51/1, 2, 73/1, 2

Pseudoendothyra of the group *P. ornata* (Brady) 47/1, 48/1, 52/1, 4, 74/4, 6–8

Pseudoglomospira sp. 46/3, 4, 49/1, 76/1, 80/3

Pseudoissinella sp. 22/1, 25/2, 28/1, 35/3, 4, 38/4, 41/1, 3, 4, 59/2, 3

Pseudokamaena sp. 38/4

Pseudostaffella sp. 87/3, 93/3, 4, 94/1–3

Pycnostroma? sp. 35/3, 48/4

"*Radiosphaera*" sp. 12/4, 40/4, 45/4, 56/3, 57/3, 4, 59/4, 70/4

"*Radiosphaera*" aff. "*R*". *basilica* (Reitlinger) 14/5

"*Radiosphaera*" of the group "*R*". *sol* (Williamson) 72/3, 4

Rectoseptaglomospiranella nalivkini (Malakhova) 7/4, 54/1–4

Septabrunsiina sp. 11/3, 18/1, 24/1, 30/4, 56/2

Septabrunsiina anteflexa (Zeller) 79/6

Septabrunsiina donica Lipina 57/3, 4

Septabrunsiina krainica (Lipina) 57/3, 4

Septabrunsiina mackeei Skipp *in* Skipp, Holcomb and Gutschick ORTH. MUT. 23/1–4, 36/1–4, 39/3

Septabrunsiina parakrainica Skipp *in* Skipp, Holcomb and Gutschick 13/3, 14/7, 78/1–4, 79/3, 8

Septaglomospiranella sp. 2/2, 3/4, 4/3, 4, 6/4, 12/4, 55/1–4, 56/2

"*Septaglomospiranella*" sp. 13/3

Septaglomospiranella (*Neoseptaglomospiranella*) *dainae* Lipina 5/4, 7/2, 5

Septaglomospiranella primaeva (Chernysheva) (non Rauser-Tschernoussova) 4/2

"*Septatournayella*" *henbesti* Skipp, Holcomb and Gutschick 42/3, 63/4, 84/2

Septatournayella(?) kennedyi Skipp, Holcomb and Gutschick 14/2, 3

Septatournayella pseudocamerata (Lipina *in* Lebedeva) 56/1, 58/1–4, 60/1–4, 85/5

Skippella sp. 21/2, 23/1–4, 24/1, 26/1, 29/2, 30/4, 31/3?, 36/1–4, 62/1, 2, 84/3, 4, 90/1, 2

Skippella redwallensis (Skipp *in* McKee and Gutschick) 69/1, 2, 72/5, 91/1, 2

Spinoendothyra sp. 15/1, 57/1, 2

Spinoendothyra paracostifera (Lipina) 8/4

Spinoendothyra spinosa (Chernysheva) 11/3, 13/2, 56/4, 57/3, 4, 58/1–4

Spinothyra gen. nov. 80/4

Spinothyra pauciseptata (Rauser-Tschernoussova) 81/1–4

Stacheia? skimoensis Mamet and Rudloff 19/2, 82/3

Stacheoides sp. 20/1, 2, 22/3, 27/4, 31/1, 41/3, 4

Stacheoides meandriformis Mamet and Rudloff 27/1, 3, 30/3

Stacheoides? spissa Petryk and Mamet 50/1, 2

Stacheoides tenuis Petryk and Mamet 30/3, 32/2, 35/2, 67/1, 2

Tetrataxis acutus Durkina 89/8

Tetrataxis angusta Vissarionova 75/4, 85/8–10

Tetrataxis of the group *T. conica* Ehrenberg emend von Möller 93/2

Tuberendothyra sp. 18/1, 56/2

Tuberendothyra tuberculata (Chernysheva) 5/2, 3, 6/1, 7/6–8

Ungdarella sp. 89/6

Ungdarella peratrovichensis Mamet and Rudloff 77/2, 3

Uslonia sp. 57/3, 4

Uviella? sp. 68/1

Vicinesphaera sp. 8/4, 9/4, 12/4, 40/4, 41/1, 3, 4, 55/1–3, 56/4, 57/1–4, 61/2, 3

Volvotextularia mississippiana (Cooper) 88/18–22

Yukonella bamberi Mamet and Rudloff 90/3, 4, 91/3, 4, 92/1, 2

Zellerina sp. 77/1

Zellerina cooperi (Zeller) 79/1

Zellerina discoidea (Girty) 47/2, 52/2, 75/1

References

Armstrong, A. K. and Mamet, B. L.
1970: Biostratigraphy and dolomite porosity trends of the Lisburne Group *in* Adkison, W. L. and Brosgé, M. M., eds., Proceedings of the geological seminar on the North Slope of Alaska; Pacific Sec. Am. Assoc. Petrol. Geol., p. N1–N16.

Armstrong, A. K. and Mamet, B. L.
in press: Carboniferous microfacies, microfossils and corals, Lisburne Group, Arctic Alaska; U.S. Geol. Surv., Prof. Paper.

Armstrong, A. K., Mamet, B. L., and Dutro, J. T.
1970: Foraminiferal zonation and carbonate facies of the Mississippian and Pennsylvanian Lisburne Group, Central Brooks Range, Arctic Alaska; Bull. Am. Assoc. Petrol. Geol., v. 54, no. 5, p. 687–698.

Armstrong, A. K., Mamet, B. L., and Dutro, J. T., Jr.
1971: Lisburne Group, Cape Lewis–Niak Creek, northwestern Alaska; U.S. Geol. Surv., Prof. Paper 750-B, p. B23–B34.

Bamber, E. W. and Waterhouse, J. B.
1971: Carboniferous and Permian stratigraphy and paleontology, northern Yukon Territory, Canada; Bull. Can. Petrol. Geol., v. 19, no. 1, p. 29–250.

Douglas, R. J.
1958: Mount Head map-area, Alberta; Geol. Surv. Can., Mem. 291.

Dunham, R. J.
1962: Classification of carbonate rocks according to deposition texture *in* Classification of carbonate rocks – A symposium; Am. Assoc. Petrol. Geol., Mem. I, p. 108–121.

Durkina, A. V.
1959: Foraminifera of the Lower Carboniferous deposits of the Timan–Pechora Province (in Russian); Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst., Trudy 136, Mikrofauna SSSR no. 10, p. 132–389.

Gabrielse, H.
1963: McDame map-area, Cassiar District, British Columbia; Geol. Surv. Can., Mem. 319.

Gordon, M.
1964: Carboniferous cephalopods of Arkansas; U.S. Geol. Surv., Prof. Paper 460.

Grozdilova, L. P. and Lebedeva, N. S.
1954: Foraminifera of the Lower Carboniferous and Bashkirian Stage of the Middle Carboniferous of the Kolvo-Vishera area (in Russian); Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst., Trudy 81, Mikrofauna SSSR no. 7, p. 4–236.

Irish, E. J.
1963: Late Carboniferous and Permian Stratigraphy of part of northeastern British Columbia; Bull. Can. Petrol. Geol., v. 11, no. 4, p. 373–388.

Kidd, F. A.
1963: The Besa River Formation; Bull. Can. Petrol. Geol., v. 11, no. 4, p. 369–372.

Macauley, G., Penner, D. G., Procter, R. M., and Tisdall, W. H.
1964: Carboniferous *in* Geological history of Western Canada; Alberta Soc. Petrol. Geol., p. 89–102.

Macqueen, R. W. and Bamber, E. W.
1968a: Stratigraphy of Banff Formation and lower Rundle Group (Mississippian), southwestern Alberta; Geol. Surv. Can., Paper 67-47.
1968b: Stratigraphy and facies relationships of the Upper Mississippian Mount Head Formation, Rocky Mountains and Foothills, southwestern Alberta; Bull. Can. Petrol. Geol., v. 16, no. 3, p. 225–287.

Mamet, B. L.
1962: Remarques sur la microfaune de Foraminifères du Dinantien; Bull. Soc. belge, Géol. Paléont. Hydrol., v. 70, no. 2, p. 166–173.
1965: Remarques sur la microfaune du "Marbre Noir" de Dinant; Ann. Soc. géol. Belgique, v. 88, no. 5–6, p. 188–219.
1968: Foraminifera, Etherington Formation (Carboniferous), Alberta, Canada; Bull. Can. Petrol. Geol., v. 16, no. 2, p. 167–179.

Mamet, B. L. and Armstrong, A. K.
1972: Lisburne Group, Franklin and Romanzof Mountains, northeastern Alaska *in* Geological Survey research 1972; U.S. Geol. Surv., Prof. Paper 800-C, p. C127–C144.

Mamet, B. L. and Gabrielse, H.
1969: Foraminiferal zonation and stratigraphy of the type section Nizi Formation (Carboniferous System, Chester Group), British Columbia; Geol. Surv. Can., Paper 69-19, p. 1–20.

Mamet, B. L. and Mason, D.
1968: Foraminiferal zonation of the Lower Carboniferous Connor Lake section, British Columbia; Bull. Can. Petrol. Geol., v. 16, no. 2, p. 147–166.
1970: Lisburne Group, lithostratigraphy and foraminiferal zonation, Trout Lake, northwest Yukon Territory; Bull. Can. Petrol. Geol., v. 18, no. 4, p. 556–565.

Mamet, B. L., Mikhailoff, N., and Mortelmans, G.
1970: La stratigraphie du Tournaisien et du Viséen inférieur de Landelies. Comparison avec les coupes du Tournaisis et du bord nord du synclinal de Namur; Soc. belge Géol., Paléont. Hydrol., Mém. 8, no. 9, p. 1–80.

Mamet, B. L. and Playford, P. E.
1968: Sur la présence de Quasiendothyrinae (Foraminifères) en Australie Occidentale (Canning Basin); C.R. som. Soc. géol. France (7e série), v. 9, p. 229, 230.

Mamet, B. L. and Rudloff, B.
1972: Algues carbonifères de la partie septentrionale de l'Amérique du Nord; Revue de Micropaléontologie, v. 15, no. 2, p. 75–114.

Mamet, B. L. and Skipp, Betty
1970a: Preliminary foraminiferal correlations of Early Carboniferous strata in the North American Cordillera; Liège Univ. Cong. et Coll., v. 55, p. 327–348.
1970b: Lower Carboniferous foraminifera; preliminary zonation and stratigraphic implication for the Mississippian of North America; Sixth Internat. Congr. Carboniferous Stratigraphy, v. 3, p. 1129–1146.

McKee, E. D. and Gutschick, R. C.
1969: History of the Redwall Limestone; Geol. Soc. Am., Mem. 114, p. 173–257.

Moore, P. F.
1958: Late Paleozoic stratigraphy in the Rocky Mountains and foothills of Alberta, a critical historical review *in* Jurassic and Carboniferous of Western Canada – A symposium; Am. Assoc. Petrol. Geol., John Andrew Allan Memorial Volume, p. 145–176.

Nelson, S. J.
1960: Mississippian lithostrotionid zones in the southern Canadian Rocky Mountains; J. Paleontol., v. 34, no. 1, p. 107–126.
1961: Permo-Carboniferous of the northern Yukon Territory; J. Alberta Soc. Petrol. Geol., v. 9, p. 1–9.

Omara, S. and Conil, R.
1965: Lower Carboniferous Foraminifera from Southwestern Sinai, Egypt; Soc. géol. Belgique, Annales, v. 88, no. 5, p. 221–242.

Oswald, D. H.
1968: Mississippian stratigraphy of the Nordegg area, Alberta; Alberta Soc. Petrol. Geol., Guidebook, p. 42–47.

Petryk, A. A. and Mamet, B. L.
1972: Lower Carboniferous algal flora, southwestern Alberta; Can. J. Earth Sci., v. 9, no. 7, p. 767–802.

Petryk, A. A., Mamet, B. L., and Macqueen, R. W.
1970: Preliminary foraminiferal zonation, Rundle Group and uppermost Banff Formation (Lower Carboniferous), southwestern Alberta; Bull. Can. Petrol. Geol., v. 18, no. 1, p. 84–103.

Procter, R. M. and Macauley, G.
1968: Mississippian of Western Canada and Williston Basin; Bull. Am. Assoc. Petrol. Geol., v. 52, no. 10, p. 1956–1968.

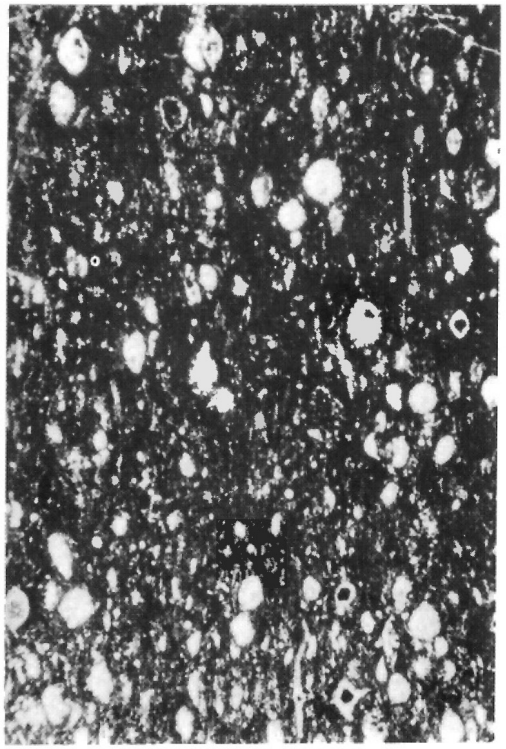
Rauser–Tschernoussova, D. M.
1948: On some representants of the group *Endothyra bradyi* Mikhailov (in Russian); Adad. Nauk SSSR, Inst. Geol., Trudy 62, no. 19, p. 176, 177.

Skipp, Betty
1969: Foraminifera, *in* McKee, E. D., and Gutschick, R. C., History of the Redwall Limestone in northern Arizona; Geol. Soc. Am., Mem. 114.

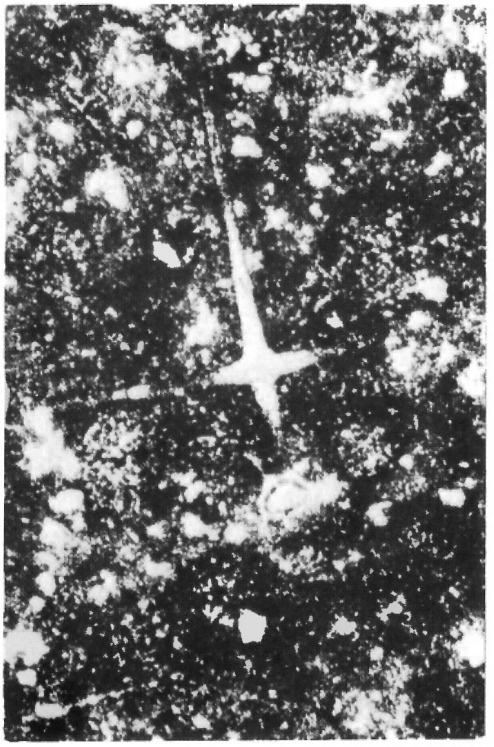
Solovieva, M. F.
1969: On the Lower–Middle Carboniferous limit in Nova Zemlyia (in Russian); Nauchno-Issled. Inst. Geologii Arktiki, Uchennye Zapiski, Paleont. Biostrat., Bull. 28, p. 5–15.

Stearn, C. W.
1956: Type-section of the Shunda Formation; J. Alberta Soc. Petrol. Geol., v. 4, p. 237–239.

Sutherland, P. K.
1958: Carboniferous stratigraphy and rugose corals of northeastern British Columbia; Geol. Surv. Can., Mem. 295.



1



2

"EXSHAW" FORMATION

Figure 1. "Exshaw" Formation (lower), 195 feet above base; undetermined Lower Tournaisian Zone.

Silicified, fine- to medium-grained radiolarian wackestone; some sponge spicules; deepest platform facies illustrated in this report; sedimentologically and petrographically different from the type Exshaw of Alberta; x38.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd.; section CH; Mamet No. 102/3; GSC type No. 39217.

Figure 2. "Exshaw" Formation (upper), 464 feet above base; undetermined Lower Tournaisian Zone.

Recrystallized, fine- to medium-grained spiculitic chert; x121.

Location and collector as in fig. 1; Mamet No. 101/28; GSC type No. 39218

3



4



BANFF FORMATION

Figure 3. Banff Formation (lowermost); undetermined Tournaisian Zone.

Silicified sponge spiculite (sponge packstone); deep part of the platform; x38.

Location and collector as in fig. 1; Mamet No. 101/29; GSC type no. 39219.

Figure 4. Banff Formation (lower), 890 feet above base; undetermined Tournaisian Zone.

Silicified sponge spiculite (sponge packstone); x38.

Location and collector as in fig. 1; Mamet No. 102/1; GSC type No. 39220.

PLATE 2

BANFF FORMATION

Figure 1. Banff Formation (upper), 432 feet above base, depth 12,056 feet; Zone 7, Middle Tournaisian.

Medium-grained, poorly sorted, recrystallized pelmatozoan-pellet packstone; matrix as ghost; bryozoans, brachiopods, Earlandiidae (*Earlandia* sp.) incertae sedis (*Paracalligelloides–Irregularina* sp.), and *Calcisphaera* sp. are conspicuous; x31.

Phillips Ancona No. 1 8-27-39-11W5, Alberta, locality 61; collected by Chevron Standard Ltd.; Mamet No. 102/5; GSC type No. 39221.

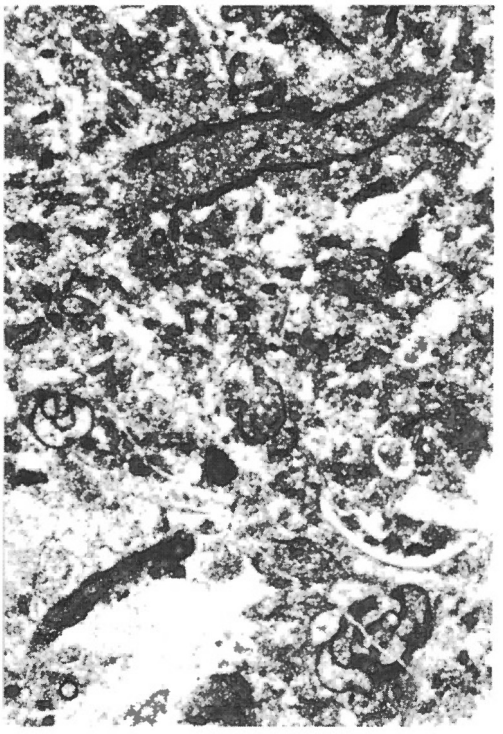


1

Figure 2. Banff Formation (upper), 442 feet above base, depth 12,046 feet; Zone 7, Middle Tournaisian.

Poorly sorted, recrystallized, pelmatozoan-pellet packstone; matrix as ghost; bryozoans, brachiopods, and foraminifers are present; *Latiendothyra* of the group *L. parakosvensis* (Lipina) and *Septaglomospiranella* sp.; the incertae sedis *Paracalligelloides–Irregularina* is mud filled. *Calcisphaera* sp. are conspicuous; x31.

Location and collector as in fig. 1; Mamet No. 100/2; GSC type No. 39222.



2

3

Figure 3. Banff Formation (upper), 467 feet above base, depth 12,001 feet; Zone 7, Middle Tournaisian.

Poorly sorted, recrystallized pelmatozoan-pellet packstone; matrix as ghost; brachiopods, echinoid spine and algae (*Girvanella* sp.) are present; foraminifer is *Latiendothyra* of the group *L. parakosvensis* (Lipina); x38.

Location and collector as in fig. 1; Mamet No. 100/11; GSC type No. 39223.



4

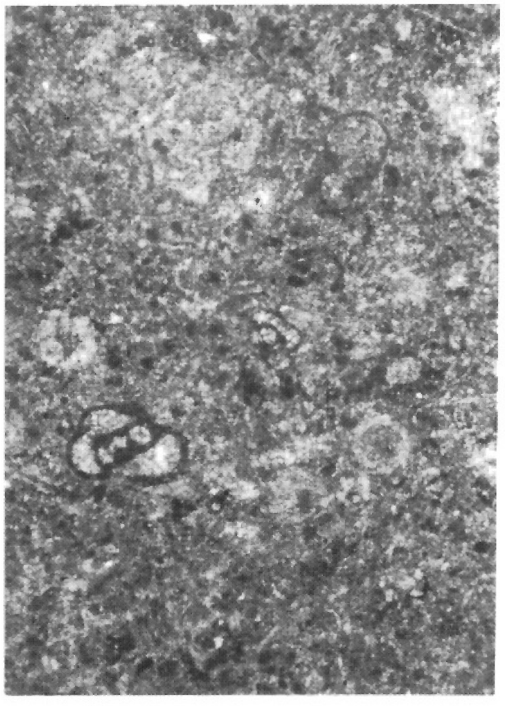
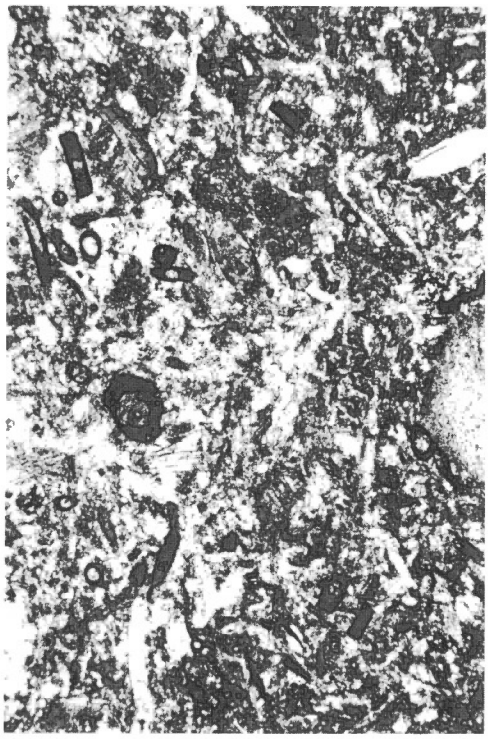


Figure 4. Banff Formation (upper), 169 feet below top; Zone 7, Middle Tournaisian. Fine- to medium-grained, pellet-pelmatozoan-foraminifer wackestone; foraminifers are *Chernyshinella disputabilis* Dain and *Latiendothyra* sp.; calcispheres and *Parathurammina* sp. are conspicuous; x31.

Clearwater River, Alberta, locality 12; collected by R. W. Macqueen; GSC loc. 74679; Mamet 237/23; GSC type No. 39224.

BANFF FORMATION



1



2

Figures 1, 2. Banff Formation (middle), 612 feet above base; Zone pre-7 or 7, Middle Tournaisian.

Recrystallized, poorly sorted, pelmatozoan-bryozoan-brachiopod packstone, with abundant *Earlandia* of the group *E. elegans* (Rauser-Tschernoussova); x31.

Mount Lorette, Alberta, locality 42; collected by R. W. Macqueen; GSC loc. 74624; Mamet Nos. 234/23 and 234/25; GSC type Nos. 39225 (fig. 1), 39226 (fig. 2).

3



4

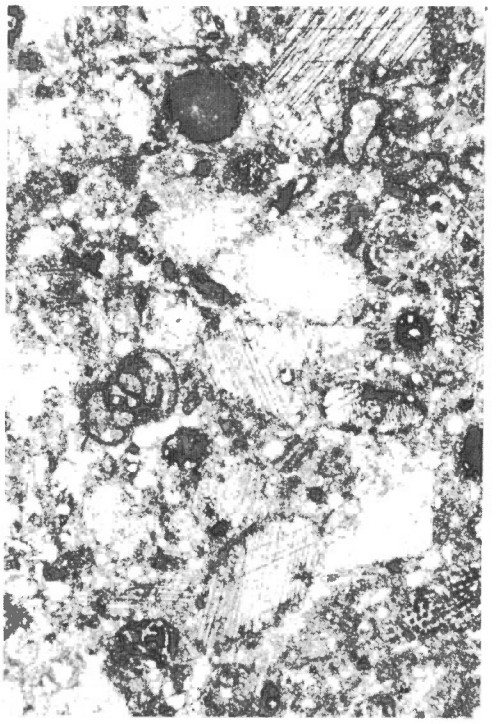


Figure 3. Banff Formation (middle), 498 feet below top; Zone pre-7 or 7, Middle Tournaisian.

Medium- to coarse-grained pelmatozoan plates with epitaxial overgrowth; *Earlandia* of the group *E. moderata* (Malakhova), an echinoid spine and lumps are present; x31.

Flat Creek, Alberta, locality 21; collected by R. W. Macqueen, GSC loc. 74544; Mamet No. 237/7; GSC type No. 39227.

Figure 4. Banff Formation (upper), 71 feet below top; Zone 7, Middle Tournaisian.

Recrystallized, medium-grained, poorly sorted, pelmatozoan-bryozoan "grainstone"; original amount of matrix impossible to assess due to widespread epitaxial overgrowth on the ossicles; additional elements are lumps, pellets, and micrite-filled *Septaglomospiranella* sp. and *Brunsiina* sp.; x31.

Late Minnewanka, Alberta, locality 34; collected by R. W. Macqueen; GSC loc. 74031; Mamet No. 233/29; GSC type No. 39228.

PLATE 4

LOWER PEKISKO FORMATION

Figure 1. Pekisko Formation (lower), 10 feet below top; Zone 7, Middle Tournaisian.

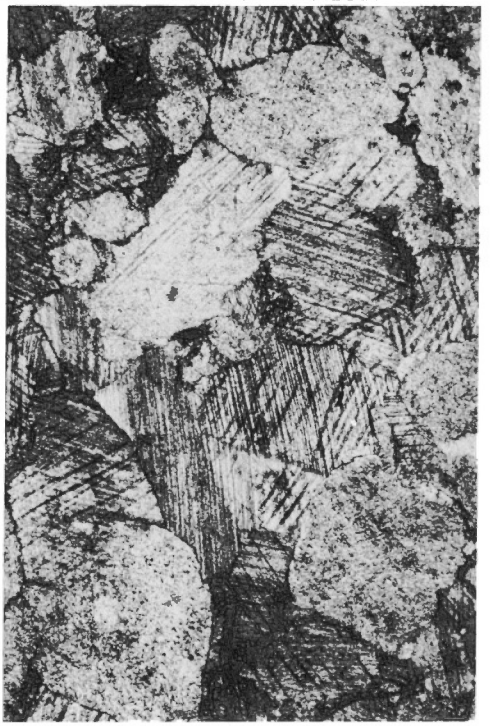
Coarse-grained, epitaxial overgrowth on crinoid ossicles; exact nature of original rock unknown; x31.

Mount Tyrrell, Alberta, locality 46; collected by R. W. Macqueen; GSC loc. C-1005; Mamet No. 148/23; GSC type No. 39229.

Figure 2. Pekisko Formation (lower), 1 foot above base; Zone 7, Middle Tournaisian.

Medium-grained, pelmatozoan-brachiopod-lump "grainstone"; three sections of *Septaglomospiranella primaeva* (Chernysheva) (non Rauser-Tschernoussova); x38.

Lower Clearwater River, Alberta, locality 12a; collected by N. C. Ollerenshaw; GSC loc. 77066; Mamet No. 86/20; GSC type No. 39230.



1



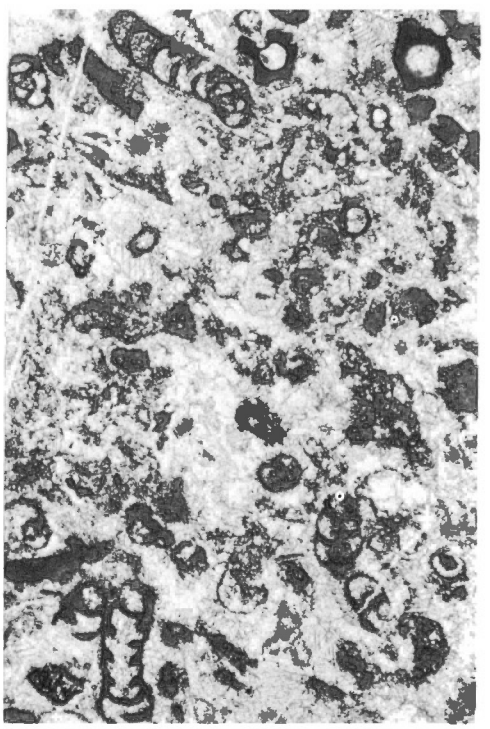
2

3

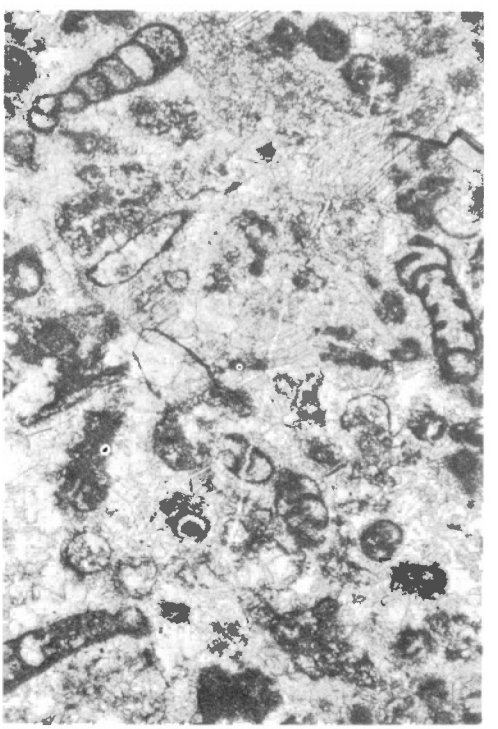
Figures 3, 4. Pekisko Formation (lower), 25–30 feet above base; boundary of Zones 7/8, boundary between Middle and Late Tournaisian, Osage age equivalent.

Recrystallized, medium-grained, pelmatozoan-foraminiferal "grainstone"; abundant *Palaeospiroplectammina* of the group *P. chernyshinensis* (Lipina), with *Septaglomospiranella* sp. and *Parathurammina* of the group *P. suleimanovi* Lipina; x31.

Sphinx Creek, Nikanassin Range, Alberta; locality 67a; collected by E. W. Mountjoy; Mamet Nos. 180/20, 180/23; GSC type Nos. 39231 (fig. 3), 39232 (fig. 4).



4



UPPER PEKISKO FORMATION

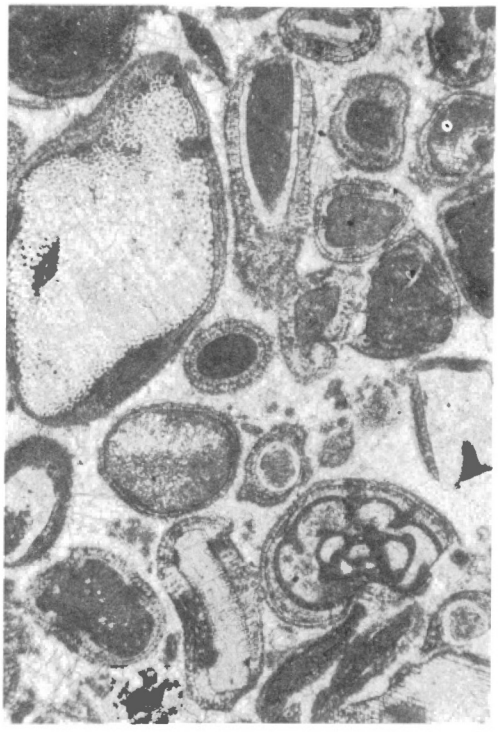


1



2

3



4



Figure 1. Pekisko Formation (upper), approximately 7 feet below top; Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium-grained, well-sorted, lump-oolite grainstone; nuclei formed by pelmatozoan plates, *Kamaena maclareni* Mamet and Rudloff, *Kamaena delicata* (Antropov), bryozoans, and brachiopods; x38.

Nordegg, Alberta, locality 48; collected by R. W. Macqueen; GSC loc. C-1261; Mamet No. 175/28; GSC type No. 39233.

Figures 2, 3. Pekisko facies of Shunda Formation; Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium- to coarse-grained lump-oolite grainstone; nuclei formed by pelmatozoan plates, lumps, *Tuberendothyra tuberculata* (Chernysheva), brachiopods, and kamaenid algae; micrite coating in fig. 2 simulates an *Earlandia*, but the thallus of *Kamaena* is still recognizable in the upper right of photograph; x51 and x31.

Clearwater River, Alberta, locality 12; collected by R. W. Macqueen; GSC loc. 74681; Mamet Nos. 237/26 and 237/27; GSC type Nos. 39234 (fig. 2), 39235 (fig. 3).

Figure 4. Pekisko facies of Shunda Formation; Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium-grained, oolite-pelmatozoan packstone; *Septaglomospiranella* (*Neoseptaglomospiranella*) *dainae* Lipina, lumps, brachiopods, and bryozoans serve as nuclei; x31.

Clearwater River, Alberta, locality 12; collected by R. W. Macqueen; GSC loc. 74682; Mamet No. 237/28; GSC type No. 39236.

PLATE 6

UPPER PEKISKO FORMATION

Figure 1. Pekisko Formation (upper); Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium-grained, rather well sorted, pelmatozoan - foraminifer - bryozoan wackestone; some oolitization and mud coating; two oblique sections of *Tuberendothyra tuberculata* (Chernysheva); x31.

Panther River, Alberta, locality 57; collected by R. W. Macqueen; GSC loc. 74011; Mamet No. 233/14; GSC type No. 39237.

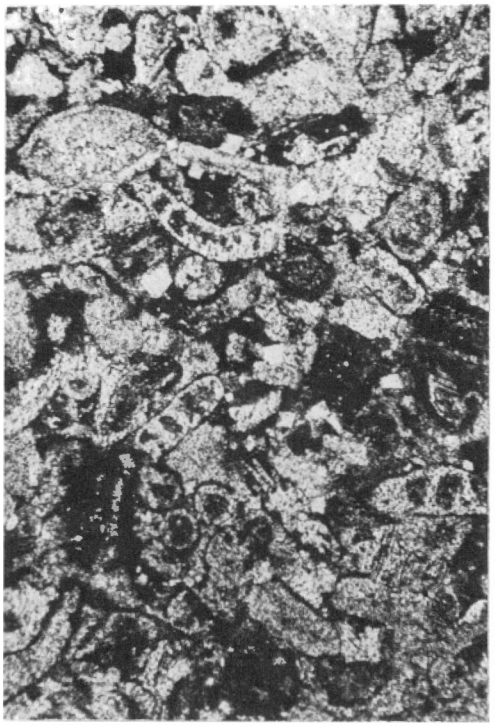
Figure 2. Pekisko Formation (upper), approximately 108 feet above base; Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium-grained, kamaenid [*Palaeoberesella lahuseni* (von Möller)] algal mat; pressure solution is widespread and the outline of the thalli, lumps, and pelmatozoan plates is poorly defined; x38.

Nordegg, Alberta, locality 48; collected by R. W. Macqueen; GSC loc. C-2402; Mamet No. 157/26; GSC type No. 39238.

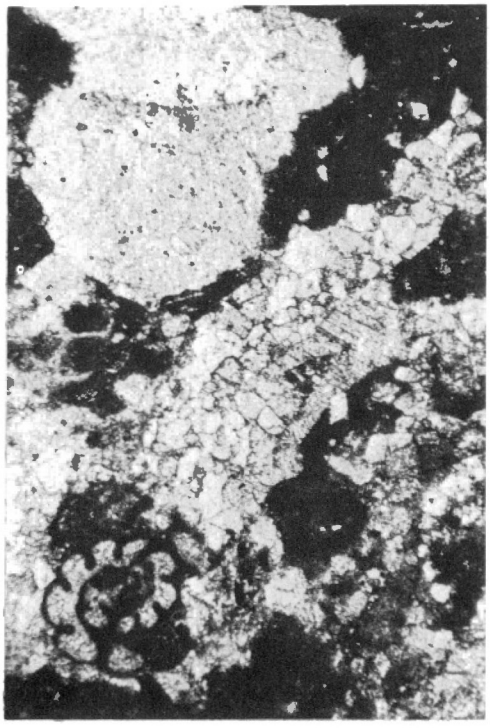


1



2

3



4

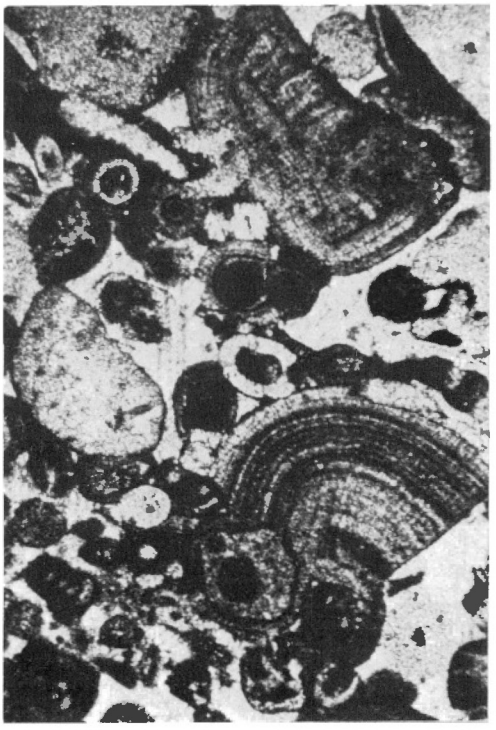


Figure 3. Pekisko Formation (upper), 35 feet below top; Zone 8, Late Tournaisian, middle Osage age equivalent.

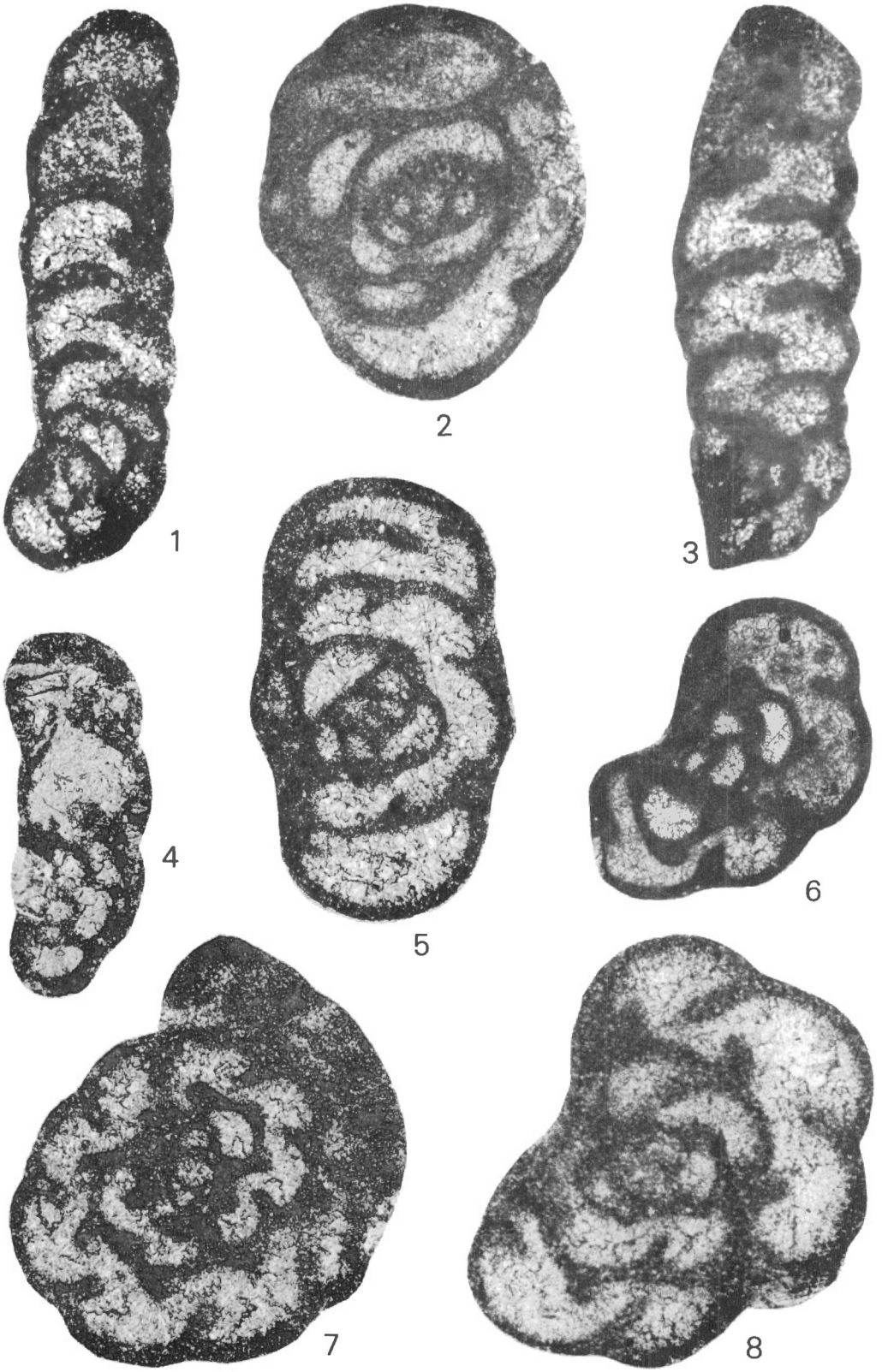
Recrystallized lump - pelmatozoan "grainstone", some dolomite rhombs; high section of "*Plectogyra trachida*" of Zeller; x31.

Deception Creek, Alberta, locality 15; collected by R. W. Macqueen; GSC loc. C-2459; Mamet No. 159/28; GSC type No. 39239.

Figure 4. Pekisko Formation (upper), 1 foot below top; Zone 8, Late Tournaisian, middle Osage age equivalent.

Poorly sorted, coarse-grained, oolite-lump grainstone; note the broken oolite fragments mud-filled foraminifers (*Septaglomospiranella* sp.) simulating lumps, kamaenids, and algal, mud-coated fragments; x31.

Location and collector as in fig. 3; GSC loc. C-1325; Mamet No. 157/9; GSC type No. 39240.



Figures 1, 3. *Palaeospiroplectammina* of the group *P. chernyshinensis* (Lipina)

1. Pekisko Formation, 25–30 feet above base; boundary of Zones 7/8, boundary between Middle and Late Tournaisian, Osage age equivalent; x121.

Sphinx Creek, Nikanassin Range, Alberta; locality 67a; collected by E. W. Mountjoy; sample number 2-M-55; Mamet No. 180/22; GSC type No. 39241.

3. As in fig. 1; x121; Mamet No. 180/18; GSC type No. 39243.

Figures 2, 5. *Septaglomospiranella* (*Neoseptaglomospiranella*) *dainae* Lipina

2. Pekisko Formation (upper); Zone 8, Late Tournaisian, Osage age equivalent; x121.

Clearwater River, Alberta; locality 12 (Pekisko facies of Shunda Formation); collected by R. W. Macqueen; GSC loc. 74682; Mamet No. 237/27; GSC type No. 39242.

5. Pekisko Formation (upper); Zone 8, Late Tournaisian, Osage age equivalent; x121.

Clearwater River, Alberta, locality 12 (Pekisko facies of Shunda Formation); collected by R. W. Macqueen; GSC loc. 74681; Mamet No. 237/24; GSC type No. 39245a.

Figure 4. *Rectoseptaglomospiranella nalivkini* (Malakhova) (="*Granuliferelloides jasperensis*" of McKay and Green)

Pekisko Formation (lower), 195 feet above base; top of Zone 7, Middle Tournaisian, Osage age equivalent; x121.

Blackstone Gap, Alberta, locality 6; collected by Chevron Standard Ltd.; section EA-21; Mamet No. 142/20; GSC type No. 39244.

Figures 6–8. *Tuberendothyra tuberculata* (Chernysheva)

6. As in fig. 5; x78; GSC loc. 74681; Mamet No. 237/25; GSC type No. 39245.

7. Pekisko Formation (upper), 125 feet above base; Zone 8, Late Tournaisian, Osage age equivalent; x121.

Blackstone Gap, Alberta, locality 6; collected by Chevron Standard Ltd.; Mamet No. 102/7; GSC type No. 39246.

8. Pekisko Formation (upper), approximately 7 feet below top; Zone 8, Late Tournaisian, Osage age equivalent; x121.

Nordegg, Alberta, locality 48; collected by R. W. Macqueen; GSC loc. C-1261; Mamet No. 152/1; GSC type No. 39247.

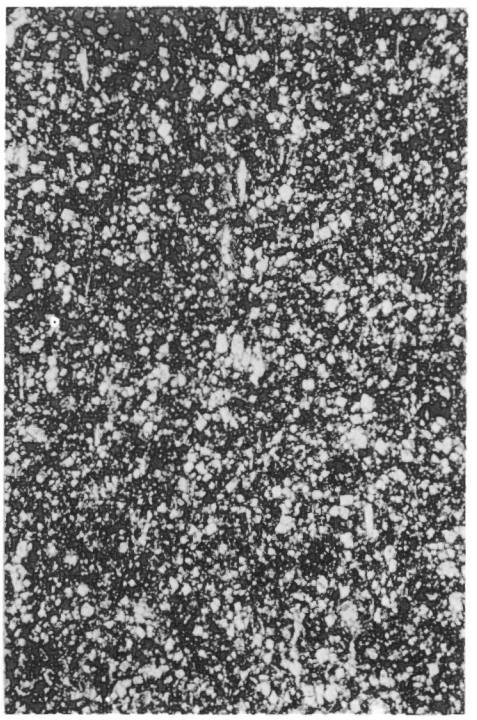
PLATE 8

LOWER SHUNDA FORMATION

Figure 1. Shunda Formation (lower), 27 feet above base; Zone 8, Late Tournaisian, middle Osage age equivalent.

Dolomitized, fine-grained, euxinic mudstone; x31.

Mount Tyrrell, Alberta, locality 46; collected by R. W. Macqueen; GSC loc. C-1008; Mamet No. 148/24; GSC type No. 39248.



1

Figure 2. Shunda Formation (lower), 30 feet above base; Zone 8, Late Tournaisian, middle Osage age equivalent.

Medium-grained pelmatozoan-bryozoan hash; lump and brachiopod ghosts; original nature of the rock unknown, as pelmatozoan plates have epitaxial overgrowth; some diagenetic quartz crystals; x31.

Location and collector as in fig. 1; GSC loc. C-1009; Mamet No. 148/25; GSC type No. 39249.



2

Figure 3: Shunda Formation (lower), 99 feet above base; Zone 8, Late Tournaisian, middle Osage age equivalent.

Fine-grained, euxinic mudstone; x31.

Location and collector as in fig. 1; GSC loc. C-1014; Mamet No. 148/30; GSC type No. 39250.

3

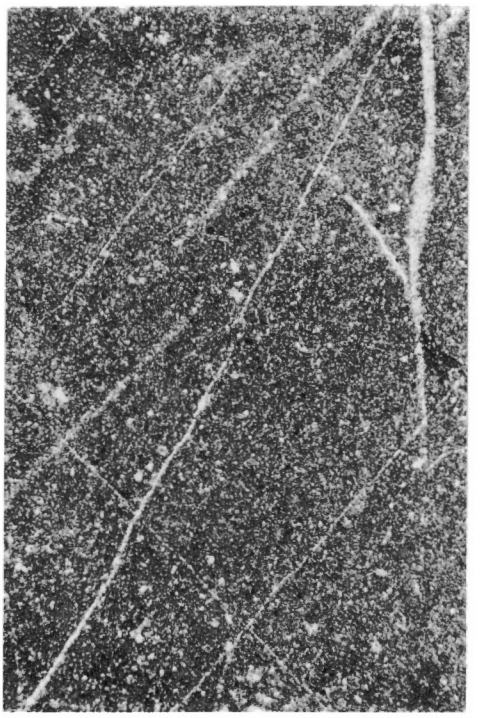
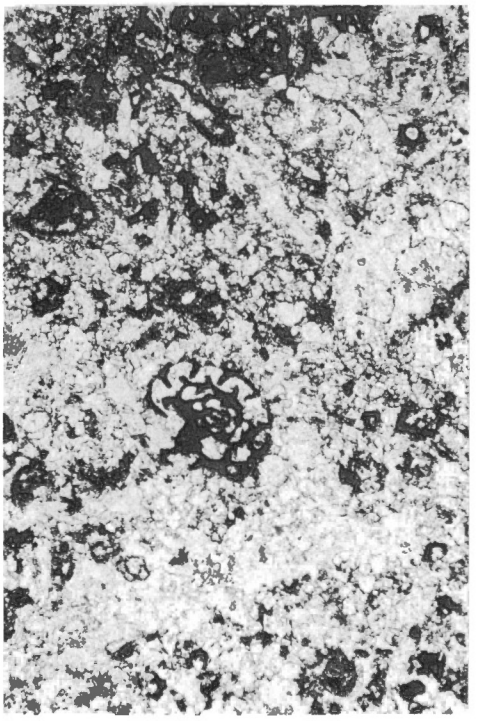


Figure 4. Shunda Formation (lower), 18 feet above base; Zone 8, Late Tournaisian, middle Osage age equivalent.

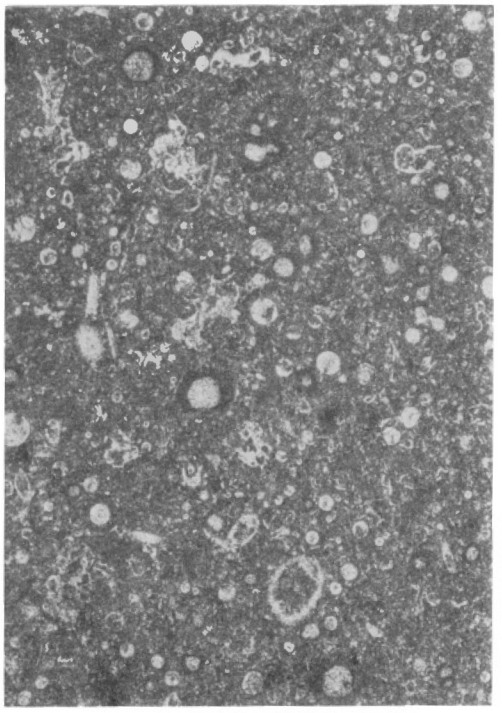
Recrystallized, slightly dolomitic, pelmatozoan-pellet "grainstone"; *Spinoendothyra paracostifera* (Lipina), *Vicinesphaera* sp., and *Parathurammina* of the group *P. suleimanovi* Lipina are present; x31.

Job Creek, Alberta, locality 31; collected by R. W. Macqueen; GSC loc. C-1313; Mamet No. 150/7; GSC type No. 39251.

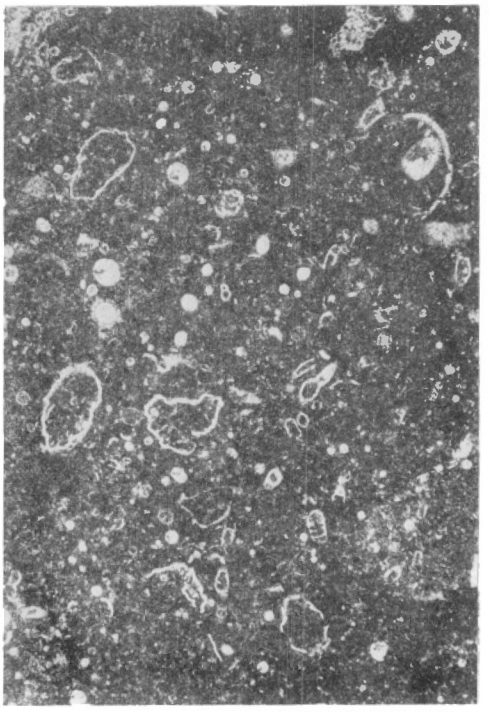
4



UPPER SHUNDA FORMATION



1



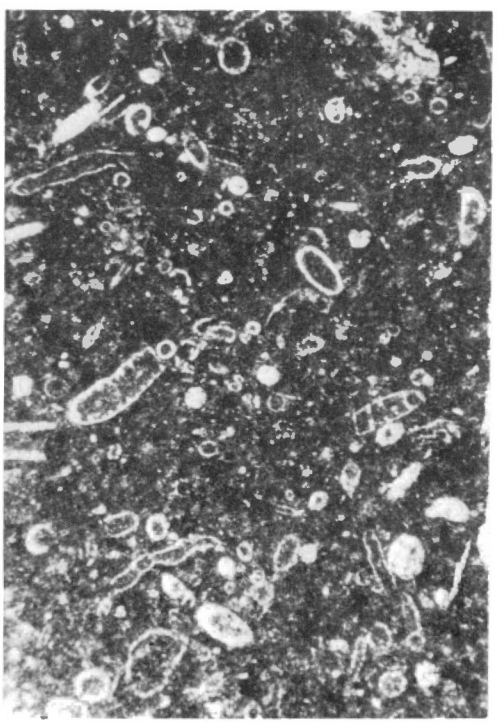
2

Figures 1, 2. Shunda Formation (upper), 14 feet below top; boundary of Zones 9/10, Tournaisian–Viséan transition.

Lagoonal, algae-calcisphere wackestone; abundant *Calcisphaera* sp., *Kamaena* sp., and *Proninella* sp.; calcisphere wall fused with enclosing matrix and outline of spore case is difficult to recognize; most algae thalli were crumpled by retraction of the euxinic mud during lithification; some ostracodes and parathuramminids are present; x31.

Brazeau River, Alberta, locality 8; collected by Chevron Standard Ltd.; Mamet Nos. 101/3 and 100/23; GSC type Nos. 39252 (fig. 1), 39253 (fig. 2).

3



4

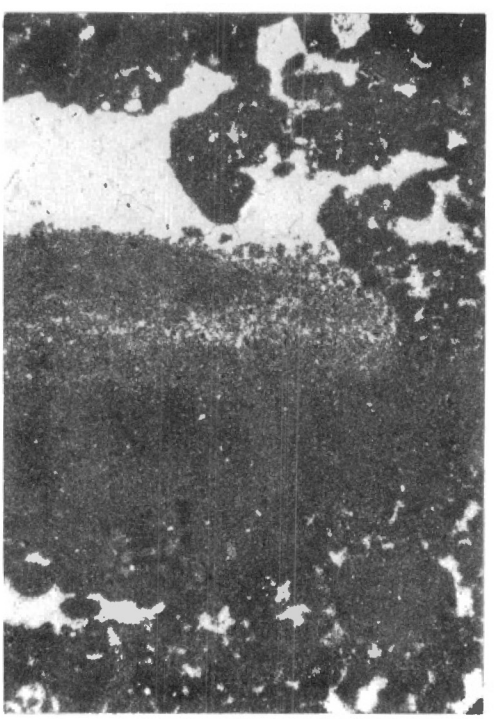


Figure 3. Shunda Formation (upper), 115 feet below top; Zone 9, Late Tournaisian, upper Osage age equivalent.

Lagoonal, algal wackestone; numerous *Kamaena* sp. and *Proninella* sp. are mixed with scarce ostracodes and calcispheres; as in figs. 1 and 2, the thalli are mud filled, but the algal spore cases are sparite filled; x31.

Mount Merlin, Alberta, locality 44; collected by R. W. Macqueen; GSC loc. C-2486; Mamet No. 159/14; GSC type No. 39254.

Figure 4. Shunda Formation (upper), 78 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Mud- and pellet-filled birdseye in a lump-pelletoidal loferite; rare *Calcisphaera* sp. and *Vicinesphaera* sp.; x31.

Canyon Creek, Alberta, locality 10; collected by R. W. Macqueen; GSC loc. C-1061; Mamet No. 175/19; GSC type No. 39255.

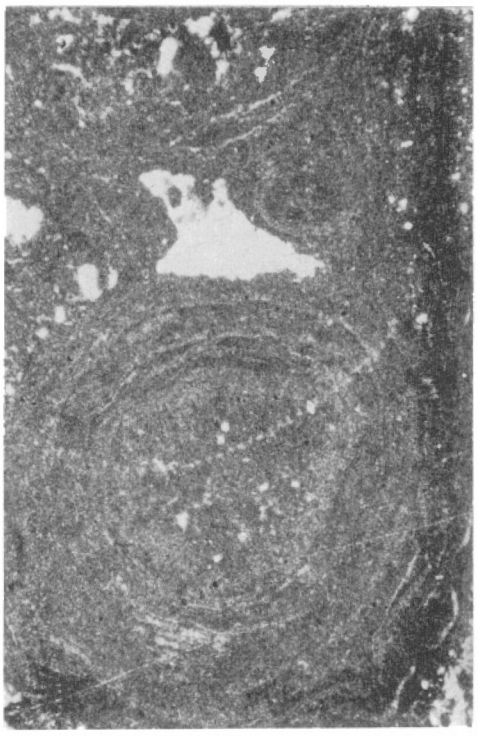
PLATE 10

UPPER SHUNDA FORMATION

Figure 1. Shunda Formation (upper), 101 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Algal oncolith with small "spongy" birdseyes; x31.

Canyon Creek, Alberta, locality 10; collected by R. W. Macqueen; GSC loc. C-1072; Mamet No. 149/18; GSC type No. 39256.

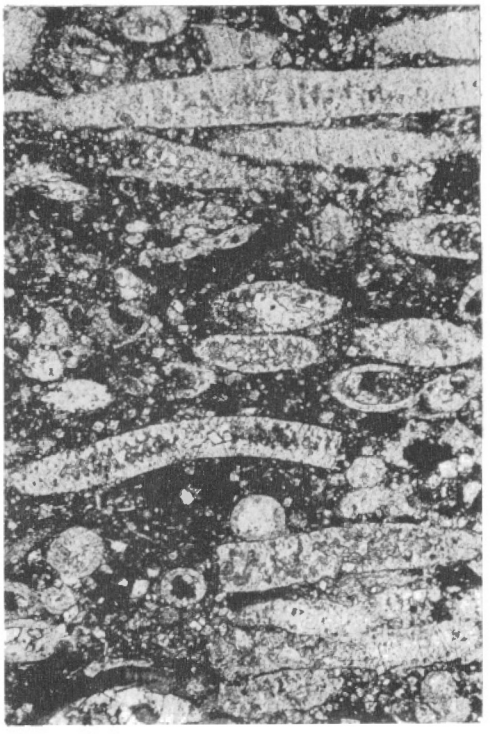


1

Figure 2. Shunda Formation (upper), 12 feet below top; top of Zone 9, latest Tournaisian, upper Osage age equivalent.

Kamaenid algal mat; intertwined *Palaeoberesella* cf. *P. lahuseni* (von Möller) formed a resistant boundstone-type layer; x31.

Location and collector as in fig. 1; GSC loc. C-1078; Mamet No. 175/37; GSC type No. 39257.



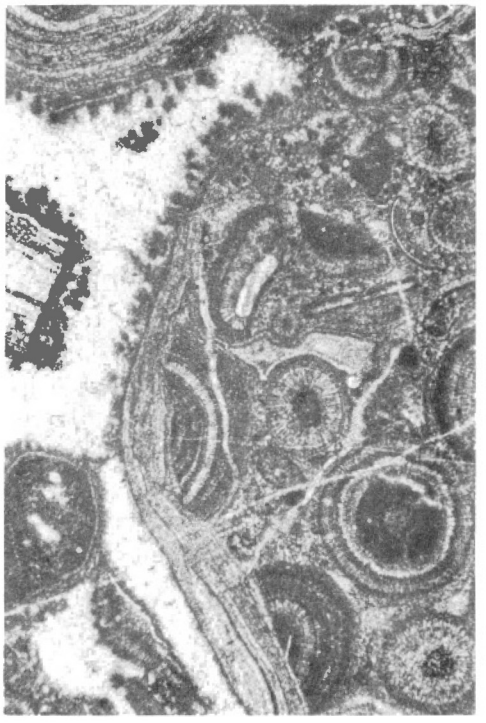
2

Figures 3, 4. Shunda Formation (upper), 122 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Spongiostromid pellets coating oncolitic "intraclasts" and pisolites; the matrix is composed of such algal pellets reduced to fine particles; x31.

Sirdar Mountain, Alberta, locality 64; collected by R. W. Macqueen; GSC loc. C-1305; Mamet Nos. 176/26, 176/28; GSC type Nos. 39258 (fig. 3), 39259 (fig. 4).

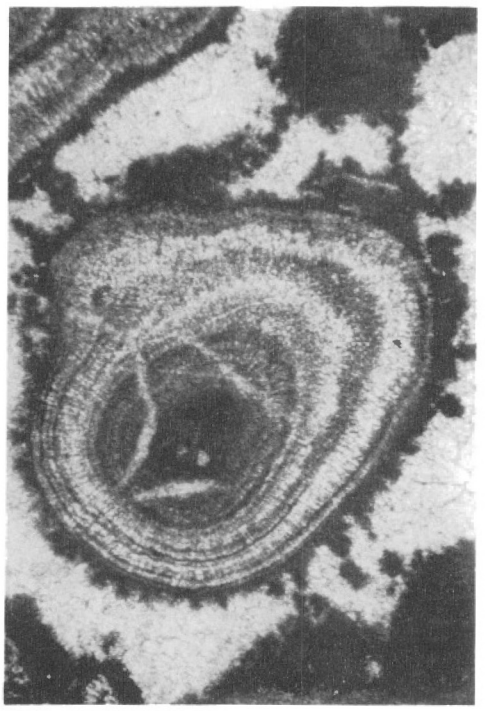
3



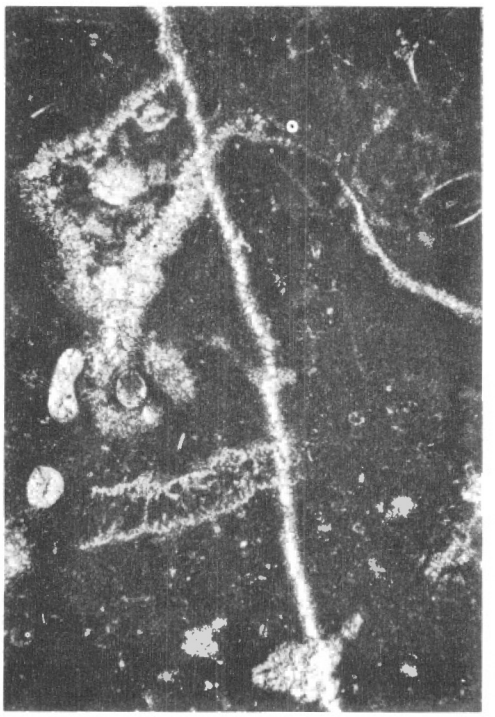
4



UPPER SHUNDA FORMATION



1



2

Figure 1. Shunda Formation (upper), 122 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Spongiostromid "pellets" coating an oncolitic pisolite; x38.

Sirdar Mountain, Alberta, locality 64; collected by R. W. Macqueen; GSC loc. C-1305; Mamet No. 152/25; GSC type No. 39260.

Figure 2. Shunda Formation (upper), 44 feet below top; Zone 9, Late Tournaisian, upper Osage age equivalent.

Proninella sp. in an ostracode mudstone; birdseyes of probable algal origin.

Mount Tyrrell, Alberta, locality 46; collected by R. W. Macqueen; GSC loc. C-1029; Mamet No. 149/2; GSC type No. 39261.

3



4

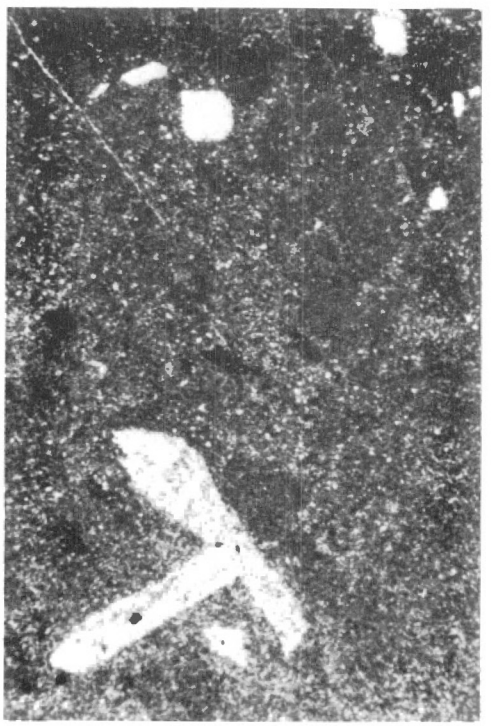


Figure 3. Shunda Formation (upper), 12 feet below top; Zone 9, Late Tournaisian, upper Osage age equivalent.

Medium-grained, recrystallized, foraminifer-pellet-pelmatozoan grainstone; some lumps are present; foraminifers are *Spinoendothyra spinosa* (Chernysheva), and *Septabrunsiina* sp.; x38.

Location and collector as in fig. 2; GSC loc. C-1033; Mamet No. 150/34; GSC type No. 39262.

Figure 4. Shunda Formation (upper), 50 feet below top, Zone 9, Late Tournaisian, upper Osage age equivalent.

Silicified gypsum pseudomorphs in a dark, pelletoid, slightly recrystallized mudstone; x31.

Job Creek, Alberta, locality 31; collected by R. W. Macqueen; GSC loc. C-2434; Mamet No. 158/10; GSC type No. 39263.

PLATE 12

UPPER SHUNDA FORMATION

Figure 1. Shunda Formation (upper), 43 feet below top; Zone 9, Late Tournaisian, upper Osage equivalent.

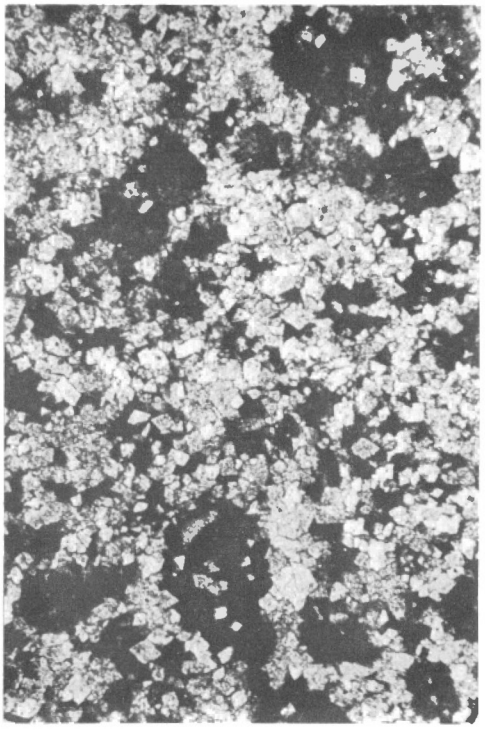
Dolomitized lump grainstone with foraminiferal ghosts; x31.

Job Creek, Alberta, locality 31; collected by R. W. Macqueen; GSC loc. C-2435; Mamet No. 158/13; GSC type No. 39264.

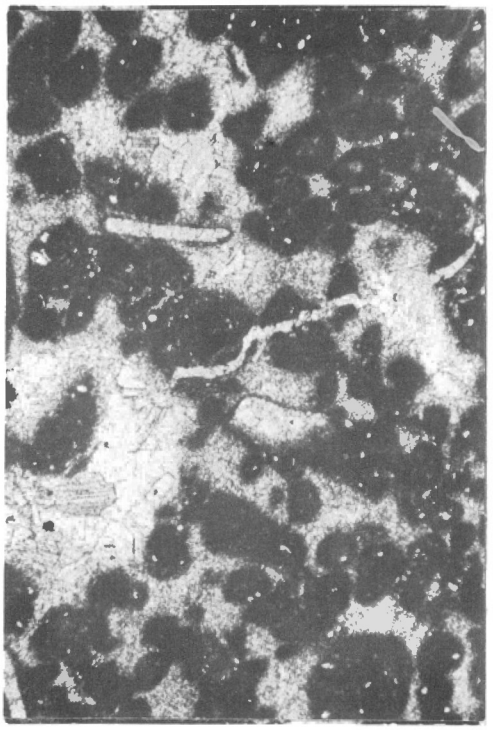
Figure 2. Shunda Formation (upper), 67 feet below top; Zone 9, Late Tournaisian, upper Osage age equivalent.

Algal lump loferite; x31.

Ghost River, Alberta, locality 23; collected by R. W. Macqueen; GSC loc. C-1096; Mamet No. 149/25; GSC type No. 39265.



1



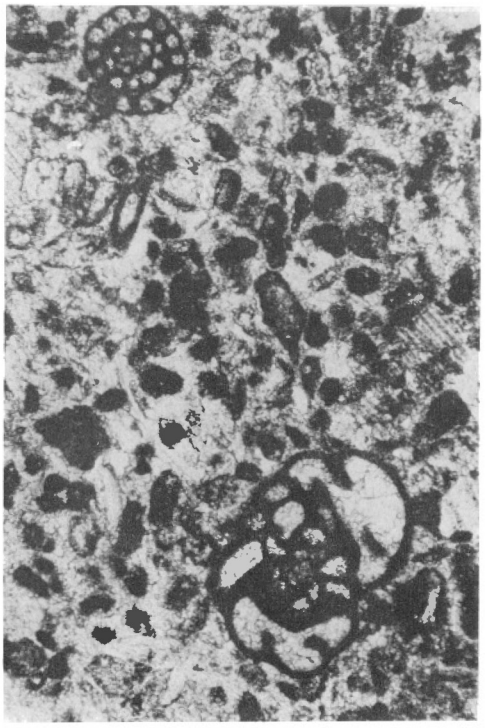
2

3

Figure 3. Shunda Formation (upper), 12 feet below top; boundary of Zones 9/10, Tournaisian–Viséan boundary.

Medium-grained, pellet-foraminifer-pelmatozoan grainstone; foraminifers are *Inflatoendothyra inflata* (Lipina) OBJ, *Earlandia* of the group *E. moderata* (Malakhova), and "*Globoendothyra*" *? trachida* (Zeller); x38.

Mount Tyrrell, Alberta, locality 46; collected by R. W. Macqueen; GSC loc. C-1033; Mamet No. 149/4; GSC type No. 39266.

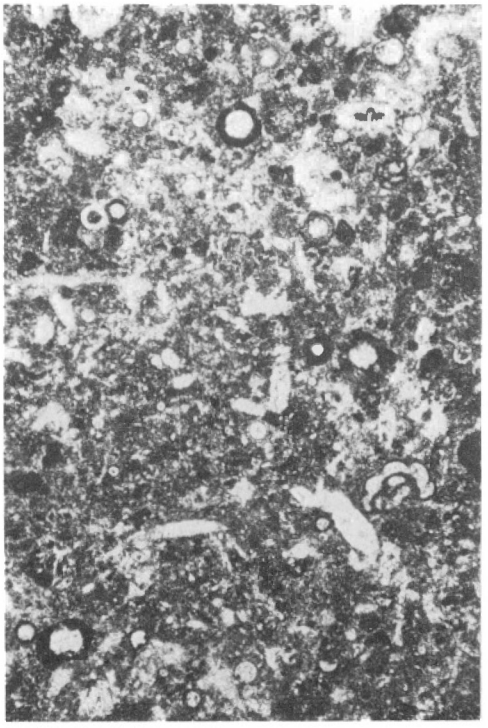


4

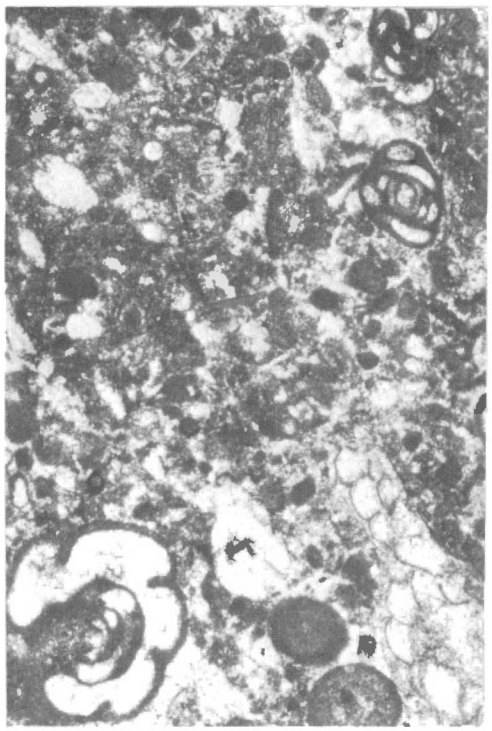
Figure 4. Shunda Formation (upper), 149 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Fine- to medium-grained, pelmatozoan-pellet-calcisphere wackestone; *Septaglomospiranella* sp.; *Calcisphaera laevis* Williamson, *Vicinesphaera* sp., *Parathurammina* of the group *P. suleimanovi* Lipina, "*Radiosphaera*" sp., and *Palaeocancellus* sp. are present; x 31.

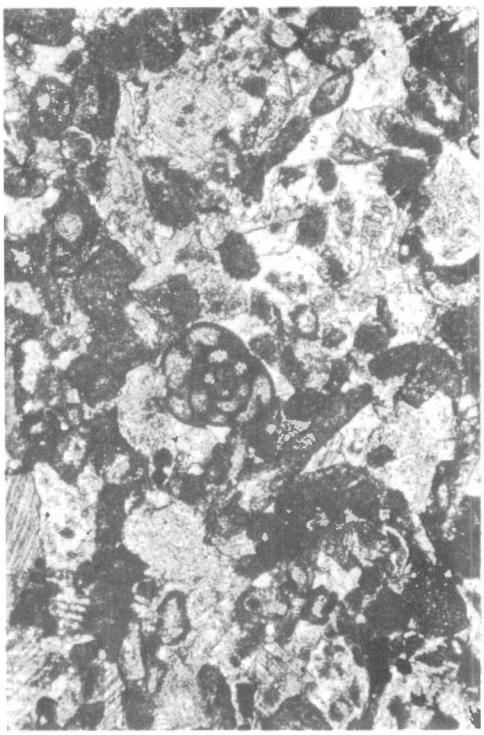
Deception Creek, Alberta, locality 15; GSC loc. C-1338; Mamet No. 150/10; GSC type No. 39267.



UPPER SHUNDA FORMATION



1



2

Figure 1. Shunda Formation (upper), 290–295 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Fine- to medium-grained, lump-pelmatozoan-bryozoan packstone; some cement; rare pseudo-oolites and pellets; foraminifers are *Latiendothyra parakosvensis* (Lipina), *Latiendothyra* sp., and *Glomospiranella* sp.; x 38.

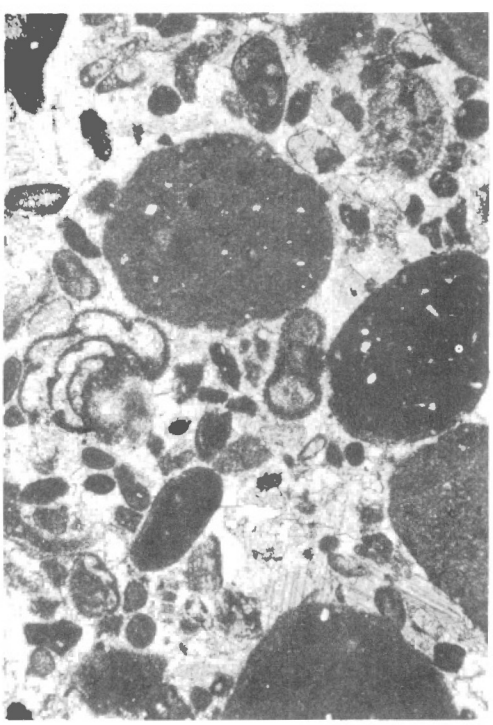
Folding Mountain, Alberta, locality 22; collected by E. W. Bamber; GSC loc. 55413; Mamet No. 93/26; GSC type No. 39268.

Figure 2. Shunda Formation (upper), 178 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent.

Medium-grained, recrystallized pelmatozoan-lump-foraminifer grainstone; epitaxial overgrowth on ossicles; rare pellets; some algal, mud-coated grains; foraminifer is *Spinoendothyra spinosa* (Chernysheva); x31.

Sentinel Mountain, Alberta, locality 62; collected by R. W. Macqueen; GSC loc. C-1151; Mamet No. 176/4; GSC type No. 39269.

3



4



Figure 3. Shunda Formation (upper), 45 feet below top; Zone 9, Late Tournaisian, upper Osage age equivalent.

Poorly sorted, lump-pellet grainstone; some pelmatozoan plates; foraminifers are *Septabrunsiina parakrainica* Skipp *in* Skipp, Holcomb and Gutschick and "*Septaglomospiranella*" with secondary deposits; x31.

Clearwater River, Alberta, locality 12; collected by R. W. Macqueen; GSC loc. 74683; Mamet No. 237/29; GSC type No. 39270.

Figure 4. Shunda Formation (upper), undetermined level; Zone 9, Late Tournaisian, upper Osage age equivalent.

Medium-grained, pelmatozoan-lump-brachiopod-bryozoan grainstone; algal, mud-coated grains; foraminifers are *Inflatoendothyra inflata* (Lipina) OBJ, (="*Endothyra*" *eospiroides* Skipp *in* McKee and Gutschick), *Earlandia* of the group *E. clavatula* (Howchin), and *Parathurammina* of the group *P. suleimanovi* Lipina; x31.

North Ram Gap, Alberta, locality 49; collected by Chevron Standard Ltd.; Mamet No. 142/28; GSC type No. 39271.

PLATE 14

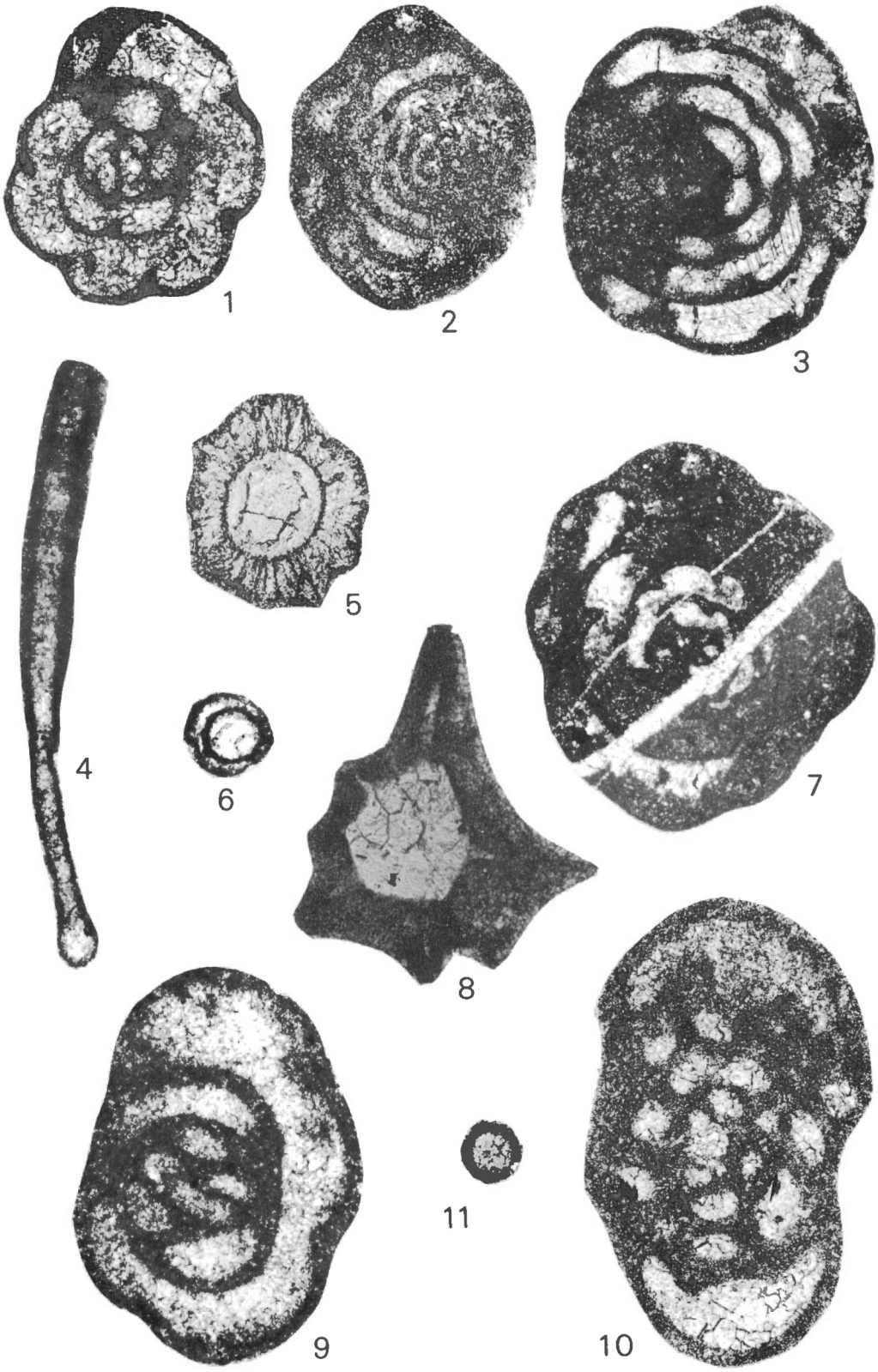


Figure 1. *Latiendothyra* of the group *L. parakosvensis* (Lipina) – *Latiendothyra parakosvensis* (Lipina)

Shunda Formation (lower), 640 feet below top; Zone 8, Late Tournaisian, middle Osage age equivalent; x121.

Mount Hanington, British Columbia; locality 39; collected by Shell Canada Ltd.; Mamet No. 60/25; GSC type No. 39272.

Figures 2, 3. *Septatournayella (?) kennedyi* Skipp, Holcomb and Gutschick

2. Shunda Formation (upper), 290–295 feet above base; Zone 9, Late Tournaisian, upper Osage age equivalent; x121.

Folding Mountain, Alberta, locality 22; collected by E. W. Bamber; GSC loc. 55413; Mamet No. 93/18; GSC type No. 39273.

3. Location, collector, and stratigraphic level as in fig. 1; x121; Mamet No. 60/23; GSC type No. 39274.

Figure 4. "*Earlandia*" *consternatio* (Conkin)

Location, collector and stratigraphic level as in fig. 2; x121; Mamet No. 93/11; GSC type No. 39275.

Figure 5. "*Radiosphaera*" aff, "*R.*" *basilica* (Reitlinger)

Shunda Formation (upper), 14 feet below top; boundary of Zones 9/10, Tournaisian–Viséan boundary; x148.

Brazeau River, Alberta, locality 8; collected by Chevron Standard Ltd.; Mamet No. 100/34; GSC type No. 39276.

Figure 6. *Eovolutina tujmasensis* Lipina

Locality, collector, and stratigraphic level as in fig. 2; x148; GSC loc. 55413; Mamet No. 93/19; GSC type No. 39277.

Figure 7. *Septabrunsiina parakrainica* Skipp *in* Skipp, Holcomb and Gutschick

Shunda Formation, top of formation; boundary between Zones 9 and 10, Tournaisian–Viséan boundary; x78.

Brazeau River, Alberta, locality 8; collected by Chevron Standard Ltd.; Mamet No. 100/19; GSC type No. 39278.

Figure 8. *Parathurammina* of the group *P. spinosa* (Williamson)

Locality, collector, and stratigraphic level as in fig. 5; x121; Mamet No. 100/32; GSC type No. 39279.

Figure 9. *Glomospiranella* of the group *G. subglobosa* Malakhova

Locality, collector, and stratigraphic level as in fig. 2; x121; Mamet No. 93/27; GSC type No. 39280.

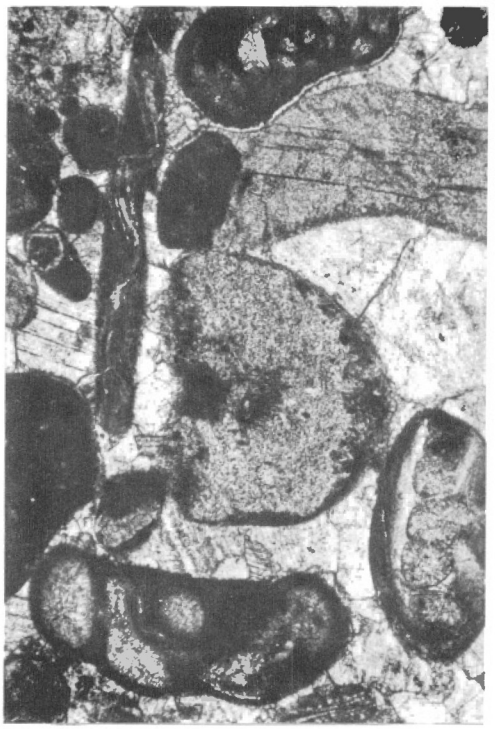
Figure 10. *Paradainella* sp.

Locality, collector, and stratigraphic level as in fig. 5; x 121; Mamet 333/7; GSC type No. 39281.

Figure 11. *Calcisphaera laevis* Williamson

Locality, collector, and stratigraphic level as in fig. 5; x121; Mamet No. 100/28; GSC type No. 39282.

TURNER VALLEY FORMATION



1



2

Figure 1. Turner Valley Formation (lower), 20 feet above base; basal Zone 10; earliest Viséan, Salem age equivalent.

Coarse-grained, pelmatozoan-foraminifer-lump grainstone; bryozoans, brachiopods, and pellets present; foraminifers are *Globoendothyra* of the group *G. baileyi* (Hall), "*Globoendothyra*" (*?*) *trachida* (Zeller), and *Spinoendothyra* sp.; x31.

Sheep Creek, Alberta, locality 63; collected by R. W. Macqueen; GSC loc. C-1048; Mamet No. 175/18; GSC type No. 39283.

Figure 2. Turner Valley Formation (lower), 33 feet above base; Zone 10, Early Viséan, Salem age equivalent.

Exvotarisella? cf. *E?. index* (Ehrenberg *sensu* von Möller) in a recrystallized packstone; note epitaxial overgrowth on the alga cortex; x121.

Mount Tyrrell, Alberta, locality 46; collected by R. W. Macqueen; GSC loc. C-1037; Mamet No. 151/3; GSC type No. 39284.

Figures 1 and 2 are atypical of the Turner Valley Formation, which is difficult to zone because endothyrids and algae usually are transformed into dolomitic ghosts.

3



4

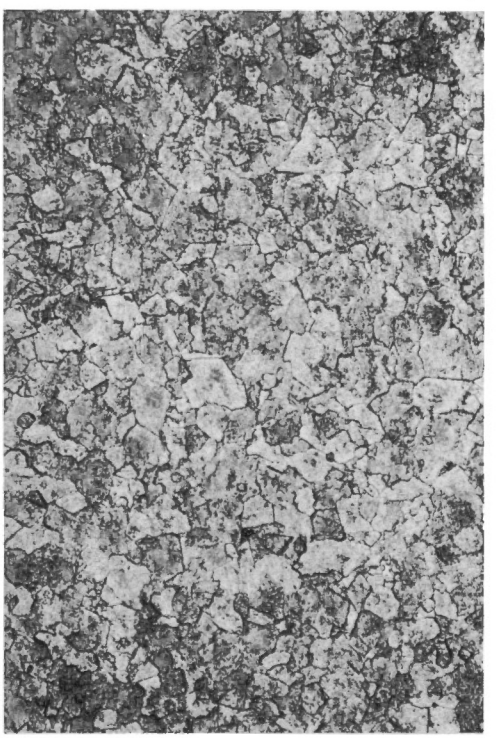


Figure 3. Turner Valley Formation (lower), 106 feet above base; undetermined Lower Viséan Zone, Salem age equivalent.

Medium-grained dolomitized packstone; x31.

Southesk-Cairn, Alberta, locality 66; collected by R. W. Macqueen; GSC loc. C-2469; Mamet No. 182/2; GSC type No. 39285.

Figure 4. Turner Valley Formation (lower), 37 feet above base; undetermined Lower Viséan Zone, Salem age equivalent.

Medium-grained, granular dolomite; x31.

Cadomin, Alberta, locality 9; collected by R. W. Macqueen; GSC loc. C-1260; Mamet No. 197/12; GSC type No. 39286.

PLATE 16

TURNER VALLEY FORMATION

Figure 1. Turner Valley Formation (upper); Zone 11, Early Viséan, Salem age equivalent.

Coarse-grained, bioclastic, crinoid-brachiopod grainstone; interpenetrant grains are widespread; an echinoderm spine, *Orthriosiphon saskatchewanensis* Johnson and Konishi, and *Globoendothyra* sp. are conspicuous; x31.

Jasper Lake, Alberta, locality 30a; collected by B. L. Mamet; Mamet No. 276/12, IGC 12; GSC type No. 39287.

Figure 2. Two thalli of *Orthriosiphon saskatchewanensis* Johnson and Konishi in a coarse-grained crinoid-bryozoan grainstone; stylolitic interpenetrant contacts are widespread; a "*Globoendothyra*" is "digested" by a crinoid ossicle; x31.

Location, collector, and stratigraphic level as in fig. 1; Mamet No. 276/27, IGC 12; GSC type No. 39288.



1



2

3

Figure 3. *Eoforschia* sp., *Dainella* sp., and *Globoendothyra* sp., in an interpenetrant grainstone; x31.

Locality, collector, and stratigraphic level as in fig. 1; Mamet No. 276/29, IGC 12; GSC type No. 39289.



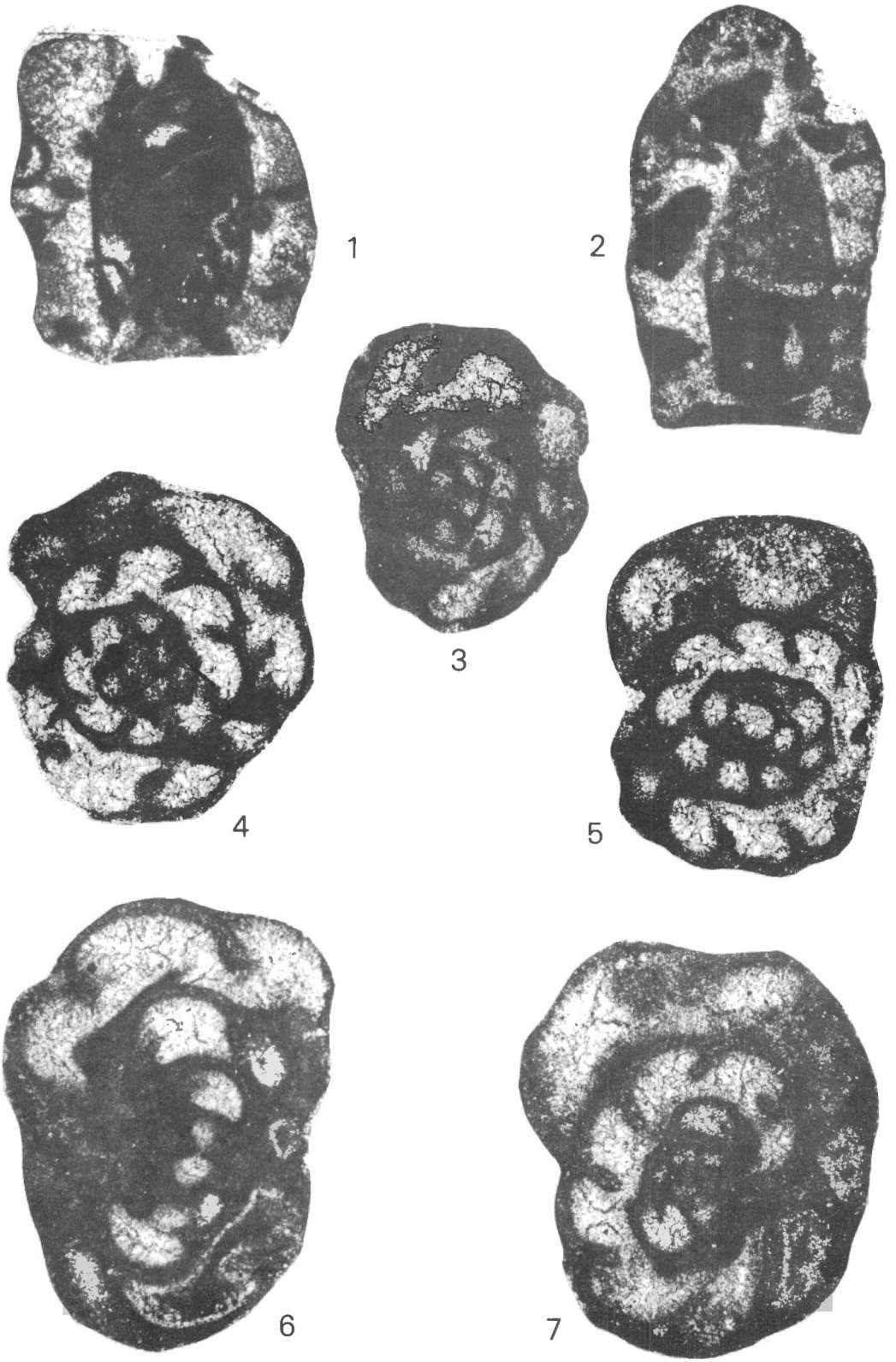
4

Figure 4. "*Globoendothyra*"*? trachida* (Zeller) in an interpenetrant grainstone; x31.

Locality, collector, and stratigraphic level as in fig. 1, Mamet No. 276/11, IGC 12; GSC type No. 39290.



TURNER VALLEY MICROBIOTA



Figures 1, 2. *Orthriosiphon saskatchewanensis* Johnson and Konishi

1. Turner Valley Formation (upper); Zone 11, Early Viséan, Salem age equivalent; x38.

Jasper Lake, Alberta, locality 30a; collected by B. L. Mamet; Mamet No. 276/13; IGC 12; GSC type No. 39291.

2. Locality, collector, and stratigraphic level as in fig. 1; x38; Mamet No. 276/14, IGC 12; GSC type No. 39292.

Figures 3–5. "*Globoendothyra*"*?* aff. "*G*". *trachida* (Zeller) (*Endothyra bridgensis* Skipp *in* McKee and Gutschick *part*); locality, collector, and stratigraphic level as in fig. 1; x78.

3. Mamet No. 276/15, IGC 12; GSC type No. 39293.

4. Mamet No. 276/21, IGC 12; GSC type No. 39294.

5. Mamet No. 276/23, IGC 12; GSC type No. 39295.

Figure 6. "*Globoendothyra*"*? trachida* (Zeller)

Location, collector, and stratigraphic level as in fig. 1; x78; Mamet No. 276/10, IGC 12; GSC type No. 39296.

Figure 7. *Globoendothyra* of the group *G. baileyi* (Hall)

Location, collector, and stratigraphic level as in fig. 1; x78; Mamet No. 276/22, IGC 12; GSC type No. 39297.

PLATE 18

LIVINGSTONE FORMATION

Figure 1. Livingstone Formation (basal); Zone 8, Late Tournaisian, Osage age equivalent.

Coarse-grained, pelmatozoan-bryozoan "grainstone", epitaxial overgrowth on ossicles; pressure solution widespread; foraminifers are *Tuberendothyra* sp. and a micrite-coated *Septabrunsiina?* sp.; x31.

Carrot Creek, Alberta, locality 11; collected by R. W. Macqueen; GSC loc. 74092; Mamet No. 233/35; GSC type No. 39298.

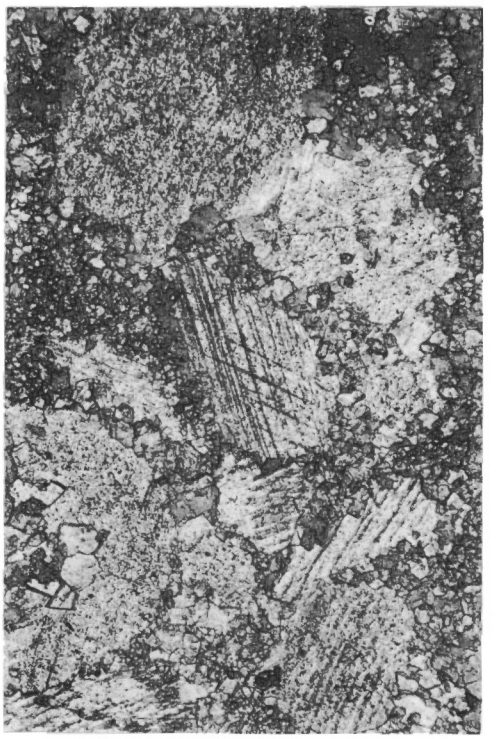


1

Figure 2. Livingstone Formation, 294 feet below top of formation, undetermined Lower Viséan zone, Salem age equivalent.

Dolomite rhombs and epitaxial calcite overgrowth on pelmatozoan plates; x31.

Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74299; Mamet No. 232/25; GSC type No. 39299.



2

Figure 3. Livingstone Formation (lower), undetermined level and zone.

Tectonically stressed pelmatozoan-bryozoan hash; original composition of the rock difficult to assess; note the fluid appearance of the bryozoan fronds and the wavy twin lamellae of the epitaxial crinoid ossicles; such stress is uncommon in the Canadian Rocky Mountains, indicating thrusting of Carboniferous slices under minimal overburden; x31.

Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74280; Mamet No. 232/23; GSC type No. 39300.

3

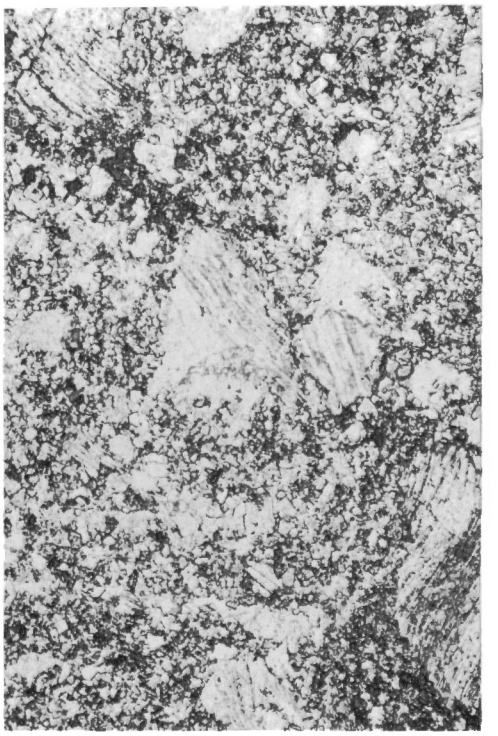


Figure 4. Livingstone Formation (lower), 481 feet below top; undetermined Upper Tournaisian zone.

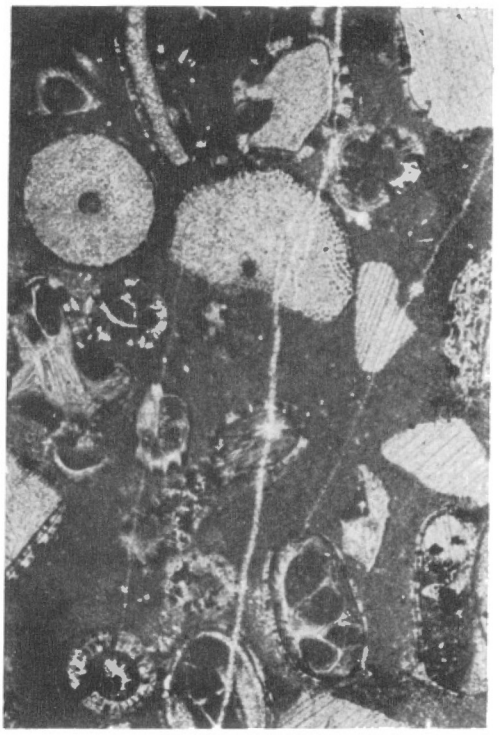
Stressed pelmatozoan dolomite; a step further, beyond that illustrated in fig. 3, toward complete destruction of the original fabric; x31.

Lake Minnewanka, Alberta, locality 34; collected by R. W. Macqueen; GSC loc. 74038; Mamet No. 233/30; GSC type No. 39301.

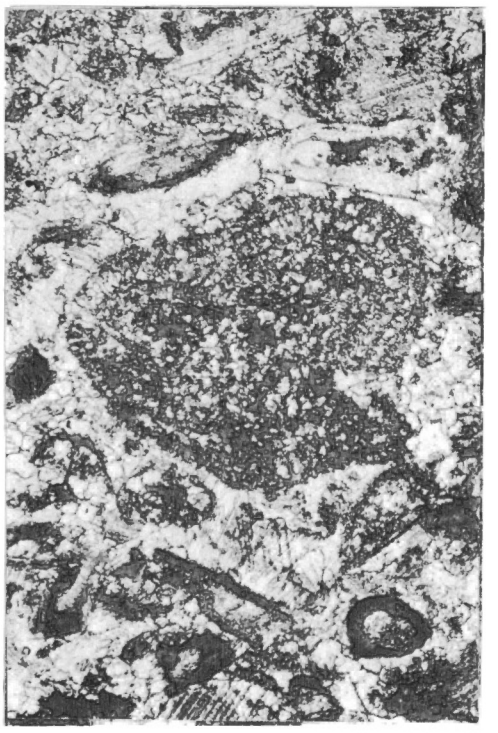
4



LIVINGSTONE FORMATION



1



2

Figure 1. Livingstone Formation (upper), 819.5 feet above base; undifferentiated Upper Tournaisian zone.

Medium-grained oolitic and protooolitic packstone; nuclei are lumps, algae, bryozoans, brachiopods, and pelmatozoans; an unusual facies, where oolitic grains were ultimately dumped into a mud bank; x31.

Mount Lorette, Alberta, locality 42; collected by R. W. Macqueen; GSC loc. 74632; Mamet No. 234/26; GSC type No. 39302.

Figure 2. Livingstone Formation (upper), 1,318 feet above base; undetermined Lower Viséan zone.

Typical coarse-grained, bryozoan-pelmatozoan Livingstone hash, with epitaxial overgrowth; an endothyrid ghost and *Stacheia? skimoensis* Mamet and Rudloff are present; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd.; section CH; Mamet No. 182/17; GSC type No. 39303.

3



4



Figure 3. Livingstone Formation (upper), 1,569 feet above base; undetermined Lower Viséan zone (11?).

Coarse-grained, pelmatozoan-bryozoan "grainstone"; epitaxial overgrowth widespread; *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger) and of the group *E. moderata* (Malakhova) are present; x38.

Location and collector as in fig 2; Mamet No. 181/8; GSC type No. 39304.

Figure 4. Top of Livingstone grading to the Mount Head Formation, Early to Middle Viséan boundary.

Coarse-grained, bryozoan-pelmatozoan-lump grainstone; mud-coated algal or microfaunal fragment; the "pseudosepta" are similar to those observed among the incertae sedis *Irregularina*, *Caligella*, and *Paracaligella*, generally attributed by Russian authors to the foraminifers; x31.

Connor Lakes, British Columbia; locality 14; collected by Chevron Standard Ltd.; section CK; Mamet No. 168/29; GSC type No. 39305.

PLATE 20

WILEMAN MEMBER, MOUNT HEAD FORMATION

Figures 1, 2. Wileman Member, Mount Head Formation, 29 feet above base of member; Zone 11, Early Viséan, Salem age equivalent.

Recrystallized, medium-grained, pelmatozoan packstone (fig. 1) grading to a pelmatozoan-lump "grainstone" (fig. 2); some dolomite rhombs, silt grains, diagenetic quartz crystals and finely disarticulated bryozoan fronds are visible in fig. 1; epitaxial overgrowth is widespread in fig. 2, where the original amount of mud matrix is impossible to assess; *Eoendothyranopsis* sp. and *Stacheoides* are present; x31 (fig. 1), x38 (fig. 2).

Boulder Creek, Alberta, locality 7; collected by R. W. Macqueen; GSC loc. 74494; Mamet Nos. 233/17 and 233/18; GSC type Nos. 39306 (fig. 1), 39307 (fig. 2).



1



2

BARIL MEMBER, MOUNT HEAD FORMATION

Figure 3. Baril Member, Mount Head Formation, 9 feet above base of member; Zone 11?, Early Viséan?, Salem age equivalent.

Poorly sorted accumulation of pelmatozoan plates, stacheein thalli, bryozoan fronds, and brachiopod fragments in a recrystallized matrix; some detrital quartz, dolomite rhombs, and lumps; x31.

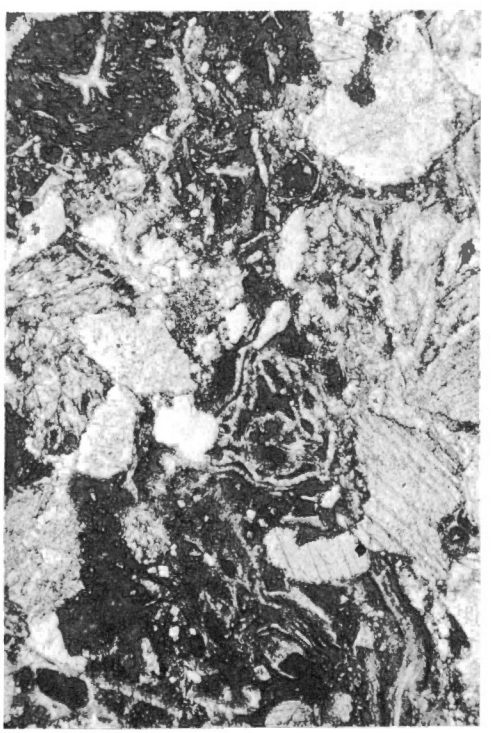
Location and collector as in figs. 1, 2; GSC loc. 74499; Mamet No. 233/19; GSC type No. 39308.

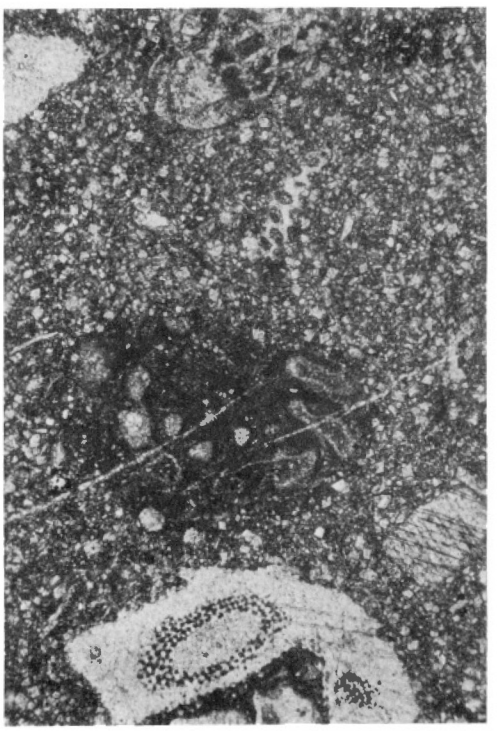
Figure 4. Baril Member, Mount Head Formation, 15.5 feet above base of member; Zone 11?, Early Viséan?, Salem equivalent.

Dolomitized pelmatozoan wackestone with *Globoendothyra* of the group *G. baileyi* (Hall); x38.

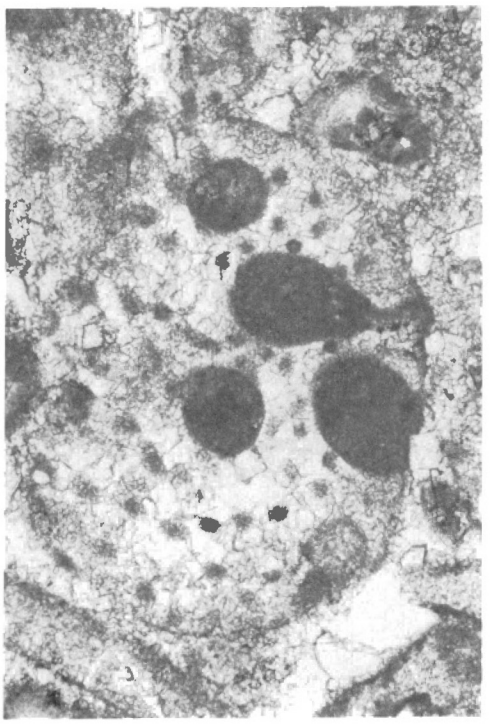
Location and collector as in figs. 1, 2; GSC loc. 74500; Mamet No. 233/20; GSC type No. 39309.

3

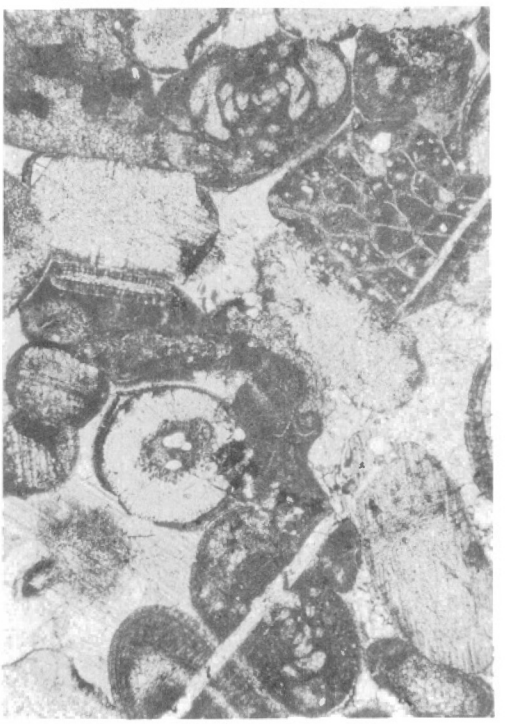




4



1



2

BARIL MEMBER, MOUNT HEAD FORMATION

Figure 1. Baril Member, Mount Head Formation, 17 feet above base of member; Zone 11, Early Viséan, Salem age equivalent.

Orthriosiphon saskatchewanensis Johnson and Konishi in a medium-grained, recrystallized lump-algae "grainstone"; some dolomite rhombs; algal mud-coated grains; x78.

Mount Burke, Alberta, locality 38; collected by R. W. Macqueen; GSC loc. 74570; Mamet No. 237/35; GSC type No. 39310.

Figure 2. Baril Member, Mount Head Formation, 6 feet above base of member; Zone 11 or 12?, Early to Middle Viséan?, Salem age equivalent.

Medium-grained, foraminifer-pelmatozoan grainstone; "intraclasts" of oolitic packstone, mud-filled bryozoan fronds, pellets and algal mud-coated grains are present; both foraminifers are *Skippella* sp.; x31.

Plateau Mountain, Alberta, locality 60; collected by R. W. Macqueen; GSC loc. 74580; Mamet No. 233/11; GSC type No. 39311.

3



4



SALTER MEMBER, MOUNT HEAD FORMATION

Figure 3. Salter Member, Mount Head Formation, approximately 68 feet above base of member; Zone 12, Middle Viséan, Salem age equivalent.

Coarse-grained, poorly sorted, oolite-lump grainstone. *Orthriosiphonoides* is present; x31.

Grotto Creek, Alberta, locality 25; collected by R. W. Macqueen; GSC loc. C-33596; Mamet No. R39/5; GSC type No. 39312.

Figure 4. Salter Member, Mount Head Formation, 41 feet above base of member; Zone 12, Middle Viséan, Salem age equivalent.

Poorly sorted, medium- to coarse-grained pelmatozoan-brachiopod packstone; some pressure solution; dolomite rhombs in the matrix; bryozoans and foraminifers [*Eoendothyranopsis* of the group *E. spiroides* (Zeller)] are scarce; x38.

Location and collector as in fig. 3; GSC loc. 74131; Mamet No. 237/19; GSC type No. 39313.

PLATE 22

SALTER MEMBER, MOUNT HEAD FORMATION

Figure 1. Salter Member, Mount Head Formation, 68 feet above base of member; Zone 12, Middle Viséan, Salem age equivalent.

Orthriosiphonoides salterensis Petryk in a medium-grained oolite-lump grainstone; gastropods, algae (*Pseudoissinella* sp.), and algal mud-coated grains are present; x78.

Grotto Creek, Alberta, locality 25; collected by R. W. Macqueen; GSC loc. 62058; Mamet No. R38/17; GSC type No. 39314.

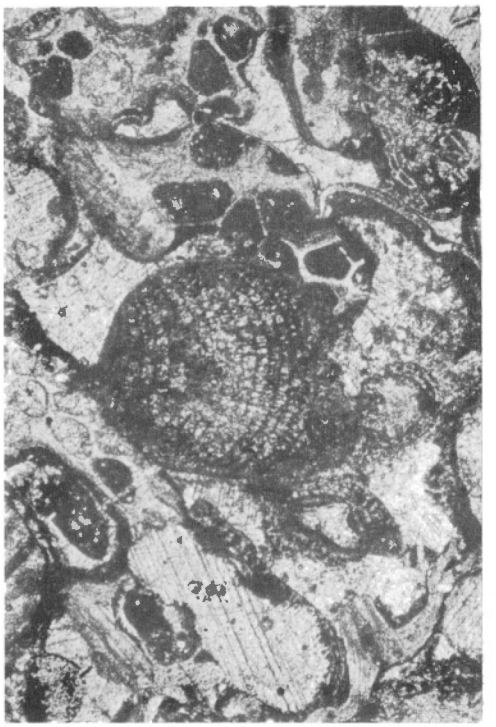
Figure 2. Salter Member, Mount Head Formation, 96 feet below top of member; Zone 12, Middle Viséan, Salem age equivalent.

Medium-grained, pelmatozoan-bryozoan-lump grainstone; microfaunal debris mainly mud coated; algae are represented by a mud-filled *Archaeolithophyllum ?*and weathered Stacheeinae; x38.

South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74492a; Mamet No. R27/11; GSC type No. 39315.



1



2

Figure 3. Salter Member, Mount Head Formation, 6 feet below top of member; Zone 12, Middle Viséan, Salem age equivalent.

Recrystallized pelmatozoan-lump grainstone-packstone; original mud matrix partly to completely recrystallized and dolomitized; abundant mud-coated debris; foraminiferal ghosts (*Globoendothyra* sp.) and weathered *Stacheoides* are present; x31.

Mount Aylmer, Alberta, locality 37; collected by R. W. Macqueen; GSC loc. 74652; Mamet No. 237/10; GSC type No. 39316.

Figure 4. Salter Member, Mount Head Formation, 61 feet above base of member; Zone 12, Middle Viséan, Salem age equivalent.

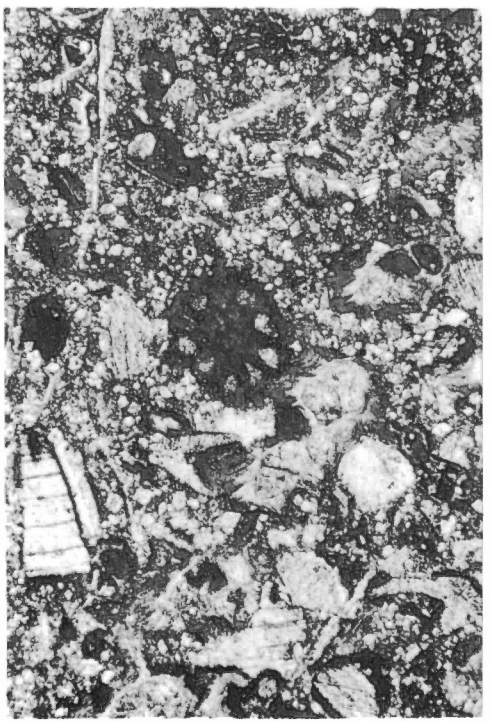
Recrystallized bryozoan-pelmatozoan hash; original mud matrix partly to completely recrystallized and dolomitized; some brachiopod fragments, lumps, and foraminifers (*Globoendothyra* sp.) as ghosts; x31.

Lake Minnewanka, Alberta, locality 34, collected by R. W. Macqueen; GSC loc. 74043; Mamet No. 233/31; GSC type No. 39317.

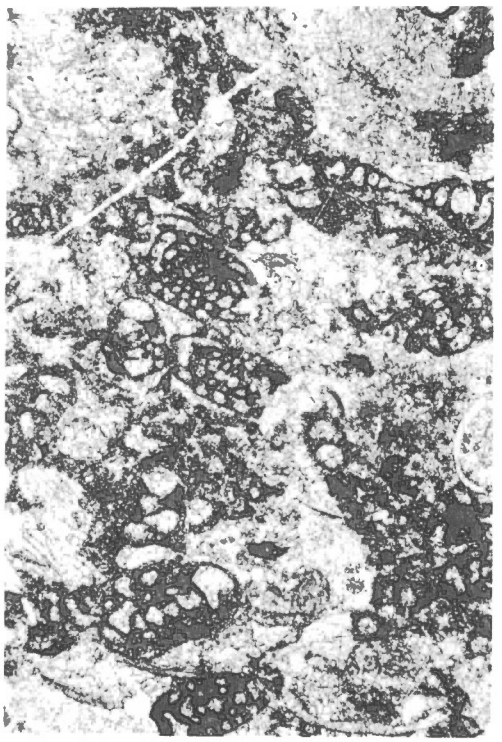
3



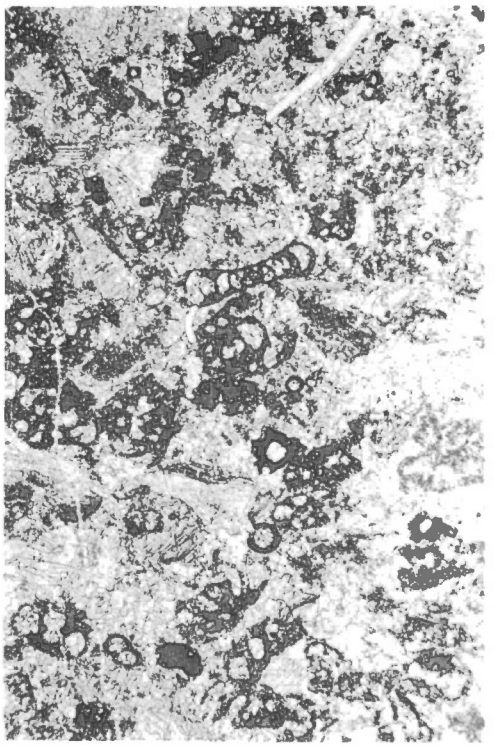
4



SALTER MEMBER, MOUNT HEAD FORMATION

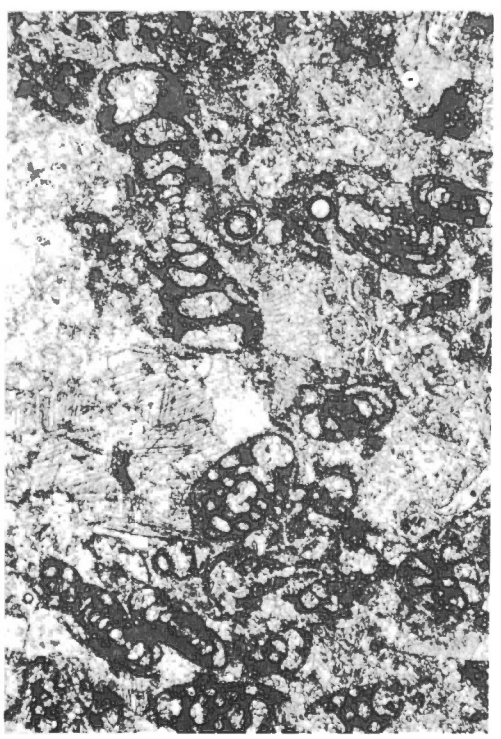


1



2

3



4



Figures 1–4. Salter Member, Mount Head Formation, 83 feet above base of member; boundary of Zones 12/13, Middle Viséan, Salem–St. Louis boundary age equivalent.

Recrystallized foraminiferal-pelmatozoan "grainstone"; epitaxial overgrowth and recrystallization do not allow assessment of the original mud matrix content; brachiopods and ostracodes are conspicuous; foraminifers abundant, partly destroyed by recrystallization; *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoforschia minoris* (Lipina), *Eoendothyranopsis spiroides* (Zeller), *Eoendothyranopsis* of the group *E. spiroides* (Zeller), *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Skippella* sp., *Septabrunsiina mackeei* Skipp *in* Skipp, Holcomb, and Gutschick ORTH. MUT., *Parathurammina* of the group *P. suleimanovi* Lipina, *Calcisphaera pachysphaerica* (Pronina), and *Calcisphaera laevis* Williamson are also present; x31.

Grizzly Creek, Alberta, locality 24; collected by R. W. Macqueen; GSC loc. 74155; Mamet Nos. 234/10, 11, 12, 13; GSC type Nos. 39318 (fig. 1), 39319 (fig. 2), 39320 (fig. 3), 39321 (fig. 4).

PLATE 24

LOOMIS MEMBER, MOUNT HEAD FORMATION



1

Figure 1. Loomis Member, Mount Head Formation, 11.5 feet above base of member; boundary of Zones 12/13, Middle Viséan, Salem–St. Louis boundary age equivalent.

Poorly sorted, rather coarse grained, foraminifer - pelmatozoan grainstone with algae and coated grains; foraminifers are *Earlandia* of the group *E. clavatula* (Howchin) and of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger), *Septabrunsiina* sp., and an immature *Skippella* sp.; x38.

Boulder Creek, Alberta, locality 7; collected by R. W. Macqueen; GSC loc. 74507; Mamet No. 108/31; GSC type No. 39322.



2

Figure 2. Loomis Member, Mount Head Formation, 61 feet below top of member; Zone 13, Middle Viséan, St. Louis age equivalent.

Medium-grained proto-oolitic grainstone; some lumps; all grains (pelmatozoans, bryozoans, foraminifers) are either micrite covered or oolitized; oblique section of *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva) and *Eoforschia* sp.; x31.

Location and collector as in fig. 1; GSC loc. 74515; Mamet No. 233/23; GSC type No. 39323.

3



Figure 3. Loomis Member, Mount Head Formation, precise stratigraphic level unknown (faulted section); Zone 13, Middle Viséan, St. Louis age equivalent.

Mud-filled *Orthriosiphon saskatchewanensis* Johnson and Konishi in a medium-grained pelmatozoan-lump proto-oolite grainstone; x51.

Mount Lorette, Alberta, locality 42; collected by R. W. Macqueen; GSC loc. 74638; Mamet No. 234/27; GSC type No. 39324.

4

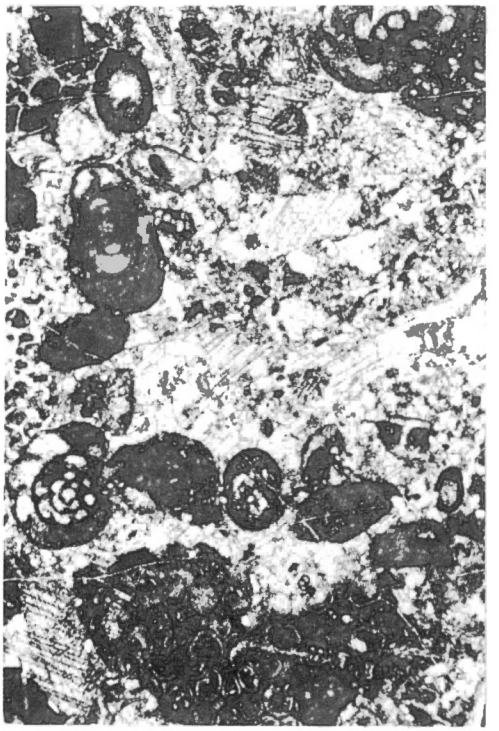


Figure 4. Loomis Member, Mount Head Formation, 19 feet below top of member; Zone 13, Middle Viséan, St. Louis age equivalent.

Recrystallized, poorly sorted, medium- to coarse-grained foraminifer-algae-pelmatozoan pellet grainstone with relict mud matrix; some bryozoans and lumps; mud-filled *Koninckopora inflata* (de Koninck) in the lower part of the photograph; foraminifers are *Globoendothyra* sp., an equatorial and an axial section of *Eoendothyranopsis scitula* (Toomey) and *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger); x31.

South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74480; Mamet No. 236/37; GSC type No. 39325.

MIDDLE MOUNT HEAD FORMATION (UNDIFFERENTIATED)



1



2



3



4

Figure 1. Middle Mount Head (undifferentiated), 2,134 feet below top of formation; Zone 13, Middle Viséan, St. Louis age equivalent.

Coarse-grained, poorly sorted, recrystallized, foraminifer-bryozoan-brachiopod-lump grainstone-packstone. Interpenetrant grains and stylolitic contacts. Some dolomite rhombs. Mud-filled *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva) and *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain); x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., Section CK; Mamet No. 87/7; GSC type No. 39326.

Figure 2. Middle Mount Head (undifferentiated), 2,114 feet below top of formation; Zone 13, Middle Viséan, St. Louis age equivalent.

Oolitized *Eoendothyranopsis* aff. *E. prodigiosa* (Armstrong) in a poorly sorted lump-pellet grainstone. Note the sparite cement in the void between the foraminifer and its oolitic envelope. Small debris of *Koninckopora* sp. and *Pseudoissinella* sp.; x38.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/11; GSC type No. 39327.

Figure 3. Middle Mount Head (undifferentiated), 2,171 feet below top of formation; Zone 13, Middle Viséan, St. Louis age equivalent.

Medium-grained, well-sorted, oolitic grainstone. Oolitic coating on pelmatozoans, brachiopods, bryozoans, algae, and foraminifers [*Globoendothyra paula* (Vissarionova), *Brunsia* sp., and a mud-filled *Endothyra* of the group *E. similis* Rauser–Tschernoussova and Reitlinger]; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/16; GSC type No. 39328.

Figure 4. Middle Mount Head (undifferentiated), 2,201 feet below top of formation; Zone 13, Middle Viséan, St. Louis age equivalent; x31.

Medium-grained, foraminifer-lump-pelmatozoan grainstone; some lumps are mud-filled foraminifers (*Eoendothyranopsis* sp.), rare bryozoans, and algae; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain) and an oolitized *Globoendothyra* of the group *G. tomiliensis* (Lebedeva).

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/21; GSC type No. 39329.

PLATE 26

MIDDLE MOUNT HEAD FORMATION (UNDIFFERENTIATED)

Figure 1. Middle Mount Head (undifferentiated), 1,971 feet below top of formation; Zone 13, Middle Viséan, St. Louis age equivalent.

Medium- to coarse-grained, rather well sorted, oolitic grainstone; note the broken oolite (lower left) and the pressure solution between the grains; nuclei are foraminifers [oblique section of *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Skippella* sp., and *Globoendothyra* sp.], bryozoans, and brachiopods; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/27; GSC type No. 39330.

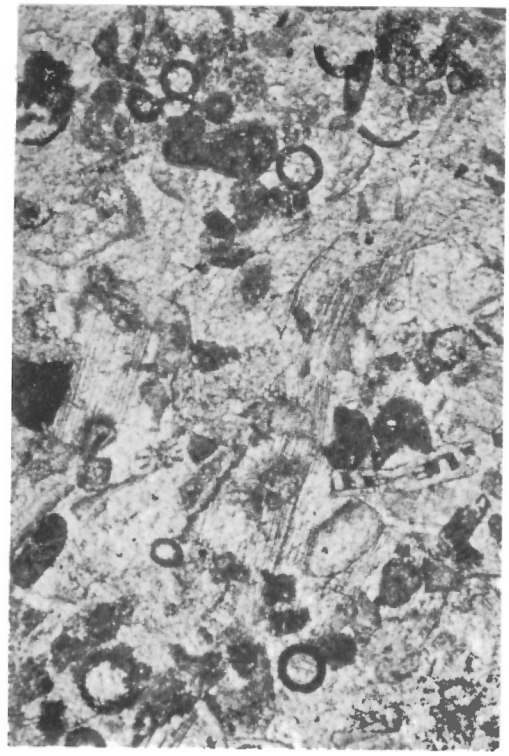


1

Figure 2. Middle Mount Head (undifferentiated), 1,662 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, medium-grained, pelmatozoan-lump-pellet grainstone, calcispheres [*Calcisphaera pachysphaerica* (Pronina)], Earlandiidae [*Earlandia* of the group *E. clavatula* (Howchin)], and *Kamaena* sp. are present; x38.

Location and collector as in fig. 1; Mamet No. 88/14; GSC type No. 39331.



2

Figure 3. Middle Mount Head (undifferentiated), 1,652 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Mud-filled *Globoendothyra paula* (Vissarionova) in a pelmatozoan-pellet packstone; some cement; most grains are micrite coated; the diaphanotheca of the Globoendothyridae is particularly well preserved; x51.

Location and collector as in fig. 1; Mamet No. 88/16; GSC type No. 39332.

3



Figure 4. Middle Mount Head (undifferentiated), 1,633 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, medium- to coarse-grained, poorly sorted foraminifer-pelmatozoan packstone; some cement; brachiopods, bryozoans and enigmatic *Paracalligelloides?* are present; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), an immature *Eoendothyranopsis* sp., and *Globoendothyra paula* (Vissarionova); x31.

Location and collector as in fig. 1; Mamet No. 88/19; GSC type No. 39333.

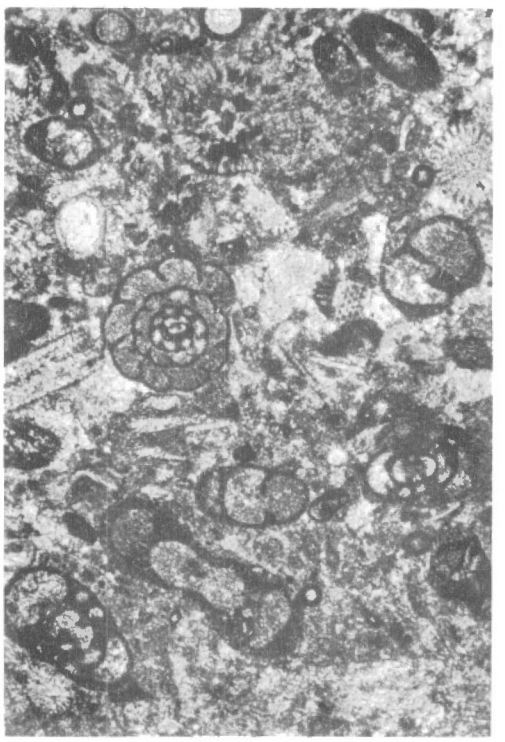
4



MIDDLE MOUNT HEAD FORMATION (UNDIFFERENTIATED)



1



2

3



4



Figure 1. Middle Mount Head Formation (undifferentiated), 1,501 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Medium- to coarse-grained, algae-pelmatozoan packstone; abundant debris of *Stacheoides meandriformis* Mamet and Rudloff, mud-filled *Koninckopora* sp., and weathered Stacheeinae; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 89/7; GSC type No. 39334.

Figure 2. Middle Mount Head (undifferentiated), 1,492 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, medium- to coarse-grained, poorly sorted, foraminifer-pelmatozoan-alga packstone; echinoid spines, calcispheres and brachiopod fragments are present; foraminifers represented by an axial and an equatorial section of *Eoendothyranopsis scitula* (Toomey), *Eoendothyranopsis* sp., *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger), *Globoendothyra* sp., and *Eoforschia* sp.; *Calcisphaera laevis* Williamson and Stacheeinae are present; x31.

Location and collector as in fig. 1; Mamet No. 89/10; GSC type No. 39335.

Figure 3. Middle Mount Head (undifferentiated), 1,407 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Mud-filled thallus of *Stacheoides meandriformis* Mamet and Rudloff in a pelmatozoan-lump-alga "grainstone"; interpenetrant grains widespread; an issinellid alga and an *Eoendothyranopsis* sp. are conspicuous; x31.

Location and collector as in fig. 1; Mamet No. 89/2; GSC type No. 39336.

Figure 4. Middle Mount Head (undifferentiated), 1,234 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Mud-filled thalli of *Epistacheoides connorensis* Mamet and Rudloff, *Aoujgalia* sp., and *Stacheoides* sp., in a coarse pelmatozoan grainstone; all grains are micrite covered; x38.

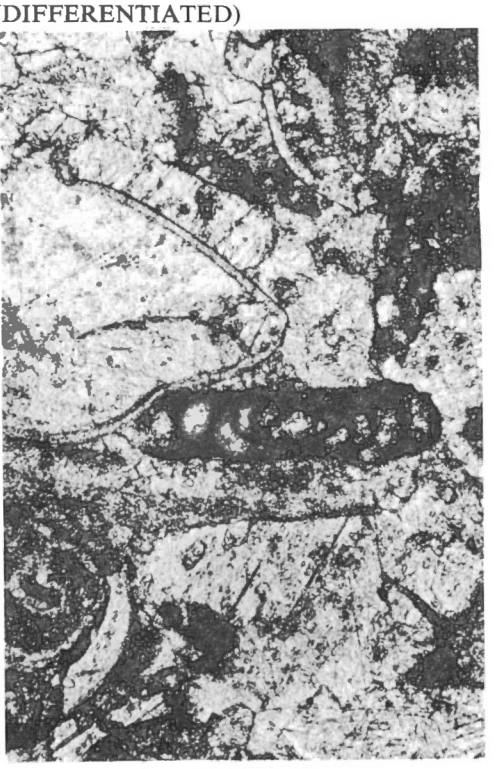
Location and collector as in fig. 1; Mamet No. 89/9; GSC type No. 39337.

PLATE 28

MIDDLE MOUNT HEAD FORMATION (UNDIFFERENTIATED)



1



2

Figure 1. Middle Mount Head (undifferentiated), 1,161 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained, foraminifer-alga grainstone; abundant micrite-coated grains with irregular outlines; note the well-preserved pseudofibrous layer of the mud-filled dasyclad *Koninckopora inflata* (de Koninck); *Globoendothyra* of the group *G. tomiliensis* (Lebedeva) and *Pseudoissinella* are present; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 89/14; GSC type No. 39338.

Figure 2. Middle Mount Head (undifferentiated), 1,093 feet below top of formation; Zone 14, Late Viséan, St. Louis age equivalent.

Detail of a pelmatozoan-brachiopod-pellet "grainstone" with *Brunsia lenensis* Bogush and Yuferev and an ostracode; recrystallization of some elements is erratic – the pseudo fibrous layer of mud-filled *Koninckopora* (upper right) is hardly recognizable, whereas the tectum of the pseudoammodiscid is well preserved; x148.

Location and collector as in fig. 1; Mamet No. 90/1; GSC type No. 39339.

MARSTON MEMBER, MOUNT HEAD FORMATION

3



4

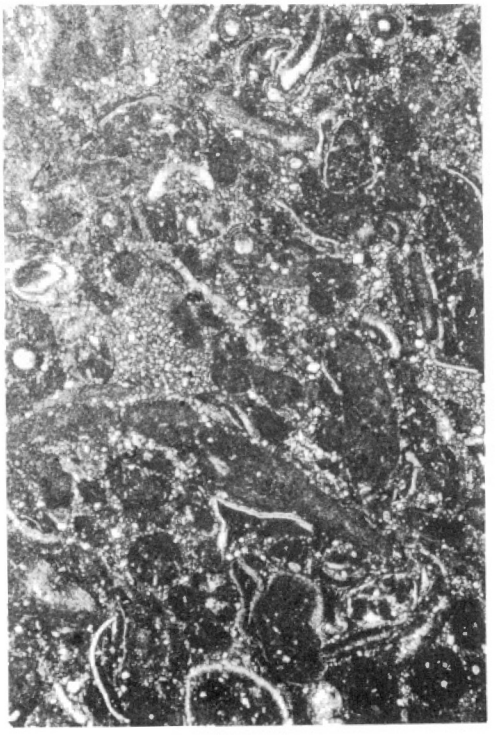


Figure 3. Marston Member, Mount Head Formation, 2 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained, unsorted accumulation of dasyclad thalli (*Koninckopora tenuiramosa* Wood), brachiopod valves, echinoid spines, pelmatozoan plates, and pellets; pressure solution widespread; x31.

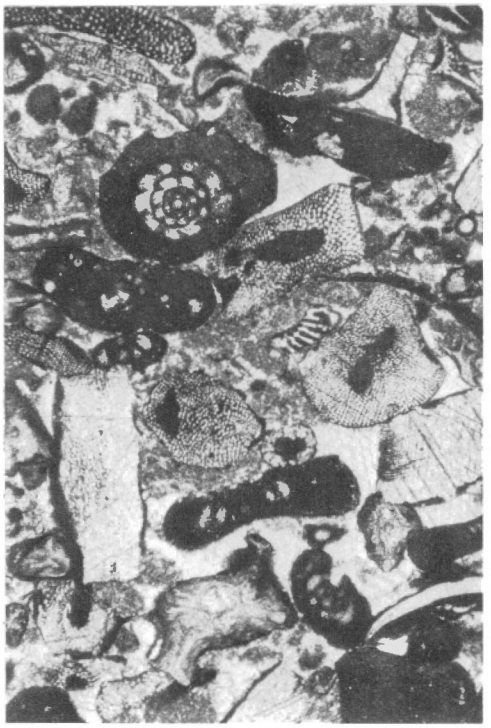
Highwood Valley, Alberta, locality 27; collected by R. W. Macqueen; GSC loc. 74554; Mamet No. 234/35; GSC type No. 39340.

Figure 4. Marston Member, Mount Head Formation, 57 feet above base of member; Zone 14, Late Viséan; St. Louis age equivalent.

Slightly recrystallized and dolomitized lump packstone; recrystallization mainly in the original mud matrix and probably penecontemporaneous with the lithification; disarticulated brachiopods, ostracodes, calcispheres, and earlandiids are present; x31.

Location and collector as in fig. 3; GSC loc. 74555; Mamet No. 234/36; GSC type No. 39341.

OPAL MEMBER, MOUNT HEAD FORMATION

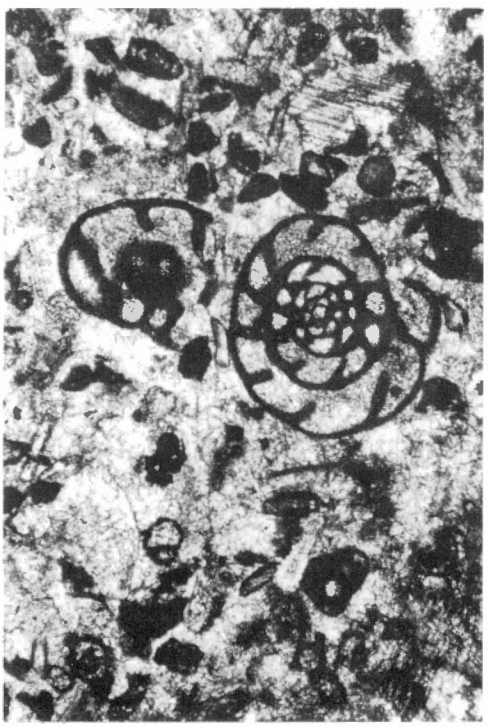


1



2

3



4

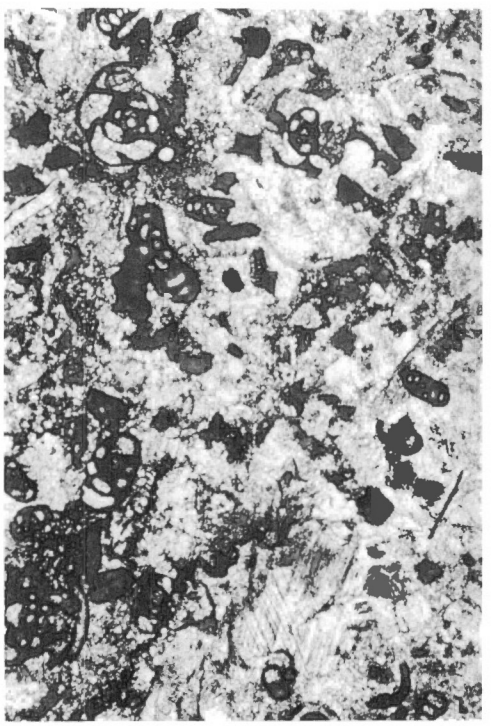


Figure 1. Opal Member, Mount Head Formation, 223 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Medium- to coarse-grained, pelmatozoan-lump-foraminifer grainstone-packstone; most of the "lumps" are mud-filled foraminifers; crinoid ossicles in various states of pitting and weathering; algal-coated grains, brachiopods, *Calcisphaera laevis* Williamson, and bryozoans are scarce; foraminifers are *Eoendothyranopsis macra* (Zeller), *Endothyra* sp., and *Eoforschia* sp.; a section of kamaenid alga is visible above *Eoforschia* sp.; x31.

Elbow Lake, Alberta, locality 17; collected by R. W. Macqueen; GSC loc. 74377; Mamet No. 107/20; GSC type No. 39342.

Figure 2. Opal Member, Mount Head Formation, 106 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, slightly dolomitic, poorly sorted, pelmatozoan-foraminifer packstone; brachiopods, ostracodes, and bryozoans are present; foraminifers represented by *Globoendothyra paula* (Vissarionova) and two sections of *Skippella* sp.; recrystallized kamaenid thallus in centre of photograph; x31.

Location and collector as in fig. 1; GSC loc. 74370; Mamet No. 107/28; GSC type No. 39343.

Figures 3, 4. Opal Member, Mount Head Formation, 84 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Poorly sorted, pelmatozoan-foraminifer-lump-pellet grainstone; some recrystallized matrix; interpenetrant grains with stylolitic contacts; some bryozoans and mud-coated fragments; foraminifers are *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Globoendothyra* sp., *Endothyra* sp., and *Eoforschia* sp.; x31.

Location and collector as in fig. 1; GSC loc. 74367; Mamet Nos. 107/32 and 107/33; GSC type Nos. 39344 (fig. 3), 39345 (fig. 4).

PLATE 30

OPAL MEMBER, MOUNT HEAD FORMATION

Figure 1. Opal Member, Mount Head Formation, 165 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

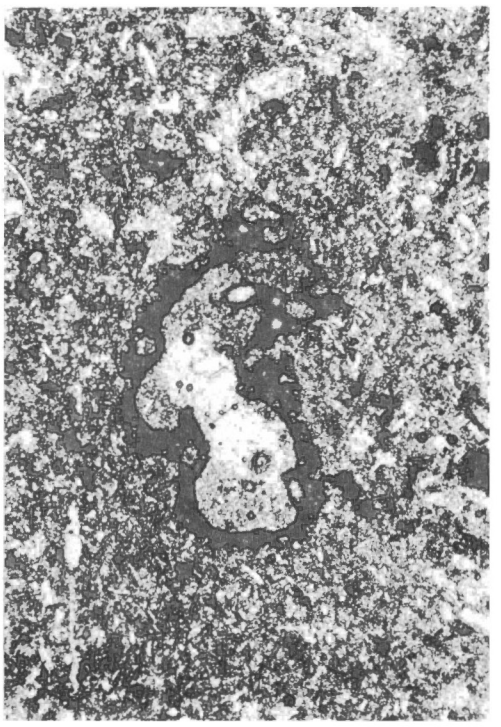
Highly recrystallized, poorly sorted wackestone; the incertae sedis *Paracalligelloides?* displays tubular perforations; the wall is calcareous-secreted with minor additional agglutinated particles; x38.

Storm Creek, Alberta, locality 68; collected by R. W. Macqueen; GSC loc. 57975; Mamet No. R36/32; GSC type No. 39346.

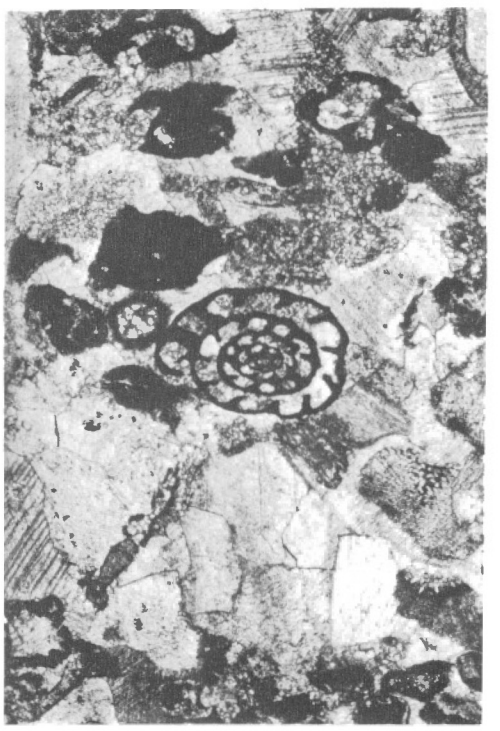
Figure 2. Opal Member, Mount Head Formation, 77 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Medium-grained, pelmatozoan-foraminifer-lump "grainstone"; epitaxial overgrowth widespread and original amount of matrix unknown; *Eoendothyranopsis* sp. in the centre; x31.

Location and collector as in fig. 1; GSC loc. C-329; Mamet No. 135/5; GSC type No. 39347,



1



2

Figure 3. Opal Member, Mount Head Formation, 40 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained, well-sorted, pelmatozoan-algal-lump grainstone; most lumps are mud-filled foraminifers (e.g., *Eoendothyranopsis* sp., lower right of the photograph); bryozoans, micrite algal-coated grains, and echinoid spine are also present; note the encrusting nature of the Stacheeinae *Stacheoides tenuis* Petryk and Mamet and a barely recognizable *Stacheoides meandriformis* Mamet and Rudloff; pelmatozoan plates are highly weathered and could be confused with stacheeins; mud-filled *Koninckopora tenuiramosa* Wood is present (upper left of the photograph); x31.

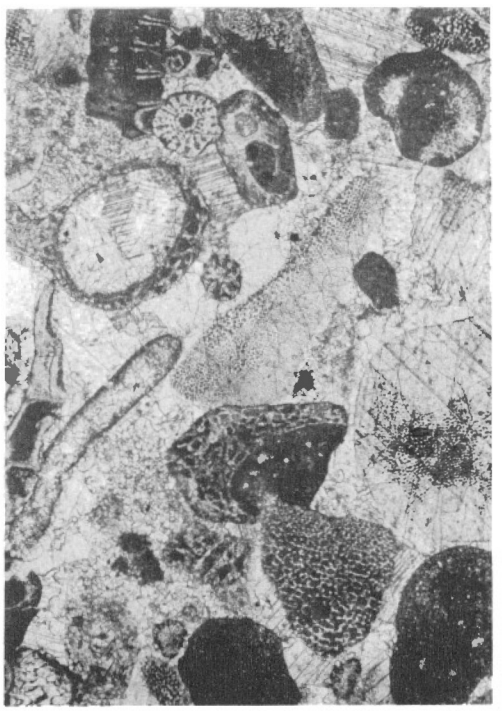
Grotto Creek, Alberta, locality 25; collected by R. W. Macqueen; GSC loc. 74133; Mamet No. 237/20; GSC type No. 39348.

Figure 4. Opal Member, Mount Head Formation, 86 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

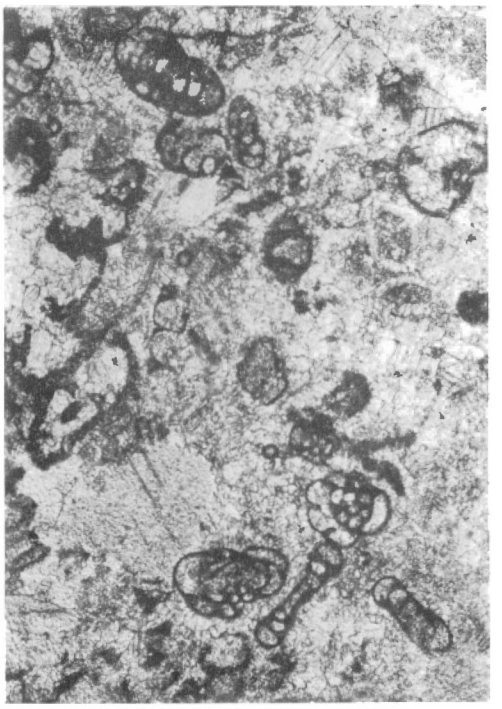
Recrystallized, medium-grained, foraminifer-pelmatozoan "grainstone"; original matrix and lumps still recognizable as ghosts; foraminifers, unevenly preserved, are *Eoforschia* sp., *Skippella* sp., *Endothyra* sp., *Septabrunsiina* sp., and *Eoendothyranopsis scitula* (Toomey); a large *Paracalligelloides?* is also present; x31.

Ghost River, south fork, Alberta, locality 23a; collected by Chevron Standard Ltd.; Mamet No. 101/6; GSC type No. 39349.

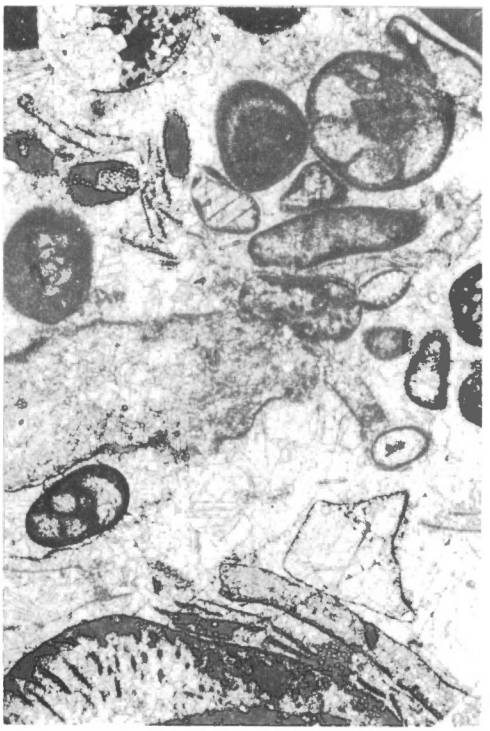
3



4



OPAL MEMBER, MOUNT HEAD FORMATION



1



2

Figure 1. Opal Member, Mount Head Formation, approximately 120 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained, foraminifer-lump-alga grainstone; mud-coated grains; algae are *Stacheoides* sp. (with diagenetic quartz) and *Orthriosiphonoides* sp.; foraminifers are *Globoendothyra* sp. and a mud-filled *Endothyra* sp.; x 31.

King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74601; Mamet No. 236/4; GSC type No. 39350.

Figure 2. Opal Member, Mount Head Formation, approximately 230 feet above the member; Zone 14, Late Viséan, St. Louis age equivalent.

Rather well sorted, coarse-grained, oolite-lump grainstone; impressed oolites; some pressure solution; shape of lumps is variable; bryozoan fronds, algal mud-coated grains, and angular intraclasts are present; *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva) and *Eotuberitina* are conspicuous; x31.

Location and collector as in fig. 1; GSC loc. 74604; Mamet No. 236/7; GSC type No. 39351.

3



4



Figures 3, 4. Opal Member, Mount Head Formation, 142 feet below top of member; boundary of Zones 14/15, Late Viséan, St. Genevieve? age equivalent.

Unevenly sorted, coarse-grained, pelmatozoan-lump-foraminifer grainstone-packstone; mud-filled thallus of dasyclad alga (*Koninckopora tenuiramosa* Wood), weathered Stacheeinae and crushed bryozoan fronds are present; original amount of matrix unknown as pressure solution is extensive and all grain contacts are corroded; foraminifers represented by *Globoendothyra* sp., *Eoendothyranopsis robusta* (McKay and Green), cf. *Skippella* sp., and *Eoendothyranopsis* sp.; x31.

Location and collector as in fig. 1; GSC loc. 74612; Mamet Nos. 236/11 and 236/13; GSC type Nos. 39352 (fig. 3), 39353 (fig. 4).

PLATE 32

MARSTON MEMBER, MOUNT HEAD FORMATION

Figure 1. Marston Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

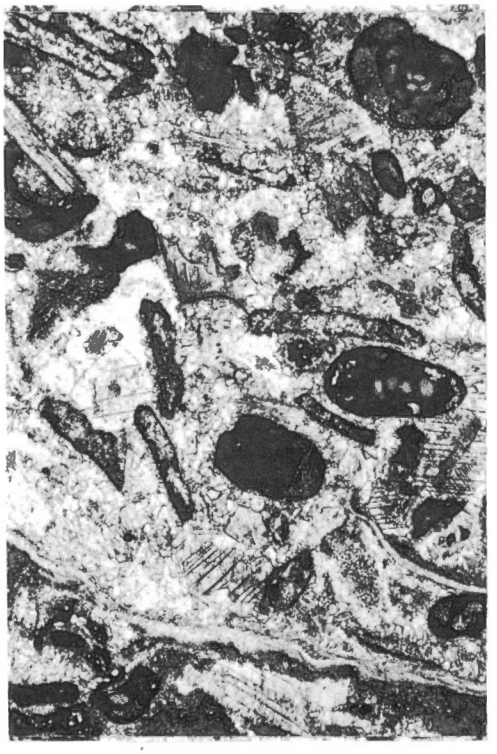
Poorly sorted, medium-grained, brachiopod, mud-coated grainstone. Some matrix preserved in the foraminifers; *Eoendothyranopsis scitula* (Toomey), *Eoforschia* sp., and *Globoendothyra* sp.; x31.

Mount McDougall, Alberta, locality 43; collected by R. W. Macqueen; GSC loc. 74140; Mamet No. 243/2; GSC type No. 39354.

Figure 2. Marston Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Poorly sorted, medium- to coarse-grained, algae-lump-pelmatozoan grainstone-packstone; some bryozoans, ostracodes, brachiopods, and mud-coated fragments; note the abundance of encrusting stacheeins (*Stacheoides tenuis* Petryk and Mamet and other undeterminable thalli); x31.

Mount McDougall, Alberta, locality 43; collected by R. W. Macqueen; GSC loc. 74140; Mamet No. 234/3; GSC type No. 39355.



1



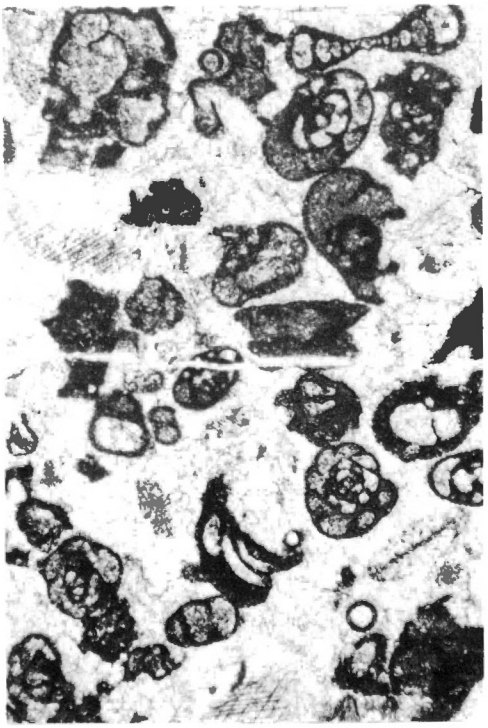
2

Figures 3, 4. Marston Member, Mount Head Formation, 37 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Medium-grained, rather well sorted, foraminifer-pelmatozoan "grainstone"; some bryozoan fronds; algal-coated grains epitaxial overgrowth on crinoid ossicles; foraminifers, partly mud filled, in all states of preservation—*Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Eoendothyranopsis* sp., *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoforschia moelleri* (Malakhova *in* Dain), *Eoforschia minoris* (Lipina), *Endothyra* sp., and *Globoendothyra* sp.; *Calcisphaera pachysphaerica* (Pronina) and the enigmatic *Paracalligelloides?* are present; x31.

Location and collector as in fig. 2; GSC loc. 74142; Mamet Nos. 109/16 and 109/20; GSC type Nos. 39356 (fig. 3), 39357 (fig. 4).

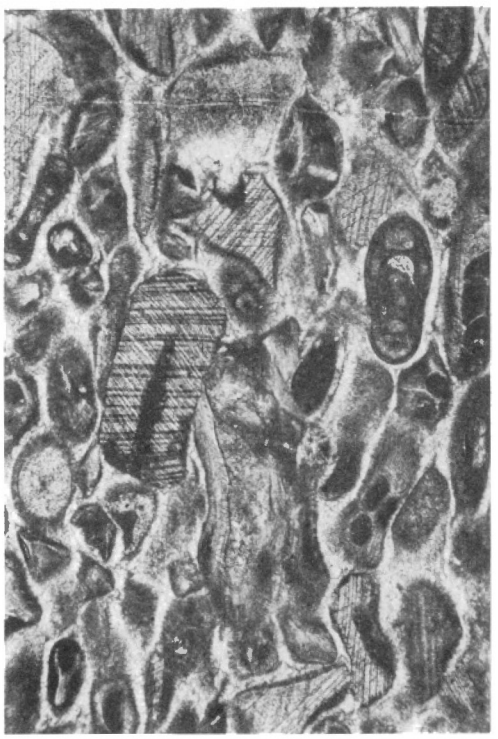
3



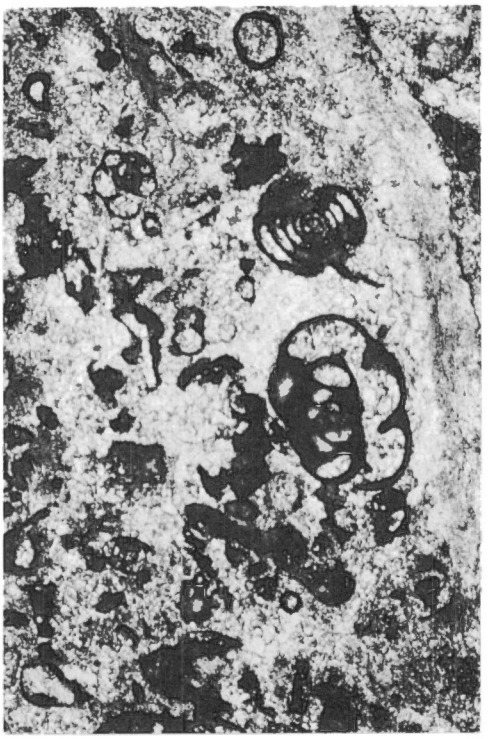
4



OPAL MEMBER, MOUNT HEAD FORMATION



1



2



3



4

Figure 1. Loomis Member?, Mount Head Formation, 73 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Medium-grained, rather well sorted bryozoan-lump-pelmatozoan grainstone; the "fluid" appearance of the rock is not due to tectonic stress, but to compaction of abundant bryozoan fronds; foraminifers (undeformed) are *Eoforschia* sp. and *Eoendothyranopsis* sp.; x31.

Mount Hood, Alberta, locality 40; collected by R. W. Macqueen; GSC loc. C-33597; Mamet No. 237/2; GSC type No. 39358.

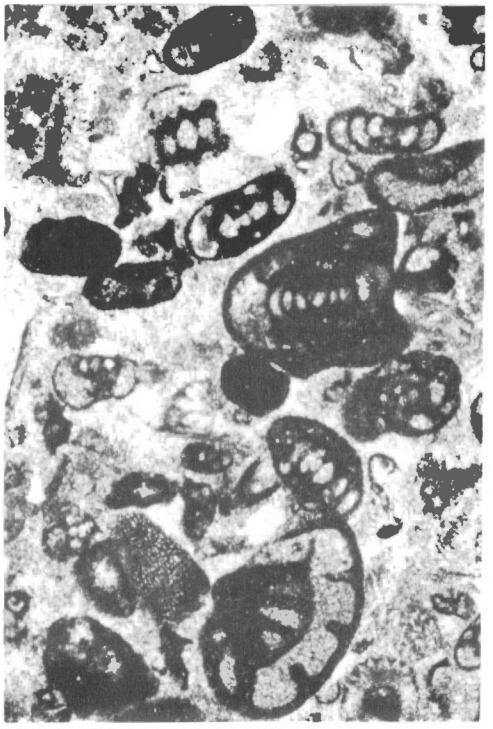
Figures 2–4. Opal Member, Mount Hood Formation, 13 feet below top of member; boundary of Zones 14/15, Late Viséan, St. Genevieve? age equivalent.

Recrystallized, medium- to coarse-grained, poorly sorted, foraminifer-lump-pelmatozoan "grainstone"; epitaxial overgrowth widespread and original amount of matrix undetermined; pelletoid intraclasts, pellets, bryozoans, brachiopods, mud-coated fragments, and dasyclad thalli [*Koninckopora inflata* (de Koninck)] are present; foraminifers, partly mud filled, are *Globoendothyra paula* (Vissarionova), *Eoendothyranopsis robusta* (McKay and Green), *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Globoendothyra* sp., *Endothyra* of the group *E. bowmani* Phillips emend Brady and *Endothyranopsis* sp.; *Parathurammina* sp., and *Calcisphaera pachysphaerica* (Pronina) also are present; x 31.

Tunnel Mountain, Alberta, locality 71; collected by R. W. Macqueen; GSC loc. C-308; Mamet Nos. 134/33, 135/1, and 135/2; GSC type Nos. 39359 (fig. 2), 39360 (fig. 3), 39361 (fig. 4).

PLATE 34

OPAL MEMBER, MOUNT HEAD FORMATION



1



2

Figure 1. Opal Member, Mount Head Formation, 13 feet below the top of member; boundary of Zones 14/15, Late Viséan, St. Genevieve? age equivalent.

Recrystallized, coarse-grained, poorly sorted, foraminifer-pelmatozoan "grainstone"; some lumps and algal debris (*Anatolipora* sp.); foraminifers are *Globoendothyra* sp., *Eoendothyranopsis robusta* (McKay and Green), *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Endothyranopsis?* sp., *Endothyra?* sp., and *Parathurammina* of the group *P. spinosa* (Williamson); x31.

Tunnel Mountain, Alberta, locality 71; collected by R. W. Macqueen; GSC loc. C-308; Mamet No. 124/28; GSC type No. 39362.

Figures 2, 3. Opal Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, unsorted, pelmatozoan-brachiopod-lump packstone; some cement in the voids under brachiopod valves or dasyclad thalli [*Globoendothyra paula* (Vissarionova) under a well-preserved thallus of *Koninckopora inflata* (de Koninck)]; the outline of the enigmatic *Paracalligelloides* sp. is reminiscent of a certain well-known French general's profile; x31.

Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74318; Mamet Nos. R23/10 and 108/10; GSC type Nos. 39363 (fig. 2), 39364 (fig. 3).

3



4

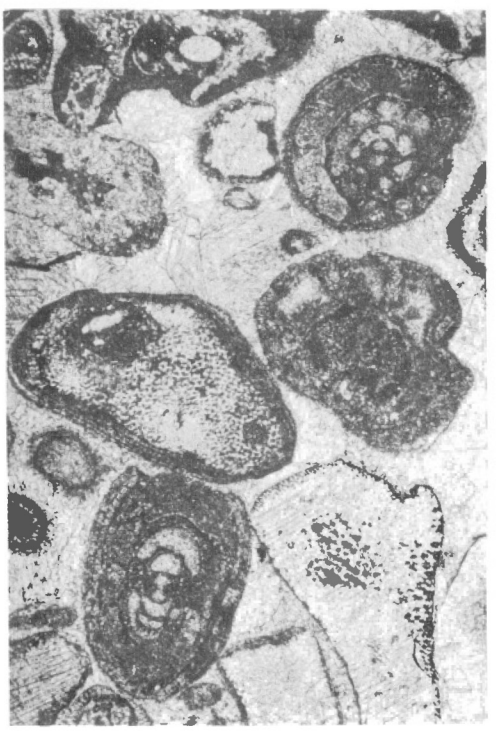
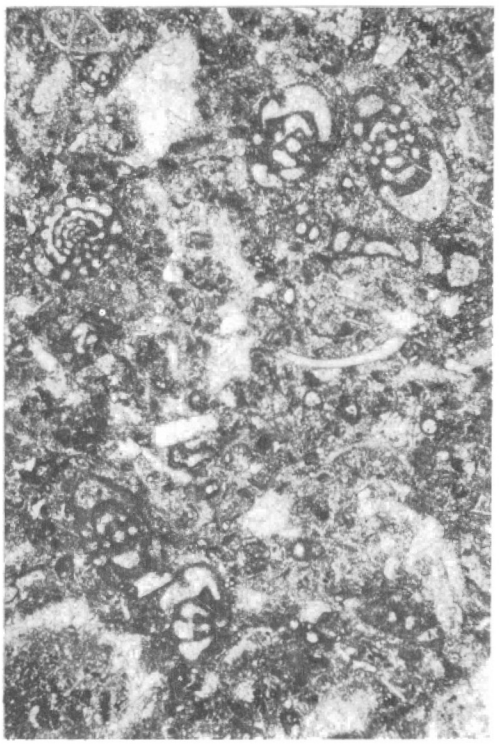


Figure 4. Opal Member, Mount Head Formation, 196 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Well-sorted, coarse-grained, pelmatozoan-proto-oolitic grainstone; oolitic coating well developed on *Eoendothyranopsis ermakiensis* (Lebedeva), *Eoendothyranopsis macra* (Zeller), and *Globoendothyra* sp.; crinoid ossicles unevenly pitted; x 31.

Location and collector as in figs. 2 and 3; GSC loc. 74320; Mamet No. 108/16; GSC type No. 39365.

OPAL MEMBER, MOUNT HEAD FORMATION



1



2



3



4

Figure 1. Opal Member, Mount Head Formation, top of the formation; boundary of Zones 14/15, Late Viséan, St. Genevieve? age equivalent.

Slightly recrystallized, medium-grained, poorly sorted, foraminifer-pelmatozoan packstone. Pellets, brachiopods, bryozoans, and ostracodes are present. Foraminifers represented by *Banffella banffensis* (McKay and Green), *Globoendothyra* sp., *Eoforschia* sp., *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva) associated with parathuramminids (*Parathurammina* sp.); x31.

Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74334; Mamet No. 233/8; GSC type No. 39366.

Figure 2. Opal Member, Mount Head Formation, 252 feet below the top of the formation; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained, pelmatozoan-lump grainstone. Crinoid ossicles are unevenly pitted. Bryozoans, mud-covered fragments, and foraminifers (*Eoforschia* sp., *Eoendothyranopsis* sp.) are conspicuous. The encrusting alga *Stacheoides tenuis* Petryk and Mamet is present; x31.

South Misty Range section, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74466; Mamet No. 236/31; GSC type No. 39367.

Figure 3. Opal Member, Mount Head Formation, 230 feet below the top of the formation; Zone 14, Late Viséan, St. Louis age equivalent.

Poorly sorted, recrystallized, alga-brachiopod - pelmatozoan packstone. Some cement. Oolite and mud-covered fragments are present. Brachiopod fragment encrusted by Spongiostromata (*Pycnostroma?* sp.). Other algae are *Pseudoissinella* sp. and *Kamaena* sp. A mud-filled *Eoendothyranopsis* is present at the top of the photograph; x31.

South Misty Range section, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74467; Mamet No. 236/33; GSC type No. 39368.

Figure 4. Opal Member, Mount Head Formation, 202 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent.

Unevenly sorted, medium- to coarse-grained alga-lump grainstone. Some bryozoans. Algal mud-coating is frequent (*Pseudoissinella* thallus). Lumps are mud-filled, unidentifiable foraminifers.

South Misty Range section, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 57893; Mamet R40/1; GSC type No. 39369.

PLATE 36

OPAL MEMBER, MOUNT HEAD FORMATION

Figures 1–4. Opal Member, Mount Head Formation, 320 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.

Medium- to coarse-grained, poorly sorted, foraminifer-lump-alga-pelmatozoan grainstone; some epitaxial overgrowth on the crinoid ossicles; pellets, bryozoans and brachiopods, and some coated grains present; abundant foraminifers—*Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Skippella* sp., *Endothyranopsis compressa* (Rauser–Tschernoussova and Reitlinger), *Globoendothyra paula* (Vissarionova), *Archaediscus* of the group *A. krestovnikovi* Rauser–Tschernoussova *Earlandia* sp., *Endothyra* sp., *Brunsia* sp., *Septabrunsiina mackeei* Skipp *in* Skipp, Holcomb and Gutschick ORTH. MUT., *Banffella* sp., and *Earlandinella* sp.; *Calcisphaera pachysphaerica* (Pronina) and *Koninckopora inflata* (de Koninck) are present; x31.

South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74468; Mamet Nos. 109/30, 109/31, 109/34, and R20/3; GSC type Nos. 39370 (fig. 1), 39371 (fig. 2), 39372 (fig. 3), 39373 (fig. 4).



1

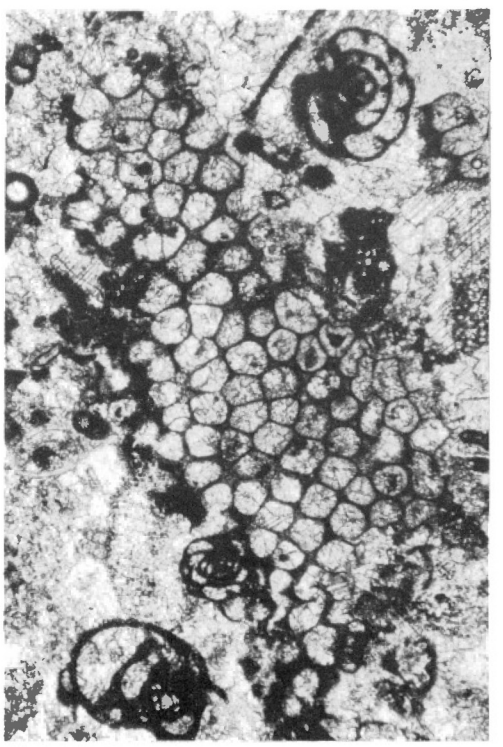


2

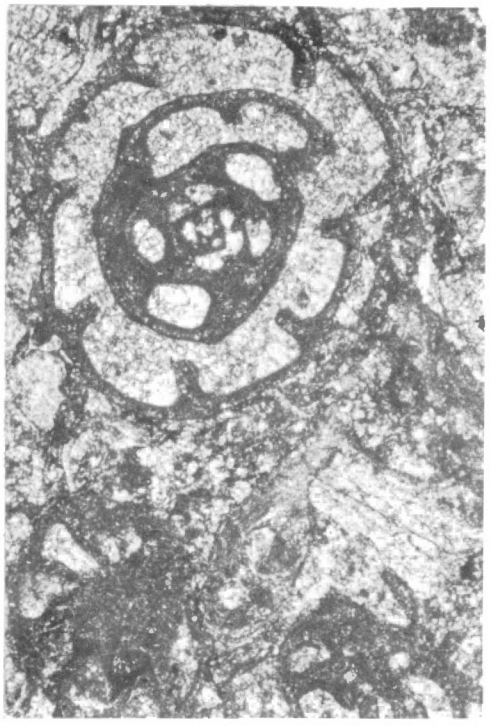
3



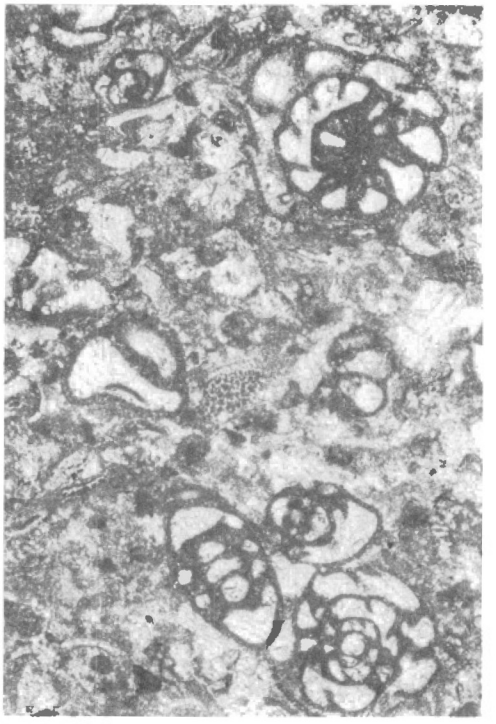
4



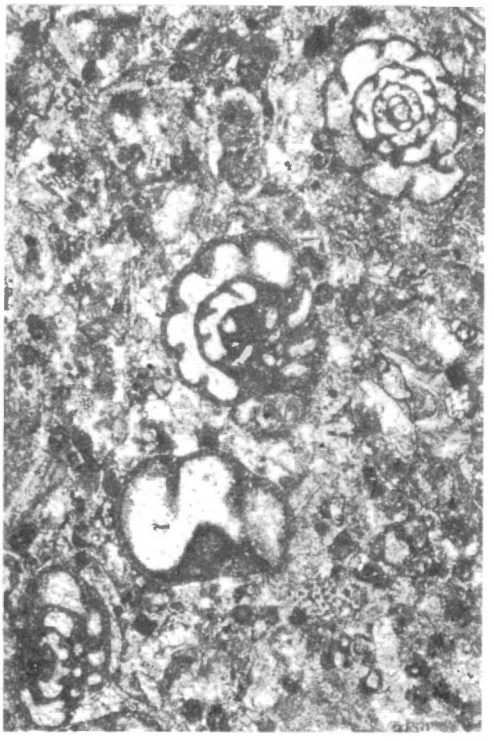
CARNARVON MEMBER, MOUNT HEAD FORMATION



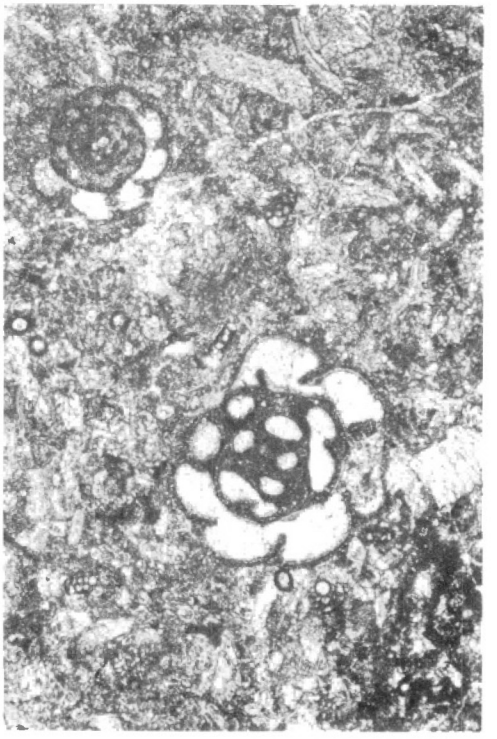
1



2



3



4

Figure 1. Carnarvon Member, 921 feet below top of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Slightly recrystallized, poorly sorted, unevenly grained foraminifer-pelmatozoan packstone; some bryozoans and hard pellets; despite the recrystallization, the disphanotheca of the gigantic *Globoendothyra* of the group *G. globulus* (d'Eichwald emend von Möller) is clearly visible; oblique sections of *Endothyranopsis* sp. and *Eoendothyranopsis* sp. are also present; x38.

Connor Lakes, British Columbia; locality 14; collected by Chevron Standard Ltd.; section CK; Mamet No. 90/9; GSC type No. 39374.

Figures 2, 3. Carnarvon Member, 819 feet below top of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Slightly recrystallized, poorly sorted, unevenly grained, foraminifer-pelmatozoan packstone; some bryozoan fronds, hard pellets and brachiopod valves; foraminifers belong almost exclusively to *Eoendothyranopsis—E.* of the group *E. ermakiensis* (Lebedeva), immature *E. robusta* (McKay and Green), *E. scitula* (Toomey), and *E.* of the group *E. rara* (Grozdilova *in* Lebedeva); x31.

Location and collector as in fig. 1; Mamet Nos. 90/13 and 90/12; GSC type Nos. 39375 (fig. 2), 39376 (fig. 3).

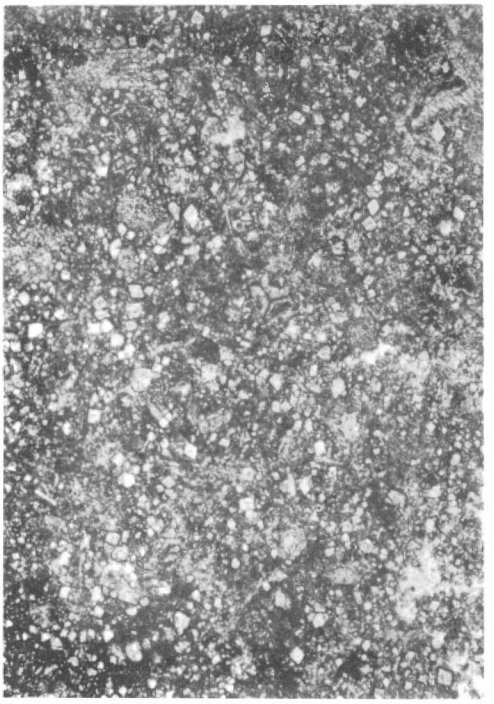
Figure 4. Carnarvon Member, 797 feet below top of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Slightly recrystallized, poorly sorted, unevenly grained, foraminifer-pelmatozoan packstone; note the secondary sparitic layer lining the chambers of *Globoendothyra* of the group *G. tomiliensis* (Lebedeva), which should not be mistaken for a diaphanotheca; *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Parathurammina* sp., and *Calcisphaera* sp. are present; x31.

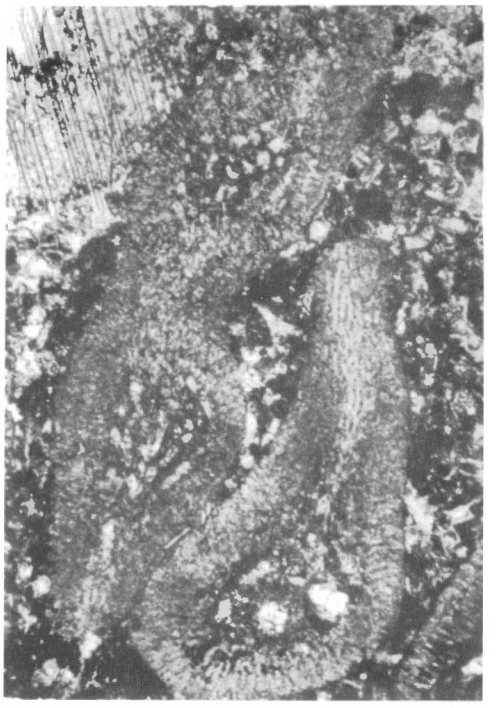
Location and collector as in fig. 1; Mamet No. 91/5; GSC type No. 39377.

PLATE 38

CARNARVON MEMBER, MOUNT HEAD FORMATION



1



2

Figure 1. Carnarvon Member, 26 feet below top of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Dolomitic, crinoid-foraminifer wackestone; figured elements as ghosts (*Eoendothyranopsis* sp., *Koninckopora* sp.); x31.

Ghost River, south fork, Alberta, locality 23a; collected by Chevron Standard Ltd.; Mamet No. 101/13; GSC type No. 39378.

Figure 2. Carnarvon Member, Mount Head Formation, 115 feet below top of Carnarvon Member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Large thalli of *Epistacheoides nephroformis* Petryk and Mamet in a recrystallized pelletoid packstone; x31.

Ewin Creek, British Columbia, locality 20; collected by M. Lerand, No. SQ 20/62; Mamet No. 65/12; GSC type No. 39379.

3



4



Figure 3. Carnarvon Member, Mount Head Formation, 33 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Medium-grained, slightly recrystallized, pelmatozoan-bryozoan packstone with immature *Eoendothyranopsis* sp. and calcispheres; x31.

Tunnel Mountain, Alberta, locality 71; collected by R. W. Macqueen; GSC loc. 74081; Mamet No. 237/5; GSC type No. 39380.

Figure 4. Carnarvon Member, Mount Head Formation, 74 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

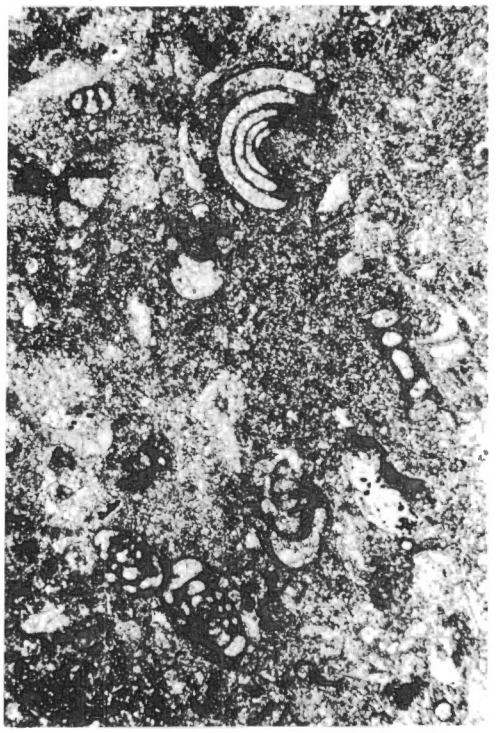
Lagoonal, algal wackestone; the matrix is slightly recrystallized; rare birdseyes; numerous algae (*Kamaena* sp., *Pseudokamaena* sp., *Palaeoberesella* sp., *Pseudoissinella* sp.) associated with *Eoendothyranopsis* sp. and *Parathuramмina* sp.; x31.

Mount Aylmer, Alberta, locality 37; collected by R. W. Macqueen; GSC loc. 74655; Mamet No. 237/11; GSC type No. 39381.

CARNARVON MEMBER, MOUNT HEAD FORMATION



1



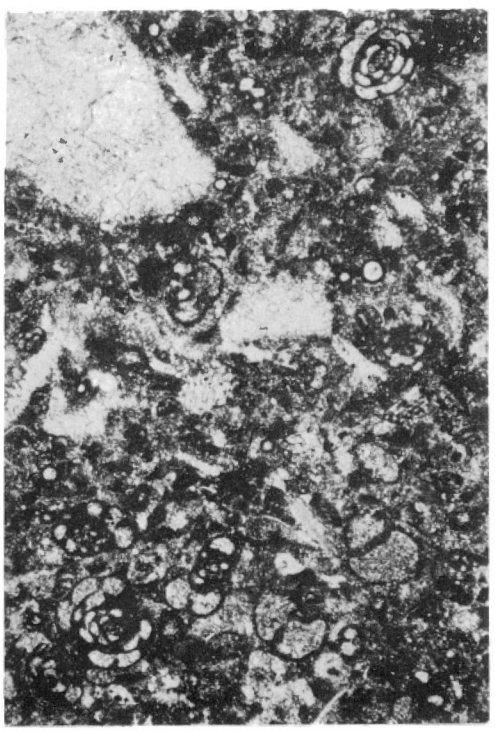
2

Figures 1, 2. Opal or Carnarvon? Member, undetermined level; Zone 15, Late Viséan, St. Genevieve age equivalent.

Slightly recrystallized, poorly sorted, unevenly grained, foraminiferal wackestone; recrystallization of the matrix and the foraminifers variable; few algae (kamaenids), pelmatozoans, ostracodes, and brachiopods; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoendothyranopsis* of the group *E. rara* (Grozdilova *in* Lebedeva), *Eoendothyranopsis* sp., *Endothyra* sp., *Endothyranopsis* sp., and *Parathurammina* sp.; x31.

Mount Lorette, Alberta, locality 42; collected by R. W. Macqueen; Mamet Nos. 234/21 and 234/22; GSC type Nos. 39382 (fig. 1), 39383 (fig. 2).

3



4



Figure 3. Opal or Carnarvon? Member, Mount Head Formation, 72 feet below top of member; boundary of Zones 14/15?, Late Viséan, St. Louis or St. Genevieve age equivalent.

Slightly recrystallized, poorly sorted, medium-grained, foraminifer-pelmatozoan wackestone; rare pellets; few *Calcisphaera laevis* Williamson, ostracodes, and brachiopods; foraminifers are immature *Endothyranopsis* of the group *E. compressa* (Rauser–Tschernoussova and Reitlinger), *Eoendothyranopsis* sp., and *Septabrunsiina mackeei* Skipp *in* Skipp, Holcomb and Gutschick ORTH. MUT.; x31.

Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74334; Mamet No. 108/23; GSC type No. 39384.

Figure 4. Carnarvon Member, Mount Head Formation, 15 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Poorly sorted, foraminifer-brachiopod wackestone; some crinoids; foraminifers are *Eoforschia* sp., *Endothyranopsis* sp., *Eoendothyranopsis* sp., *Parathurammina* sp., and *Banffella* sp.; x38.

Panther River, Alberta, locality 57; collected by R. W. Macqueen; GSC loc. 74019; Mamet No. 233/16; GSC type No. 39385.

PLATE 40

CARNARVON MEMBER, MOUNT HEAD FORMATION

Figures 1–3. Carnarvon Member, Mount Head Formation, 87 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Recrystallized, poorly sorted, unevenly grained, pelmatozoan-foraminifer wackestone; the matrix is completely recrystallized into fine-grained, granular microspar; recrystallization of the foraminifer wall is fairly advanced; *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Eoendothyranopsis robusta* (McKay and Green), *Endothyranopsis* sp., *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Globoendothyra* sp.; the incertae sedis *Paracalligelloides* sp. is also present (fig. 2); x31.

Boulder Creek, Alberta, locality 7; collected by R. W. Macqueen; GSC loc. 74543; Mamet Nos. 236/2, 236/3, 233/28; GSC type Nos. 39386 (fig. 1), 39387 (fig. 2), 39388 (fig. 3).



1



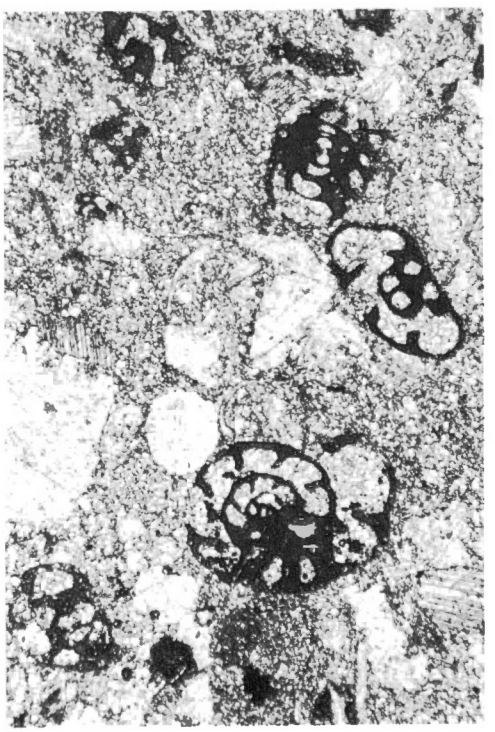
2

Figure 4. Carnarvon Member, Mount Head Formation, 24 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

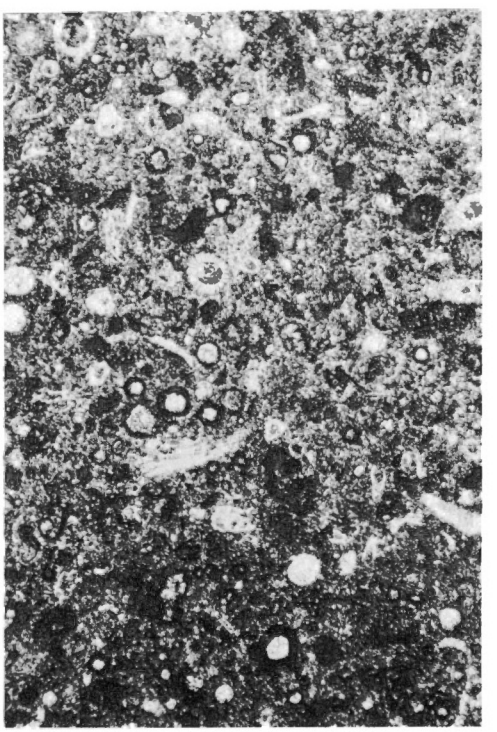
Slightly recrystallized, fine-grained, rather well sorted, calcisphere wackestone; biota is composed essentially of calcisphaeres (*Calcisphaera* sp., "*Radiosphaera*" sp., *Palaeocancellus* sp.), and parathuramminids (*Parathurammina* sp., *Vicinesphaera* sp.), with few additional algae (*Palaeoberesella* sp., *Proninella* sp.), and ostracodes; x38.

Location and collector as in figs. 1–3, GSC loc. 74529; Mamet No. 108/35; GSC type No. 39389.

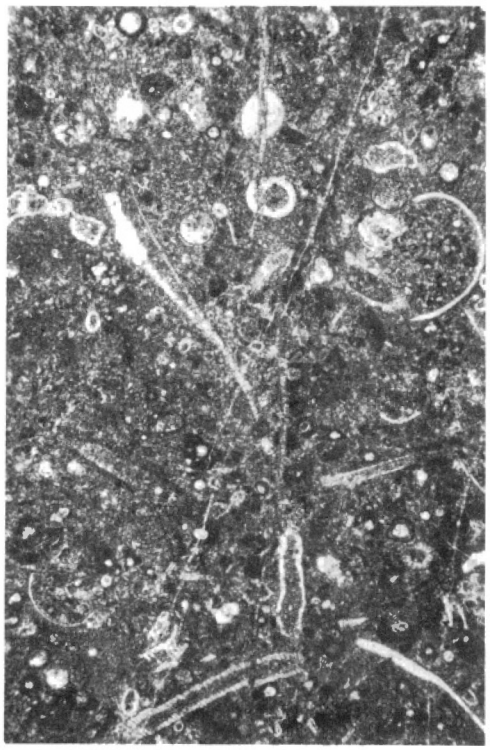
3



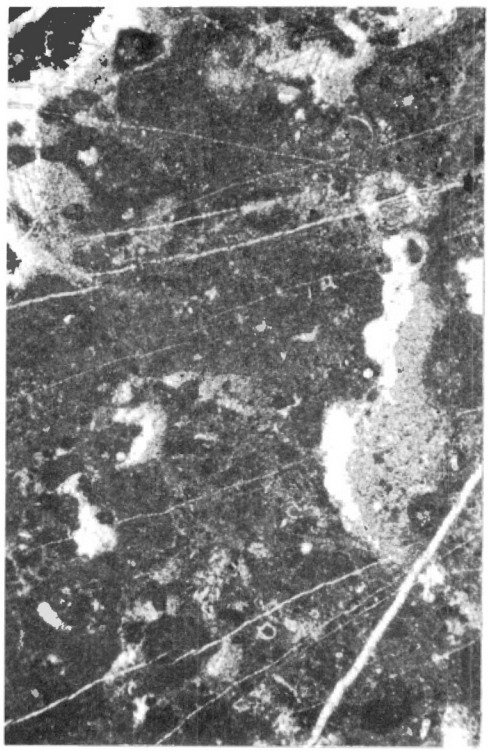
4



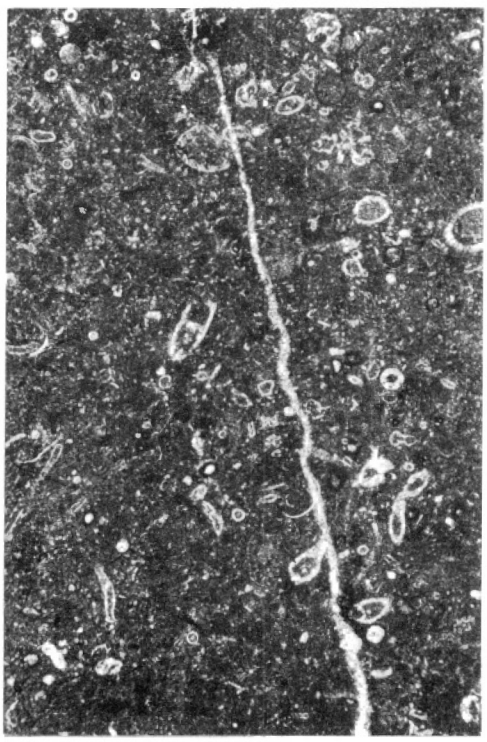
CARNARVON MEMBER, MOUNT HEAD FORMATION



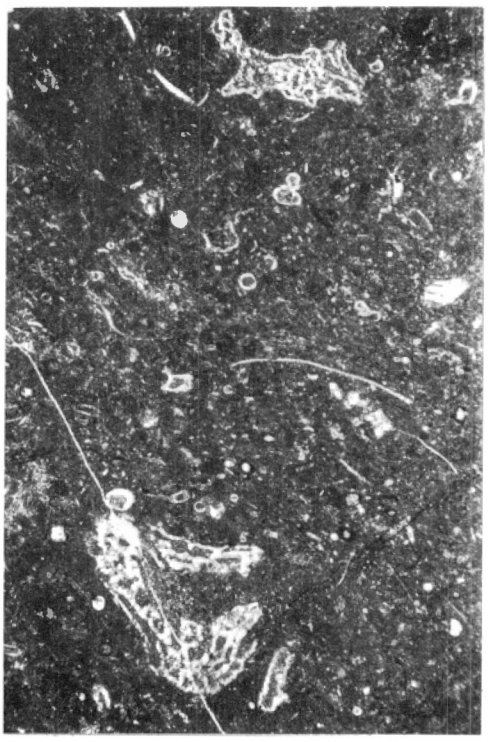
1



2



3



4

Figure 1. Carnarvon Member, Mount Head Formation, 24 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Lagoonal, algal wackestone; abundant algal spore cases [*Calcisphaera laevis* Williamson, *Calcisphaera pachysphaerica* (Pronina)], and thalli (*Pseudoissinella* sp., *Proninella* sp., kamaenids); rare parathuramminids (*Parathurammina* of the group *P. suleimanovi* Lipina, *Vicinesphaera* sp.), earlandiids, *Eotuberitina* and ostracodes; x31.

Boulder Creek, Alberta, locality 7; collected by R. W. Macqueen; GSC loc. 74529; Mamet No. 233/26; GSC type No. 39390.

Figure 2. Carnarvon Member, Mount Head Formation, 51 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Lagoonal, loferite mudstone; some Spongiostromata pellets in the matrix; birdseyes are partly filled by micritic sediment (turn photograph 90° to the right for original sample orientation); biota scarce—ostracodes, calcispheres and algae; x31.

Location and collector as in fig. 1; GSC loc. 74531; Mamet No. 233/27; GSC type No. 39391.

Figures 3, 4. Carnarvon Member, Mount Head Formation, 4 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent.

Lagoonal, algal wackestone; abundant mud-filled, crumpled algal thalli (*Kamaena* sp., *Pseudoissinella* sp., *Stacheoides* sp., and *Proninella* sp.) mixed with spore cases (*Calcisphaera* sp.), and parathuramminids (*Parathurammina* sp. and *Vicinesphaera* sp.); crumpling of the thalli probably caused by mud compaction during diagenesis; x31.

Mount McDougall, Alberta, locality 43; collected by R. W. Macqueen; GSC loc. 74143; Mamet Nos. 234/4 and 234/5; GSC type Nos. 39392 (fig. 3), 39393 (fig. 4).

PLATE 42

MOUNT HEAD MICROBIOTA

Figures 1, 2, 4, 6, 8. *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain) (= *Tournayella nonconstricta* McKay and Green)

1. Opal Member, Mount Head Formation, 18 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Elbow Lake, Alberta, locality 17; collected by R. W. Macqueen; GSC loc. 74356; Mamet No. 107/36; GSC type No. 39394.

2. Opal Member, Mount Head Formation, 244 feet above base of member; Zone 14, Late Viséan, St. Louis equivalent; x78.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74324; Mamet No. 233/4; GSC type No. 39395.

4. Salter Member, Mount Head Formation, 83 feet below top of member; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent; x78.
Grizzly Creek, Alberta, locality 24; collected by R. W. Macqueen; GSC loc. 74155; Mamet No. 234/15; GSC type No. 39397.

6. Opal Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
Location and collector as in fig. 2; GSC loc. 74318; Mamet No. 238/35; GSC type No. 39399.

8. Opal or Carnarvon Member?, Mount Head Formation, 72 feet below top of member; Zone 14 or 15?, Late Viséan; x78.
Location and collector as in fig. 2; GSC loc. 74334; Mamet No. 233/7; GSC type No. 39401.

3. "*Septatournayella*" *henbesti* Skipp, Holcomb and Gutschick
Middle part of Mount Head Formation (undifferentiated), 2,150 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x38.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/15; GSC type No. 39396.

5, 7. *Brunsia lenensis* Bogush and Yuferev

5. Middle part of Mount Head Formation (undifferentiated), 1,853 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
Location and collector as in fig. 3; Mamet No. 87/35; GSC type No. 39398.

7. Middle part of Mount Head Formation (undifferentiated), 1,183 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Location and collector as in fig. 3; Mamet No. 89/12; GSC type No. 39400.

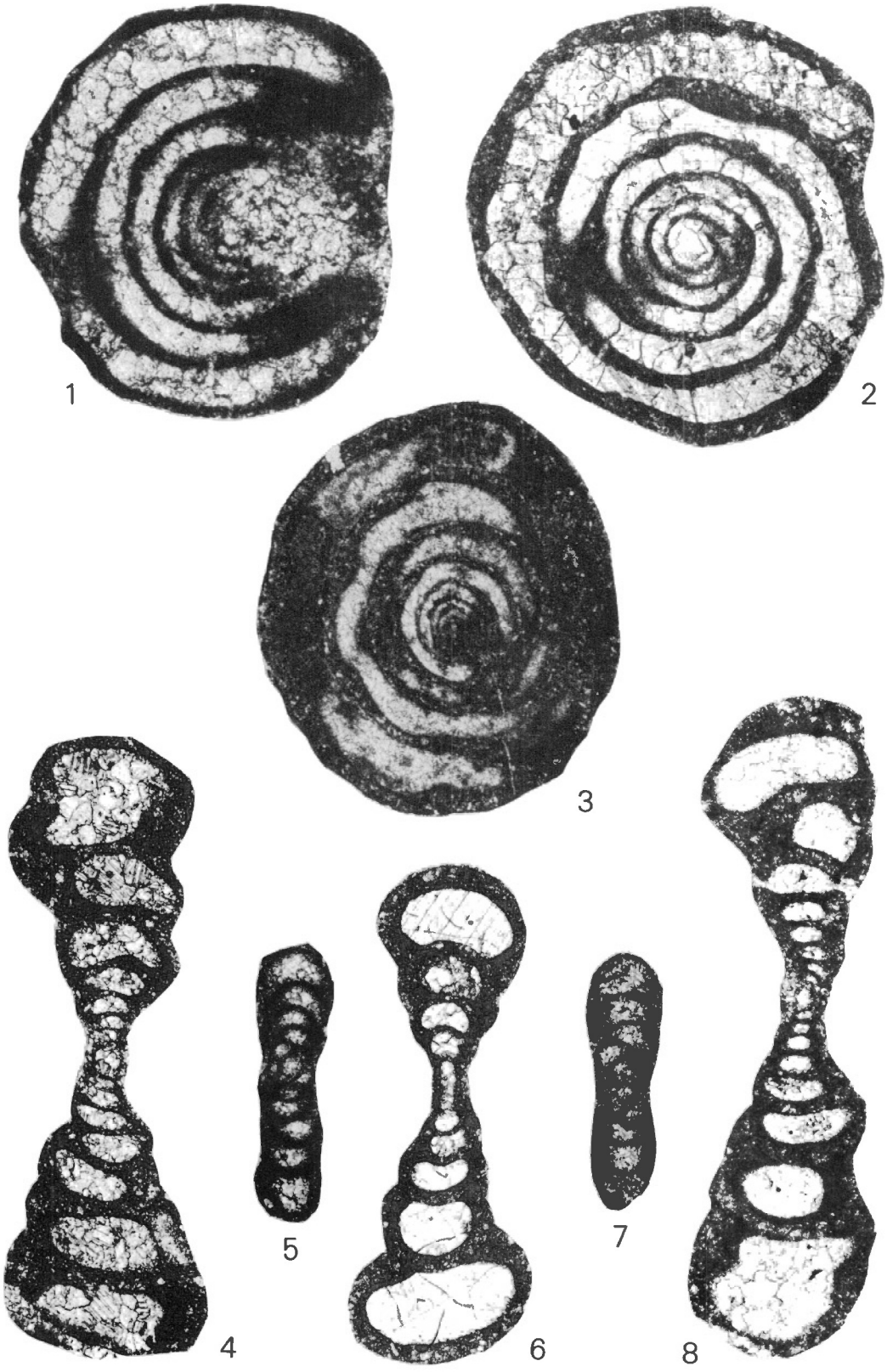

1
2
3
4
5
6
7
8

PLATE 43

MOUNT HEAD MICROBIOTA

Figure 1. *Pseudoammodiscus* sp.
Middle Mount Head Formation (undifferentiated), 1,959 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/28; GSC type No. 39402.

Figures 2, 3. *Brunsia lenensis* Bogush and Yuferev

2. Middle Mount Head Formation (undifferentiated), 1,580 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Location and collector as in fig. 1; Mamet No. 88/28; GSC type No. 39403.

3. Middle Mount Head Formation (undifferentiated), 1,537 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Location and collector as in fig. 1; Mamet No. 88/33; GSC type No. 39404.

4–6, 8, 10. *Eoendothyranopsis scitula* (Toomey)

4. Opal Member, Mount Head Formation, 115 feet above base; Zone 14, Late Viséan, St. Louis age equivalent; x38.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74317; Mamet No. 108/9; GSC type No. 39405.

5. Middle Mount Head (undifferentiated), 1,487 feet below top; Zone 14, Late Viséan, St. Louis equivalent; x78.
Location and collector as in fig. 1; Mamet No. 89/11, GSC type No. 39406.

6. Loomis Member, Mount Head Formation, 19 feet below top of member; Zone 13, Middle Viséan, St. Louis age equivalent; x78.
South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74480; Mamet No. 236/36; GSC type No. 39407.

8. Opal Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74318, Mamet No. 232/34; GSC type No. 39409.

10. Salter Member, Mount Head Formation, 83 feet below top of member; boundary of Zones, 12/13, Middle Viséan, Salem/St. Louis boundary equivalent; x121.
Grizzly Creek, Alberta, locality 24; collected by R. W. Macqueen, GSC loc. 74155; Mamet No. 234/14; GSC type No. 39411.

7. *Eoendothyranopsis* aff. *E. prodigiosa* (Armstrong)
Opal Member, Mount Head Formation, 196 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x38.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74320; Mamet No. 108/17; GSC type No. 39408.

9, 11. *Eoendothyranopsis spiroides* (Zeller)

9. Locality, collector and stratigraphic level as in fig. 10; x121; Mamet No. 234/17; GSC type No. 39410.

11. Locality, collector, and stratigraphic level as in fig. 10; x121; Mamet No. 234/19, GSC type No. 39412.

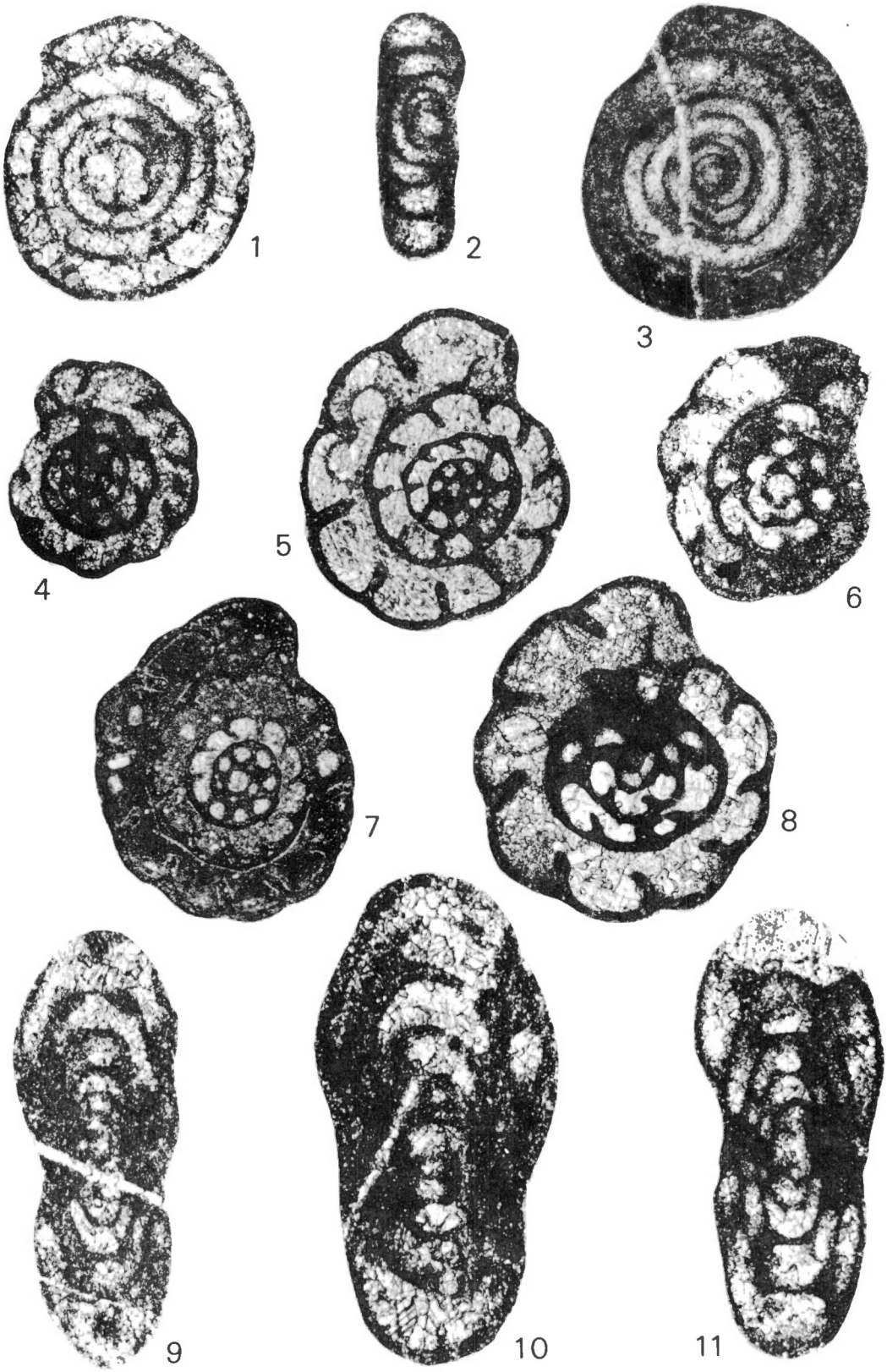

1
2
3
4
5
6
7
8
9
10
11

PLATE 44

MOUNT HEAD MICROBIOTA

Figures 1, 3. *Eoendothyranopsis thompsoni* (Anisgard and Campau)

1. Middle Mount Head Formation (undifferentiated), 1,437 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 88/32; GSC type No. 39413.

3. Opal Member, Mount Head Formation, 458 feet above base of member; Zone 14?, Late Viséan, St. Louis age equivalent; x78.
King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74609; Mamet No. 236/9; GSC type No. 39415.

2. *Globoendothyra* of the group *G. tomiliensis* (Lebedeva)-*Globoendothyra paula* (Vissarionova)
Middle Mount Head (undifferentiated), 1,546 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Location and collector as in fig. 1; Mamet No. 88/31; GSC type No. 39414.

4, 5. *Endothyranopsis* of the group *E. compressa* (Rauser–Tschernoussova and Reitlinger)

4. *Endothyranopsis compressa* (Rauser–Tschernoussova and Reitlinger) (=*Endothyra arrecta* McKay and Green)
Upper Carnarvon Member, Mount Head Formation; Zone 15, Late Viséan, St. Genevieve age equivalent; x38.
Mount Livingstone, Alberta, locality 41a; collected by M. Lerand; GSC loc. C-33598; Mamet No. 66/28; GSC type No. 39416.

5. *Endothyranopsis convexa* (Rauser–Tschernoussova)
Loomis Member, Mount Head Formation, 47 feet below top of member; Zone 13, Middle Viséan, St. Louis age equivalent; x78.
Flat Creek, Alberta, locality 21; collected by R. W. Macqueen; GSC loc. 74546; Mamet No. 237/8; GSC type No. 39417.

6. *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva)–*Eoendothyranopsis donica typica* Brazhnikova and Rostovceva emend
Opal Member, Mount Head Formation, 264 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x51.
King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74607; Mamet No. 109/7; GSC type No. 39418.

7. *Endothyra* of the group *E. bowmani* Phillips emend Brady
Mount Head Formation (undifferentiated), 961 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 87/34; GSC type No. 39419.

8. *Banffella banffensis* (McKay and Green)
Marston Member, Mount Head Formation, 37 feet below top of member; Zone 14, Late Viséan, St. Louis age equivalent.
Mount McDougall, Alberta, locality 43; collected by R. W. Macqueen; GSC loc. 74142; Mamet No. 109/22; GSC type No. 39420.

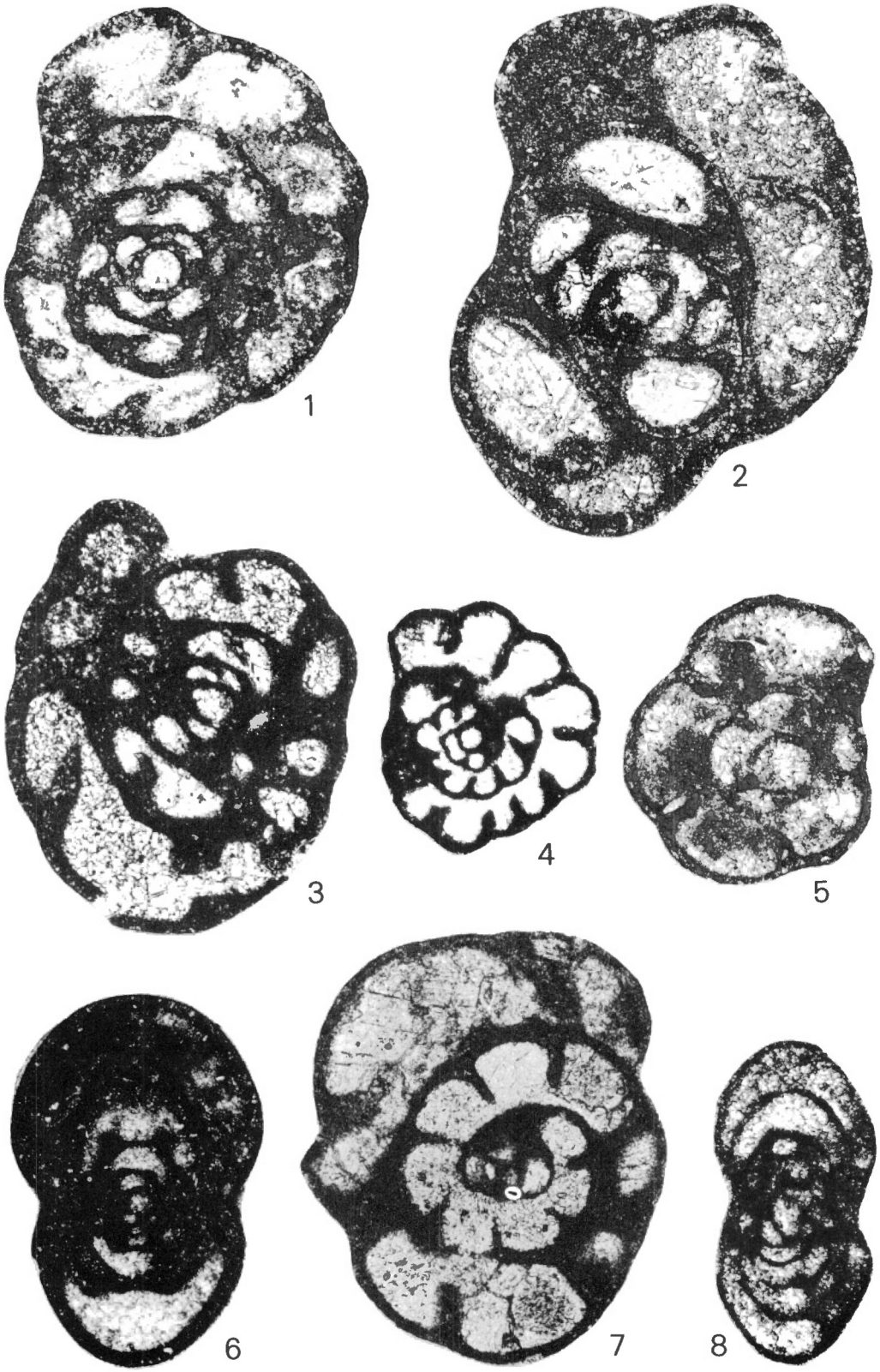

1
2
3
4
5
6
7
8

PLATE 45

MOUNT HEAD MICROBIOTA

Figure 1. *Atractyliopsis cumberlandensis* Rich
Carnarvon/Etherington contact; Zone 15, Late Viséan; x78.
Highwood Valley, Alberta, locality 27; collected by B. L. Mamet (ETH 2); Mamet No. R35/25; GSC type No. 39421.

2. *Koninckopora tenuiramosa* Wood
Opal Member, Mount Head Formation, 458 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74609; Mamet No. R26/10; GSC type No. 39422.

3. *Aoujgalia variabilis* Termier and Termier
Middle Mount Head Formation (undifferentiated), 1,527 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x51.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 89/1; GSC type No. 39423.

4. "*Radiosphaera*" sp. (="*Asterosphaera*" sp.)
Carnarvon Member, Mount Head Formation, 24 feet above base of member; Zone 15, Late Viséan, St. Genevieve age equivalent; x148.
Boulder Creek, Alberta, locality 7; collected by R. W. Macqueen; GSC loc. 74529; Mamet No. 108/34; GSC type No. 39424.

5. *Eotuberitina reitlingerae* (Mikluko–Maklai)
Opal Member, Mount Head Formation, 535 feet above base of member; Zone 14?, or 15?, Late Viséan, St. Louis or St. Genevieve age equivalent; x180.
Elpoca Creek, Alberta; locality 18; collected by R. W. Macqueen; GSC loc. 74333; Mamet No. 108/19; GSC type No. 39425.

6. *Diplosphaerina inaequalis* (Derville)
Middle Mount Head Formation (undifferentiated), 1,696 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x148.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 88/11; GSC type No. 39426.

Figures 7–9. *Paracalligelloides* sp.

7. Opal Member, Mount Head Formation, 53 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74311; Mamet No. 232/26; GSC type No. 39427.

8. Opal Member, Mount Head Formation, 125 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
Location and collector as in fig. 5; GSC loc. 74318; Mamet No. 232/33; GSC type No. 39428.

9. Opal Member, Mount Head Formation, 81 feet above base of member; Zone 14, Late Viséan, St. Louis age equivalent; x78.
Location and collector as in fig. 5; GSC loc. 74315; Mamet No. 232/30; GSC type No. 39429.

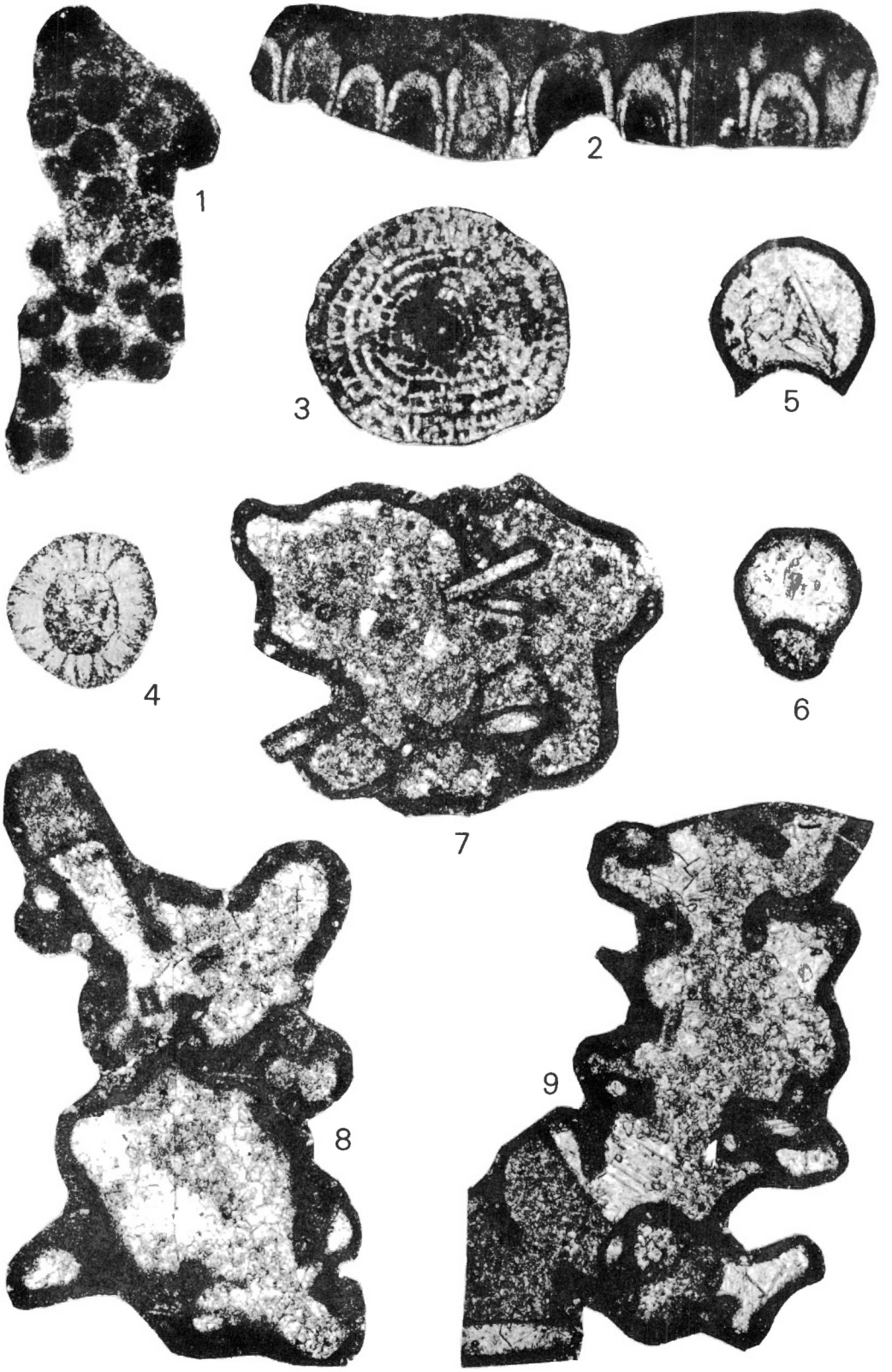

1
2
3
4
5
6
7
8
9

PLATE 46

ETHERINGTON FORMATION (BOUNDARY BEDS)

Figure 1. Mount Head/Etherington transition beds; boundary of Zones $15/16_{inf}$, Late Viséan.

Calcareous sponge spiculite; x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 91/8; GSC type No. 39430.

Figure 2. Mount Head/Etherington transition beds; boundary of Zones $15/16_{inf}$, Late Viséan.

Rather well sorted, medium-grained, pelmatozoan-bryozoan-lump grainstone; crinoid ossicles show all degrees of alteration from unpitted plates to weathered "spongy" ossicles; lumps of various origins; foraminifers are *Endothyra* of the group *E. bowmani* Phillips emend Brady (*Endothyra excentralis* Cooper), *Archaediscus* of the group *A. krestovnikovi* Rauser-Tschernoussova, and *Globoendothyra* sp.; algae are scarce and mud filled; x31.

Location and collector as in fig. 1; Mamet No. 91/9; GSC type No. 39431.

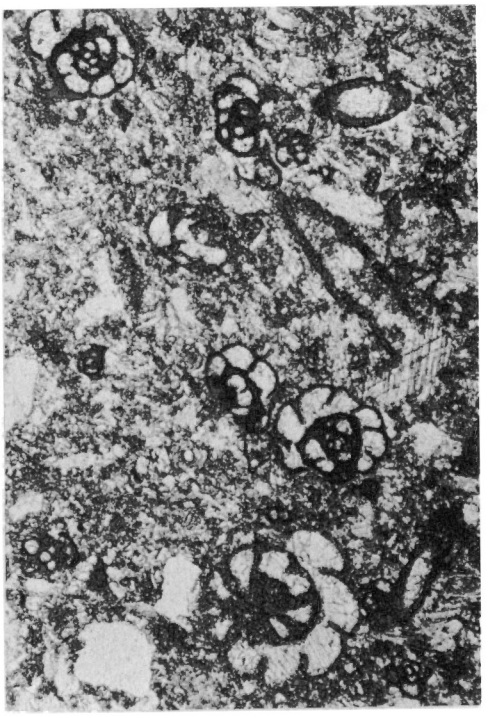


1

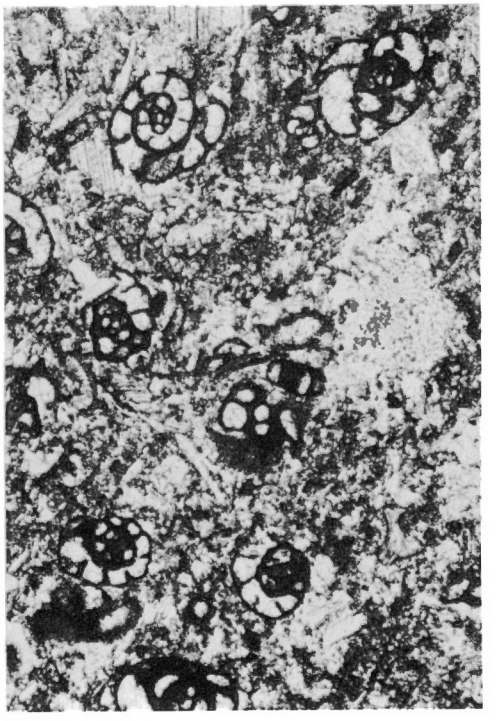


2

3



4



Figures 3, 4. Mount Head/Etherington transition beds; boundary of Zones $15/16_{inf}$, Late Viséan.

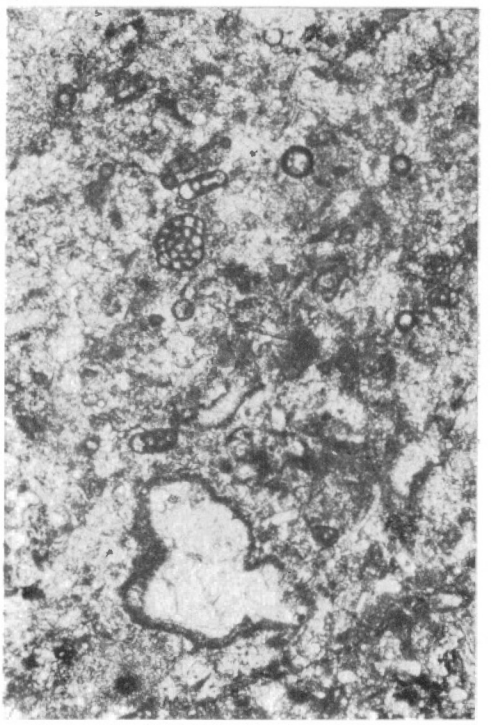
Slightly recrystallized, rather poorly sorted, medium-grained, foraminifer-pelmatozoan wackestone; some bryozoans and brachiopods; recrystallization of the matrix more pronounced than that of the enclosed fossils; foraminifers are *Endothyra* of the group *E. bowmani* Phillips emend Brady (*Endothyra bowmani* Phillips emend Brady, *Endothyra excentralis* Cooper), *Globoendothyra* sp., *Earlandia* of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger) *Earlandia* of the group *E. clavatula* (Howchin), and *Pseudoglomospira* sp.; x31.

Ghost River, south fork, Alberta, locality 23a; collected by Chevron Standard Ltd.; Mamet Nos. 101/15 and 101/14; GSC type Nos. 39432 (fig. 3), 39433 (fig. 4).

LOWER ETHERINGTON FORMATION



1



2

Figure 1. Etherington Formation (lower), 1,139 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Recrystallized, medium-grained, pelmatozoan-lump packstone-grainstone; ossicles and lumps as ghosts; amount of original matrix difficult to assess due to recrystallization; keeled *Pseudoendothyra* of the group *P. ornata* (Brady) (*P.* aff. *P. bona* Rozovskaia); x31.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 91/13; GSC type No. 39434.

Figure 2. Etherington Formation (lower), 1,071 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Fine- to medium-grained, recrystallized wackestone; algal spore cases [*Calcisphaera laevis* Williamson, *Calcisphaera pachysphaerica* (Pronina)] rather abundant; equatorial section of *Zellerina discoidea* (Girty), scattered undeterminable endothyroids and the enigmatic *Paracalligelloides?* sp.; x31.

Location and collector as in fig. 1; Mamet No. 92/1; GSC type No. 39435.

3



4

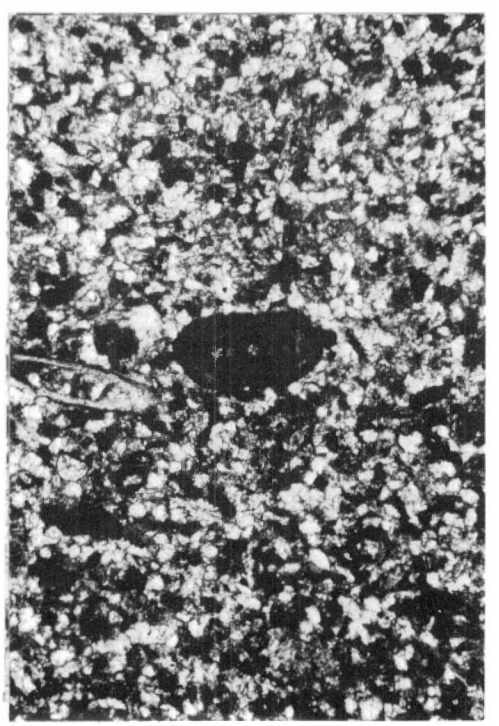


Figure 3. Etherington Formation (lower), 1,068 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Coarse-grained lump-oolite grainstone; extensive micrite coating of a tubular alga(?) simulates *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger); x31.

Location and collector as in fig. 1; Mamet No. 92/3; GSC type No. 39436.

Figure 4. Etherington Formation (lower), 973 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Recrystallized, pelletoidal siltstone with micritized *Pseudoendothyra*; x31.

Location and collector as in fig. 1; Mamet No. 92/7; GSC type No. 39437.

PLATE 48

LOWER ETHERINGTON FORMATION

Figure 1. Etherington Formation (lower), 1,139 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Medium-grained, poorly sorted, pelmatozoan-lump grainstone with rare brachiopod debris and pseudo-oolites; some micrite-coated grains; mud-filled *Pseudoendothyra* of the group *P. ornata* (Brady) (*P. struvii auctores*) and *Globoendothyra* sp.; x38.

Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 91/14; GSC type No. 39438.



1

Figure 2. Etherington Formation (lower), 1,104 feet below top; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Medium- to coarse-grained, well-sorted, pelmatozoan - bryozoan - oolite grainstone; oolite nuclei of variable origin, mostly lumps or ossicles; a mud-filled *Pseudoendothyra* sp. simulates a lump; oblique section of *Pseudoendothyra ampla* (Thompson); x31.

Location and collector as in fig. 1; Mamet No. 91/17; GSC type No. 39439.



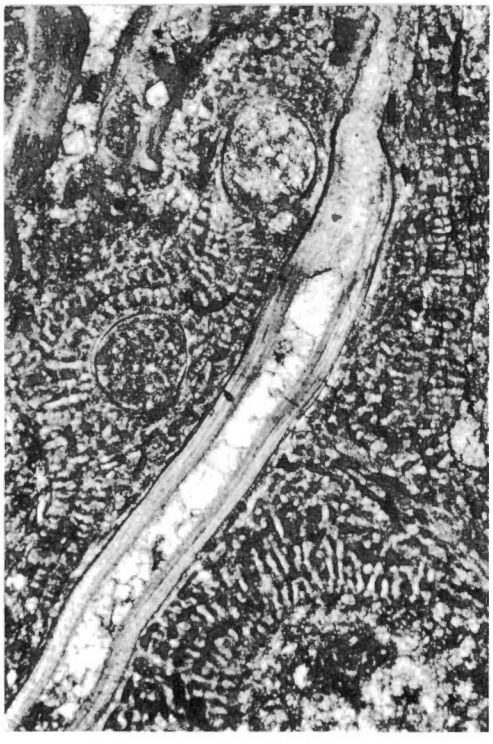
2

3

Figure 3. Etherington Formation (lower), 406 feet below top; Zone 16_{sup}, Late Viséan, lower Chester age equivalent.

Encrusting *Epistacheoides connorensis* Mamet and Rudloff in a recrystallized, slightly dolomitic, bryozoan grainstone; x31.

Location and collector as in fig. 1; Mamet No. 89/14; GSC type No. 39440.



4

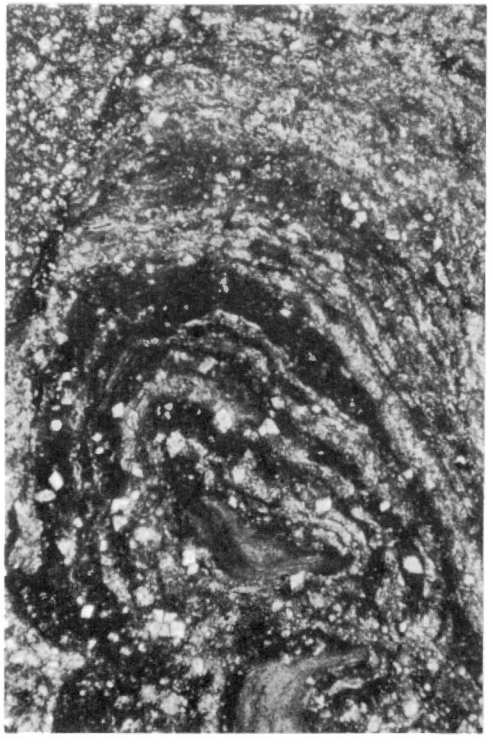


Figure 4. Etherington Formation (lower), 100 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

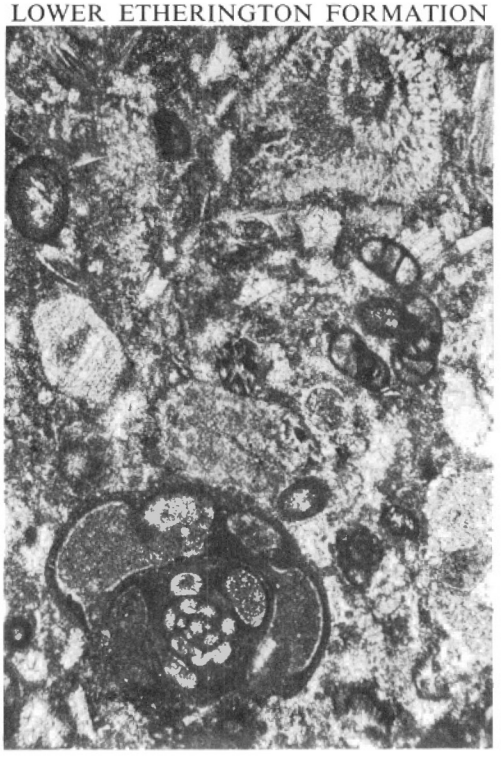
Encrusting Spongiostromata (*Pycnostroma?*) with poor interlaminations in a recrystallized, dolomitized mudstone; x31.

Elbow Lake, Alberta, locality 17; collected by R. W. Macqueen; GSC loc. 74342; Mamet No. R25/1; GSC type No. 39441.

LOWER ETHERINGTON FORMATION



1



2

3



4

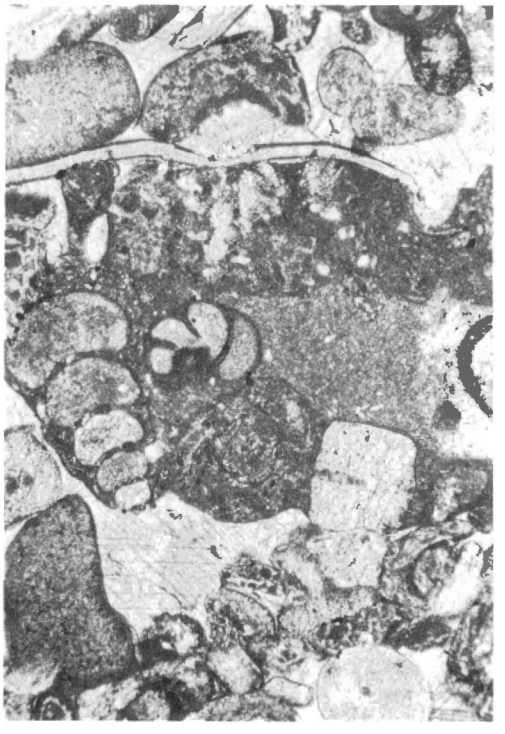


Figure 1. Etherington Formation (lower), 340 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Medium-grained, well-sorted, bioclastic-oolitic grainstone; oolitized pelmatozoans, bryozoans, and foraminifers mixed with non-abraded foraminifers (*Pseudoglomospira* sp., *Endothyra* of the group *E. similis* Rauser–Tschernoussova and Reitlinger); euhedral diagenetic quartz in oolites; x38.

King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74619; Mamet No. 236/20; GSC type No. 39442.

Figures 2, 3. Etherington Formation (lower), 116 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Slightly recrystallized, unevenly grained, poorly sorted, foraminifer-alga-pelmatozoan packstone; cement scarce; foraminifers partly mud-filled; note the pseudofibrous lining of the *Globoendothyra* chambers [*Globoendothyra* of the group *G. globulus* (d'Eichwald emend von Möller)]; other foraminifers are *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger), *Earlandia* of the group *E. clavatula* (Howchin), *Endothyra* of the group *E. bowmani* Phillips emend Brady (*Endothyra bowmani* Phillips emend Brady, *Endothyra excentralis* Cooper); a mud-filled *Epistacheoides nephroformis* Petryk and Mamet is conspicuous in the upper right of fig. 2; x31.

Location and collector as in fig. 1; GSC loc. 74618; Mamet Nos. 236/21 and 236/22; GSC type Nos. 39443 (fig. 2), 39444 (fig. 3).

Figure 4. Etherington Formation (lower), 50 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Unevenly grained, poorly sorted, foraminifer-bryozoan-pelmatozoan grainstone with matrix relicts; some brachiopods, pellets, and lumps; a mud-filled *Globoendothyra* in the centre of the photograph simulates a lump; foraminifers are *Endothyra* sp. and an olique section of *Palaeotextularia* of the group *P. consobrina* Lipina; Stacheeinae are present; x31.

Location and collector as in fig. 1; GSC loc. 74617; Mamet No. 238/18; GSC type No. 39445.

PLATE 50

LOWER ETHERINGTON FORMATION

Figures 1, 2. Etherington Formation (lower), 190.5 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Coarse-grained, algal grainstone; disarticulated encrusting thalli of *Stacheoides? spissa* Petryk and Mamet; abundant micrite-coated grains; x38 (fig. 1), x31 (fig. 2).

South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74453; Mamet Nos. R27/29 and R27/30; GSC type Nos. 39446 (fig. 1), 39447 (fig. 2).

Figure 3. Etherington Formation (lower), 25.5 feet above base; Zone 16_{inf}, Late Viséan, lower Chester age equivalent.

Well-sorted, medium- to coarse-grained, oolitic grainstone; two generations of cement; numerous impressed oolites; nuclei are micrite-coated "grains", crinoid ossicles, brachiopod valves and foraminifers; *Globoendothyra* sp. and *Endothyra* sp.; x31.

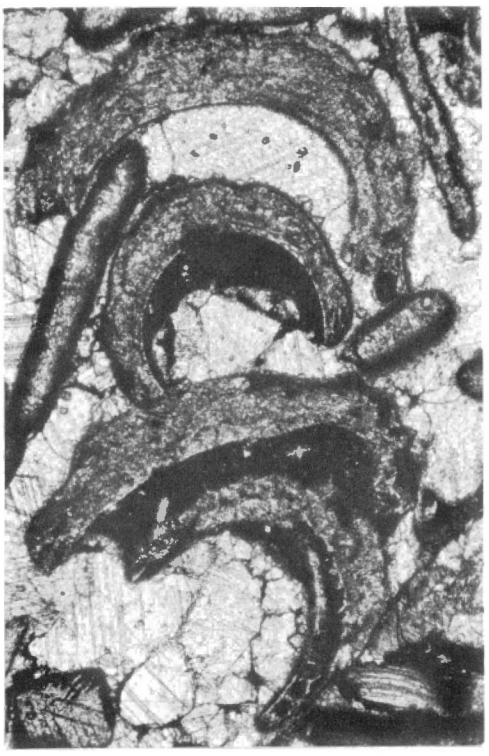
Location and collector as in fig. 1; GSC loc. 74456; Mamet No. 236/28; GSC type No. 39448.

MIDDLE ETHERINGTON FORMATION

Figure 4. Etherington Formation (middle), 245 feet above base of section; Zone 17, Early Namurian, middle Chester age equivalent.

Recrystallized, medium-grained, foraminifer-pelmatozoan-pellet wackestone; some lumps; all figured elements as ghosts, including numerous *Pseudoendothyra composita* (Dutkevitch); x38.

Mount Hosmer, Alberta, locality 41; collected by M. Lerand, No. SQ23/53; Mamet No. 65/2; GSC type No. 39449.



1

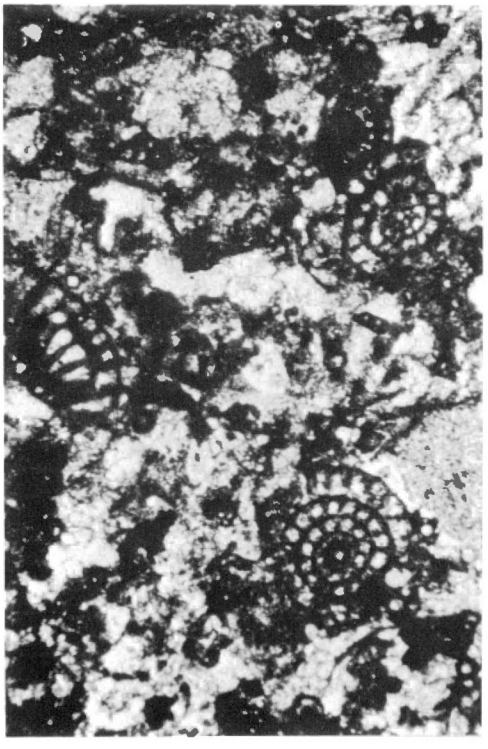


2

3



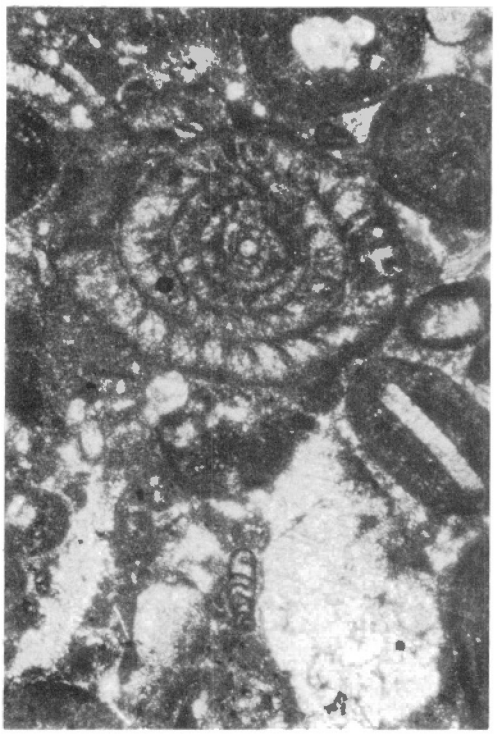
4



UPPER ETHERINGTON FORMATION



1



2

Figure 1. Etherington Formation (upper), 300 feet above base of section; basal Zone 18, Early Namurian, upper Chester age equivalent.

Coarse-grained, poorly sorted, foraminifer-lump grainstone; note interpenetrant grains; *Palaeotextularia* of the group *P. consobrina* Lipina (*Palaeotextularia asper* Cooper) and *Pseudoendothyra* of the group *P. kremenskensis* Rozovskaia are conspicuous; x38.

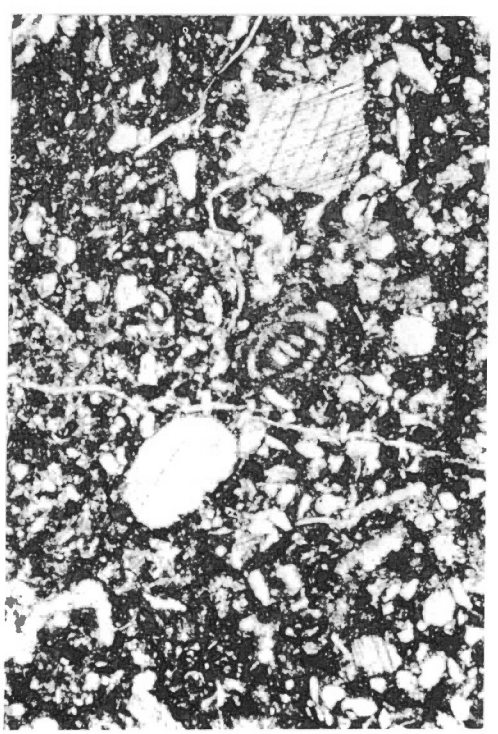
Mount Hosmer, Alberta, locality 41; collected by M. Lerand, No. SQ23/64; Mamet No. 66/9; GSC type No. 39450.

Figure 2. Etherington Formation (upper), approximately 405 feet above base of section; Zone 18, Early Namurian, upper Chester age equivalent.

Coarse-grained, unevenly sorted, foraminifer-lump-oolite grainstone-packstone; diagenetic quartz; foraminifers are *Pseudoendothyra* of the group *P. kremenskensis* Rozovskaia and *Ammovertella* sp.; x31.

Location and collector as in fig. 1, No. SQ23/79; Mamet No. 66/21; GSC type No. 39451.

3



4

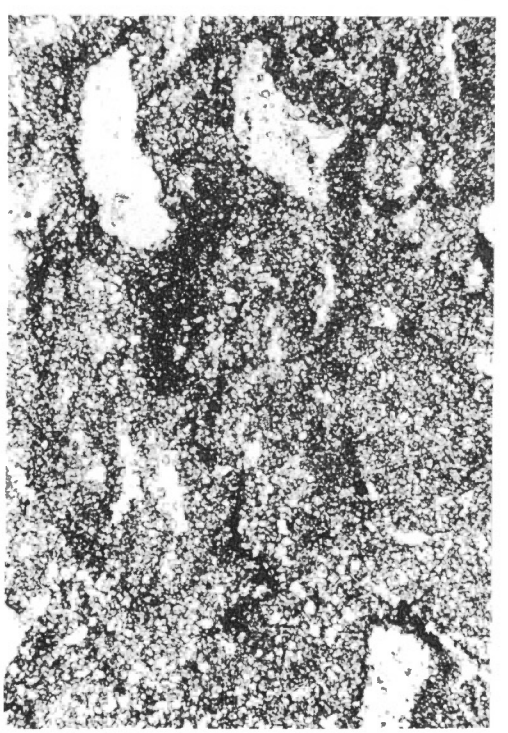


Figure 3. Etherington Formation (upper), 323.5 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Medium-grained, poorly sorted, pelmatozoan wackestone, with detrital quartz grains; foraminifers (*Pseudoendothyra* sp.) as ghosts; x31.

South Misty Range, Alberta, locality 67; collected by R. W. Macqueen; GSC loc. 74441; Mamet No. 236/26; GSC type No. 39452.

Figure 4. Etherington Formation (upper), 291.5 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Fine-grained, granular, silicified dolomite; x31.

Location and collector as in fig. 3; GSC loc. 74444; Mamet No. 236/27; GSC type No. 39453.

PLATE 52

ETHERINGTON MICROBIOTA

Figures 1, 4. *Pseudoendothyra* of the group *P. ornata* (Brady)—*Pseudoendothyra ampla* (Thompson)

1. Etherington Formation (lower), 1,139 feet below top of formation; Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
Connor Lakes, British Columbia, locality 14; collected by Chevron Standard Ltd., section CK; Mamet No. 91/12; GSC type No. 39454.

4. Etherington Formation (lower), 1,104 feet below top of formation; Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
Location and collector as in fig. 1; Mamet No. 91/16; GSC type No. 39457.

2. *Zellerina discoidea* (Girty) (= *Paramillerella tortula* of Zeller)
Etherington Formation (lower), 860 feet below top of formation, Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
Location and collector as in fig. 1; Mamet No. 92/8; GSC type No. 39455.

3. *Globoendothyra* of the group *G. tomiliensis* (Lebedeva)—*Globoendothyra paula* (Vissarionova)
Mount Head/Etherington contact, transition between Zones 15 and 16_{inf}, Late Viséan; x78.
Elpoca Creek, Alberta, locality 18; collected by R. W. Macqueen; GSC loc. 74339; Mamet No. 233/10; GSC type No. 39456.

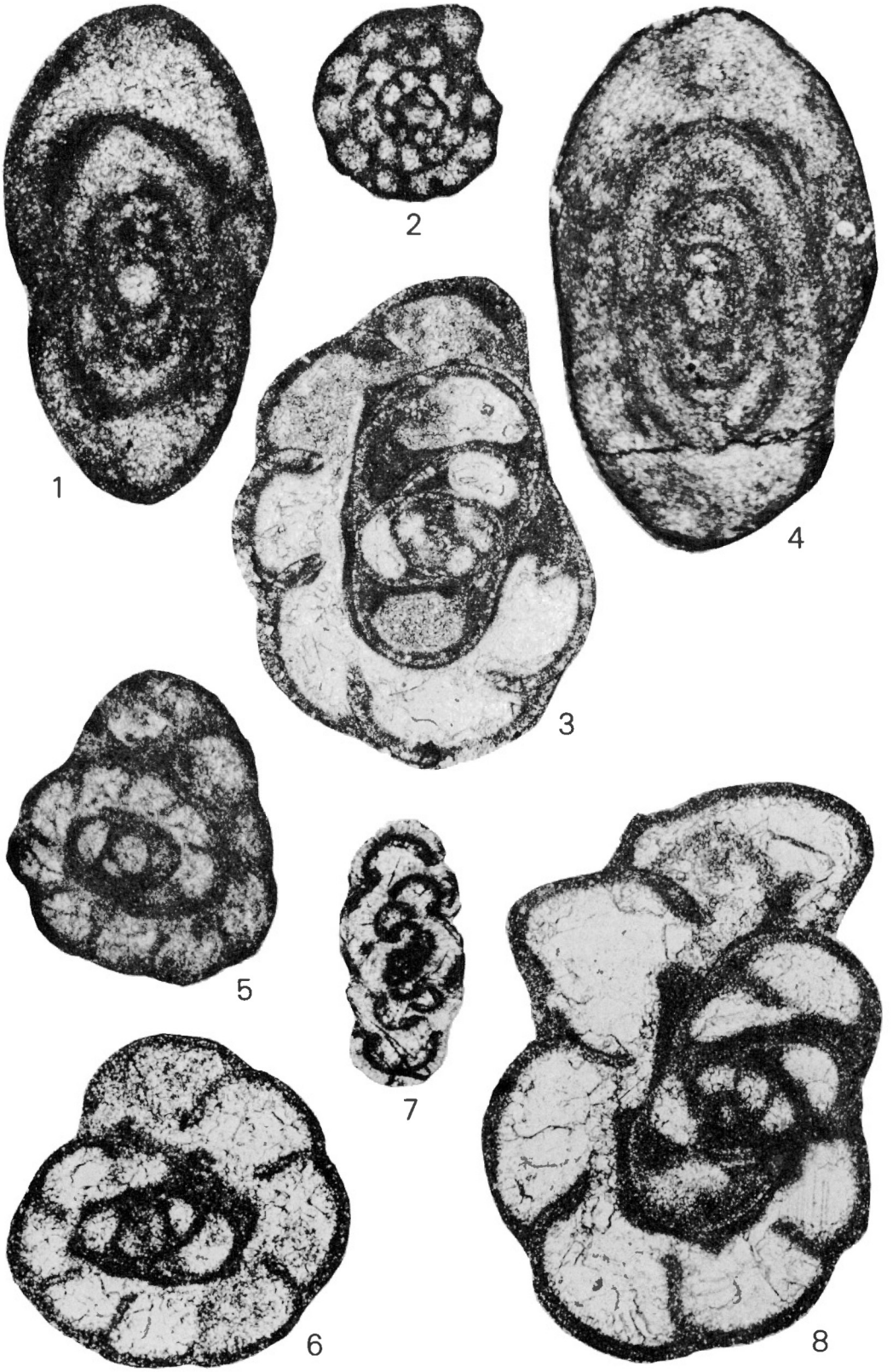
5, 6. *Endothyra* of the group *E. bowmani* Phillips emend Brady

5. *Endothyra excentralis* Cooper
Etherington Formation (lower), 75 feet above base of section; Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
Mount Hosmer, Alberta, locality 41; collected by M. Lerand, No. SQ23/17; Mamet No. 65/11; GSC type No. 39458.

6. Etherington Formation (lower), 116 feet above base of formation; Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
King Creek, Alberta, locality 33; collected by R. W. Macqueen; GSC loc. 74618; Mamet No. 236/24; GSC type No. 39459.

7. *Archaediscus* of the group *A. krestovnikovi* Rauser–Tschernoussova
Etherington Formation (lower), 148 feet above base of formation; Zone 16_{inf}, Late Viséan, lower Chester age equivalent; x121.
Mount McDougall, Alberta, locality 43; collected by R. W. Macqueen; GSC loc. 74153; Mamet No. 234/7; GSC type No. 39460.

8. *Endothyra phrissa* (Zeller)
Mount Head/Etherington contact, transition between Zones 15 and 16_{inf}, Late Viséan; x121.
Ghost River, south fork, Alberta, locality 23a; collected by Chevron Standard Ltd.; Mamet No. 101/17; GSC type No. 39461.


1
2
3
4
5
6
7
8

BANFF FORMATION

Figure 1. Banff Formation (upper), 231 feet below top, depth 2,853 feet; Zone pre-7, Early to earliest Middle Tournaisian.

Unevenly grained pelmatozoan-brachiopod wackestone-packstone; typical Banff "deeper water" carbonate, where lumps, pellets, and foraminifers are conspicuously absent; x31.

Imperial Kahntah No. (1) b-29-C/94-I-7, British Columbia, locality 28; collected by R. M. Procter; GSC loc. C-2230; Mamet No. 123/21; GSC type No. 39462.

Figure 2. Banff Formation (upper), 239 feet below top, depth 4,061 feet; Zone pre-7, Early to basal Middle Tournaisian.

Slightly recrystallized, silty, unevenly grained, poorly sorted, brachiopod-gastropod-pelmatozoan packstone; *Latiendothyra parakosvensis* (Lipina) is present; x38.

H.B.–Imperial–Union Paddy (1) a-49-B/94-H-16, British Columbia, locality 26; collected by R. M. Procter; GSC loc. C-2242; Mamet No. 124/10; GSC type No. 39463.

Figures 3, 4. Banff Formation (top); Zone 7, Middle Tournaisian.

Recrystallized pelmatozoan-pellet wackestone; some cement; typical of the widespread "*Bisphaera* facies"; this enigmatic taxon is usually assigned to the foraminifers; fig. 4 shows the thin tectum and the pseudo-fibrous layer identical to that observed in *Saccaminopsis*, another enigmatic Lower Carboniferous taxon; x51 (fig. 3), x121 (fig. 4).

Mount Hanington north, British Columbia, locality 39; collected by Shell Canada Ltd.; Mamet Nos. 61/7 and 61/8; GSC type Nos. 39464 (fig. 3) and 39465 (fig. 4).



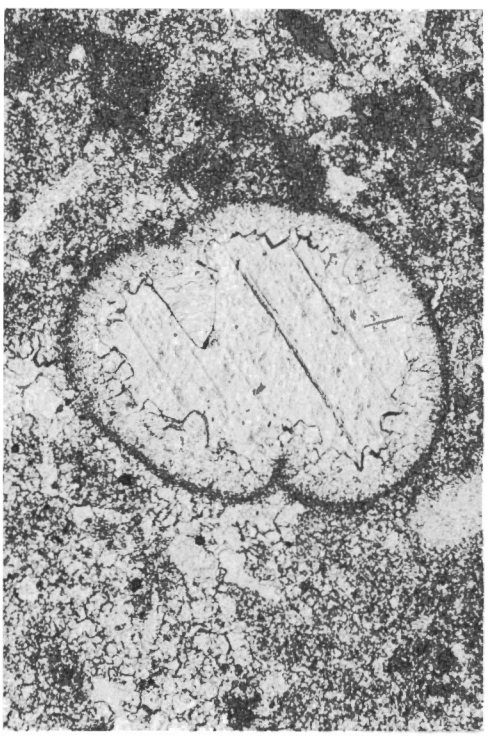
1



2

3





4

PLATE 54

BANFF FORMATION

Figures 1–4. Banff Formation (top); Zone 7, Middle Tournaisian.

Slightly recrystallized foraminifer-pellet wackestone; pelmatozoans, gastropods, and brachiopods are present; this exceptionally rich foraminiferal horizon (the Banff Formation is usually devoid or poor in plurilocular forms) is characteristic of the Middle Tournaisian—*Latiendothyra rjausakensis* (Lipina), *Chernyshinella* aff. *C. paucicamerata* Lipina, *Chernyshinella glomiformis maxima* (Lipina), *Latiendothyra* sp., and *Rectoseptaglomospiranella nalivkini* (Malakhova); x51.

Mount Hanington north, British Columbia, locality 39; collected by Shell Canada Ltd.; Mamet Nos. 61/9, 61/5, 61/4, and 61/3; GSC type Nos. 39466 (fig. 1), 39467 (fig. 2), 39468 (fig. 3), and 39469 (fig. 4).



1



2

3

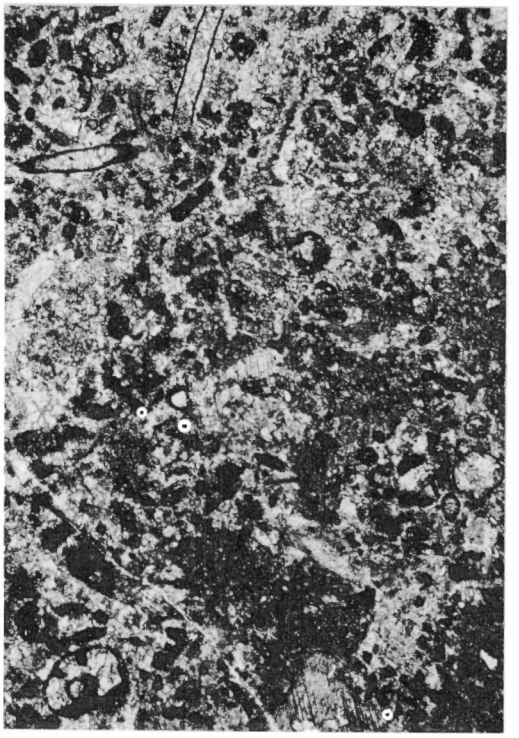


4





1



2

Figures 1–3. Banff Formation, 37–57 feet below top; Zone 7, Middle Tournaisian.

Unevenly grained, recrystallized packstone-grainstone; stromatolitic encrustation is widespread; microfossils are *Earlandia* of the group *E. elegans* (Rauser–Tschernoussova) and of the group *E. moderata* (Malakhova), *Septaglomospiranella* sp., *Latiendothyra* sp., *Bisphaera* sp., *Parathurammina* sp., and *Vicinesphaera* sp.; x31.

Hook Creek, British Columbia, locality 27a; collected by E. W. Bamber; GSC loc. C-33599; Mamet Nos. 281/20, 281/22, and 281/24; GSC type Nos. 39470 (fig. 1), 39471 (fig. 2), 39472 (fig. 3)

3



4

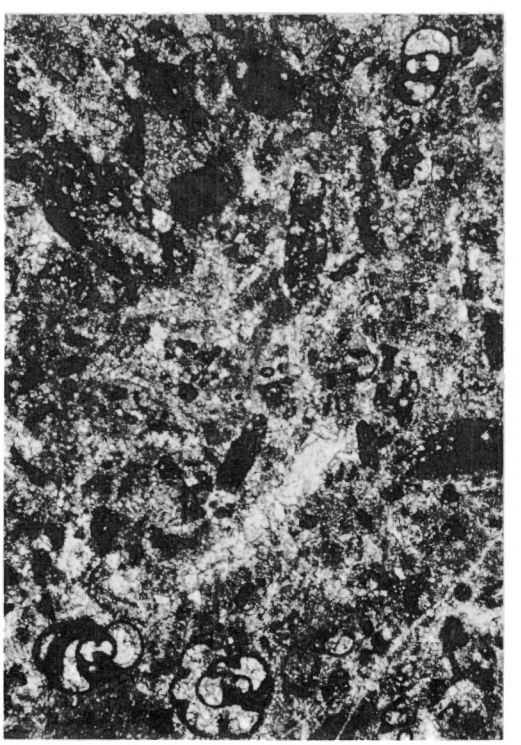


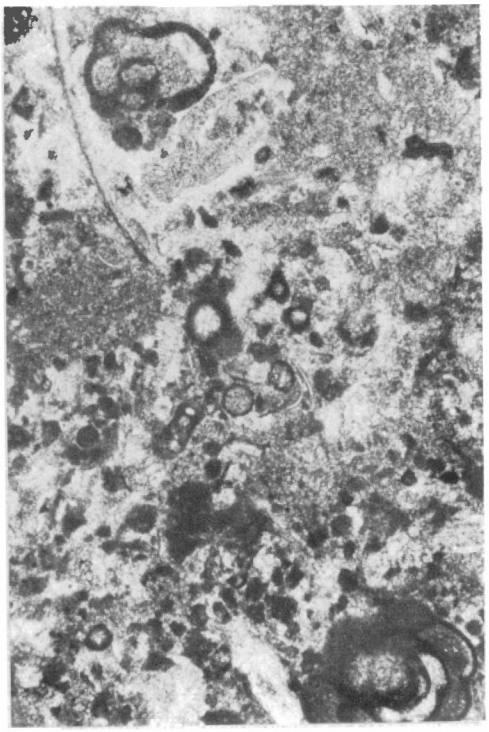
Figure 4. Banff Formation, 17–37 feet below top; Zone 7, Middle Tournaisian.

Recrystallized packstone-grainstone with algal pellets and lumps; microfossils are *Latiendothyra* sp., *Septaglomospiranella* sp., *Calcisphaera laevis* Williamson, and *Parathurammina* sp.; x31.

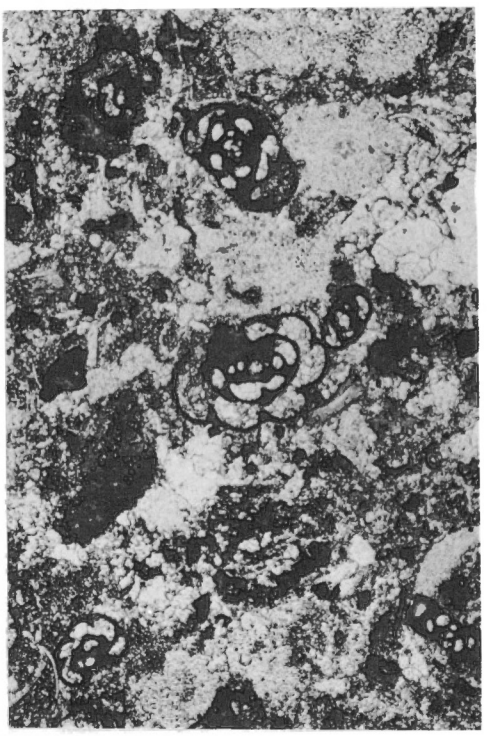
Location and collector as in fig. 1; GSC loc. C-33600; Mamet No. 281/25; GSC type No. 39473.

PLATE 56

SHUNDA FORMATION

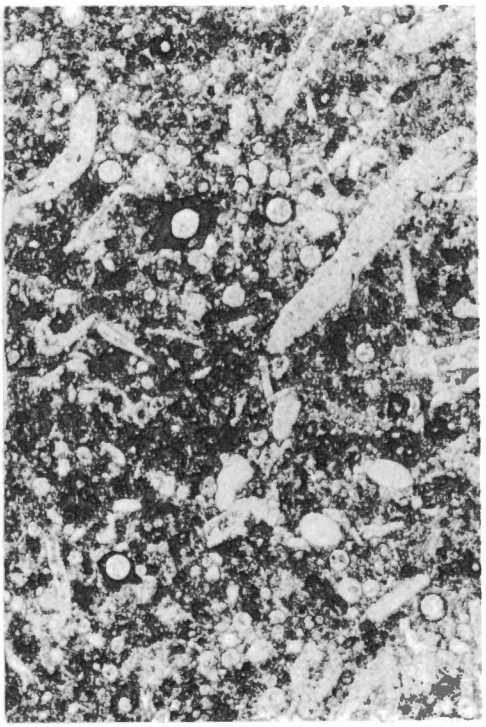


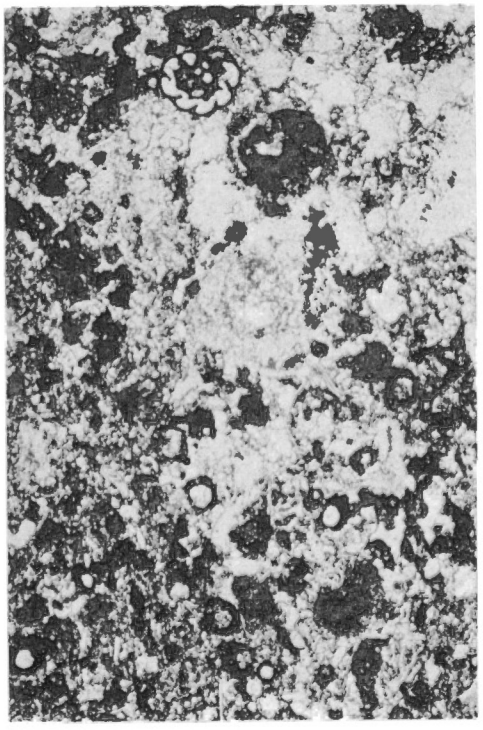
1



2

3





4

Figure 1. Shunda Formation (lower), 158 feet above base, depth 2,464 feet; basal zone 8, Late Tournaisian, Osage age equivalent.

Recrystallized, foraminifer-pelmatozoan-pellet wackestone; some brachiopods and ostracodes are present; parathuramminids (*Parathurammina* sp.) are mud coated and cannot be identified to the species or group level; foraminifers contain recrystallized mud filling [*Septatournayella pseudocamerata* (Lipina *in* Lebedeva)], *Eotuberitina* sp., and an undeterminable oblique section of a tournayellid ("*Eochernyshinella*" of the Russian authors); x31.

Imperial Kahntah No. (1) b-29-C/94-I-7, British Columbia, locality 28; collected by R. M. Procter; GSC loc. 43461; Mamet No. 96/5; GSC type No. 39474.

Figure 2. Shunda Formation (lower), 163 feet above base, depth 2,459 feet; Zone 8, Late Tournaisian, Osage age equivalent.

Medium-grained, poorly sorted, recrystallized foraminifer-pelmatozoan wackestone; some cement; pellets, lumps, bryozoans, and ostracodes are conspicuous; *Latiendothyra* of the group *L. parakosvensis* (Lipina), *Tuberendothyra* sp., *Septaglomospiranella* sp., and *Septabrunsiina* sp. are present; x31.

Location and collector as in fig. 1; GSC loc. C-2225; Mamet No. 123/20; GSC type No. 39475.

Figure 3. Shunda Formation (upper), depth 12,033 feet; Zone 9, Late Tournaisian, Osage age equivalent.

Unsorted packstone with kamaenids [*Palaeoberesella lahuseni* (von Möller)] and parathuramminids (*Parathurammina* of the group *P. suleimanovi* Lipina), brachiopods and ostracode fragments are rare; some "*Radiosphaera*" and *Eotuberitina* sp.; x38.

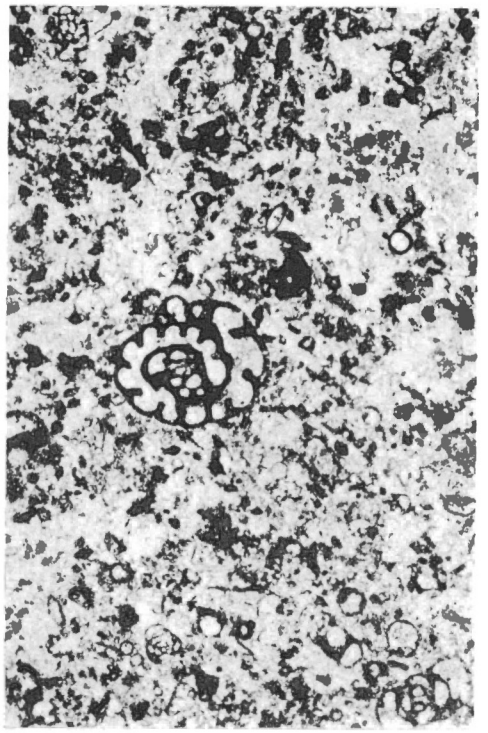
Sohio-Un. Prod. *et al.* Tupper Creek c-70-B/93-P-9, British Columbia, locality 65; collected by R. M. Procter; GSC loc. C-2248; Mamet No. 124/20; GSC type No. 39476.

Figure 4. Shunda Formation (upper), 408 feet above base, depth 6,855 feet; Zone 9, Late Tournaisian, Osage age equivalent.

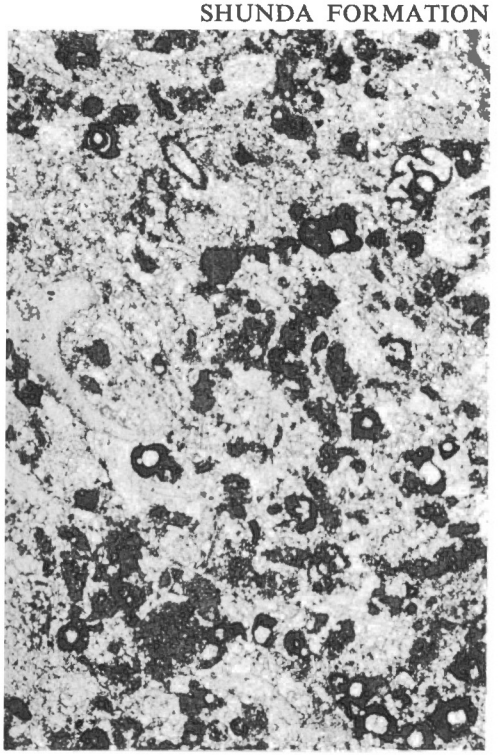
Recrystallized, fine- to medium-grained parathuramminid-pelmatozoan-pellet packstone; lumps and plurilocular foraminifers [*Spinoendothyra spinosa* (Chernysheva)] are present; *Vicinesphaera* sp. and *Parathurammina* of the group *P. suleimanovi* Lipina are abundant; x38.

Texaco NFA Boundary Lake (1) 6-6-86-13W6, British Columbia, locality 69; collected by R. M. Procter; GSC loc. C-2167; Mamet No. 122/20; GSC type No. 39477.

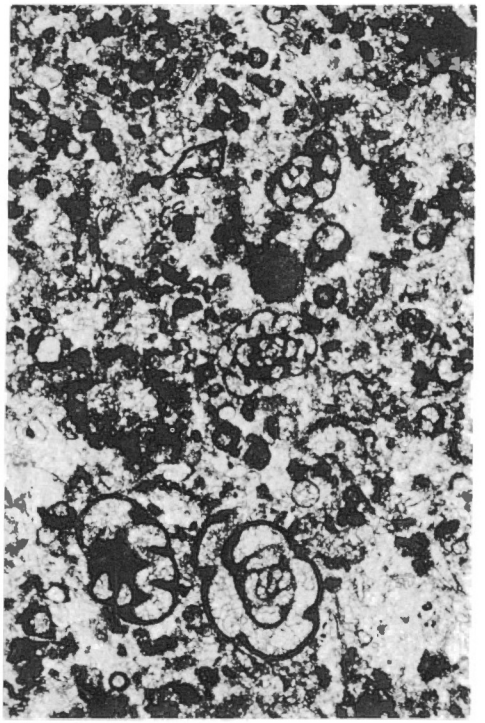
SHUNDA FORMATION



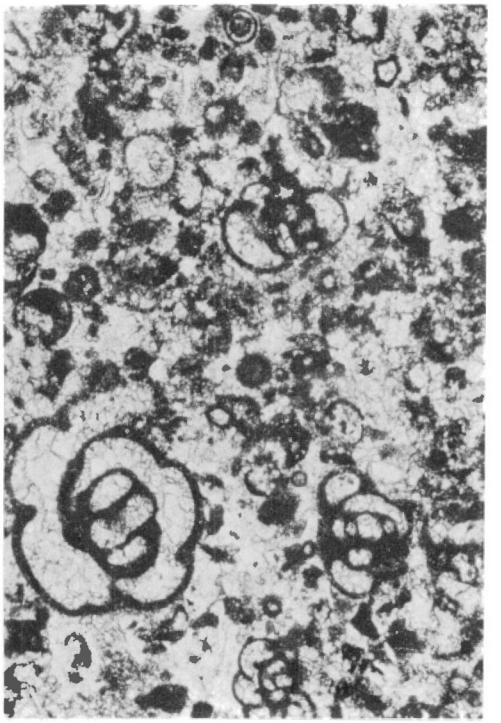
1



2



3



4

Figure 1. Shunda Formation (upper), 413 feet above base, depth 6,850 feet; Zone 9, Late Tournaisian, Osage age equivalent.

Fine- to medium-grained, rather well sorted foraminifer-pellet grainstone; foraminifers unevenly weathered: a *Spinoendothyra* (upper left) is hardly recognizable, whereas *Inflatoendothyra inflata* (Lipina) OBJ (in the centre) is well preserved; *Latiendothyra* sp., *Earlandia* of the group *E. moderata* (Malakhova), *Parathurammina* of the group *P. suleimanovi* Lipina; *Vicinesphaera* sp. and *Calcisphaera* also are present; x31.

Texaco NFA Boundary Lake (1) 6-6-86-13W6, British Columbia, locality 69; collected by R. M. Procter; GSC loc. C-2167a; Mamet No. 123/2; GSC type No. 39478.

Figure 2. Shunda Formation (upper), 408 feet above base, depth 6,855 feet; Zone 9, Late Tournaisian, Osage age equivalent.

Fine- to medium-grained, rather well sorted, granular, lagoonal parathurammind-pelletoidal grainstone; some brachiopods and ostracodes are present; biota composed mostly of *Parathurammina* of the group *P. suleimanovi* Lipina and of *Vicinesphaera* sp.; *Spinoendothyra* sp., *Earlandia* sp., and *Eovolutina* sp. also are present; x31.

Location and collector as in fig. 1; GSC loc. C-2167; Mamet No. 122/18; GSC type No. 39479.

Figures 3, 4. Shunda Formation (upper), 403 feet above base, depth 6,860 feet; Zone 9, Late Tournaisian, Osage age equivalent.

Medium-grained, poorly sorted, foraminifer-pellet grainstone; biota composed of *Spinoendothyra spinosa* (Chernysheva), *Latiendothyra* sp., *Septabrunsiina krainica* (Lipina), *Septabrunsiina donica* Lipina, *Parathurammina* of the group *P. suleimanovi* Lipina, *Vicinesphaera* sp., *Uslonia* sp., *Calcisphaera laevis* Williamson, *Eovolutina* sp., and "*Radiosphaera*" sp.; x31 (fig. 3), x38 (fig. 4).

Location and collector as in fig. 1; GSC loc. C-2168; Mamet Nos. 123/11 and 123/4; GSC type Nos. 39480 (fig. 3) and 39481 (fig. 4).

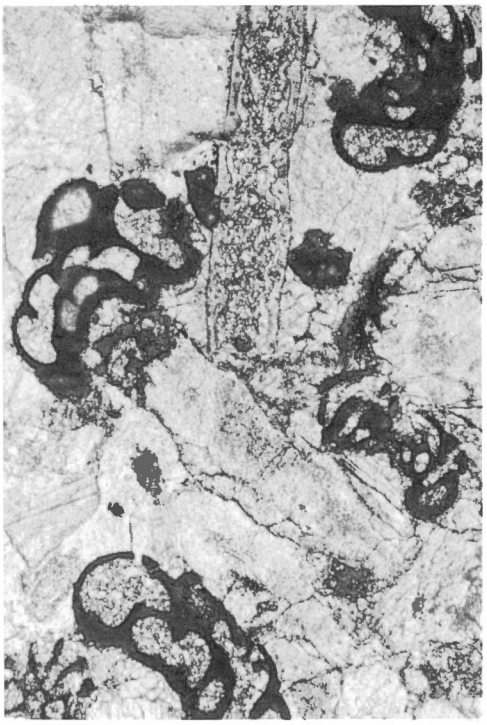
PLATE 58

SHUNDA FORMATION

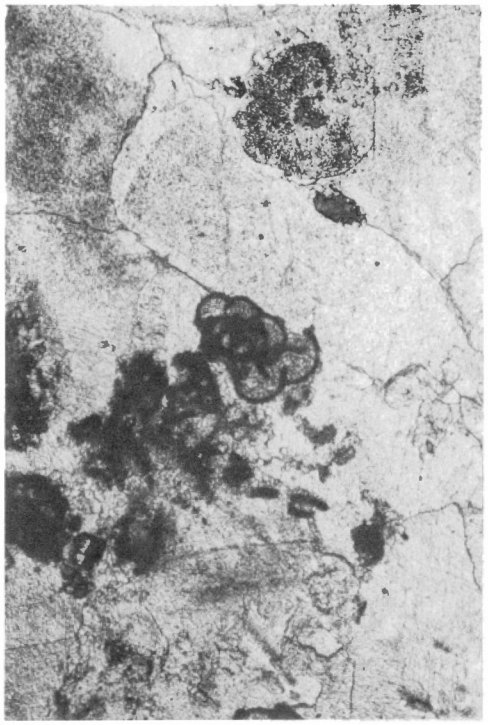
Figures 1–4. Shunda Formation (upper), 298 feet above base, depth 3,855 feet; Zone 9, Late Tournaisian, Osage age equivalent.

Medium- to coarse-grained, well-sorted, foraminifer-pelmatozoan epitaxial "grainstone"; original amount of matrix unknown; some bryozoans and brachiopods; recrystallization of the foraminifers variable and dependent upon the orientation of the test with respect to epitaxial overgrowth; foraminifers abundant—*Septatournayella pseudocamerata* (Lipina *in* Lebedeva) (axial and equatorial sections), *Spinoendothyra spinosa* (Chernysheva) and *Latiendothyra latispiralis* (Lipina); x31.

Imperial Sikanni Chief (1) b-92-D/94-I-4, British Columbia, locality 29; collected by R. M. Procter; GSC loc. 43425; Mamet Nos. 95/2, 95/4, 95/8, and 121/23; GSC type Nos. 39482 (fig. 1, 39483 (fig. 2), 39484 (fig. 3), and 39485 (fig. 4).



1

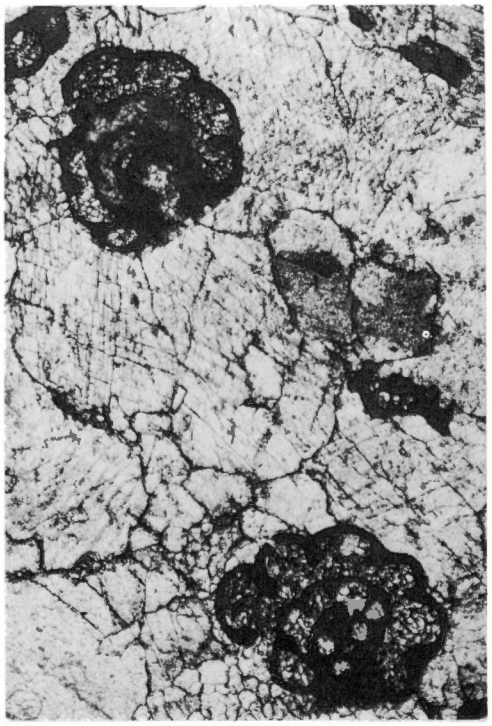


2

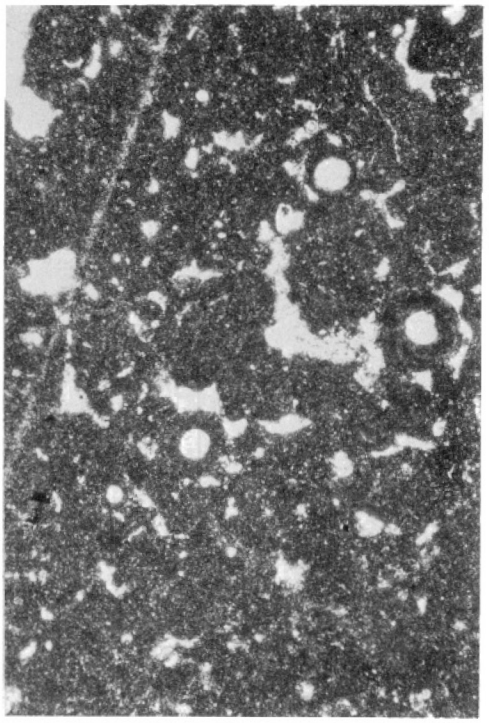
3



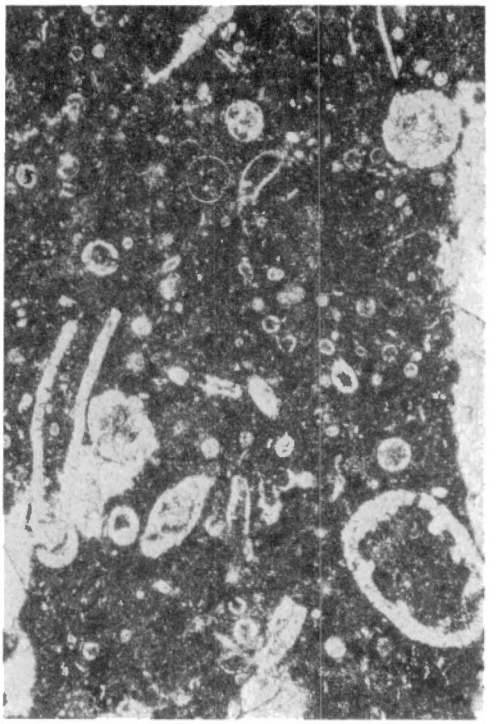
4



SHUNDA FORMATION



1



2

Figure 1. Shunda Formation (middle), 480 feet below top; Zone 9, Late Tournaisian, Osage age equivalent.

Lagoonal loferite; birdseyes developed in a Spongiostromata-pellet wackestone; "calcispheres" are mud coated and cannot be identified, even at the generic level; x31.

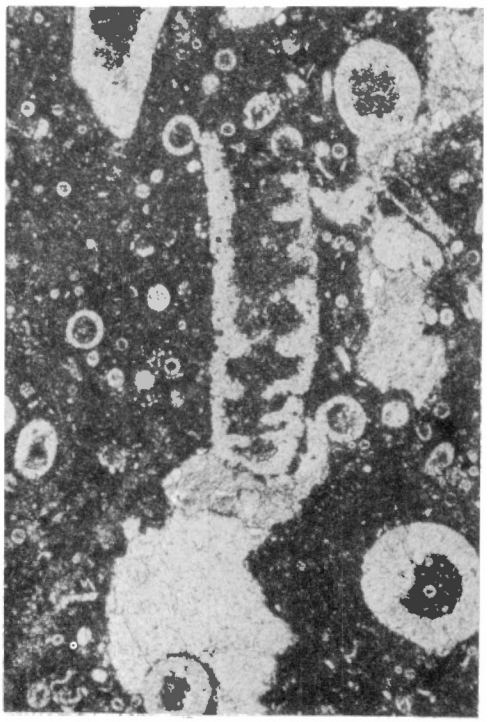
Mount Hanington, British Columbia, locality 39; collected by Shell Canada Ltd.; Mamet No. 60/16; GSC type No. 39486.

Figures 2, 3. Shunda Formation (upper), 390 feet below top, Zone 9, Late Tournaisian, Osage age equivalent.

Unsorted, kamaenid lagoonal wackestone; cylindrical thalli of *Exvotarisella index* (Ehrenberg sensu von Möller) and *Palaeoberesella lahuseni* (von Möller) are associated with crumpled *Proninella* sp. and *Pseudoissinella* sp.; calcispheres are present, but barely identifiable as the wall is indistinguishable from the surrounding dark, euxinic, microcrystalline matrix; x51.

Location and collector as in fig. 1; Mamet Nos. 60/12 and 60/13; GSC type Nos. 39487 (fig. 2) and 39488 (fig. 3).

3



4



Figure 4. Shunda Formation (upper), 310 feet below top; Zone 9, Late Tournaisian, Osage age equivalent.

Slightly recrystallized, unsorted kamaenid-calcisphere lagoonal wackestone; accumulation in situ of mud-filled *Palaeoberesella* cf. *P. lahuseni* (von Möller) and *Proninella* sp.; *Calcisphaera* sp. and "*Radiosphaera*" sp. are abundant; x51.

Location and collector as in fig. 1; Mamet No. 60/10; GSC type No. 39489.

PLATE 60

SHUNDA MICROBIOTA

Figures 1–4. *Septatournayella pseudocamerata* (Lipina *in* Lebedeva)

1. Shunda Formation (upper), 298 feet above base, depth 3,855 feet; Zone 9, Late Tournaisian, Upper Osage age equivalent; x51.
Imperial Sikanni Chief (1) b-92-D/94-I-4, British Columbia, locality 29; collected by R. M. Procter; GSC loc. 43425; Mamet No. 121/22; GSC type No. 39490.

2. Location, collector, and stratigraphic level as in fig. 1; x38; Mamet No. 121/22; GSC type No. 39491.

3. Location, collector, and stratigraphic level as in fig. 1; x38; Mamet No. 95/13; GSC type No. 39492.

4. Location, collector, and stratigraphic level as in fig. 1; x38; Mamet No. 95/17; GSC type No. 39493.

5–12. *Parathurammina* of the group *P. spinosa* (Williamson). The figures are arranged to show the progressive mud coating of the spinose test, which is hardly recognizable in the last figure (fig. 12).

5. Shunda Formation (upper), 307 feet above base, depth 3,846 feet; Zone 9, Late Tournaisian, upper Osage age equivalent; x121.
Location and collector as in fig. 1; GSC loc. C-2212; Mamet No. 122/11; GSC type No. 39494.

6. Shunda Formation, depth 12,033 feet; Zone 9, Late Tournaisian, upper Osage age equivalent; x121.
Sohio-Un. Prod. *et al.* Tupper Creek c-70-B/93-P-9, British Columbia, locality 65; collected by R. M. Procter; GSC loc. C-2248; Mamet No. 124/1; GSC type No. 39495.

7. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/29; GSC type No. 39496.

8. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 124/2; GSC type No. 39497.

9. Shunda Formation (upper), 408 feet above base, depth 6,855 feet; Zone 9, Late Tournaisian, upper Osage age equivalent; x121.
Texaco NFA Boundary Lake (1) 6-6-86-13W6, British Columbia, locality 69; collected by R. M. Procter; GSC loc. C-2167; Mamet No. 122/19; GSC type No. 39498.

10. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 124/3; GSC type No. 39499.

11. Location, collector, and stratigraphic level as in fig. 5; x121; Mamet No. 122/12; GSC type No. 39500.

12. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/27; GSC type No. 39501.

13. *Parathurammina* of the group *P. dagmarae* Suleimanov—*Parathurammina* aff. *P. subvasta* (Bykova)
Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/29; GSC type No. 39502.

14. *Eotuberitina grandis* (Golubsov)
Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 124/3; GSC type No. 39503.

15. *Parathurammina* of the group *P. paracushmani* Reitlinger
Location, collector, and stratigraphic level as in fig. 9; x121; Mamet No. 123/1; GSC type No. 39504.

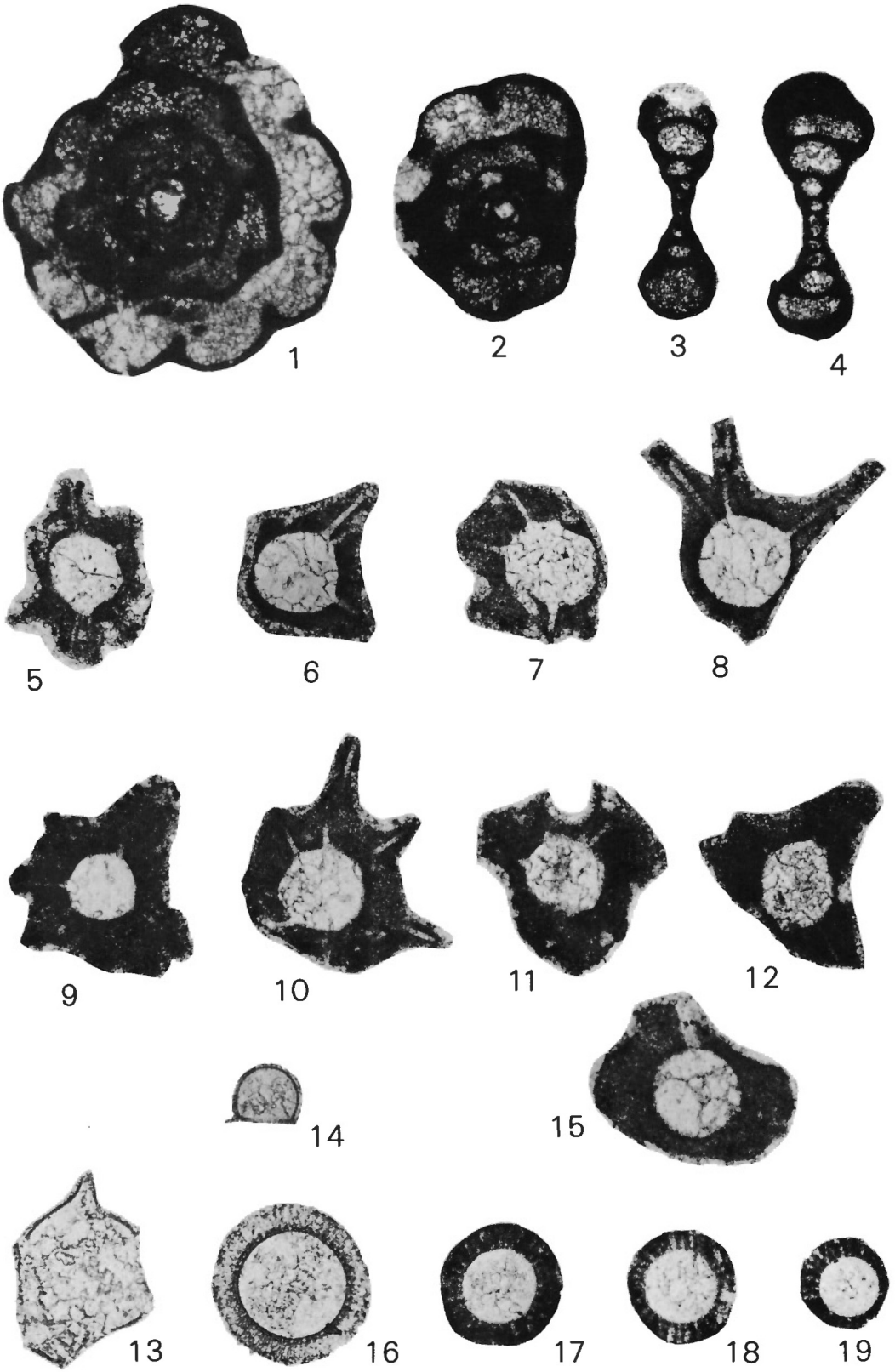
16. *Palaeocancellus* aff. *P. cancellatus* (Williamson)
Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/29; GSC type No. 39505.

17–19. undetermined calcispheres? (*Palaeocancellus?* sp.)

17. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/28; GSC type No. 39506.

18. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 124/4; GSC type No. 39507.

19. Location, collector, and stratigraphic level as in fig. 6; x121; Mamet No. 123/28; GSC type No. 39508.


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

LOWER DEBOLT FORMATION

Figure 1. Debolt Formation (lower), 77 feet above base, depth 2,168 feet; Zone 10, Early Viséan, Salem age equivalent. Medium-grained, rather poorly sorted, lump-pellet-foraminifer grainstone; some recrystallization; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoforschia minoris* (Lipina), *Earlandia* sp., *Latiendothyra* sp., and *Parathurammina* sp.; x38.

Imperial Kahntah No. (1) b-29-C/94-I-7, British Columbia, locality 28; collected by R. M. Procter; GSC loc. C-2223; Mamet No. 136/16; GSC type No. 39509.

Figures 2, 3. Debolt Formation (lower), 118 feet above base, depth 3,594 feet; Zone 11, Early Viséan, Salem age equivalent.

Medium-grained, recrystallized, pelmatozoan-foraminifer-lump grainstone; some matrix; rare hard lumps; foraminifers unevenly weathered; *Eoendothyranopsis spiroides* (Zeller), *Eoendothyranopsis* of the group *E. spiroides* (Zeller), *Latiendothyra latispiralis* (Lipina), *Globoendothyra* sp., *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger), *Endothyra* sp., *Parathurammina* of the group *P. suleimanovi* Lipina, and *Vicinesphaera* sp.; x31.

Imperial Sikanni Chief (1) b-92-D/94-I-4. British Columbia, locality 29; collected by R. M. Procter; GSC loc. C-2211; Mamet Nos. 122/7 and 122/8; GSC type Nos. 39510 (fig. 2), and 39511 (fig. 3).

Figure 4. Debolt Formation (lower), 120 feet above base, depth 3,592 feet; Zone 11, Early Viséan, Salem age equivalent.

Medium-grained, recrystallized, pelmatozoan-foraminifer-pellet grainstone; trace of matrix ghosts; mud-filled, recrystallized *Globoendothyra* of the group *G. baileyi* (Hall) with a pellet in the penultimate chamber; ultimate chamber partly destroyed by epitaxial overgrowth on a crinoid ossicle; some diagenetic quartz; x31.

Location and collector as in figs. 2 and 3; GSC loc. C-2210; Mamet No. 122/4; GSC type No. 39512.



1



2

3



4



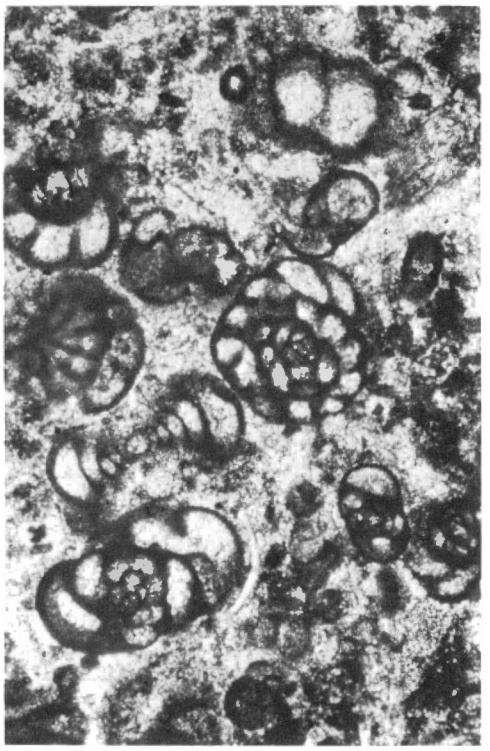
PLATE 62

LOWER DEBOLT FORMATION

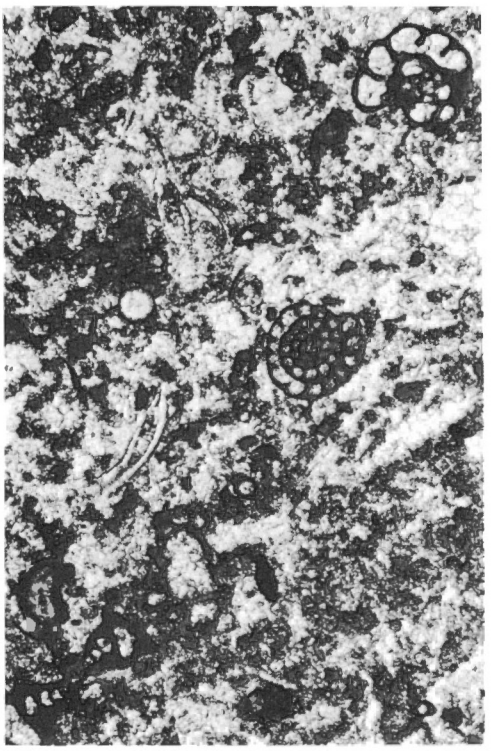
Figures 1, 2. Debolt Formation (lower), 104 feet above base, depth 3,364 feet; Zone 11, Early Viséan, Salem age equivalent.

Poorly sorted, medium-grained, recrystallized foraminifer-pelmatozoan-pellet packstone-grainstone; some brachiopods and ostracodes; foraminifers partly mud-filled: *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Globoendothyra* of the group *G. baileyi* (Hall), "*Globoendothyra*"(*?*) *trachida* (Zeller), *Eoendothyranopsis spiroides* (Zeller), *Eoendothyranopsis* sp., cf. *Skippella* sp., *Endothyra* sp., *Earlandia* sp., and *Parathurammina* sp.; x38 (fig. 1), x31 (fig. 2).

H.B.-Imperial-Union Paddy (1) a-49-B/94-H-16, British Columbia, locality 26; collected by R. M. Procter; GSC loc. 43510; Mamet Nos. 96/7 and 96/9; GSC type Nos. 39513 (fig. 1), 39514 (fig. 2).

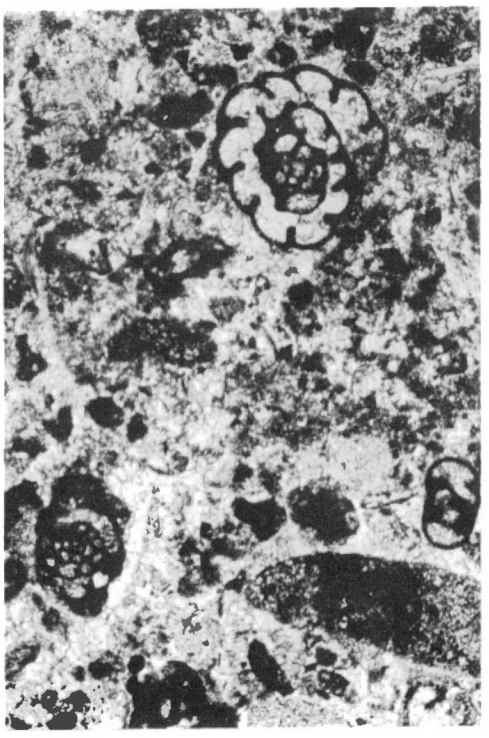


1

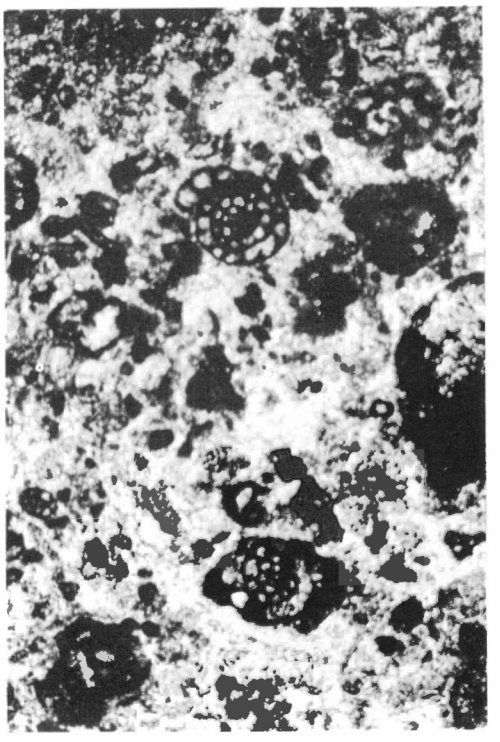


2

3



4

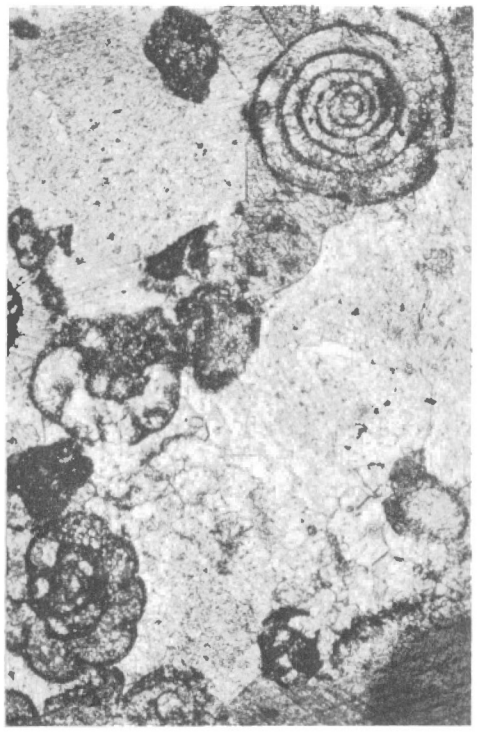


Figures 3, 4. Debolt Formation (lower), 97 feet above base, depth 3,371 feet; Zone 11, Early Viséan, Salem age equivalent.

Poorly sorted, unevenly grained, recrystallized foraminifer-pelmatozoan-pellet-lump grainstone-packstone; some brachiopod valves; foraminifers unevenly weathered, partly mud-filled; *Globoendothyra* of the group *G. baileyi* (Hall), *Eoendothyranopsis spiroides* (Zeller) and endothyrid ghosts; x31.

Location and collector as in figs. 1 and 2; GSC loc. 43992; Mamet Nos. 128/14 and 128/15 (partial overlap); GSC type Nos. 39515 (fig. 3), 39516 (fig. 4).

LOWER DEBOLT FORMATION

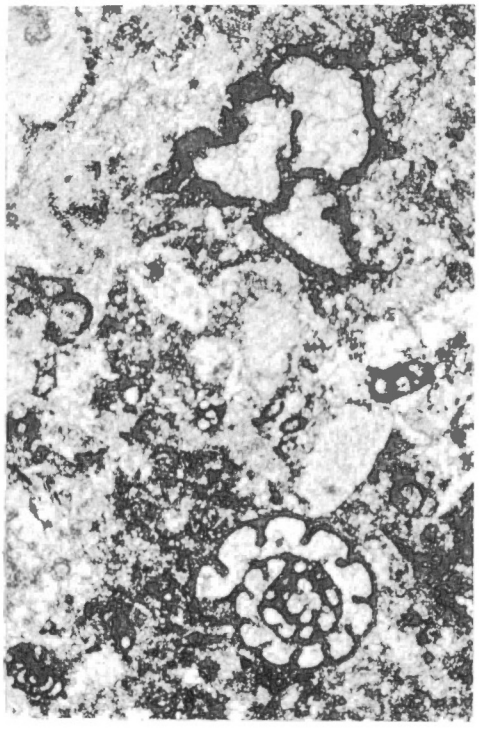


1

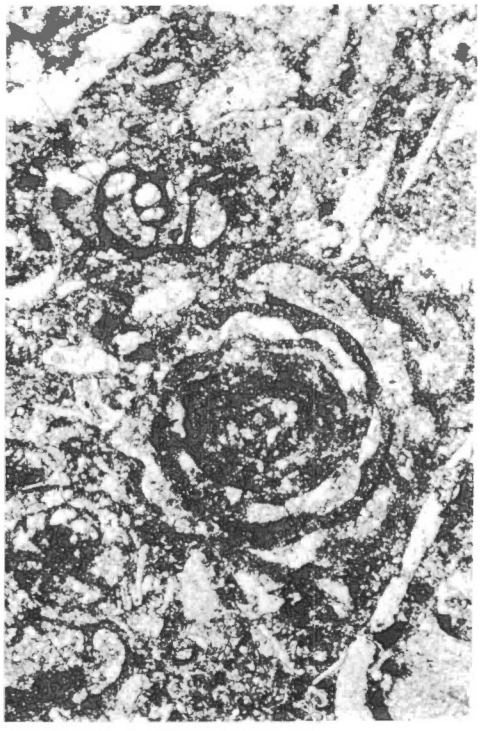


2

3



4



Figures 1–3. Debolt Formation (lower), 92 feet below top, depth 7,097 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

Coarse-grained, foraminifer-pelmatozoan packstone-grainstone; epitaxial sparite overgrowth on the crinoids; original amount of matrix undeterminable; most of the lumps are mud-filled foraminifers—*Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Globoendothyra* of the group *G. tomiliensis* (Lebedeva), *Eoendothyranopsis hinduensis* (Skipp *in* McKee and Gutschick), *Eoendothyranopsis thompsoni* (Anisgard and Campau), and *Parathurammina* sp.; the incertae sedis *Paracalligelloides?* is widespread; x31.

Pacific Highway (3) a-69-I/94-B-16, British Columbia, locality 54; collected by R. M. Procter; GSC loc. 43967; Mamet Nos. 124/27, 124/31, and 128/1; GSC type Nos. 39517 (fig. 1), 39518 (fig. 2), 39519 (fig. 3).

Figure 4. Debolt Formation (lower), 45 feet below top, depth 7,045 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

Coarse-grained, poorly sorted, recrystallized pelmatozoan-foraminifer packstone; some brachiopod fragments and lumps are present; foraminifers unevenly preserved — "*Septatournayella*" *henbesti* Skipp, Holcomb and Gutschick, *Eoendothyranopsis* sp., and *Globoendothyra* sp.; x31.

Location and collector as in figs. 1–3; GSC loc. 43401; Mamet No. 123/22; GSC type No. 39520.

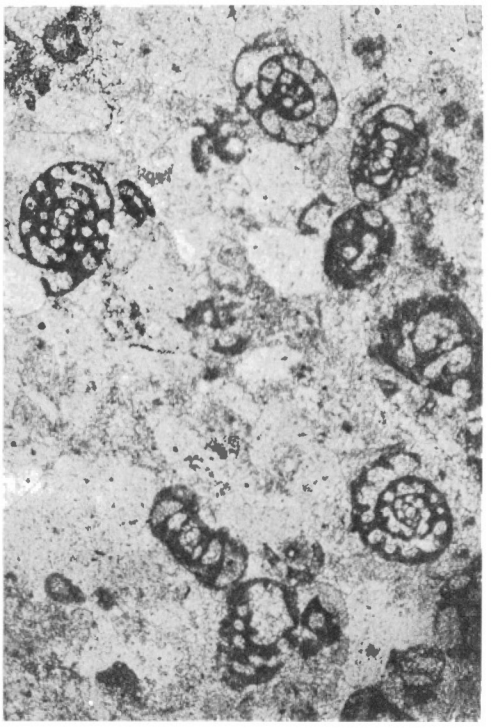
PLATE 64

LOWER DEBOLT FORMATION

Figures 1–3. Debolt Formation (lower), 130 feet below top, depth 7,354 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

Medium- to coarse-grained, well-sorted, slightly recrystallized, foraminifer-pelmatozoan grainstone; epitaxial overgrowth on ossicles; some bryozoan fronds; foraminifers are mostly *Eoendothyranopsis*—*E.* of the group *E. spiroides* (Zeller), *E. hinduensis* (Skipp *in* McKee and Gutschick), *E.* of the group *E. rara* (Grozdilova *in* Lebedeva) and *E.* cf. *E. thompsoni* (Anisgard and Campau); *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain) and *Globoendothyra* sp. also are present; x31.

Pacific Highway (1) b-25-I/94-B-16, British Columbia, locality 53; collected by R. M. Procter; GSC loc. 43982; Mamet Nos. 128/9, 128/10, and 128/13; GSC type Nos. 39521 (fig. 1), 39522 (fig. 2), 39523 (fig. 3).



1



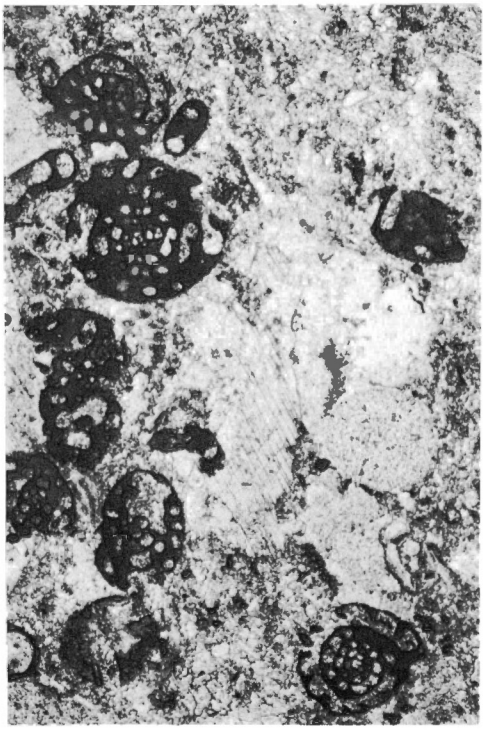
2

Figure 4. Debolt Formation (lower), 109 feet below top, depth 7,333 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

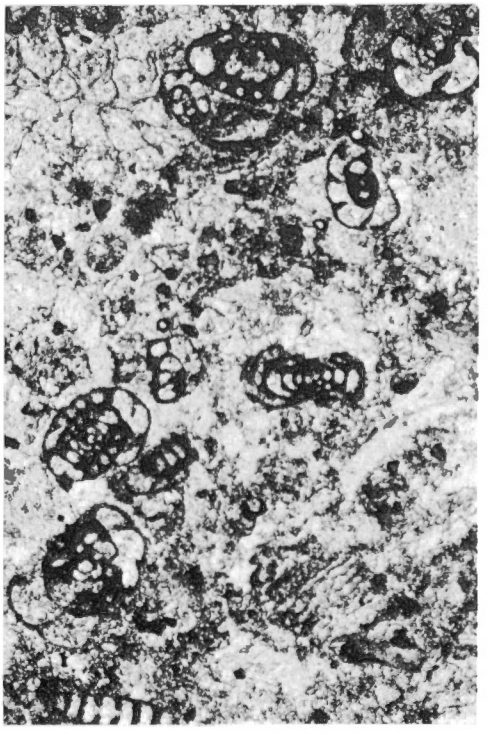
Medium- to coarse-grained, rather poorly sorted, recrystallized foraminifer-pelmatozoan packstone; some brachiopod fragments, bryozoans and pellets; foraminifers are *Eoendothyranopsis* of the group *E. rara* (Lebedeva), *Eoendothyranopsis spiroides* (Zeller), *Globoendothyra* sp., *Endothyranella recta* (Brady), *Endothyra* sp., and *Parathurammina* sp.; x31.

Location and collector as in figs. 1–3; GSC loc. 43362; Mamet No. 128/28; GSC type No. 39524.

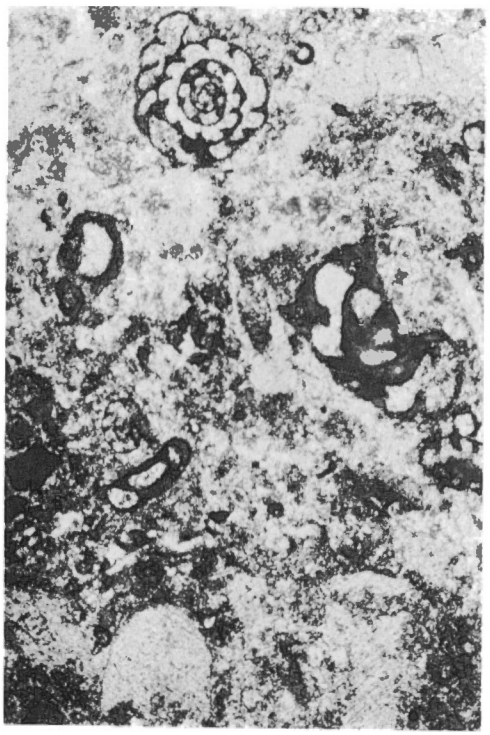
3



4



LOWER DEBOLT FORMATION



1



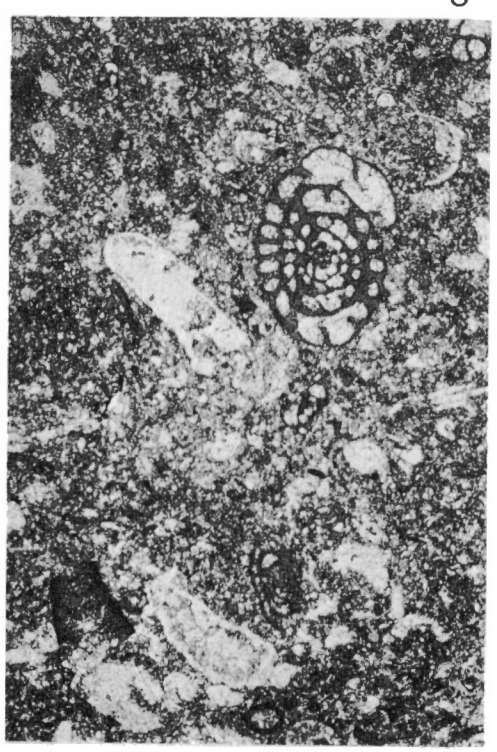
2

Figures 1, 2. Debolt Formation (lower), 109 feet below top, depth 7,333 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

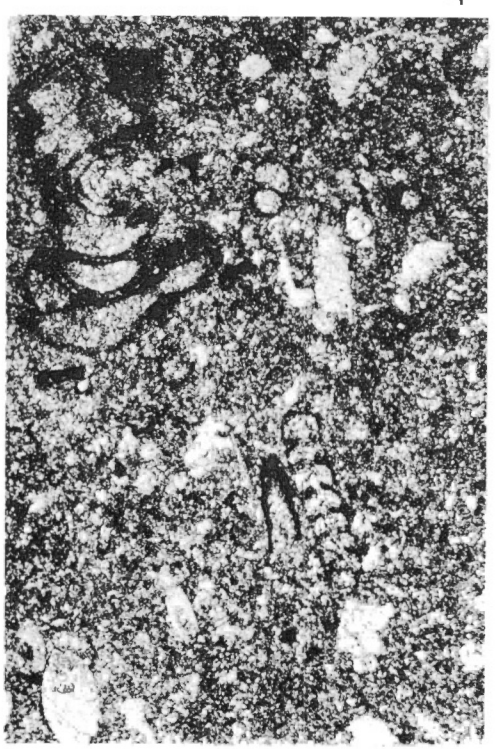
Medium- to coarse-grained, rather poorly sorted, recrystallized foraminifer-pelmatozoan packstone-grainstone; intermediate steps between a packstone where the matrix is still recognizable and a coarse-grained "cement" where epitaxial overgrowth has obliterated all of the fine-grained elements (mud matrix, small pellets), this process "improves" the sorting index as the small figured elements are preferentially eliminated; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoendothyranopsis* of the group *E. spiroides* (Zeller), *Eoendothyranopsis hinduensis* (Skipp *in* McKee and Gutschick), *Globoendothyra* sp., and *Planoendothyra?* sp.; rare *Calcisphaera* also are present; x31.

Pacific Highway (1) b-25-I/94-B-16, British Columbia, locality 53; collected by R. M. Procter; GSC loc. 43362; Mamet Nos. 128/31 and 128/33; GSC type Nos. 39525 (fig. 1), 39526 (fig. 2).

3



4



Figures 3, 4. Debolt Formation (lower), 83 feet below top, depth 7,307 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.

Unevenly grained, poorly sorted, foraminifer-pelmatozoan-algae wackestone; foraminifers are *Eoendothyranopsis hinduensis* (Skipp *in* McKee and Gutschick), *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Endothyranella recta* (Brady), *Earlandia* of the group *E. clavatula* (Howchin), and *Earlandia* of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger); the alga *Proninella* sp. is present; x31 (fig. 3), x38 (fig. 4).

Location and collector as in figs. 1 and 2; GSC loc. 43346; Mamet Nos. 128/16 and 128/17; GSC type Nos. 39527 (fig. 3), 39528 (fig. 4).

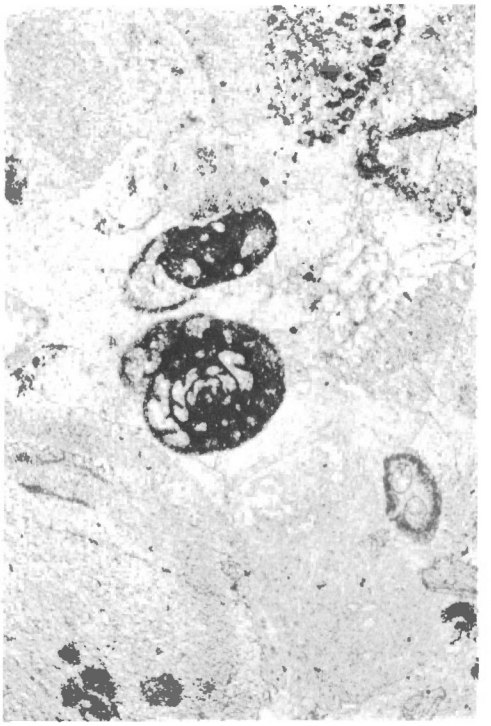
PLATE 66

UPPER DEBOLT FORMATION

Figure 1. Debolt Formation (upper), 168 feet below top, depth 3,233 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Coarse-grained, epitaxial pelmatozoan bryozoan "grainstone" with *Eoendothyranopsis* aff. *E. scitula* (Toomey); x31.

Altair *et al.*, Tenaka d-82-L/94-J-2, British Columbia, locality 2; collected by R. M. Procter; GSC loc. C-2219; Mamet No. 123/24; GSC type No. 39529.

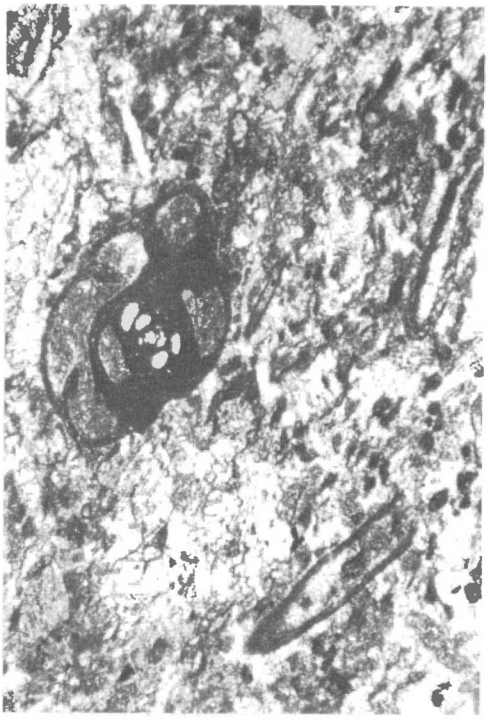


1

Figure 2. Debolt Formation (upper), 283 feet below top, depth 9,545 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Recrystallized, slightly stressed, foraminifer-pelmatozoan grainstone-packstone; some pellets; foraminifers are mud-filled *Globoendothyra* of the group *G. tomiliensis* (Lebedeva), *Globoendothyra paula* (Vissarionova), *Earlandia* of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger), and *Earlandia* of the group *E. elegans* (Rauser-Tschernoussova); x31.

Triad BP Bush Mountain a-15-A/93-O-10, British Columbia, locality 70; collected by R. M. Procter; GSC loc. C-2794; Mamet No. 161/28; GSC type No. 39540.



2

Figure 3. Debolt Formation (upper), 679 feet below top, depth 8,527 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Slightly recrystallized, granular, micro-dolomitic, foraminifer-pelmatozoan, wackestone; ostracodes present; *Eoendothyranopsis scitula* (Toomey) conspicuous in the lower half; x31.

West Canadian Lily Lake c-81-F/94-G-2, British Columbia, locality 73; collected by R. M. Procter; GSC loc. C-2209; Mamet No. 143/3; GSC type No. 39531.

3

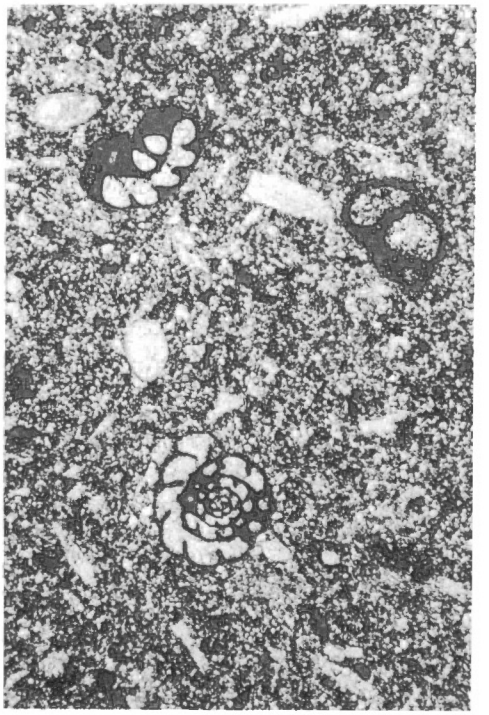
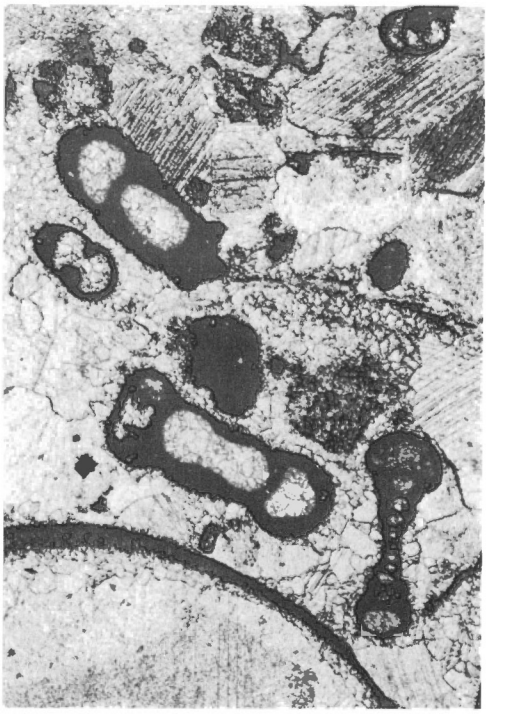


Figure 4. Debolt Formation (upper), 645 feet below top, depth 8,493 feet; Zone 13, Late Viséan, St. Louis age equivalent.

Coarse-grained epitaxial pelmatozoan-foraminifer "grainstone" with *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoforschia moelleri* (Malakhova *in* Dain), and *Eoforschia minoris* (Lipina); brachiopod fragments, pellets and lumps are rare; x31.

Location and collector as in fig. 3; GSC loc. C-2208; Mamet No. 142/31; GSC type No. 39532.

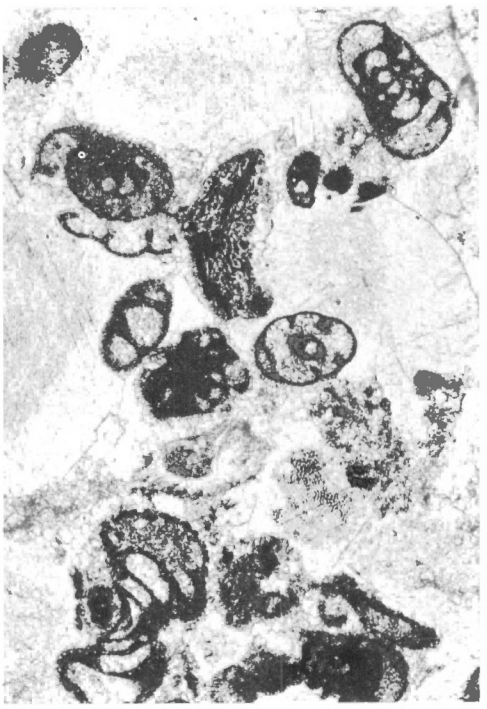
4



UPPER DEBOLT FORMATION



1



2

Figures 1, 2. Debolt Formation (upper), 645 feet below top, depth 8,493 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Coarse-grained, epitaxial pelmatozoan-foraminifer "grainstone"; ossicles unevenly weathered; lumps, bryozoans and pellets are present; some of the foraminifers were originally mud-filled as shown by the *Eoforschia* ghost in the centre of fig. 1; foraminifers are *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Eoendothyranopsis* sp., and *Globoendothyra paula* (Vissarionova); the algae are weathered thalli of *Stacheoides tenuis* Petryk and Mamet; x31.

West Canadian Lily Lake c-81-F/94-G-2, British Columbia, locality 73; collected by R. M. Procter; GSC loc. C-2208; Mamet Nos. 142/32 and 143/1; GSC type Nos. 39533 (fig. 1), 39534 (fig. 2).

3



4



Figures 3, 4. Debolt Formation (upper), 84 feet below top; depth 6,871 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Coarse-grained, well-sorted, foraminifer-lump grainstone; most of the lumps are mud-filled foraminifers; some pelmatozoans and algae (*Orthriosiphon* sp.) are present; foraminifers represented by *Eoforschia moelleri* (Malakhova *in* Dain), *Globoendothyra paula* (Vissarionova), *Eoendothyranopsis scitula* (Toomey), and *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva); x31.

Pacific Highway (3) a-69-I/94-B-16, British Columbia, locality 54; collected by R. M. Procter; GSC loc. 43398; Mamet Nos. 94/2 and 94/4; GSC type Nos. 39555 (fig. 3), 39536 (fig. 4).

PLATE 68

UPPER DEBOLT FORMATION

Figure 1. Debolt Formation (upper), 84 feet below top, depth 6,871 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

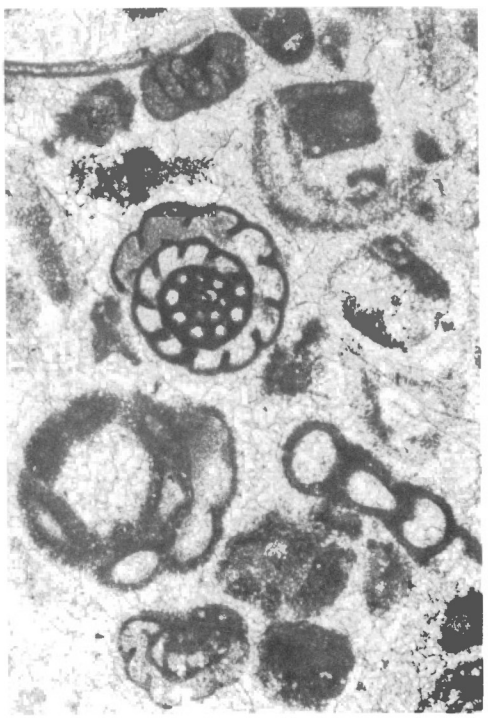
Coarse-grained, well-sorted foraminifer-"lump" grainstone; foraminifers are *Uviella?* sp., *Eoforschia* sp., *Eoendothyranopsis thompsoni* (Anisgard and Campau), and *Endothyra* sp.; x31.

Pacific Highway (3) a-69-I/94-B-16, British Columbia, locality 54; collected by R. M. Procter; GSC loc. 43398; Mamet No. 94/1; GSC type No. 39537.

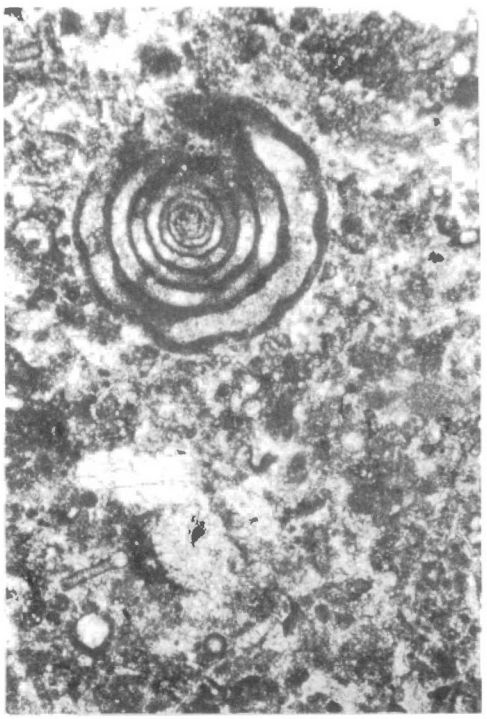
Figures 2–4. Debolt Formation (upper), 66 feet below top, depth 7,054 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Unevenly grained, poorly sorted, foraminifer-pellet grainstone; some matrix; foraminifers are *Eoforschia moelleri* (Malakhova *in* Dain), *Eoendothyranopsis scitula* (Toomey), *Eoendothyranopsis prodigiosa* (Armstrong), *Endothyra* of the group *E. bowmani* Phillips emend Brady (*Endothyra* aff. *E. obsoleta* Rauser-Tschernoussova), *Endothyra* sp., *Globoendothyra* sp., *Parathurammina* sp., and *Earlandia* of the group *E. elegans* (Rauser-Tschernoussova); the incertae sedis *Eotuberitina* sp. and the algal spore case *Calcisphaera* sp. are widespread; x38 (fig. 2), x31 (figs. 3, 4).

Pacific Highway (2) a-47-1/94-B-16, British Columbia, locality 55; collected by R. M. Procter; GSC loc. 43445; Mamet Nos. 95/34, 95/35, and 95/20; GSC type Nos. 39538 (fig. 2), 39539 (fig. 3), 39540 (fig. 4).

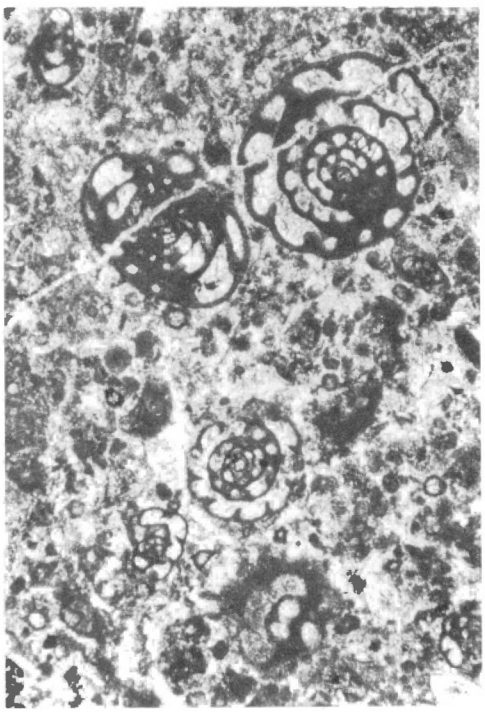


1

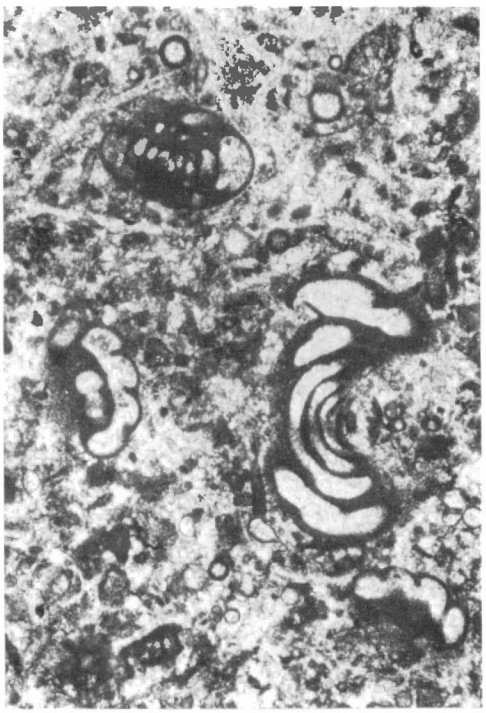


2

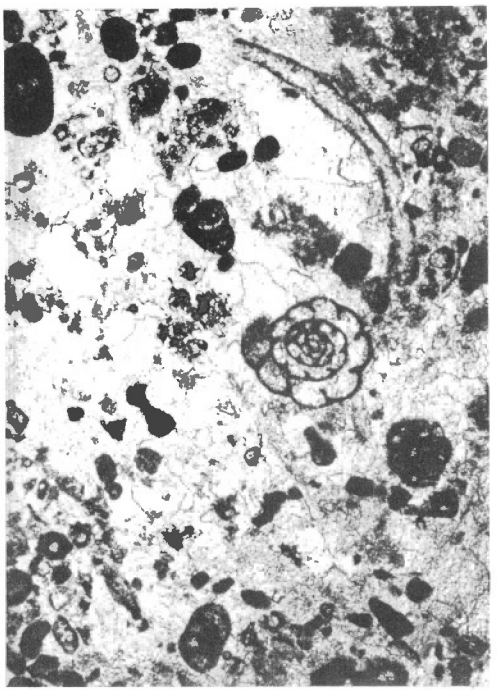
3



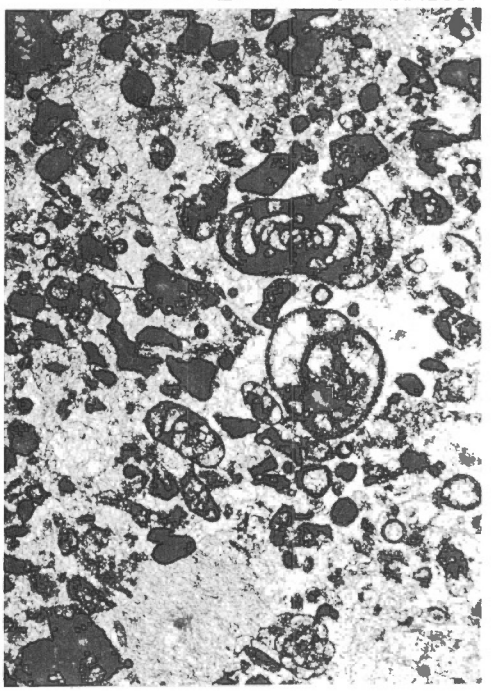
4



UPPER DEBOLT FORMATION



1



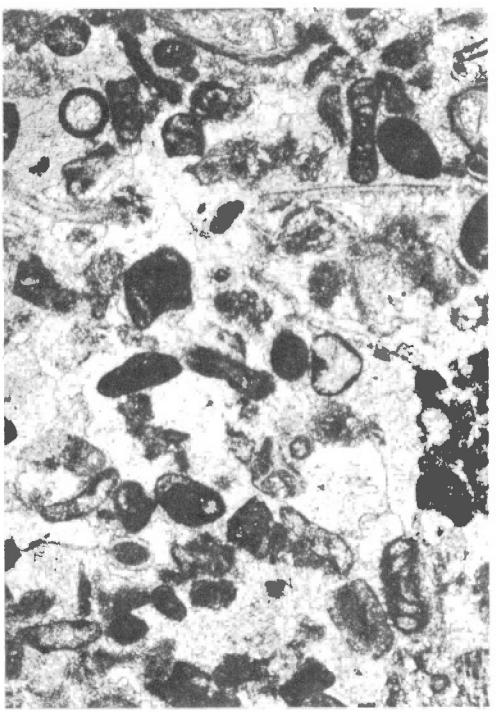
2

Figures 1, 2. Debolt Formation (upper), 169 feet below top, depth 7,619 feet; Zone 13, Middle Viséan, St. Louis age equivalent.

Medium-grained, unevenly sorted, foraminifer-pellet grainstone; lumps and micrite-coated grains present; foraminifers are *Skippella redwallensis* (Skipp *in* McKee and Gutschick), *Globoendothyra* sp., juvenile *Eoendothyranopsis scitula* (Toomey), and *Endothyra* sp.; *Calcisphaera laevis* Williamson is abundant; x31.

West Nat. *et al.* Halfway (3) 8-11-87-25W6, British Columbia, locality 74; collected by R. M. Procter; GSC loc. C-2802; Mamet Nos. 162/9 and 162/11; GSC type Nos. 39541 (fig. 1), 39542 (fig. 2).

3



4



Figure 3. Debolt Formation (upper), 186 feet below top, depth 8,034 feet; Zone 14, Late Viséan, St. Louis age equivalent.

Medium-grained, well-sorted, foraminifer-pelmatozoan-lump grainstone; scarce bryozoans, brachiopods and algal-coated grains; foraminifers represented by *Brunsia lenensis* Bogush and Yuferev, *Brunsia* of the group *B. irregularis* (von Möller), *Earlandia* sp., and undeterminable mud-filled endothyrids; x31.

West Canadian Lily Lake c-81-F/94-G-2, British Columbia, locality 73; collected by R. M. Procter, GSC loc. C-2198; Mamet No. 129/6; GSC type No. 39543.

Figure 4. Debolt Formation (upper), 170 feet below top, depth 8,018 feet; Zone 14, Late Viséan, St. Louis age equivalent.

Coarse-grained foraminifer-pelmatozoan-lump epitaxial "grainstone"; scarce bryozoan fragments and the foraminifer *Eoforschia moelleri* (Malakhova *in* Dain); x31.

Location and collector as in fig. 3; GSC loc. C-2195; Mamet No. 142/29; GSC type No. 39544.

PLATE 70

UPPER DEBOLT FORMATION

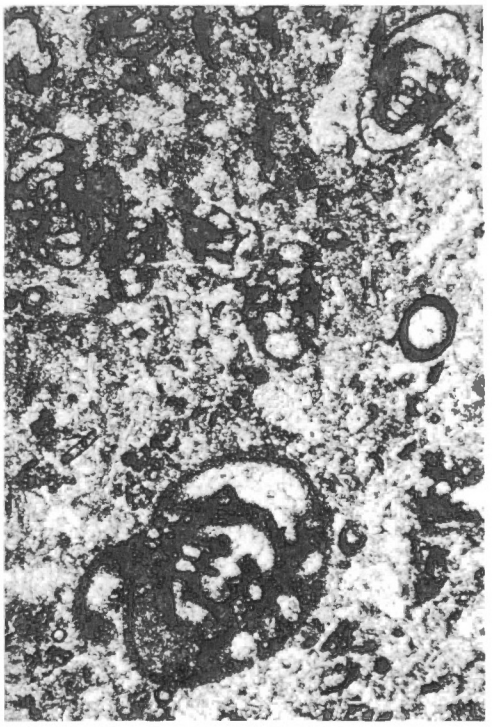
Figures 1, 2. Debolt Formation (upper), 11 feet below top, depth 7,461 feet; boundary of Zones 14/15, Late Viséan, St. Genevieve? age equivalent.

Recrystallized, poorly sorted, unevenly grained, foraminiferal wackestone; pelmatozoan plates and pellets; foraminifers include *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Eoendothyranopsis robusta* (McKay and Green), *Eoendothyranopsis scitula* (Toomey), *Earlandia* of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger), *Earlandia* of the group *E. clavatula* (Howchin), and *Earlandia* of the group *E. elegans* (Rauser-Tschernoussova); most of the "calcispheres" are *Earlandia* sections; the enigmatic *Paracalligelloides* sp. is present; x31.

West Nat. *et al.* Halfway (3) 8-11-87-25W6, British Columbia, locality 74; collected by R. M. Procter; GSC loc. C-2798; Mamet Nos. 161/36 and 162/2; GSC type Nos. 39545 (fig. 1), 39546 (fig. 2).



1



2

3

Figure 3. Chert pebble, probably reworked from upper Debolt Formation, collected from Belloy Formation, depth 6,328 feet; undetermined Upper Viséan Zone.

Dolomitized chert; note the euhedral dolomite rhombs; original carbonate, visible as ghost, was a pelmatozoan-bryozoan-brachiopod "grainstone"; x38.

Pacific Fort St. John 43-8-20-83-18W6, British Columbia, locality 56; collected by R. M. Procter; GSC loc. C-34010; Mamet No. 124/8; GSC type No. 39547.

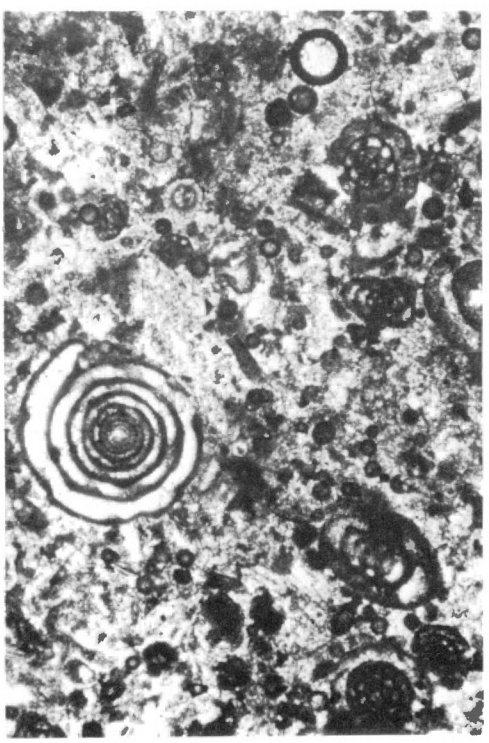


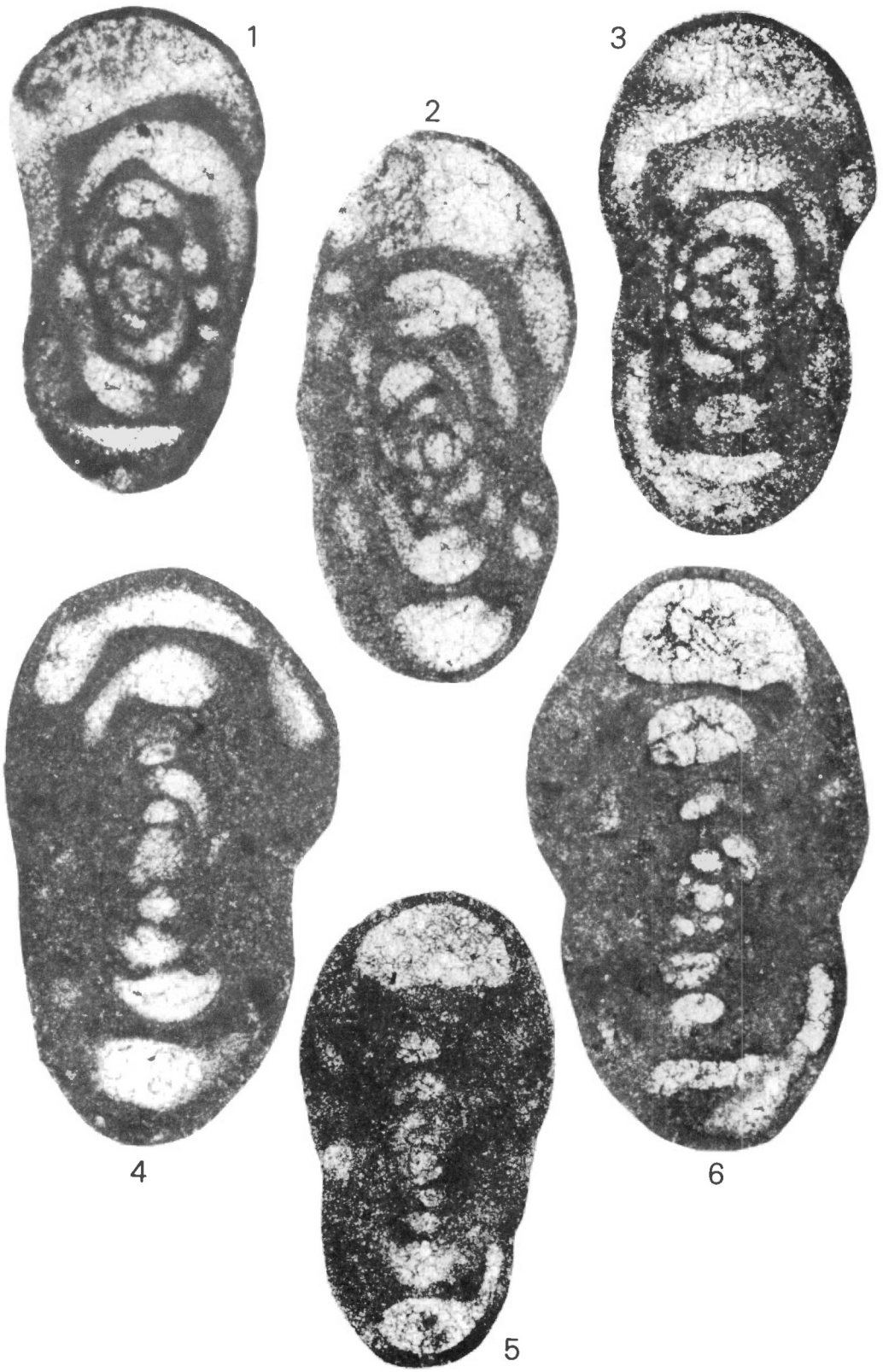
4

Figure 4. Debolt Formation (upper), 33 feet below top, depth 5,873 feet; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, poorly sorted, foraminifer-pellet grainstone-packstone; *Eoforschia* of the group *E. moelleri* (Malakhova *in* Dain), *Priscella* sp., *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Earlandia* sp., *Calcisphaera laevis* Williamson, *Parathurammina* sp., and "*Radiosphaera*" sp. are present; x31.

Texaco NFA Boundary Lake (1) 6-6-86-13W6, British Columbia, locality 69; collected by R. M. Procter; GSC loc. 70428; Mamet No. 96/13; GSC type No. 39548.





Figures 1–3. "*Eolasta*[illegible]*staffella*" of the group "*E.*" *ovalis* Vdovenko

1. Debolt Formation (lower), 77 feet above base, depth 2,168 feet; Zone 10, Early Viséan, Salem age equivalent; x121.

Imperial Kahntah No. (1) b-29-C/94-I-7, British Columbia, locality 28; collected by R. M. Procter; GSC loc. C-2223; Mamet No. 123/15; GSC type No. 39549.

2. Location, collector, and stratigraphic level as in fig. 1; x121; Mamet No. 123/13; GSC type No. 39550.

3. Debolt Formation (lower), 104 feet above base, depth 3,364 feet; Zone 11, Early Viséan, Salem age equivalent; x121.

H. B.-Imperial-Union Paddy (1) a-49-B/94-H-16, British Columbia, locality 26; collected by R. M. Procter; GSC loc. 43510; Mamet No. 97/2; GSC type No. 39551.

Figures 4, 6. *Eoendothyranopsis ermakiensis* (Lebedeva)

4. Debolt Formation (upper), 66 feet below top, depth 7,054 feet; Zone 13, Middle Viséan, St. Louis age equivalent; x121.

Pacific Highway (2) a-47-I/94-B-16, British Columbia, locality 55; collected by R. M. Procter; GSC loc. 43445; Mamet No. 95/14; GSC type No. 39552.

6. Location, collector, and stratigraphic level as in fig. 4; x121; GSC loc. 43445; Mamet No. 96/28; GSC type No. 39554.

Figure 5. *Eoendothyranopsis scitula* (Toomey)

Location, collector, and stratigraphic level as in fig. 4; x121; GSC loc. 43445; Mamet No. 96/29; GSC type No. 39553.

PLATE 72

DEBOLT MICROBIOTA

Figures 1, 2. *Endothyra* of the group *E. bowmani* Phillips emend Brady

1. *Endothyra pseudobradyi* Brazhnikova
Prophet Formation (upper), 460 feet below top of formation; Zone 13?, Middle Viséan, St. Louis age equivalent; x121.
Nabesche River area, British Columbia, locality 16; collected by Shell Canada Ltd. (Ducette RS 5 N 61); Mamet No. 61/19; GSC type No. 39555.

2. *Endothyra bowmani* Phillips emend Brady
Debolt Formation (upper), 22 feet below top, depth 3,087 feet; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Altair *et al.* Tenaka d-82-L/94-J-2, British Columbia, locality 2; collected by R. M. Procter; GSC loc. C-2218, Mamet No. 123/25; GSC type No. 39556.

3, 4. "*Radiosphaera*" of the group "*R.*" *sol* (Williamson)

3. Debolt Formation (upper), 66 feet below top, depth 7,054 feet; Zone 13, Middle Viséan, St. Louis age equivalent; x180.
Pacific Highway (2) a-47-I/94-B-16, British Columbia, locality 55; collected by R. M. Procter; GSC loc. 43445; Mamet No. 95/23; GSC type No. 39557.

4. Location, collector, and stratigraphic level as in fig. 3; x180; Mamet No. 95/23′; GSC type No. 39558.

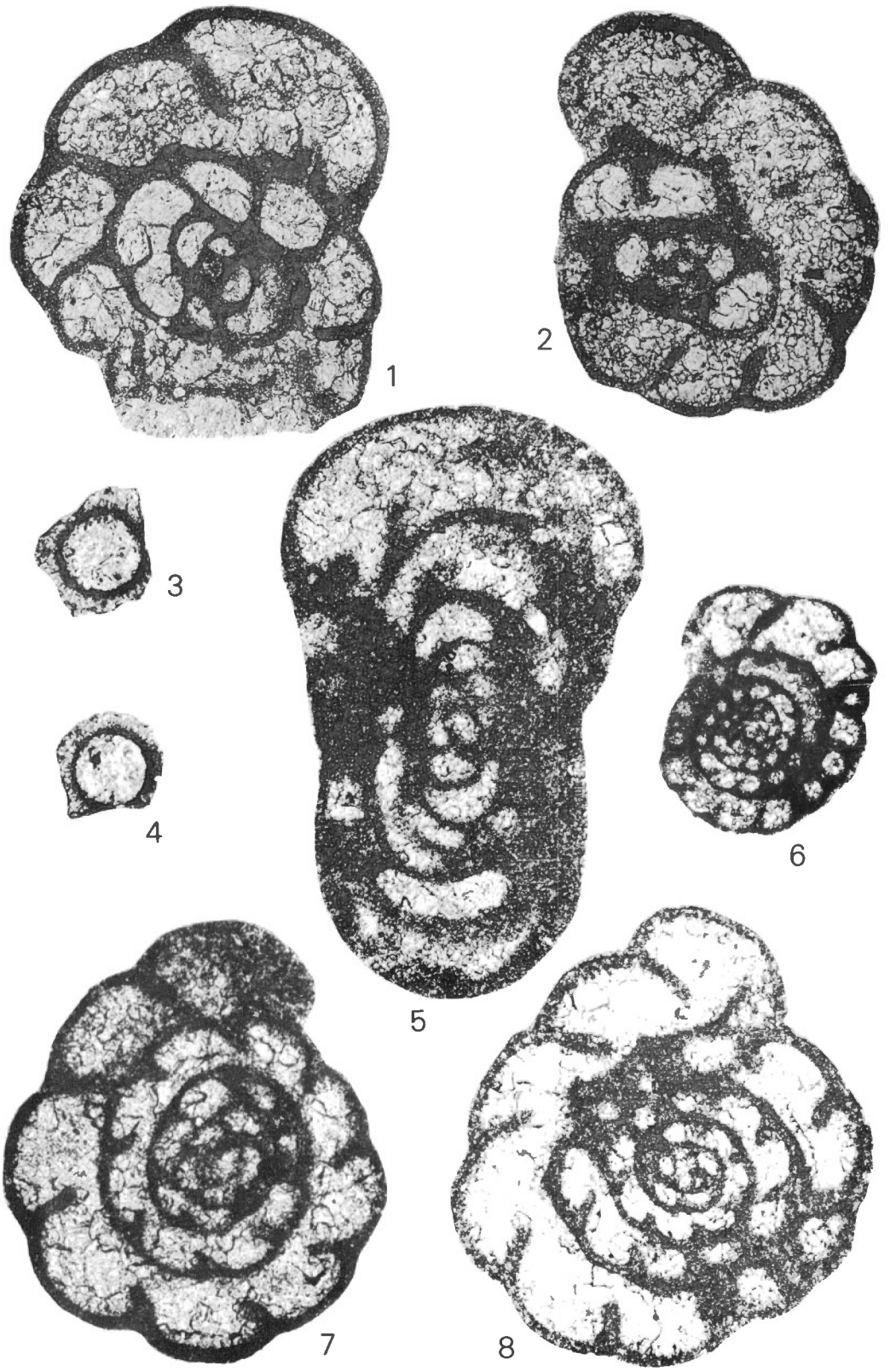
5. *Skippella redwallensis* (Skipp *in* McKee and Gutschick)
Debolt Formation (upper), depth 7,619 feet; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
West Nat. *et al.* Halfway (3) 8-11-87-25W6, British Columbia, locality 74; collected by R. M. Procter; GSC loc. C-2802; Mamet No. 162/10; GSC type No. 39559.

6. *Eoendothyranopsis* of the group *E. spiroides* (Zeller)—*Eoendothyranopsis hinduensis* (Skipp *in* McKee and Gutschick)
Debolt Formation (lower), 109 feet below top, depth 7,333 feet; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis age equivalent; x51.
Pacific Highway (1) b-25-I/94-B-16, British Columbia, locality 53; collected by R. M. Procter; GSC loc. 43362; Mamet No. 129/1; GSC type No. 39560.

7, 8. *Eoendothyranopsis scitula* (Toomey)

7. Location, collector, and stratigraphic level as in fig. 5; x121; Mamet No. 162/8; GSC type No. 39561.

8. Debolt Formation (upper), 679 feet below top, depth 8,527 feet; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
West Canadian Lily Lake c-81-F/94-G-2, British Columbia, locality 73; collected by R. M. Procter; GSC loc. C-2209; Mamet No. 143/2; GSC type No. 39562.


1
2
3
4
5
6
7
8

PERATROVICH? FORMATION

Figures 1, 2. Peratrovich? Formation, 100 feet above base; Zone 17, Early Namurian, middle Chester age equivalent.

Medium- to coarse-grained, pelmatozoan-brachiopod-foraminifer packstone; some mud-filled endothyrids and mud-coated grains; foraminifers are *Pseudoendothyra* of the group *P. kremenskensis* Rozovskaia, *Pseudoendothyra composita* (Dutkevich), and a section which could belong to a juvenile *Endothyranopsis?* sp. or a *Cribrospira?* sp.; the alga *Atractyliopsis* sp. is conspicuous in fig. 2; x31.

Mess Creek, Telegraph Creek area, 7 miles SSW of Spectrum Range, British Columbia, locality 36; collected by J. W. H. Monger; GSC loc. C-5555; Mamet Nos. 254/7 and 254/8; GSC type Nos. 39563 (fig. 1), 39564 (fig. 2).

Figure 3. Peratrovich? Formation, top of the carbonate section; Zone 18, Early Namurian, upper Chester age equivalent.

Medium-grained, foraminifer-pelmatozoan-brachipod grainstone; some pellets; equatorial section of *Eostaffella* of the group *E. radiata* (Brady) showing the development of pseudochomata; x78.

Mess Creek, Telegraph Creek area, 8 miles SSW of Spectrum Range, British Columbia, locality 36; collected by J. W. H. Monger; GSC loc. C-5566, Mamet No. 254/21; GSC type No. 39565.

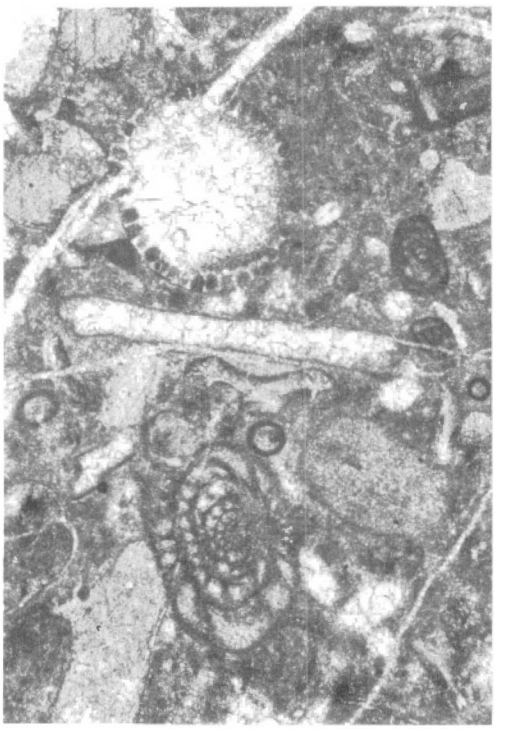
Figure 4. Peratrovich? Formation, top of the carbonate section; Zone 18 (or slightly younger), Early Namurian, upper Chester age equivalent.

Slightly recrystallized foraminifer-pellet packstone; *Bradyina* sp., Endothyridae, Eostaffellidae, and Tuberitinidae are present; x31.

Location and collector as in fig. 3; GSC loc. C-5568; Mamet No. 254/11; GSC type No. 39566.

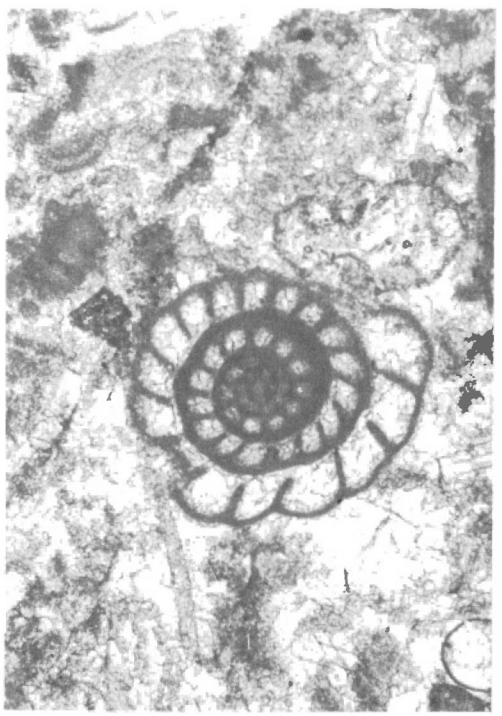


1



2

3



4

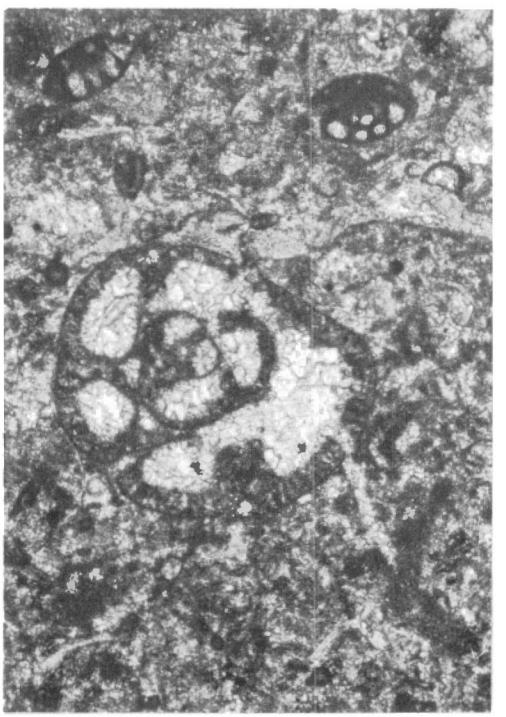


PLATE 74

PERATROVICH? MICROBIOTA

Figures 1, 2. *Endothyranopsis* of the group *E. sphaerica* (Rauser–Tschernoussova and Reitlinger *in* Rauser–Tschernoussova, Beljaev and Reitlinger)

1. Peratrovich? Formation, 900 feet above lowest exposed limestone; Zone 18, Early Namurian, upper Chester age equivalent; x78.

Mess Creek, Telegraph Creek area, 7 miles SSW of Spectrum Range, British Columbia, locality 36; collected by J. W. H. Monger; GSC loc. C-5564; Mamet No. 254/23; GSC type No. 39567.

2. Location, collector, and stratigraphic level as in fig. 1; x78; Mamet No. 254/27; GSC type No. 39568.

Figures 3, 5. *Neoarchaediscus grandis* (Reitlinger)

3. Location and collector as in fig. 1; x121; GSC loc. C-5564; Mamet No. 254/30; GSC type No. 39569.

5. Location and collector as in fig. 1; x121; GSC loc. C-5564; Mamet No. 254/28; GSC type No. 39571.

Figures 4, 6–8. *Pseudoendothyra* of the group *P. ornata* (Brady) – "*Pseudoendothyra struvei*" (von Möller) sensu *auctores*

4. Peratrovich? Formation, 200 feet above lowest exposed limestone; Zone 17, Early Namurian, middle Chester age equivalent; x78.

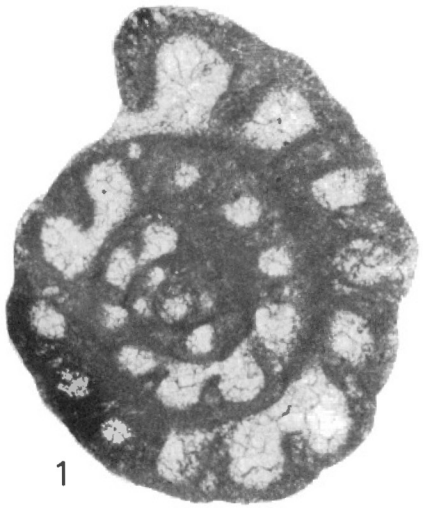
Location and collector as in fig. 1; GSC loc. C-5556; Mamet No. 254/14; GSC type No. 39570.

6. Location, collector, and stratigraphic level as in fig. 4; x78; Mamet No. 254/18; GSC type No. 39572.

7. Location, collector, and stratigraphic level as in fig. 4; x78; Mamet No. 254/20; GSC type No. 39573.

8. Peratrovich? Formation, 100 feet above base; Zone 17, Early Namurian, middle Chester age equivalent; x78.

Location and collector as in fig. 1; GSC loc. C-5555; Mamet No. 254/9; GSC type No. 39574.


1


2


3

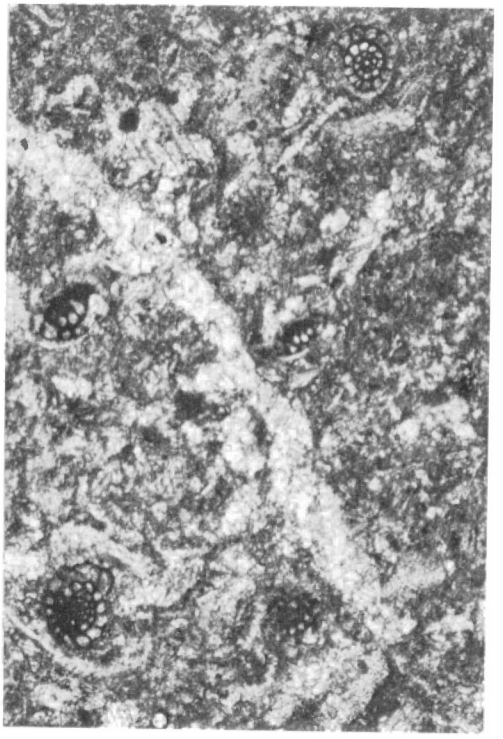

4


5

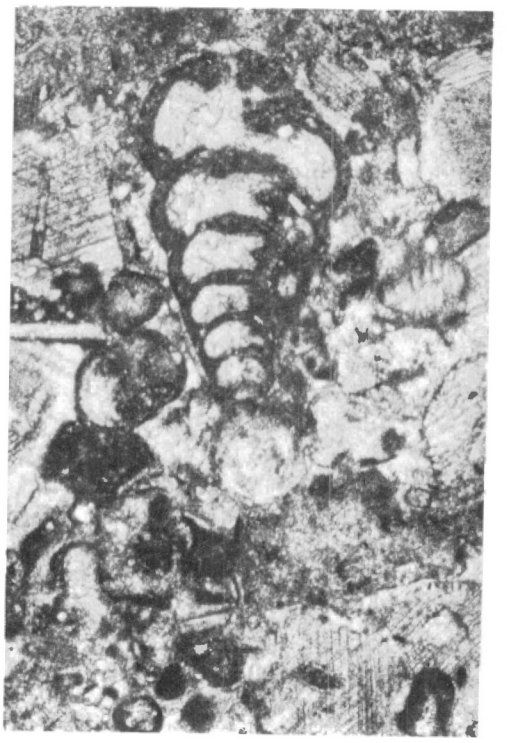

6


7


8



1



2

3



4



Figure 1. Nizi Formation, base of Member C, 636 feet above base of formation; Zone 17, Early Namurian, upper Chester age equivalent.

Fine- to medium-grained foraminifer-pelmatozoan wackestone; some pellets and brachiopod valves; foraminifers are *Eostaffella* sp., *Zellerina discoidea* (Girty), and *Endothyra* sp.; x31.

Nizi Creek, type section, McDame map-area, British Columbia, locality 47; collected by H. Gabrielse; GSC loc. 79458; Mamet No. 131/8; GSC type No. 39575.

Figure 2. Nizi Formation, Member C, 707 feet above base of formation; Zone 17, Early Namurian, upper Chester age equivalent.

Recrystallized, unevenly sorted, medium- to coarse-grained foraminifer-pelmatozoan-pellet packstone; some cement; lumps are mud-filled endothyrids; *Cribrostomum bradyi* (von Möller) is conspicuous; x38.

Location and collector as in fig. 1; GSC loc. 79650; Mamet No. 130/16; GSC type No. 39576.

Figure 3. Nizi Formation, Member C, 775 feet above base of formation; Zone 17, Early Namurian, upper Chester age equivalent.

Poorly sorted, medium-grained, foraminifer-pelmatozoan-bryozoan "grainstone"; epitaxial overgrowth on pelmatozoans destroys the original mud matrix; few lumps and brachiopod fragments; foraminifers are *Cribrostomum bradyi* (von Möller) (note that this oblique section would be confused for a *Palaeotextularia* sp., but the fossil is obviously conspecific with the cribate palaeotextulariid of fig. 2), *Endothyra bowmani* Phillips emend Brady, and crushed *Earlandia* sp.; x31.

Location and collector as in fig. 1; GSC loc. 79652; Mamet No. 130/18; GSC type No. 39577.

Figure 4. Nizi Formation, Member C, 848 feet above base of formation; Zone 17, Early Namurian, upper Chester age equivalent.

Poorly sorted, medium-grained foraminifer-pelmatozoan-bryozoan "grainstone"; epitaxial overgrowth destroys the original matrix; foraminifers are *Earlandia* sp. and an oblique section of *Tetrataxis angusta* Vissarionova (compare with Pl. 85, figs. 8–10; due to the obliqueness of the section, the apical angle appears to be much greater than 50° and the fossil could be attributed erroneously to *Tetrataxis immaturata* Grozdilova); x38.

Location and collector as in fig. 1; GSC loc. 79654; Mamet No. 130/14; GSC type No. 39578.

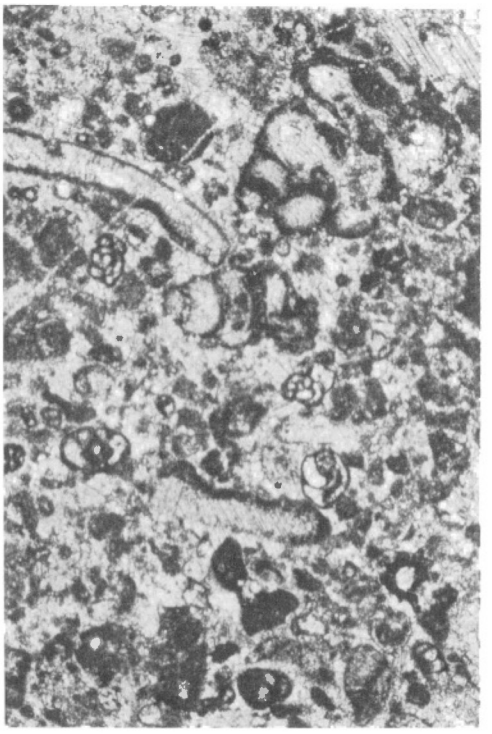
PLATE 76

NIZI FORMATION

Figure 1. Nizi Formation, Member E, 1,466 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Poorly sorted, unevenly grained, foraminifer-pelmatozoan-brachiopod-pellet grainstone; some lumps; foraminifers are *Climacammina* sp., *Biseriella* of the group *B. parva* (Chernysheva), *Pseudoglomospira* sp., and undeterminable endothyroids; x38.

Nizi Creek, type section, McDame map-area, British Columbia, locality 47; collected by H. Gabrielse; GSC loc. 79480; Mamet No. 131/28; GSC type No. 39579.

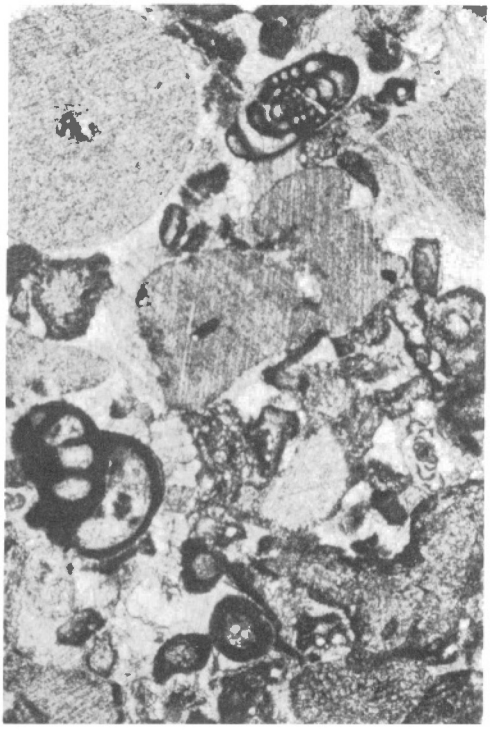


1

Figure 2. Nizi Formation, Member E, 1,476 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Coarse-grained, poorly sorted, foraminifer pelmatozoan-lump grainstone; algal micrite coated grains; foraminifers are *Archaediscus* of the group *A. krestovnikovi* Rauser-Tschernoussova, *Globoendothyra* sp., *Eostaffella* sp., and *Earlandia* sp.; x31.

Location and collector as in fig. 1; GSC loc. 79468; Mamet No. 131/14; GSC type No. 39580.



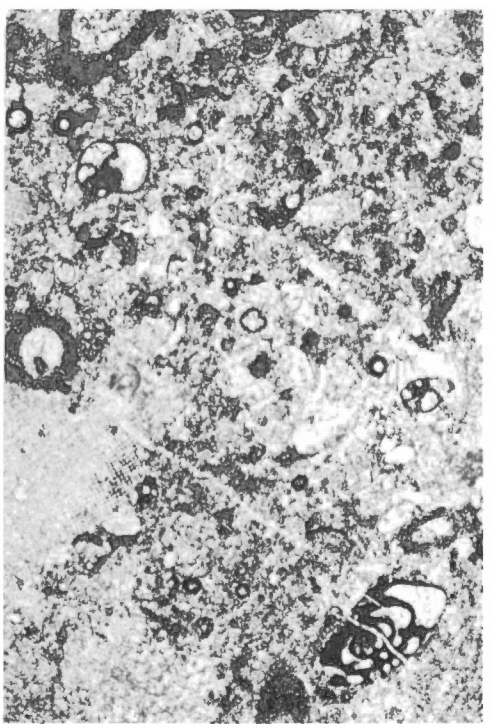
2

Figures 3, 4. Nizi Formation, Member E, 1,496 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Poorly sorted, recrystallized, foraminifer-pelmatozoan wackestone; matrix unevenly recrystallized, simulating cement; foraminifers are crushed *Climacammina* sp. (not *Cribrostomum* sp.), *Biseriella* of the group *B. parva* (Chernysheva), keeled *Eostaffella* sp., *Archaediscus krestovnikovi* Rauser-Tschernoussova, *Parathurammina* sp., *Earlandia* of the group *E. vulgaris* (Rauser-Tschernoussova and Reitlinger), and *Globoendothyra* ghosts; calcispheres and *Eotuberitina* sp. are present; x31 (fig. 3), x38 (fig. 4).

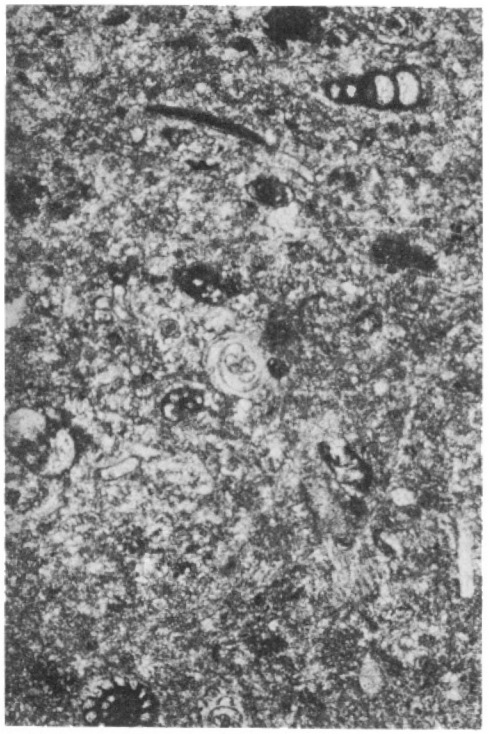
Location and collector as in fig. 1; GSC loc. 79474; Mamet No. 131/17 and 131/18; GSC type Nos. 39581 (fig. 3), 39582 (fig. 4).

3

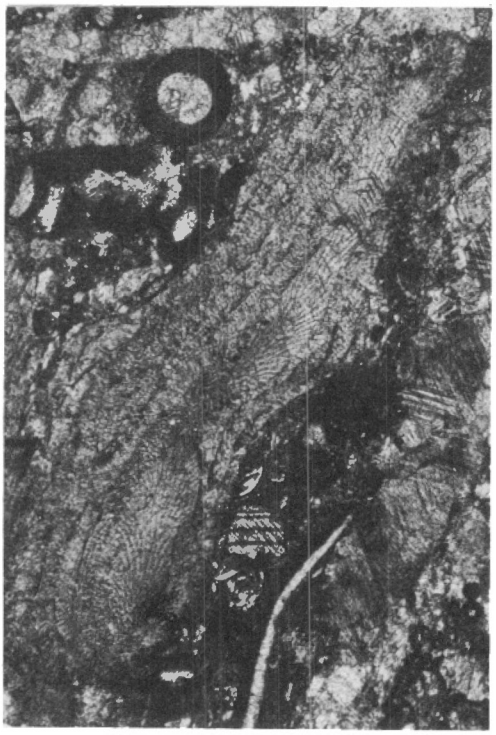


4



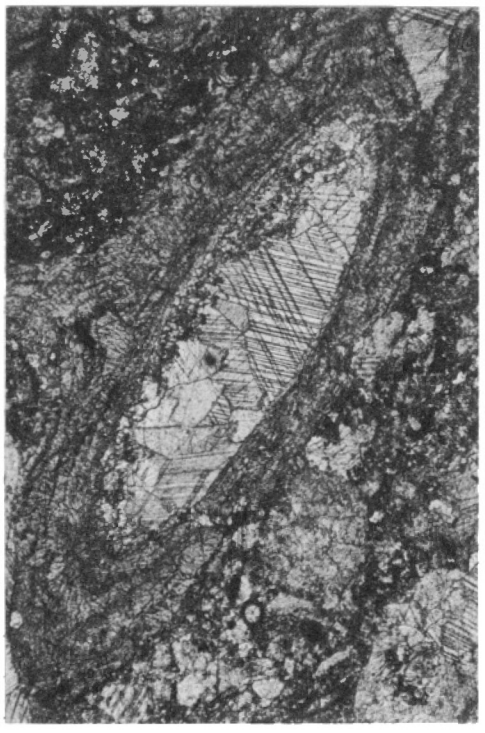


1



2

3



4

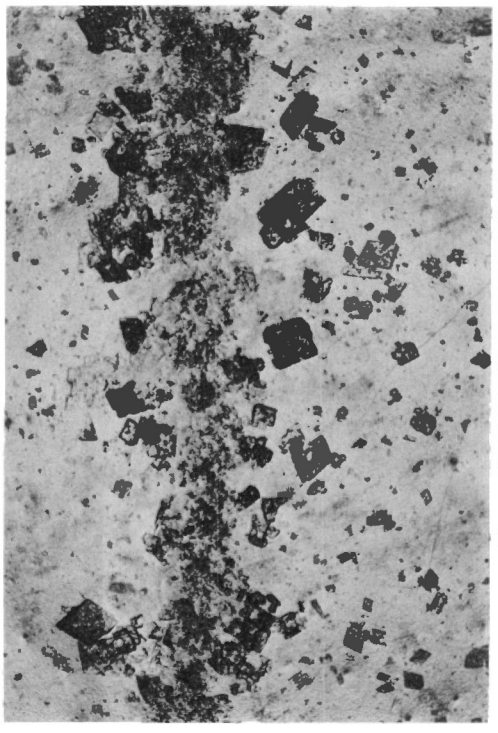


Figure 1. Nizi Formation, Member E, 1,546 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Slightly recrystallized, fine- to medium-grained foraminiferal wackestone; few pelmatozoans, brachiopods and lumps; foraminifers are *Eostaffella* sp., *Zellerina* sp., *Archaediscus* of the group *A. krestovnikovi* Rauser-Tschernoussova, *Neoarchaediscus* sp., and undeterminable palaeotextulariids; x31.

Nizi Creek, type section, McDame map-area, British Columbia, locality 47; collected by H. Gabrielse; GSC loc. 79457; Mamet No. 131/5; GSC type No. 39583.

Figures 2, 3. Nizi Formation, Member E, 1,506 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Recrystallized, argillaceous, foraminifer-pelmatozoan-alga packstone; grains are corroded and sometimes interpenetrant; *Earlandia* sp., endothyrids, and *Calcisphaera* sp. are dwarfs compared to the massive thalli of *Ungdarella peratrovichensis* Mamet and Rudloff; x31.

Location and collector as in fig. 1; GSC loc. 79476; Mamet Nos. R35/16 and R31/20; GSC type Nos. 39584 (fig. 2), 39585 (fig. 3).

Figure 4. Nizi Formation, top of Member E, 1,586 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent.

Dolomitic chert; note euhedral non-corroded dolomite rhombs which commonly show two growth generations; x31.

Location and collector as in fig. 1; GSC loc. 79462; Mamet No. 131/10; GSC type No. 39586.

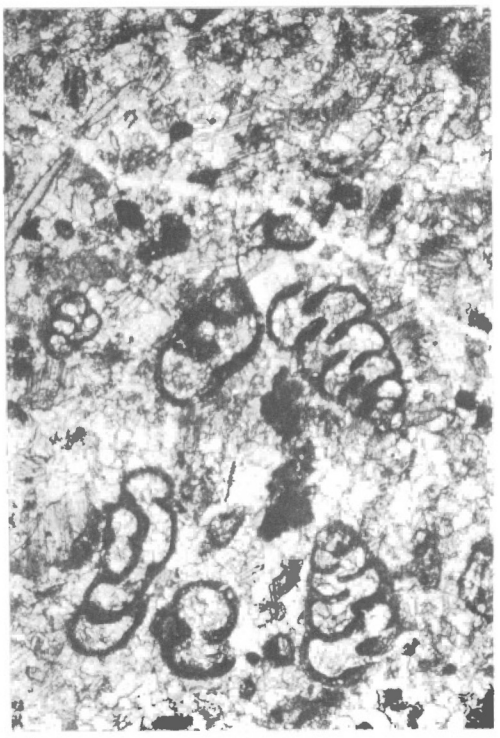
PLATE 78

UNNAMED FORMATION

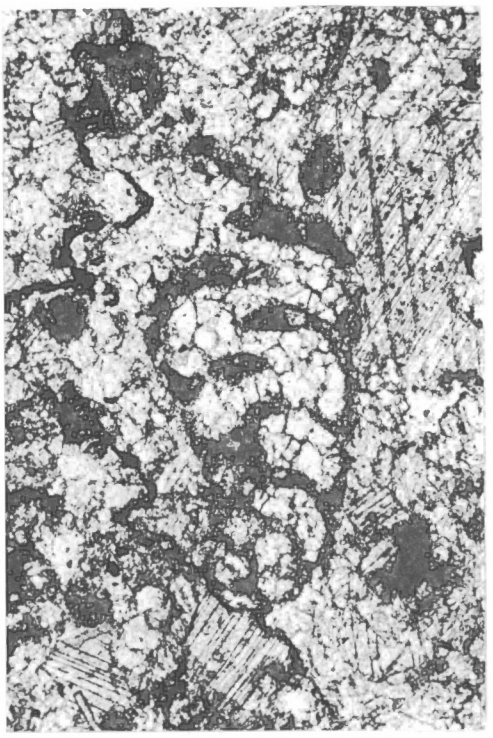
Figures 1–4. Unnamed Formation, Zone 9? to slightly younger, Late Tournaisian? to slightly younger, Keokuk? or Salem age equivalent.

Medium-grained, recrystallized, foraminifer-pelmatozoan "grainstone"; all grains are corroded and stylolitic contacts (fig. 2) are frequent; epitaxial overgrowth obscures the original matrix; due to recrystallization, even pelmatozoans are difficult to recognize and the foraminifers seem to "float" in a granular sparite groundmass; some pellets, ostracodes, and algal mud-coated grains are still recognizable; foraminiferal assemblage of particular importance as it is the only known occurrence in North America of the Palaeotextulariidae roots; abundant *Eotextularia mongeri* sp. nov. (*see* the initial glomospiral part in figs. 2 and 3) are mixed with *Septabrunsiina parakrainica* Skipp *in* Skipp, Holcomb and Gutschick; x38 (fig. 1), x121 (fig. 2), x31 (fig. 3), x38 (fig. 4).

Tulsequah map-area, British Columbia, locality 72a; collected by J. W. H. Monger; GSC loc. 79403; Mamet Nos. 129/13, 129/14, and 129/21; GSC type Nos. 39587 (fig. 1), 39588 (fig. 2), 39589 (fig. 3), 39590 (fig. 4).

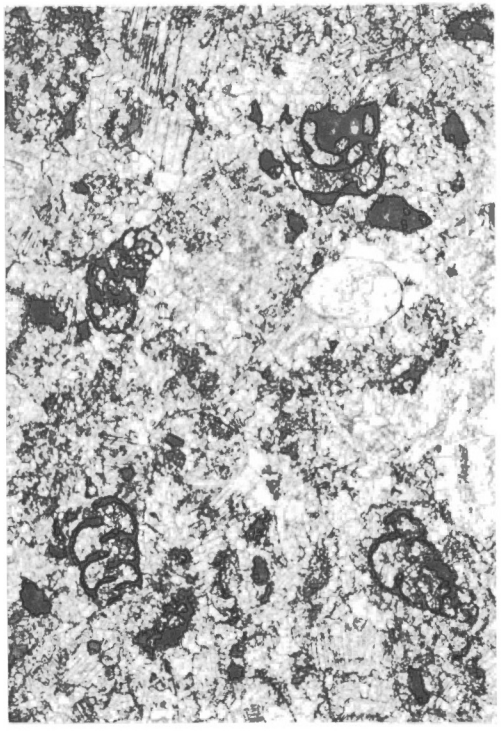


1

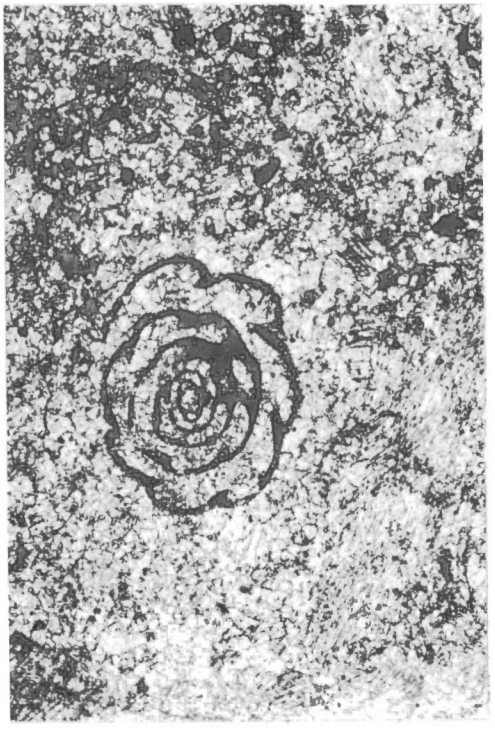


2

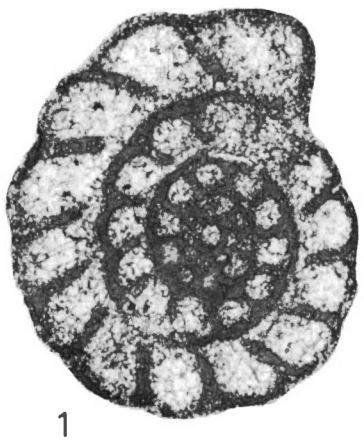
3

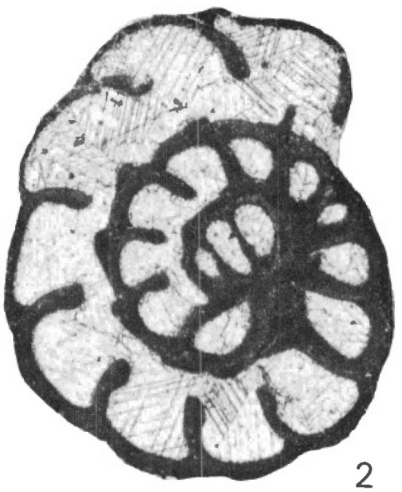


4



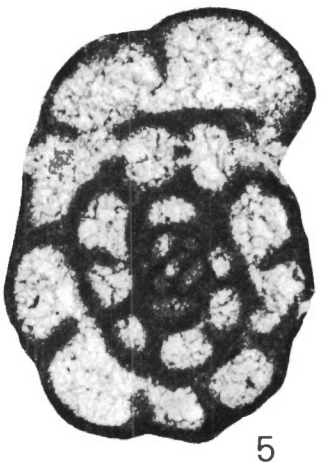
NIZI AND UNNAMED FORMATIONS, ATLIN AREA, MICROBIOTA













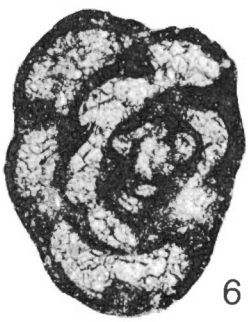




Figure 1. *Zellerina cooperi* (Zeller)

Nizi Formation, Member C, 636 feet above base of formation; Zone 17, Early Namurian, middle Chester age equivalent; x121.

Nizi Creek type section, McDame map-area, British Columbia, locality 47; collected by H. Gabrielse; GSC loc. 79458; Mamet No. 131/9; GSC type No. 39591.

Figure 2. *Omphalotis* sp.

Nizi Formation, Member E, 1,486 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent; x38.

Location and collector as in fig. 1; GSC loc. 79483; Mamet No. 131/29; GSC type No. 39592.

Figures 3, 8. *Septabrunsiina parakrainica* Skipp *in* Skipp, Holcomb and Gutschick

3. Unnamed Formation; Zone 9 or slightly younger, Late Tournaisian or slightly younger; x121.

Tulsequah map-area, British Columbia, locality 72a; collected by J. W. H. Monger; GSC loc. 79403; Mamet No. 129/15; GSC No. 39593.

8. Location and collector as in fig. 3; x51; GSC loc. 79403; Mamet No. 129/22; GSC type No. 39598.

Figure 4. *Eostaffella* of the group *E. radiata* (Brady) – "*Eostaffella mosquensis*" Vissarionova of the Russian authors (=*Eostaffella oregonensis* Sada and Danner)

Location and collector as in fig. 1; x121; GSC loc. 79483; Mamet No. 134/14; GSC type No. 39594.

Figure 5. *Endothyra* of the group *E. bowmani* Phillips emend Brady

Nizi Formation, Member E, 1,506 feet above base of formation; Zone 18, Early Namurian, upper Chester age equivalent; x121.

Location and collector as in fig. 1; GSC loc. 79476; Mamet No. 131/24; GSC type No. 39595.

Figure 6. *Septabrunsiina anteflexa* (Zeller)

Location and collector as in fig. 3; x121; GSC loc. 79403; Mamet No. 129/12; GSC type No. 39596.

Figure 7. *Eotextularia mongeri* sp. nov.

Location and collector as in fig. 3; x121; GSC loc. 79403; Mamet No. 129/18; GSC holotype No. 39597.

PLATE 80

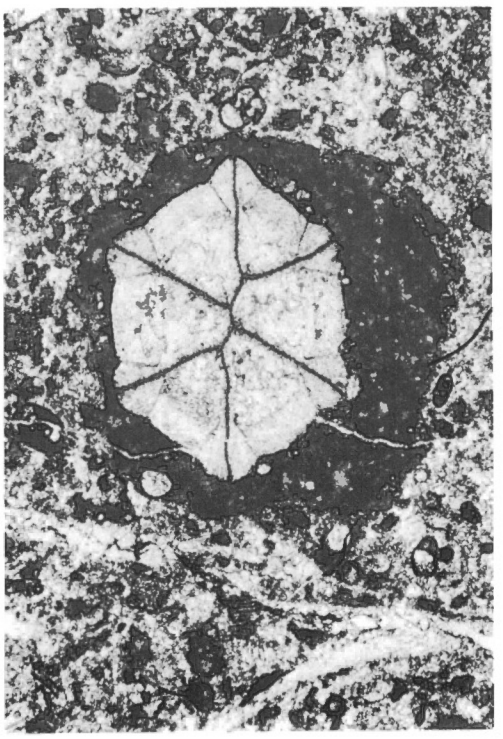
PERATROVICH? FORMATION

Figure 1. Unnamed formation, probably equivalent to the Peratrovich Formation, basal part; Zone 18 or slightly younger, Early Namurian, upper Chester age equivalent or slightly younger.
Pelletoidal grainstone with stromatolitic encrustation around the heterocoral *Hexaphyllia; Biseriella* of the group *B. parva* (Chernysheva), *Mediocris* sp., *Priscella* sp., *Calcisphaera* sp., and *Eotuberitina* sp. are present; x31.
5 miles NW of SE end of Nakina Lake, Atlin map-area, British Columbia, locality 3; collected by J. W. H. Monger; GSC loc. C-22312; Mamet No. 274/21; GSC type No. 39599.

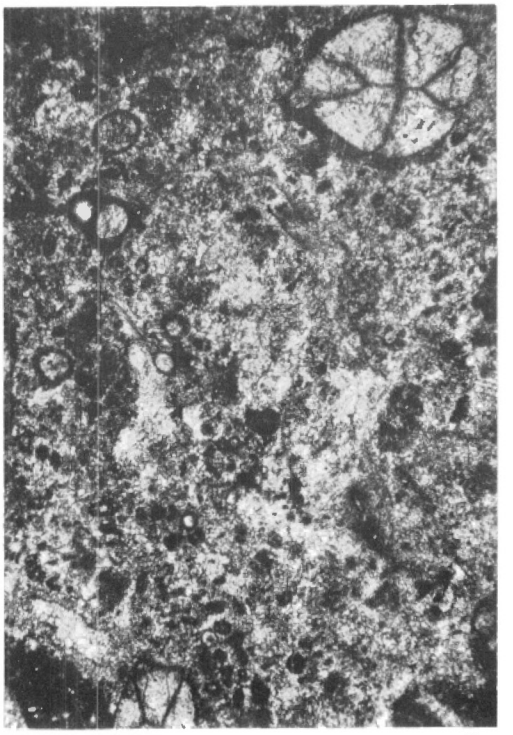
2. Pelletoidal grainstone with ghosts of recrystallized matrix and pellets; two *Hexaphyllia* associated with calcispheres and endothyrids; x31.
Locality and collector as in fig. 1; Mamet No. 273/77; GSC type No. 39600.

3. *Hexaphyllia, Eostaffella oregonensis* Sada and Danner, *Priscella* sp., *Calcisphaera* sp., *Pseudoglomospira* sp., and *Earlandia* sp. are present in a pelletoidal grainstone with recrystallized matrix ghosts; x31.
Locality and collector as in fig. 1; Mamet No. 275/22; GSC type No. 39601.

4. Detail of the preceding facies showing the recrystallized porous tectum of *Spinothyra* gen. nov. and a *Mediocris* sp.; x121.
Locality and collector as in fig. 1; Mamet No. 274/17; GSC type No. 39602.

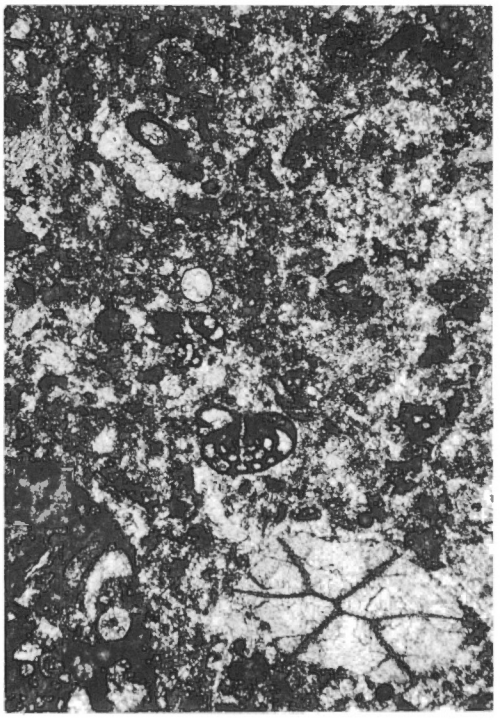


1



2

3



4

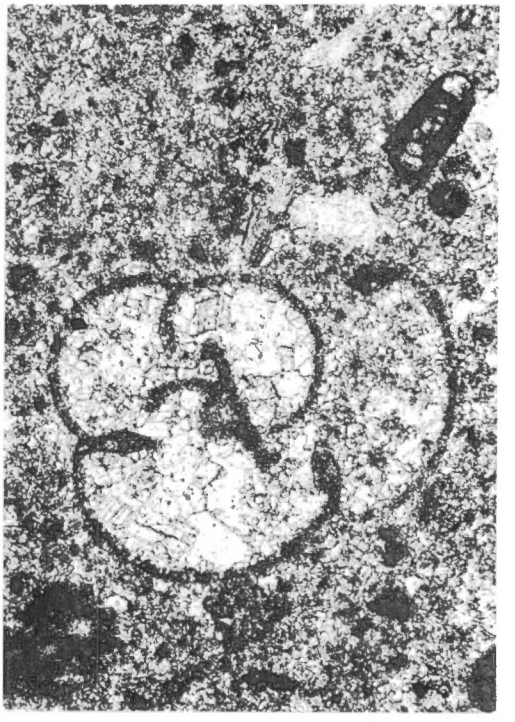


PLATE 81

PERATROVICH? MICROBIOTA

Figures 1–4. *Spinothyra pauciseptata* (Rauser–Tschernoussova) gen. nov.

1. Unnamed formation, probably equivalent to the Peratrovich Formation, basal part; Zone 18 or slightly younger, Early Namurian, upper Chester age equivalent or slightly younger; x78.
5 miles NW or SE end of Nakina Lake, Atlin map-area, British Columbia, locality 3; collected by J. W. H. Monger; GSC loc. C-22312; Mamet No. 273/19; GSC type No. 39603.

2. Locality and collector as in fig. 1; x78; Mamet No. 274/18; GSC type No. 39604.

3. Locality and collector as in fig. 1; x78; Mamet No. 273/12; GSC type No. 39605.

4. Locality and collector as in fig. 1; x78; Mamet No. 273/11; GSC type No. 39606.

5–9. *Priscella prisca* (Rauser–Tschernoussova and Reitlinger)

5. Locality and collector as in fig. 1; x121; Mamet No. 275/18; GSC type No. 39607.

6. Locality and collector as in fig. 1; x121; Mamet No. 276/19; GSC type No. 39608.

7. Locality and collector as in fig. 1; x121; Mamet No. 273/17; GSC type No. 39609.

8. Locality and collector as in fig. 1; x121; Mamet No. 273/16; GSC type No. 39610.

9. Locality and collector as in fig. 1; x121; Mamet No. 273/16a; GSC type No. 39611.

10. *Priscella* of the group *P. prisca* (Rauser–Tschernoussova and Reitlinger)
Locality and collector as in fig. 1; x121; Mamet No. 274/6; GSC type No. 39612.

11. *Omphalotis* of the group *O. circumplicata* (Howchin)
Locality and collector as in fig. 1; x78; Mamet No. 275/15; GSC type No. 39613.

12, 13. *Biseriella* sp.

12. Locality and collector as in fig. 1; x121; Mamet No. 274/16; GSC type No. 39614.

13. Locality and collector as in fig. 1; x78; Mamet No. 275/21; GSC type No. 39615.

14. *Diplosphaerina* sp.
Locality and collector as in fig. 1; x121; Mamet No. 273/21; GSC type No. 39616.

15–17. *Mediocris mediocris* (Vissarionova)

15. Locality and collector as in fig. 1; x121; Mamet No. 275/11; GSC type No. 39617.

16. Locality and collector as in fig. 1; x121; Mamet No. 275/20; GSC type No. 39618.

17. Locality and collector as in fig. 1; x121; Mamet No. 275/12; GSC type No. 39619.

18. *Mediocris* aff. *M. breviscula* (Ganelina)
Locality and collector as in fig. 1; x121; Mamet No. 273/13; GSC type No. 39620.

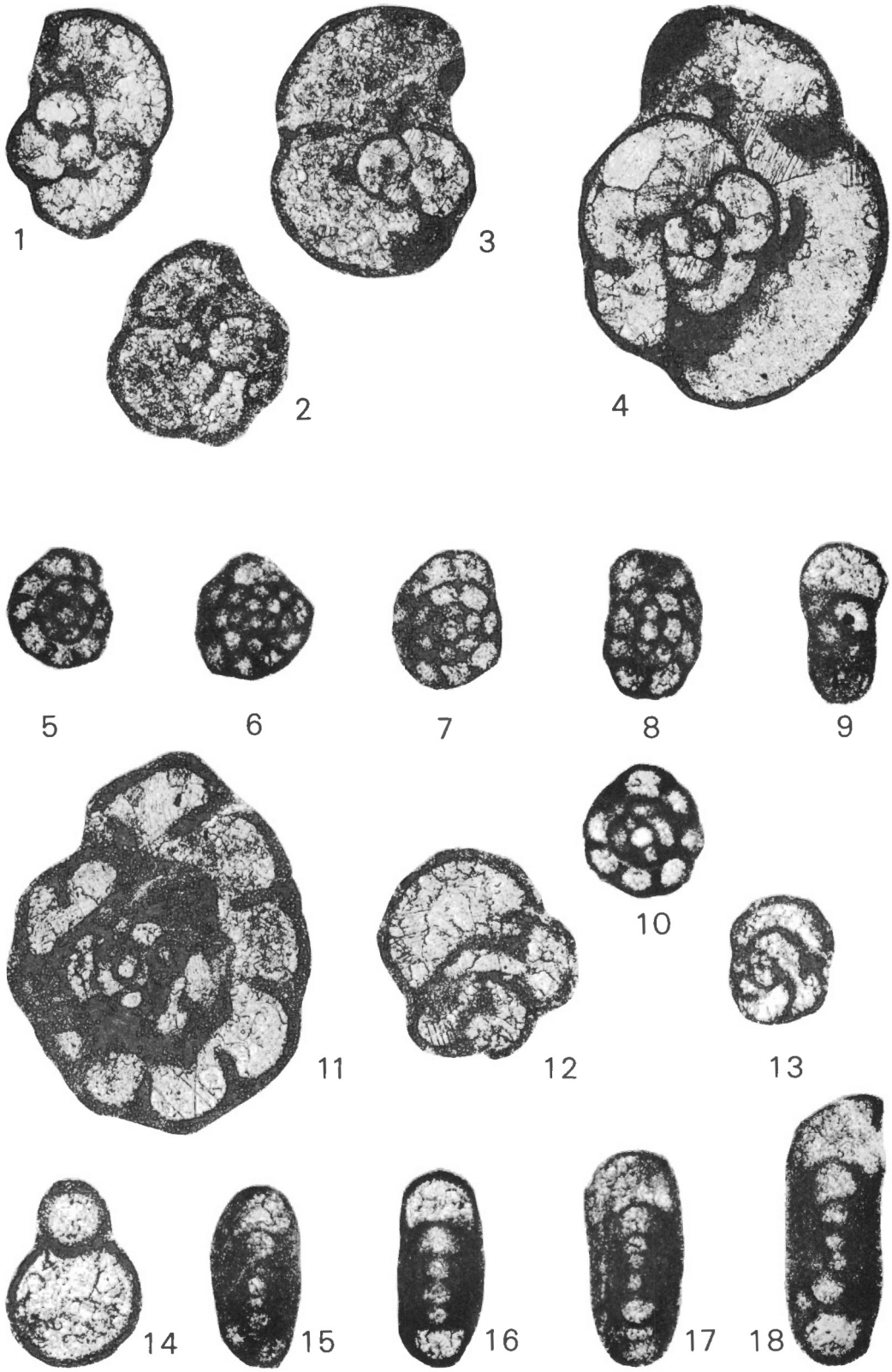

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

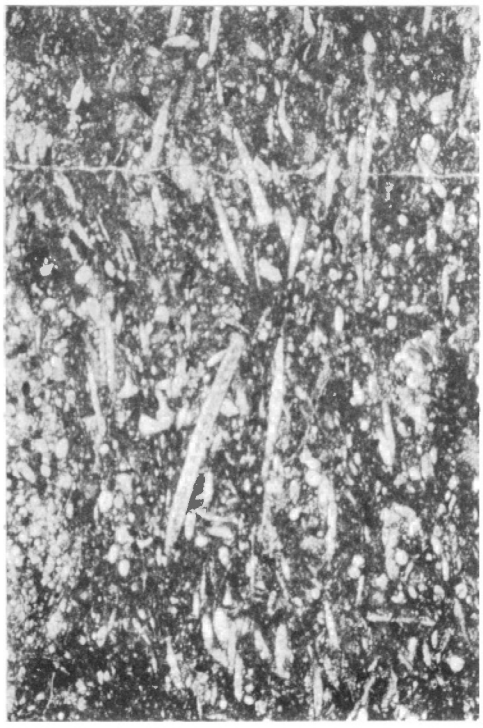
PLATE 82

PROPHET FORMATION

Figure 1. "Prophet" Formation, 1,020 feet below top of section; undifferentiated Tournaisian zone.

Calcareous sponge spiculite; x31.

Rabbit River, McDame map-area, British Columbia, locality 60a; collected by H. Gabrielse; GSC loc. 79583; Mamet No. 130/20; GSC type No. 39621.

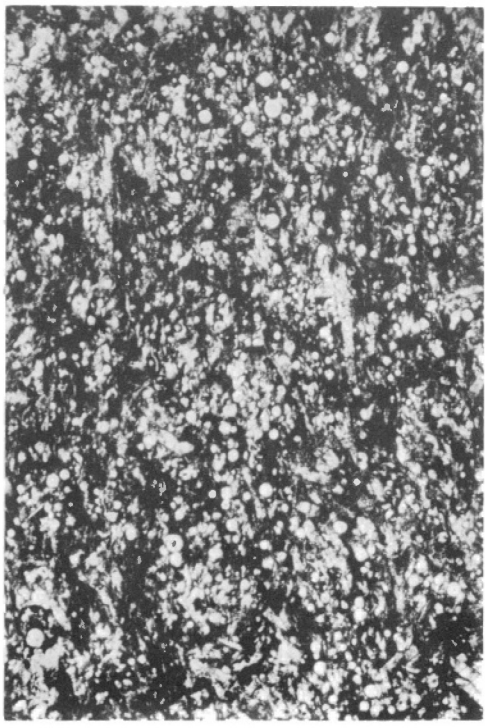


1

Figure 2. Prophet Formation, 879–890 feet below top of formation; undetermined Upper Tournaisian or Lower Viséan zone?

Silicified radiolarite with sponge spicules; x38.

North of Bat Creek waterfall, British Columbia, type section, locality 4; collected by E. W. Bamber; GSC loc. C-33601; Mamet No. 119/14; GSC type No. 39622.



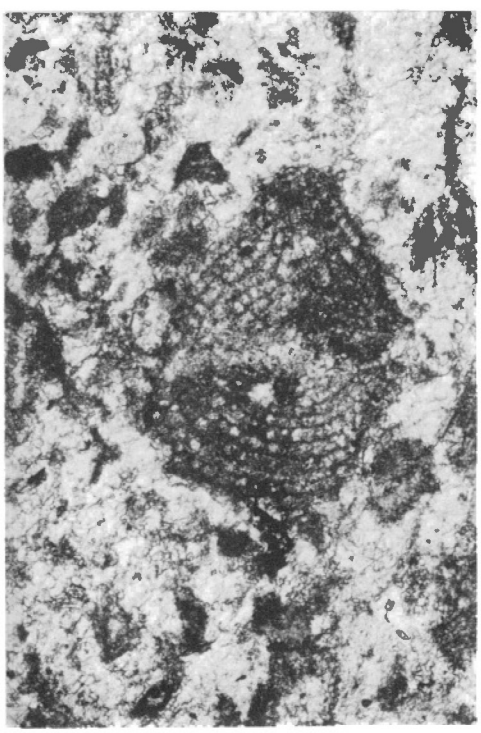
2

3

Figure 3. Prophet Formation, 430–440 feet below top of formation; Zone 11?, Early Viséan?, Salem age equivalent.

Stacheia? skimoensis Mamet and Rudloff in a recrystallized, pelletoidal "grainstone"; x51.

Location and collector as in fig. 2; GSC loc. C-2334; Mamet No. 119/10; GSC type No. 39623.

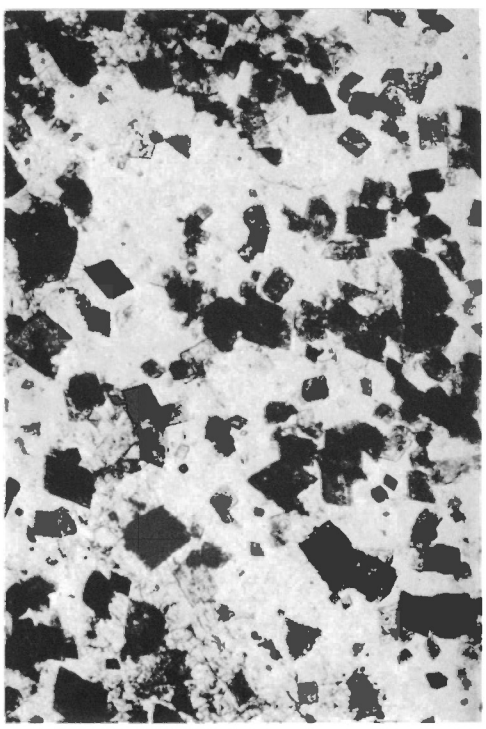


4

Figure 4. Prophet Formation, 480–490 feet below top of formation; Zone 11?, Early Viséan, Salem age equivalent.

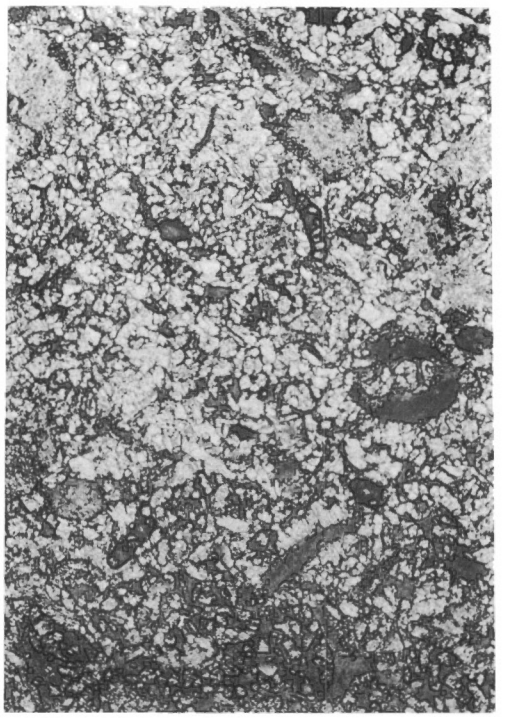
Dolomitic chert; x51.

Location and collector as in fig. 2; GSC loc. C-2337a; Mamet No. 119/12; GSC type No. 39624.





1



2

PROPHET FORMATION

Figure 1. Prophet Formation, 270–280 feet below top of formation; Zone 12, Middle Viséan, Salem age equivalent.

Eoforschia sp. and *Endothyra* sp. in a pelmatozoan epitaxial "grainstone"; x51.

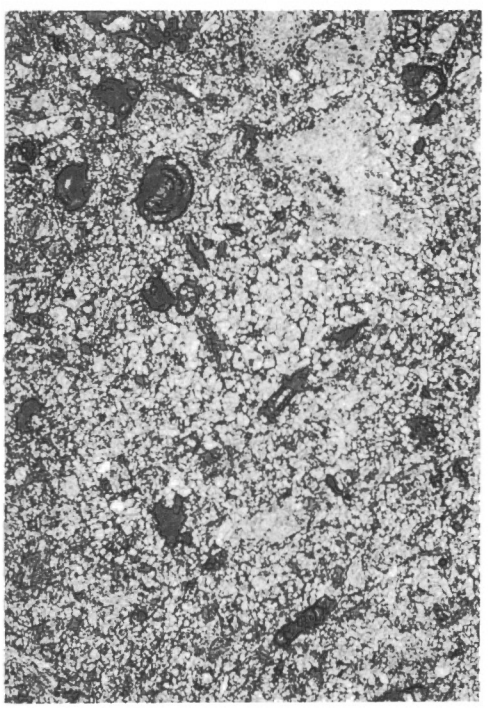
North of Bat Creek waterfall, British Columbia, type section, locality 4; collected by E. W. Bamber; GSC loc. C-2323; Mamet No. 119/9; GSC type No. 39625.

Figure 2. Prophet Formation, 9–10 feet below top; Zone 14, Late Viséan, St. Louis age equivalent.

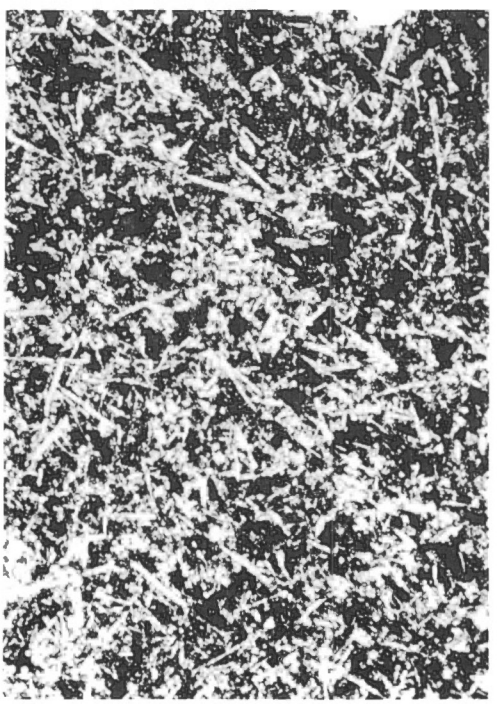
Recrystallized, medium-grained, granular pelmatozoan "grainstone"; some bryozoans and brachiopods; typical "*Brunsia* facies" (*Brunsia lenensis* Bogush and Yuferev), where most of the foraminifers belong to that genus; all other foraminifers and algae are scarce or absent; x31.

25 miles north of Clearwater River Mouth (Peace River), British Columbia, locality 13; collected by E. W. Bamber; GSC loc. 66421; Mamet No. 99/22; GSC type No. 39626.

3



4



GOLATA FORMATION

Figure 3. Golata Formation (upper), 460 feet above base; Zone 14, Late Viséan, St. Louis age equivalent.

Recrystallized, medium-grained, granular pelmatozoan grainstone; typical "*Brunsia* facies" with *Brunsia lenensis* Bogush and Yuferev, *Brunsia* of the group *B. irregularis* (von Möller), and minute *Earlandia* sp.; x31.

Location and collector as in fig. 2; GSC loc. 66429; Mamet No. 99/10; GSC type No. 39627.

BESA RIVER FORMATION

Figure 4. Besa River Formation (top), undetermined Tournaisian zone.

Silicified sponge spiculite; x38.

Besa River, British Columbia, type section, locality 5; collected by E. W. Bamber; GSC loc. C-33602; Mamet No. 119/22; GSC type No. 39628.

PLATE 84

FLETT FORMATION

Figure 1. Flett Formation (lower), 249 feet above base; undetermined Tournaisian zone.
Calcareous sponge spiculite; x38.
Jackfish Gap, Yohin Ridge, District of Mackenzie, type section, locality 30; collected by E. W. Bamber; GSC loc. 68801; Mamet No. 100/3; GSC type No. 39629.

2. Flett Formation (middle), 634 feet above base; Zone 10, Early Viséan, Salem age equivalent.
Unevenly sorted, uneven-grained, foraminifer-pelmatozoan "grainstone"; epitaxial overgrowth on ossicles; bryozoans and brachiopods present; foraminifers are "*Septatournayella*" *henbesti* Skipp, Holcomb and Gutschick and *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger); *Calcisphaera laevis* Williamson is present; x38.
Location and collector as in fig. 1; GSC loc. 68810; Mamet No. 120/5; GSC type No. 39630.

Figures 3, 4. Flett Formation (upper), 1,172 feet above base; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent.
Medium-grained, poorly sorted, recrystallized, pelmatozoan-foraminifer "grainstone"; epitaxial overgrowth frequent; some bryozoan and brachiopod fragments; foraminifers are *Eoendothyranopsis* of the group *E. spiroides* (Zeller), *Endothyra* of the group *E. bowmani* Phillips emend Brady (*Endothyra pseudobradyi* Brazhnikova), *Earlandia* of the group *E. vulgaris* (Rauser–Tschernoussova and Reitlinger), *Skippella* sp., *Eoendothyranopsis* sp., and *Endothyranella* sp.; x38 (fig. 3), x31 (fig. 4).
Location and collector as in fig. 1; GSC loc. 68816; Mamet Nos. 120/19 and 120/26; GSC type Nos. 39631 (fig. 3), 39632 (fig. 4).

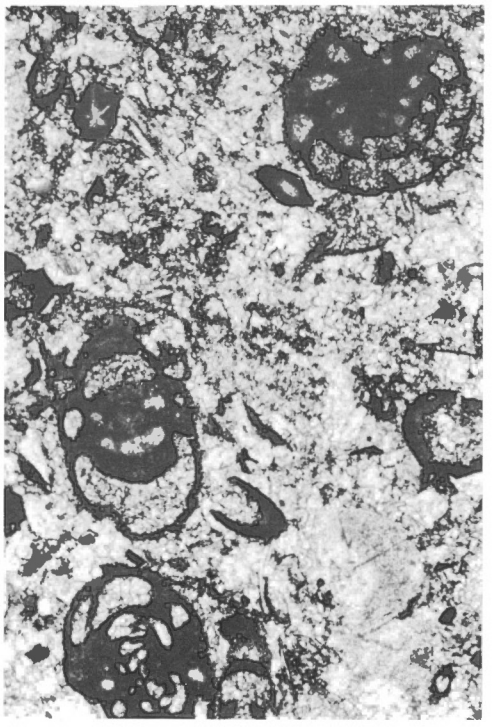


1



2

3



4

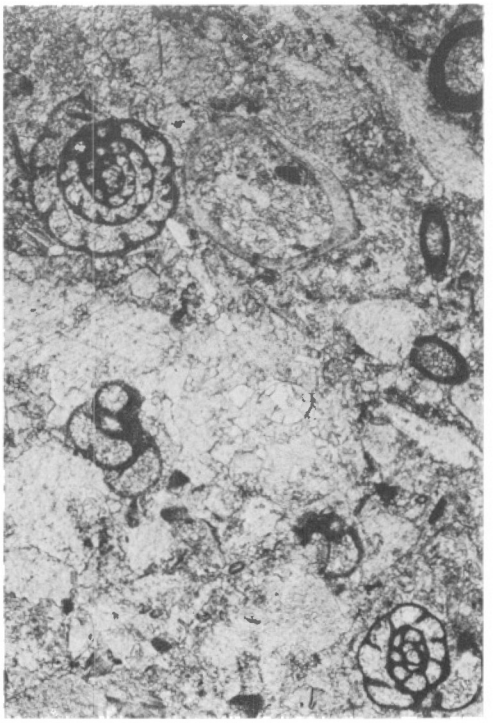


PLATE 85

FLETT AND PROPHET MICROBIOTA

Figures 1–3, 7. *Eoendothyranopsis* aff. *E. thompsoni* (Anisgard and Campau)

1. Flett Formation (upper), 1,172 feet above base; boundary of Zones 12/13, Middle Viséan, Salem/St. Louis boundary age equivalent; x121.
Jackfish Gap, Yohin Ridge, District of Mackenzie, type section, locality 30; collected by E. W. Bamber; GSC loc. 68816; Mamet No. 120/21; GSC type No. 39633.

2. Locality and collector as in fig. 1; x121; Mamet No. 120/30; GSC type No. 39634.

3. Locality and collector as in fig. 1; x121; Mamet No. 120/27; GSC type No. 39635.

7. Locality and collector as in fig. 1; x121; Mamet No. 120/31; GSC type No. 39639.

4. *Priscella* of the group *P. prisca* (Rauser–Tschernoussova and Reitlinger)
Flett Formation (middle), 634 feet above base; Zone 10, Early Viséan, Salem age equivalent; x121.
Location and collector as in fig. 1; GSC loc. 68810; Mamet No. 120/12; GSC type No. 39636.

5. *Septatournayella pseudocamerata* (Lipina *in* Lebedeva)
Flett Formation, undetermined footage in the lower part of the formation; Zone 9, Late Tournaisian, upper Osage age equivalent; x31.
Jackfish Gap, Yohin Ridge, District of Mackenzie, locality 30; collected by Chevron Standard Ltd.; Mamet No. 100/17; GSC type No. 39637.

6. *Globoendothyra paula* (Vissarionova)
Prophet Formation (upper), 45 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x31.
North of Bat Creek waterfall, British Columbia, type section, locality 4; collected by E. W. Bamber; GSC loc. 66585; Mamet No. 119/7; GSC type No. 39638.

8–10. *Tetrataxis angusta* Vissarionova

8. Prophet Formation (upper), 13 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x38.
North of Bat Creek waterfall, British Columbia, locality 4; collected by E. W. Bamber; GSC loc. 66584; Mamet No. 99/6; GSC type No. 39640.

9. Locality and collector as in fig. 8; x38; Mamet No. 99/6′; GSC type No. 39641.

10. Location and collector as in fig. 1; x38; GSC loc. 68813; Mamet No. 120/28; GSC type No. 39642.

11, 12. *Brunsia lenensis* Bogush and Yuferev

11. Golata Formation (upper), 460 feet above base; Zone 14, Late Viséan, St. Louis age equivalent; x121.
25 miles north of Clearwater River mouth (Peace River), British Columbia, locality 13; collected by E. W. Bamber; GSC loc. 66429; Mamet No. 99/8; GSC type No. 39643.

12. Locality and collector as in fig. 11; x121; Mamet No. 99/12; GSC type No. 39644.

13. *Brunsia* sp.
Prophet Formation (upper), 9–10 feet below top; Zone 14, Late Viséan, St. Louis age equivalent; x121.
Location and collector as in figs. 11 and 12; GSC loc. 66421; Mamet No. 99/21; GSC type No. 39645.

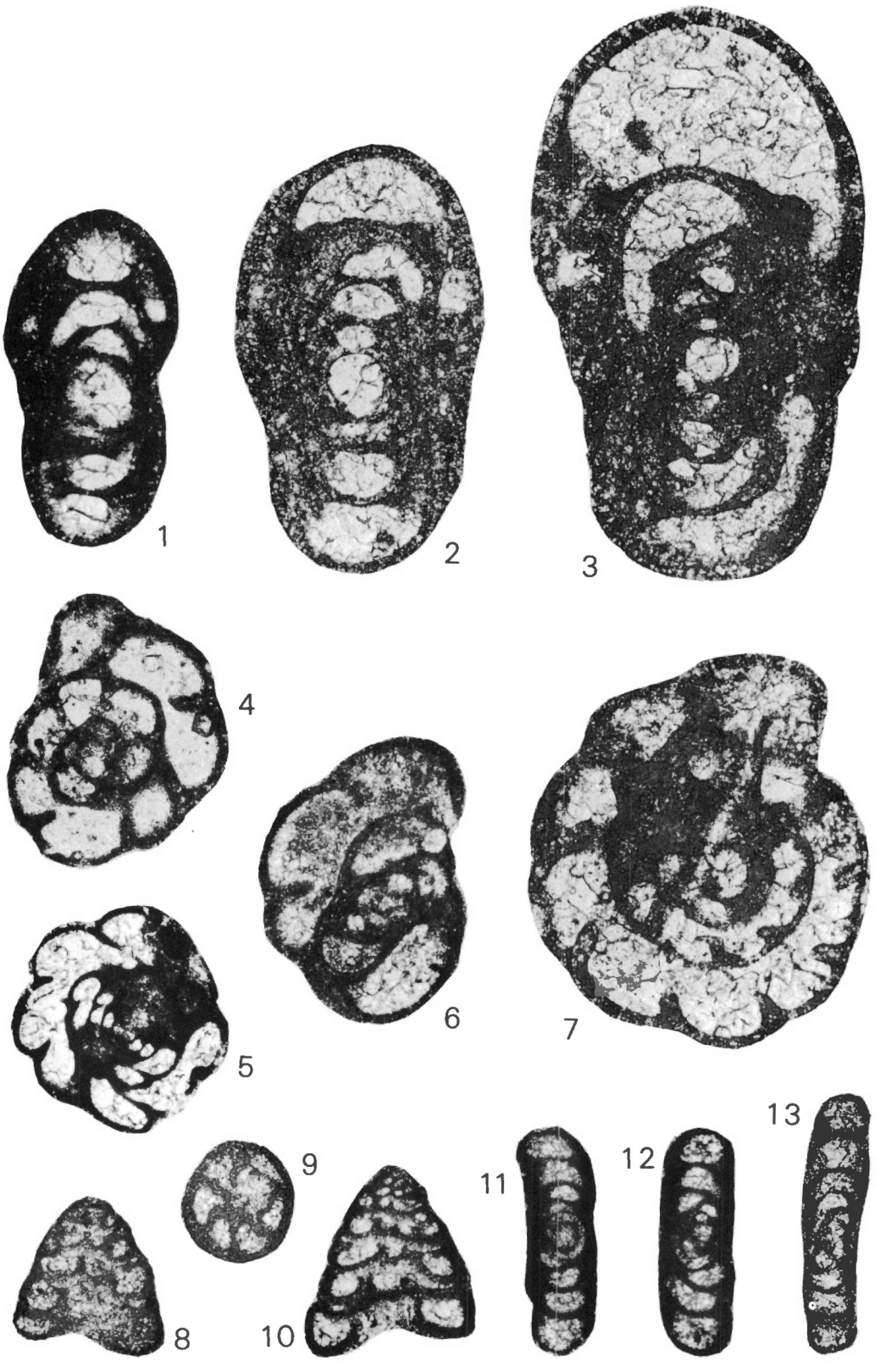

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE 86

HART RIVER, UNNAMED, AND ETTRAIN FORMATIONS

Figure 1. Hart River Formation (upper), 461 feet above base; Zone 16 undifferentiated, Late Viséan, lower Chester age equivalent.

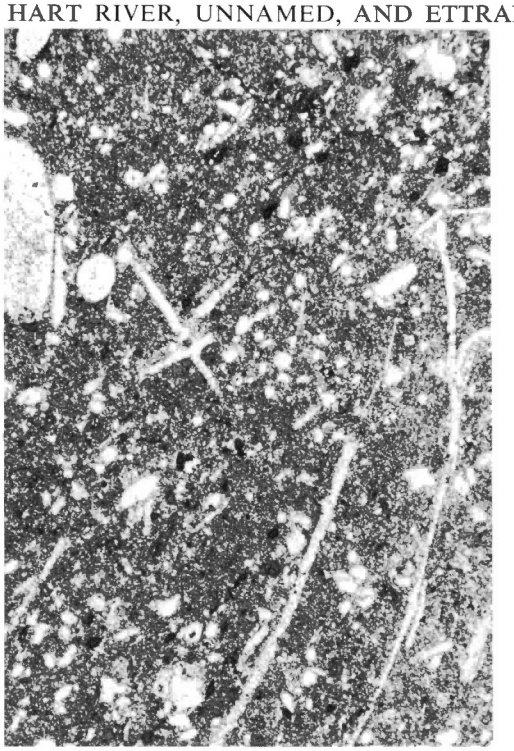
Fine-grained, poorly sorted, silty, spicule wackestone; some pelmatozoans, ammonoids, and ostracodes are present; x38.

Peel River rapids, Yukon Territory, type section, locality 58; collected by E. W. Bamber; GSC loc. 53734; Mamet No. 97/4; GSC type No. 39646.

Figure 2. Hart River Formation (upper), 340 feet above base; Zone 16 undifferentiated, Late Viséan, lower Chester age equivalent.

Poorly sorted, limonite-stained, gastropod-pelmatozoan packstone; some ammonoid and ostracode fragments are present; x31.

Location and collector as in fig. 1; GSC loc. 53738; Mamet No. 97/5; GSC type No. 39647.



1



2

3

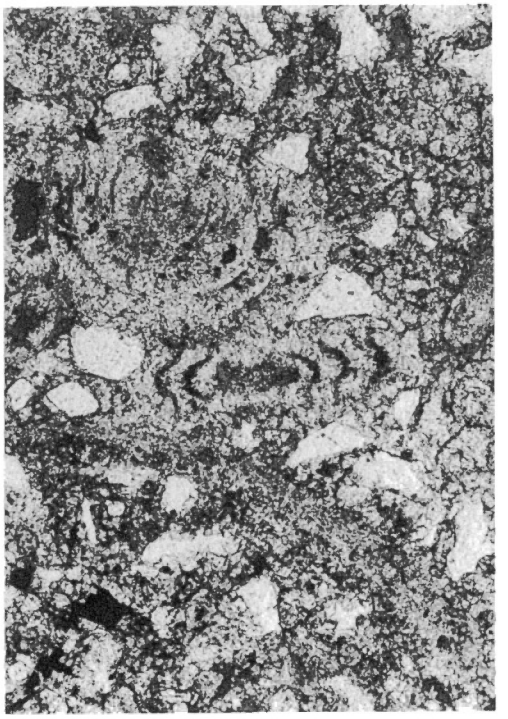


Figure 3. Unnamed formation, 258 feet below the base of the Fantasque Formation; Zone 18, Early Namurian, upper Chester age equivalent.

Recrystallized, foraminifer-pelmatozoan-brachiopod "grainstone" bearing angular quartz; numerous axial and equatorial sections of *Planospirodiscus taimyricus* Sossipatrova; x121.

North Tetsa River, south of mile 380, Alaska Highway, British Columbia, locality 50; collected by E. W. Bamber; GSC loc. 60897; Mamet No. 92/28; GSC type No. 39648

4

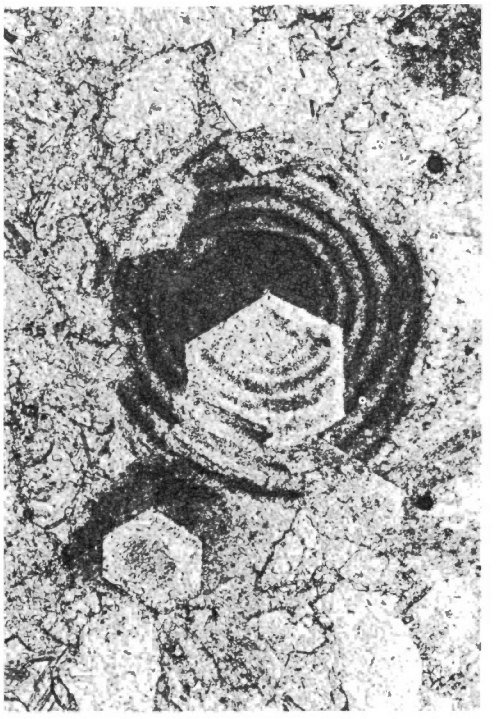


Figure 4. Ettrain Formation (lower), 142 feet above base; Zone 21, Atoka age equivalent.

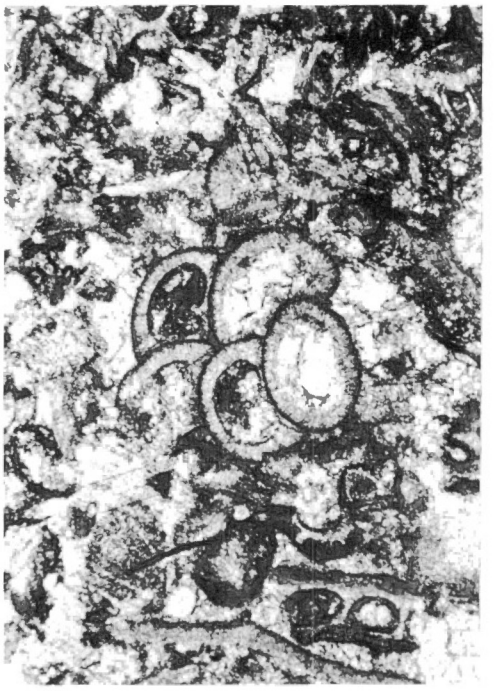
Recrystallized, granular foraminifer-pelmatozoan "grainstone"; diagenetic quartz crystals in *Monotaxinoides multivolutus* (Reitlinger); x121.

Whitestone River, Yukon Territory, locality 75; collected by E. W. Bamber; GSC loc. 53792; Mamet No. 161/16; GSC type No. 39649.

ETTRAIN FORMATION



1



2

Figure 1. Ettrain Formation (lower), 92 feet above base; Zone 21, Atoka age equivalent.

Poorly sorted, medium- to coarse-grained, pelmatozoan-foraminifer grainstone; lumps and bryozoan fronds are present; the keriotheca of *Bradyina* of the group *B. cribrostomata* Rauser–Tschernoussova and Reitlinger is micrite covered; x31.

Whitestone River, Yukon Territory, locality 75; collected by E. W. Bamber; GSC loc. 53792; Mamet No. 162/19; GSC type No. 39650.

Figure 2. Ettrain Formation (upper), 1,169 feet above base; Zone 22, Middle Carboniferous.

Poorly sorted, coarse-grained, pelmatozoan-bryozoan packstone-grainstone; epitaxial overgrowth on pelmatozoan plates; some grain reduction; section through thallus(?) of the incertae sedis *Asphaltina cordillerensis* Mamet and Rudloff; x38.

Ettrain and Jungle Creek headwaters, northern Ogilvie Mountains, Yukon Territory, locality 19; collected by E. W. Bamber; GSC loc. C-2724; Mamet No. 161/14; GSC type No. 39651.

3



4

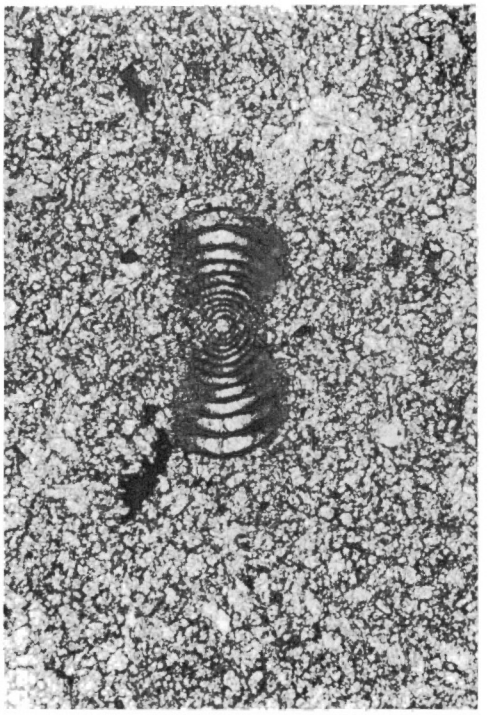


Figure 3. Ettrain Formation (upper), 1,326 feet above base; Zone 22 or younger?, Middle Carboniferous.

Coarse-grained, rather well sorted, pelmatozoan-lump-alga grainstone; pseudo-oolites, oolites, and algal micrite coated fragments are present; grains are interpenetrant; weathered thallus of *Komia?* sp. and the fusulinid *Pseudostaffella* sp.; x38.

Location and collector as in fig. 2; GSC loc. 53982; Mamet No. 178/5; GSC type No. 39652.

Figure 4. Ettrain Formation (lower), 10–20 feet below top; Zone 22 or younger?, Middle Carboniferous.

Recrystallized, granular, slightly dolomitic microspar with an equatorial section of *Monotaxinoides multivolutus* (Reitlinger); x31.

Peel River rapids, Yukon Territory, locality 58; collected by S. J. Nelson; section T3; Mamet No. 92/18; GSC type No. 39653.

PLATE 88

UNNAMED FORMATION AND ETTRAIN MICROBIOTA

Figures 1–4. *Monotaxinoides multivolutus* (Reitlinger)

1. Ettrain Formation (top); Zone 22 or younger, Middle Carboniferous; x121.
Peel River rapids, Yukon Territory, locality 59; collected by E. W. Bamber; GSC loc. 53700; Mamet No. 179/32; GSC type No. 39654.
2. Locality and collector as in fig. 1; x121; Mamet No. 179/21; GSC type No. 39655.
3. Ettrain Formation (Lower Limestone Unit of Nelson, 1961), 10–20 feet below top; Zone 22 or younger, Middle Carboniferous; x121.
Peel River rapids, Yukon Territory, locality 59; collected by S. J. Nelson; section T3; Mamet No. 92/19; GSC type No. 39656.
4. Locality and collector as in fig. 3; x121; Mamet No. 92/15; GSC type No. 39657.

5–17. *Planospirodiscus taimyricus* Sossipatrova (*P. effetus* Sossipatrova)

5. Unnamed formation, 258 feet below base of Fantasque Formation; Zone 18, Early Namurian, upper Chester age equivalent; x121.
North Tetsa River, south of mile 380, Alaska Highway, British Columbia, locality 50; collected by E. W. Bamber; GSC loc. 60897; Mamet No. 93/5; GSC type No. 39658.
6. Locality and collector as in fig. 5, x121; Mamet No. 92/11; GSC type No. 39658a.
7. Locality and collector as in fig. 5; x121; Mamet No. 93/3; GSC type No. 39659.
8. Locality and collector as in fig. 5; x121; Mamet No. 92/3; GSC type No. 39660.
9. Locality and collector as in fig. 5; x121; Mamet No. 93/4; GSC type No. 39661.
10. Locality and collector as in fig. 5; x121; Mamet No. 93/8; GSC type No. 39662.
11. Locality and collector as in fig. 5; x121; Mamet No. 92/5; GSC type No. 39663.
12. Locality and collector as in fig. 5; x121; Mamet No. 93/6; GSC type No. 39664.
13. Locality and collector as in fig. 5; x121; Mamet No. 92/1; GSC type No. 39665.
14. Locality and collector as in fig. 5; x121; Mamet No. 93/1; GSC type No. 39666.
15. Locality and collector as in fig. 5; x121; Mamet No. 93/7; GSC type No. 93667.
16. Locality and collector as in fig. 5; x121; Mamet No. 92/4; GSC type No. 39668.
17. Locality and collector as in fig. 5; x121; Mamet No. 92/6; GSC type No. 39669.

18–22. *Volvotextularia mississippiana* (Cooper)

18. Ettrain Formation (Lower Limestone Unit of Nelson, 1961), 10–20 feet below top; Zone 22 or younger?, Middle Carboniferous; x121.
Peel River rapids, Yukon Territory, locality 59; collected by S. J. Nelson; section T3; Mamet No. 92/23; GSC type No. 39670.
19. Locality and collector as in fig. 18; x121; Mamet No. 92/14; GSC type No. 39671.
20. Ettrain Formation (lower), 20 feet above base; undetermined Namurian zone; x121.
Peel River, Yukon Territory, locality 58; collected by E. W. Bamber; GSC loc. C-2696; Mamet No. 161/2; GSC type No. 39672.
21. Locality and collector as in fig. 18; x121; Mamet No. 92/21; GSC type No. 39673.
22. Locality and collector as in fig. 18; x121; Mamet No. 92/27; GSC type No. 39674.

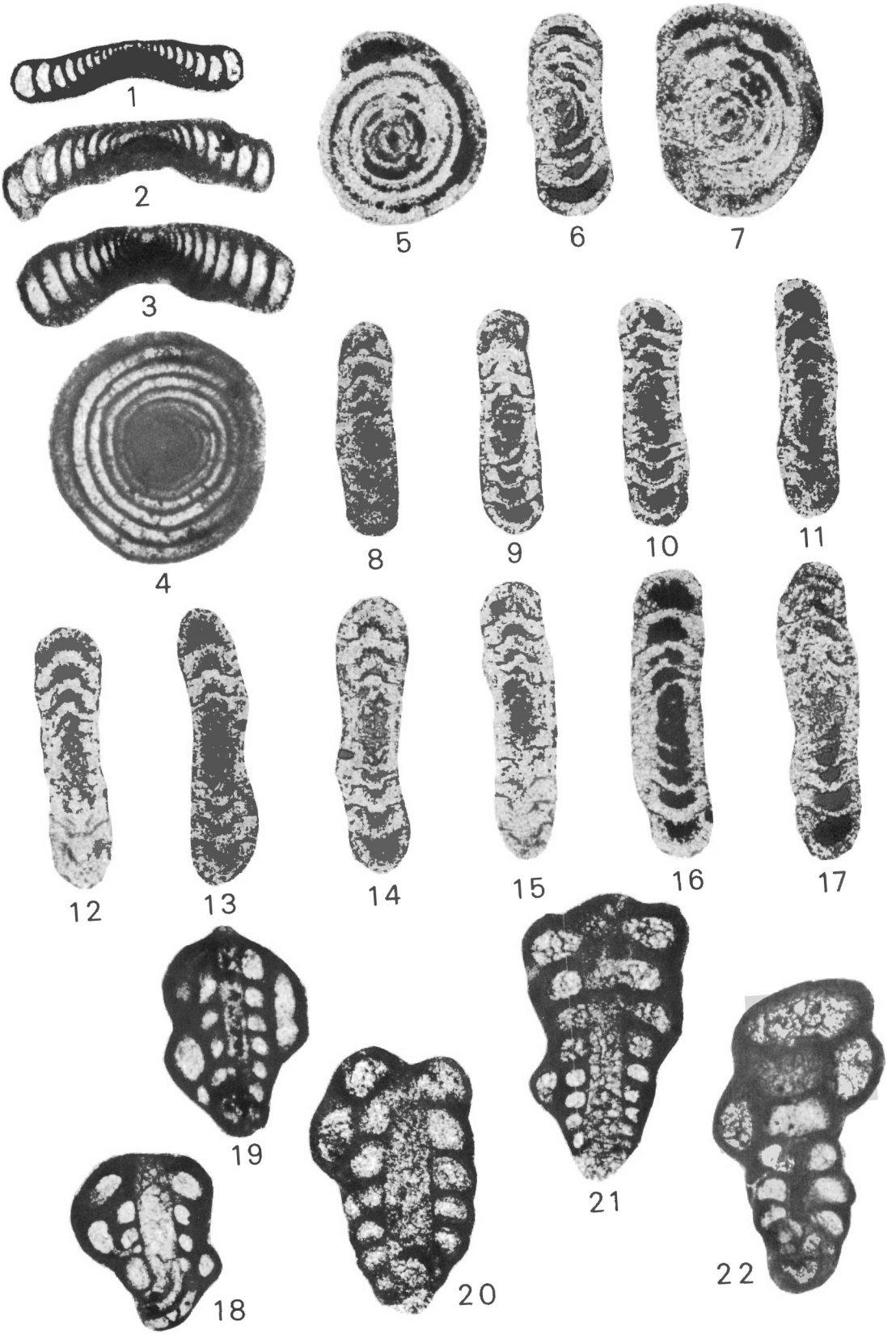

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

PLATE 89

ETTRAIN MICROBIOTA

Figure 1. *Bradyina magna* Roth and Skinner (= *?Bradyina nautiliformis* von Möller)
Ettrain Formation, 902 feet above base; undetermined post-mid-Moscovian zone; x31.
Nahoni Range, Ogilvie Mountains, Yukon Territory, locality 46a; collected by Chevron Standard Ltd.; section 6683/14; Mamet No. 270/16; GSC type No. 39675.

2. *Bradyina cribrostomata* Rauser–Tschernoussova and Reitlinger
Ettrain Formation, 852 feet above base; undetermined post-mid-Moscovian zone; x31.
Location and collector as in fig. 1; section 6683/40; x31; Mamet No. 270/15; GSC type No. 39676.

3. *Millerella* of the group *M. marblensis* Thompson emend
Ettrain Formation, 2 feet above base; Zone 21, Westphalian, Atoka age equivalent; x121.
Location and collector as in fig. 1; section 6683/74; Mamet No. 270/4; GSC type No. 39677.

Figures 4, 5. *Eoschubertella* sp.

4. Ettrain Formation, 292 feet above base; Zone 22, Wesphalian; x78.
Location and collector as in fig. 1; section 6683/63; Mamet No. 270/6; GSC type No. 39678.

5. Ettrain Formation, 292 feet above base; Zone 22, Westphalian; x78.
Location and collector as in fig. 1; section 6683/63; Mamet No. 270/7; GSC type No. 39679.

6. *Ungdarella* sp.
Ettrain Formation, 772 feet above base; undetermined post-mid-Moscovian Zone; x38.
Location and collector as in fig. 1; section 6683/18; Mamet No. 270/18; GSC type No. 39680.

7. *Neoarchaediscus grandis* (Reitlinger)
Ettrain Formation, base of formation; Zone 20, Bashkirian, Morrow age equivalent; x148.
West flank of Brown Anticline (=Cathedral Anticline), Yukon Territory, locality 8a; collected by Chevron Standard Ltd.; section 6685/46; Mamet No. 270/19; GSC type No. 39681.

8. *Tetrataxis* of the group *T. angusta* Vissarionova (*Tetrataxis acutus* Durkina)
Ettrain Formation, 70 feet below top; undetermined post-mid-Moscovian zone; x98.
Peel River, east of the Hart River junction, Yukon Territory, locality 59; collected by Chevron Standard Ltd.; section T3 630; Mamet No. 269/11; GSC type No. 39682.

9. *Climacammina* of the group *C. moelleri* Reitlinger
Ettrain Formation, 110 feet below top; undetermined post-mid-Moscovian zone; x31.
Nahoni Range, Ogilvie Mountains, Yukon Territory, locality 46a; collected by Chevron Standard Ltd.; section 6682/13; Mamet No. 270/2; GSC type No. 39683.

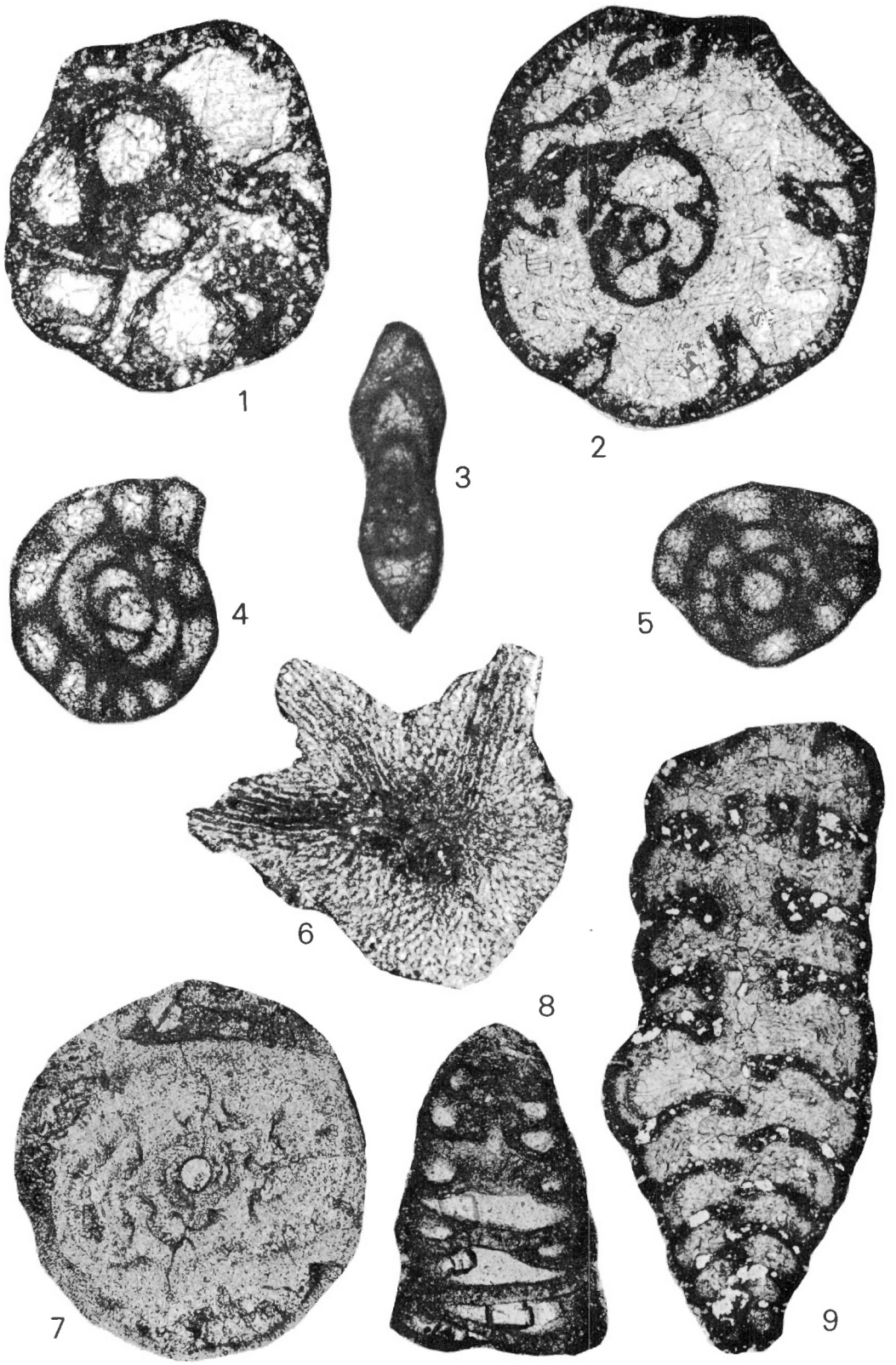

1
2
3
4
5
6
7
8
9

PLATE 90

ALAPAH LIMESTONE

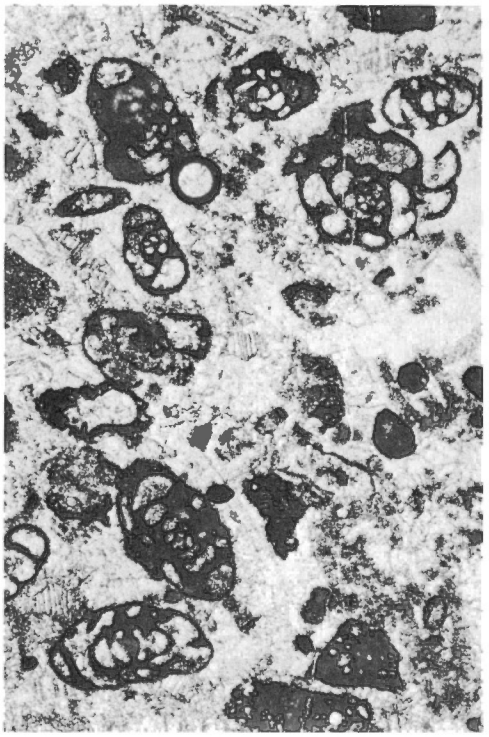
Figures 1, 2. Kayak Shale/Alapah Limestone contact; Zone 13, Middle Viséan, St. Louis age equivalent.

Recrystallized, medium-grained, foraminifer-pelmatozoan-lump grainstone; recrystallized matrix ghosts; brachiopod fragments and algal micrite coated grains; the dasyclad *Koninckopora tenuiramosa* Wood, and algal spore cases (*Calcisphaera* sp.) are present; foraminifers are *Globoendothyra paula* (Vissarionova), *Eoendothyranopsis* sp., *Skippella* sp., *Planoendothyra* sp., *Endothyra* sp., *Endothyranopis?* sp. and *Earlandia* sp.; x31.

Mount Sedgwick, Yukon Territory, locality 45; collected by E. W. Bamber; GSC loc. 53909; section 117 B-3; Mamet Nos. 97/18 and 97/30; GSC type Nos. 39684 (fig. 1), 39685 (fig. 2).

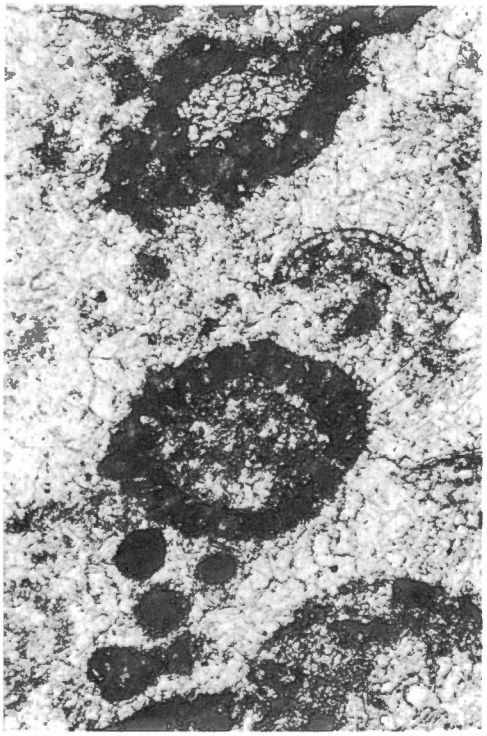


1



2

3



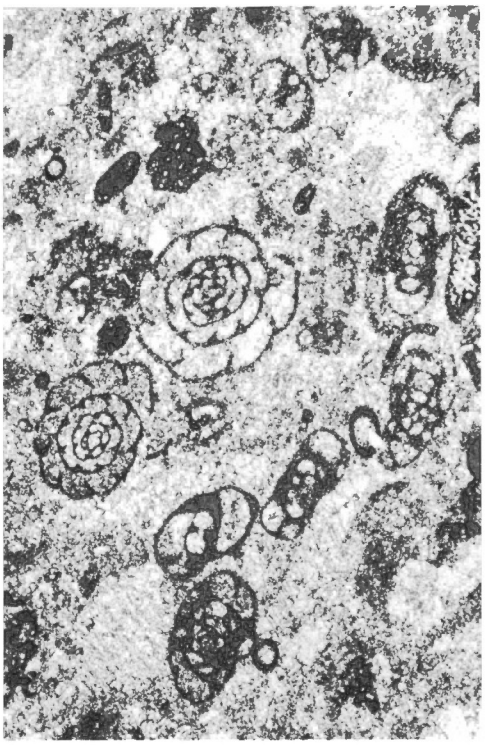
4



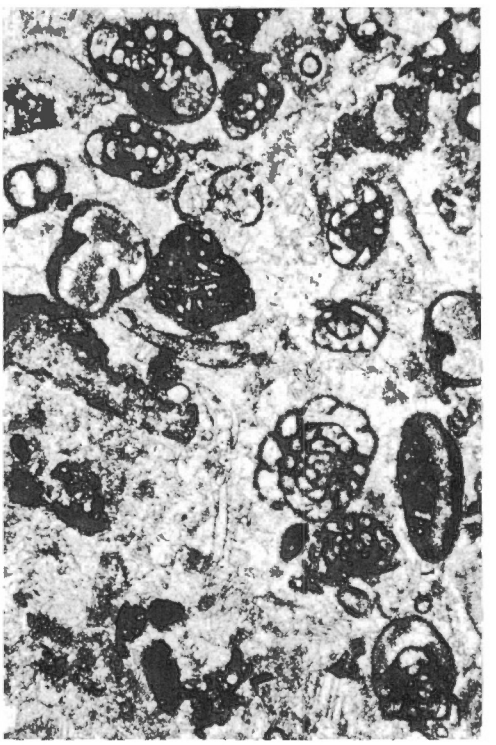
Figures 3, 4. Detail of the same sample showing the mud-filled thalli of *Yukonella bamberi* Mamet and Rudloff; x78.

Location and collector as in figs. 1 and 2; section 117 B-8; Mamet Nos. R36/3 and R36/4; GCS type Nos. 39686 (fig. 3), 39687 (fig. 4).

ALAPAH LIMESTONE



1



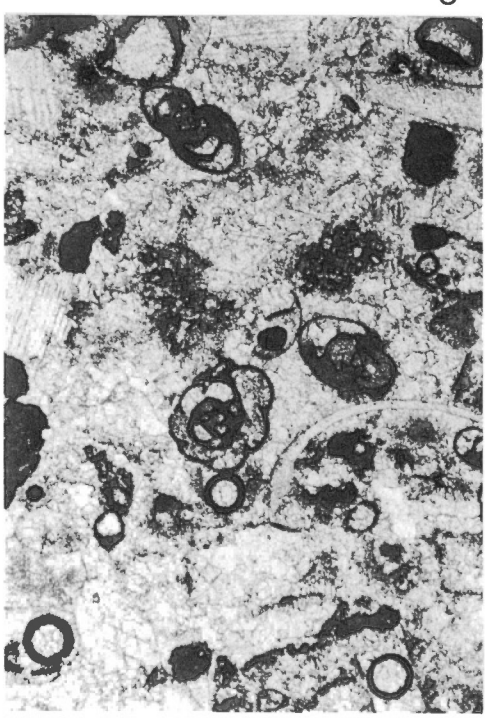
2

Figures 1, 2. Kayak Shale/Alapah Limestone contact; Zone 13, Middle Viséan, St. Louis age equivalent.

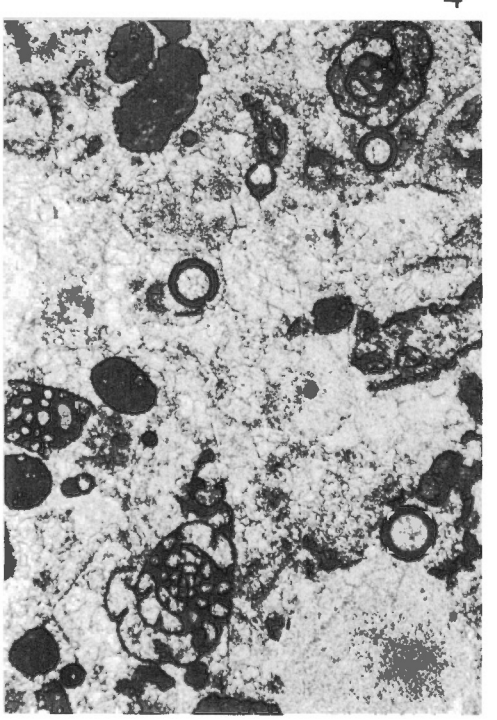
Recrystallized, medium-grained, well-sorted foraminifer-lump grainstone; matrix as ghost; algal micrite coated grains and pelmatozoans are scarce; foraminifers are *Eoendothyranopsis* of the group *E. rara* (Lebedeva), *Eoendothyranopsis scitula* (Toomey), *Skippella redwallensis* (Skipp *in* McKee and Gutschick) and *Globoendothyra* sp.; *Calcisphaera laevis* Williamson and *Calcisphaera pachysphaerica* (Pronina) are present; x38 (fig. 1), x31 (fig. 2).

Mount Sedgwick, Yukon Territory, locality 45; collected by E. W. Bamber; GSC loc. 53909; section 117 B-3; Mamet Nos. 97/20 and 97/25; GSC type Nos. 39688 (fig. 1), 39689 (fig. 2).

3



4



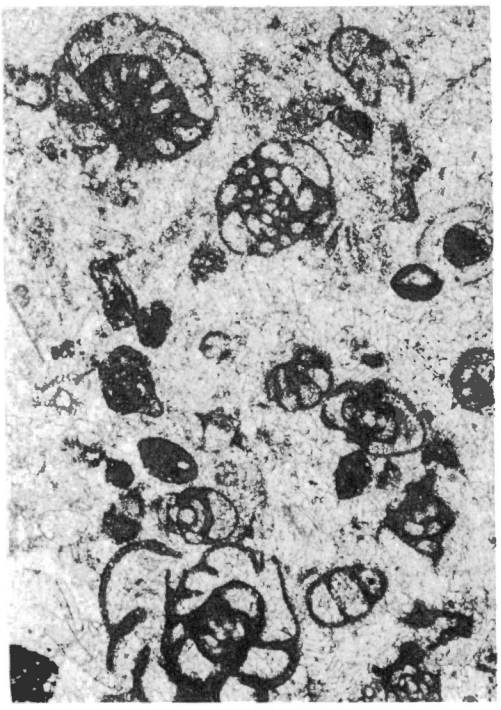
Figures 3, 4. Kayak Shale/Alapah Limestone (basal), talus sample; Zone 13, Late Viséan, St. Louis age equivalent.

Recrystallized, medium-grained, lump-foraminifer-pelmatozoan grainstone; some pellets and brachiopod debris; *Yukonella bamberi* Mamet and Rudloff is quite abundant; foraminifers are *Eoendothyranopsis scitula* (Toomey), *Eoendothyranopsis* cf. *E. macra* (Zeller) and a juvenile *Globoendothyra paula* (Vissarionova); *Calcisphaera pachysphaerica* (Pronina) is abundant; x31.

Location and collector as in figs. 1 and 2; GSC loc. 53910; section 117 B-3; Mamet Nos. 98/8 and 98/9; GSC type Nos. 39690 (fig. 3), 39691 (fig. 4).

PLATE 92

ALAPAH LIMESTONE



1



2

Figures 1, 2. Kayak Shale/Alapah Limestone (basal), talus sample; Zone 13, Late Viséan, St. Louis age equivalent.

Recrystallized, medium-grained, rather well sorted foraminifer-pelmatozoan grainstone; some lumps (mud-filled foraminifers), algal-coated grains, brachiopods, ostracodes, and algae (*Yukonella bamberi* Mamet and Rudloff); foraminifers are *Globoendothyra paula* (Vissarionova), *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva), *Eoendothyranopsis scitula* (Toomey), *Endothyranopsis* sp., *Earlandinella* sp., *Endothyra* sp., and *Parathurammina* sp.; x38 (fig. 1), x31 (fig. 2).

Mount Sedgwick, Yukon Territory, locality 45; collected by E. W. Bamber; GSC loc. 53910; section 117 B-3; Mamet Nos. 98/11 and 98/14; GSC type Nos. 39692 (fig. 1), 39693 (fig. 2).

3



4



Figure 3. Alapah Limestone, 961 feet above base; Zone 18, Early Namurian, upper Chester age equivalent.

Unevenly grained, poorly sorted, bryozoan-pelmatozoan-brachiopod packstone with *Planospirodiscus taimyricus* Sossipatrova; x38.

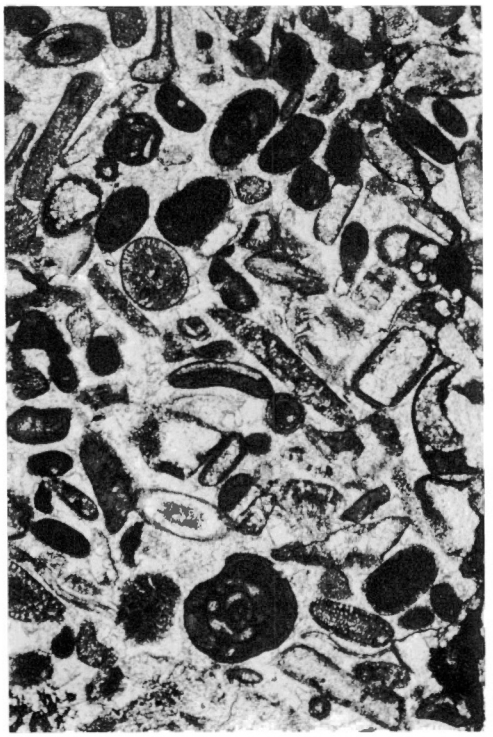
Trout Lake, Yukon Territory, locality 72; collected by Chevron Standard Ltd.; Mamet No. 179/10; GSC type No. 39694.

Figure 4. Alapah Limestone, 1,151 feet above base; Zone 18, Early Namurian, upper Chester age equivalent.

Medium-grained, pelmatozoan-lump-pellet grainstone; some bryozoans and brachiopods; crinoid ossicles slightly chertified; *Biseriella* of the group *B. parva* (Chernysheva) in the centre; x38.

Location and collector as in fig. 3; Mamet No. 179/6; GSC type No. 39695.

ETTRAIN FORMATION (WAHOO LIMESTONE EQUIVALENT)



1



2

Figure 1. Ettrain Formation (upper), 307 feet above base; Zone 21, Atoka age equivalent.

Medium-grained, rather well sorted, pelmatozoan-brachiopod-lump grainstone; oolites and pseudo-oolites present; rare algal-coated grains; foraminifers are mud filled: *Eoschubertella? yukonensis* (Ross), *Pseudoendothyra* sp., *Planoendothyra* sp., and *Globivalvulina* sp.; x31.

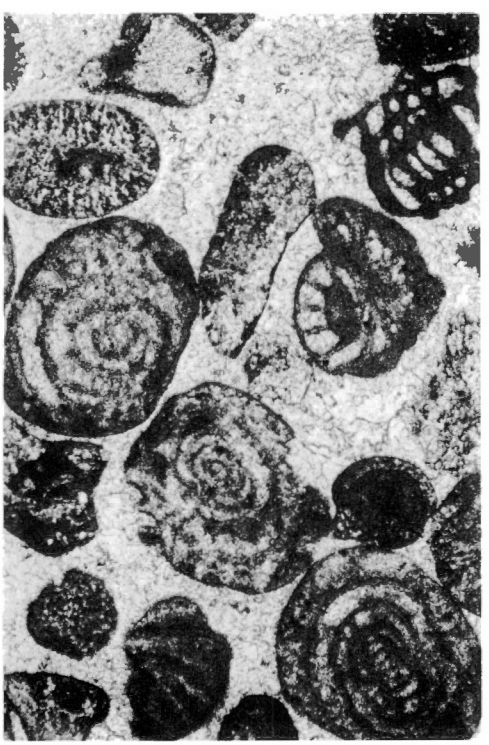
Keele Range, 24 miles SSE of Old Crow Lake, Yukon Territory, locality 52; collected by Chevron Standard Ltd.; ZB 4-63-60; Mamet No. 179/18; GSC type No. 39696.

Figure 2. Ettrain Formation (upper), 801 feet above base; Zone 21, Atoka age equivalent.

Poorly sorted, medium-grained, pelmatozoan-lump grainstone; some pellets, bryozoans, and foraminifers (*Tetrataxis* of the group *T. conica* Ehrenberg emend von Möller) are conspicuous; x38.

Location and collector as in fig. 1; ZB 4-63-75; Mamet No. 179/20; GSC type No. 39697.

3



4



Figures 3, 4. Ettrain Formation (upper), 834 feet above base; Zone 21, Atoka age equivalent.

Well-sorted, coarse-grained, pelmatozoan-oolite-foraminifer grainstone; pelmatozoans unevenly weathered; foraminifers abundant, represented exclusively by the fusulinid *Pseudostaffella* sp.; x38 (fig. 3), x31 (fig. 4).

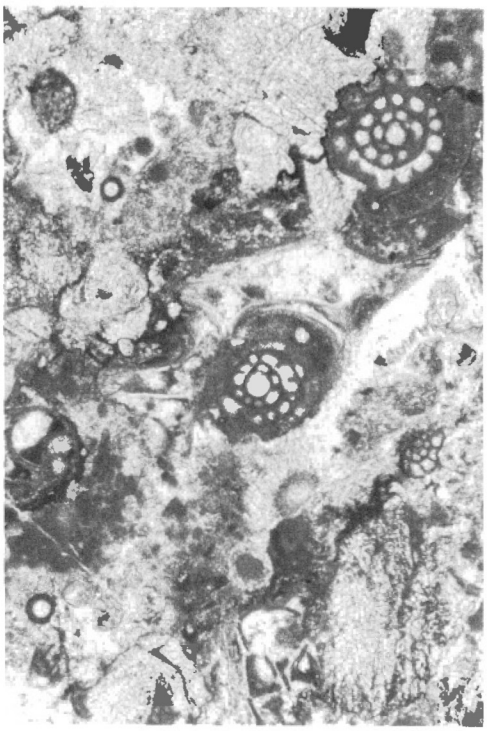
Location and collector as in fig. 1; ZB 4-63-77; Mamet Nos. 179/21 and 179/22; GSC type Nos. 39698 (fig. 3), 39699 (fig. 4).

PLATE 94

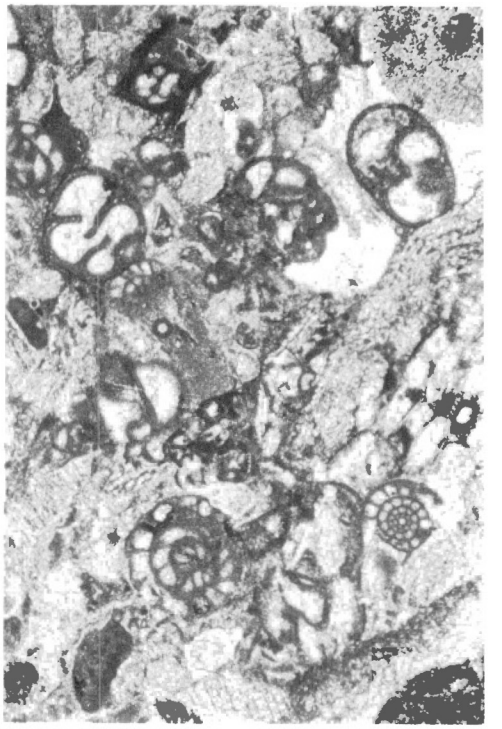
ETTRAIN FORMATION AND WAHOO LIMESTONE

Figures 1–3. Ettrain Formation (upper), 307 feet above base; Zone 21, Atoka age equivalent.
Unevenly grained, poorly sorted foraminifer-pelmatozoan grainstone; recrystallization and pressure solution widespread; crinoid ossicles with epitaxial overgrowth; most grain contacts are stylolitic; some lumps, pseudo-oolites; pellets, brachiopods and bryozoans; foraminifers, unevenly weathered, are *Globivalvulina* of the group *G. bulloides* (Brady), keeled *Pseudoendothyra* sp., *Eoschubertella?* sp., *Pseudostaffella* sp., and *Eostaffella* sp.; *Calcisphaera* sp. is present; x31 (fig. 1), x31 (fig. 2), x38 (fig. 3).
Keele Range, south of Old Crow, Yukon Territory, locality 51; collected by Chevron Standard Ltd.; ZA 4-63-10481; Mamet Nos. 179/26, 179/27, and 179/15; GSC type Nos. 39700 (fig. 1), 39701 (fig. 2), 39702 (fig. 3).

4. Wahoo Limestone, 85 feet below top; Zone 21, Atoka age equivalent.
Recrystallized, rather well sorted, coarse-grained, oolitic and pseudo-oolitic grainstone; silicified *Pseudoendothyra* sp. serve as nuclei; x31.
Malcolm River, Yukon Territory, locality 35; collected by E. W. Bamber; GSC loc. 53900; section 117 C-5; Mamet No. 79/12; GSC type No. 39703.



1



2

3



4

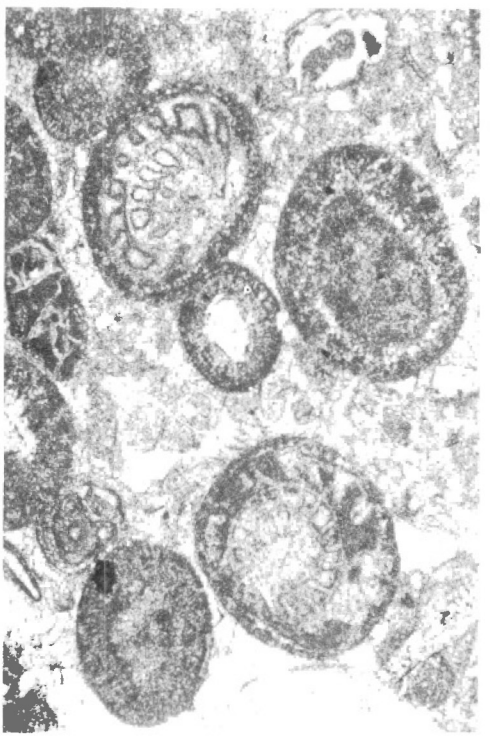


PLATE 95

ALAPAH AND ETTRAIN MICROBIOTA

Figures 1, 4. *Eoendothyranopsis scitula* (Toomey)

1. Kayak Shale/Alapah Limestone (basal), talus sample; Zone 13, Late Viséan, St. Louis age equivalent; x121.
Mount Sedgwick, Yukon Territory, locality 45; collected by E. W. Bamber; GSC loc. 53910; section 117 B-3; Mamet No. 98/6; GSC type No. 39704.

4. Locality and collector as in fig. 1; x121; Mamet No. 97/29; GSC type No. 39707.

2. *Koninckopora tenuiramosa* Wood
Locality and collector as in fig. 1; x38; Mamet No. R36/13; GSC type No. 39705.

3. *Eoendothyranopsis* of the group *E. ermakiensis* (Lebedeva)
Alapah Limestone, 3,750 feet below top; Zone 13, Middle Viséan, St. Louis age equivalent; x121.
Joe Creek, Yukon Territory, locality 32; collected by Imperial Oil Ltd.; 117 B-20; Mamet No. 204/15; GSC type No. 39706.

5. *Eoendothyranopsis* cf. *E. prodigiosa* (Armstrong)
Kayak Shale/Alapah Limestone contact; Zone 13, Middle Viséan, St. Louis age equivalent; x78.
Mount Sedgwick, Yukon Territory, locality 45; collected by E. W. Bamber; GSC loc. No. 53909; section 117 B-3; Mamet No. 97/36; GSC type No. 39708.

6. *Eoendothyranopsis macra* (Zeller)
Locality and collector as in fig. 1; x121; Mamet No. 98/9; GSC type No. 39709.

7. *Asteroarchaediscus baschkiricus* (Krestovnikov and Teodorovitch)
Ettrain Formation, 230 feet above base; Zone 20, Morrow age equivalent; x148.
Keele Range, 24 miles SSE of Old Crow Lake, Yukon Territory, locality 52; collected by Chevron Standard Ltd.; ZB 4-63-54; Mamet No. 179/12; GSC type No. 39710.

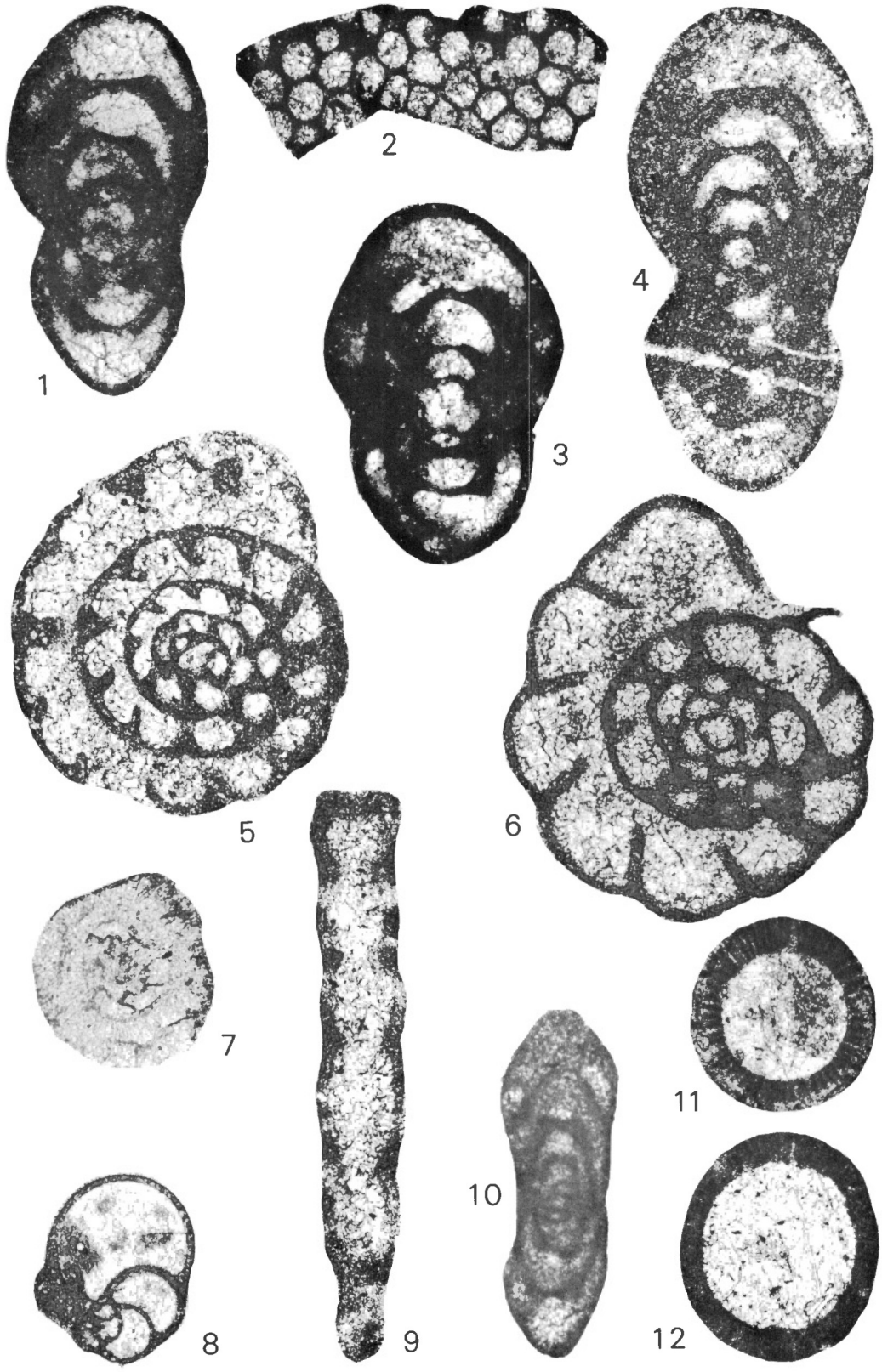
8. *Globivalvulina* of the group *G. bulloides* (Brady)
Ettrain Formation, 1,333 feet above base; Zone 21 or 22?, Atoka age equivalent or younger; x31.
Keele Range, 24 miles SSE of Old Crow Lake; Yukon Territory, locality 52; collected by Chevron Standard Ltd.; ZB 4-63-116; Mamet No. 179/24; GSC type No. 39711.

9. *Earlandinella* sp.
Locality and collector as in fig. 5; x121; Mamet No. 98/1; GSC type No. 39712.

10. *Millerella pressa* Thompson
Ettrain Formation, 230 feet above base; Zone 20, Morrow age equivalent; x121.
Keele Range, 24 miles SSE of Old Crow Lake, Yukon Territory, locality 52; collected by Chevron Standard Ltd.; ZB 4-63-54; Mamet No. 179/16; GSC type No. 39713.

11. *Calcisphaera pachysphaerica* (Pronina). (=*Pachysphaeroides* Conil OBJ)
Locality and collector as in fig. 5; x121; Mamet No. 97/31; GSC type No. 39714.

12. *Calcisphaera* sp.
Locality and collector as in fig. 11; x121; Mamet No. 97/22; GSC type No. 39715.


1
2
3
4
5
6
7
8
9
10
11
12