Micropaleontological Zonation (Foraminifers, Algae) and Stratigraphy, Carboniferous Peratrovich Formation, Southeastern Alaska
Micropaleontological Zonation (Foraminifers, Algae) and Stratigraphy, Carboniferous Peratrovich Formation, Southeastern Alaska

By BERNARD L. MAMET, SYLVIE PINARD, and AUGUSTUS K. ARMSTRONG

U.S. GEOLOGICAL SURVEY BULLETIN 2031
CONTENTS

Abstract 1
Introduction 1
Previous work 3
Acknowledgments 3
Regional geologic setting 4
Tectonic setting 4
Stratigraphy of the Peratrovich Formation 4
Cherty spiculite and radiolarite member 4
Lower cherty limestone member 6
Lower limestone member 6
Upper cherty limestone member 7
Upper limestone member 7
Sedimentary Carboniferous environments of southeast Alaska 7
Stratigraphic distribution of the sedimentary environments 8
Stratigraphic distribution of microfossils 10
Micropaleontological zonation and occurrences elsewhere 10
Paleobiogeographic concepts 16
Discussion and conclusions 18
Summary 20
References cited 21
Index 28

PLATES

[Plates 1–16 follow the index; plates 17–20 in pocket]

1. Brunsia, Earlandia, Eoforschia, "Hemigordius", Pseudoammodiscus, Pseudoglomospira, Septatournayella?
2. Endothyra, Eoforschia
3. Endothyra, Endothyranella, Planendothyra, Priscella
4. Globoendothyra, Omphalotis
5. Eoendothyranopsis
6. Endothyranopsis, Eoendothyranopsis
7. Endothyranopsis
8. Bradyina, Janischewsksina, Spinothyra
9. Bradyina, Janischewsksina
10. Eostaffella, Eostaffellina, Mediocris, Millerella
11. Eostaffella, Millerella, Pseudoendothyra, Zellerinella
12. Eolasiodiscus, Howchinia, Monotaxinoides, Tetrataxis
13. Bisertiella, Climacammina, Cribrostomum, Deckerella, Globivalvulina, Palaeotextularia
15. Archaeodiscus, Asteroarchaediscus, Neoarchaediscus, Planospirodiscus
16. Bituberitina, Diplosphaerina, Earlandia, Glomospirides, Insolentitheca, Pseudoglomospira, Volvotextularia
17. Stratigraphic distribution of microfossils from the Peratrovich Formation In pocket
18-20. Measured sections and distribution of major constituents of:
18. Sections X-1, Peratrovich Island, and X-2, Klawak Island  **In pocket**
19. Sections X-7, X-8, and X-9, Shlikof Island  **In pocket**
20. Sections X-6, Toti Island, X-11, Madre de Dios Island, and X-12, Ladriones Island  **In pocket**

FIGURES
1. Index map showing islands where the Peratrovich Formation is mapped, southeast Alaska  2
2. Photograph of typical exposure of Peratrovich Formation along shore of Ladriones Island  3
3. Correlation of schematic lithostratigraphic and biostratigraphic sections of Peratrovich Formation  5
4. Sequence of depositional facies in the Peratrovich Formation  9
5. Foraminiferal species/genus ratio of the Peratrovich microfauna compared to those of the Taymir-Alaska and Tethys domains  17
6. First occurrences of selected microfossils in foraminiferal zones for three different domains  17
7. Diachronic acmes of Eostaffellidae and *Eoendothyranopsis* in three realms during the Visean  18
8. Examples of zone and stage limits of foraminifers in three domains  19
9. Stratigraphic distribution of the chlorophyte *Koninckopora* in Tethys realm and three regions of North America  20
Micropaleontological Zonation (Foraminifers, Algae) and Stratigraphy, Carboniferous Peratrovich Formation, Southeastern Alaska

By Bernard L. Mamet¹, Sylvie Pinard², and Augustus K. Armstrong³

ABSTRACT

Stratigraphic, petrographic and micropaleontologic studies of the carbonate sequences of the Mississippian Peratrovich Formation define five informally named members (ascending): cherty spiculite and radiolarite member, lower cherty limestone member, lower limestone member, upper cherty limestone member, and upper limestone member. They define a shoaling-upward sequence having a minimum aggregate thickness of 560 m. The basal part of the formation has no microfossils, and its age cannot be assigned with precision. The first datable bed is late Tournaisian in age (Zone ~9). It is succeeded by beds of Visean (Zones ~10, 13, 14, 15, 16i, 16j), early Namurian (Zones 17, 18) and debatable Namurian (?) age. The affinities of the Peratrovich fauna and flora are as much Tethyan as American, and thus the microfauna forms a bridge between the two domains. Biostratigraphy suggests a Tethyan origin for most of the Carboniferous microfauna, which migrated in successive waves toward North America. This mixed fauna permits reconstruction of the Carboniferous paleogeography and imposes constraints on tectonic models for the North American Cordillera.

INTRODUCTION

Calcareaeous foraminifers were recognized during the middle of this century by the Russian school (Rauzer-Chernoussova, 1948a–i) as useful tools for identifying zonation. By the 1960’s, they were routinely used for biostratigraphy in Western Europe and in Russia (Mamet, 1962; Conil and Lys, 1964). In North America, Zeller (1957) first recognized the stratigraphic value of these fossils. Subsequently, several authors extended this kind of zonation to the North American Cordillera (Armstrong, 1958; Woodland, 1958, Skipp, 1969; Sando and others, 1969; Mamet and Gabrielse, 1969; Petryk and others, 1970; Armstrong and others, 1970; Mamet and Armstrong, 1972; Brenckle, 1973; Mamet, 1975a; Rich, 1980, 1982; Groves, 1983; Beauchamp and Mamet, 1985; Mamet and others, 1987).

In the Cascade Ranges of the western North America Cordillera, eugeosynclinal deposits are known from southeastern Alaska to California (Irwin, 1972). They transect the states of Washington (Danner, 1970) and Oregon to form an outer belt of the Cordillera, which Monger and others (1972) called the “island belt.” The faunas identified in these deposits reflect an association of both American and Tethyan faunas and are of special interest for Mississippian (early Carboniferous) paleogeographic reconstructions.

The Peratrovich Formation crops out as small disconnected faulted inliers in the Prince of Wales Island region (fig. 1), which is part of the Alexander Archipelago of southeastern Alaska. The main purpose of this report is to establish in the Peratrovich a micropaleontological zonation based on foraminifers, similar to that defined by Mamet and Skipp (1970), and to correlate eight stratigraphic sections. These sections were measured and collected by Armstrong on Klawak, Ladrones, Madre de Dios, Peratrovich, Shelikof, and Toti Islands off the west coast of Prince of Wales Island (pls. 18–20). The best Peratrovich exposures are along the coast between low and high tide lines, and access to them is by boat (fig. 2).

This stratigraphic study is based on about 900 thin sections from Armstrong’s collections. In addition to identifying specimens for biostratigraphic purposes, the study
Figure 1. Index map showing islands where Peratrovich Formation (coarse dots) is mapped, southeast Alaska. Overlying Ladrones Limestone or Klawak Formation (ruled) also shown in some areas. Geology from Eberlein and others (1983).

2 Micropaleontological Zonation (Foraminifers, Algae) and Stratigraphy, Carboniferous Peratrovich Formation, Southeastern Alaska
has permitted establishment of a sedimentary model for the
sequence of carbonate rocks in the Peratrovich Formation.

PREVIOUS WORK

Early in this century, the Prince of Wales Island re­
gion was the object of a preliminary series of geologic in­
vestigations directed toward two distinct sectors: one for
mining exploration, and the other for stratigraphic studies.
In the economic sector, systematic reconnaissance work
was initiated by Brooks (1902), Wright and Wright (1908),
Smith (1914), and Buddington (1923). In the field of stra­
tigraphy, faunal lists were compiled first by Kindle (1907),
then by Edwin Kirk, G.H. Girty, and Rudolf Ruedemann
(in Buddington and Chapin, 1929); a systematic study of
the brachiopods was undertaken by Kirk (1922, 1925,
1926). These early studies ended with the regional work of
Buddington and Chapin (1929).

Mining exploration, related to strategic metals, was
briefly revived from 1941 to 1944 (Kennedy and Walton,
1946; Twenhofel and others, 1946, 1949; Warner and oth­
ers, 1961).

In 1947, G.D. Eberlein initiated a second series of
stratigraphic investigations by the U.S. Geological Survey.
He extended the compilation of the geologic maps of
Sainsbury (1960) and Condon (1961) toward the south.
Subsequently, Eberlein and Churkin (1970) divided the
Paleozoic rocks exposed on the northwestern coast of
Prince of Wales Island into 10 new formations, which they
described in detail. Churkin and Eberlein (1975b) also
published a 1:63,000-scale map of the Craig C-4 quadran­
gle region. Herreid and others (1978) added a geologic
map of the vicinity of the Craig A-2 quadrangle to the
compilation of stratigraphic data of southeastern Alaska.
Eberlein and others (1983) compiled a geologic map of
the entire Craig quadrangle, and Gehrels and Berg (1984)
compiled one of southeastern Alaska.

On the purely paleontological side, additional faunal
lists were published by Ovenshine and Webster (1970) and
by J.G. Johnson (in Ovenshine and Webster, 1970). Sev­
eral other publications illustrate the Paleozoic fauna. They
include the description of Late Silurian brachiopods (Kirk
and Amsden, 1952) and of Late Ordovician, Silurian, and
Early Devonian graptolites (Churkin and Carter, 1970;
Churkin and others, 1970, 1971). The Ordovician, Siluri­
an, and Devonian corals were described by Tchudinova
and others (1974) and by Oliver and others (1975). The
corals of the Peratrovich Formation were studied by Arm­
strong (1970). Later, Armstrong (1975) compared the Pe­
atrovich corals with those of the Lisburne Group in
northern Alaska and found certain similarities between the
two faunas. It should be noted that Girty (in Buddington
and Chapin, 1929) had also noticed these similarities.

Systematic descriptions of Devonian conodonts were
published by Savage (1977a, b, 1981b) and Savage and
others (1977). Ordovician conodonts were described by
Savage and Savage (1980), and Pennsylvanian conodonts
by Savage and Barkeley (1985). Simultaneously, Savage
(1981a) and Savage and others (1978) described Devonian
brachiopods. Several theses, supervised by Savage, discuss
the Late Devonian conodonts (Hobbert, 1980), the cono­
donts of the Peratrovich Formation (Faulhaber, 1977), the
Pennsylvanian conodonts (Barkeley, 1981), and the brachi­
opods of the Klawak Formation (Vaskey, 1982).

Foraminiferal studies, almost ignored in this area,
were initiated by Douglass (1971), who described the
Pennsylvanian fusulinids.

ACKNOWLEDGMENTS

Field work and stratigraphic sampling were done in
the summer of 1966 by A.K. Armstrong while working in
a U.S. Geological Survey field camp headed by G.D.
Eberlein and Michael Churkin, Jr. This project was initia­
ted and supervised by George Gryc.

A scholarship from the Natural Sciences and Engi­
neering Research Council of Canada enabled Sylvie Pi­
nard to study these collections under the direction of
Bernard L. Mamet at the University of Montreal. She
wrote a Master’s thesis (1982) on which part of this publi­
cation is based.

Figure 2. Typical shoreline and dense conifer forest, Ladrone­
Island, Alaska. Collecting and studies of the Peratrovich For­
mation were made between low and high tide levels where
rocks are free of soil and vegetation. Field studies were done
from outboard motor boats.

Acknowledgments 3
REGIONAL GEOLOGIC SETTING

On Prince of Wales Island, the Wales Group, consisting of metamorphic rocks, forms the pre-Late Cambrian basement. In the Alexander Archipelago of southeast Alaska, the Wales Group is overlain by a thick sequence of Paleozoic volcanic and sedimentary rocks, estimated at more than 3,000 meters thick by Eberlein and Churkin (1970) and currently referred to as the Alexander terrane. This sequence is exposed on the Prince of Wales Island and on Kuiu, Kupreanof, Admiralty, and Chichagof Islands to the north-northwest. It occupies a north-northwest-trending structural element, flanked on both sides by Mesozoic assemblages.

The Paleozoic strata are Ordovician to Permian in age. The Mississippian rocks consist of the Peratrovich Formation, the Saginaw Bay Formation (part), and the Iyoukeen Formation (Loney and others, 1975).

The Peratrovich Formation at its type locality is exposed in a syncline plunging to the south and faulted on the east side. Despite the fact that the upper and lower contacts are covered, Eberlein and Churkin (1970) consider them to be regionally concordant. The Peratrovich Formation overlies the Devonian Wadleigh Limestone and is overlain by the Pennsylvanian Klawak Formation and Ladrones Limestone.

TECTONIC SETTING

The enigmatic assemblages of rocks and faunas composing the rim of the Pacific, of which the Peratrovich Formation is a part, have given rise to several interpretations.

Before the advent of plate tectonics, Eardley (1947) and Kay (1947) interpreted the Precambrian and Paleozoic rocks as representing autochthonous volcanic arcs developed in a relatively fixed position in the outer part of the Cordilleran geosyncline. Later, other classic eugeosynclinal models were described by White (1959) and by Brew and others (1966).

More recently, three kinds of models have been proposed. The first suggests that various tectonic terranes derived from fragments of Asia, or from a landmass drifting in the paleo-Pacific, finally collided with the North American continent (Wilson, 1968; Danner, 1970; Moores, 1970; Nur and Ben-Avraham, 1977; Brandon, 1980). The second model involves large displacements along transform faults (Monger and Ross, 1971; Monger and others, 1972; Jones and others, 1972; Berg and others, 1972; Irwin and Yole, 1972; Tempelman-Kluit, 1979). In the third model, a group of continental microplates and para-autochthonous island arcs are displaced with respect to North America; this leads to the opening and closing of basins during the Paleozoic, followed in the Mesozoic by displacements along transform faults (Churkin, 1974; Churkin and Eberlein, 1975a). In this paper, we show that the third model is more consistent with the microfaunal data.

STRATIGRAPHY OF THE PERATROVICH FORMATION

The Peratrovich Formation is the name given by Eberlein and Churkin (1970) for the Mississippian rocks exposed in the area of Craig, Alaska. This formation consists of fossiliferous limestones and dolomites. Chert nodules occur throughout the sequence, whereas bedded dark-gray cherts occur only in the lower part. Eberlein and Churkin (1970) divided the formation into three informally named members: the cherty member, the cherty limestone member and the limestone member. We here divide the formation into the following five informally named members (ascending): cherty spiculite and radiolarite member, lower cherty limestone member, lower limestone member, upper cherty limestone member, and upper limestone member (fig. 3).

According to Eberlein and Churkin (1970) and Churkin and Eberlein (1975b), the formation reaches a thickness of 275 to 300 meters. Armstrong (1970) suggested a similar figure, 330 m, based on sections measured on Madre de Dios, Shelikof, and Toti Islands. The estimate of 1,100 m proposed by Faulhaber (1977) is based on measured stratigraphic sections and on conodont intervals. Our study, based on the zoning of foraminifers, indicates a minimum thickness of 560 m. The limestone and cherty limestone members are repeated twice, adding 230 m to Armstrong’s estimate (1970). The complex tectonics of the region are not well understood, and the thickness of the radiolitrites within the basal part of the formation is not known.

Dunham’s classification (1962) of carbonate rocks, modified by Embry and Klovan (1971) is used in this report. Graphic illustrations of eight measured stratigraphic sections, accompanied by estimates of the abundance of carbonate particles and fossil bioclasts, are shown in plates 18-20. Stratigraphic correlation of these sections is shown in figure 3.

Cherty spiculite and radiolarite member

The contact between the Peratrovich Formation and the underlying Wadleigh Limestone is not exposed on Peratrovich Island. In the Madre de Dios and Shelikof Islands...
## STRATIGRAPHIC SECTIONS AND DESCRIPTION

<table>
<thead>
<tr>
<th>SYSTEMS</th>
<th>STAGE</th>
<th>SUBSTAGE</th>
<th>GLOBAL ZONAL/PERILOCAL ZONAL GEOLOGICAL TIME</th>
<th>AGGREGATE MEASURED THICKNESS (METERS)</th>
<th>SUBUNIT</th>
<th>MEMBER</th>
<th>FORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboniferous</td>
<td>Mississippian</td>
<td>Viséan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td>Pennsylvanian</td>
<td>Bashkirian</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Namurian</td>
<td>Namurian</td>
<td>Early</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Namurian</td>
<td>Early</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STACHEIINAE BRECCIA
- Second level of Waulsortian reefs
- First level of Waulsortian reefs

### COARSE LITHOCLASTIC GRAINSTONES
- With Donezella and Cuneiphycus
- Ungdarella-Komia boundstones

### LIMESTONES WITH MUD-COATED GRAINS
- Climacammina, and lithoclasts

### UNGDARELLA AND KONINCKOPORA LIMESTONES
- Cherty limestones with mudstone matrix

### BRUNSIAS FACIES
- Alternation of gray dolomites and limestones

### ALTERNATION OF DARK-GRAY DOLOMITES AND LIMESTONES
- Foraminiferal limestone and nodular chert

### CHERTIFIED LIMESTONE AND DOLOMITE

### EXPLANATION

<table>
<thead>
<tr>
<th>COMPOSITION (IN PERCENT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chert</td>
</tr>
<tr>
<td>Shale</td>
</tr>
<tr>
<td>Foraminiferal zones</td>
</tr>
<tr>
<td>Recognized by presence</td>
</tr>
<tr>
<td>or absence of specimens</td>
</tr>
<tr>
<td>from section</td>
</tr>
<tr>
<td>Cherty</td>
</tr>
<tr>
<td>Spiculite and radiolarite</td>
</tr>
</tbody>
</table>

---

1 Global foraminiferal zones based on Mamet and Skipp (1970) and Mamet (1975a)

---

Stratigraphy of the Peratrovich Formation 5
areas, the base of the cherty spiculite and radiolarite member seems to be concordant with the calcareous tuff found in the uppermost part of the Port Refugio Formation (Eberlein and Churkin, 1970).

This lowermost member of the Peratrovich is composed of thin beds of black chert interbedded with black silty shale. The thickness of the chert beds and the amount of chert decrease toward the top of the member. Beds of lenticular micritic limestones are found in the lowermost part of section X-7 on Shelikof Island, where the measured section is 90 m thick. Here the upper part of the member is dolomitized and contains chert nodules. Armstrong (1970) assigned that dolomite to the cherty limestone member of Eberlein and Churkin (1970).

The cherty member of Eberlein and Churkin (1970) is, in part, equivalent to our cherty spiculite and radiolarite member and is estimated to be about 65 m thick. Armstrong (1970), Churkin and Eberlein (1975b), and Vaskey (1982) confirm this thickness. However, Faulhaber (1977) notes 230 m of exposed Devonian Wadleigh Formation and the presence of 750 m of Mississippian radiolarians on the east coast of Wadleigh Island.

The lower part of the cherty spiculite and radiolarite member is devoid of fossils except for sponge spicules and radiolarians. Armstrong (1970) indicated a probable Kinderhookian and (or) Osagean age for the rocks of this part of the member. The dolomites of the upper part of the member contain abundant echinoderms, sponge impressions, and a few corals and brachiopods. Armstrong (in Eberlein and Churkin, 1970) assigned a Touraisian (Osagean) age for the upper part of the member, based on the assemblage of the foraminifers Septaglomospiranella sp., Septabrasiniina sp. and Endothyra sp. Faulhaber (1977) confirms this age by the presence of the conodonts Gnathodus bulbosus, G. texanus pseudosemiglaber and Taphrognathus varians. The uppermost limestones (Eberlein and Churkin, 1970; Armstrong, 1970) include several foraminifers, including Archaeodiscus sp. and Globoendothyra sp., which indicate a Visean (Meramecian) age.

**Lower cherty limestone member**

The lower cherty limestone member is at least 190 m thick, and about 25% of it is nodular chert. In most of the beds the chert appears to selectively replace the limestone while preserving the sedimentary structures and textures.

This member is divided into two subunits (fig. 3) on the basis of the amount of dolomite present. The lower subunit is composed of chertified limestones and abundant dolomites. On Shelikof Island as much as 80 percent of the rock in section X-7 may be dolomite. This subunit is also found in the lower part of sections X-6 and X-9 on Toti and Shelikof Islands, respectively, where the dolomites are less abundant. The limestones are generally packstones with abundant echinoderms and bryozoans and smaller amounts of peloids.

The presence of corals (Rugosa) is recognized throughout this member. Armstrong (1970) illustrated several new species from this subunit of the member, notably Diphyphyllum venosum, D. klawockensis, Stelechophyllum? birdi, and Faberophyllum girtyi, associated with Lithostratium (Siphonodendron) warreni, Acrocyathus pennsylvanicum, Ekvasyophyllum cf. E. inclinatum, E. williamsi, Stelechophyllum? aff. S.? maclareni, and Thysanophyllum astraeiforme, all Meramecian (Visean) in age. (Updated names from Sando’s (1983) generic classification of rugose corals are used in this report.)

The upper subunit (foraminiferal chertified limestone with Issinella and Koninckopora?) occurs in the upper parts of sections X-6, X-7, and X-9 on Toti and Shelikof Islands, in the lower half of section X-11 on Madre de Dios Island, and in the basal part of section X-8 on Shelikof Island. The limestones consist mainly of packstones and wackestones with algae (Issinella and Koninckopora?) and echinoderms and grainstones with Issinella. Ooids also characterize this subunit of the member.

In addition to the corals reported above, two species described for the first time by Armstrong (1970), Faberophyllum girtyi and Sciophyllum alaskaensis, were found with Lithostratium (Siphonodendron) sp. and Stelechophyllum banifensis. These corals are also characteristic of the Visean (Meramecian).

**Lower limestone member**

The lower limestone member is characterized by limestones that are interbedded with massive dolomite and chert. Chert nodules are rare and limited to the dolomite beds. This sequence is about 120 m thick and constitutes the upper half of section X-11 on Madre de Dios Island and much of the lower part of section X-8 on Shelikof Island. Armstrong (1970) estimated a thickness of 130 m, which is close to our measurements. His studies indicate that the lower limestone member is correlative with the lower part of the limestone member of Eberlein and Churkin (1970). We have subdivided this member into three subunits (fig. 3).

The lower subunit, the thickest of the three, is characterized by alternation of massive dark dolomites and limestones with Issinella and Koninckopora. These limestones are wackestones with brachiopods, echinoderms, algae, and foraminifers; they are associated with bafflestones containing Issinella and (or) Kamaena. Some packstones also include echinoderms, bryozoans, brachiopods and foraminifers.

The middle subunit marks the appearance of the light-gray shallow-water facies, an alternation of massive dolomites and light limestones with Issinella and Koninckopora.
This subunit includes the rock and fossil types of the lower subunit as well as packstones and wackestones composed of pellets, echinoderms, calcispheres and foraminifers. Grainstones formed by oolites, pellets, algae, echinoderms, brachiopods, byrozoans, and foraminifers are also common.

The upper subunit, the *Brusnia* facies, is composed of pelloid wackestones and packstones of ooids, echinoderms, brachiopods, and byrozoans; *Brusnia* is abundant.

Armstrong (1970) observed that corals are less abundant in the rocks of the lower limestone member than in the lower cherty limestone member. He identified *Fabero­phyllum, Petalaxis,* and *Stelechophyllum.* Faulhaber (1977) reported several genera among the conodonts: *Cavus­gnathus, Gnathodus, Hindeodella, Neoprioniodus, Ozarko­dina, Polygnathus,* and *Spaghnomithactus*—a Meramecian assemblage (equivalent to the Visean).

**Upper cherty limestone member**

The upper cherty limestone member is composed of limestones with minor amounts of dolomite, interbedded with beds of chert nodules. Carbonate beds are thin to medium in thickness. This member forms the upper part of section X-8 on Shelikof Island and the lower part of section X-1 on Peratrovich Island. It is 110 m thick and is divided into three subunits (fig. 3).

The lower subunit is a 10-m-thick cherty limestone with a lime mudstone matrix. The carbonate rocks are pel­let-, *Kamaena-* echinoderm-, brachiopod-, byrozoan-, cor­al-bearing wackestones.

The middle subunit is a limestone with *Ungdarella* and *Koninekopora* and is composed of echinoderm-, *Koninekopora, Ungdarella,* and foraminifer-bearing pack­stones and echinoderm-, pelleteoid-, and foraminifer-bearing wackestones. Chert nodules are abundant.

The upper subunit is a limestone with mud-coated grains, *Climacocammina,* and lithoclasts. The limestones are composed of mud-coated grains and echinoderm-, pellet-, byrozoan-, brachiopod-, and foraminifer-bearing grain­stones and packstones associated with boundstones that include *Ungdarella* and *Komia.* Foraminifers and algae indicate a late Visean to early Namurian age for these rocks.

**Upper limestone member**

The upper limestone member is a light-gray limestone that has less dolomitic limestone than the lower members and includes light-gray to brown chert beds. The member consists of a composite sequence formed by the upper part of section X-1 on Peratrovich Island, section X-2 on Klawak Island, and the lower part of section X-12 on Ladrones Island, having a total thickness of about 80 m. Armstrong (1970) indicated that the rocks of the member are correla­tive with the upper part of the limestone member of Eber­lein and Churkin (1970), and those reports give a thickness of 80 to 100 m for the rocks of our upper limestone mem­ber. Faulhaber (1977) indicated that the upper limestone member is 45 m thick at the type section at the south end of Peratrovich Island and that an additional 30 to 50 m of the member is present below the Klawak Formation. We divid­ed the member into two subunits (fig. 3).

The lower subunit is characterized by coarsely crys­talline lithoclast grainstones. The bioclasts are fragments of echinoderms, brachiopods, and byrozoans in a pelletoi­dal matrix. Boundstones are present in the subunit and are formed by *Ungdarella.* The top of this subunit is marked by an erosional surface.

The upper subunit is composed of massive *Ungdarel­la-* and *Komia*-bearing boundstones. Its basal bed consists of wackestones with byrozoans, *Ungdarella,* and *Komia* in a pelletoid matrix. The upper part of this subunit consists of *Ungdarella-* and *Komia*-bearing boundstones interbed­ded with packstones and grainstones containing lithoclasts and bioclasts. This subunit is bound at the top and the base by erosional disconformities.

A discordant contact probably separates the Peratrovich Formation from the Klawak Formation on Peratrovich Island. The field data of Eberlein and Churkin (1970) in the region of the type locality indicate a concordant contact. Subsequently, Armstrong (1970) and Churkin and Eberlein (1975b) indicated the probable presence of a paraconformity. Savage and Barkeley (1985) recorded no Late Mississippian conodont holdovers in the lowest samples of the Klawak and suggested a hiatus between the Peratrovich Formation and the overlying sequence. However, the conodont assemblage of the basal part of the Klawak Formation is stratigraphically not very specific. Savage and Barkeley (1985) report *Idiognathoides noduliferus* and *Neognathodus bothrops,* two species having a wide range from the Morrowan to the Atokan. On the Ladrones Islands, the Peratrovich Formation is overlain by the Ladrones Limestone, and a paraconformity separates these two units (Armstrong, 1970; Eberlein and Churkin, 1970; Faulhaber, 1977; Barkeley, 1981).

In the upper limestone member, Armstrong (1970) reported the presence of the foraminifers *Pseudoendothyra* sp., *Neoarchaeodiscus* spp., *Bradyina* spp., *Archeodiscus* spp., and *Millerella* sp., and a new species of coral indicating a Chesterian age (Namurian or younger). Faulhaber (1977) noted the occurrence of conodonts from the middle and late Chesterian, notably *Gnathodus girtyi simplex* and *Cavusgnathus alius.* We show herein that part of the mem­ber is indeed Chesterian in age and that the uppermost part has a mixed foraminiferal assemblage.

**SEDIMENTARY CARBONIFEROUS ENVIRONMENTS OF SOUTHEAST ALASKA**

Eight sedimentary environments have been recog­nized in the Carboniferous sequence of southeastern Alaska.
and are portrayed below in order of decreasing bathymetry. This depositional model is compared to Wilson's asymmetrical model (1975) and Mamet's model (1972b).

Euxinic basin—This facies is characterized by silicified lime mudstones, wackestones, and associated bedded and nodular black cherts (radiolarites) and organic-rich pyritic black shales. The thin beds exhibit weak cross laminations and fine, regular laminations. The fauna are limited to radiolarians associated with a few rare spicules, ammonoids, and ostracodes.

Marginal basin—As in the preceding environment, silicified lime mudstones and wackestones are common, accompanied by black shales and cherts. The limestones are pyritic, argillaceous, and euxinic. Nodular limestones appear in the uppermost part of this sequence. The fauna are restricted and include rare radiolarians, abundant sponge spicules, and ostracodes. Spicules are common.

Pelmatozoan meadows—This carbonate platform or ramp facies is composed of echinoderm packstones. Ossi

cles that are not abraded indicate that the debris accumulated in place. Spicules are rare and are found in chert nodules. Deposition was below the zone of wave action.

Open-marine platform with echinoderms and bryozoans (below the zone of wave action)—Limestones of this platform are primarily echinoderm and bryozaon packstones and wackestones. Fenestellid bryozoans are everywhere, and their fronds are still intact. Plurilocular foraminifers (Tetrataxidae) occur for the first time. These carbonate strata developed below or at the base of the wave-action zone. In this environment, fenestellid bafflestones form Waulsortian mounds, which are common in the Klawak Formation but are not known in the Peratro

vich Formation.

Open-marine platform (zone of wave action)—Brachiopods and red algae (rhodophytes) are added to the previous faunal assemblage in this environment. The carbonate rock types are wackestones, packstones, grainstones, and reworked fragments of boundstones. Lithoclasts and allochthonous debris show signs of abrasion.

Fore barrier (zone of wave action)—The fore-barrier environment is shallower than the open-marine platform and is characterized by great faunal and floral diversity associated with channelized ooid grainstones. In addition to the preceding flora, reworked Palaeosiphonocladales, dasycladaceans, Girvanella, stromatolites, and Spongiosstromata are found. Lime mudstones are absent. Fragments of reworked boundstones are common and indicate a high-energy environment.

Algal barrier—Two kinds of carbonate barriers occur in the Peratrovich Formation: (1) rhodophyte (red algae) boundstones, and (2) Palaeosiphonocladale bafflestones. These two carbonate rock types indicate different energy conditions. Boundstones are more resistant to wave action and are associated with packstones and grainstones formed in tidal channels where the algal barrier is in a high-energy environment and contains abundant oolites and protolites. The Palaeosiphonocladale bafflestones are associated with wackestones that were deposited in a calmer lagoonal setting.

Open and restricted lagoon—Wackestones and lime mudstones with pelletoidal matrices are the predominant carbonate rock types. Dolomites with rare pseudomorphs of anhydrite are found in association with these rock types. Foraminifers, brachiopods, and bryozaons become rare, while calcispheres proliferate. Among the algae, the Palaeobacerellaceae abound in the presence of Codiaecae. Birdseye structures are common, and the foraminifers are mainly represented by unilocular forms such as Earlandia.

STRATIGRAPHIC DISTRIBUTION OF THE SEDIMENTARY ENVIRONMENTS

Having defined these environments, we apply them to the Carboniferous stratigraphic sequence in the area of western Prince of Wales Island (fig. 4).

Euxinic and marginal basin facies characterize the cherty spiculate and radiolarite member. They are overlain by open-marine facies in a rapid regression near the base of the lower subunit of the lower cherty limestone member, which developed into carbonate platform or ramp facies having abundant echinoderm and bryozaon bioclasts. This facies is followed immediately by a brief episode of restricted lagoonal deposition. A marine transgression restores an open-marine environment for the remainder of the subunit.

The upper subunit of this member has the lowest Issinella bafflestone beds that are associated with Issinella wackestones and packstones. These are the result of breakdown by wave action.

The lower and middle subunits of the lower limestone member have lithologically similar bafflestones that also include kamaenids and Koninckopora. The sedimentary regime of the short-lived Brusisia facies, the upper subunit of this member, is difficult to explain. Proliferation of Brusisia at the expense of other plurilocular Endothyridae is problematical. It could reflect an abrupt drop in salinity.

The lower and middle subunits of the upper cherty limestone member are fore-barrier facies, and the upper subunit consists of barrier boundstones whose red algae and dasycladaceans are associated with the products of their destruction in an open-marine environment.

The lower and upper subunits of the upper limestone member are lithologically similar to each other and show a progressive increase in the diversity and complexity of the Ungdarella boundstone and of the Ungdarella and Komia remains.

The Ladrones Limestone and Klawak Formation overlie the Peratrovich Formation on different islands and represent a transgressive sequence. The base of each overlying
<table>
<thead>
<tr>
<th>SYSTEMS</th>
<th>STAGE</th>
<th>SUB-STAGE</th>
<th>FORAM ZONE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississippian</td>
<td>Early</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Namurian</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carboniferous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td>Baekrichian</td>
<td>Early</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXPLANATION
- Waulsortian reefs (fenestellid bafflestones)
- Rhodophyte bafflestones (Ungdarella, Komia, and others)
- Palaeosiphonecladale bafflestones (lassinella)
- Reworked blocks
- Cherty spilolite and radiolite member
- Unconformity

Figure 4. Sequence (heavy line) of depositional facies in the Peratovich Formation and overlying rocks, southeast Alaska. Arranged in bathymetric order, deepest at left. 1, Euxinic basin; 2, Margin- al basin; 3, Pelmatozoan meadows; 4, Open-marine platform (below zone of wave action); 5, Open-marine platform (zone of wave action); 6, Fore barrier (zone of wave action); 7, Algal barrier; 8, Lagoon. Relative positions of global foraminiferal zones (after Mamet and Skipp, 1970; Mamet, 1975a) compared to those of this report (SE AK).
formation is characterized by Waulsortian reefs, which are carbonate mounds formed by the filtration trapping of lime mud by fenestellid bryozoans below the zone of wave action.

The sequence of the eight environments of the Peratrovich Formation represents, in a general way, a regressive sedimentary sequence as interpreted by Armstrong (1970) and Vaskey (1982).

Two major models of carbonate belts have been proposed. One is asymmetrical and has an important barrier that separates basin environments from extensive lagoons (Wilson, 1975). The other model shows a gradual transition between these two environments (Irwin, 1965; Mamet, 1972b).

The strata sequence of the Peratrovich Formation is not consistent with Wilson’s model. Nowhere do we observe rigid framework reefs with fore-reef deposits and an extensive (large) slope facies. Instead, the transition from open-marine facies to restricted facies is gradual, and the thin barriers that separate environments are transitional and fluctuate.

The environments are generally consistent with Mamet’s model for the Cordillera (1972b), although two differences are observed. No silicified limestones with phosphate nodules, which indicate the euxinic basin margin, and no supratidal evaporites have been seen.

STRATIGRAPHIC DISTRIBUTION OF MICROFOSSILS

The stratigraphic distribution of microfossils in the Peratrovich Formation (Foraminifera, Algae, and incertae sedis) is represented in plate 17. Many characteristic specimens are pictured on plates 1–16.


The basal part of the Peratrovich Formation is characterized by an assemblage comprising species of the Earlandiidae and Endothyridae associated with a few residual species of Tournayellidae and Tetrataxidae. This fauna is characteristic of the Tournaissian to early Visean and is cosmopolitan.

The basal part of the middle part of the Peratrovich Formation (middle of the lower cherty limestone member) contains a much richer and more diverse fauna. Although the Tournayellidae disappear, there are now, in addition to numerous Earlandiidae, Endothyridae, and Tetrataxidae, representatives of the Archaediscidae, Endothyranopsidae, Forschiidae, Globoendothyridae, and the first primitive Palacotextulariidae. This assemblage is typical of the middle Visean (Meramecian).

Forschiidae disappear in the middle part of the formation (lower limestone member), and the Endothyranopsidae are gradually impoverished. The abundant and diverse families cited in the middle Visean continue along with Eostaffiellidae and Pseudoendothyridae in the late Visean (early Chesterian), an assemblage that is known worldwide.

The upper part of the formation (upper cherty limestone member) has a very rich assemblage that contains at least 14 families: Apterinellidae, Archaediscidae (with the Archaediscinae and Astroarchaediscinae), Biseriamminidae, Bradyinidae, Calcivertellidae, Earlandiidae, Endothyridae, Endothyranopsidae, Eolasiodiscidae, Eostaffiellidae, Omphalotidae, Palacotextulariidae, Pseudoendothyridae, and Tubericidae. This fauna is indicative of the early Namurian (late Chesterian).

In the uppermost part of the section, still rich in microfossils, the disappearance of the Omphalotidae and the first appearance of the Ozawainellidae probably indicate the base of the Bashkirian.

MICROPALEONTOLOGICAL ZONATION AND OCCURRENCES ELSEWHERE

The distribution of faunal elements shown on plate 17 permits establishment of several stratigraphic divisions within the Peratrovich and its overlying formations. Parenthetical numbers following genus names refer to the taxa numbers on plate 17.

The basal part of the Peratrovich Formation is composed of cherty radiolarites. Macrofauna and foraminifers are absent in the radiolarian deep-water facies, precluding an age determination.

The lowest horizon that yields a meager foraminiferal microfauna is in the cherty spiculite and radiolarite member. The environment of deposition and the facies were not favorable for foraminifers and resulted in a limit-
Lower member of the Wachsmuth Limestone, central member of the Peratrovich Formation contains a faunule of early Visean age. This is indicated by the coexistence of the Madison Limestone of Idaho and Montana, which is abundant in North America (Mamet and Skipp, 1970).

In North America, Zone 9 is recognized by the presence of elements of the older fauna cited (Armstrong and Mamet, 1977) and by the addition of Septaglomospiranelia, Septabrunsiina, Spinotournayella, Latendothyra and the acme of Spinoendothyra (Beauchamp and Mamet, 1985; Mamet and others, 1986). To these fauna are sporadically added Eoforschia and Eotextularia? (Mamet and others, 1970). In the Tethyan realm, the last two genera proliferate along with Brunsia, Carbonella, and Tournayella. Advanced forms not found in the North American domain, for example, Litutothella and Pseudolituotubella, belong to the Forschidae.

Zone 9 is identified in several carbonate stratigraphic sequences in North America:

1. Lower part of the Anchor Limestone of Nevada (Brenckle, 1973).
5. Kinkead Spring Limestone of the Antelope Range, Nevada (Hose and others, 1982).
6. Thunder Springs Member of the Redwall Limestone of Arizona (Skipp, 1969).
8. Lower parts of the Prophet and Flett Formations of northeastern British Columbia and southwestern Northwest Territories (Bamber and Mamet, 1978; Richards, 1989).
10. The lower part of the Little Flat Formation of southeastern Idaho (Lageson and others, 1979).

No microfauna characteristic of Zones 11 and 12 are found in the middle part of the lower subunit of the lower cherty limestone member of the Peratrovich Formation.

Shallow-water carbonate facies appear in the uppermost part of this subunit concomitant with the appearance of numerous foraminifers and algae. A middle Visean age (Zone 13) is assigned to this part of the section due to the appearance and abundance of Archaeodiscus of the group A. krestovnikovi (17), notably Archaeodiscus krestovnikovi (19) and A. koktjubensis (18), associated with Eoendothyranopsis scitula (25), Eoforschia of the group E. moelleri (26), and Globoendothyra of the group G. tomiensis (29). To this assemblage is added the relatively rare Septatournayella? kennedyi (40).

Except for Septatournayella?, this assemblage is known in Member C of the Prophet Formation and in the lower part of the upper member of the Debolt Formation of northeastern British Columbia (Bamber and Mamet, 1978). In the Tethys, several common faunal elements are added to this circum-hemispheric assemblage, notably: Eostaffella, Valvulinella, Vissariotaxis, and Forschia, in addition to the first appearances of Howchinia, Omphalotis, Endostaftella, Spinothyra, Janischewskina, and Mediocris.
(Mamet and Skipp, 1970). The last five forms, essentially endemic to the Tethys, occur in the Peratrovich Formation at different horizons. In the Tethys, *Endothyranopsis compressa* normally appears in this zone; it is very rare in the Peratrovich Formation.

The middle Visean Zone 13 is equivalent to the middle part of the Meramecian in the North America midcontinent. It also occurs in the following formations:

1. The lower part of the Yellowpine Limestone of Nevada (Brenacle, 1973).
2. The Loomis Member of the Mount Head Formation and upper part of the Livingstone Formation, southwestern Alberta (Petryk and others, 1970; Mamet, 1976; Bamber and Mamet, 1978).
3. The part of the Hachita Formation that is laterally equivalent to the Rancheria Formation of New Mexico and west Texas (Armstrong and Mamet, 1978b).
4. The Little Flat Formation in the Northern Rocky Mountains of the United States (Sando and others, 1969; Skipp and others, 1979; Lageson and others, 1979).
5. The upper part of the White Knob Limestone, upper part of the Middle Canyon Formation, and lower part of the Scott Peak Formation of Idaho (Skipp and others, 1979).
6. The upper part of the Flett Formation, Mackenzie District of the Northwest Territories (Richards, 1989).
7. The upper part of the Kayak Shale of the Endicott Group in the British Mountains, Yukon Territory (Mamet and Ross in Bamber and Waterhouse, 1971).

In the Peratrovich Formation, zone 14 (late Visean) has a diverse fauna in the foraminiferal chertified limestones of the upper subunit of the lower cherty limestone member and in the alternations of shale dolomites and limestones of the lower subunit of the lower limestone member. It is characterized by the proliferation of Archaeodiscidae with open lumen, associated with *Eoforschia* of the *E. moelleri* group (26), *Endothyranopsis* of the *E. erakiensis* group (58), *Endothyranopsis hirosei* (57), and *Endothyranopsis compressa* (56). *Baniffella* (48) is a rare form with a short vertical stratigraphic distribution. Except for *Endothyranopsis hirosei*, all these faunal elements are represented in the upper part of the Flett Formation and lower part of the Mattson Formation in the Mackenzie Mountains, as well as in the uppermost part of the Prophet Formation and lower part of the Golata Formation of northeastern British Columbia (Bamber and Mamet, 1978).

Zone 14 is also recognized in the following stratigraphic levels:

1. The middle part of the Yellowpine Limestone of Nevada (Brenacle, 1973).
2. The Marston Member and lower part of the Opal Member of the Mount Head Formation of southwestern Alberta (Petryk and others, 1970; Mamet, 1976; Bamber and Mamet, 1978).
4. The middle part of the Scott Peak Formation of Idaho and lower part of the Great Blue Limestone of Idaho (Skipp and others, 1979).
5. The Monroe Canyon Limestone of Idaho and Wyoming (Sando and others, 1969; Skipp and others, 1979; Lageson and others, 1979).
8. The lower part of the Stoddart Group of northeastern British Columbia (Mamet, 1976).

Zone 15 (late Visean) fauna occurs in the Peratrovich Formation in the middle and upper subunits of the lower limestone member and in the lower subunit of the upper cherty limestone member. The microfauna is less abundant than that of Zone 14 and is recognized by the appearance of very large *Globoendothyra* [G. *ishimica* (72) and *Globoendothyra* of the *G. globulus* group (73)] and of *Palaeo­textularia* s.s. (*P. longisepetata*) (75).

In the Tethys, several taxa join this cosmopolitan assemblage. Among them are abundant *Howchinia* and *Valvulinella*, accompanied by *Archaediscus karreri*, *Climacanmina* and *Cribrostomum*. For an example of this assemblage, see the microfossils of the Boulonnais in northern France (Mamet, 1973).

In the Peratrovich Formation, the usual fauna of Zone 15 is interrupted by the enigmatic appearance of *Brun sia* in the upper subunit of the lower limestone member. This level, called the “*Brun sia* facies,” marks the elimination of most of the preceding fauna, except for some calcispheres (1, 11), *Earlandia* (2, 3, 12, 13), and *Brun sia* of the *B. lenensis* group (21). Specimens of the genus *Planoa rchaediscus* (36) sometimes constitute an appreciable percentage of this assemblage.

It is difficult to explain the presence of *Brun sia* in different horizons of the late Visean of the North American Cordillera (Mamet and Armstrong, 1972; Mamet, 1976; Armstrong and Mamet, 1977). The disappearance of most of the plurilocular foraminifers could indicate an im-
important change in temperature and (or) salinity. But it is difficult to explain how these two factors could result in the concomitant disappearance of most of the microflora, which normally is better adapted to such environmental variations.

Zone 15 is also known in the following strata:

1. The upper part of the Yellowpine Limestone and lower part of the Battleship Wash Formation in Nevada (Brenchle, 1973).
2. The Carnarvon Member and the upper part of the Opal Member of the Mount Head Formation of southwestern Alberta (Mamet, 1968a; Petryk and others, 1970; Mamet, 1976, and Bamber and Mamet, 1978).
3. The upper part of the Hachita Formation, Escabrosa Group, Rancheria Formation, and lower part of the Paradise Formation of New Mexico (Armstrong and Mamet, 1978b, 1988).
4. The Monroe Canyon Limestone of the Cordillera in Idaho and Wyoming (Sando and others, 1969; Skipp and others, 1979; Lageson and others, 1979).
5. The Scott Peak Formation and Great Blue Limestone of Idaho (Skipp and others, 1979).

The Zone 15/16I lower boundary (late Visean) in the Peratrovich Formation is at the base of the upper cherty limestone member. It corresponds with the extinction of Eoformschia (26) and Eoendothyranopsis (71) and their replacement (see fig. 7) by the Eostaffellidae, including Eostaffella of the E. radiata group (79) and Zellerinella (83) and by the Pseudoendothyridae, with Pseudoendothyra of the P. struevi group (81). The appearance of primitive Neoarchaediscus (80) and the local presence of the alga Ungdarella, notably Ungdarella uralica (82), also mark Zone 16I which is in the middle part of the Ungdarella- and Koninkkopora-bearing limestones.

This assemblage is comparable to that observed in the Alapah Limestone of the Lisburne Group in the Yukon (Mamet and Ross in Bamber and Waterhouse, 1971). In most of North America, the extinction of the alga Koninkkopora corresponds with the Zone 15/16I boundary. However, Koninkkopora ranges above this to the upper boundary of Zone 16I in the Peratrovich Formation and in the Tethys (see fig. 9).

In the Tethys, endemic forms like Litnotubella, Haplophragmina, Forschia, and Forchiella decrease drastically at this level. It should be noted that Zellerinella is unknown in the Tethyan fauna but is present in the Peratrovich Formation. There is much taxonomic confusion in the literature, and the genus is regrettably confused with the Tethyan Endostaffella (Rich, 1986).

This assemblage is easily correlated with that observed in the Alapah Limestone of the Lisburne Group in the Yukon (Mamet and Ross in Bamber and Waterhouse, 1971).

Zone 16I ( latest Visean) in the Peratrovich Formation is limited to the upper part of the middle subunit of the upper cherty limestone member and contains a fauna dominated by Asterorhodiscinae including Neoarchaediscus incertus (88) and N. parvus (89). In contrast to other formations of the North American Cordilleran Planospirodiscus (90) is rather rare (Mamet and Armstrong, 1972; Armstrong and Mamet, 1977). It should be stressed that the Tethyan Howchinia bradyina (86) is present in this horizon, (Mamet, 1972a).

Zones 16I and 16I are known in the lower part of the Chesterian (Aux Vases Sandstone to Golconda Formation) and the Floyd Formation in the southern Appalachians of southeastern United States in the North America midcontinent (Rich, 1986). They are also recognized in these formations:

2. The upper part of the Rancheria Formation and the lower part of the Helm Formation of Texas and New Mexico, and the Paradise Formation of New Mexico and Arizona (Armstrong and Mamet, 1978b, 1988).
4. The Amsden Formation of the Rocky Mountains (Sando and others, 1969; Skipp and others, 1979; Lageson and others, 1979).
5. The uppermost part of the Scott Peak Formation, the South Creek Formation, and the lower part of the Surrett Canyon Formation of Idaho and their lateral equivalents the Big Snowy Formation and the Great Blue Limestone, also in Idaho (Skipp and others, 1979).
8. The upper part of the Mattson Formation of the Mackenzie Range and of the Stoddart Group of northeastern British Columbia (Bamber and Mamet, 1978).
10. The lower part of the Nuka Formation and lower part of the Tupik Formation (Lisburne Group), Brooks Range, Alaska (Armstrong, 1975).

Zone 17, the lower part of the Namurian (basal part of the Serpukhovian), is recognized by the appearance and rapid development of *Asteroorphaediscus baschkiricus* (95) (Mamet and others, 1966; Hallett, 1970; and Mamet, 1975a), accompanied by the first *Endothyranopsis sphaerica intermedia* (99), mixed in the Peratrovich with *Climacamina* sp. (96) and *Cribrostomum* sp. (97).

The bilayered Palaeotextulariidae are a very significant part of the Zone 17 fauna of the upper subunit of the upper cherty limestone member of the Peratrovich Formation but are not present in the Etherington Formation of southwestern Alberta (Mamet, 1968a).

Zone 17 corresponds to the middle part of the Chesterian of the midcontinent (Glen Dean and Menard Limestones) and the Floyd Formation in the southern Appalachians (Rich, 1986). Zone 17 is also known in the following formations:

1. The upper part of the Battleship Wash Formation of Nevada (Brenckle, 1973).
4. The Amsden Formation of the Northern Rocky Mountains of the United States (Sando and others, 1969; Skipp and others, 1979; Lageson and others, 1979).
8. The Monroe Canyon Limestone and Big Snowy Formation, Idaho (Sando and others, 1969; Skipp and others, 1979).

Zone 18 has the first appearance of *Biseriella*, with *Biseriella* of the *B. parva* group (105) and of *Eostaffellina*, notably *E. ovesa* (112) and *E. paraprotvae* (113). In abundance and diversity, this faunule resembles that of Zone 14. Especially marked are the presence of Bradyiniidae, with *Bradyina* of the *B. cribrostomata* group (107), and of Palaeotextulariidae, represented by *Climacamina antiqua* (108). In Zone 18, *Archaediscus* (17–19) undergoes a resurgence, as do *Howchinia bradyina* (86), *Zellerinella desig­nata* (91). The same phenomenon occurs for algae like *Fasciella* (27), *Ungdarella uraltica* (82), and *Asphaltina cordillerensis* (84). In the Peratrovich Formation, Zone 18 is limited to the lower subunit of the upper limestone member.

The Tethys has many of the same taxa except for *Zellerinella*. *Eostaffellina* is much more abundant in the Tethys and is an index fossil in the equivalents of the Protva Horizon of the Northern and Canadian Rocky Mountains (Sando and others, 1969; Mamet and Ross in Bamber and Waterhouse, 1971). Spherical "*Pseudoendothyra*" (*Volgel­la*), unknown in North America, are also used in the Tethys for recognition of Zone 18 (Mamet, 1974, 1975a). Zone 18 is the upper part of the Chesterian, and its foraminiferal assemblages are found in the Clore and Kinkaid Limestones of the midcontinent. Zone 18 is present in the Bangor Limestone and Pennington Formation of the southern Appalachians (Rich, 1986). Zone 18 is also identified in the following sedimentary sequences:

1. The upper part of the Battleship Wash Formation of Nevada (Brenckle, 1973).
2. The upper part of the Monroe Canyon Limestone of the United States Cordillera (Sando and others, 1969; Lageson and others, 1979).
3. The middle part of the Surrrett Canyon Formation, Idaho (Mamet and others, 1971; Skipp and others, 1970).
4. The Big Snowy Formation of the northern United States Cordillera (Sando and others, 1969; Skipp and others, 1979).
5. The Amsden Formation of the northern United States Cordillera (Mamet, 1975a; Lageson and others, 1979; Skipp and others, 1979).
6. The basal part of the Etrrain Formation in the Keele Range, Yukon Territory (Mamet and Ross in Bamber and Waterhouse, 1971; Mamet and Mason, 1970).
7. The Nizi Formation (upper part) and an unusual formation in the Atlin Lake region, British Columbia (Mamet and Gabrielse, 1969; Mamet, 1976).
10. The Borup Fiord and Otto Fiord Formations, Ellesmere Island, Canada (Davies and Nassichuk, 1980).
Zone ≥18–20 has again a diverse microfauna. In addition to the microfauna of Zone 18 described above, numerous Janischewskina operculata (132) and J. typica (133) are mixed with gigantic Omphalotis omphalota (136). The red alga Ungdarella peratrovichensis (137) is abundant at this level, and U. uralica (82) has its acme. The age of this horizon is controversial because Janischewskina is completely unknown elsewhere in North America. It usually extends through Zone 19 in Eurasia but is known to occur as high as Zone 20 in southern China (Rui, 1987). Omphalotis and Endothyranopsis range higher in the Peratrovich Formation than in any known sequence in the Tethys.

Zone 19 was originally identified in the Donets Basin in the Ukraine and in the northern hemisphere by the brief acme of Quasiarchaediscus and Eosignooidina? (Brazhnikova, 1964; Mamet, 1974; Mamet and Ross in Bamber and Waterhouse, 1971). These two genera were not found in the Peratrovich Formation. This is not due to poor sampling, as the fauna is abundant and the ancestral forms of Archaediscidae are well represented. Micropaleontologic evidence suggests that Zone 19 is missing from the Peratrovich by a hiatus or is replaced by the assemblage of Zone ≥18–20, which is limited to the upper subunit of the upper limestone member.

The absence of Zone 19 in the Peratrovich Formation provides new insight into the problem of the Mississippian-Pennsylvanian boundary. In the midcontinent region, the Pennsylvanian begins with Zone 20 and is often separated from Zone 18 or 19 by a hiatus. In the type Pennsylvanian, the basal part of the system is nonmarine and thus contains no foraminifers. In the type Morrowan, the conglomerate basal part of the group (Zone 20) rests discordantly on the Mississippian, which was eroded (Zone 18 or 19) (Brenckle, 1977; Mamet, 1982). In fact, no section between the Mississippian and Pennsylvanian is continuous in the central part of North America (Groves, 1983). Zone 19 is considered as very latest Mississippian in age. A latest Chesterian age for the zone is suggested by Sando and others (1969) for the Amsden Formation in the northern Cordillera of the United States and by Armstrong and Mamet (1977) for the Alapah Limestone in Alaska. Other faunal evidence from the Indian Springs Formation and from the basal part of the Bird Spring Formation in Nevada (Brenckle, 1973) supports this hypothesis. Mamet (1975a) recognized Zone 19 in the Amsden Formation of Wyoming. Armstrong and Mamet (1978b) and Mamet (1982) established a Mississippian-Pennsylvanian boundary near Zone 19/20 that corresponds to the contact between the Paradise Formation and the Horquilla Limestone of New Mexico and Arizona. Again a hiatus is present, although it represents a short time interval.

The most continuous section spanning the Mississippian-Pennsylvanian boundary is exposed at Granite Mountain in Nevada. The conodont species Adetognathus unicornis (Rexroad et Burton) is in the lower part of Zone 19. The middle part of Zone 19 contains the first occurrence of Rhachistostegus primus (Dunn). The first occurrence of Declinognathodus noduliferus (Ellison and Graves) occurs near the base of the Pennsylvanian, Zone 20, but there is a hiatus between Zones 19 and 20 (Mamet, 1984; Wardlaw, 1984; Gordon and others, 1985).

Microfacies studies (carbonate sedimentology, foraminifers, and algae) indicate that the Granite Mountain succession (Gordon and others, 1985) is essentially continuous across the Mississippian-Pennsylvanian boundary, without any important sedimentation hiatus (Mamet, 1984). It is thick and not condensed, shows repeated minor oscillation in open-marine facies, and has no carbonate restriction. The boundary is emphasized by two important phylectic changes in the foraminifers: the derivation of Globivalvulina from Biseriella, and that of Milleraella from Eostaffella.

Reitlinger (1980) has shown that the foraminifers of the Homoceras Zone (boundary between the Bogdanovsk and Krasnopoliensk beds), although poorly diagnostic, are above Zone 19 and below the first occurrence of the Bashkirian Zone 20. Again, a small hiatus can be recognized by the first occurrence of a diaphanotheca in Globivalvulina (Globivalvulina sp. D of Brenckle as proposed by Wagner and others, 1985). Whatever the precise position of the Mississippian-Pennsylvanian boundary (and perhaps also that of the Serpukhovian-Bashkirian), the age of the Zone ≥18–20 Ungdarella- and Komia-bearing boundstones of the upper subunit of the upper limestone member of the Peratrovich Formation is difficult to assess because (1) at least two paraconformities are present, (2) Zone 19 is absent, (3) the primitive Globivalvulina is difficult to recognize, and (4) the Tethyan Janischewskina assemblage is unknown in the rest of North America.

Zone 20, observed in the Klawak Formation and Ladrones Limestone, is characterized by the appearance of Milleraella s.s. (Mamet and Armstrong, 1972), represented by M. carbonica (146) and M. prilukiensis (147). Pseudogomolospora gordialiformis (119) becomes prolific in this horizon. Within the microflora, Epistacheoides connorrensis and E. nephroformis (61), Asphalitella horowitzi (70), and Asphalitina cordillerensis (84) are abundant.

In the Tethys realm, the same faunal characteristics are found, with the addition of Semistaffella and primitive Pseudostafla (Mamet, 1975a). The first Pseudostafla antiqua marks the Bashkirian deposits of the Russian platform. This marker does not exist in North America except in Alaska (Mamet, 1976) and in the Canadian Arctic. This implies that Bashkirian equivalents in the rest of North America are identified only on the basis of Milleraella. In North America, the Bradyinidae usually appear for the first time in the Pennsylvanian, with well-evolved forms. In the Tethys, primitive Bradyina are already abundant in the uppermost part of the Visean, while in the Peratrovich faunas, they occur in the early Serpukhovian.
Zone 20 corresponds to the Morrowan of the mid-continent of North America (Groves, 1983), with the first true fusulines in the basal part of the Pennsylvanian. This zone is also known in these formations:

1. The Bird Spring Formation and Ely Limestone in Nevada (Brenchke, 1973; Mamet, 1982).
6. The La Tuna Formation of western Texas (Lane and others, 1972).

Zone 21 was studied only briefly because existence of Waulsortian reefs does not favor the presence of foraminifers. Conodonts reported by Savage and Barkeley (1985) from the same levels are “Idiognathoides noduliferus, I. pacificus, and I. delicatus” mixed with Hindeodus minutus, Neognathodus bothrops, and Taphrognathus alaskensis. These concepts allow us to establish three domains of foraminiferal microfauna and algal microflora for the early Carboniferous (Mamet, 1962, Mamet and Skipp, 1979). The abundant and diverse fauna and flora of the Tethys domain (fig. 5) indicate equatorial to tropical temperature conditions. The Tethys realm includes Ireland, England, Belgium, France, Germany, southern Poland, the Donets Basin of the Ukraine, North Africa, Libya, Egypt, Kazakhstan, Iran, Laos, South China, Vietnam, Malaysia, and part of Australia (Mamet and Skipp, 1979).

The intermediate Kuznets-North American domain is represented by less abundant and less diverse fauna and flora that indicate relatively warm waters. Its realm includes central Siberia and the middle of the North American continent, except for a narrow band along the western Cordillera of North America.

The Taymir-Alaska domain has low diversity and reduced fauna and flora, reflecting temperate water conditions. This Arctic realm includes the Russian Lena, Kolyma, and Pechora River regions and Omolon massif, Novaya Zemlya Islands, northern Alaska, and the Canadian Arctic.


**PALEOBIOGEOGRAPHIC CONCEPTS**

The principle of actualism, that processes of the past can be inferred from those of the present, is not easy to apply to the Carboniferous foraminifers. The Holocene has three kinds of foraminifers: shallow-platform benthic forms, basin benthic forms, and pelagic forms. In the Paleozoic, only the first forms are known. Despite this fundamental difference, the principle can be applied to shallow-water benthic foraminifers. On a modern carbonate platform, the distribution of benthic Protista is controlled by the water temperature. The temperature distribution of surface waters forms belts that are more or less parallel to the equator. Therefore, the geographic distribution of specific benthic fauna on carbonate platforms is chiefly a function of latitude (Stehli, 1965; Lipina, 1973; Smith, 1989).

The foraminifers that live on carbonate platforms are abundant and show greatest generic and specific diversity in the lower latitude regions and show less generic diversity toward the poles. This gradient in the diversity distribution of platform taxa is synonymous with thermal gradients; it may vary in intensity but not in direction during the course of geologic time. Thus, this gradient provides an adequate tool for estimating the positions of the equator and poles throughout geologic time (Boersma, 1978; Smith, 1989).

These concepts allow us to establish three domains of foraminiferal microfauna and algal microflora for the early Carboniferous (Mamet, 1962, Mamet and Skipp, 1979). The abundant and diverse fauna and flora of the Tethys domain (fig. 5) indicate equatorial to tropical temperature conditions. The Tethys realm includes Ireland, England, Belgium, France, Germany, southern Poland, the Donets Basin of the Ukraine, North Africa, Libya, Egypt, Kazakhstan, Iran, Laos, South China, Vietnam, Malaysia, and part of Australia (Mamet and Skipp, 1979).

The intermediate Kuznets-North American domain is represented by less abundant and less diverse fauna and flora that indicate relatively warm waters. Its realm includes central Siberia and the middle of the North American continent, except for a narrow band along the western Cordillera of North America.

The Taymir-Alaska domain has low diversity and reduced fauna and flora, reflecting temperate water conditions. This Arctic realm includes the Russian Lena, Kolyma, and Pechora River regions and Omolon massif, Novaya Zemlya Islands, northern Alaska, and the Canadian Arctic.

Detailed examination of foraminifers and algae allows us to place the Peratovich Formation in a general

A critical examination of the microfauna shows that the absolute abundance of a foraminifer population decreases from the Tethys toward the Taymir-Alaska domain. In a 1-cm³ specimen of a Tethyan grainstone with Kon- inckopora, between 300 and 500 individual foraminifers can be counted. This same facies in the Kuznets-North American domain contains only one-third as many. Finally, in the Taymir-Alaska domain, it is exceptional to obtain more than 50 to 100 individuals, and the dasyclad algae are very scarce (Mamet, 1977).

There has always been a decrease in species diversity toward the poles. The early Carboniferous had at least 800 valid species for the Tethys; this declines to 400 for the intermediate domain and, finally, to 100 for the Arctic. Statistically, the number of endemic species for the Tethys is clearly greater than that for the other two domains combined. The number of genera varies very little within each of the domains. However, the species/genus ratio declines drastically from the abundant and diverse community of the Tethys to its Arctic counterpart (fig. 5).

From a morphological aspect, the variation in test size is not significant from one domain to another. However, certain gigantic forms are limited to the Visean in the Bashkirian and disappear in the Moscovian. Emphasized that the type of facies exerts an even greater control on the distribution of chlorophyte microflora than on the foraminifers. These algae are good indicators for shallow environments and surface sea-water temperature (Flügel, 1977).

In the Tethys, the algal proliferation and great specific diversity distinguish this flora from those of the other domains (Mamet, 1990). In these equatorial to tropical waters, several chlorophyte algae take part in building geologic reefs that consist of boundstones, banks, and biostromes (Wray, 1977).

The most abundant algae in the Tethys belong to the Chlorophycophyta, in particular the family Dasycladales. In the Carboniferous, more than 60 genera represent this order,
particularly Koninckopora, Coelospora, Nanopora, Atractyliopsis, and Anthracoporellopsis. Although 43 genera are known in the western Tethys, only 12 are known in North America and 11 in the Peratrovich Formation.

The most abundant cyclocrinid, Koninckopora, often builds banks in environments that have normal circulation. Unlike most of the algae, this genus effectively contributes to the biostratigraphic zoning of marine carbonate rocks because of its rather limited stratigraphic distribution.

Codiaceae, another family belonging to the Chlorophyceae, includes Calcifolium at the Visean-Namurian boundary. These abundant forms, which are exclusive to the Tethys, also have some stratigraphic value (Mamet and Roux, 1975a, b). Among the other taxa, but much less important and long ranging, are the cosmopolitan Ortonella, Mitcheldeania, Garwoodia, and Bevocastria. They occupied lagoonal environments that had either open or restricted circulation. Codiaceae are relatively less important contributors to carbonate sediment than are the Dasycladales. Finally, very few Udoteaceans are known.

Blue-green algae, the cyanobacteria, are the second most common algae. Incrustations formed by Pycnostro­ma, Polymorphocodium, and Sphaerocodium are found in lagoonal facies as well as in turbulent-water facies with Dasycladales. Girvanella is always abundant in the photic zone, thus indicating shallow bathymetry.

The Palaeosiphonocladales are less prolific than the preceding algae; nevertheless, they play an appreciable sedimentary role in lagoonal facies. Entangled thalli form more or less solid mats, which filter the sediment and form bafflestones.

Rhodophycophyta are mainly represented by the Ungdarracleae and Stachieiinae, notably Fourstonella, Stachela, Epistacheoides, Stachoeide, Ungdarella, and Komia. These extend as far poleward as the temperate waters of the Taymir-Alaska domain.

Passing from the Tethys to the North American domain, species diversity decreases abruptly. The Dasycladales gradually become impoverished, and new forms restricted to this domain arise; among them are Albertaporella (Mamet and Roux, 1981), Sphinctoporella, and Windsoporella (Mamet and Rudloff, 1972). Koninckopora banks become fairly rare.

Among the Codiaceae, Calcifolium is completely absent in the North American microflora. Pseudohedstroemia (Mamet and Roux, 1978) appears sporadically. Palaeosiphonocladales and Solenopores, like most other types of algae, decline in importance in North America. Only the Ungdarellaceae maintain the same productivity as in the Tethys.

As far as endemism is concerned, the Peratrovich flora is unique. Among Carboniferous green algae, 149 species are endemic to the Tethys, 20 species to the North American domain, and none to the Peratrovich Formation, whose flora is completely cosmopolitan (Mamet and Pinnard, 1985).

**DISCUSSION AND CONCLUSIONS**

The micropaleontological study of the Peratrovich Formation shows that the foraminiferal microfauna and the algal microflora belong neither to the Tethyan nor to the Kuznets–North American domains. They are neither Stikinian nor Cache Creekian in the sense of Monger (1984).

We now consider several puzzling anomalies, again beginning with those pertaining to the foraminifers and followed by those of the algae.

In terms of abundance, the high number of individuals in the Peratrovich microfauna denotes a Tethyan character. On the other hand, the moderate number of genera in the microfauna indicates an intermediate position between the two domains. A large number of genera normally not found in North America are abundant in the Peratrovich microfauna. For instance, these taxa include

---

**Figure 7.** Diachronic acmes of Eostaffellidae in three realms during the Visean. Eostaffellidae are dominant only when **Eoendothyranopsis** is absent or rare. Foraminiferal zones after Mamet and Skipp (1970) and Mamet (1975a).
Janischewskina, Spinophyra, Viseidiscus, and Mediocris. Banffella and Zellerinella, normally endemic to North America, are well represented. Such a mixture of endemic forms belonging to both domains points to a mixed microfauna.

The Peratrovich species/genus ratio (fig. 5) indicates a microfauna typical of the Taymir-Alaska domain. In the Tethys, many genera are represented by four to six species, and genera with more than ten species are known. In the Taymir-Alaska (Arctic Siberia and North America) domain, most genera are monospecific, and the maximum number of species identified for one genus is about ten; this ratio is also observed in the Peratrovich microfauna.

Omphalotis omphalota among the gigantic forms is usually restricted to the Tethys but occurs in the Peratrovich microfauna. On the other hand, several common forms in the Tethys were not identified in this study. Among them are Endoystaffella, Forschia, Forschiella, Haplophragmina, Loeblichia, “Permodiscus”, Propermodiscus, and Valvulinella (Mamet, 1972a, 1974).

The distribution of Dainella is perplexing. Common in the North American and Tethys domains, Dainella does not appear in the Peratrovich microfauna. This absence cannot be attributed to poor sampling or to observational error.

Three well-documented cases of phylogenetic sequences are compared. First, we consider the Tethyan sequence Endothyranopsis-Cribrospira-Janischewskina-Bradyina, presented in order of first appearances. In most of North America the two intermediate genera, Cribrospira and Janischewskina, are missing. In the Peratrovich Formation, only the absence of Cribrospira breaks the continuity of the sequence (Mamet and Skipp, 1970).

Second, in the Tethyan sequence of Tetrataxis-Howchinia-Monotaxinoides-Eolastidiscus, the transitional form Howchinia has not been identified elsewhere in North America. The presence of the entire sequence in the Peratrovich Formation indicates a Tethyan affinity.

Third, in the Brunsia-Viseidiscus-“Permodiscus”-Propermodiscus-Archaediscus sequence, only the final form, Archaediscus, appears in the North American domain, apparently without any ancestral link from Brunsia. The presence of Viseidiscus in the Peratrovich provides a partial link between Brunsia and Archaediscus.

In many places, diachronism of first occurrences is observed. For instance, the first Tethyan Bradyina appears in the upper part of Visean Zone 16. On most of the North American continent, these forms are known sparsely in Zone 20 and become abundant in the Bashkirian Zone 21. Between these two first appearances there is more than one stage of difference. However, in the Peratrovich Formation, Bradyina proliferates in Zone 18, between the zones of the other two domains (fig. 6). This strongly suggests that the Peratrovich served as a bridge between the Tethys and most of North America.

A similar case is observed among double-walled Palaeotextulariidae, for example, Climacomya and Cribrostomum. They first appear in Zone 15 in the Tethys and Zone 18 in the North American domain. The Peratrovich Formation, again serving as a bridge, contains these forms first in Zone 17 (fig. 6).

Eostaffella is an example of diachronism at the level of the acme zone. This was discussed earlier in the section on paleobiogeography. The acme zones of Eostaffella in the Peratrovich Formation and in the rest of North America are nearly identical (fig. 7) but are strongly diachronous with respect to the Tethys.

Another example of diachronism pertains to the upper limits of faunal ranges (fig. 8). Endothyranopsis, Janischewskina, Omphalotis, and Spinophyra are usually eliminated at the base of the Bashkirian in the Tethys domain. However, these genera all cross this boundary in the Peratrovich Formation and occur somewhat rarely in the base of Zone 20. This late disappearance gives the Peratrovich microfauna a unique character.

The boundary between Zones 15 and 16½ in North America is equivalent to the Meramecian-Chesterian boundary, marked by the extinction of Eoendothyranopsis and Eoforschia. These same extinctions at that time in the Peratrovich Formation (fig. 8) suggest an American character for the fauna.

The compilation of all these foraminiferal data leads us to conclude that the Peratrovich microfauna is neither typically North American nor obviously Tethyan. It is clearly a mixed microfauna.
When we consider the algal microflora, the total abundance of algae also puts this microflora in a position intermediate between the Tethys and North American realms. The number of genera represented, 28, is more like that of the Tethyan microflora. On the other hand, the 44 species give a rather low species/genus ratio, typically an American character.

In the early Carboniferous around the world, 53 species are very widely dispersed; among them, 29 are observed in the Peratrovich microflora. Moreover, the Peratrovich includes 4 of 20 species normally endemic to North America and 3 of 66 species normally endemic to the western Tethys. Among the Rhodophycophyta, the Ungdarellaceae and the Stacheiinae abound in the Peratrovich and sometimes form organic banks in facies having normal circulation. The Solenoporids constitute only a very small part of the flora, as everywhere else in North America.

Nodular Codiaceans are rare in the Peratrovich, represented by Ortonella, Mitcheldeania, Bevocastria and Pseudohedstroemia. The first three are cosmopolitan, and the last is endemic to North America. The absence of Calcifodium in the Peratrovich seems very significant and excludes this flora from the Tethyan domain.

On the other hand, Dasycladales are well represented in the Peratrovich by Koninckopora, Anthracoporellopsis, Atractyliopsis, and others; despite their large number, however, they are not very diverse. The microflora has none of the Dasycladales typical of most of North America, such as Windsoporella, Albertaporella, and Sphinctoporella. The cyclocrinid Koninckopora is quite abundant (fig. 9) and forms sedimentary banks. This abundance is strikingly different from that in the Yukon and northern Alaska where the genus plays no role in carbonate sedimentation.

Among Schizophyta, Girvanelles are not well represented in the Peratrovich, but they are certainly more abundant than in most of North America. The low abundance of the Spongiostromata characterizes a flora of the North American domain.

Finally, the Kamaenidae are not well represented in the Peratrovich because its carbonate sequence contains few lagoonal facies. In summary, the Peratrovich flora is essentially cosmopolitan and has no more affinities with the rest of North America than with the Tethys domain (Mamet, 1992).

**SUMMARY**

This study shows that the Peratrovich Formation plays an intriguing role in the distribution of Carboniferous faunas and floras. For the first time, foraminiferal and algal assemblages are defined within the eugeosynclinal carbonate rocks of the North American Cordillera. These new assemblages impose constraints in developing tectonic models. They are inconsistent with models that propose that the Cordilleran terranes are fragments derived from Asia (Wilson, 1968; Danner, 1970). In addition, they are related to the Stikinia terrane but not typically related to the terranes of southwestern United States.

The position of the Peratrovich Formation in the general framework of Carboniferous stratigraphy supports a Tethyan origin for a great part of its microflora. This hypothesis suggests that the Tethys was the cradle of these foraminifers, which systematically migrated toward North America (Mamet and Skipp, 1970).

Because the only means of locomotion for adult benthic foraminifers are pseudopods, however, it seems reasonable to postulate that strong marine currents provided the means of dispersion for large-scale migrations. As a model, we postulate a warm marine current moving toward the present-day northwest from the southwest along the axis of the Cordilleran geosyncline.

**EXPLANATION**

- Extinction
- Rare
- Present
- Very abundant (acme)

Figure 9. Stratigraphic distribution of the chlorophyte Koninckopora in Tethys domain and in three regions of North America. (Genus is still recognized in the Serpukhovian in southern China.) Foraminiferal zones after Mamet and Skipp (1970).
This is precisely the model proposed by Raymond and others (1985, fig. 7.12). This Namurian oceanic circulation pattern was also used by Dutro (1987) to explain brachiopod paleogeographic distributions.

Uniformly distributed sites of carbonate sedimentation between America and northern Asia seem essential for the process of migration. In fact, Churkin (1975) reported that the Paleozoic rocks of the geosyncline at the edge of the Pacific Ocean and the Alaska Range continue and connect with lithologically similar rocks in the Koryak Mountains in the northeastern part of the former Soviet Union. If the area that is now Alaska constituted the route of passage between Asia and North America in the Carboniferous, the paleomagnetic reconstruction by Scotese (1986) does not work.

By accepting the idea of warm marine currents coming from northeast Asia, the presence of the mixed Peratovich microfauna juxtaposed with an American microfauna farther east is explained by a relatively fixist theory of continental blocks. Bringing in allochthonous terranes by large displacements along transform faults is not necessary to explain these observations. The Peratovich is not a suspect terrane; it is an intriguing one.

REFERENCES CITED


Brenckle, P.L., 1973, Smaller Mississippian and Lower Pennsylvanian calcareous foraminifers from Nevada: Cushman


Foundation for Foraminiferal Research, Special Publication 11, 82 p.

Lipina, O.A., 1973, [Tournaisian stratigraphy and paleobiogeography based on the Foraminifera]: Akademiya Nauk SSSR, Voprosy Mikropaleontologii, v. 16, p. 3–75. [In Russian.]


—1948a, [About some Endothyra of the group Endothyra bradyi Mikhailov]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 176–181. [In Russian.]


—1948c, [Foraminifers and stratigraphy of the Visean and the Namurian series of the central part of the Russian platform and areas adjoining the Urals]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 102–142. [In Russian.]

—1948d, [Some new Lower Carboniferous Foraminifera from the Syzran district]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 239–243. [In Russian.]

—1948e, [Some new species of Foraminifera from the Lower Carboniferous sediments of the Moscow Basin]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 227–238. [In Russian.]

—1948f, [Stratigraphy of the Visean series of the southern part of the Moscow Basin, by means of foraminiferal fauna]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 3–40. [In Russian.]

—1948g, [The genus Cribrospira Möller]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 186–189. [In Russian.]

—1948h, [The genus Haplophragmella and similar forms]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 159–165. [In Russian.]

—1948i, [The Lower Carboniferous Endothyra of the group Endothyra crassa Brady and similar forms]: Akademiyu Nauk SSSR, Geologicheskogo Instituta Trudy 62, no. 19, p. 166–175. [In Russian.]

Raymond, Anne, Parker, W.C., and Parrish, J.T., 1985, Phyto­geography and paleoclimate of the Early Carboniferous, in Tiffney, B.H., ed., Geological factors and the evolution of
Rui Lin, 1987, [Fusulinaceans across the Mid-Carboniferous ---1980, Carboniferous calcareous Foraminifera from north­
---1986, Foraminifera, stratigraphy and regional interpreta­
Rich, Mark, 1974, Upper Mississippian (Carboniferous) calcare­ous algae from northeastern Alabama, south-central Tennes­
---1980, Carboniferous calcareous Foraminifera from north­


INDEX

A

Abstract, 1
abundans, Komia, pl. 17
Acrocyathus pensylvanicum, 6
Adetognathus unicornis, 15
advena, Eostaffella, pl. 10, 17
alaskensis, Sciophyllum, 6
alaskensis, Taphroganathus, 16
Albertaporella, 18, 20
Alexander Archipelago, 1
terrane, 4
Algal barrier, 8
aliquantulus, Cuneiphycus, pl. 17
aljutovica, Planoendothyra, pis. 3, 17
altus, Cavusgnathus, 7
Amphrocystis, pls. 14, 17
angusta, Tetrataxis, pl. 12, 17
antiqua, Climacammina, 14; pis. 13, 17
Pseudostaffella, 15
Aoujgalia richi, pl. 17
Aphralysia capriorae, pl. 17
approximatus, Archaediscus, pls. 15, 17
Archaediscus, 14, 19
approximatus, pls. 15, 17
chernoussovensis, pl. 17
karreri, 12, 17
koktjubensis, 11; pis. 14, 17
krestovnikovi, 11; pis. 14, 17
moelleri, pls. 15, 17
sp., 6
spp., 7
Archeolithophyllum missouriensum, pl. 17
Asphaltina, pls. 18-20
cordillerensis, 14, 15, pl. 17
Asphaltinella, pls. 18-20
horowitzi, 15; pl. 17
Asteroarchaeodiscus baschkiricus, 14; pls. 15, 17
ovoides, pls. 15, 17
sp., pl. 17
astraeiforme, Thyasophyllum, 6
Atractyliopsis, 18, 20
minima, pl. 17

B

Banffella, 12, 19
sp., pl. 17
banffensis, Stelechophyllum, 6
baschkiricus, Asteroarchaeodiscus, 14; pls. 15, 17
Bevocastria, 18, 20
conglobata, pl. 17
birdi, Stelechophyllum?, 6
Biseriella, 14, 15
parva, 14; pls. 13, 17
sp., pl. 17
Bitubertina sp., pl. 16
bothrops, Neognathodus, 7, 16
bowmani, Endothyra, pls. 3, 17
bradyi, Cribrostomum, pl. 13

C

Calcifolium, 18, 20
Calcisphaera laevis, pl. 17
pachysphaerica, pl. 17
capriorae, Aphralysia, pl. 17
Carbonella, 11
carbonica, Millerella, 15; pls. 11, 17
Carboniferous environments, southeast Alaska, 7
stratigraphic distribution, 8
Cavusgnathus, 7
altus, 7
chernoussovensis, Archaediscus, pl. 17
chesterensis, Eostaffella, pls. 10, 17
clavata, Earlrandia, pls. 1, 17
Climacammina, 5, 7, 12, 14, 17, 19
antiqua, 14; pls. 13, 17
padunensis, pls. 13, 17
sp., pl. 17
Coelosporella, 18
compressa, Endothyranopsis, 12; pls. 7, 17
connica, Bradyina, pls. 9, 17
Conclusions, 18
conica, Tetrataxis, pls. 12, 17
connorensis, Epistacheoides, 15; pl. 17
Conodonts, 3
Consobrinella, pl. 17
cordillerensis, Asphaltina, 14, 15; pl. 17
crassa, Endothyranopsis, pl. 17
Cribrospiru, 19
cribrostomata, Bradyina, 14; pl. 17
Cribrostomum, 12, 17, 19
bradyi, pl. 13
paraeximium, pls. 13, 17
sp., 14; pl. 17
Cuneiphycus, 5; pls. 18-20
aliquantulus, pl. 17
texana, pl. 17

D

Dainella, 11, 19
Deckerella laheei, pls. 13, 17
Declinognathodus noduliferus, 15
delicata, Kamaena, pl. 17
delicatus, Idiognathoides, 16
demaneti, Nodosarchaediscus, pl. 14

densa, Pseudoendothyra, pls. 11, 17

designata, Zellerinella, 14; pls. 11, 17
devea, Priscella, pl. 17
deveonica, Issinella, pl. 17
Diachronism, 17, 19
Diphyphyllum klawockensis, 6
venosum, 6
Diplophaerina mastophora, pls. 16, 17
ovoidea, pls. 16, 17
sp., pl. 17
discoidea, Zellerinella, pls. 11, 17
Discussion, microfossils, Peratrovich Formation, 18
donbassicus, Eolasiodiscus, pis. 12, 17
Donezella, 5; pls. 18-20
latigini, pl. 17

Earlandia, 12; pl. 16
clavatula, pls. 1, 17
elegans, pls. 1, 17
minima, pl. 17
vulgaris, 11; pls. 1, 17
Ekvasophyllum inclinatum, 6
willami, 6
elegans, Earlandia, pls. 1, 17
Endemism, 18
Endostaffella, 11, 13, 19
Endothyra, 11
bowmani, pls. 3, 17
excellens, pls. 3, 17
excentrals, pls. 3, 17
hortonensis, pls. 3, 17
obsoleta, pls. 3, 17
similis, pls. 3, 17
torquida, pls. 2, 17
sp. 6; pl. 17
Endothyranella recta, pls. 3, 17
sp., pl. 17
Endothyranopsis, 15, 19
compressa, 12; pls. 7, 17
crassa, pl. 17
hirosei, 12; pls. 7, 17
sphaerica, pls. 6, 7
intermedia, 14; pls. 6, 7, 17
Environments, Carboniferous, southeast Alaska, 7
stratigraphic distribution, 8
Eoendothyranopsis, 11, 13, 17, 18, 19
ermakiensis, 12; pls. 5, 6, 17
pressa-rara, pls. 5, 6, 17
robusta, pl. 17
scitula, 11; pls. 6, 17
Eoendothyranopsis? sp., pl. 5
Eoforschia, 11, 13, 19
moelleri, 11, 12; pls. 1, 2, 17
Eolasiodiscus, 19
donbassicus, pls. 12, 17
Eosigmoilina, 15
Eostaffella, 11, 15, 17, 18, 19
advena, pls. 10, 17
chestereensis, pls. 10, 17
infecta, pls. 10, 17
mosquensis, pl. 10
radiata, 13; pls. 10, 17
sp., pls. 11, 17

Eostaffellina, 14
ovesa, 14; pls. 10, 17
paraprotvae, 14; pls. 10, 17
sp., pl. 17
Eotextularia, 11
Eotuberitina, pl. 17
Eovolutina, pl. 16
Epistacheoides, 18
connorensis, 15; pl. 17
nephroformis, 15; pl. 17
ermakiensis, Eoendothyranopsis, 12; pls. 5, 6, 17
Eoxic basin, 8
excellens, Endothyra, pls. 3, 17
excentrals, Endothyra, pls. 3, 17
"exotica, Globivalvulina," pl. 17

Faberophyllum, 7
girtyi, 6
Fasciella, 14; pls. 18-20
kizilia, pl. 17
sp., pl. 17
flabellata, Hedstroemia, pl. 17
Foraminiferal zones, 10
Fore barrier, 8
Forschia, 11, 13, 19
Forschchiella, 13, 19
Fourstonella, 18
fursenkoii, Glomospiroides, pl. 17

Garwoodia, 18
Geologic setting, 4
girtyi, Faberophyllum, 6
simplex, Gnathodus, 7
Girvanello, 18; pls. 18-20
wetheredii, pl. 17
Globivalvulina, 15; pl. 17
bulloides, 16; pl. 17
moderata, pl. 13
sp. D, 15
"Globivalvulina exotica," pl. 17
Globoendothyra, 11; pl. 17
globulus, 12; pls. 4, 17
ishimica, 12; pls. 4, 17
paula, pls. 4, 17
tomilensis, 11; pls. 4, 17
sp., 6, 11; pl. 17
globulus, Globoendothyra, 12; pls. 4, 17
Glomospiroides fursenkoii, pl. 17
mikhailovi, pls. 16, 17
Glomospiroides? sp., pls. 16, 17
Gnathodus, 7
bulbosus, 6
girtyi simplex, 7
texanus pseudosemiglaber, 6
gordialiformis, Pseudoglomospira, 15; pls. 16, 17
gracilis, Proninella, pl. 17
grandis, Neoarchaediscus subbaschkiricus, pls. 15, 17
gregorii, Planospirodicus, pls. 15, 17

Haplophragmina, 13, 19
Hedstroemia flabellata, pl. 17
Hemigordius sp., pls. 1, 17

Index 29
Hindeodella, 7
Hindeodus minutus, 16
hirorei, Endothyranopsis, 12; pls. 7, 17
Homoceras, 15
horowitzi, Asphalinitella, 15; pl. 17
horrida, Insolentitheca, 15; pls. 9, 17
hortonensis, Endothyra, 3, 17
Howchinia, 11, 12, 19
bradyina, 13, 14; pls. 12, 17
Idiognathoides delicatus, 16
"Idiognathoides" noduliferus, 1, 16
incertus, Neoarchaediscus, 13; pls. 15, 17
inclination, Evasophyllum, 6
inflata, Koninckopora, pl. 17
inflecta, Eostaffella, 14; pls. 10, 17
Insolentitheca horrida, 16; pls. 17
intermedia, Endothyranopsis sphaerica, 14; pls. 6, 7, 17
Introduction, 1
irregularis, Pseudoglomospira, 1; pls. 1, 17
ishimica, Globoendothyra, 12; pis. 4, 17
issinella, 6, 8, 9; pis. 18-20
devonica, 17
sainsii, pl. 17
Janischewskina, 11, 15, 19
operculata, 15, pl. 17
typica, 15; pls. 8, 9, 17
sp., pl. 17
Kamaena, 6, 7; pls. 18-20
delicata, pl. 17
sp., pl. 17
karreri, Archaeodiscus, 12, 17
kennedyi, Septatournayella?, 11; pls. 1, 17
kizilia, Fasciella, pl. 17
klawockensis, Diphyphyllum, 6
koktjubensis, Archaediscus, 11; pls. 14, 17
Komia, 5, 7, 8, 15, 18; pls. 18-20
abundans, pl. 17
Koninckopora, 5, 6, 7, 8, 13, 18, 20; pls. 18-20
inflata, pl. 17
tenitramosa, pl. 17
sp., pl. 17
krestovnikovi, Archaeodiscus, 11; pls. 14, 17
Kuznets-North American domain, 16, 17, 18, 19
K
Kamaena, 6, 7; pls. 18-20
delicata, pl. 17
sp., pl. 17
karreri, Archaeodiscus, 12, 17
kennedyi, Septatournayella?, 11; pls. 1, 17
kizilia, Fasciella, pl. 17
Klawak Formation, 3, 4, 5, 7, 8, 9, 15
Klawak Island, 1, 5, 7
klawockensis, Diphyphyllum, 6
koktjubensis, Archaediscus, 11; pls. 14, 17
Komia, 5, 7, 8, 15, 18; pls. 18-20
abundans, pl. 17
Koninckopora, 5, 6, 7, 8, 13, 18, 20; pls. 18-20
inflata, pl. 17
tenitramosa, pl. 17
sp., pl. 17
krestovnikovi, Archaeodiscus, 11; pls. 14, 17
Kuznets-North American domain, 16, 17, 18, 19
L
Ladrones Island, 1, 5, 7
Ladrones Limestone, 4, 5, 7, 8, 9, 15, 16
laevis, Calcisphaera, pl. 17
Lagoon, open and restricted, 8
laheei, Deckerella, pls. 13, 17
lahuseni, Palaeoberesella, pl. 17
Latiendothyra, 11
lenensis, Brusina, 12; pls. 1, 17
Lithostrotion (Siphonodendron) warreni, 6
(Siphonodendron) sp., 6
Litouotubella, 11, 13
Loeblichia, 19
longiseptata, Palaetaextularia, 12; pls. 13, 17
lutugini, Donezella, pl. 17
Macaronesia, 6
madre de Dios Island, 1, 4, 5, 6
Mametella skimoensis, pl. 17
mamei, Pseudoammodiscus, pls. 1, 17
Marginal basin, 8
Mastovporidium, pls. 17-20
mastothea, Diplosphaerina, pl. 16, 17
meandririforms, Stacheoides, pl. 17
Mediocris, 11, 19
breviscula, pis. 10, 17
Microfossils, stratigraphic distribution, 10
mikhailovi, Globoendothyra, pl. 16, 17
Millerella, 15
carbonica, 15; pls. 11, 17
prilukiensis, 15; pls. 10, 17
sp., 7
minima, Atractyliopsis, pl. 17
Earlandia, pl. 17
minutus, Hindeodus, 16
Mississippian-Pennsylvanian boundary, 15
Missouriensium, Archaeolithophyllum, pl. 17
Mitcheldeania, 18, 20
nicholsoni, pl. 17
moderator, Globivalvulina, pl. 13
moelleri, Archaeodiscus, pl. 15, 17
Eoforschia, 11, 12; pls. 1, 2, 17
Monotaxinoides, 19
multivolus, pl. 17
transitorius, pls. 12, 17
sp., pls. 12, 17
Monotaxinoides? subconicus, pls. 12, 17
mosquensis, Eostaffella, pl. 10
multivolus, Monotaxinoides, pl. 17
Nanopora, 18
Neoarchaediscus, 13
incertus, 13; pls. 15, 17
parvus, 13; pls. 14, 17
regularis, 13; pl. 17
subbaschkiricus, pls. 15, 17
grandis, pls. 15, 17
timanicus, pl. 17
sp., pls. 14, 17
sp., 7
Neognathodus bothrops, 7, 16
Neoportuniodus, 7
nephridiforms, Epistacheoides, 15; pl. 17
nicholsoni, Mitcheldeania, pl. 17
Nodosarchaediscus demaneti, pl. 14
sp., pl. 14
noduliferus, Declinognathodus, 15
"Idiognathoides," 7, 16
North American domain, 18, 19
Nostocites vesiculosa, pl. 17
sp., pl. 17
obsoleta, Endothyra, pls. 3, 17
Occurrences, foraminiferal zones, 10
omphalota, Omphalotis, 15, 16, 17; pls. 4, 17
Omphalotis, 11, 15, 19
omphalota, 15, 16, 19; pls. 4, 17
Open-marine platforms, 8
operculata, Janischewskena, 15; pl. 17
ornata, Pseudoendothyra, pl. 11
Orthriosiphon saskatchewanensis, pl. 17
Orthriosiphonoides sp., pl. 17
Ortonella, 18, 20
sp., pl. 17
ovesa, Eostaffellina, 14; pls. 10, 17
ovoidea, Diplosphaerina, pls. 16, 17
ovoideas, Asteroarchaediscus, pls. 15, 17
Ozarkodina, 7

P
pachysphaera, Calcisphaera, pl. 17
pacificus, Idiognathoides, 16
padunensis, Climacamina, pls. 13, 17
Palaeoberesella lavuseni, pl. 17
sp., pl. 17
Palaeotextularia longisegata, 12; pls. 13, 17
sp., pl. 17
Paleobiogeography, concepts, 16
Paracalligelloides sp., pl. 17
paraximum, Cribrostomum, pls. 13, 17
paraminima, Tetrataxis, pls. 12, 17
paraprograe, Eostaffellina, 14; pls. 10, 17
parva, Biseriella, 14; pls. 13, 17
parviconica, Tetrataxis, pl. 12
parvus, Neoarchaediscus, 13; pls. 14, 17
regularis, Neoarchaediscus, 13; pl. 17
pauciseptata, Spinothyra, pls. 8, 17
paula, Globoendothyra, pls. 4, 17
Pelmatozoan meadows, 8
pennsylvanicum, Acrocyathus, 6
Peratovich Formation, stratigraphy, 4
Cherty spiculite and radiolarite member, 4, 8, 10
Lower cherty limestone member, 6, 8, 10, 11
Lower limestone member, 6, 8, 10, 12
Upper cherty limestone member, 7, 8, 10, 12, 13
Upper limestone member, 7, 8, 14, 15
Peratovich Island, 1, 4, 5, 7
peratovichensis, Ungedrella, 15; pl. 17
Permodiscus, 19
Petalaxis, 7
Phylogenetic sequences, 19
Planochaediscus, 12
sp., pl. 17
Planodiscus, pls. 14, 17
Planendothyra alituvicna, pls. 3, 17
pseudomosquensis, pl. 17
Planospirodiscus, 13
gregorii, pls. 15, 17
sp., pl. 17
polyfurcata, Psuedohedstroemia, pl. 17
Polygnathus, 7
Polyphacoccum, 18
polytrematoidea, Stacheoidea, pl. 17
pottani, Bradyina, pls. 8, 9, 17
pressa-rara, Eoendothyranopsis, pls. 5, 6, 17
prilukiensis, Millereia, 15; pls. 10, 17
primas, Rhachistognathus, 15
Prince of Wales Island, 1, 3, 4
prisca, Priscella, pls. 3, 17
Priscella, 11
dexa, pl. 17
prisca, pls. 3, 17
Proninella, pls. 18-20
gracilis, pl. 17
trigosa, pl. 17
Propermodiscus, 11, 19
Pseudoammodiscus mamei, pls. 1, 17
volgensis, pls. 1, 17
Pseudoendothyra, 11
densia, pls. 11, 17
ornata, pl. 11
sau Viei, 13; pls. 11, 17
sp., 7
"Pseudoendothyra" (Volgella), 14
Pseudoglamospira gordialiformis, 15; pls. 16, 17
irregularis, pls. 1, 17
Pseudohedstroemia, 18, 20
polyfurcata, pl. 17
Pseudolitotubellina, 11
pseudomosquensis, Planendothyra, pl. 17
pseudosemiglaber, Gnathodus texanus, 6
Pseudostaflifl, 15, 16
antiqua, 15
sp., 16; pl. 17
Pseudoaxitis, 11
sp., pl. 17
Pycnostroma, 18
Q
Quasiarchaediscus, 15
Quasipolyderma, pl. 16
R
radiata, Eostaffella, 13; pls. 10, 17
recta, Endothyranella, pls. 3, 17
References cited, 21
regularis, Neoarchaediscus parvus, 13; pl. 17
Rhachistognathus primus, 15
richi, Aoujgalia, pl. 17
robusta, Eoendothyranopsis, pl. 17
rotula, Bradyina, 17
S
sainsii, Issinella, pl. 17
saskatchewanensis, Orthriosophon, pl. 17
Scyophyllum alaskaensis, 6
sciutla, Eoendothyranopsis, 11; pls. 6, 17
Sedimentary environments, Carboniferous, southeast Alaska, 7
stratigraphic distribution, 8
Semistaffella, 15
Septabrunsiina, 11
sp., 6
Septaglomospiranella, 11
sp., 6; pl. 17
Septatournayella sp., 11; pl. 17
Septatournayella? kennedyi, 11; pls. 1, 17
Shelikof Island, 1, 4, 5, 6
similis, Endothyra, pls. 3, 17
simplex, Gnathodus girtyi, 7
(Siphonodendron) warreni, Lithostrotion, 6
sp., Lithostrotion, 6
skimoensis, Mametella, pl. 17
Skippella sp., pl. 17
Spathognathodus, 7
Sphaerocodium, 18
Sphinctoporella, 18, 20
Spinocyathus, 11
Spinocyathus, 11, 19
pauciseptata, pias. 8, 17
Spinotournayella, 11
spirillinoides, Brunsia, pl. 17
spissa, Stacheoides?, pl. 17
Spongiostromata, 8
Stacheia, 18
Stachoeides, 18; pias. 18-20
meandriiformis, pl. 17
polytrematoides, pl. 17
tenuis, pl. 17
Stachoeides? spissa, pl. 17
Stelechophyllum, 7
bonfensis, 6
Stelechophyllum? birdi, 6
maclareni, 6
strigosa, Proninella, pl. 17
struvi, Pseudoendothyra, 13; pias. 11, 17
subbauschkiricus, Neoarchaeodiscus, pias. 15, 17
grandis, Neoarchaeodiscus, pias. 15, 17
subconicus, Monotaxinoides?, pias. 12, 17
Summary, 20

Taphrognathus alaskensis, 16
varians, 6
Taymir-Alaska domain, 16, 17, 19
Tectonic setting, 4
tenuiramosa, Koninckopora, pl. 17
tenuis, Stachoeides, pl. 17
Terrane, Alexander, 4
Tethys, 1, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
Tetrataxis, 19
angusta, pias. 12, 17
conica, pias. 12, 17
paraminima, pias. 12, 17
parviconica, pl. 12
texana, Cuneiphycus, pl. 17
texanus pseudosemiglaber, Gnathodus, 6
Thysanophyllum astraiforme, 6
timanicus, Neoarchaeodiscus, pl. 17
tomiliensis, Globothyra, 11; pias. 4, 17
torquida, Endothyra, pias. 2, 17
Togi Island, 1, 4, 5
Tournayella, 11
transitius, Monotaxinoides, pias. 12, 17
transius, Viseidiscus, pias. 14, 17
Trepeiopsis, pl. 16
Tubertina, pl. 17
typica, Janischewskina, 15; pias. 8, 9, 17
PLATES 1–16

All illustrated specimens are from the Peratrovich Formation, except where noted otherwise (Klawak Formation or Ladrones Limestone). Captions for specimens include the name, University of Montreal Department of Geology number, Armstrong field-note footage (number shows year of collection, section number, and stratigraphic position in feet above base of section), locality, level in the section, foraminiferal zone, stage, and magnification.

Contact photographs of the plates in this report are available, at cost, from the U.S. Geological Survey Photographic Library, Federal Center, Denver, CO 80225
PLATE 1

FIGURES 1, 2. *Earlandia* of the group *E. elegans* (Rauzer-Chernousova 1937).
1. Se 3/16, 66X-1+380 (L.1), Peratrovich Island, 116.3 m above base of section, Zone 18–20, Namurian(?), ×62.
2. Se 2/24, 66X-1+285 (L.6), Peratrovich Island, 87.2 m above base of section, Zone 18, early Namurian, ×97.
3. Se 25/30, 66X-1+100, Madre de Dios Island, 30.6 m above base of section, Zone 14, late Visean, ×62.
4. Ma 366/15, 66X-1+470 (L.1), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×97.
5. Ma 507/11, 66X-12+180C, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
6. Ma 508/13, 66X-12+280E, Ladrones Island, 85.7 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.
7. Ma 508/10, 66X-12+280B, same locality as figure 6, ×97.
8, 9, 11. *Brusnia* of the group *B. lenensis* Bogush and Juferev 1966.
8. Ma 506/28, 66X-12+160D, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
9. Se 22/4, 66X-6+60, Toti Island, 18.4 m above base of section, Zone 13, middle Visean, ×97.
11. Se 3/17, 66X-1+380 (L.1), same locality as figure 1, ×62.
10. Ma 371/7, 66X-11+110 (L.3), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Visean, ×97.
18. Ma 369/37, 66X-11+110 (L.23), same locality as figure 10, ×97.
12. Ma 370/8, 66X-11+110 (L.28), same locality as figure 10, ×97.
13. Ma 372/4, 66X-11+110, same locality as figure 10, ×118.
14, 15. "*Hemigordius*" sp.
14. Ma 506/31, 66X-12+170A, Ladrones Island, 52.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
15. Ma 506/17, 66X-12+160A, same locality as figure 8, ×97.
16. Se 15/33, 66X-12+50 (L.22), Ladrones Island, 15.3 m above base of section, Zone 18–20, Namurian(?), ×97.
17. Ma 367/30, 66X-1+380 (L.2), same locality as figure 1, ×97.
19. Ma 371/34, 66X-11+110 (L.2), same locality as figure 10, ×97.
20. Ma 370/3, 66X-11+110 (L.28), same locality as figure 10, ×97.
21. Se 11/28, 66X-11+150 (L.46), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Visean, ×121.
22. Secondary deposit (hook) of *Eoforschia* of the group *E. moelleri* (Malakhova in Dain 1953).
22. Ma 371/28, 66X-11+150 (L.49), same locality as figure 21, ×121.
23. Se 11/26, 66X-11+150 (L.46), same locality as figure 21, ×62.
BRUNSIA, EARLANDIA, EOFORSCHIA, "HEMIGORDIUS", PSEUDOAMMODISCUS, PSEUDOGLOMOSPIRA, SEPTATOURNAYELLA(?)
1. Ma 371/30, 66X-11+150 (L.50), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Viséan, ×97.
2. Ma 371/2, 66X-11+110 (L.39), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Viséan, ×78.
3. Ma 371/36, 66X-11+150 (L.52), same locality as figure 1, ×78.
4. Se 9/11, 66X-11+90 (L.10), Madre de Dios Island, 27.5 m above base of section, Zone 14, late Viséan, ×62.
5. Ma 368/34, 66X-11+90 (L.10), same locality as figure 4, ×62.
6. Ma 370/37, 66X-11+110 (L.38), same locality as figure 2, ×62.
7. Se 11/6, 66X-11+110 (L.35), same locality as figure 2, ×62.

8. Ma 371/3, 66X-11+140 (L.54), Madre de Dios Island, 42.8 m above base of section, Zone 14, late Viséan, ×87.
9. Se 10/24, 66X-11+110 (L.31), same locality as figure 2, ×97.
10. Se 10/17, 66X-11+110 (L.38), same locality as figure 2, ×97.
11. Ma 370/5, 66X-11+110 (L.28), same locality as figure 2, ×97.
12. Ma 370/6, 66X-11+110 (L.28), same locality as figure 2, ×97.
13. Ma 370/13, 66X-11+110 (L.28), same locality as figure 2, ×97.
ENDOTHYRA, EOFORSCHIA
PLATE 3

1. Ma 37/26, 66X-11+150 (L.49), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Visean, ×97.
2. Ma 369/39, 66X-11+110 (L.23), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Visean, ×97.
3. Ma 370/36, 66X-11+110 (L.38), same locality as figure 2, ×97.
4. Ma 370/26, 66X-11+110 (L.33), same locality as figure 2, ×97.
5. Ma 370/12, 66X-11+110 (L.31), same locality as figure 2, ×97.
6. Ma 370/30, 66X-11+110 (L.34), same locality as figure 2, ×97.
7. Ma 371/24, 66X-11+110 (L.49), same locality as figure 2, ×97.
8. Ma 370/34, 66X-11+110 (L.34), same locality as figure 2, ×97.
9. Ma 371/25, 66X-11+150 (L.49), same locality as figure 1, ×97.
10. Ma 370/5, 66X-11+110 (L.28), same locality as figure 2, ×97.
11. Ma 370/18, 66X-11+110 (L.31), same locality as figure 2, ×97.
12. Ma 370/17, 66X-11+110 (L.31), same locality as figure 2, ×97.
17. Ma 371/27, 66X-11+150 (L.49), same locality as figure 1, ×97.
13. Ma 370/15, 66X-11+110 (L.31), same locality as figure 2, ×97.
14. Se 10/19, 66X-11+110 (L.28), same locality as figure 2, ×62.
15. Se 12/1, 66X-11+150 (L.48), same locality as figure 1, ×62.
16. Se 10/15, 66X-11+110 (L.28), same locality as figure 2, ×62.
18. Ma 506/26, 66X-12+160C, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
19. Se 14/17, 66X-8+620, Shelikof Island, 189.7 m above base of section, Zone 17, early Namurian, ×97.
20. Ma 275/34, 66X-8+300, Shelikof Island, 91.8 m above base of section, Zone 15, late Visean, ×97.
21. Ma 275/33, 66X-8+300, same locality as figure 20, ×97.
22. Se 11/1 66X-11+110 (L.32), same locality as figure 2, ×97.
23. Se 11/11 66X-11+110 (L.37), same locality as figure 2, ×62.
24. Ma 369/28 66X-11+110 (L.22), same locality as figure 2, ×97.
25. Se 11/17 66X-11+110 (L.39), same locality as figure 2, ×97.
ENDOTHYRA, ENDOTHYRANELLA, PLANOENDOTHYRA, PRISCELLA

1. Se 6/24, 66X-1+440 (L.19), Peratrovich Island, 134.6 m above base of section, Zone 18-20, Namurian(?), ×78.
2. Se 8/26, 66X-1+470 (L.7), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×62.
3. Ma 366/12, 66X-1+455, Peratrovich Island, 139.2 m above base of section, Zone 18-20, Namurian(?), ×62.


4. Ma 368/24, 66X-8+540, Shelikof Island, 165.2 m above base of section, Zone 16, late Visean, ×62.
9. Ma 367/113, 66X-1+366 (L.7), Peratrovich Island, 112.0 m above base of section, Zone 18-20, Namurian(?), ×62.

5-8, 10, 11. *Globoendothyra* of the group *G. tomiensis* (Grozdilova and Lebedeva 1954).

5-8, 10. *Globoendothyra ishimica* (Rauzer-Chernousova 1948).
5. Ma 506/32, 66X-12+170A, Ladrones Island, 52.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×62.
6. Se 15/17, 66X-12+40, Ladrones Island, 12.2 m above base of section, Zone 18-20, Namurian(?), ×62.
7. Se 4/26, 66X-1+415, Peratrovich Island, 127.0 m above base of section, Zone 18-20, Namurian(?), ×62.
8. Se 4/26, 66X-1+415, same locality as figure 7, ×62.
10. Se 8/22, 66X-1+470, Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×62.
11. Ma 403/1, 66X-6+260, Toti Island, 79 m above base of section, Zone 14, late Visean, ×62.
GLOBOENDOTHYRA, OMPHALOTIS
Figure 1–6. *Eoendothyranopsis* of the group *E. pressa-rara* (Grozdilova in Lebedeva 1954).

1. Ma 370/25, 66X-11+110 (L.23), Madre de Dios, 33.6 m above base of section, Zone 14, late Visean, x62.
2. Ma 368/36, 66X-11+90 (L.11), Madre de Dios Island, 27.5 m above base of section, Zone 14, late Visean, x78.
3. Ma 371/35, 66X-11+150 (L.52), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Visean, x78.
4. Ma 371/18, 66X-11+150 (L.47), same locality as figure 3, x78.
5. Ma 360/27, 66X-11+100 (L.22), Madre de Dios Island, 30.6 m above base of section, Zone 14, late Visean, x62.
6. Ma 372/3, 66X-11+110 (L.23), same locality as figure 1, x78.
7. Se 11/4, 66X-11+110 (L.33), same locality as figure 1, x97.


7. Ma 370/33, 66X-11+110 (L.37), same locality as figure 1, x97.
8. Se 10/5, 66X-11+110 (L.23), same locality as figure 1, x97.

10–12. *Eoendothyranopsis* sp.

10. Se 25/8, 66X-11+100, same locality as figure 5, x97.
11. Se 25/29, 66X-11+100, same locality as figure 5, x97.
12. Ma 370/20, 66X-11+110 (L.31), same locality as figure 1, x97.
EOENDOTHYRANOPSIS
PLATE 6


1. Ma 368/12, 66X-1+415 (L.5), Peratrovich Island, 127.0 m above base of section, Zone 18–20, Namurian(?), ×30.
2. Ma 368/22, 66X-1+430 (L.11), Peratrovich Island, 131.6 m above base of section, Zone 18–20, Namurian(?), ×30.
3. Ma 506/27, 66X-12+160D, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×30.
4. Ma 368/20, 66X-1+470 (L.8), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×30.
5. Ma 176/25, 66X-1+440 (L.38), Peratrovich Island, 134.6 m above base of section, Zone 18–20, Namurian(?), ×25.


6. Ma 370/35, 66X-11+110 (L.38), same locality as figure 11, ×78.
7. Ma 317/5, 66X-11+110 (L.39), same locality as figure 11, ×97.
8. Se 12/8, 66X-11+150 (L.54), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Visean, ×62.
10. Ma 3 70/29, 66X-11+110 (L.33), same locality as figure 11, ×97.


9. Ma 369/20, 66X-11+110 (L.22), same locality as figure 11, ×97.
12. Ma 370/32, 66X-11+110 (L.28), same locality as figure 11, ×97.
Figures 1, 2. *Endothyranopsis compressa* (Rauzer-Chernousova and Reitlinger 1936).
   2. Se 10/6, 66X-11+110 (L.23), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Visean, ×62.

3, 4. Transition between *Endothyranopsis compressa* (Rauzer-Chernousova and Reitlinger 1936) and *E. hirosei* Okimura 1965.
   3. Ma 371/18, 66X-11+120 (L.42), Madre de Dios Island, 36.7 m above base of section, Zone 14, late Visean, ×97.
   4. Ma 370/11, 66X-11+110 (L.31), same locality as figure 2, ×97.

   5. Ma 371/3, 66X-11+110 (L.29), same locality as figure 2, ×97.
   6. Ma 370/13, 66X-11+110 (L.31), same locality as figure 2, ×97.
   7. Ma 371/21, 66X-11+150 (L.48), Madre de Dios Island, 45.9 m above base of section, Zone 14, late Visean, ×97.
   8. Ma 370/21, 66X-11+110 (L.34), same locality as figure 2, ×97.
   9. Ma 369/35, 66X-11+110 (L.23), same locality as figure 2, ×97.

   10. Se 6/25, 66X-1+440 (L.18), Peratrovich Island, 134.6 m above base of section, Zone ≥18–20, Namurian(?), ×25.
      11. Se 6/24, 66X-1+440 (L.17), same locality as figure 10, ×25.

1. Ma 366/19, 66X-1+470 (L.3), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×30.

2. Ma 366/13, 66X-1+470 (L.1), same locality as figure 1, ×30.

3. Ma 366/5, 66X-1+461 (L.5), Peratrovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×25.

4. Se 4/7 66X-1+366 (L.9), Peratrovich Island, 112.0 m above base of section, Zone ≥18–20, Namurian(?), ×25.

5. Bradyina potanini Venukoff 1889.


7. Se 6/8, 66X-1+366 (L.6), same locality as figure 4, ×25.

8. Ma 366/17, 66X-1+470 (L.2), same locality as figure 1, ×30.

9. Se 17/8, 66X-12+110 (L.45), Ladrones Island, 33.6 m above base of section, Zone ≥18–20, Namurian(?), ×25.

10. Se 16/7, 66X-12+70 (L.29), Ladrones Island, 21.4 m above base of section, Zone ≥18–20, Namurian(?), ×25.

11. Ma 367/3, 66X-1+366 (L.1), same locality as figure 4, ×30.

12. Se 4/35, 66X-1+415 (L.8), Peratrovich Island, 127.0 m above base of section, Zone ≥18–20, Namurian(?), ×25.


13. Ma 376/3, 66X-1+470, same locality as figure 1, ×25.
BRADYINA, JANISCHEWSKINA, SPINOTHYRA
PLATE 9

1. Se 8/18, 66X-1+470 (L.1), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×25.
2. Se 6/15, 66X-1+440 (L.23), Peratrovich Island, 134.6 m above base of section, Zone ≥18–20, Namurian(?), ×25.

4–6, 10. Bradyina potanini Venukoff 1889.
4. Se 6/2, 66X-1+440 (L.22), same locality as figure 2, ×25.
5. Ma 173/25, 66X-1+430, Peratrovich Island, 131.6 m above base of section, Zone ≥18–20, Namurian(?), ×25.
10. Ma 366/22, 66X-1+470 (L.5), same locality as figure 1, ×30.

7. Se 5/28, 66X-1+415 (L.2), Peratrovich Island, 127.0 m above base of section, Zone ≥18–20, Namurian(?), ×25.
8. Se 4/34, 66X-1+415 (L.7), same locality as figure 7, ×25.
11. Ma 506/14, 66X-12+150E, Ladrones Island, 45.9 m above base of section, Ladrones Lime­stone, Zone 20, early Bashkirian, ×62.

   1. Ma 368/13, 66X-1+415 (L.5), Peratrovich Island, 127.0 m above base of section, Zone 218–20, Namurian(?), ×97.
   2. Ma 508/19, 66X-12+280C, Ladrones Island, 85.7 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.
   3. Ma 366/16, 66X-1+470 (L.1), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×97.
   4. Se 18/5, 66X-12+150A, Ladrones Island, 45.9 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
   5. Ma 508/16, 66X-12+280E, same locality as figure 2, ×97.

   6. Se 8/9, 66X-1+470 (L.10), same locality as figure 3, ×62.
   7. Ma 366/26, 66X-1+470 (L.6), same locality as figure 3, ×97.
   8. Ma 508/9, 66X-12+260B, Ladrones Island, 79.6 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.
   9. Se 19/11, 66X-1+260C, same locality as figure 8, ×97.
   10. Se 18/2, 66X-12+150B, same locality as figure 4, ×62.
   11. Ma 508/15, 66X-12+260D, same locality as figure 8, ×97.
   12. Ma 367/29, 66X-1+366 (L.11), Peratrovich Island, 112.2 m above base of section, Zone 218–20, Namurian(?), ×97.
   15. Ma 366/18, 66X-1+470 (L.2), same locality as figure 3, ×97.

   13. Ma 367/18, 66X-1+366 (L.10), Peratrovich Island, 112.0 m above base of section, Zone 218–20, Namurian(?), ×97.
   14. Se 2/12, 66X-1+163 (L.11), Peratrovich Island, 49.8 m above base of section, Zone 17, early Namurian, ×97.
   16. Se 8/22, 66X-1+470 (L.10), same locality as figure 3, ×62.

   17. Ma 506/19, 66X-12+260A, same locality as figure 8, ×97.

   18. Ma 366/9, 66X-1+461 (L.10), Peratrovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×97.

   19. Ma 367/17, 66X-1+366 (L.11), same locality as figure 13, ×97.
   20. Se 2/9, 66X-1+163 (L.8), same locality as figure 14, ×97
   21. Ma 368/25, 66X-8+620, Shelikof Island, 189.7 m above base of section, Zone 17, early Namurian, ×97.
   22. Ma 367/4, 66X-1+366 (L.1), same locality as figure 13, ×97.

   23. Ma 505/33, 66X-12+150A, same locality as figure 4, ×97.
   24. Ma 366/35, 66X-1+290 (L.3), Peratrovich Island, 88.7 m above base of section, Zone 18, early Namurian, ×97.
   25. Ma 367/17, 66X-1+366 (L.11), same locality as figure 13, ×97.

   26. Ma 367/8, 66X-1+366 (L.4), same locality as figure 13, ×97.
PLATE 11

   1. Ma 506/22, 66X-12+160B, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
   2. Se 3/6, 66X-1+366 (L.4), Peratrovich Island, 112.0 m above base of section, Zone ≥18–20, Namurian(?), ×97.
   3. Ma 366/36, 66X-1+305 (L.7), Peratrovich Island, 93.3 m above base of section, Zone ≥18–20, Namurian(?), ×97.

   4. Ma 507/9, 66X-12+180C, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
   5. Ma 506/23, 66X-12+160B, same locality as figure 1, ×97.
   6. Se 18/12, 66X-12+160B, same locality as figure 1, ×62.
   7. Se 5/29, 66X-1+420 (L.2), Peratrovich Island, 128.5 m above base of section, Zone ≥18–20, Namurian(?), ×62.
   9. Ma 505/32, 66X-12+150A, Ladrones Island, 45.9 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
10. Ma 173/19, 66X-1+420, same locality as figure 7, ×97.
   11. Ma 472/11, 66X-12+250, Ladrones Island, 76.5 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×62.
12. Eostaffella sp.
   12. Se 19/4, 66X-12+250, same locality as figure 11, ×62.

   13. Se 8/3, 66X-12+470 (L.7), Ladrones Island, 143.8 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×62.
   15. Ma 367/5, 66X-1+366 (L.2), same locality as figure 2, ×97.
   16. Se 3/13, 66X-1+366 (L.11), same locality as figure 2, ×62.
   17. Se 3/5, 66X-1+366 (L.4), same locality as figure 2, ×62.
   18. Ma 366/38, 66X-1+366 (L.1), same locality as figure 2, ×97.
   19. Se 17/3, 66X-12+110 (L.46), Ladrones Island, 33.6 m above base of section, Zone ≥18–20, Namurian(?), ×62.
21. Ma 366/30, 66X-1-425 (L.4), Peratrovich Island, 74.9 m above base of section, Zone 18, early Namurian, ×78.

20. Pseudoendothyra of the group P. ornata (Brady, 1876) [=Pseudoendothyra of the group P. struvei (von Möller 1880)].
   20. Ma 507/3, 66X-12+180A, same locality as figure 4, ×97.
EOSTAFFELLA, MILLERELLA, PSEUDOENDOTHYRA, ZELLERINELLA
PLATE 12

1. Ma 372/9, 66X-7+340, Shelikof Island, 104.0 m above base of section, Zone 10 or slightly younger, early Visean, ×97.
2. Ma 372/8, 66X-7+110, Shelikof Island, 33.6 m above base of section, Zone 9 or slightly younger, late Tournaisian, ×97.
3. Ma 366/11, 66X-1+461, Peratrovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×78.
5. Ma 372/10, 66X-7+340, same locality as figure 1, ×97.

4. Se 16/24, 66X-12+90 (L.37), Ladrones Island, 27.5 m above base of section, Zone ≥18–20, Namurian(?), ×62.

6. Se 19/26, 66X-1+470 (L.7), Peratrovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×62.
7. Ma 366/10, 66X-1+461, same locality as figure 3, ×78.
8. Ma 366/10, 66X-1+461, same locality as figure 3, ×78.

9. Ma 394/21, 66X-1+0, Peratrovich Island, base of section, Zone 168, latest Visean, ×97.
10. Ma 394/7, 66X-1+0, same locality as figure 9, ×97.
11. Ma 394/20, 66X-1+0, same locality as figure 9, ×97.

12, 13. *Monotaxinoides* sp.
12. Ma 507/23, 66X-12+230, Ladrones Island, 70.4 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.
13. Ma 366/14, 66X-1+470 (L.1), same locality as figure 6, ×97.

14. Se 1/3, 66X-12+430, Ladrones Island, 131.2 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.

15. Se 5/32, 66X-1+420 (L.2), Peratrovich Island, 128.5 m above base of section, Zone ≥18–20, Namurian(?), ×97.

16. Ma 173/36, 66X-1+440, Peratrovich Island, 134.6 m above base of section, Zone ≥18–20, Namurian(?), ×97.
17. Ma 173/15, 66X-1+420, same locality as figure 15, ×97.
EOLASIODISCUS, HOWCHINIA, MONOTAXINOIDES, TETRATAxis
Plate 13

   1. Se 3/18, 66X-1+380 (L.1), Peratrovich Island, 116.2 m above base of section, Zone 18–20, Namurian(?), x62.
   2. Se 1/6, 66X-12+740, Ladrones Island, 226.4 m above base of section, Ladrones Limestone, Zone 22, late Bashkirian, x78.
   3. Se 26/13, 66X-1+380 (L.4), same locality as figure 1, x97.
   4. Se 26/9, 66X-1+380 (L.1), same locality as figure 1, x97.
   5. Se 26/1, 66X-1+380 (L.4), same locality as figure 1, x97.

4, 7. Globivalvulina of the group G. moderata Reitlinger 1949 (primitive Globivalvulina with poorly developed diaphanoca).
   4. Ma 506/3, 66X-12+150B, Ladrones Island, 45.9 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, x97.
   5. Ma 367/9, 66X-1+380 (L.4), same locality as figure 1, x97.

   8. Ma 507/15, 66X-12+180E, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, x62.
   9. Ma 367/35, 66X-1+380 (L.4), same locality as figure 1, x78.

10. Cribrostomum bradyi (von Möller 1879)
   10. Ma 19/15, 66X-12+260, Ladrones Island, 79.6 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, x25.

   11. Se 26/33 and 34, 66X-1+440 (L.20), Peratrovich Island, 134.6 m above base of section, Zone 18–20, Namurian(?), x62.

   12. Ma 507/14, 66X-12+180E, same locality as figure 8, x41.

   13. Ma 366/20, 66X-1+470 (L.4), Peratrovich Island, 143.8 above base of section, Klawak Formation, Zone 20, early Bashkirian, x30.

   14. Se 26/31 and 32, 66X-12+70 (L.20), Ladrones Island, 21.4 m above base of section, Zone 18–20, Namurian(?), x62.
BISERIELLA, CLIMACAMMINA, CRIBROSTOMUM, DECKERELLA, GLOBIVALVULINA, PALAEOTEXTULARIA
PLATE 14

FIGURE 1. *Viseidiscus transitus* (Reitlinger, 1969) (=“*Planodiscus*” of authors and *Ammarchaediscus* of authors). 1. Se 9/32, 66X-11+100 (L.17), Madre de Dios Island, 30.6 m above base of section, Zone 14, late Visean, x97. 2–31. *Archaediscus* of the group *A. krestovnikovi* Rauzer-Chernoussova 1948. 26. Se 6/5, 66X-1+420 (L.2), Peratrovich Island, 128.5 m above base of section, Zone ≥18–20, Namurian(?), x97. 27. Se 8/16, 66X-12+160C, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, x97. 31. Se 3/19, 66X-1+380 (L.1), Peratrovich Island, 116.2 m above base of section, Zone ≥18–20, Namurian(?), x97. 2–12, 15, 29, 30. *Archaediscus koktjubensis* Rauzer-Chernoussova 1948. 2. Ma 505/12, 66X-12+140B, Ladrones Island, 42.8 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, x97. 3. Ma 369/17, 66X-11+100 (L.16), same locality as figure 1, x97. 4. Ma 369/4, 66X-11+90 (L.11), Madre de Dios Island, 27.5 m above base of section, Zone 14, late Visean, x97. 5. Ma 369/8, 66X-11+90 (L.12), same locality as figure 4, x97. 6. Se 11/13, 66X-11+110 (L.37), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Visean, x97. 7. Ma 369/6, 66X-11+100 (L.19), same locality as figure 1, x97. 8. Ma 370/4, 66X-11+110 (L.38), same locality as figure 6, x97. 9. Se 25/20, 66X-11+100, same locality as figure 1, x97. 10. Se 25/27, 66X-11+110 (L.16), same locality as figure 6, x97. 11. Ma 369/22, 66X-11+100 (L.19), same locality as figure 1, x97. 12. Ma 369/9, 66X-11+90 (L.13), same locality as figure 4, x97. 13. Se 9/18, 66X-11+90 (L.10), same locality as figure 4, x97. 14. Se 6/23, 66X-1+440 (L.20), Peratrovich Island, 134.6 m above base of section, Zone ≥18–20, Namurian(?), x97. 15. Se 9/22, 66X-11+90 (L.12), same locality as figure 4, x97. 16. Se 23/9, 66X-6+320 (L.10), Toti Island, 98.2 m above base of section, Zone 14, late Visean, x97. 17. Se 4/3, 66X-1+380 (L.6), same locality as figure 1, x97. 18. Ma 369/11, 66X-11+90 (L.14), same locality as figure 4, x97. 19. Ma 366/8, 66X-1+461 (L.10), Peratrovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, x97. 20. Ma 366/8, 66X-1+461 (L.10), Peratrovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, x97. 21. Se 6/32, 66X-12+90 (L.40), Ladrones Island, 27.5 m above base of section, Zone ≥18–20, Namurian(?), x97. 22. Se 16/32, 66X-12+90 (L.40), same locality as figure 21, x97. 23. Ma 173/8, 66X-1+420, same locality as figure 26, x97. 24. Se 11/8, 66X-11+110 (L.35), same locality as figure 6, x97. 25. Se 9/5, 66X-11+130, Madre de Dios Island, 39.6 m above base of section, Zone 14, late Visean, x97. 26. Se 11/4, 66X-11+110 (L.37), same locality as figure 6, x97. 32, 33. "*Nodosarchaediscus*” sp. 32. Ma 507/13, 66X-12+180D, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, x97. 33. Se 16/18, 66X-12+90 (L.36), same locality as figure 21, x97. 34, 35. *Neoarchaediscus parvus* (Rauzer-Chernoussova 1948). 34. Se 14/33, 66X-12+90 (L.4), Ladrones Island, base of section, Zone 18, early Namurian, x97. 35. Ma 508/7, 66X-12+260A, Ladrones Island, 79.6 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, x97. 36, 37. *Neoarchaediscus* sp. 36. Se 16/30, 66X-12+90 (L.40), same locality as figure 21, x97. 37. Se 3/32, 66X-1+380 (L.5), same locality as figure 31, x97.
ARCHAEDISCUS, NEOARCHAEDISCUS, "NODOSARCHAEDISCUS", VISEIDISCUS
PLATE 15


1. Se 9/32, 66X-11+100 (L.17), Madre de Dios Island, 30.6 m above base of section, Zone 14, late Viséan, ×97.

2–4. Planospirodiscus gregorii (Dain in Dain and Grozdilova 1953).

2. Ma 368/19, 66X-1+470 (L.9), Patrotovich Island, 143.8 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×97.

3. Se 7/13, 66X-1+445 (L.1), Patrotovich Island, 136.2 m above base of section, Zone ≥18–20, Namurian(?), ×78.

4. Se 2/20, 66X-1+275, Peratrovich Island, 84.2 m above base of section, Zone 18, early Namurian, ×97.


5. Se 15/29, 66X-12+50 (L.23), Ladrones Island, 15.3 m above base of section, Zone ~18–20, Namurian(?), ×97.

6. Se 2/20, 66X-1+275, Peratrovich Island, 27.5 m above base of section, Zone ≥18–20, Namurian(?), ×97.


7. Se 3/24, 66X-1+380 (L.3), Patrotovich Island, 116.2 m above base of section, Zone ≥18–20, Namurian(?), ×78.

8. Ma 507/7, 66X-12+180B, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.

9. Ma 173/32, 66X-12+432, Ladrones Island, 134.2 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.

10. Se 3/24, 66X-1+380 (L.4), same locality as figure 7, ×97.

11. Se 3/33, 66X-1+380 (L.6), same locality as figure 7, ×97.

12. Ma 173/21, 66X-1+420, Peratrovich Island, 128.5 m above base of section, Zone ≥18–20, Namurian(?), ×97.

13. Ma 173/31, 66X-12+432, same locality as figure 9, ×97.

14. Ma 505/27, 66X-12+150A, Ladrones Island, 45.9 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.


15. Ma 173/22, 66X-1+420, same locality as figure 12, ×97.

16. Ma 366/1, 66X-1+457 (L.5), Patrotovich Island, 139.8 m above base of section, Zone ≥18–20, Namurian(?), ×97.

17. Se 18/10, 66X-12+150A, same locality as figure 14, ×78.

18. Se 15/27, 66X-12+50 (L.24), same locality as figure 5, ×78.


20. Ma 505/5, 66X-12+140A, Ladrones Island, 42.8 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.

21. Ma 173/7, 66X-1+420, same locality as figure 12, ×97.

22. Ma 506/10, 66X-12+150D, same locality as figure 14, ×97.

23. Ma 506/5, 66X-12+150C, same locality as figure 14, ×97.

24. Ma 506/38, 66X-12+170B, Ladrones Island, 52.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.

25. Ma 366/3, 66X-1+461 (L.4), Patrotovich Island, 141.0 m above base of section, Klawak Formation, Zone 20, early Bashkirian, ×97.

26. Ma 505/24, 66X-12+140E, same locality as figure 20, ×97.

27. Ma 505/22, 66X-12+140E, same locality as figure 20, ×97.

28. Se 18/8, 66X-12+150A, same locality as figure 14, ×97.


28. Se 17/11, 66X-12+120 (L.48), Ladrones Island, 36.7 m above base of section, Zone ≥18–20, Namurian(?), ×78.

30. Ma 507/22, 66X-12+230, Ladrones Island, 70.4 m above base of formation, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.

31. Ma 173/9, 66X-1+420, same locality as figure 12, ×97.

32. Ma 506/33, 66X-12+170A, same locality as figure 24, ×97.

33. Se 16/15, 66X-12+80 (L.39), Ladrones Island, 24.5 m above base of section, Zone ≥18–20, Namurian(?), ×97.

34. Ma 505/15, 66X-12+140C, same locality as figure 20, ×97.
ARCHAEDISCUS, ASTEROARCHAEDISCUS, NEOARCHAEDISCUS, PLANOSPIRODISCUS

1. Se 15110, 66X-12+30 (L.13), Ladrones Island, 9.2 m above base of section, Zone 18–20, Namurian(?), ×97.
2. Se 15118, 66X-12+40 (L.19), Ladrones Island, 12.2 m above base of section, Zone 18–20, Namurian(?), ×97.
3. Ma 372/37, 66X-12+5 (L.6), Ladrones Island, 1.5 m above base of section, Zone 18, early Namurian, ×97.
4. Se 15112, 66X-12+40 (L.17), same locality as figure 2, ×97.

5, 6. Calcisphere in an *Earlandia* simulating a *Quasipolyderma* or an *Eovolutina*.

5. Se 16/4, 66X-6+60 (L.26), Toti Island, 18.4 m above base of section, Zone 13, middle Visean, ×97.
6. Se 1117, 66X-11+110 (L.35), Madre de Dios Island, 33.6 m above base of section, Zone 14, late Visean, ×97.


7. Ma 506/26, 66X-12+170B, Ladrones Island, 52.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
8. Ma 507/1, 66X-12+170E, same locality as figure 7, ×97.
9. Ma 506/11, 66X-12+150D, Ladrones Island, 45.9 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
14. Ma 507/5, 66X-12+180B, Ladrones Island, 55.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.

10, 15. Wall of *Glomospiroides*? sp.

10. Ma 367/25, 66X-1+380 (L.9), Peratrovich Island, 116.2 m above base of section, Zone 18–20, Namurian(?), ×78.
15. Ma 367/37, 66X-1+380 (L.2), same locality as figure 10, ×97.


11. Se 1118, 66X-11+110 (L.39), same locality as figure 6, ×97.


12. Se 4/9, 66X-1+380 (L.2), same locality as figure 10, ×97.

13. *Bituberitina* sp.

13. Se 16/25, 66X-12+180B, same locality as figure 14, ×97.


16. Ma 368/1, 66X-1+380 (L.5), same locality as figure 10, ×62. Note agglutination of two different genera, refuting a syzygial origin.

17, 18. *Glomospiroides*? sp.

17. Ma 506/20, 66X-12+160A, Ladrones Island, 49.0 m above base of section, Ladrones Limestone, Zone 20, early Bashkirian, ×97.
18. Ma 508/14, 66X-12+280D, Ladrones Island, 85.7 m above base of section, Ladrones Limestone, Zone 21, middle Bashkirian, ×97.

19. *Volvotextularia* sp. (=*Trepeilopsis* of the literature).

19. Se 18/28, 66X-12+180C, same locality as figure 14, ×97.
BITUBERITINA, DIPLOSPHAERINA, EARLANDIA, GLOMOSPIROIDES, INSOLENTITHECA, PSEUDOGLOMOSPIRA, VOLVOTEXTULARIA