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THE ARTHROPOD FAUNA OF THE UPPER CARBONIFEROUS ROCKS OF THE MARITIME PROVINCES

BY

M. J. COPELAND

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PREFACE

Upper Carboniferous rocks of the Maritime Provinces have long been known to contain the only reserves of bituminous coal in Eastern Canada. Coal has been mined in Nova Scotia in commercial quantities since at least 1720 and records of coal being shipped from Minto, New Brunswick to New England date back as far as 1639. The earliest detailed survey of part of these coal-bearing strata was made by Sir William E. Logan in his first year as Director of the newly-formed Geological Survey of Canada. Since then numerous geologists have surveyed additional coal-bearing Upper Carboniferous strata throughout the Maritimes. In recent years W. A. Bell has established a composite stratigraphic sequence within the Maritime coalfields of more than 28,000 feet of Upper Carboniferous beds and has described their contained floras.

The present report affords the first account of the stratigraphic succession of Upper Carboniferous fossil arthropod faunas found mostly within the several Maritime coalfields. A faunal zonation of these strata and correlation of the coalfields based on arthropod remains have resulted, and have substantiated and augmented the previous stratigraphic work of W. A. Bell. A general discussion of the arthropods is given, and they are described and illustrated. Most of the arthropods are referable to species already known from Europe, but one new family, one new genus, and sixteen new species are described.

GEORGE HANSON,
Director, Geological Survey of Canada

OTTAWA, February 15, 1956

THE ARTHROPOD FAUNA OF THE UPPER CARBONIFEROUS ROCKS OF THE MARITIME PROVINCES

CHAPTER I

INTRODUCTION

The arthropods dealt with in this report were collected from Upper Carboniferous strata in northern Nova Scotia, southeastern New Brunswick, and Prince Edward Island. The sediments containing them were laid down in several basins of deposition, including the important Sydney, Pictou, and Cumberland coalfields and the smaller fields of Port Hood, Mabou Mines, and St. Rose.

Today these Carboniferous strata underlie about 30,000 square miles of country between and around the Caledonia, Cobequid, Antigonish, and Cape Breton Uplands. These Uplands are a present day expression of more important highlands that existed in the Maritime Provinces of Canada through a large part of Upper Carboniferous time. They delimited several major and minor basins of deposition, and their erosion provided much of the coarser clastic material to river alluvium and lacustrine deposits that accumulated in the intervening sedimentary basins. The great thickness of these basin sediments, aggregating many thousands of feet, and the occurrence within the sedimentary sequence of local fans of boulder-conglomerate has led to the conclusion that the ancient upland areas were tectonically positive and complementary to progressively subsiding adjacent basins (Bell, 1927; 1944, p. 2)[1].

The strata containing the arthropod faunas, except for the very early part which may be estuarine or even partly marine, are non-marine, a factor supporting the inferred limnic nature of the basins. They are collectively designated here Upper Carboniferous rather than Pennsylvanian, because the earliest of them, including some considered to be Namurian in age, may belong to a late stage in the Mississippian.

The study of the arthropod faunas was undertaken during the field seasons of 1950, 1951-1953 for the primary purpose of age correlation and to evaluate their usefulness in a zonal classification. Collections of material were made by the author during several field seasons while engaged in stratigraphic investigations. Other material used in the study was from earlier collections of the Geological Survey of Canada.

The author is deeply indebted to Dr. R. V. Kesling and other members of the Department of Geology, University of Michigan, for their direction and guidance during the preparation of this material. He also acknowledges his indebtedness to those who aided him during the field and laboratory investigations.

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[1]Names and dates in parentheses are those of references cited in Chapter IV.

CHAPTER II

STRATIGRAPHY

DEPOSITIONAL ENVIRONMENT

The non-marine Upper Carboniferous sedimentary rocks of the Maritime area were deposited in what Bell (1944, p. 2) has termed the 'Fundy basin'. This depositional basin is bordered on the south by the Meguma crystalline massif and on the north by the New Brunswick Highland. The floor of the major geosynclinal basin was progressively folded and warped during Upper Carboniferous time, resulting in secondary subsiding basins and complementary rising uplands. The most important upland areas from west to east were the Caledonia, Cobequid, Antigonish (McLellan-Brown), and Cape Breton Uplands, which delimited in part three major sub-basins, Cumberland, Minas, and Sydney.

The Caledonia Upland formed part of the northern boundary of the Cumberland basin, and was the southern boundary of what may be termed the 'New Brunswick shelf', because it lacks definite basin structures and was actually an eroded part of the New Brunswick Highland upon which Upper Carboniferous sedimentation encroached. Two subsidiary extensions of the ancient Caledonia Upland partly encircled a Moncton sub-basin situated in southeastern New Brunswick. The Cobequid Upland separated the Cumberland from the Minas basin throughout a large part of middle and late Upper Carboniferous time. These basins, however, apparently merged through structural gaps between the Cobequid and the McLellan-Brown Uplands, and between the latter and the Cape Breton Upland. A smaller Sydney basin lay southeast of the Cape Breton Upland, but little is known about the upland that formed its southern border.

STRATIGRAPHIC CLASSIFICATION

In the past, numerous geologists have attempted to use lithological criteria for classification of the Upper Carboniferous strata of the region (*see* Hayes and Bell, 1923, pp. 3-4; 12). These classifications attempted to group Upper Carboniferous strata into lithological units based on the presence of a lower coarse phase (the Millstone grit) and an upper zone or zones of coal-bearing strata (the Productive Coal Measures). Stratigraphic classifications based on lithological similarities have, however, proved to be impossible in inter-basinal correlation.

Readily recognizable beds of distinctive lithology are employed in local areas, with various degrees of success, to zone the deposits stratigraphically. These beds may be coal seams, non-marine limestones, conglomerates, or red and black shales. A stratigraphic division of local strata based on key beds is extremely valuable in limiting the range of coal-bearing deposits, and has been used with good results by Shaw (1951).

Bell (1944, p. 30) divided the Upper Carboniferous strata of the Maritimes into several groups, each with a distinctive flora and fauna. These are, in ascending order, the Canso, Riversdale, Cumberland, and Pictou groups. Wherever possible, Bell's stratigraphic terminology has been used in the present paper.

MAJOR AREAS OF DEPOSITION

As already mentioned, beds of Upper Carboniferous age within the Maritime region are found in several basins. These are essentially parallel northeast trending structures collectively designated as the Fundy basin or geosyncline, and separated from each other by upland areas, mainly of intrusive rocks. Sediments of Upper Carboniferous age were deposited between, and at times encroached upon, the adjacent upland areas. Owing to differential uplift and subsidence, structural relationships of most stratigraphic units may vary within each of these depositional areas. To some extent a distinctive sedimentational facies may be recognized as characteristic of one basin and differing from that of adjacent areas of deposition.

The Minas basin of deposition occupies the central lowlands of Nova Scotia. It comprises a narrow strip of land extending along the Minas basin of the Bay of Fundy eastward to the Pictou coalfield in eastern-central Nova Scotia. Two independent extensions of this structural trough are present on Cape Breton Island with a sedimentary facies similar to that of the true Minas basin. In the northern extension deposits are scattered in discontinuous patches along the northwestern coast, whereas in the southern extension deposits are scattered along the southern coast of the island. These two areas of Minas facies deposition are separated from each other by the Creignish and Cape Breton Uplands and are cut off from the Cumberland basin by a presumed positive structure north of the McLellan-Brown Upland. Rocks of the Minas and Cumberland facies are in contact along the Stellarton structural gap, which contains the economically important Pictou coalfield. This gap appears to have been a continuously sinking graben during the time of deposition of the lower Pictou Stellarton group.

Beds of Upper Carboniferous age have been known to occur throughout the Minas basin since Fletcher reported on the geology of numerous map-areas (1881). Hyde (1913) was the first to report on Upper Carboniferous strata around the Strait of Canso and at Riversdale and Parrsboro. The Lake Ainslie area on the western coast of Cape Breton Island contains strata of the Minas basin facies, which were reported on by Norman (1935). The best summation of some of the Upper Carboniferous rocks of the Minas basin and its subsidiary extensions was published by Bell (1944).

The Upper Carboniferous rocks of the Minas basin are commonly in fault contact with rocks of Lower Carboniferous or older age. These strata have been cut by numerous faults and are overlain in places by extrusive and sedimentary rocks of Triassic age. Owing to the faulting and lack of easily recognized marker horizons, measurement of these Upper Carboniferous sections is particularly difficult and, in places, impossible. The best exposed sections may be found within a radius of

20 miles of Truro. There, strata of the Canso, Riversdale, Cumberland, and part of the Pictou groups are exposed in faulted sections.

In the eastern sub-basins of Minas facies on Cape Breton Island, Upper Carboniferous beds rest disconformably upon older strata. Throughout the central part of Cape Breton the Upper Carboniferous rocks are relatively undisturbed, with only minor amounts of folding and faulting. Along the northwestern coast of the island, strata of the Canso, Riversdale, and Pictou groups occur as discontinuous patches in fault contact with rocks of Lower Carboniferous age. Several of these small areas contain economic coal deposits such as those of the Port Hood, Mabou Mines, Inverness, St. Rose, and Chimney Corner coalfields. Due to the absence of beds of Cumberland age on Cape Breton Island and the occurrence of beds of other Upper Carboniferous groups bearing a distinct Minas facies, a presumed barrier north of the McLellan-Brown Upland has been postulated by Bell (1944, p. 2) to separate the facies of the Minas and Cumberland basins in this area.

The Cumberland basin of deposition occupies the northern isthmus of Nova Scotia and the entire province of Prince Edward Island. Structurally it is bounded by the Caledonia Upland to the northeast and the Cobequid Upland to the south. A possible easterly boundary may have been intermittently present during the Upper Carboniferous north of the McLellan-Brown uplift (Bell, 1944, p. 2), restricting eastward deposition of rocks of the Cumberland facies. A narrow extension of this basin to the west may account for the occurrence of Cumberland type deposits in the Saint John area, New Brunswick.

The presence of Upper Carboniferous rocks in this area was first noted by Lyell (1843) and Logan (1845). Dawson (1855 et seq.) later studied these strata and divided them into several stratigraphic units. A second stratigraphic section of the Joggins area was published by Poole (1908). Matthew (1889 et seq.) was the first to study the rocks in the vicinity of Saint John, but it was not until 1914 that the true age of these Upper Carboniferous strata was defined by Stopes. More recently, Bell (1913, 1924, 1944) has divided this thick sequence of Upper Carboniferous beds into comprehensive stratigraphic units based on lithological and palæobotanical criteria. A lithological subdivision of the rocks of the western part of this basin was presented by Shaw (1951).

The Upper Carboniferous rocks in the western part of the Cumberland basin rest disconformably on rocks of Lower Carboniferous age. These strata have not been greatly deformed although several northeast trending faults of various stratigraphic displacements are present in the area. The structure is essentially that of a northeast trending syncline interrupted at several places by a series of upthrust Lower Carboniferous beds. A complete section of the lower part of the Upper Carboniferous sequence occurs along the coast of Chignecto Bay, extending from a point 5 miles north of Joggins for 35 miles southwest. This Joggins section, which contains nearly 13,000 feet of Upper Carboniferous strata, is one of the most widely known sequences of Upper Carboniferous rocks in the world.

The strata in the eastern part of the Cumberland basin consist of some rocks of higher stratigraphic position than those exposed near Joggins.

There rocks of the lower part of the Upper Carboniferous have been folded into a series of northeast trending anticlines and synclines that have been masked by a mantle of younger Carboniferous strata, the Pictou group. Within the synclines developed along the Northumberland coast of Nova Scotia this group has a thickness of over 7,000 feet. Farther east in Prince Edward Island younger beds are exposed, but whether they are also of late Upper Carboniferous (Stephanian) or are of early lower Permian age is as yet uncertain.

The Moncton sub-basin occupies the southeastern part of New Brunswick. It is bounded on the west by two easterly trending extensions of the Caledonia Upland and plunges to the east beneath transgressive beds of Pictou age. The eastern part of this sub-basin has not definitely been proved in the subsurface to be distinct from the Cumberland basin to the south. The structure of this area has been mapped by Wright (1922) and Gussow (1953). Strata of Lower Carboniferous age are disconformably overlain by beds of the Riversdale group, which lie unconformably beneath rocks of the Pictou group.

The Morien or Sydney basin, the third major area of Upper Carboniferous sedimentation on Cape Breton Island, lies around Sydney, and contains the economically important Sydney coalfield. Sediments of this basin encroached on the Cape Breton Upland to the north, but no evidence of a southern boundary is known. The beds plunge with shallow easterly dips beneath the Atlantic ocean. Upper Carboniferous strata of this basin are restricted to beds of the lower Canso group, conformably overlain by rocks of the Pictou group. A summary of the history and previous work in this area has been published by Hayes and Bell (1923, pp. 2-7).

The New Brunswick shelf, the largest area of Upper Carboniferous deposits in the Maritimes, occupies a large triangular region in eastern and central New Brunswick. This shelf area is bounded on the northwest by the New Brunswick–Gaspé Highlands and on the southwest by the Caledonia Upland. A veneer of flat-lying Pictou beds blankets the entire area. These beds are not known to exceed 1,000 feet in thickness. Economic coal deposits of the Pictou group are mined at Minto and Chipman, and have been reported on by Muller (1952).

UPPER CARBONIFEROUS STRATA

The Upper Carboniferous rocks of the Maritime Provinces have been divided by Bell (1944, p. 5) into the following groups, the Pictou being the youngest:

Pictou group
  Unconformity and local disconformity

Cumberland group
  Unconformity and local disconformity

Riversdale group
  Unconformity and local disconformity

Canso group

Canso Group

Definition

The Canso group has been defined by Bell (1944, p. 5) and is well developed in the type section exposed along the Strait of Canso near Port Hastings (op. cit., p. 6). This section is comprised of over 2,000 feet of alternating red and grey shales and sandstones. These predominantly fine-grained rocks are the characteristic facies of the Minas sedimentary basin and the associated sub-basins on Cape Breton Island. A second facies of the Canso is present in the Cumberland basin, comprised of thick, ripple-marked, and sun-cracked, red shales and red and grey sandstones, grey argillaceous shales being rare or absent.

The contact of the Canso group with the older Windsor group in some areas is a disconformity whereas elsewhere a conformable contact is postulated and an arbitrary boundary has been drawn. This conformable (?) contact has been placed at or above the uppermost occurrence of marine shells and marks the boundary between the substantially marine Windsor and the non-marine Canso beds. Within the Cumberland basin, however, the boundary has been placed within non-marine strata lying above marine Windsor (Bell, 1944, p. 8).

There is evidence that the Windsor sea withdrew first from the New Brunswick shelf area and the Cumberland basin. Unfossiliferous red sandstones and shales of the Maringouin formation are present in southeastern New Brunswick and western Nova Scotia lying above marine lower Windsor strata. These rocks are overlain by red and grey sandstones of the Shepody formation which contains plant remains indicative of the Canso group. On Cape Breton Island and in the Minas basin, on the other hand, marine upper Windsor strata immediately underlie strata of the Canso group, and rocks of brackish-water facies are intercalated within the lower part of the Mabou and Point Edward formations of Canso age. The presence of species of *Beyrichiopsis* and *Paraparchites* within lower Canso strata of these two formations may indicate the highest occurrence of Carboniferous brackish-water deposition in the Maritimes.

Distribution of Arthropods

The Canso group may be arbitrarily divided into two faunal units. Nowhere has the upper unit been found stratigraphically above the lower unit, but rocks of presumed lower Canso age exhibit a pronouncedly different fauna from those of the upper Canso. An intermingling of the faunas of these two divisions appears to be present near Parrsboro, although certain elements of both units are lacking. The lower unit is represented by predominantly non-marine strata, locally with some intercalated brackish-water beds. The non-marine rocks contain species of *Tealliocaris*, *Dithyrocaris*, and *Lynceites*. These arthropods have been found together in the West Bay formation near Parrsboro, and occur separately in lower Canso strata near Port Hastings and Mabou. The presumably brackish-water beds contain the distinctive ostracod genera *Paraparchites* and *Beyrichiopsis*. They are associated with *Carbonita fabulina* (Jones and Kirkby), a freshwater ostracod, and *Carbonicola* cf. *aquilina* Sowerby, a brackish or freshwater pelecypod. This fauna has been found at Bay St. Lawrence, Point Edward, and Mabou, N.S.

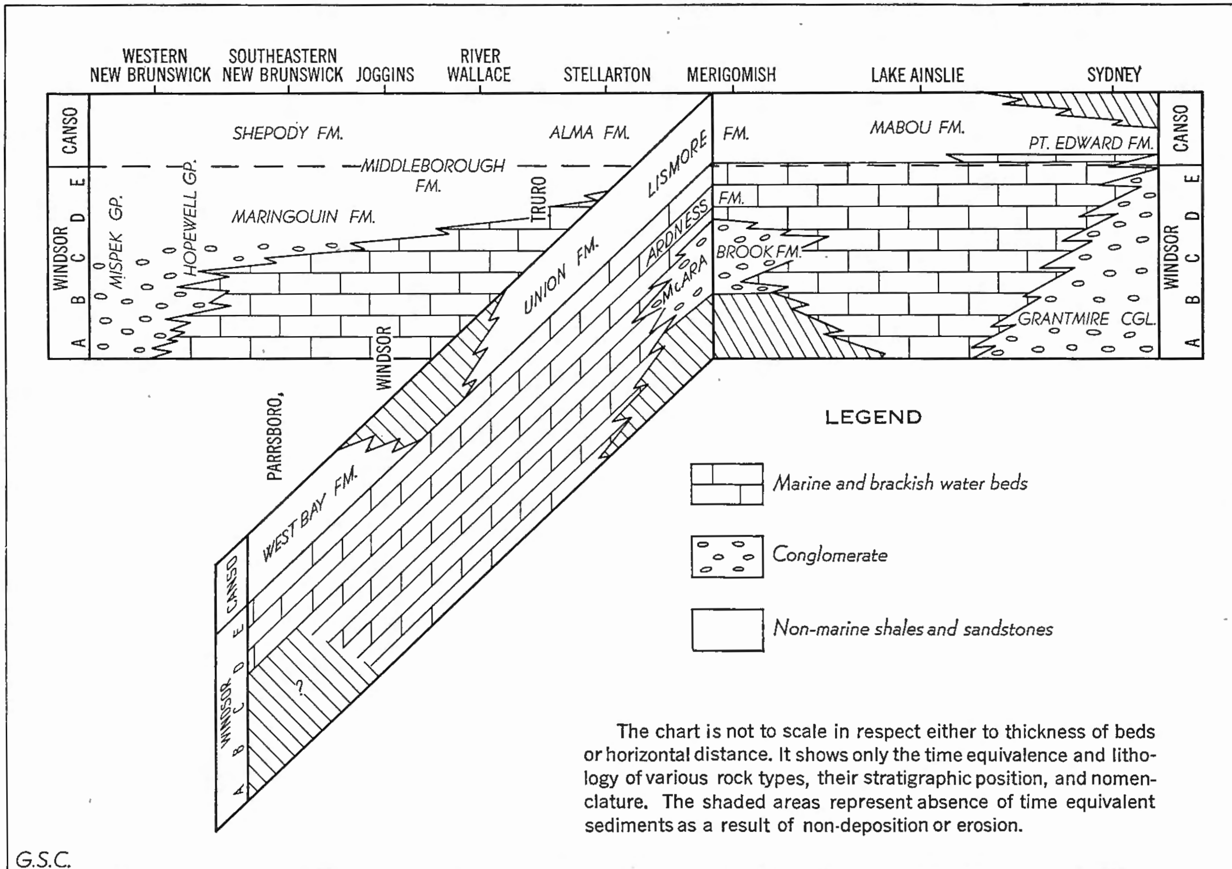


FIGURE 1. Time Chart of the Windsor and Canso Groups.

The upper unit of the Canso group is represented by non-marine shales and siltstones with a well-developed conchostracan fauna. The most prominent of these are *Leaia baentschiana* (Beyrich) and *Leaia acutilirata* n.sp. This fauna has been found in the type section on the Strait of Canso, near Lismore, Union, Parrsboro, and Joggins, N.S., and in the Shepody formation in southeastern New Brunswick.

Correlation

Difficulty is encountered in correlating the Canso group with equivalent strata outside the Maritime region. The lower faunal unit contains two ostracods which are questionably referred to *Paraparchites okeni* (Münster) and *Paraparchites scotoburdigalensis* (Hibbert). These ostracods are found associated with *Beyrichiopsis* sp. in the Carboniferous Limestone series of Scotland (Jones and Kirkby, 1886; and Latham, 1932).

The presence of species of *Tealliocaris* presents a special problem. This genus has previously been reported only from strata of the Scottish Calciferous Sandstone series, the lowest division of the Lower Carboniferous of Scotland (Peach, 1908). One species, *T. caudafimbriata* n.sp., is common to both the Calciferous Sandstone and the lower Canso. Both groups moreover may bear a flora similar to that of the Namurian A zone of the Upper Carboniferous of Europe. On the basis of this floral correlation and the position of the lower Canso beds above strata of the Windsor group carrying a Lower Carboniferous (Visean) marine fauna, these beds are placed stratigraphically in the basal part of the Upper Carboniferous.

The upper Canso unit contains numerous conchostracans. This fauna includes *Leaia baentschiana* (Beyrich), *Leaia leidyi* (Lea), and *Leaia tricarinata* Meek and Worthen, all of lower Upper Carboniferous age.

An interval of non-deposition or erosion of Upper Namurian age shown by Bell (1944, Fig. 11) to separate the Canso and Riversdale groups, cannot be certainly distinguished on the basis of faunal assemblages. A gradation from strata of Namurian to possible lower Westphalian A age appears to be indicated with only a slight faunal variation and no apparent lithological break.

Riversdale Group

Definition

The Riversdale group has been defined by Bell (1944, p. 12) from the type locality near Riversdale, Colchester County. No adequate measurement can be made of this section due to faulting, but several thousand feet of fine-grained grey shales occur interbedded with a few thin sandstone beds.

This group of strata is entirely non-marine in origin, grey sandstones and shales comprising most of the strata. Locally a basal conglomerate may be present, as at Joggins where the Claremont formation disconformably overlies strata of the Canso group and at Parrsboro where basal conglomerates of the Parrsboro formation lie with marked angular unconformity on the West Bay formation of Canso age. As with the Canso group, two distinct facies are evident in strata of the Riversdale group. One, the Minas facies, includes great thicknesses of dark grey fluviolacustrine shales locally bearing numerous pelecypods and ostracods. A few seams of workable coal are present in strata of this facies at Port Hood and St. Rose on Cape Breton Island. This facies is typically developed throughout the Minas basin of deposition and its two independent subsidiary sub-basins on Cape Breton Island. The second, or Cumberland facies, is present throughout the Cumberland and part of the Moncton basins. There, strata of the Boss Point formation reach an average thickness of 3,000 feet and are composed of thick grey sandstone beds with associated thin grey shales.

A disconformity is generally present between the Riversdale and Cumberland groups, but the contact on the Black River near Springhill is unconformable. In the Pictou coalfield, the New Glasgow conglomerate of the Cumberland group lies unconformably upon the Alma formation of the Canso group (Bell, 1940, p. 19), and the Riversdale is missing. Elsewhere, outside the Cumberland basin where no normal contact can be observed, the depositional relationship of these groups is unknown.

Distribution of Arthropods

The strata of the Riversdale group contain a homogeneous fauna, no distinctive faunal zones being distinguishable. *Belinurus grandaevus* Jones and Woodward, a species of xiphosuran, has been found in the type Riversdale section and in the Parrsboro formation near Parrsboro. *Belinurus reginae* Baily is found in the Riversdale group associated with *Belinurus grandaevus*, but is more widespread in the older Canso group. The Riversdale group also contains *Anthrapalaemon dubius* (Milne-Edwards), a species of mysidacean found in the Parrsboro, Riversdale, Port Hood, and Boss Point formations. This species ranges through the Riversdale group into the lower part of the younger Cumberland group. The mysidacean *Pygocephalus cooperi* Huxley occurs with *A. dubius* throughout the Riversdale group.

Correlation

Correlation of the Riversdale group with formations outside the Maritime area may only be made with Upper Carboniferous strata of similar age in western Europe. *Belinurus reginae*, *Anthrapalaemon dubius*, and *Pygocephalus cooperi*, all present in the Riversdale group, are found in the lower and middle Westphalian A zone of Europe. *Belinurus reginae* is also present in strata of the European Upper Namurian group (Pruvost, 1930). A correlation of the Riversdale group therefore appears possible with the lower and middle Westphalian A zone of western Europe.

Cumberland Group

Definition

The Cumberland group has been defined by Bell (1944, p. 19) from its type locality along the eastern coast of the Cumberland basin near Joggins. Over 9,000 feet of continental sedimentary rocks are exposed in this section. These strata have been subdivided by Bell (1914, pp. 364, 368, 369) and Shaw (1951) on lithological bases, but cannot be subdivided on the basis of the contained fauna.

The datum plane for the lithological subdivision has been chiefly based on the occurrence of the Joggins coal-bearing facies. This facies has been found, however, to pinch out in an eastward direction from Joggins against conglomerates of the lower Cumberland group. A second coal-bearing facies is present near Springhill but is assumed by Bell (1944, p. 19) to be stratigraphically younger than the Joggins seams. The remaining strata of the Cumberland group consist of lensing zones of red and grey conglomerate, shale, and sandstone, the upper members of which overlap upon the Cobequid Upland in a transgressive sequence. Few strata of the Cumberland group are present east of Springhill. There the Cumberland group pinches out beneath rocks of the transgressive Pictou group. Cumberland strata also occur in the Pictou coalfield where they were described by Bell (1940, pp. 16-21) and named the New Glasgow conglomerate. To the west, a narrow belt of Cumberland rocks is exposed near Saint John. These strata may indicate westward extension of the Cumberland basin of deposition.

Rocks of presumed Cumberland age are present in the Minas basin near Kemptown, 10 miles east of Truro. They consist of basal conglomerates with overlying shales and sandstones and some included coal seams. No fauna has been reported but, according to Bell (personal communication), palæobotanical evidence seems to indicate the equivalence of these strata to the Cumberland group.

Distribution of Arthropods

The arthropod fauna of this group contains few diagnostic species. The fauna is similar to that of the Riversdale group, few new elements being present. Numerous ostracods are found among which *Carbonita elongata* (Jones and Kirkby), *C. rankiniana* (Jones and Kirkby), and *C. secans* (Jones and Kirkby) are the most diagnostic species. Numerous myriapods have been discovered near Joggins, but these forms are of little stratigraphic use. *Anthrapalaemon dubius* (Milne-Edwards) is found in the Joggins coal-bearing facies but this form is also present in the underlying Riversdale group.

Correlation

All ostracod species in the Cumberland fauna are present in the Lower and Middle Coal Measures of Great Britain (Jones and Kirkby, 1886, 1879). Most of these species have been reported from equivalent (Westphalian upper A and B) strata of continental Europe. Van der Heide (1951) and Pruvost (1930) have reported the occurrence of *Anthrapalaemon dubius* throughout the Westphalian A zone of Belgium. Very little fauna has been reported from the upper, mostly conglomeratic, facies of the Cumberland group (the Shulie formation of Bell, 1914), but the presence of the ostracod *Carbonita altilis* (Jones and Kirkby) indicates the equivalence of this strata to the Middle Coal Measures of Great Britain. This species occurs in beds stratigraphically above the highest occurrence of *A. dubius* in the Joggins section and would therefore suggest correlation with the late Westphalian A or Westphalian B zones of Europe.

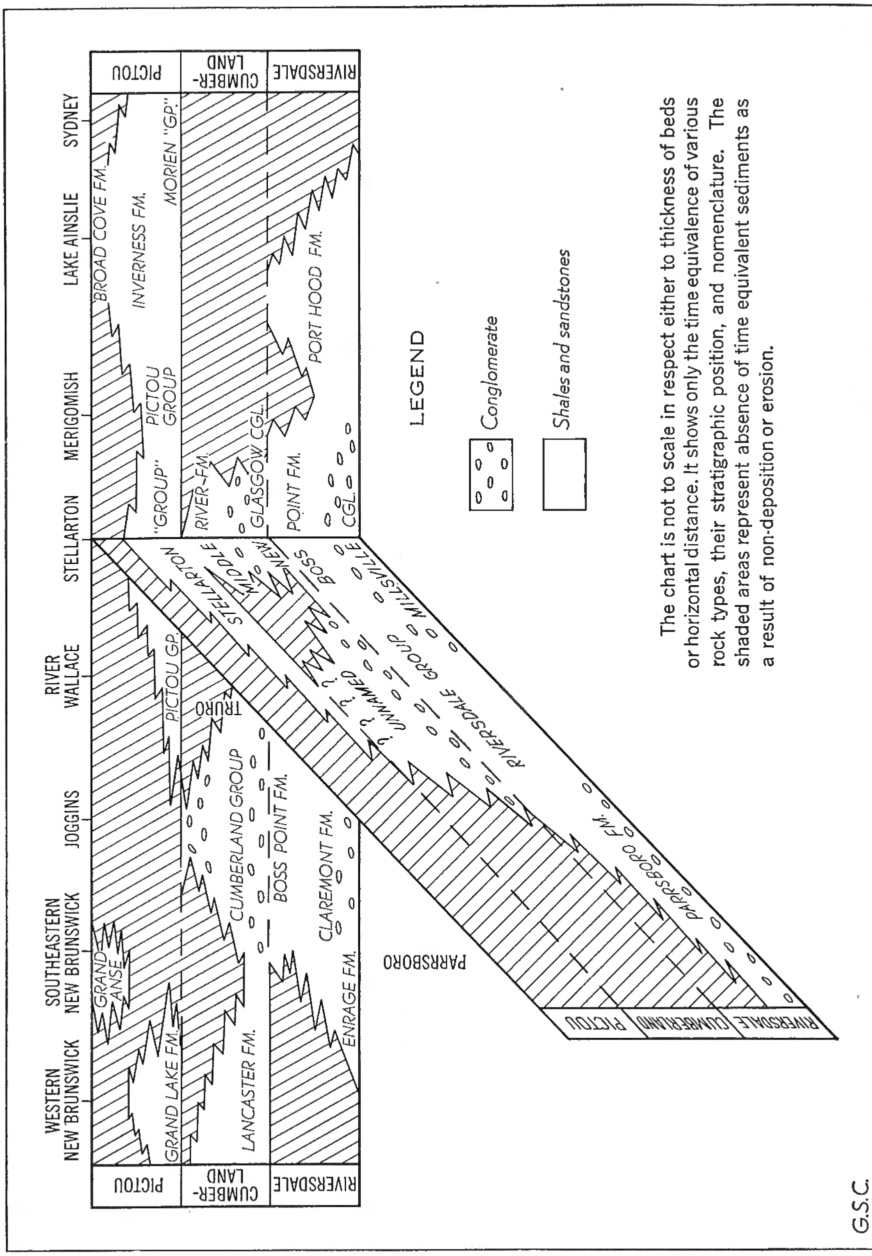


FIGURE 2. Time Chart of the Riversdale, Cumberland and Pictou Groups.

Pictou Group

Definition

This group has been defined by Bell (1944, p. 21) from the type section exposed in the Tatamagouche syncline of the Cumberland basin. A maximum thickness of 7,400 feet of Pictou strata is present in this area. This thickness varies greatly due to the unequal deposition of Pictou sediments on a folded and unconformable surface of pre-Pictou age. Similar structural conditions are assumed to be present on Prince Edward Island where beds younger than the Pictou overlie undifferentiated Upper Carboniferous rocks believed to be older than Cumberland.

Rocks of the lower Pictou group occur in the Stellarton structural gap and near Truro in the Minas basin. The Stellarton "series" of the Pictou coalfield comprises over 9,000 feet of lower Pictou strata. This sequence is composed mostly of grey and black shale with a few intercalated coal seams.

Numerous areas of Pictou rocks are found in discontinuous exposures on Cape Breton Island. At Sydney the coal-bearing Morien group, stratigraphically equivalent to the Pictou group, consists of strata several thousands of feet thick lying disconformably on rocks of the Canso group. Two areas of Pictou rocks are present on the western coast of Cape Breton. One area, the Inverness coalfield, contains strata equivalent to the upper part of the Pictou group, termed the Inverness formation (Norman, 1935, p. 47). These beds are overlain by strata younger than those exposed at the type section in the Cumberland basin to which the name Broad Cove formation has been applied by Norman (op. cit., p. 48). The second area, that of Mabou Mines, comprises unnamed beds 2,000 feet thick exposed in a shore section $\frac{3}{4}$ mile in length. On palæobotanical evidence these strata are considered to be the lowest beds of the Pictou group exposed in western Cape Breton.

Elsewhere in the Maritimes, relatively unfossiliferous beds of lower and middle Pictou age form a transgressive series of red and grey sandstones and shales distributed as a thin mantle over Carboniferous and older rocks. These beds are exposed throughout the Moncton basin and the New Brunswick shelf areas and extend from the northern border of the Caledonia Upland to the southeastern margin of the New Brunswick Highland.

Distribution of Arthropods

The arthropod fauna of this group differs greatly from that of the older Upper Carboniferous strata of the Maritime Provinces. Few diagnostic species are, however, widespread. *Carbonita inflata* (Jones and Kirkby) and *Carbonita scalpellus* (Jones and Kirkby), two species of ostracods, are found in the Pictou group of the Pictou, Sydney, and Mabou Mines coalfields. *Euproöps amiae* Woodward, a species of xiphosuran found exclusively in the Sydney coalfield, is found in the roof shales of the Backpit and Phalen seams near Sydney. Numerous fossil insects (mostly blattoids) occur in strata of the Pictou group, showing a marked numerical increase in this class over the preceding stratigraphic groups.

Correlation

Correlation of the Pictou group with strata outside the Maritime Provinces may be made only with Upper Carboniferous deposits in western continental Europe. *Carbonita inflata* and *C. scalpellus* occur in the Upper Coal Measures of Great Britain (Jones and Kirkby, 1879, p. 36), and in correlative strata of the upper Westphalian zones of continental Europe. A definite increase in the number of insect species (mainly blattoids) in the Assise de Bruay zone of France, similar to the increase in insect species found in the Pictou group, has been demonstrated by Pruvost. He termed this zone the "Couches d'insectes". These French strata are correlated with the Upper Coal Measures of Great Britain and the Westphalian C and D zones of Germany. A similar stratigraphic correlation appears to be probable for most of the Pictou group.

Upper Carboniferous Strata of Post-Pictou Age

Unfossiliferous strata of continental origin are known to overlie beds of Pictou age at two localities; near Inverness on the west coast of Cape Breton Island and on Prince Edward Island. In both instances these strata are comprised of red shales, sandstones, and minor conglomerates conformably overlying beds of upper Pictou age. The beds on Prince Edward Island contain a sparse vertebrate fauna of questioned lower Permian age, but, through lack of more diagnostic evidence, an Upper Carboniferous age is possible for these strata. These, and the beds near Inverness, may be considered to be equivalent to part of the Stephanian group of western Europe.

CONCLUSIONS

The Upper Carboniferous succession in the Maritime Provinces palæontologically shows three distinct subdivisions. The lowest of these, the Canso group, consists of widely distributed brackish-water and non-marine facies deposited under fluviolacustrine floodplain conditions, with distinctive mysidacean and conchostracan faunas. The second subdivision comprises the non-marine Riversdale and Cumberland groups carrying a common, easily recognizable ostracod fauna. Bell (1944, p. 29) has already pointed out the similarity of flora within these two groups. The upper subdivision is composed of the lithologically heterogeneous non-marine Pictou group, deposited mostly within the eastern and northern parts of the Fundy basin and having a distinctive insect fauna. The floral and faunal successions are shown on the following table.

Diagnostic Upper Carboniferous Flora and Fauna of the Maritime Provinces

European stages		Groups (Maritime Provinces)	Arthropods (this paper)	Pelecypods (W. A. Bell)	Flora (W. A. Bell)
Westphalian	D C	Pictou	Blattoidea spp. *Euproöps amiae* *Carbonita inflata* *Carbonita scalpellus*	*Anthraconauta phillipsi*	*Ptychocarpus unitus* *Linopteris obliqua* *Lonchopteris* spp.
	B	Cumberland	Diplopoda *Carbonita* spp.	*Naiadites modiolaris*	*Adiantites* spp.
	A	Riversdale	*Anthrapalaemon dubius* *Pygocephalus cooperi* *Belinurus grandaevus*	*Anthracomya* cf. *modiolaris*	*Neuropteris smithsii* *Whittleseya desiderata*
Namurian		Canso	*Leaia acutilirata* *Lynceites cansoensis* *Dithyrocaris glabroides* *Tealliocaris* spp. *Beyrichiopsis lophota* *Paraparchites* spp. ?	*Anthracomya angulata* *Carbonicola* sp.	*Sphenopteridium* sp. *Asterocalamites* sp.

CHAPTER III

PALÆONTOLOGY

INTRODUCTION

This part of the report deals with the systematic palæontology of the Upper Carboniferous arthropods of the Maritime Provinces. The classification adopted for the various faunal groups is as follows: Ostracoda, Bassler and Kellett, 1934; Conchostraca, Raymond, 1946; Kobayashi, 1954; Mysidacea, Peach, 1908; Xiphosura, Raymond, 1944; Insecta, Handlirsch, 1908. All specimens were collected by the author and other officers of the Geological Survey of Canada and are retained in the collections of the Geological Survey in Ottawa. All type specimens are in the type collection of the Geological Survey of Canada. A table showing the stratigraphic distribution of Upper Carboniferous arthropods of the Maritime Provinces and the list of G. S. C. locality numbers from which these arthropods were obtained are included.

LIST OF GEOLOGICAL SURVEY OF CANADA LOCALITY NUMBERS

Canso Group

594. Point Edward, N.S. Coll. W. A. Bell, 1920.

878. West Bay near Parrsboro, N.S., 83H99. Coll. M. Haycock, 1925.

1404. Point north of Cape Enrage, N.B., west of lighthouse. Coll. W. A. Bell, 1936.

1439. West Bay near Parrsboro, N.S., east of Ottawa House. Coll. W. A. Bell, 1936.

1454. Section south of the golf course, Parrsboro, N.S. Coll. W. A. Bell, 1936.

1565. West Bay near Parrsboro, N.S. Coll. W. A. Bell, 1936.

1786. West Bay near Parrsboro, N.S. Coll. W. A. Bell, 1924.

1826. Mabou fm.—Southwest Mabou River, Station 53. Coll. W. A. Bell, 1927.

2074. Station 4, McKay Brook, N.S. Coll. 1923.

2439. West Bay near Parrsboro, N.S. Coll. W. A. Bell, 1938.

2462. Near Lismore, N.S., on Sutherland River, below Ross' bridge. Coll. W. A. Bell, 1938.

3571. Parrsboro, N.S. Coll. ?

9565. West side of Parrsboro Harbour, Bed B 18, topmost 12-18", thin layer of *Leaia*. Coll. J. E. Hyde, 1914.

9573. West Bay, Parrsboro, N.S., over Reptile tracks. Coll. J. E. Hyde, 1914.

9600. Point Edward, N.S., Bed 6 of Robb, below Quarantine station. Coll. J. E. Hyde, 1915.

9603. Point Edward, N.S., nodular bed, Note 24, Bed 4. Coll. J. E. Hyde, 1915.

12238. West Bay, west of Partridge Island. Coll. W. A. Bell, 1945.

12241. One chain north of brook flowing into the St. of Canso, ½ mile south of Havre Boucher lighthouse. Coll. D. P. Manzer, 1945.

12253. Brown's Brook, 27 chains below road at Datan's Bridge. No date.

12259. Port Hastings, N.S., on the St. of Canso, Stations 92 and 95. Coll. W. A. Bell, 1945.

12261. Third brook northwest of Eddy's Cove, towards Mulgrave, N.S. Coll. D. P. Manzer, 1945.

12263. Little River, 60 chains below the railway which crosses at outlet of Beaver Dam Lake, St. of Canso area. Coll. Teed, 1945.

12270. Fifteen chains along the coast from Madden Cove, on the St. of Canso. Coll. D. P. Manzer, 1945.

12271. Four chains north of the southern end of the section at Creignish, N.S. Coll. D. P. Manzer, 1945.

12624. Bay St. Lawrence, N.S., 300′ east of first cove west of wharf. Coll. W. A. Bell, 1946.

25609. Shore section, ½ mile north of Margaree Harbour, N.S. Coll. M. J. Copeland, 1952.

25610. 900′ north of southern end of the Canso section on the shore near Creignish, N.S. Coll. M. J. Copeland, 1954.

25621. Near Parrsboro, N.S., 1,500′ northwest of Partridge Island. Coll. M. J. Copeland, 1954.

25623. Bay St. Lawrence, N.S., Lot No. 2, 1,000′ east of southern end of Canso section. Coll. M. J. Copeland, 1954.

25628. Bay St. Lawrence, N.S., Lot No. 1, 2,000′ east of wharf. Coll. M. J. Copeland, 1954.

25629. West Bay, Parrsboro, N.S., 2,000′ north of Partridge Island, below rippled red and grey shales. Coll. M. J. Copeland, 1954.

25641. East side of Parrsboro Harbour, N.S., at "Brodericks" marked on H. Fletcher's map. Coll. M. J. Copeland, 1954.

25644. St. of Canso, N.S., 1,500′ above the base of the type section. Coll. M. J. Copeland, 1954.

Riversdale Group

1405. Between Moose River and Moose Creek, on shore of Minas Basin, N.S. Coll. W. A. Bell, 1936.

1449. Upper part of Boss Point formation, near Joggins, N.S. Coll. W. A. Bell, 1936.

1581. Middle part of the Parrsboro formation, on west side of Parrsboro inlet, Bed B 12. Coll. W. A. Bell, 1936.

1811. Port Hood, N.S., Bed 2e on shore. Coll. W. A. Bell, 1928.

1902. River Inhabitants, N.S., near Glendale above the red bridge. Coll. W. A. Bell, 1925.

1946. West Branch of North River, N.S., 58J104–105. Coll. W. A. Bell, 1925.

2247. Black River, N.S., 2,400′ northeast of station. Coll. W. A. Bell, 1925.

6575. St. Rose Mine, No. 3 seam, St. Rose, N.S. Coll. A. O. Hayes.

9566. Bed B29, West Bay near Parrsboro, N.S. Coll. J. E. Hyde, 1914.

9572. West Bay, Parrsboro, N.S., upper half of Bed 3, *Belinurus* zone. Coll. J. E. Hyde, 1914.

9576. West Bay, Parrsboro, N.S., Bed C 28-1. Coll. J. E. Hyde, 1914.

9581. West Bay, Parrsboro, N.S., Bed B 12. Coll. W. A. Bell, 1930.

9583. Parrsboro, N.S., Bed B 18, on west side of Parrsboro inlet. Coll. J. E. Hyde, 1914.

25612. Mabou Mines, N.S., ½ mile north of Finlay Point. Coll. M. J. Copeland, 1952.

25615. Chimney Corner, N.S., roof of No. 2 seam exposed on shore. Coll. M. J. Copeland, 1952.

25616. Mabou Mines, N.S., ½ mile north of Finlay Point. Coll. M. J. Copeland, 1952.

25625. Fifteen miles east of Parrsboro, N.S., on Harrington River, 1 mile upstream from No. 2 highway bridge. Coll. M. J. Copeland, 1954.

25627. Five miles east of Parrsboro, N.S., 1,000′ east of the mouth of Diligent River. Coll. M. J. Copeland, 1953.

25630. Harrington River, 15 miles east of Parrsboro, N.S., 2,000′ below old logging dam. Coll. M. J. Copeland, 1954.

25633. Near Joggins, N.S., 500 and 1,500′ north of Boss Point. Coll. M. J. Copeland, 1954.

25637. Sea Coal Brook, N.S., ½ mile upstream from Sea Coal Bay. Coll. M. J. Copeland, 1954.

25642. Cape Maringouin, N.B., 2,100′ above the red beds of the Enrage formation. Coll. M. J. Copeland, 1950.

25643. Downey Cove, 8 miles north of Joggins, N.S. Coll. M. J. Copeland, 1950.

25646. Third railway cutting east of Riversdale station, N.S. Coll. H. M. Ami, 1897.

25649. Harrington River, N.S. Coll. H. M. Ami, 1898.

Riversdale Group ?

877. Treen Bluff section, Cumberland? group, Malagash Point, N.S. Coll. G. W. H. Norman, 1938.

3041. Treen Bluffs, 3,200′ east of Treen Point, N.S., Cumberland or Pictou groups? Coll. W. A. Bell, 1928.

Cumberland Group

1016. Springhill, N.S. Coll. M. Haycock, 1924.

1041. Springhill, N.S., 200′ above the Hewson Mine. Coll. M. Haycock, 1924.

1468. St. George's Brook, 12 miles east of Chignecto, N.S. Coll. W. A. Bell, 1935.

1507. Springhill, N.S., Hewson brook in tunnel on Sand Run seam. Coll. W. A. Bell, 1935.

1684. Lancaster formation near Milkish Head, east of Saint John, N.B. Coll. A. O. Hayes, 1913.

2254. Lancaster formation at Fern Ledges west of Saint John, N.B. Coll. W. J. Wilson, 1880.

2316. Brown Brook, tributary of Middle River at Station 14. Coll. W. A. Bell, 1924.

3520. Cove to south of Milkish Head, Kennebecasis Bay near Saint John, N.B. Coll. I. W. Jones, 1914.

25611. Dump of Bayview No. 8 mine, on the Forty Brine seam, Joggins, N.S. Coll. M. J. Copeland, 1950.

Pictou Group

511. Thorburn, N.S., Thorburn borehole, depth 467-476′. Coll. W. A. Bell, 1924.

512. Thorburn, N.S., Greenwood-Henderson borehole, depth 470-474′. Coll. W. A. Bell, 1924.

514. East shore of Morien Bay at south Port Morien at horizon of Mullins seam. Coll. W. A. Bell, 1920.

616. Glace Bay, N.S., Donkin No. 6 mine dump. Coll. H. M. Ami, 1907.

1521. Greener Point, Barrington Cove, north of Sydney Harbour, N.S. Coll. W. A. Bell, 1935.

2366. Borehole on McLellan Brook, N.S., depth 295-300′. Coll. W. A. Bell, 1923.

2487. Pictou coalfield, Stellarton series, unknown borehole, depth 977′. Coll. W. A. Bell, 1938.

2645. Pictou coalfield, Stellarton, N.S., borehole 60, 1,172′. Coll. W. A. Bell, 1929.

2804. Pictou coalfield, borehole from Drummond colliery, No. 8 level, Scott pit, depth 5-10′. Coll. W. A. Bell, 1923.

2814. Pictou coalfield, McLellan Brook, above Steep Brook, N.S. Coll. W. A. Bell, 1925.

2952. Pictou coalfield, borehole No. 20, Coalburn, N.S. Coll. W. A. Bell, 1928.

25613. Pictou coalfield, borehole at Albion mine, Stellarton, N.S. Coll. M. J. Copeland, 1954.

25614. Mabou Mines, N.S., roof of 11-foot seam, 150′ southwest of creek. Coll. M. J. Copeland, 1952.

25618. Mabou Mines, N.S., borehole No. 2, sample 13. Coll. M. J. Copeland, 1954.

25619. Mabou Mines, N.S., borehole No. 2, sample No. 10, depth 306′. Coll. M. J. Copeland, 1954.

25620. Mabou Mines, N.S., borehole No. 2, sample 21, depth 297′. Coll. M. J. Copeland, 1954.

25622. Sydney coalfield, N.S., freshwater limestone above the Blackrock seam on north shore of Boulardarie island. Coll. M. J. Copeland, 1954.

25626. New Aberdeen, N.S., No. 20 mine tunnel. Coll. M. J. Copeland, 1954.

25634. Mabou Mines, N.S., borehole No. 2, sample 13. Coll. M. J. Copeland, 1954.

25638. Mabou Mines, N.S., borehole No. 2, sample 2. Coll. M. J. Copeland, 1954.

25639. Mabou Mines, N.S., borehole No. 2, sample 11. Coll. M. J. Copeland, 1954.

25640. Mabou Mines, N.S., borehole No. 4, sample 15. Coll. M. J. Copeland, 1954.

25645. Glace Bay, N.S., Donkin No. 6 Mine. Coll. H. M. Ami, 1907.

25647. Glace Bay, N.S., Caledonia No. 4 Mine. Coll. H. M. Ami, 1907.

25650. Little Miminegosh pond at end of road in from Roseville school, P.E.I. Coll. V. Prest, 1953.

Unnumbered Localities

Canso group.

Alma, N.S., in brook ½ mile below Millbrook. Coll. W. A. Bell, 1923.
Alma, N.S., east of Salt Springs, West River. Coll. W. A. Bell, 1926.
Merigomish, N.S., second bridge up French River. Coll. W. A. Bell, 1924.

Riversdale group.

Salmon River, ½ mile below Kemptown, N.S. Coll. M. J. Copeland, 1954.

Cumberland group.

Bed 53, Division 4 of Logan's section, Joggins, N.S. Coll. W. A. Bell, 1911.

Pictou group.

Greenwood borehole on McPherson property, McLellan Mt. road, N.S. Coll. W. A. Bell, 1924.

Coalburn borehole, No. 60, depth 394′, Pictou coalfield, N.S. Coll. W. A. Bell, 1928.

23997. Mississippian? strata, north branch of Becaguimec River, about one mile above Cloverdale, N.B. Coll. J. F. Caley, 1935.

Stratigraphic Distribution of Species

	Canso	Riversdale	Cumberland	Pictou
Carbonita agnes		X		
C. altilis		X	X	
C. elongata		X	X	
C. fabulina	X	X	X	X
C. inflata				X
C. pungens		X	X	
C. rankiniana			X	
C. secans			X	
C. scalpellus				X
Hilboldtina evelinae		X		
H. rugulosa			X	
Candona bairdioides		X	X	
C. salteriana		X	X	
Gutschickia ninevehensis		X		
G. bretonensis		X		
Paraparchites okeni?	X			
P. scotoburdigalensis?	X			
Sansabella carbonaria		X		
S. reversa		X		
Beyrichiopsis lophota	X			
Leaia leidyi	X			
L. baentschiana	X	?		
L. tricarinata	X	X		
L. silurica	X		X	X
L. laevis		?		X
L. acutangularis	X			
L. acutilirata	X			
L. magnacostata				X
Eoleaia elongata		X		
Monoleiolophus conemaughensis		X		
Asmussia alta			X	X
A. tenella		X	X	X
Euestheria dawsoni	X			
E. raymondi	?			
Lioestheria? simoni	?			
L. striata	X			X
Cyclestherioides blackstonensis	X			
Palaeolimnadiopsis pruvosti		?		
Lynceites cansoensis	X			
Anthrapalaemon dubius		X	X	
A. sp.				X
Pygocephalus cooperi		X		
P. cf. cooperi		X		
Tealliocaris caudafimbriata	X			
T. barathrota	X			
T. belli	X			
Anthracophausia sp.	X			

Stratigraphic Distribution of Species—Concluded

	Canso	Riversdale	Cumberland	Pictou
Palaeocaris cf. typus				X
Belinurus reginae	X	X		
B. grandaevus	X	X		
Euproöps cf. danae	X	?		
E. amiae				X
Eurypterus brasdorensis				X
Eurypterus sp.		X		
Anthracomartus sp.	?			
Eoscorpius sp.				?
Dithyrocaris glabroides	X			
Amynilyspes springhillensis			X	
Xylobius sigillariae			X	
Archiulus xylobioides			X	
Brodioptera cumberlandensis		X		
B. amiae		X		
Geroneura wilsoni			X	
Meganeura sp.				X
Palaeodictyoptera incertae sedis				X
Archimylacris acadica?				X
A. morienensis				X
A. sp. 1				X
A. sp. 2				X
A. sp. (pronotum)				X
Hemimylacris sp. (pronotum)				X
(Blattoidea) carri				X
(B.) schuchertiana				X
Phylloblatta? spp.				X
Myriapoda incertae sedis			X	
Crustacea incertae sedis	X?			X
Insecta incertae sedis				X

SYSTEMATIC PALÆONTOLOGY

Classification of Upper Carboniferous Arthropods of the Maritime Provinces

Class **CRUSTACEA**

Order OSTRACODA

Family CYPRIDIDAE Baird 1845
Genus *Carbonita* Strand 1928
Genus *Hilboldtina* Scott and Summerson 1943

Subfamily CANDONINAE Kaufman 1900
Genus *Candona* Baird 1845
Genus *Gutschickia* Scott 1944

Superfamily *LEPERDITIACEA* Bassler and Kellett 1934
Family APARCHITIDAE Jones 1901
Genus *Paraparchites* Ulrich and Bassler 1906

Family KLOEDENELLIDAE Ulrich and Bassler 1908
Genus *Sansabella* Roundy 1926
Genus *Beyrichiopsis* Jones and Kirkby 1886

Subclass **BRANCHIOPODA**

Order CONCHOSTRACA

Family LEAIADIDAE Raymond 1946
Genus *Leaia* Jones 1863
Genus *Eoleaia* Kobayashi 1954
Genus *Monoleiolophus* Raymond 1946

Family LIOESTHERIIDAE Raymond 1946

Subfamily ASMUSSIINAE Kobayashi 1954
Genus *Asmussia* Pacht 1849

Subfamily LIOESTHERIINAE Kobayashi 1954
Genus *Euestheria* Depéret and Mazeran 1912
Genus *Lioestheria* Depéret and Mazeran 1912

Subfamily CYCLESTHERIOIDINAE Kobayashi 1954
Genus *Cyclestherioides* Raymond 1946

Family LIMNADIIDAE Burmeister 1843

Subfamily ESTHERIININAE Kobayashi 1954
Genus *Palaeolimnadiopsis* Raymond 1946

Order NOTOSTRACA ?

Family LYNCEITIDAE nov.
Genus *Lynceites* Goldenberg 1870

Subclass **MALACOSTRACA**

Superorder EUMALACOSTRACA

Group PERACARIDA Packard 1879

Order MYSIDACEA

Family LOPHOGASTRIDAE Sars
Genus *Anthrapalaemon* Salter 1861
Genus *Pygocephalus* Huxley 1857
Genus *Tealliocaris* Peach 1908

Family EUPHAUSIIDAE
Genus *Anthracophausia* Peach 1908

Group SYNCARIDA Packard

Order ANASPIDACEA

Family GAMPSONYCHIDAE Packard 1885
Genus *Palaeocaris* Meek and Worthen 1865

Class **ARACHNOIDEA**

Subclass **MEROSTOMATA**

Order XIPHOSURA

Suborder LIMULADA

Superfamily *BELINURACEA* Raymond 1944
Family BELINURIDAE Packard 1885
Genus *Belinurus* König 1820

Superfamily *EUPROÖPACEA* Raymond 1944
Family EUPROÖPIDAE Eller 1938
Genus *Euproöps* Meek 1867

Order EURYPTERIDA
Family EURYPTERIDAE Burmeister
Genus *Eurypterus* De Kay 1825

Subclass **ARACHNIDA**

Order ANTHRACOMARTI
Family ANTHRACOMARTIDAE Haase
Genus *Anthracomartus* Karsch 1882

Order SCORPIONES
Suborder EUSCORPIONES

Family EOSCORPIONIDAE
Genus *Eoscorpius* Meek and Worthen 1868

Class **ARCHAEOSTRACA**

Order RHINOCARINA
Family RHINOCARIDAE Clarke 1913
Genus *Dithyrocaris* Scouler 1843

Class **DIPLOPODA**

Order PALAEOMORPHA
Family AMYNILYSPIDAE nov.
Genus *Amynilyspes* Scudder 1881

Order EURYSTERNA
Family ARCHIULIDAE Scudder
Genus *Xylobius* Dawson 1859
Genus *Archiulus* Scudder 1868

Class **INSECTA**

Subclass **PTERYGOTA**

Order MEGASECOPTERA
Family BRODIIDAE Handlirsch 1906
Genus *Brodioptera* nov.

Order MIXOTERMITOIDEA
Family MIXOTERMITIDAE Handlirsch 1908
Genus *Geroneura* Matthew 1889

Order PROTODONATA
Family MEGANEURIDAE Handlirsch 1908
Genus *Meganeura* Brogniart 1885

Order PALAEODICTYOPTERA
Palaeodictyoptera *incertae sedis*

Superorder BLATTOPTEROIDEA

Order BLATTARIA
Family ARCHIMYLACRIDAE Handlirsch 1908
Genus *Hemimylacris*
Genus *Archimylacris* Scudder 1868
Genus *Phylloblatta* ? Handlirsch 1906

ARTHROPODA *incertae sedis*

Description of Species

Order, OSTRACODA

Genus, *Carbonita* Strand 1928

Carbonia Jones 1870, p. 218, non Robineau-Desvoidy 1863, p. 808.
Carbonita Strand 1928, p. 41.

The genus *Carbonia* was proposed in 1870 by Jones for ostracods collected from non-marine beds in the Upper Carboniferous (Coal Measures) of Wales. Strand (1928, p. 41) changed the generic designation to *Carbonita* as the name *Carbonia* was preoccupied by Robineau-Desvoidy in 1863.

Scott and Summerson (1943, p. 667) split the *Carbonita* group of ostracods into two genera: *Cypridopsis* Brady 1868, which contained all smooth or reticulate fossil species, and *Hilboldtina* Scott and Summerson 1943, p. 669, which contained all longitudinally striated species. This division of the *Carbonita* group has not been retained by subsequent workers (i.e. Cooper 1946, p. 66). The writer believes such a division has a degree of merit and in this paper part of the 1943 classification is used. The smooth-shelled carbonitas are, however, not assigned to the genus *Cypridopsis* but to *Carbonita*. The genus *Hilboldtina* is employed with the same scope as that suggested by Scott and Summerson.

Carbonita agnes (Jones)

Plate I, figures 19-21

Carbonia agnes Jones 1870, p. 218, Pl. IX, figs. 6, 7.
Carbonita agnes Bassler and Kellett 1934, p. 237.

Remarks. Specimens from the Maritimes agree with the original description by Jones. They are more elongate laterally than most other species of *Carbonita*, with pronounced overlap of the right valve over the left on the anterior, posterior, and ventral margins. The posterior dorsal border is highly arched; surface coarsely punctate.

Occurrence. Riversdale group; localities 25612 and 25633.

Type. Hypotype, G.S.C. No. 12841.

Carbonita altilis (Jones and Kirkby)

Plate I, figures 1-3, 15-18

Carbonia fabulina altilis Jones and Kirkby 1889, p. 269, figs. 1-4.
Carbonita fabulina altilis Bassler and Kellett 1934, p. 238.

Remarks. This species differs from *Carbonita fabulina* (Jones and Kirkby) in having a greater posterior and ventral overlap of the right valve. It differs from *C. humilis* (Jones and Kirkby) in being shorter and having a more pronounced posterior angulation.

Occurrence. Riversdale and Cumberland groups; localities 1449, 1811, 6575, 25611, 25612, 25615, 25616, 25633, 25637, 25642, 25643.

Type. Hypotypes G.S.C. Nos. 12833, 12839.

Carbonita elongata (Jones and Kirkby)

Plate I, figures 22-25.

Carbonia ? elongata Jones and Kirkby 1884, p. 361, Pl. XII, fig. 10.
Carbonita elongata Bassler and Kellett 1934, p. 237.

Remarks. This is one of the most elongate carbonitas described from these strata. It appears to be intermediate in length between *C. altilis* and *C. agnes*. This species differs from the preceding in having a more ventral posterior angulation of the right valve.

Occurrence. Riversdale and Cumberland groups; localities 1449, 6575, 25611, 25633.

Type. Hypotype, G.S.C. No. 12842.

Carbonita fabulina (Jones and Kirkby)

Plate I, figures 10, 11

Cythere fabulina Jones and Kirkby 1867, p. 218.
Cythere ? fabulina Jones and Kirkby 1867, p. 218.
Cyprida elongata Goldenberg 1870, pp. 286-7, fig. 3.
Carbonia fabulina Jones 1870, p. 218.
Cytherella inflata Jones and Kirkby 1884, p. 358.
Carbonita fabulina Bassler and Kellett 1934, p. 237.
Cypridopsis fabulina Scott and Summerson 1943, p. 668.

Remarks. This species has been figured by numerous authors from strata in Europe and has been found by several geologists in Carboniferous rocks of North America. It has only a slight overlap of the right valve on the anterior and posterior margins; the ventral overlap is more pronounced. There is no posterior angulation as is present in *C. altilis* and other species of this genus. The surface is coarsely punctate to nearly smooth with all gradations between these two extremes.

Occurrence. Canso to Pictou groups; localities 512, 594, 1449, 1811, 1902, 6575, 12624, 25611, 25612, 25614, 25615, 25616, 25620, 25621, 25622, 25634, 25637, 25638, 25642, 25643.

Type. Hypotype, G.S.C. No. 12835.

Carbonita inflata (Jones and Kirkby)

Plate I, figures 12-14; Plate II, figures 18, 19

Carbonia fabulina var. *inflata* Jones and Kirkby 1879, p. 31, Pl. II, figs. 15-19.
Bythocypris tumidus Upson 1933, p. 24, Pl. II, figs. 11*a-c*.
Carbonita fabulina inflata Bassler and Kellett 1934, p. 238.
Whipplella cuneiformis Holland 1934, p. 344, Pl. XXV, figs. 5*a-c*.
Carbonita ? tumida Kellett 1935, p. 160, Pl. XVI, figs. 9*a-d*.
Carbonita inflata Cooper 1946, p. 66, Pl. VIII, figs. 40-42.

Remarks. This species may be easily recognized by the obesity of the posterior part of the carapace and the equal size of the valves.

Occurrence. Pictou group; localities 25614, 25650.

Type. Hypotypes, G.S.C. Nos. 12838, 12843.

Carbonita pungens (Jones and Kirkby)

Cythere pungens Jones and Kirkby 1867, p. 222.
Carbonia pungens Jones and Kirkby 1879, p. 37, Pl. III, figs. 22-23.
Cythere (*Darwinella* ?) *pungens* Jones and Kirkby 1884, pp. 319, 325.
Carbonita pungens Bassler and Kellett 1934, p. 239.
Darwinula pungens Cooper 1946, p. 78, Pl. X, figs. 39, 40.

Remarks. Valves and carapaces preserved as crushed and fragmental pieces. Valves equal, carapace elongate with a pronounced central muscle scar.

Occurrence. Riversdale and Cumberland groups; localities 1811, 25611.

Carbonita rankiniana (Jones and Kirkby)

Plate II, figures 22, 23

Cythere rankiniana Jones and Kirkby 1867, p. 217.
Carbonia rankiniana Armstrong 1871, p. 28.
Carbonita rankiniana Bassler and Kellett 1934, p. 239.

Remarks. This species is distinguished from other species of *Carbonita* by its small size and much elongated carapace. This form has a much more plenate anterior margin than other species of this genus.

Occurrence. Cumberland group; locality 25611.

Type. Hypotype, G.S.C. No. 12849.

Carbonita secans (Jones and Kirkby)

Plate I, figures 8, 9

Cythere secans Jones and Kirkby 1867, p. 222.
Carbonia secans Jones and Kirkby 1879, p. 37, Pl. III, figs. 18-20.
Carbonita secans Bassler and Kellett 1934, p. 239.

Remarks. The species is smaller and has a more highly arched anterior margin than any other species of *Carbonita* yet found in the Maritimes. The ventral border is slightly concave and arched, the dorsal border is smooth, both valves meeting evenly.

Occurrence. Cumberland group; locality 25611.

Type. Hypotype, G.S.C. No. 12834.

Carbonita scalpellus (Jones and Kirkby)

Plate IV, figure 6

Carbonia scalpellus Jones and Kirkby 1879, p. 36, Pl. III, figs. 13-14.
Carbonita scalpellus Bassler and Kellett 1934, p. 240.

Remarks. No complete carapace of this species has been found in strata from the Maritimes. Isolated valves are common along some bedding planes, but most of them are crushed. Numerous impressions of these forms may be found, the shell material having been leached away. This species is much larger than *C. rankiniana* and is equivalved.

Occurrence. Pictou group; localities 511, 512, 2366, 2804, 2814, 25613, 25614, 25618, 25619, 25626, 25639, 25640.

Type. Hypotype, G.S.C. No. 12850.

Genus, *Hilboldtina* Scott and Summerson 1943

Hilboldtina evelinae (Jones)

Plate I, figures 5-7

Carbonia evelinae Jones 1870, p. 218, Pl. IX, fig. 4.
Carbonita evelinae Bassler and Kellett 1934, p. 237.
Hilboldtina evelinae Scott and Summerson 1943, p. 670.

Remarks. The longitudinal striae typical of the genus are well marked on this species, but are not as pronounced as those on *H. rugulosa* (Jones). *H. evelinae* shows pronounced ventral overlap of the right valve over the left, with lesser overlap on the ventral margin.

Occurrence. Riversdale group; localities 1811, 25616.

Type. Hypotype, G.S.C. No. 12832.

Hilboldtina rugulosa (Jones)

Carbonia agnes var. *rugulosa* Jones 1870, p. 218, Pl. IX, figs. 8, 9.
Carbonia agnes var. *subrugulosa* Jones 1870, p. 218, Pl. IX, fig. 10.
Carbonita agnes rugulosa Bassler and Kellett 1934, p. 237.
Carbonita agnes subrugulosa Bassler and Kellett 1934, p. 237.
Hilboldtina agnes rugulosa Scott and Summerson 1943, p. 670.
Hilboldtina agnes subrugulosa Scott and Summerson 1943, p. 670.
Carbonita agnes Cooper (in part) 1946, p. 66, Pl. VIII, figs. 1, 2.

Remarks. The original distinction between *C. agnes rugulosa* and *C. agnes subrugulosa* was based on differences in the length and strength of the horizontal rugulae. Such a distinction between these two varieties was not detected by the author in the Maritimes material. Although the Maritime specimens are poorly preserved, variation of extreme length and strength of these striations have been observed. The author believes that the two names of Jones belong to one species, and chooses *H. rugulosa* (Jones) as its name.

Occurrence. Cumberland group; locality 25611.

Genus, *Candona* Baird 1845

Candona bairdioides (Jones and Kirkby)

Plate IV, figures 1-3

Carbonia ? bairdioides Jones and Kirkby 1879, p. 38, Pl. III, figs. 24-27.
Carbonia bairdioides ? Jones and Kirkby 1884, p. 359, Pl. XII, figs. 8*a-d*.
Carbonita bairdioides Bassler and Kellett 1934, p. 237.
Candona bairdioides Cooper 1946, p. 65, Pl. VIII, figs. 3-10.

Remarks. This is the largest species of ostracod yet found in the Upper Carboniferous strata of the Maritimes. It is easily distinguishable from others of the genus by its highly arched dorsum, angular lateral extremities, and type of overlap of the valves. The right valve overlaps the hingeline on the dorsum, the left valve overlaps the right on the ventral and posterior margins.

Occurrence. Riversdale and Cumberland groups; localities 25611, 25616.

Type. Hypotype, G.S.C. No. 12829.

Candona salteriana (Jones)

Plate I, figure 4

Candona ? salteriana Jones 1862, p. 122, Pl. V, figs. 13, 14.
Candona ? elongata Jones and Kirkby 1884, p. 361, Pl. XII, fig. 10.
Carbonita salteriana Bassler and Kellett 1934, p. 240.
Candona salteriana Cooper 1946, p. 66, Pl. VIII, figs. 21-25.

Remarks. Dawson (1897) reported the occurrence of this form from strata of Cumberland age near Joggins, N.S. His specimens, together with those collected in the present investigation, are crushed and can be identified only with difficulty. This species differs from *C. bairdioides* (Jones and Kirkby) in having no lateral elongation of the carapace and in being equivalved.

Occurrence. Riversdale and Cumberland groups; localities 25611, 25616.

Type. Hypotype, G.S.C. No. 12844.

Genus, *Gutschickia* Scott 1944

Gutschickia ninevehensis (Holland)

Plate II, figures 20, 21

Whipplella ninevehensis Holland 1934, p. 345, Pl. XXV, figs. 3*a-c*.
Whipplella deltoidea Holland 1934, p. 345, Pl. XXV, figs. 1*a-c*.
Gutschickia ninevehensis Scott 1944, p. 146, Pl. XXIII, figs. 5-8.
Gutschickia deltoidea Scott 1944, p. 146, Pl. XXIII, figs. 1-4.
Gutschickia ninevehensis Cooper 1946, p. 68, Pl. VIII, figs. 33-35.

Remarks. Specimens from the Maritimes agree in all respects to those figured by Cooper (1946). They are equivalved, with pronounced anterior and posterior marginal flanges, and with a distinct lateral angulation on the ventral part of the carapace.

Occurrence. Riversdale group; locality 1811.

Type. Hypotype, G.S.C. No. 12840.

Gutschickia bretonensis n.sp.

Plate III, figures 9-19

Description. Surface coarsely pitted; carapace ovoid; greatest height posterior, greatest length ventral, greatest width posterior; dorsum broadly convex, posterodorsal slope short, anterior margin broadly rounded, posterior margin angular; ventral border straight to slightly convex. Valves unequal, right valve overlapping left slightly on posterodorsal margin and pronouncedly on the ventral border; left valve raised above right on the dorsum. Hinge situated on median dorsal border; muscle scar anteroventral of centre; narrow flange present on anteroventral and posteroventral margins of the left valve. Length of holotype, 1.3 mm; height, 0.93 mm; width, 0.73 mm.

Remarks. Some specimens have a pronouncedly sloping posterodorsal margin with a distinct angulation of the posterior margin. This feature is not of specific significance.

This species differs from *G. ninevehensis* (Holland) by having a more pronounced rounded anterior margin and lacking distinct anterior and posterior flanges. The specific name, *G. bretonensis*, is given for the occurrence of the form in Cape Breton Island, N.S.

Occurrence. Riversdale group; localities 25612, 25616.

Type. Holotype, G.S.C. No. 10388; Paratypes, G.S.C. Nos. 12836*a*, *b*.

Genus, *Paraparchites* Ulrich and Bassler 1906

Paraparchites okeni ? (Münster) 1830

Plate IV, figure 4

Cythere okeni Münster 1830, p. 65, No. 15.
Leperditia okeni Jones and Kirkby 1865, p. 406, Pl. XX, figs. 1-3.
Paraparchites okeni Knight 1928, p. 232.

Remarks. Only internal molds of this species have been found in the Maritimes. The specific identification of these molds is questioned. Although numerous varieties of *P. okeni* have been described, they were based on ornamentation of the shell material; the specimens from the Maritime Provinces have no part of the shell preserved, and their varietal identification is impossible.

Occurrence. Canso group; locality Southwest Mabou River, N.S. Coll. G. Norman.

Type. Hypotype, G.S.C. No. 12779.

Paraparchites scotoburdigalensis ? (Hibbert)

Plate IV, figure 5

Cypris scotoburdigalensis Hibbert 1836, p. 179.
Cythere scotoburdigalensis Jones 1862, p. 119.
Leperditia scotoburdigalensis Jones and Kirkby 1863, p. 460.
Leperditia okeni small variety Jones and Kirkby 1865, p. 406.
Leperditia okeni var. *scotoburdigalensis* Jones and Kirkby 1886, p. 35.
Leperditia scotoburdigalensis Jones 1884, pp. 314-6, 321, 324, Pl. II, figs. 7, 8.
Paraparchites scotoburdigalensis Latham 1932, pp. 354-5, fig. 2.

Remarks. Some internal molds have been found associated with *P. okeni* ? They represent valves that are non-lobate and subcircular in outline.

Occurrence. Canso group; associated with *P. okeni* ?

Type. Hypotype, G.S.C. No. 12780.

Genus, *Sansabella* Roundy 1926

Sansabella carbonaria Cooper

Plate II, figures 1-8

Sansabella carbonaria Cooper 1946, p. 115, Pl. XIX, figs. 30-35.
Jonesina robusta Kremp and Grebe 1955, pp. 161-2, Pl. XVI, figs. 11*a-d*.

Remarks. The original description of this species by Cooper (1946) does not mention the reversal of overlap which is evident from his figures of this species. The specimens from the Maritimes have reversal of overlap. They agree in all respects with the Illinois type specimens.

Occurrence. Riversdale group; Port Hood, N.S., above the main coal seam.

Type. Hypotypes, G.S.C. Nos. 12831*a-d*.

Sansabella reversa n. sp.

Plate II, figures 9-17

Description. Surface smooth, carapace subelliptical in lateral view; dorsal margin straight; ventral margin strongly convex; anterior margin plenate with a pronounced anterior "swing"; hinge median, sunken beneath dorsal border; overlapping valve with distinct projections into smaller valve at both ends of dorsal border; sulcus small or lacking, situated mid-dorsally on median part of rotund lateral surface; lateral margins narrow and flanged, meeting abruptly with the rotund lateral surface, and juncture being marked by a conspicuous angulation.

Overlap of valve right over left or left over right, more pronounced on ventral and posterior margins than elsewhere, causing a distinct flanging of the larger valve over the ventral part of the smaller valve; overlap evident at dorsal angles due to geniculate "sansabelloid" hingement.

Length of holotype, 0.76 mm.; height, 0.5 mm.; width, 0.3 mm.

Remarks. This species is more plenate anteriorly and more angular posteriorly than in most other species of this genus. The small size of the specimens is also remarkable for a species of this genus. Most specimens have the right valve overlapping the left valve along the margin, but some specimens have a larger left valve that overlaps the right valve. The species is named for occurrence of reversal of overlap.

Occurrence. Riversdale group; Port Hood, N.S., above the main coal seam.

Type. Holotype, G.S.C. No. 10386; paratype, G.S.C. Nos. 12830*a-d*.

Genus, *Beyrichiopsis* Jones and Kirkby 1886

Beyrichiopsis lophota, n.sp.

Plate III, figures 1-8

Beyrichiopsis granulata var. Hyde 1914, pp. 392-3.

Description. Carapace finely punctate, ovate-oblong in lateral view; bilobed, with three longitudinal lateral ridges; dorsal border slightly convex, dorsal margin sunken between pronounced crests; ventral border of right valve bearing a pronounced solid frill; sulcus pit-like; deepest near the lower end, shallow at dorsal margin, in some specimens almost disappearing and resembling a pit instead of a sulcus; sulcus surmounted near the dorsal margin by the highly vaulted dorsal crest and at the point of narrowest constriction by the dorsal lateral longitudinal ridge.

The three lateral ridges separated throughout the length of the valve, but approaching each other near the posterior and anterior margins of the valve; dorsal lateral ridge passes posteriorly from near the anterior margin, sagging slightly into the point of narrowest constriction of the sulcus and passing across the smooth posterior lobe, nearly joined to posterior lateral extension of the dorsal crest at the posterior. Median lateral ridge nearly in contact with the dorsal ridge at the anterior margin, passing ventrally to the major depression of the sulcus and swinging sinuously over the posterior lobe, nearly in contact with the dorsal ridge at the posterior margin. Ventral lateral ridge complete or broken centrally, anterior end starting midway in the anterior lobe and curving posteriorly to about the middle of the posterior lobe. Median lateral ridge dividing the valve into halves, dorsal lateral ridge separating the dorsal half of the valve into nearly equal parts; ventral lateral ridge directed postero-ventrally, dividing the ventral half of the valve obliquely.

Right valve overlapping left on the ventral and dorsal margins, hinge with curved projections on the right valve lying in sockets on the anterior and posterior ends of the left valve. Frill on right valve extending posteriorly from the anterior margin for three-fourths the length of the valve.

Remarks. The species is most closely similar to *B. granulata* (Jones and Kirkby) but differs from that species by the possession of pronounced dorsal crests, three lateral ridges and a solid frill on only the right valve. The specific designation *B. lophota* is derived from the Greek *λόφος* ("ridge bearing") and refers to the lateral longitudinal ridges present on the species.

Occurrence. Canso group; localities 594, 9600, 9603, 25623, 25638.

Type. Holotype, G.S.C. No. 10387; Paratype, G.S.C. No. 12837.

Order, CONCHOSTRACA

Family, LEAIADIDAE Raymond 1946

Palæontological evidence indicates that members of this family arose from some pseudestherian stock. As pointed out by Raymond (1946, p. 296), there is an apparent transition from *Asmussia* (Raymond's *Pseudestheria*), bearing no radial carinae to *Eoleaia* (Raymond's *Hemicycloleaia*), which bears indistinct, nodose carinae. This transition was effected during the Mississippian and has been demonstrated as occurring in specimens from the Horton group of Nova Scotia by Raymond (1946, p. 296) and Kobayashi (1954, p. 140). By the upper Mississippian or lower Pennsylvanian the "estherian" and "leaian" stocks were distinctly separate. Both reached an explosive radiation during the Pennsylvanian. They have world wide distribution, as shown by the occurrence of specimens from North America, Europe, South America, Australia, and Asia.

Numerous attempts have been made to classify leaian genera and species. Previous to 1946 the generic term *Leaia* was used for all forms showing two divergent radial carinae and concave inter-areas. Pruvost (1914) was the first to attempt a systematic classification of the leaian species. He believed that the angles formed by the lateral carinae and the hinge line were of specific value, and designated the anterior angle alpha and the posterior angle beta. His work showed that in Dinantian (Lower Carboniferous) species the alpha angle reaches 90 degrees, and in the Stephanian (Upper Carboniferous) species this angle reaches a maximum of 110 degrees. Raymond (1946) showed that these measurements must be used with considerable caution and that zonation based on these angles alone is not valid. The variation of the measurement of these angles on specimens of Carboniferous age may be observed in specimens from the Maritime Provinces, but does not necessarily follow the trends suggested by Pruvost.

Raymond (1946) differentiated the leaians into several genera based on the form of the lateral carapace and the number of carinae. These taxonomic criteria have since been shown to vary greatly, due to polymorphism within species (Kobayashi, 1954).

The most recent publication on these genera is by Kobayashi (1954). In this work, he has replaced Raymond's genus *Hemicycloleaia* in part with the original generic designation *Leaia*. He has also considerably revised other parts of Raymond's classification of the fossil Conchostraca.

During the course of the author's study, species of the various leaian genera have been found in strata ranging from the Canso group to the Pictou group. Some of the Canso leaian species have small (55 to 60 degrees) alpha angles, whereas the Riversdale, Cumberland, and Pictou leaias have alpha angles ranging from 85 to 100 degrees. During the time of deposition of the Riversdale to Pictou groups, the leaians increased in number of species, but show no apparent progressive change in the size of their alpha angles.

Genus, *Leaia* Jones 1863

Synonym, *Hemicycloleaia* Raymond 1946

Leaia leidyi (Lea)

Plate VII, figure 6

Cypricardinia leidyi Lea 1855, p. 341, Pl. IV.
Leaia leidyi Jones 1863, p. 116, Pl. V, figs. 11, 12.

Description. Lea, who originally believed this was a mollusc, described this species as follows (1855, p. 341):

> "Shell oblong, round before and truncate behind, very inequilateral, striate; dorsal and basal margin parallel; umbonial slope sharply carinate; anterior slope with an elevated line from the beak to the basal margin; striae about twelve, very regular, and nearly equidistant."

Remarks. This species appears to be closely allied to *L. tricarinata* Meek and Worthen. The anterior carina of *L. leidyi*, however, is straight and forms an alpha angle of slightly less than 90 degrees, whereas that of *L. tricarinata* is slightly curved and forms a corresponding angle of 90 degrees.

Occurrence. Canso group; localities 1404, 1439, 1454, 1565, 1786, 3571, 9565, 12238, 12241, 12259, 12270, 25621, 25629, 25641, 25644.

Type. Hypotype, G.S.C. No. 12825.

Leaia baentschiana (Beyrich)

Plate IV, figure 10; Plate VI, figures 3, 4; Plate VII, figures 1, 9; Plate VIII, figures 1, 2, 4

Leaia Leidyi var. *baentschiana* Beyrich 1864, p. 363.
Leaia baentschiana Laspeyres 1870, p. 744, Pl. XVI, fig. 2.
Hemicycloleaia baentschiana Raymond 1946, p. 293.
Leaia baentschiana Kobayashi 1954, p. 154.

Remarks. Specimens from the Maritimes have a straight dorsal border, the umbo is situated posterior to the anterior dorsal angle. About 12 concentric lirae are present with small nodes at their juncture with the radial carinae. There are only two radial carinae observable, the dorsal carina is crushed beneath the carapace; both carinae decrease in height ventrally, and neither extends to the ventral margin. The alpha angle of this species is nearly 100 degrees.

Occurrence. Canso and Riversdale groups; localities 1404, 1439, 1454, 1946, 2462, 9600, 12259, 12263, 25610, 25641, 25644.

Type. Hypotypes, G.S.C. Nos. 12793, 12809, 12816, 12824, 12825, 12854, 12855, 12857.

Leaia tricarinata Meek and Worthen

Plate IV, figures 8, 9; Plate VII, figures 2, 5, 7; Plate VIII, figure 5

Leaia tricarinata Meek and Worthen 1868, p. 541, figs. B1-3.
Hemicycloleaia tricarinata Raymond 1946, p. 289, Pl. VI, figs. 4, 5.
Leaia tricarinata Kobayashi 1954, pp. 141, 167.

Remarks. A discussion of the variability of individuals of this species has been published by Raymond (1946, pp. 289-290). Specimens show a straight to slightly curved anterior carina with an alpha angle of 90 to 100 degrees. Except for the slightly smaller alpha angle, this species agrees with *L. leidyi* in number of lirae and lateral shape of the carapace.

Occurrence. Canso and Riversdale groups; localities 594, 877, 1404, 1439, 1454, 1565, 1786, 1946, 2439, 2462, 9565, 9600, 12261, 12624, 25610, and the upper part of the type Riversdale section near Riversdale, N.S.

Type. Hypotypes, G.S.C. Nos. 12787, 12795, 12796, 12815, 12826, 12856.

Leaia silurica Matthew

Plate VII, figure 4

Leaia silurica Matthew 1910, p. 115, Pl. IV, fig. 3.

Remarks. This species may be readily recognized by the symmetrical nature of the radial carinae. The type specimen, figured by Matthew, appears to have been misoriented. His figure, however, shows the carinae to be symmetrical. The type appears to have an alpha angle of nearly 125 degrees with the beta angle of about 60 degrees. On the specimen obtained by the author from the same beds from which Matthew described the type, the alpha angle is about 110 degrees and the beta angle about 55 degrees. The anterior part of the carapace is not as pronouncedly lirate as the posterior part, and has an anterior ventral swing that is not shown by other species of this genus.

Occurrence. Canso, Cumberland and Pictou groups; localities 1521, 1684, 2254, 12253.

Type. Hypotype, G.S.C. No. 12818.

Leaia laevis (Raymond)

Plate VII, figure 10

Hemicycloleaia laevis Raymond 1946, p. 287, Pl. VI, fig. 2.
Leaia laevis Kobayashi 1954, p. 141.

Remarks. Specimens of this species are nearly circular in lateral view. The dorsal margin is slightly curved; the posterior margin is nearly straight, rounding into the ventral border. The anterior carina is slightly curved, the posterior carina straight. The alpha angle is 95 degrees, the beta angle 45 to 50 degrees. Lirae 14 in number, becoming nodose where they cross the posterior carina.

Occurrence. Riversdale and Pictou groups; localities 877, 1946, 3041.

Type. Hypotype, G.S.C. No. 12817.

Leaia acutangularis (Raymond)

Plate VIII, figure 3

Hemicycloleaia acutangularis Raymond 1946, p. 292, fig. 6.
Leaia acutangularis Kobayashi 1954, p. 141.

Remarks. This is one of the most acutely carinate leaias found in the Maritimes. Both carinae are curved, the anterior one concave anteriorly and the posterior one concave posterodorsally. All three concave interareas are lirate, about 15 lirae shown on one specimen. The alpha angle ranges from 65 to 75 degrees; the beta angle ranges from 25 to 30 degrees.

Occurrence. Canso group; localities 1439, 1454, 12253, 25644.

Type. Hypotype, G.S.C. No. 12819.

Leaia acutilirata n. sp.

Plate VII, figure 3

Description. Carapace elliptical in outline, dorsal margin slightly curved, anterior and ventral margins rounded, posterior margin straight. Three carinae; anterior and posterior ones straight; third carina along dorsum and projecting slightly posteriorly to the posterior margin. Alpha angle about 75 degrees, beta angle 30 degrees. Ten widely spaced and poorly defined lirae on the posterior third of the valve.

Remarks. This species is most closely allied to *L. acutangularis* (Raymond), but differs from it in having greater alpha and beta angles. The striae on the posterior third of the valve in *L. acutilirata* are not as sharply defined as those in *L. acutangularis.*

Occurrence. Canso group; localities 2074, 12270, 25629.

Type. Holotype, G.S.C. No. 10396.

Leaia magnacostata n. sp.

Plate VI, figure 5

Description. Carapace subrounded in lateral view, dorsum and posterior margins straight; anterior margin with subangular forward swing. Three prominent carinae; anterior and posterior carinae straight; third carina on dorsum. Alpha angle 90 degrees, beta angle 45 degrees. Six or more lirae, strongly developed on the lateral and ventral parts of the carapace. Umbonal area smooth, situated near the junction of the anterior and dorsal margins. Carapace broader posteriorly than anteriorly.

Remarks. The species appears almost identical to *L. leidyi* (Lea) in the possession of three carinae and similar alpha and beta angles, and differs from this species in having a posterior plenate shape, very pronounced concentric lirae, and a plain umbonal region.

Occurrence. Pictou group; locality 1521.

Type. Holotype, G.S.C. No. 10397.

Genus, *Eoleaia* Kobayashi 1954

Eoleaia elongata n. sp.

Plate VII, figure 8

Description. Carapace long, elliptical in lateral view; umbo subterminal; dorsal margin straight, lateral margins elliptical in outline. Two carinae; anterior one slightly curved; posterior one straight; alpha angle 90 degrees, beta angle ranging from 30 to 35 degrees; both carinae very prominent. Lirae few and poorly defined.

Remarks. Two other species of *Eoleaia*, *E. leaiaformis* (Raymond) and *E. laevicostata* (Raymond), have been recorded from the Mississippian strata of the Maritimes. Both have the elliptical lateral outline typical of the genus but do not have carinae as strongly developed as those on *E. elongata*.

Occurrence. Riversdale group; locality 1946.

Type. Holotype, G.S.C. No. 10399.

Genus, *Monoleiolophus* Raymond 1946

Monoleiolophus conemaughensis Kobayashi

Monoleiolophus unicostatus Raymond 1946, p. 262, Pl. III, fig. 11, (not *M. unicostatus* [Reed], 1929).
Monoleiolophus conemaughensis Kobayashi 1954, p. 141.

Remarks. This species apparently is unrelated to any other leaian-type species. It is the only leaian with a single carina that reaches neither the beak nor the posterior margin and corresponds to the beta angle of the bicarinate forms.

Occurrence. Riversdale group; locality near upper part of the type Riversdale section, on the Salmon River, N.S.

Genus, *Asmussia* Pacht 1849

Asmussia Pacht 1849, p. 44.
Posidonomya Pacht 1852, p. 26.
Estheria Jones 1856, p. 376.
Euestheria Depéret and Mazeran 1912, p. 172.
Pseudestheria Raymond 1946, p. 245.
Erisopsis Raymond 1946, pp. 233-4.
Asmussia Raymond 1946, p. 235.

Asmussia alta (Raymond)

Plate V, figures 3, 8

Pseudestheria alta Raymond 1946, p. 246, fig. 1.
Asmussia alta Kobayashi 1954, p. 153.

Remarks. Specimens have been collected from beds near Saint John, N.B. They agree in shape with the type described by Raymond (1946, p. 246), but are more coarsely striate. Examination of the holotype reveals that it is an internal mold; it probably preserves the striae more faintly than would the shell, which has been broken off.

Occurrence. Cumberland and Pictou groups; localities 1684, 2254, 3520, and Pictou coalfield, Coalburn borehole depth 529 feet.

Type. Hypotypes, G.S.C. Nos. 12799, 12800.

Asmussia tenella (Bronn)

Plate V, figure 6

Posidonomya tenella Bronn 1850, pp. 577-9.
Estheria tenella Jones 1863, p. 31, Pl. V, fig. 6; Pl. I, figs. 26, 27.
Pseudestheria tenella Raymond 1946, pp. 250, 251.
Asmussia tenella Kobayashi 1954, p. 166.

Remarks. Most of the Maritimes specimens are preserved as molds in arenaceous black and grey shales. They appear to agree in structure with those described by Jones (1863, p. 31 ff.).

Occurrence. Riversdale, Cumberland, and Pictou groups; localities 1684, 2254, 3041, 9581.

Type. Hypotype, G.S.C. No. 12853.

Genus, *Euestheria* Depéret and Mazeran 1912

Euestheria dawsoni (Jones) 1870

Plate V, figures 5, 9

Estheria sp. Dawson 1868, p. 256, fig. 58*d*.
Estheria dawsoni Jones 1870, p. 220, Pl. VII, fig. 15.
Not *Estheria dawsoni* Packard 1881.
Pseudestheria dawsoni Raymond 1946, p. 245.
Euestheria dawsoni Kobayashi 1954, p. 89.

Remarks. A few poorly preserved specimens of this species have been found in the Upper Carboniferous strata of the Maritimes.

Occurrence. Canso group; localities 25621, 25644.

Type. Hypotypes, G.S.C. Nos. 12814, 12852.

Euestheria raymondi n. sp.

Plate V, figures 1, 2

Description. Carapace subcircular, with greatest length slightly below hinge. Surface marked by numerous concentric lirae, very closely spaced near the lateral margin and more widely spaced near the umbonal region. Umbo situated on dorsum well behind the anterior edge of the valve. Hinge straight, valve plenate anteriorly, tapering to posterior.
Length of holotype, 9.5 mm.; height, 5.5 mm.

Remarks. The number of lirae and the size of the specimens differentiates this species from all other members of the genus. It is named in honour of the late Dr. P. E. Raymond of Harvard College.

Occurrence. Canso ? group or Lower Mississippian ? ; locality 23997.

Type. Holotype, G.S.C. No. 10395; paratype, G.S.C. No. 12797.

Genus, *Lioestheria* Depéret and Mazeran 1912

Lioestheria ? simoni (Pruvost)

Plate V, figure 7

Estheria tenella Jones (non Bronn) 1863, p. 31, Pl. II, fig. 39; Pl. V, figs. 1-5, 7.
Estheria simoni Pruvost 1911, p. 64, Pl. I, figs. 4-8, Text fig. 2.
Pseudestheria simoni Raymond 1946, p. 248.
Lioestheria ? simoni Kobayashi 1954, p. 55.

Remarks. Specimens from the Maritimes are preserved as impressions or films with very fine lirae. None of them is as well preserved as that figured by Pruvost, but all of them show the high umbonal region and the presence of several rugulose lirae encircling the umbone.

Occurrence. Canso group ?; locality 2034.

Type. Hypotype, G.S.C. No. 12801.

Lioestheria striata (Goldfuss and Münster)

Plate VI, figures 1, 2

Sanguinolaria striata Goldfuss and Münster 1840, p. 180, Pl. CLIX, figs. 19*a*, *b*.
Cardiomorpha striata de Koninck 1842, p. 105, Pl. H, figs. 9*a-c*.
Estheria striata Jones 1863, p. 23, Pl. I, figs. 8-18 (in part).
Lioestheria striata Raymond 1946, p. 232.

Remarks. These small "estherians" have wrinkled surfaces with very fine concentric lirae. On many bedded planes they are abundant. The thin shell material flakes off very readily leaving impressions on the surface of the rock. Immature forms of numerous species may be included within this poorly defined and relatively unknown species. The preservation of the shells is such as to prohibit their being further differentiated.

Occurrence. Canso and Pictou groups; localities 1439, 1454, 2366, 12261, 12270, 25641, other strata of the Pictou coalfield.

Type. Hypotype, G.S.C. No. 12823.

Genus, *Cyclestherioides* Raymond 1946

Cyclestherioides blackstonensis (Raymond)

Plate V, figure 4

Pseudestheria blackstonensis Raymond 1946, p. 247, Pl. III, fig. 1.
Cyclestherioides blackstonensis Kobayashi 1954, p. 154.

Description. Raymond's original description is as follows:

"Carapace subcircular, but with the greatest length at an angle oblique to the hinge. Surface apparently without markings other than rather equally spaced, slender concentric lirae, of which there seem to be ten. Umbonal region smooth, either from lack of lirae or because of the state of preservation" (Raymond, 1946, p. 247).

Remarks. The specimens are preserved as impressions in fine grey shales and show only the carapace outlines and fine, concentric lirae. Preservation appears to be similar to that of specimens examined by Raymond. The carapaces may have been very thin and only partly calcified.

Occurrence. Canso group; locality near Alma, N.S.

Type. Hypotype, G.S.C. No. 12851.

Genus, *Palaeolimnadiopsis* Raymond 1946

Palaeolimnadiopsis pruvosti Raymond 1946

Plate IV, figure 7

Estheria (Euestheria) dawsoni Pruvost 1919, p. 55, Pl. XXIV, figs. 24-28 bis.

Description. Large estherioid bearing widely spaced concentric growth lines with no indistinct radial markings, such as are present on *Estheriella.* Posterior border recurving on dorsal border to form a short spinose posterior.

Remarks. Only poorly preserved specimens of this species have been found in the Maritimes. They show most of the features shown by Raymond (1946) and Kobayashi (1954) but are more incomplete.

Occurrence. Riversdale group ? ; locality 877.

Type. Hypotype, G.S.C. No. 12794.

Order, NOTOSTRACA ?

Lynceitidae n. fam.

Description. Outline in lateral view horseshoe-shaped; anterior border broadly rounded; posterior lateral angles compressed; posterior margin bearing a pronounced notch; median dorsal ridge extending forward from the posterior notch two-thirds of the distance to the anterior margin; eye tubercles questionably present at anterior end of dorsal ridge; surface wrinkled or smooth; wrinkles, if present, parallel to the lateral margins.

Genus, *Lynceites* Goldenberg 1870

Remarks. The description of this genus by Goldenberg (1870, p. 286) gives more detail than is present on the Maritime specimens. The taxonomic position of this genus and family is questionable. Goldenberg apparently considered the genus to be closely allied with the living conchostracan genus *Lynceus* (*Lyncaeus*) O. F. Müller 1776. He figured both *Lynceites ornatus* and *Lynceus sphaericus* Müller for comparison. In some textbooks of palæontology, the genus *Lynceites* is listed as a questionable cladoceran (Piveteau, 1953; Shrock and Twenhofel, 1953), but no evidence of a bivalved nature of the carapace may be seen.

Several characters present on the specimens from the Maritimes seem to indicate notostracan affinities. The presence of a shield-shaped carapace bearing dorsally situated eyes, a median dorsal ridge, a deep posterior notch, and slight depressions or wrinkles in the position of the shell glands of *Apus* would seem to indicate some affinity to this latter genus. The poor preservation of the material and the lack of diagnostic appendages and abdominal segments do not permit the author to include this genus within that of the modern and fossil genus *Apus*. For lack of more specific information concerning the ordinal and generic classification of these forms, the author places them questionably in the order Notostraca and erects the family Lynceitidae to include all forms bearing the familial characteristics.

Lynceites cansoensis n. sp.

Plate IX, figures 8, 9

Description. Outline in lateral view shield-shaped, anterior border broadly rounded, tapering posteriorly to two mucronate extensions; median posterior notch one-fourth of entire length. Median dorsal ridge extending forward from the posterior notch one-half to two-thirds the distance to the anterior margin, with questionable eye tubercles, three in number, present at its anterior end. Surface coarsely wrinkled parallel to lateral margins; interior surface smoother than exterior, median ridge expressed internally as a groove.

Length of holotype, 5 mm.; width, 4 mm.

Remarks. In most respects this species has the characteristics described by Goldenberg for *L. ornatus*, but *L. cansoensis* appears to be somewhat more coarsely wrinkled, is larger, and has the questionable eye tubercles more widely spaced than *L. ornatus*.

Occurrence. Canso group; localities 878, 1565, 9573, and on Meadow Brook, south of Monastery, N.S.

Type. Holotype, G.S.C. No. 10383; paratype, G.S.C. No. 12792.

Order, MYSIDACEA

Genus, *Anthrapalaemon* Salter 1861

Anthrapalaemon dubius (Milne-Edwards)

Plate X, figures 3-6; Plate XI, figures 2, 3

Apus dubius Milne-Edwards 1840 (in Prestwich), p. 491, Pl. XLI, fig. 9.
Anthrapalaemon (*Palaeocarabus*) *dubius* Salter 1861, p. 532, figs. 6, 7.
Palaeocarabus russellianus Salter 1863, p. 520, figs. 1, 2.
Anthrapalaemon grossarti Woodward 1866, p. 244, Pl. III, figs. 5-7.
Anthrapalaemon (*Palaeocarabus*) *hilliana* Dawson 1877, p. 56, fig. 1.
Anthrapalaemon (*Palaeocarabus*) *hillianus* Dawson 1878, p. 55, fig. 10, Appendix.
Anthrapalaemon glaber Jones and Woodward 1899, p. 393, Pl. XV, fig. 5.
Anthrapalaemon russellianus var. *spinulosus* Peach 1908, p. 36, Pl. IV, fig. 7.
Anthrapalaemon hillianus Bell 1922, p. 162, Pl. I, fig. 10.
Anthrapalaemon grossarti Jongmans 1928, Pl. XVII, fig. 5.
Anthrapalaemon cf. *russellianus* Dix 1930, p. 103.
Anthrapalaemon grossarti Pruvost 1930, p. 179, Pl. X, fig. 4.
Anthrapalaemon dubius Van der Heide 1951, pp. 26-39, Pl. III, figs. 4, 5; Pl. IV, figs. 3-10; Pl. V, figs. 1-11; Pl. VI, figs. 1-5.

Remarks. A complete description and discussion of the synonomy of this species is given by Van der Heide (1951, pp. 26-39). He doubts the validity of those species of the genus *Anthrapalaemon* based on numerous minute variations and has included several species of older authors in *A. dubius* (Milne-Edwards).

All specimens of *Anthrapalaemon* found in the Carboniferous rocks of the Maritimes have been previously designated as *A. hillianus* Dawson 1877. The type locality for this species is near Joggins, N.S., in rocks of the Cumberland group. Very few specimens have been found in the Cumberland group, but numerous specimens have been collected from strata of the Riversdale group.

In minute details, the Maritime specimens appear to differ somewhat from those of Europe (*see* Bell, 1922, p. 162), but some of these differences may be the result of preservation. In the present study, the classification of Van der Heide is accepted and all Maritime Upper Carboniferous specimens of this genus are included in *A. dubius* (Milne-Edwards) 1840.

Occurrence. Riversdale and Cumberland groups; localities 878, 1016, 1468, 1581, 1811, 6575, 9566, 9576, 9581, 9583, 25612, 25625, 25627, 25630, 25649, and Bed 53, Division 4 of Logan's Section at Joggins, N.S.

Type. Hypotypes, G.S.C. Nos. 12781, 12789, 12812, 12813, 12821, 12822.

Anthrapalaemon sp.

Plate XXI, figure 2

Remarks. One indistinct carapace of this genus has been found bearing very indistinguishable dorsal and nuchal ridges. The median dorsal ridge does not reach the posterior ridge. No evidence is present of lateral spines on the carapace.

Occurrence. Pictou group, Asphalt borehole No. 884, at a depth of 1,269 feet, Pictou coalfield.

Type. Hypotype, G.S.C. No. 12861.

Genus, *Pygocephalus* Huxley 1857

Pygocephalus cooperi Huxley 1857

Plate X, figure 1; Plate XI, figure 1

Pygocephalus cooperi Huxley 1857, p. 369, Pl. XIII, figs. 1-3.
Pygocephalus cooperi Peach 1912, pp. 147-8, Pl. IV, figs. 10-12.

Remarks. Incomplete specimens have been found at several localities of the Riversdale group. Some of these show the ventral aspect of the cephalic and thoracic parts with associated appendages. The antennae and anterior scales of the cephalic part and several thoracic appendages have been distinguished on several specimens. Each of the seven thoracic sternites is hexagonal, three times as wide as long, and shows a faint median groove. The anterior sternite is smaller than any of the others. Each thoracic limb is attached to a hexagonal, subround side plate which lies against the posterior lateral face of the sternite immediately anterior. The "protopodite" of the limb is in contact with the anterior distal face of the side plate and lies against the side plate immediately anterior. H. Woodward (1867, p. 234, Pl. III, fig. 2) and Piveteau (1953, p. 317, Pl. II, fig. 9) erroneously show the protopodites lying in contact with the single distal lateral face of each side plate.

The abdominal segments are not well preserved on any Maritime specimen. Abdominal segments are figured by Huxley (1857) and Woodward (1867), but Huxley's figures are misleading and Woodward's figure is small and indiscernible. The reconstruction of the entire animal by Piveteau shows more detail than was evident in previous figures of this species.

There may be a generic association between *Pygocephalus* Huxley and *Anthrapalaemon* Salter. Peach (1908, p. 37) states:

> "To judge from the arrangement of the sternal plates and the limbs and tail fan of *Pygocephalus cooperi* Huxley, as figured by him and afterwards by Dr. H. Woodward, there is a close relationship between that form and the members of the present genus [*Anthrapalaemon*]."

The ventral thoracic view of *A. gracilis* Meek and Worthen 1865, obtained from the Francis Creek shales near Mazon Creek, Illinois, appears similar to a reconstruction of *P. cooperi* Huxley by Piveteau. The possible synonomy of *Pygocephalus* Huxley 1857 and *Anthrapalaemon* Salter 1861 remains in doubt.

Occurrence. Riversdale group; localities 878, 9566, 9572.

Type. Hypotypes, G.S.C. Nos. 12811, 12858.

Pygocephalus cf. *cooperi* Huxley 1857

Plate X, figure 2

Remarks. A single specimen from the beds containing *P. cooperi* shows most of the characteristics of this species, but has a more pronounced median groove crossing the sternites. A semi-circular depression is present on sternite seven which has not been observed on any specimen of *P. cooperi.* Parts of the crushed thoracic carapace may be seen on both sides of the specimen. These bear faint radial striations.

Occurrence. Riversdale group; locality 9576.

Type. Hypotype, G.S.C. No. 12810.

Genus, *Tealliocaris* Peach 1908

Tealliocaris caudafimbriata n. sp.

Plate XII, figure 3

Tealliocaris robusta var. nov. Peach 1908, pp. 25-6, Pl. III, figs. 9-12.

Description. The species is imperfectly known from two specimens. The cephalic and thoracic segments are unknown. A description of the preserved parts follows.

Carapace imperfectly preserved; smooth; with strong median keel and two lateral keels; cervical fold meeting median keel in anterior third of the carapace; posterior lateral margins evenly rounded. Six (?) abdominal segments, each three times as wide as long. Telson large, tapering to a blunt point; one pair of setate swimmerettes on either side of the terminal anal opening. The course of the gut is well marked as a median dorsal ridge on the exterior, and a furrow on the interior, crossing the abdominal segments and the telson.

Length of holotype, 13.5 mm.; length of carapace, 6.75 mm.

Remarks. This species differs from *T. robusta* Peach (1908) in having a distinct posterior swing of the thoracic shield and in lacking crenulations interior to the carapace ridges. Because the preservation is poor, no evidence of a "backwardly-directed peak in the midline of the posterior margin" can be observed, such as that mentioned by Peach (supra, p. 25) as occurring on *T. robusta* var.

The name of this species is derived from the Latin *cauda*, f., ("tail") and *fimbria*, f., ("fringe") and refers to the well-developed tail fan on the species.

Occurrence. Canso group; locality 1565.

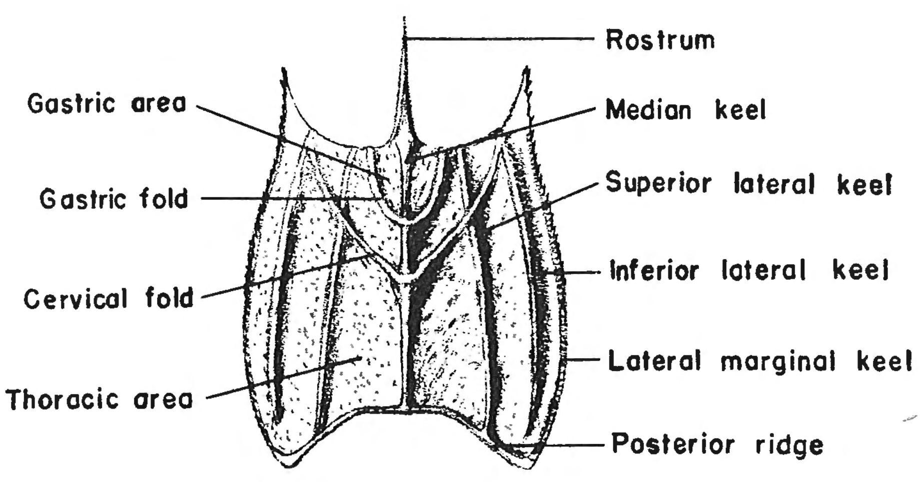
Type. Holotype, G.S.C. No. 10382.

Tealliocaris barathrota n.sp.

Plate XIII, figures 2-6; Plate XIV, figures 2, 3

Description. Carapace shield-shaped, strongly wrinkled and pitted, with seven well-developed dorsal keels; median ridge (keel) extending posteriorly from the angular rostrum to the straight median part of the ridged posterior margin, thicker at the point of juncture with the cervical fold. A superior lateral keel on each side, about 4 mm. from the median keel, extending across the cervical folds, joining the posterior ridge, and nearly parallel to the lateral marginal keel. An inferior lateral keel, joined to one of the cervical folds at the anterior margin, extending nearly to the posterior margin, and parallel to the lateral marginal keel. A lateral marginal keel along each edge, extending from the antero-lateral angle to the posterior ridge, distinctly denticulate and pitted along its entire length. Posterior corners slightly rounded, posterior lateral angles each about 75 degrees.

Dorsal carapace divided centrally by the slightly curved antero-laterally directed cervical folds which separate the anterior gastric and the posterior thoracic areas. Gastric area divided about one-third of the distance from the anterior margin by the "U-shaped" gastric fold. The gastric fold meets the anterior margin between the anterior end of the superior lateral keel and the rostrum.



Dorsal carapace of *Tealliocaris barathrota* showing the ornamentation (x 6).

Anterior cephalic part of the specimens not well preserved; strongly jointed antennae and large setate basal scales present. Seven thoracic sternites on the venter with structures at the base of the limbs that have been termed "the sternal branches of the gills" (Peach, 1908, p. 16). Five abdominal segments preserved, attenuated laterally into sharp spines (Plate XIV, fig. 3). Tail fan not well preserved.

Length of holotype 16 mm. from the anterior tip of the rostrum to the posterior edge of the fourth abdominal segment. Carapace 7 mm. wide.

Remarks. This species is known from several specimens that show the dorsal and ventral exterior and dorsal interior. The specimens are fragmental, preserved in a dense, grey shale.

The species is similar to *T. loudonensis* Peach and *T. woodwardi* Peach (1908). *T. barathrota* has a straight median posterior margin and prominent dorsal keels merging with this margin. *T. loudonensis* does not show these characters. *T. barathrota* is differentiated from *T. woodwardi* by its shorter length of carapace and superior lateral keels anterior to the cervical folds. The carapace of *T. barathrota* is more coarsely pitted and grained than other members of the genus.

The specific name is derived from the Greek βάραθρον ("pitted") referring to the coarsely pitted and wrinkled dorsal surface of the carapace.

Occurrence. Canso group; localities 1826, 12271, 25610.

Type. Holotype, G.S.C. No. 10384; paratypes, G.S.C. Nos. 12782, 12784, 12785*a-d*.

Tealliocaris belli n. sp.

Plate XII, figure 4

Description. Cephalic appendages not well preserved; parts of the basal scale and antennae present. Holotype lacking a carapace. Thoracic region with a pronounced median keel; a superior lateral keel on each side, 2 mm. from the median keel and parallel to the lateral margin; an inferior lateral keel 3 mm. from the median keel, parallel to the lateral margin.

Six abdominal segments and a broad telson preserved; abdominal segments 1.5 mm. long and 5.5 mm. wide; pronounced median ridge 1 mm. wide marking the course of the gut. Telson 4 mm. long and 10 mm. wide with extended uropods; median ridge marking the course of the gut, ending abruptly at the posterior anal opening. First uropod coarsely wrinkled, tapering distally, its proximal end having a broad contact with the telson. Impressions of two pairs of setate swimmerettes 1.25 mm. long between the first uropods and the posterior part of the telson; two swimmerettes on each side of the telson behind the uropods. No appendages visible on the thoracic or abdominal parts.

Length of specimen, 26 mm.

Remarks. *Tealliocaris belli* is similar to *T. caudafimbriata* in shape, but differs from this species in having large, wrinkled first uropods and is much larger in size.

The species is named in honour of Dr. W. A. Bell, a former Director of the Geological Survey of Canada.

Occurrence. Canso group; locality 2439.

Type. Holotype, G.S.C. No. 10381.

Genus, *Anthracophausia* Peach 1908

Anthracophausia sp.

Plate XIV, figure 1

Description. Three individuals are figured, but there is insufficient material to make a specific identification. The specimen on the right side of the figure shows a lateral view of the abdomen and tail fan, the telson is at the extreme right. The centre specimen shows the dorsal view of the gut, the shape of the telson, and the posterior part of the thoracic shield. The specimen at the left has vertical ridges on the dorsal part of the abdomen; similar ridges are not present on the other specimens.

Remarks. The specimens are similar to *A. dunsiana* Peach. The centre and right specimens agree closely with this species, but the left specimen differs from the other two in having longitudinal ridges on one of the abdominal segments.

Occurrence. Canso group; locality Southwest Mabou River, N.S.

Type. Hypotype, G.S.C. No. 12783.

Order, ANASPIDACEA

Genus, *Palaeocaris* Meek and Worthen

Palaeocaris cf. *typus* Meek and Worthen 1865

Plate XV, figure 1

Description. Specimen poorly preserved, showing only 10 to 12 thoracic segments and the tail fan. Thoracic segments partly disarticulated, telson and tail fan better preserved. Caudal appendage showing one pair of setate, elongate swimmerettes on either side of the elongate, blunted telson plate. Telson with numerous coarse setae, extending posteriorly to the swimmerettes.

Remarks. The specimen appears to be similar to *P. typus* Meek and Worthen, but insufficiently well preserved to make a specific designation.

Occurrence. Pictou group; locality 2645.

Type. Hypotype, G.S.C. No. 12777.

Class, **ARACHNOIDEA**

Order, XIPHOSURA

Genus, *Belinurus* König 1820

Belinurus reginae Baily 1863

Plate XVI, figures 2, 9, 10

Belinurus reginae Baily 1863, p. 107, Pl. V, figs. 1*a-d*.
Bellinurus reginae Woodward 1867, Pl. I, fig. 1.
Belinurus reginae Pruvost 1911, p. 299, Pl. VII, figs. 4-4*a*.
Koenigiella reginae Raymond 1944, p. 480.

Description. Specimens small, from 10 to 15 mm. in length, telson as long as body or longer; genal spines extending only to third thoracic segment, straight; ophthalmic spines short.

Remarks. This species is closely allied with *B. grandaevus* Jones and Woodward but possesses a much more elongate telson, somewhat shorter genal spines, and short ophthalmic spines which are not present on *B. grandaevus*.

Occurrence. Riversdale and Canso groups; localities 1439, 9573, 25646.

Type. Hypotypes, G.S.C. Nos. 12802, 12803*a*, *b*.

Belinurus grandaevus Jones and Woodward

Plate XVI, figures 1, 3-8

Belinurus grandaevus Jones and Woodward 1899, pp. 387-395, Pl. XV, figs. 2, 3.
Bellinurus grandaevus Ami 1899, pp. 207-8.

Description. This species is known only from Nova Scotia. It is larger than most belinurids, being from 10 to 20 mm. in length, with genal spines curved and extending backward to the fourth or fifth thoracic segment, a short telson less than the body in length, and possessing no ophthalmic spines.

Remarks. This species is more common than *B. reginae* in the Upper Carboniferous strata of the Maritimes.

Occurrence. Canso and Riversdale groups; localities 1454, 9573, 12238, 25646.

Type. The type specimens of Jones and Woodward are photographed in this paper (Plate XVI, figs. 1 and 6). No holotype was erected by the authors of this species at the time of description. The writer designates the specimen illustrated in Plate XVI, fig. 6 as the lectotype, G.S.C. No. 10391; paratype, G.S.C. No. 10400; hypotypes, 12804*a-c*, 12805, 12806.

Genus, *Euproöps* Meek 1867

Bellinurus Meek and Worthen 1865, p. 44.
Prestwichia Meek 1867, p. 257, (not Lubbock 1863, p. 140).
Euproöps Meek 1867, p. 394.

Euproöps cf. *danae* (Meek and Worthen)

Plate XVII, figure 9; Plate XXI, figure 1

Bellinurus danae Meek and Worthen 1865, p. 44.
Prestwichia danae Meek 1867, p. 257.
Euproöps danae Meek 1867, p. 395.
Euproöps colletti White 1883, p. 172, Pl. XXXIX, fig. 2.
Euproöps danae Van der Heide 1951, p. 59, Pl. VII, fig. 12.

Remarks. Specimens collected from the Maritimes show some of the features noted by the authors of this species on the type specimens from Illinois, but are so poorly preserved as to prohibit their positive identification.

Occurrence. Canso and Riversdale? groups; localities 25609, 2247?

Type. Hypotypes, G.S.C. Nos. 12828, 12860.

Euproöps amiae Woodward 1918

Plate XVII, figures 1-8

Euproöps amiae Woodward 1918, pp. 465-7, figs. 2-4.

Description. The specific description given by Woodward is essentially correct. This species is easily distinguished from other species of the genus by the short length of the head shield, extremely long and narrow genal and ophthalmic spines and axial tubercles on each abdominal segment. The tubercle on the last segment is the largest. Telson is unknown; Woodward (1918, p. 466, fig. 2) has drawn an extremely short telson on his reconstruction.

Remarks. This species appears to be somewhat similar to *E. thompsoni* Raymond (1944, pp. 486-488, fig. 2). Raymond, however, has shown figures of two specimens, which he assigned to *E. thompsoni*, with significant differences in structure. It would seem to appear that Raymond's Figure 2 (p. 488) more closely illustrates the characteristics of the species. *E. thompsoni* has a narrower cardiac lobe, a shorter cephalic shield, and shorter posterior cephalic spines than *E. amiae.* No axial tubercles such as exist on *E. amiae* are present on the specimen designated by Raymond as *E. thompsoni.*

Occurrence. Pictou group; localities 616, 25645, 25647.

Type. Woodward's type specimens are photographed in this paper. Inasmuch as no holotype was erected by Woodward at the time of description, the present writer designates the specimen figured by Woodward as Figure 2 as the lectotype, G.S.C. No. 10393; paratypes, G.S.C. Nos. 10398 and 12807; hypotypes, G.S.C. Nos. 12808*a-e*.

Order, EURYPTERIDA

Genus, *Eurypterus* De Kay 1825

Eurypterus brasdorensis Bell 1922

Plate IX, figure 7

Remarks. This species is known from one prosoma. It appears to be similar to *Eurypterus derbiensis* Woodward 1907, but insufficient structures are preserved on the present specimen to warrant a positive identification with *E. derbiensis.*

Occurrence. Pictou group; near Sydney, N.S., in grey shales overlying the old New Campbellton (4′) seam.

Eurypterus sp.

Plate XVI, figures 11-13

Remarks. Poorly preserved parts of eurypterid metasomata have been collected from strata near Parrsboro, N.S. The specimens are referred to the genus *Eurypterus* on account of the width and curvature of the preserved abdominal segments. Each segment overlaps the one immediately posterior as is common in species of this genus. No parts of the prosoma or telson have been found.

Occurrence. Riversdale group; localities 1946, 25649.

Type. Hypotypes, G.S.C. Nos. 12827*a-c*.

Subclass, **ARACHNIDA**

Order, ANTHRACOMARTI

Genus, *Anthracomartus* Karsch 1882

Anthracomartus sp.

Plate XI, figure 4

Remarks. One poorly preserved specimen of an anthracomartid has been found in the Maritimes in a block of coarse-grained sandstone which shows only the impression of the posterior part of the abdomen. The specimen shows some affinities to *A. triangularis* Petrunkevitch (1913, p. 101) in the triangular shape of the body.

Occurrence. Canso? group; ½ mile south of Black Point on the east side of the Cumberland Basin, N.S.

Type. Hypotype, G.S.C. No. 12786.

Order, SCORPIONES

Suborder, EUSCORPIONES

Genus, *Eoscorpius* Meek and Worthen 1868

Eoscorpius sp.

Plate XV, figures 4, 5

Remarks. One poorly preserved specimen has been found in the Maritimes. It is preserved in black shale. Both obverse and reverse impressions of the skeletal material are available for study. The specimen is preserved as a carbonaceous film which is readily distinguishable from the matrix. Remnants of three limbs are visible together with five post-abdominal segments and the telson.

Occurrence. Pictou? group; apparently the specimen was obtained from a stratum in the Stellarton coalfield, Nova Scotia.

Type. Hypotype, G.S.C. No. 12778.

Class, **ARCHAEOSTRACA**

Order, RHINOCARINA

Genus, *Dithyrocaris* Scouler 1843

Dithyrocaris glabroides n.sp.

Plate VI, figures 6, 7; Plate IX, figure 6

Description. Carapace subelliptical in lateral view; dorsum slightly convex, with no indication of a mid-dorsal ridge; anterior margin sloping to the rounded ventral margin; posterior margin deeply notched; postero-lateral spines prominent.

Surface smooth or slightly punctate, bearing no medial or nuchal ridges; lateral margins typically smooth; some specimens with a marginal ridge having a maximum width of $\frac{3}{4}$ mm.

Length of holotype, 11 mm.; width of one valve, 5 mm.; depth of posterior notch, 2.5 mm.

Remarks. *D. glabroides* strikingly resembles *D. glabra* Woodward and Etheridge 1873, but is less than one-half the size of this species. No posterolateral denticles similar to those on *D. glabra* are present on *D. glabroides*. Both species are smooth or slightly punctate, with no nuchal and mid-dorsal ridges, and have a relatively deep posterior notch. The species is named *D. glabroides* because it closely resembles *D. glabra*, from which it chiefly differs in smaller size.

Occurrence. Canso group; locality 1786.

Type. Holotype, G.S.C. No. 10389; paratypes, G.S.C. Nos. 12791, 12798.

Class, **DIPLOPODA**

Order, PALAEOMORPHA Verhoeff

Genus, *Amynilyspes* Scudder 1881

Remarks. Figures of the type species, *A. wortheni* Scudder, show that this species may have had diplopod characteristics. Because the specimens do not have limbs or anterior segments it is impossible to determine whether they are chilopods or diplopods. A single lateral plate (lapette) is present on each side of the dorsal plate which may indicate a simple limb assemblage. This structure has been considered sufficient evidence to remove the genus from the family Euphoberiidae to which it was originally designated (*see* Piveteau, 1953, p. 392), which typically has two lateral plates on each side of every segment. No familial designation can be made for the genus *Amynilyspes* until better preserved material is obtained.

Amynilyspes springhillensis, n.sp.

Plate XV, figure 2

Description. Species represented by one, poorly preserved specimen, 23 mm. in length, having seven imperfectly preserved segments; no anterior segments or appendages preserved. (In this description it is assumed that the curvature of the lapettes trends posteriorly; all other structures are oriented with relation to these lapettes.)

Dorsal plate of each segment strongly ridged on the posterior margin to receive the anterior margin of the following dorsal plate; each plate with an anterior row of spine bases and a posterior row of tubercles. Anterior row consisting of four spine bases arranged transversely on each plate, the two bases nearer the median line larger than the two lateral bases. Posterior row consisting of eight tubercles arranged transversely midway between the row of spine bases and the posterior margin of the dorsal plate, the two median tubercles nearly touching, the other six tubercles more widely spaced.

Lapettes (lateral plates or flaps) arcuate, flap-like, ridged on the anterior margin, adjacent to the dorsal plates. Lapettes ornamented with a linear row of three to four spine bases and a row of four to five tubercles similar to those on the dorsal plates.

Remarks. This genus is known only from two species. The smaller species, *A. wortheni* Scudder 1881, lacks much detail of ornamentation; the larger species *A. springhillensis* is more highly ornamented. Similar lapettes are present in both species.

Occurrence. Cumberland group; locality 1041.

Type. Holotype, G.S.C. No. 10385.

Order, EURYSTERNA Verhoeff

Genus, *Xylobius* Dawson 1859

Xylobius sigillariae Dawson 1859

Plate XI, figure 6

Xylobius sigillariae Dawson 1859, p. 272, figs. 4-7, 9.

Description. Body elongate, with numerous (up to 30) segments; limbs numerous, several to each segment, attached directly to the dorsal plate of each segment; dorsal plates finely ridged or striated.

Remarks. Dawson originally described these forms from Joggins, N.S., where they occurred in upright trees in the Joggins coastal section. His drawings of this species show many more structures than are present on the specimens described here.

Occurrence. Cumberland group; locality 25611.

Type. *Hypotype,* G.S.C. No. 12788.

Genus, *Archiulus* Scudder 1868 non Berlese 1886

Archiulus xylobioides Scudder

Xylobius sigillariae Dawson 1859, p. 272, fig. 8.
Xylobius sigillariae Dawson 1868, p. 385, fig. 151*b*.
Archiulus xylobioides Scudder 1868 (in Dawson) p. 496, fig. 151*b*.

Description. Part of Scudder's description is as follows: "The segments are shaped almost exactly as in *X. Dawsoni*, but are never broken up into fragments; the segments are about 1-25th of an inch in length" (in Dawson, 1868, p. 496). Segments with transverse wrinkles giving a ridged appearance, some with lateral pores situated centrally.

Remarks. This species occurs as disarticulated plates and segments. No appendages have been observed.

Occurrence. Cumberland group; locality 25611 and above the Joggins seam, Joggins, N.S.

Class, **INSECTA**

Subclass, **PTERYGOTA**

Order, MEGASECOPTERA Brogniart 1885

Genus, *Brodioptera* n. gen.

Type species. *Brodioptera cumberlandensis* n. sp.

Description. Wing spatulate to subtriangular in outline, two and one-half to three times as long as wide; subcostal and radius joined to form a prominent, fused vein; subcostal branching from radius near the apex of the wing; radius undivided; radial sector and median with few divisions; cubitus unbranched. Anal veins unknown.

Remarks. This genus is named for its close affinities to *Brodia* Scudder 1881, from which it differs in the possession of a fused subcostal-radius vein and a smooth, non-spinose, outer margin.

Brodioptera cumberlandensis n. sp.

Plate XVIII, figures 1-3

Description. Wing long and slender, three times as long as wide; costal margin nearly straight, posterior margin gradually rounding into the anal and apical margins. Subcostal vein adjacent to the costal and fused to the radial sector except at the extreme tip; radius unbranched; radial sector parallel to the radius and branching from the radius at one-third the length of the wing, giving rise to four simple posterior branches at equal distances along the vein. Median prominent, originating adjacent to the base of the radius and extending in a gentle curve to the middle of the posterior margin of the wing. Median with one superior branch at one-third its length from the base of the wing; superior branch nearly joining with the juncture of the radius-radial sector and then continuing parallel to the median. Cubitus simple, unbranched as far as is known. No anal veins preserved. Oblique cross-veins connecting the major elements at irregular intervals.

Occurrence. Riversdale group; collected by H. M. Ami, 1899, with the following information: "West Bay, Parrsboro, Cumberland County, Nova Scotia. Above marine limestones and conglomerates holding marine limestone pebbles. Carboniferous and well up in the coal measures, probably 'Coal Measures' of Joggins coalfield."

Type. Holotype, G.S.C. No. 10390, obverse and reverse impressions.

Brodioptera amiae, n. sp.

Plate XVIII, figures 4-6

Description. Wing twice as long as wide; costal margin straight, sloping gently to the posterior; posterior margin gently convex with apex abruptly rounded; subcostal prominent, separated from the radius near the apex of the wing; radius prominent, unbranched; radial sector parallel to the radius and rising from it in the proximal third of the wing, with five simple posterior branches; median originating posterior to the radius, curving gently to the mid-point of the posterior edge of the wing; with two superior branches near mid-wing; cubitus simple, unbranched, with a curvature nearly parallel to the median; anal veins consisting of four or more branches, the anterior three twigged, the fourth and fifth simple. Part of the proximal edge of the specimen not preserved.

Remarks. This species differs from *B. cumberlandensis* in the shape of the wing, the position of the median vein and the presence of anal veins.

Occurrence. Riversdale group; collected by H. M. Ami, 1899, with the following information: "Howard's Mills, River Wallace, Cumberland County, Nova Scotia. Portions of two wings of fossil insect specimens one over (and separated from) the other. Carboniferous, below the Millstone Grit."

Type. Holotype, G.S.C. No. 10391, obverse and reverse impressions.

Order, MIXOTERMITOIDEA

Genus, *Geroneura* Matthew 1889

Geroneura wilsoni Matthew

Plate IX, figure 5

Geroneura wilsoni Matthew 1889, pp. 58-9, Pl. IV, fig. 10.

Description. Wing two and one-half times as long as wide. Subcostal more than one-half the length of the wing; radius lying near and parallel to the subcostal and extending to the apex of the wing; radial sector originating from the radius at one-fifth the distance from the base of the wing, giving rise to two superior, and two inferior branches, the second inferior branch twigged. Median originating near the base of the radial sector, with two superior branches, the first near mid-wing and the second near the posterior border of the wing; cubitus possibly branched near the posterior border; three simple, unbranched anal veins; a few fine cross-veins present, joining the major veins at irregular intervals.

Remarks. Handlirsch's figure of this species (1908, Pl. XIII, fig. 8), is misleading due to the incorrect placing of the branches of the radial sector, and the inclusion of too many cross-veins joining the major elements.

Occurrence. Cumberland group; near Saint John, N.B., in black shales and slates of the "Fern Ledges" or Lancaster formation.

Type. Holotype, G.S.C. No. 8129.

Order, PROTODONATA

Family, MEGANEURIDAE Handlirsch 1908

Genus, *Meganeura* Brogniart 1885

Meganeura sp.

Plate XXI, figures 4, 5

Remarks. Specimens of this genus have been found showing the proximal anterior parts of two wings. Portions of all of the major veins have been found with transverse connections joining them nearly at right angles. The median has numerous branches directed toward the posterior edge of the wing at right angles to the main venation. These branches do not fork but are joined at right angles by transverse connections.

Occurrence. Pictou group; Sydney coalfield.

Type. Hypotypes, G.S.C. Nos. 12863, 12864.

Order, PALAEODICTYOPTERA

Palaeodictyoptera *incertae sedis*

Plate XIX, figure 2

Remarks. This order is represented by one well preserved, though fragmentary, wing. One-third of the anterior and part of the posterior edges of the wing are visible. The subcostal is sinuous, meeting the costal margin about mid-wing (?). The radius is parallel to the subcostal and meets the costal margin not far from the tip of the wing. The radial sector branches from the radius in the proximal third of the wing, continuing parallel to the radius and having three posteriorly directed branches only the first of which is known to be twigged. The median has three superior branches, the first branch is twigged and rises directly posterior to the radius-radius sector juncture. Only the first two branches of the median are twigged. The cubitus is known only from two untwigged branches. No cross-veins are present. The wing measures 2.1 cm. in length, and 1.6 cm. in width.

This specimen appears to agree closely in venation with the genus *Eubleptus* Handlirsch. *Eubleptus* however is a more elongate wing with cross-veins joining the branches and the median and radial sector in close proximity to each other. None of these features are present on the Nova Scotian specimen.

Occurrence. Pictou group; Sydney coalfield.

Type. Hypotype, G.S.C. No. 12859.

Superorder, BLATTOPTEROIDEA

Order, BLATTARIA

Genus, *Archimylacris* Scudder 1868

Archimylacris acadica ? Scudder 1868

Plate IX, figure 4

Archimylacris acadica Scudder 1868, (in Dawson), p. 388, fig. 153 (therein cit. *Archimulacris acadicus*).

Remarks. Only the proximal quarter of the wing is preserved. The specimen shows numerous cross-veins joining the major elements of the wing; a short subcostal vein branching superiorly, the major proximal elements of the radius, median, and cubitus, and the anal area with numerous anal veins.

Occurrence. Pictou group; locality 2952.

Type. Hypotype, G.S.C. No. 12845.

Archimylacris morienensis n. sp.

Plate XIX, figure 5

Description. Species known from the imprint of an elliptically-shaped wing, lacking the apical and anal parts. Superior margin strongly arched; subcostal prominent, with six anterior branches, extending over half the length of the wing; first four branches of the subcostal furcate, branches five and six simple; radius simple with three superior branches; radial sector with five or more superior branches, variously twigged; median sinuous, extending to the apex of the wing and having three superior branches, variously twigged; cubitus with at least three inferior branches; anal area unknown.

Length of holotype, 27 mm.; width, 14 mm.

Remarks. This is the largest species of *Archimylacris* yet found in the Maritime Provinces. It differs from *A. acadica* Scudder in its greater size and in not having fine cross-veins connecting the major veins.

Occurrence. Pictou group; locality 514.

Type. Holotype, G.S.C. No. 10394.

Archimylacris sp. 1

Plate XII, figure 1

Description. Material consisting of a small part of a wing, lacking the anal and apical areas. Subcostal vein occupying more than one-third of the superior margin and giving rise to five superior branches; the radius with three simple superior branches; radial sector with numerous superior branches; median and cubitus fragmentary. No anal veins preserved.

Remarks. This specimen is not sufficiently well preserved to warrant a more positive identification.

Occurrence. Pictou group; Pictou coalfield, Coalburn borehole at a depth of 319 feet.

Type. Hypotype, G.S.C. No. 12774.

Archimylacris sp. 2

Plate XIX, figures 3, 4

Description. Material consisting of imperfectly preserved wings, showing part of the radius, cubitus, and anal veins. The radius and radial sector with numerous superior branches, mostly twigged; cubitus giving rise to four inferior branches, the first branch with a single twig and the other branches simple; anal veins partly preserved, showing six branches, mostly simple.

Remarks. The specimens are not sufficiently well preserved to warrant more positive identification.

Occurrence. Pictou group; Pictou coalfield, Coalburn borehole, from no specified depth; McLellan Brook, Pictou County.

Type. Hypotypes, G.S.C. No. 12773*a*, *b*.

Archimylacris sp. (pronotum)

Plate IX, figure 1

Remarks. Two specimens of supposed *Archimylacris* pronota have been found during the present studies. The archimylacrid affinities are suggested by their nearly circular outlines similar to those figured by Handlirsch (1908, Pl. XXXI, figs. 18-28).

Occurrence. Pictou group; Pictou coalfield, Nova Scotia, Coalburn borehole No. 60, depth 384 feet, and McLellan Brook borehole, depth 97 feet.

Type. Hypotype, G.S.C. No. 12772.

Genus, *Hemimylacris*

Hemimylacris sp. (pronotum)

Plate XI, figure 5

Hemimylacris indet.: Pronotum theta, Pruvost, 1919, p. 231, Pl. XIII, figs. 11-18.

Description. Length-height ratio nearly 2:1; lateral extremities drawn out and slightly pointed; anterior and posterior margins broadly rounded. Surface wrinkled, wrinkles radiating from central raised area.

Remarks. This specimen agrees with those figured by Pruvost (1919), no specific identification can be made.

Occurrence. Pictou group; borehole on McLellan Brook, Pictou coalfield, depth 97 feet.

Type. Hypotype, G.S.C. No. 12790.

(*Blattoidea*) sp. (larva)

(*Blattoidea*) *carri* (Schuchert) 1897

Plate IX, figure 2

Dipeltis carri Schuchert 1897, p. 673, Pl. LVIII, fig. 6.
(*Blattoidea*) *carri* Handlirsch 1908, p. 179, Pl. XVIII, fig. 31.
Schistaspis bretonensis (part) Bell 1922, p. 166, Pl. I, fig. 13.

Description. Body elongate, twice as long as wide; head shield one and one-half times as long as wide. Head shield with three segments, meeting evenly on the lateral margins and extending backward over the abdominal segments. Posterior segments seven in number, equal in width, with lateral projections directed posteriorly.

Remarks. The more elongate shape of the head shield, and the number and shape of the abdominal segments differentiates this species from (*B.*) *schuchertiana* Handlirsch.

Occurrence. Pictou group; New Campbellton Mines, Sydney coalfield, Cape Breton Island, N.S., in shales overlying the roof of the 4-foot coal seam.

(*Blattoidea*) *schuchertiana* Handlirsch

Plate IX, figure 3

Dipeltis diplodiscus (part) Schuchert 1897, p. 672, Pl. LVIII, figs. 4-5.
Mylacris (*Dipeltis*) *diplodiscus* Sellards 1904, p. 124, fig. 2.
(*Blattoidea*) *schuchertiana* Handlirsch 1908, p. 180, Pl. XVIII, figs. 35-6.
Schistaspis bretonensis (part) Bell 1922, p. 166, Pl. I, figs. 12, 14.

Description. Head shield as long as wide, segments not meeting evenly on lateral margins. Posterior segments more than seven in number, tapering posteriorly with pronounced lateral projections directed posteriorly.

Remarks. This form has a larger head shield than (*B.*) *carri* (Schuchert) and has a greater number of posterior segments.

Occurrence. Pictou group; New Campbellton Mines, Sydney coalfield, Cape Breton Island, N.S., in shales overlying the roof of the 4-foot coal seam.

Genus, *Phylloblatta* Handlirsch 1906

Phylloblatta ? spp.

Plate XII, figure 2; Plate XVIII, figures 7-11; Plate XIX, figures 1, 6, 7

Description. Wings elongate, with numerous branches variously twigged; subcostal, radius, and radial sector with superior branches, remaining veins with inferior branches; numerous cross-veins at regular intervals joining the major elements of the wing.

Remarks. Specimens of this genus show the most pronounced number of vein branches with numerous cross-veins and twigs of any genus of blattoid. Unless the specimens are nearly perfectly preserved, specific identification is questionable.

Occurrence. Pictou group; Pictou coalfield, from several cores drilled within the Stellarton series.

Type. Hypotypes; G.S.C. Nos. 12846, 12847*a-e*, 12848, 12849.

ARTHROPODA *incertae sedis*

MYRIAPODA *incertae sedis*

Plate XV, figure 3

Remarks. Supposed limbs of myriapods have been commonly found in strata near Saint John, N.B. These limbs are about 2 cm. in length and have a strong spinelike projection on their distal surface. These limbs are never associated with other remains, prohibiting their generic identification.

Occurrence. Cumberland group; locality 2254.

Type. Hypotypes, G.S.C. No. 12776.

CRUSTACEA *incertae sedis*

Plate XIII, figure 1

Remarks. One specimen showing the anterior cephalic part of an unknown crustacean has been found in the Pictou coalfield. Two pairs of antennae are present showing all articulating elements.

Occurrence. Pictou group; locality 2487.

Type. Hypotype, G.S.C. No. 12775.

CRUSTACEA *incertae sedis*

Plate XX

? *Xiphosuran* tracks Pruvost, 1919, pp. 336-9, fig. 38.

Remarks. Tracks of presumed crustaceans showing numerous pairs of marks situated on either side of a "track", possibly made by a telson or tail being dragged across originally soft muds. These impressions do not appear to be those of toe marks but rather of scratches made by setate limbs.

Occurrence. Canso? group; Merigomish, Pictou County, second bridge up the French River, collected by W. A. Bell, 1924.

Type. Hypotype, G.S.C. No. 12820.

INSECTA *incertae sedis*

Plate XXI, figure 3

Remarks. A portion of one wing has been found bearing one vein with several unbranching veinlets. The intervein areas support single rows of round spots or openings at irregular intervals.

Occurrence. Pictou group; locality 2487.

Type. Hypotype, G.S.C. No. 12862.

CHAPTER IV

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PLATE I

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Figures 1-3. *Carbonita altilis* (Jones and Kirkby); left, dorsal, and ventral views of a complete carapace; locality 1449; Hypotype, G.S.C. No. 12833; (Page 25).

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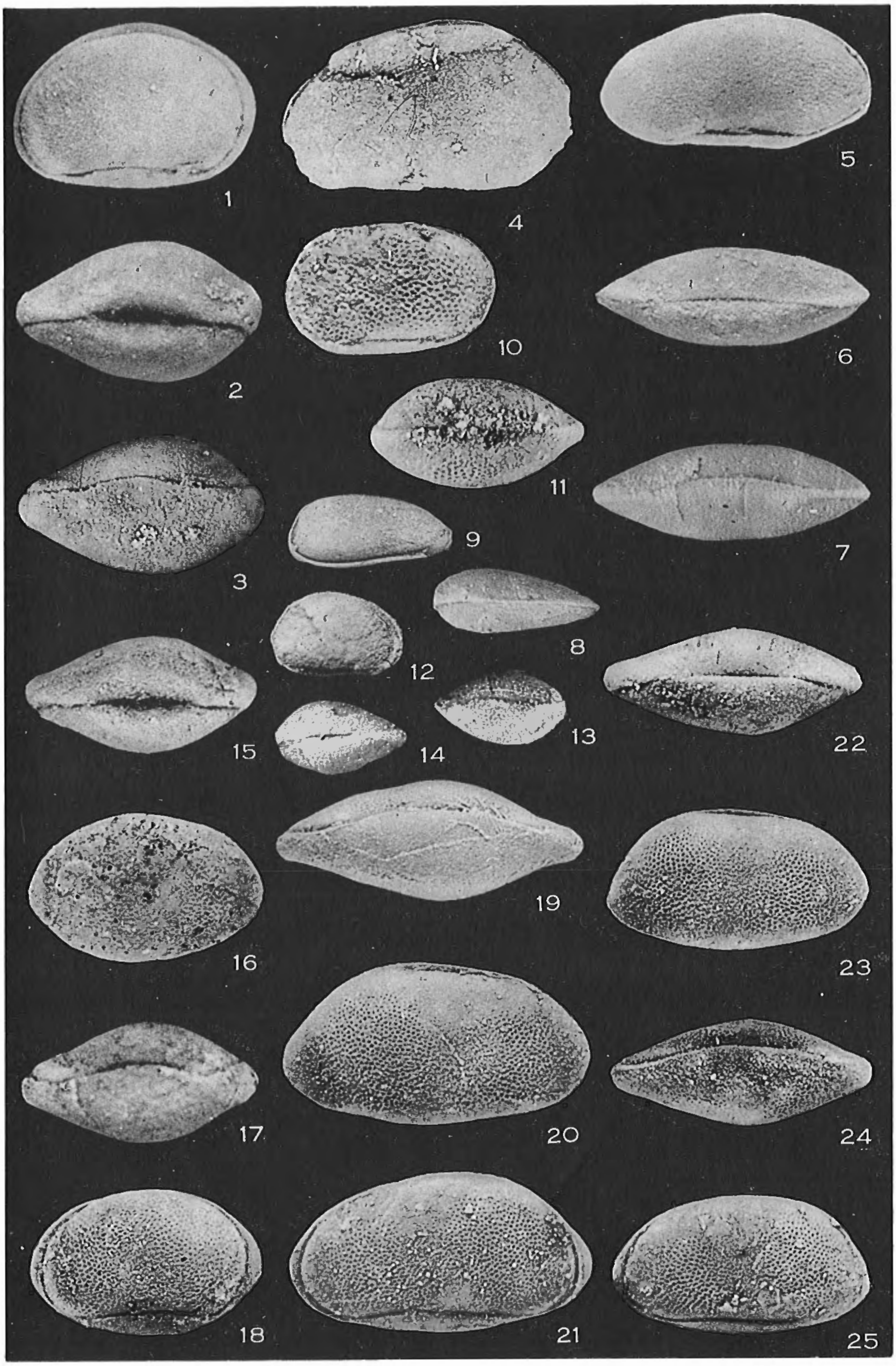
PLATE I



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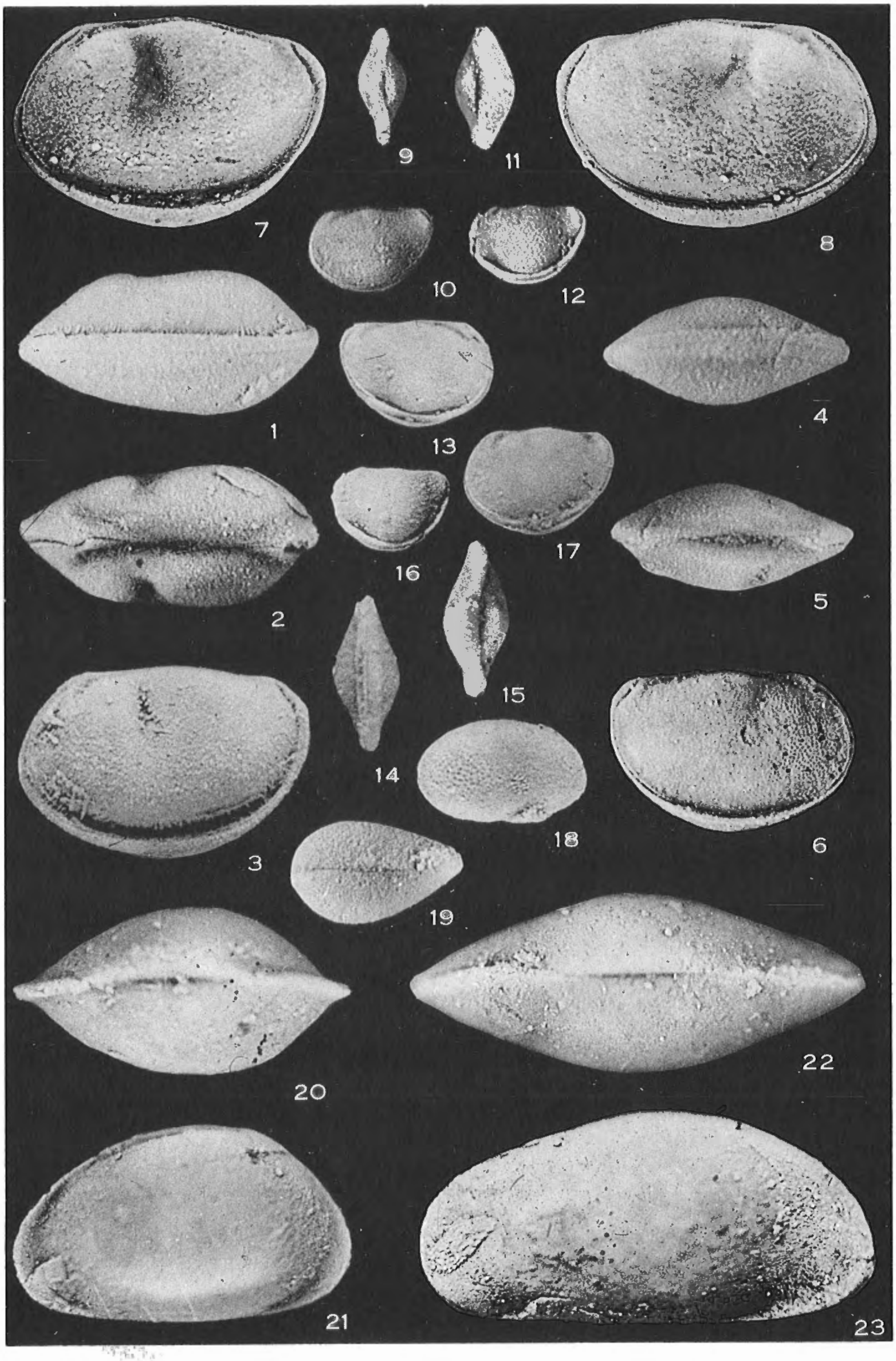

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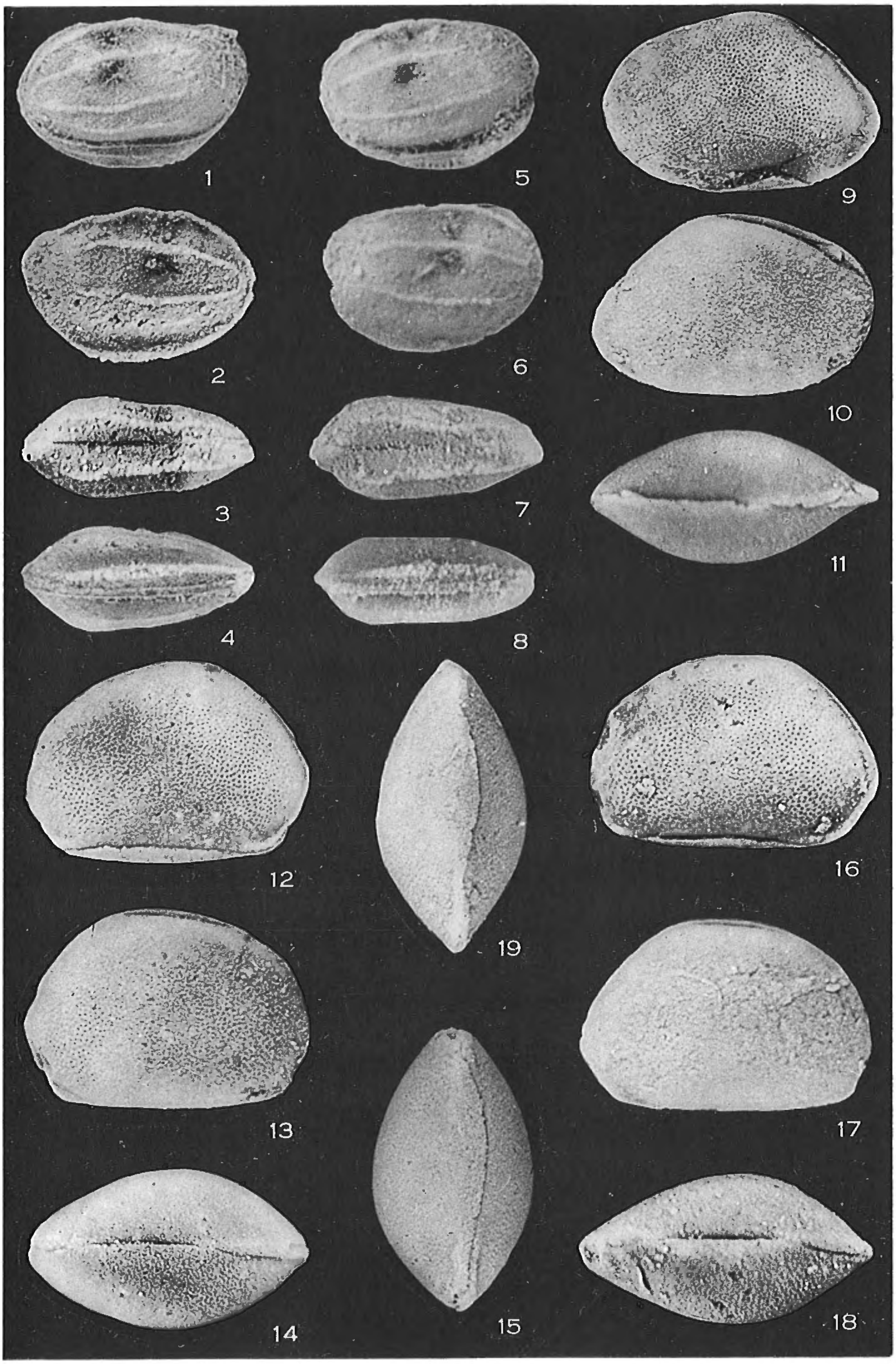

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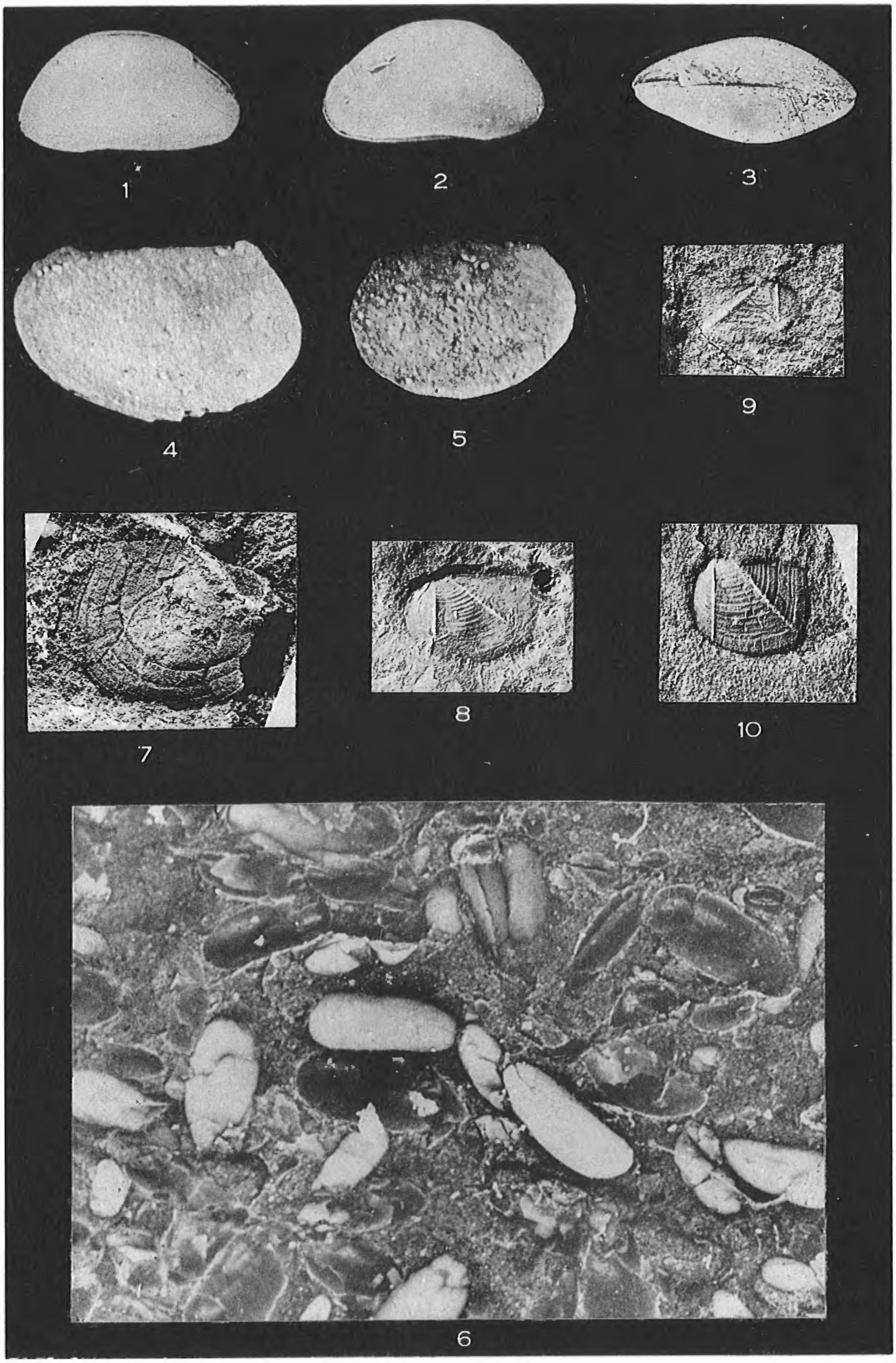

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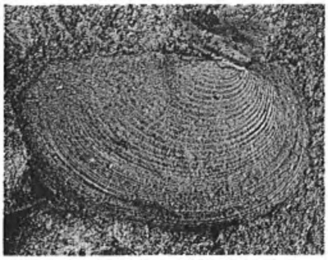

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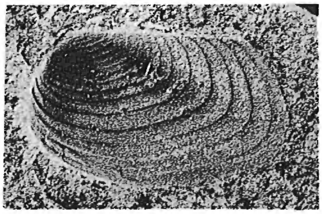

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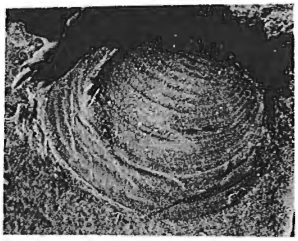

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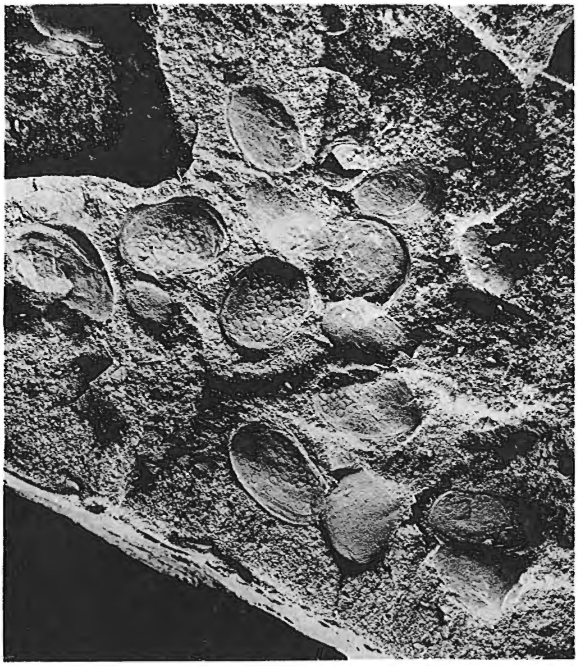

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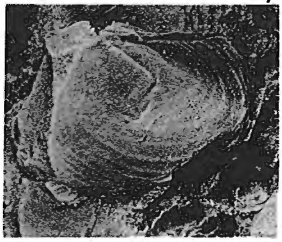

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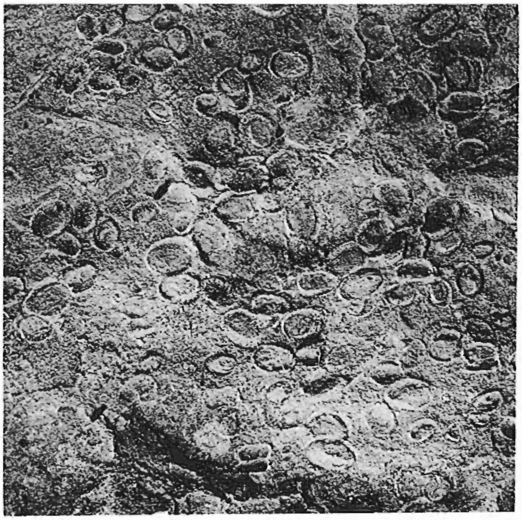
PLATE VI



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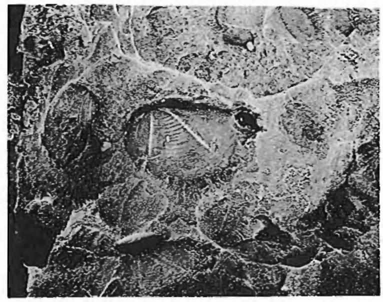

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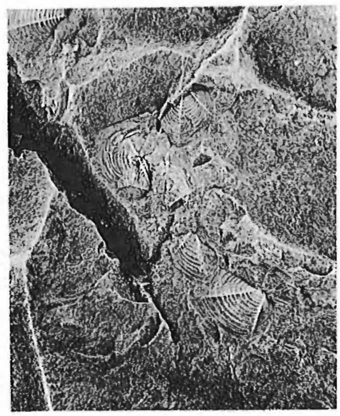

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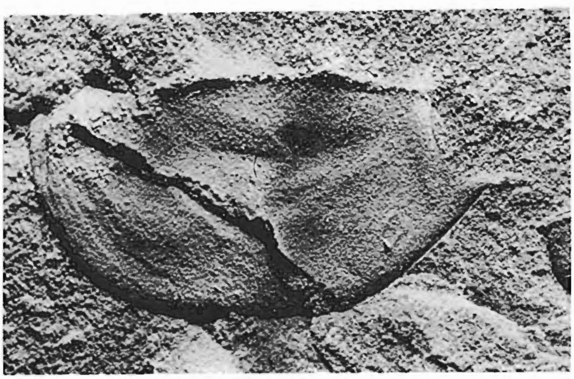

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Plate VI

Figure 1. *Lioestheria striata* (Goldfuss and Münster); view of several specimens; locality 12270; x 1½; Hypotype, G.S.C. No. 12823; (Page 39).

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PLATE VII

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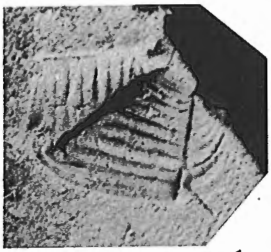
PLATE VII



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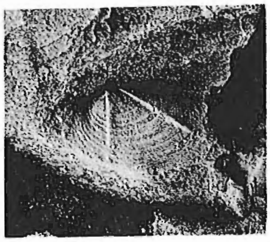

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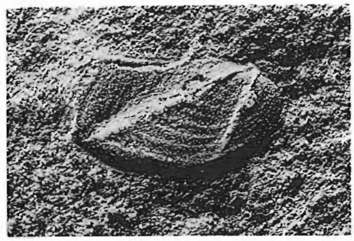

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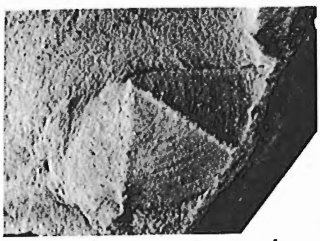

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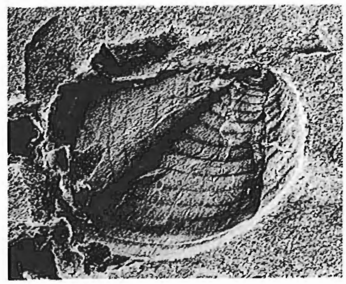

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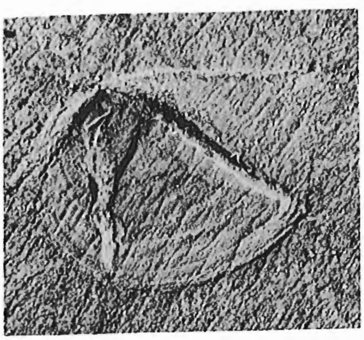

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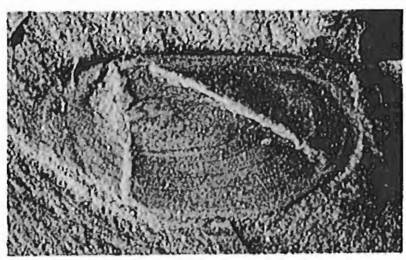

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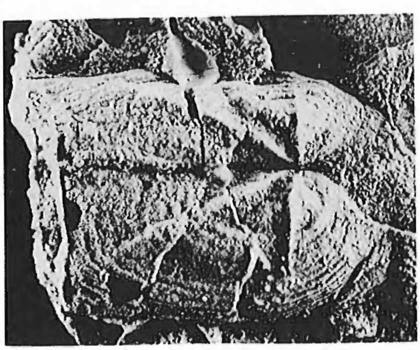

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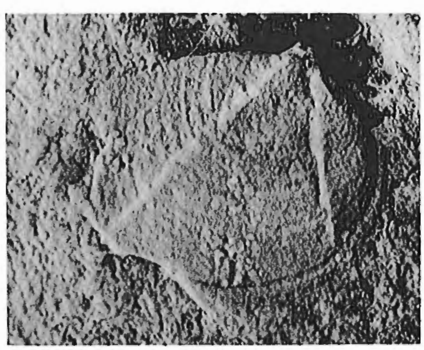

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PLATE VIII

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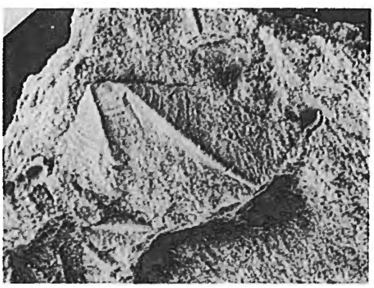

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PLATE VIII

Figure 1. *Leaia baentschiana* (Beyrich); lateral view of two specimens; locality 1404; x 5; Hypotype, G.S.C. No. 12824; (Page 34).

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Figure 4. *Leaia baentschiana* ? (Beyrich); view of several specimens; locality 2462; x 1; Hypotype, G.S.C. No. 12809; (Page 34).

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Plate IX

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PLATE IX


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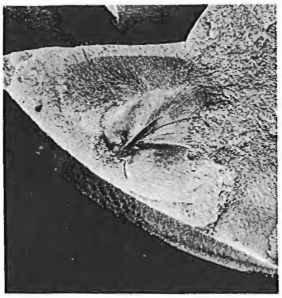
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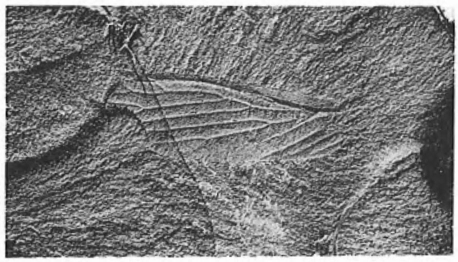
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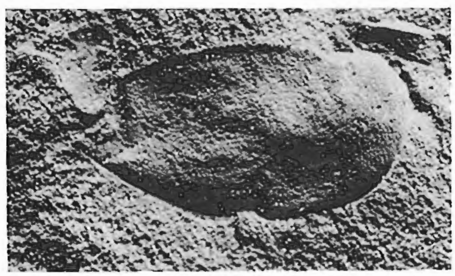
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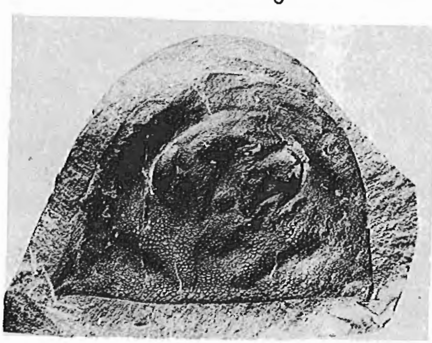
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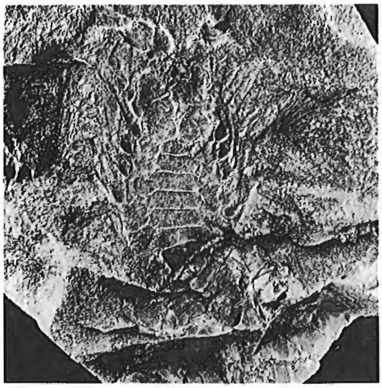
PLATE X



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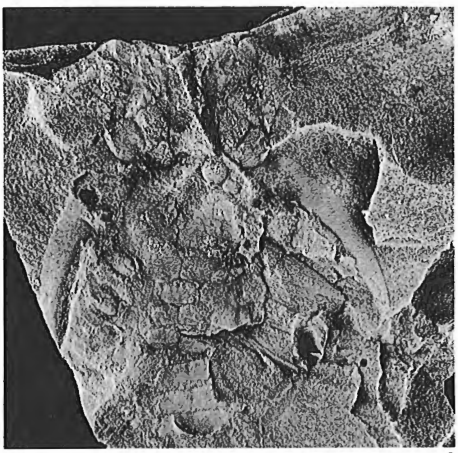

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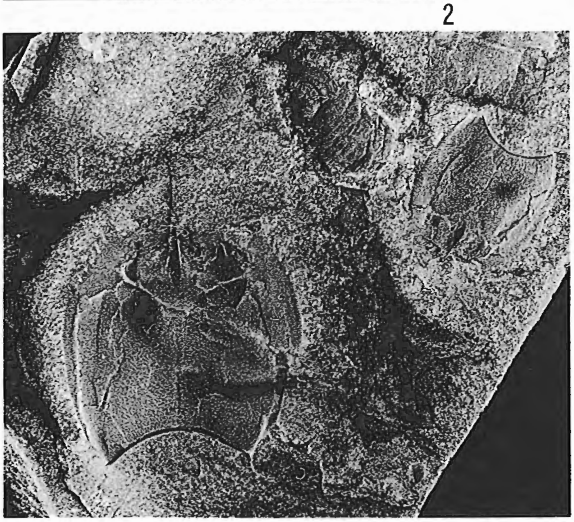

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Plate X

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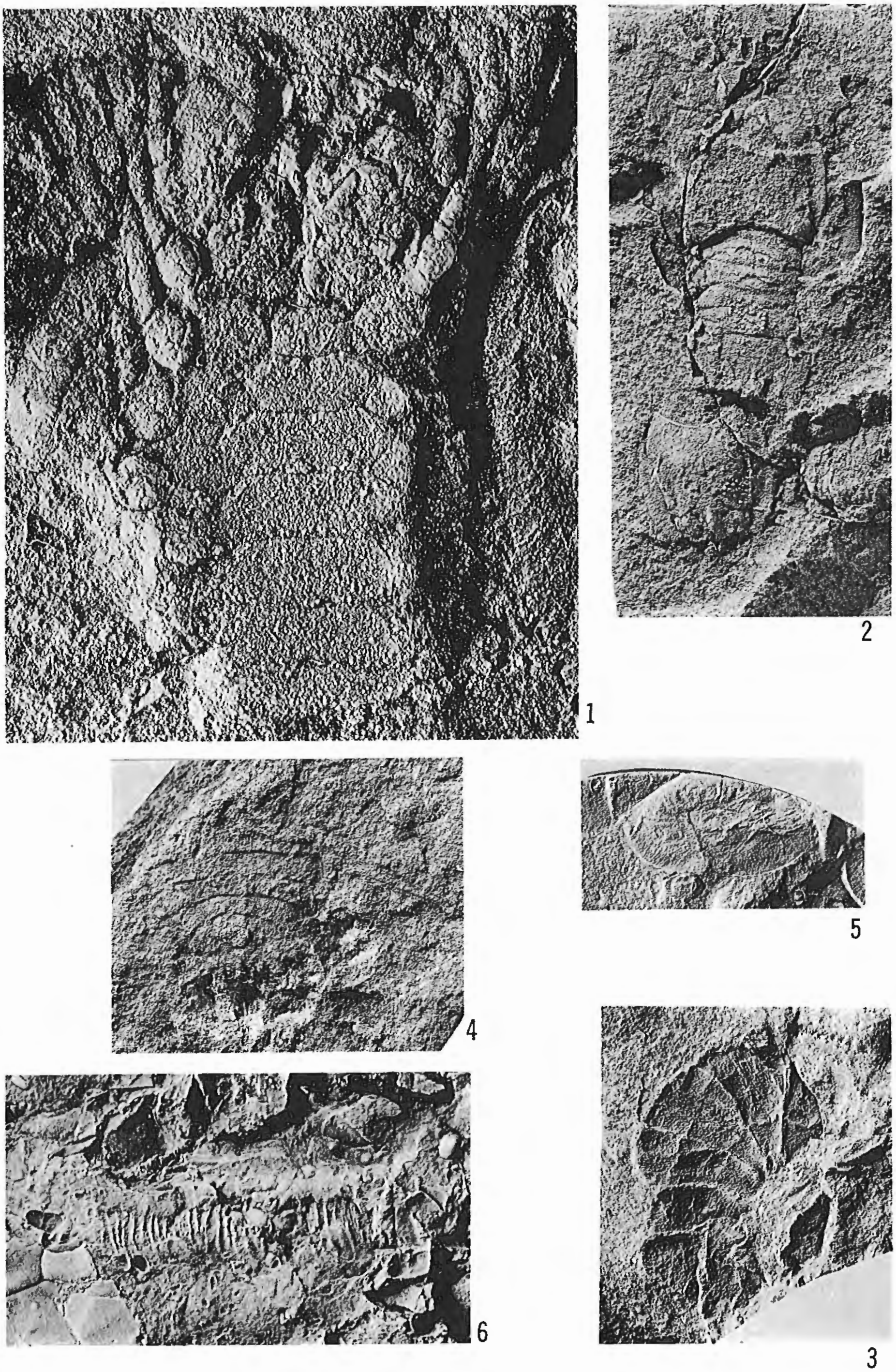
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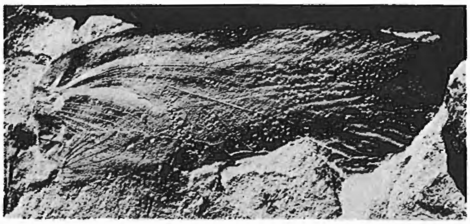

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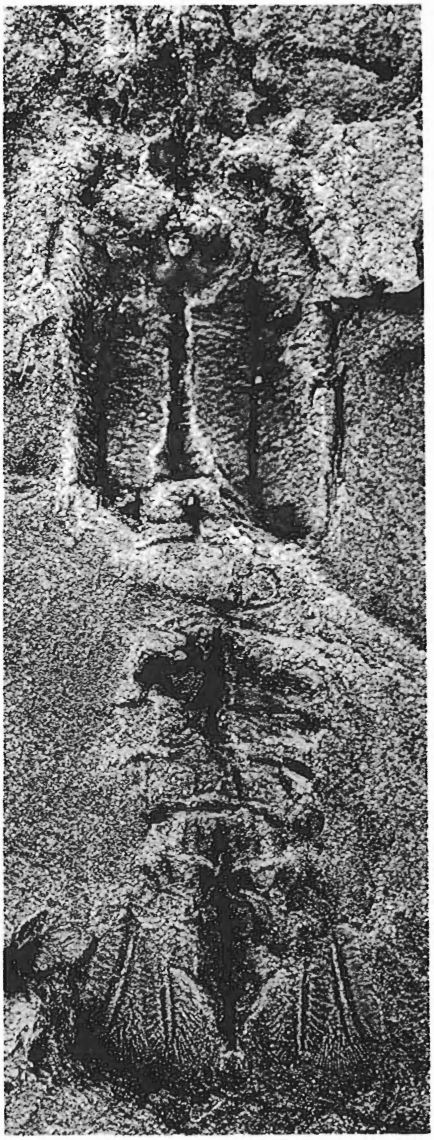

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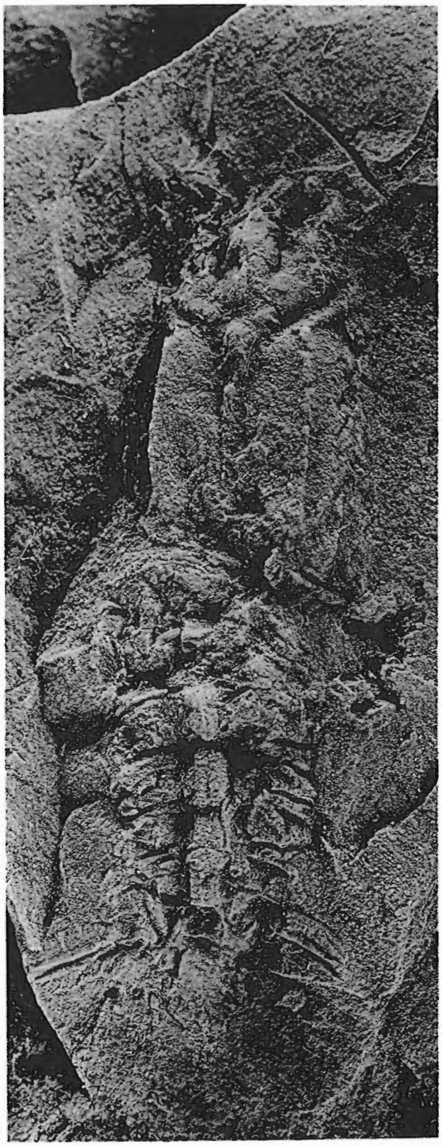

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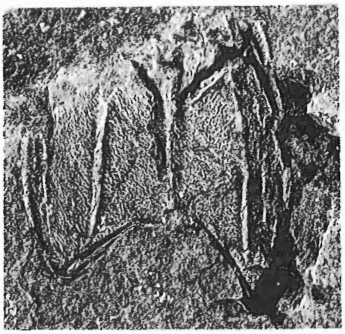

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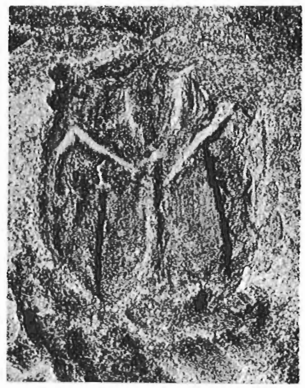

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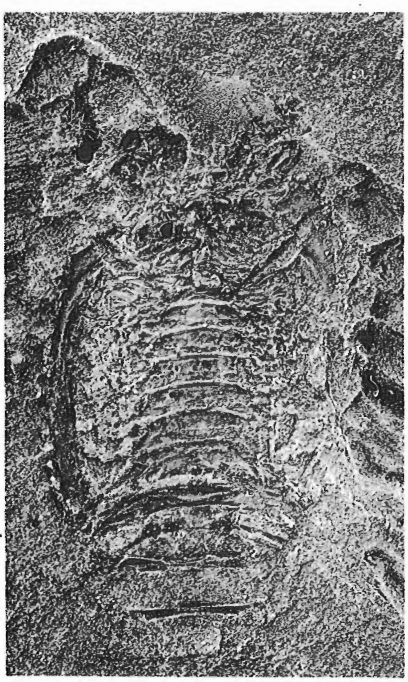

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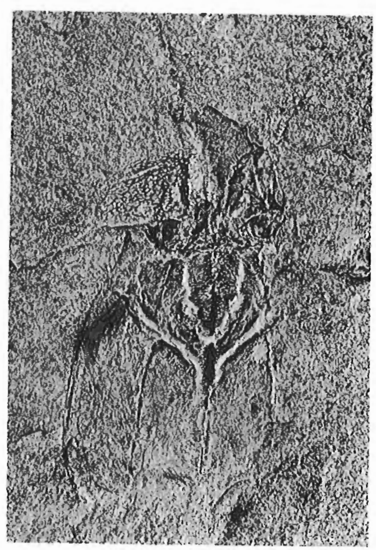

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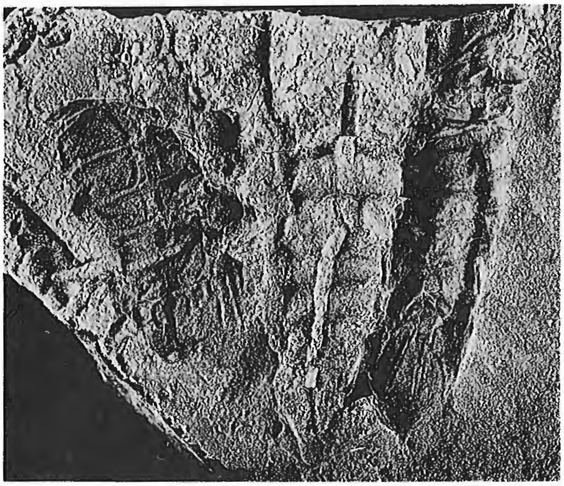
Plate XIV



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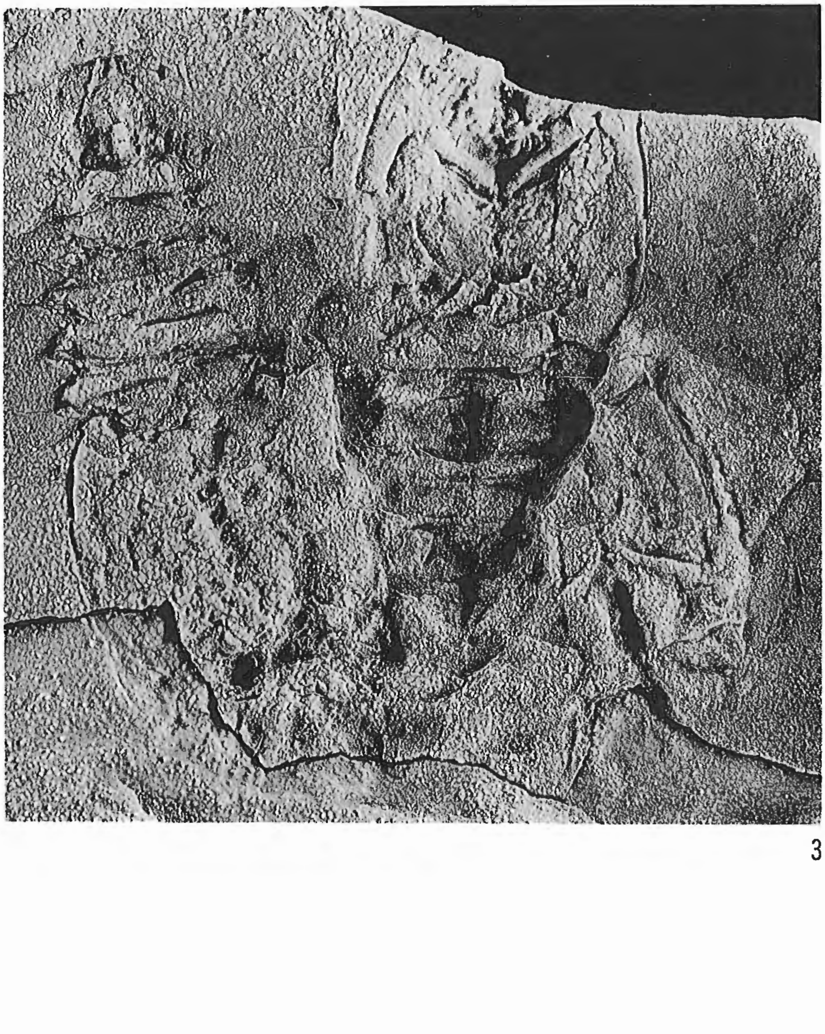

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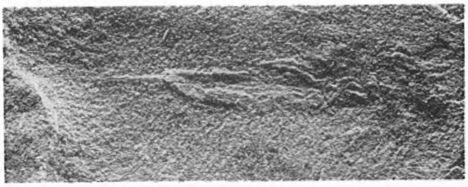

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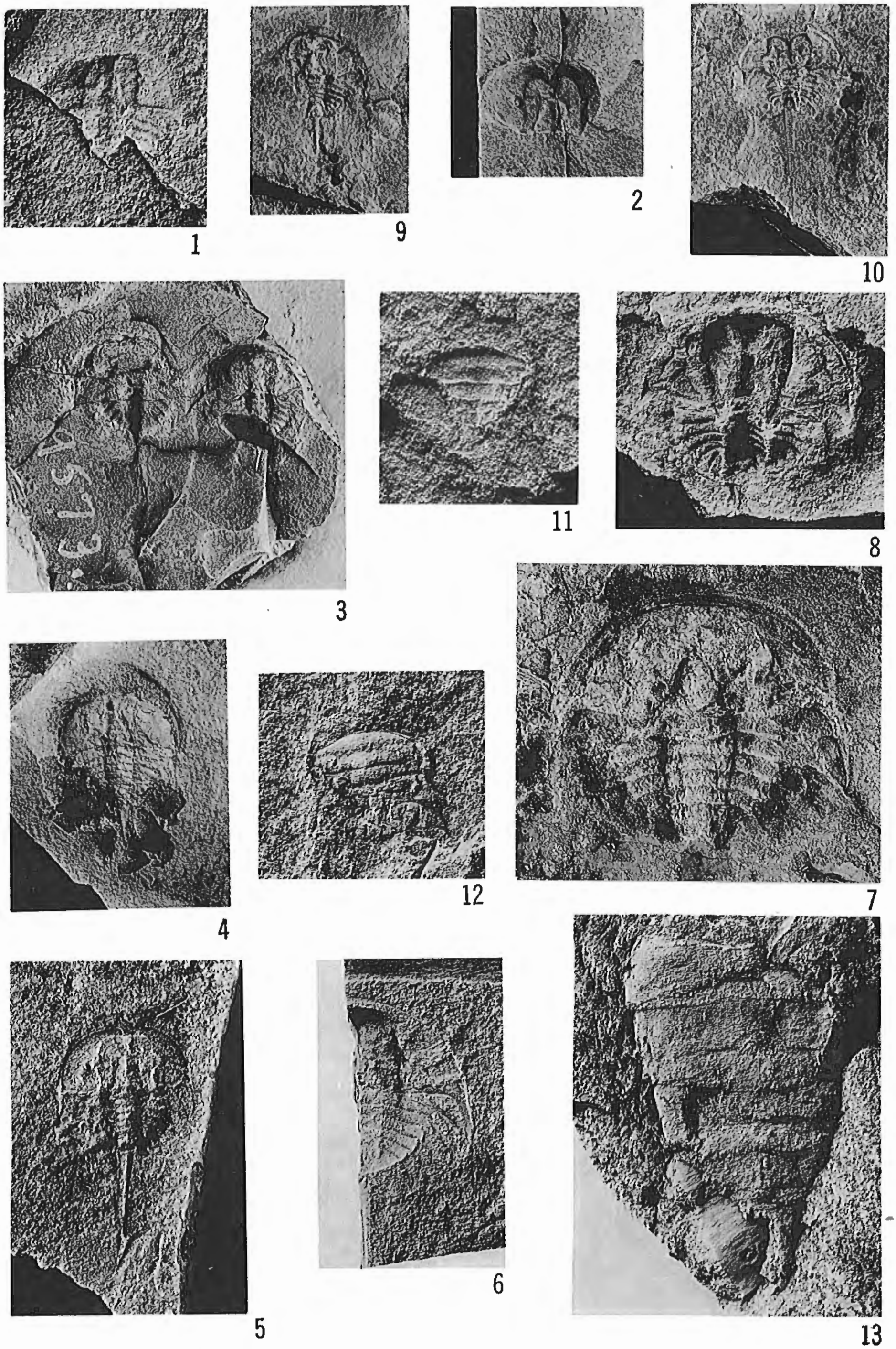
PLATE XVI



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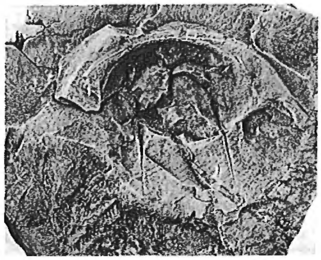

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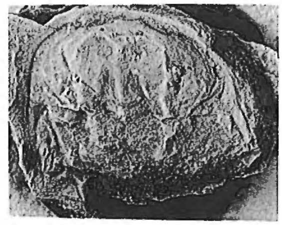

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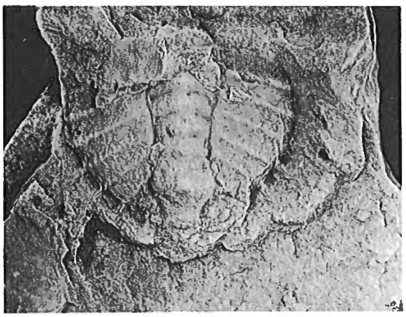

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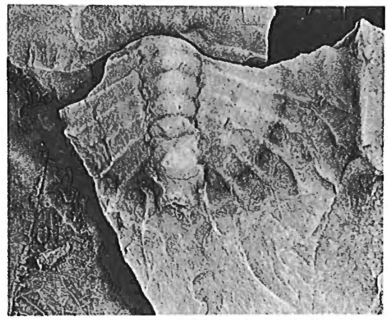

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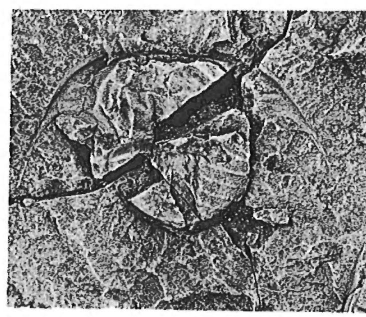

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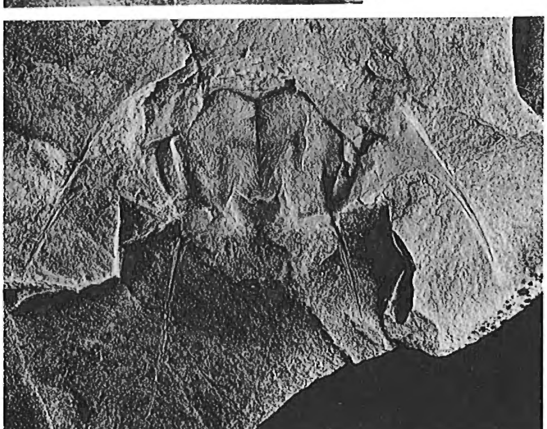

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PLATE XVIII

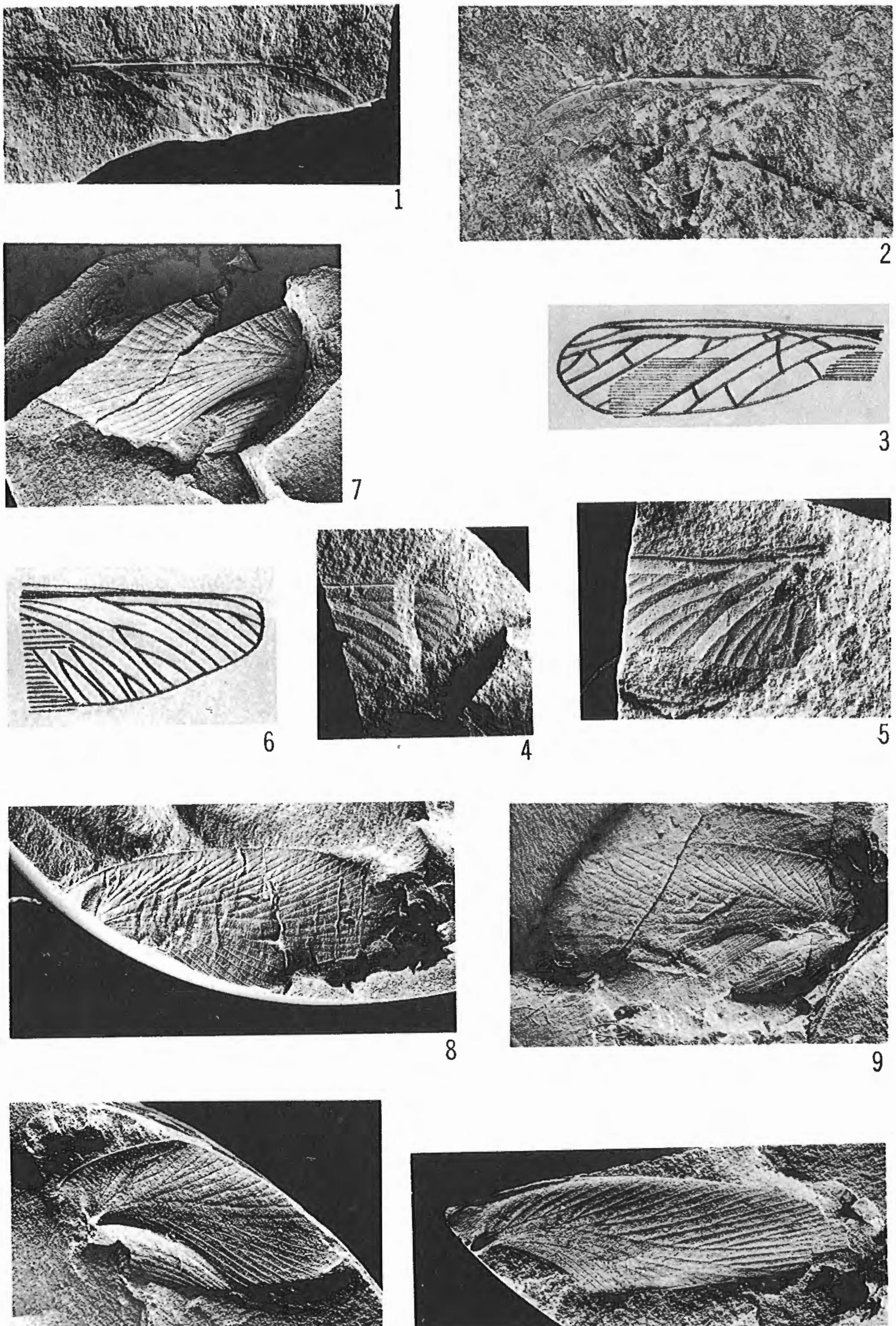

PLATE XVIII

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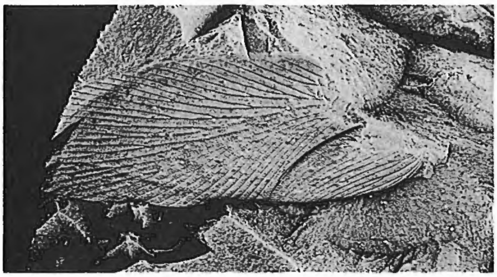

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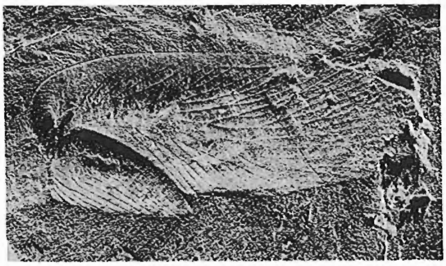

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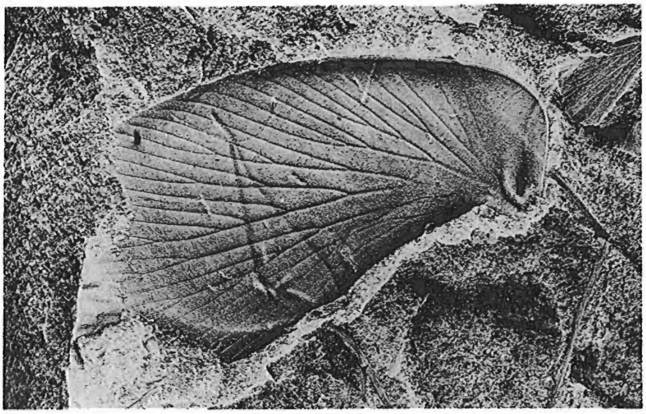

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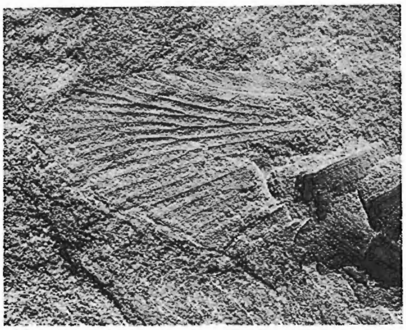

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Plate XX

PLATE XX

Crustacea *incertae sedis* (tracks); view of a slab showing several xiphosuran? trails; x ½; Merigomish, N.S., second bridge up French River; Hypotype, G.S.C. No. 12820; (Page 60).

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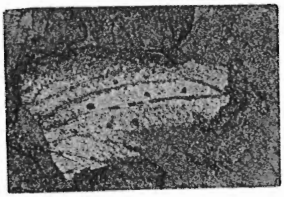

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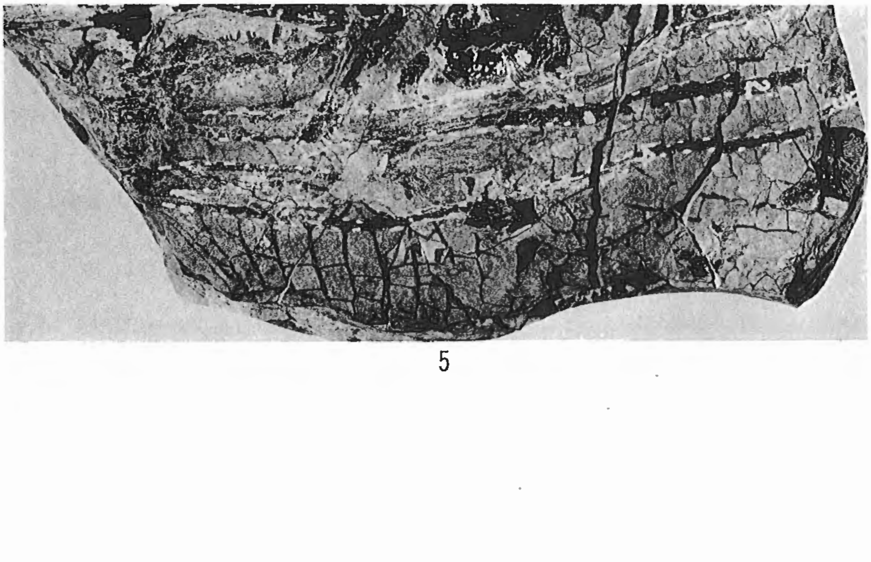

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