GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

PAPER 68-65

AN ANTLION (NEUROPTERA) AND A STONEFLY (PLECOPTERA) OF CRETACEOUS AGE FROM LABRADOR, NEWFOUNDLAND

(Report, 2 plates and 6 figures)

H. M. A. Rice

GEOLOGICAL SURVEY
OF CANADA

PAPER 68-65

AN ANTLION (NEUROPTERA) AND A STONEFLY (PLECOPTERA) OF CRETACEOUS AGE FROM LABRADOR, NEWFOUNDLAND

H. M. A. Rice

DEPARTMENT OF ENERGY, MINES AND RESOURCES

Available by mail from the Queen's Printer, Ottawa,

from Geological Survey of Canada,
601 Booth St., Ottawa,

and at the following Canadian Government bookshops:

HALIFAX
1735 Barrington Street

MONTREAL
Æterna-Vie Building, 1182 St. Catherine St. West

OTTAWA
Daly Building, Corner Mackenzie and Rideau

TORONTO
221 Yonge Street

WINNIPEG
Mall Center Bldg., 499 Portage Avenue

VANCOUVER
657 Granville Street

or through your bookseller

Price $1.50 Catalogue No. M44-68-65

Price subject to change without notice

ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1969

CONTENTS

Illustrations

ABSTRACT

During the development of the Redmond iron deposits in Labrador a bed of red argillite carrying fossil plants and some insects was discovered. The plants were determined to be of early Upper Cretaceous age and suggest a warm and humid climate at that time. Two of the fossil insects, which are in the collections of the Geological Survey of Canada, are described.

One specimen is of most of one wing of a Neuroptera, a Myrmaleontidae or a related family, and appears to be that of a large, strong flying species. It has been named Palaeoleon ferrogeneticus and is described and figured. The other is of all four wings, compressed together, of a large Pteronarcid Plecoptera. It has been named Palaeopteron complexus, and is likewise figured and described.

AN ANTLION (NEUROPTERA) AND A STONEFLY (PLECOPTERA) OF CRETACEOUS AGE FROM LABRADOR, NEWFOUNDLAND

INTRODUCTION

During the development of the Redmond iron ore deposit in the Knob Lake district of Labrador (Fig. 1), a distinctive bed of well compacted ferruginous argillite was discovered. This bed is about 5 feet wide and dips at about 45 degrees. It was traced for about 500 feet and was exposed in the mine workings for some 125 feet down the dip (Blais, 1959). Considerable interest was aroused when this bed was found to contain fossil leaves and collections of these were made by several geologists. In all, specimens of some 36 species of plants were obtained and also some of fossil insects.

The fossil plants were sent to Erling Dorf, Department of Geology, Princeton University, a leading expert on the Cretaceous floras of North America, who himself spent three days collecting from the site. Dorf (1959) was able to recognize 1 species of algae, 4 ferns, 1 lycopod, 3 conifers, and 27 species of angiosperms, most of which had previously been reported from the Cretaceous floras of the United States, Canada, and Greenland. He interpreted the age as probably early Upper Cretaceous, closest correlatives being the Raritan flora of New Jersey, the Dakota flora of the Great Plains, and the Tuscaloosa flora of Alabama.

In the meantime samples of similar argillite from the nearby Ruth Lake ore deposit were processed in the laboratories of the Geological Survey of Canada and slide mounts of the spores and pollen extracted from them were sent to Glenn E. Rouse of the University of British Columbia for examination. Rouse's findings were reported to the Geological Survey and released by D. C. McGregor as Office Report No. Fl-4-1965-DCM. Rouse recognized 8 genera of angiosperms, 3 of conifers, 2 of ferns, and one dinoflagelate. He regarded the probable age to be Paleocene, with a possible range from latest Cretaceous to earliest Tertiary.

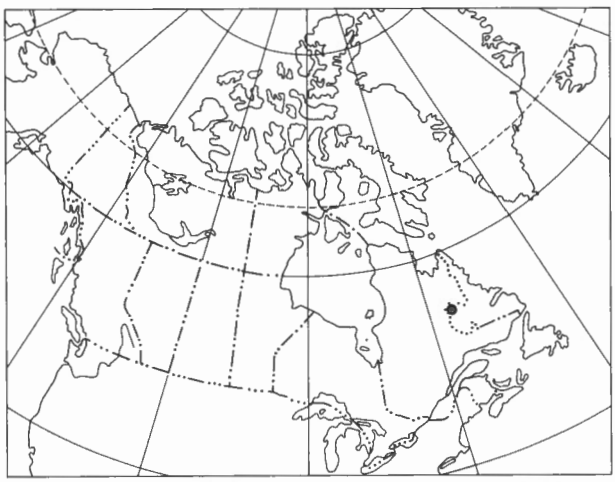

Figure 1. Index map.

Details of the stratigraphy of the Cretaceous deposits of the region are very uncertain and no exact correlation between the two localities is possible. There is therefore no reason to question the correctness of

Manuscript received 19 March 1968

either age and the fossil insects discussed here can be regarded with some confidence as being of early Upper Cretaceous age.

Dorf (Blais, 1959, p. 296) considered that the plants were indicative of a warm and humid climate with a mean temperature above 70° F, a considerable contrast to the present mean of 26° F.

NATURE OF THE MATERIAL

The two specimens described in this report are in dark red, well indurated, extremely fine grained argillite. The argillite breaks with a conchoidal fracture, with little tendency to split along bedding planes. Indeed, in each of these specimens the plane of parting has been the wing membrane itself. Details of preservation of the wings is remarkable (Pl. I and II), many of the finest veins being clearly visible.

The two specimens are both parts of large but quite dissimilar insects of the orders Neuroptera and Plecoptera.

ACKNOWLEDGMENTS

The writer is happy to acknowledge the cordial help and encouragement of members of the Taxonomy Section of the Entomology Research Institute, Department of Agriculture, especially Dr. J. F. McAlpine and Dr. J. E. H. Martin without whose aid this paper would have been much inferior.

PALEONTOLOGY

NEUROPTERA

The only specimen, and its reverse, is of part of a single, beautifully preserved wing, most of the veins and cross-veins being clearly visible (Pl. I; Figs. 2 and 3). A small part is missing at the apex and, more unfortunately, also an unknown amount of the basal part of the wing, including the point of origin of the radial sector. However, more than two-thirds of the wing is present, permitting a reasonably complete picture of the venation.

The illustrations show that the wing is certainly that of a Neuroptera. The membranous texture, the shape of the veins and the many accessory veins and cross-veins, particularly the presence of the many cross-veins in the costal cell, especially in the apical part, and the absence of cross-veins in cell R_1 are all characteristic of the order.

To determine the family is much more difficult and perhaps it is reasonable to expect that a creature that lived some 100 million years ago should not conform exactly to the definition of any modern family. Indeed it seems remarkable that an insect of such great antiquity should present so many of the features of modern insects. On available characters it would key out to the family Myrmeleontidae were it not for

the evident absence of the elongate hypostigmatic cell, Needham's truss cell (Comstock, 1918, p. 203). It might also be placed in the Ascalaphidae or the Australian family Stilbopterygidae, but in the absence of all body parts any attempt to place it more precisely would seem to be unwise. Perhaps it is best to say no more than that it belongs near the Myrmeleontidae or some related family, or possibly to a family that is ancestral.

Palaeoleon n. gen.

Type species: Palaeoleon ferrogeneticus, n. sp.

Description. Wing long and narrow, about four times as long as wide, plicate. Costal cell with many cross-veins. R_1 and subcosta long and straight, fused near apex;

Plate I. Palaeoleon ferrogeneticus n. sp. Holotype, G.S.C. No. 22188

radial sector pectinately branched, R_2 approximating $Sc + R_1$ near apex but not fused to it. Cell R_1 without cross-veins; cell $Rs - R_2$ with many cross-veins throughout, including the terminal area commonly occupied by the elongate hypostigmatic cell. Many accessory radial, medial, cubital, and anal veins. Cross-veins numerous throughout, some meeting along an irregular intercalary vein.

Palaeoleon ferrogeneticus n. sp.

Plate I; Figures 2 and 3

Description. Wing, probably fore wing, long and narrow, markedly plicate, with many strong veins and cross-veins. Superficially resembles wing of a dragonfly and suggests a strong flyer. Length of fragment 37 mm, total length of wing probably about 45 mm; maximum width 13 mm. Sc and R_1 straight and parallel, fused about 8.5 mm from apex of wing; fused veins turn abruptly backward and probably reach posterior margin of wing some 4 mm from apex. Rs straight, parallel with R_1 and equally strong,

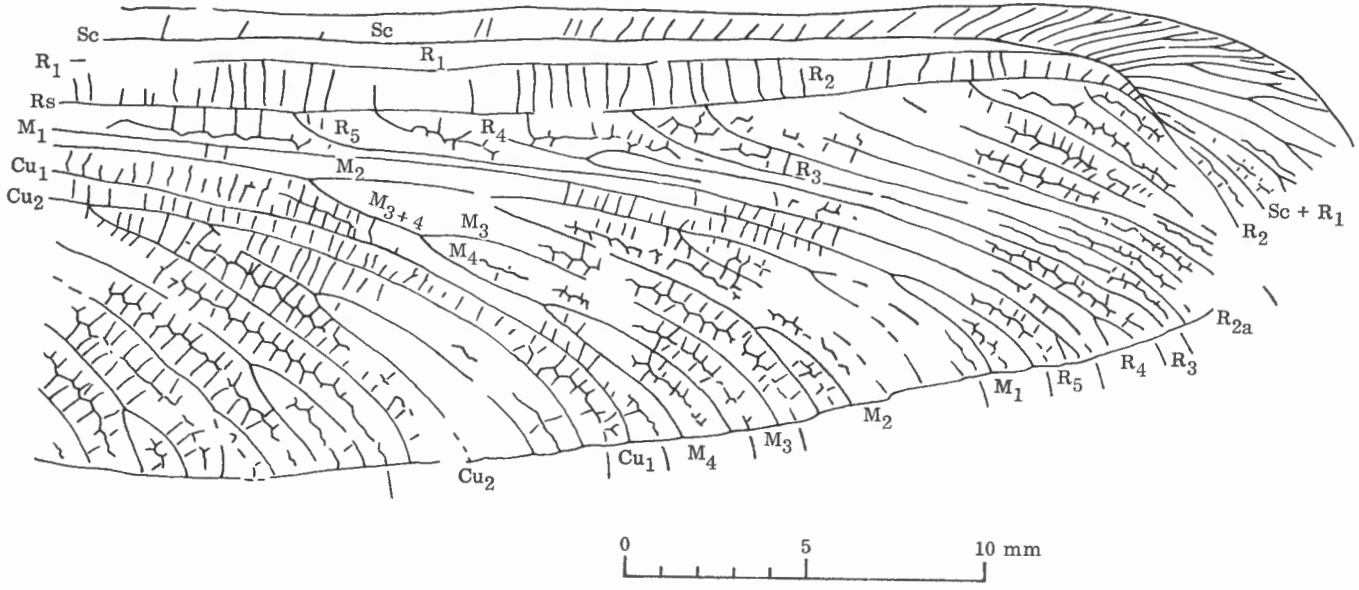

Figure 2. Camera lucida drawing of wing of Palaeoleon ferrogeneticus n. sp. Holotype G. S. C. 22188

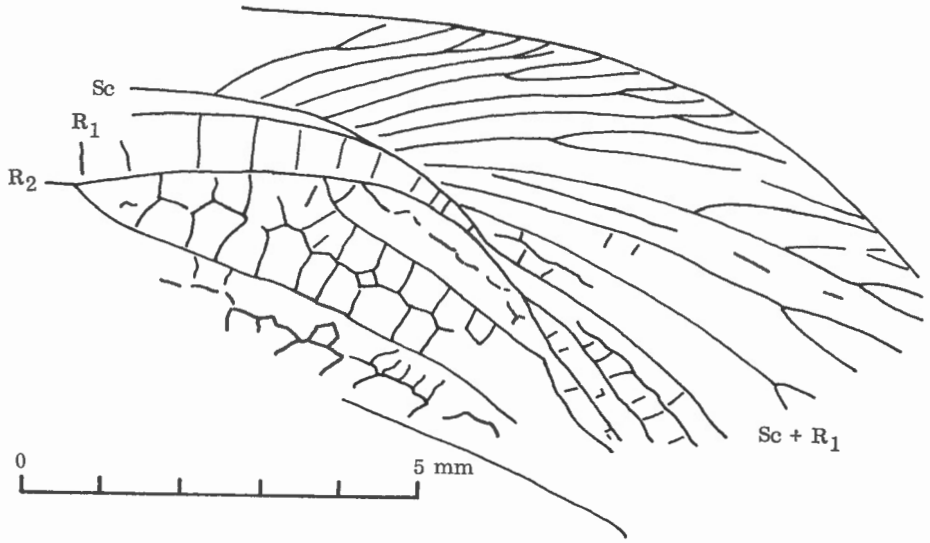

Figure 3. Camera lucida drawing of apical part of Palaeoleon ferrogeneticus wing, showing details.

pectinately branched; R_2 straight to a point almost opposite the point of fusion of R_1 and Sc and then turning posteriorly; approximate to R_1 + Sc about one-third of distance to wing margin but not actually fused with it (Fig. 3).

Costal cell about 1 mm wide for most of length, widening to 4 mm towards apex of wing; many cross-veins, simple along most of wing but branched in apical area (Fig. 3). Cell R_1 without cross-veins; cell R_2 with many fairly regularly spaced cross-veins more or less normal to the cell margins; these continue almost to the apex of the cell so that the single long strong cell in that area known as the elongate hypostigmatic cell (Brues, Melander, and Carpenter, 1954, p. 210) is not present.

The absence of the basal part of the wing, particularly of the points of origin of the radial sector and of the medial, cubital, and anal veins, makes the identity of the veins in this part of the wing less certain. Figure 2 shows what seems the most likely interpretation.

The area posterior to the radial sector is characterized by many strong veins and accessory veins, and throughout by an irregular system of cross-veins. These generally appear as two rows of polygonal cells in the spaces between the main veins, the boundary between the rows forming very irregular intercalary veins.

R_2 is pectinately branched and at least eight branches are clearly visible; all seem equally strong and it is not absolutely certain that the most basal branch visible is indeed R_5. However, if we accept this, the rest of the venation falls into

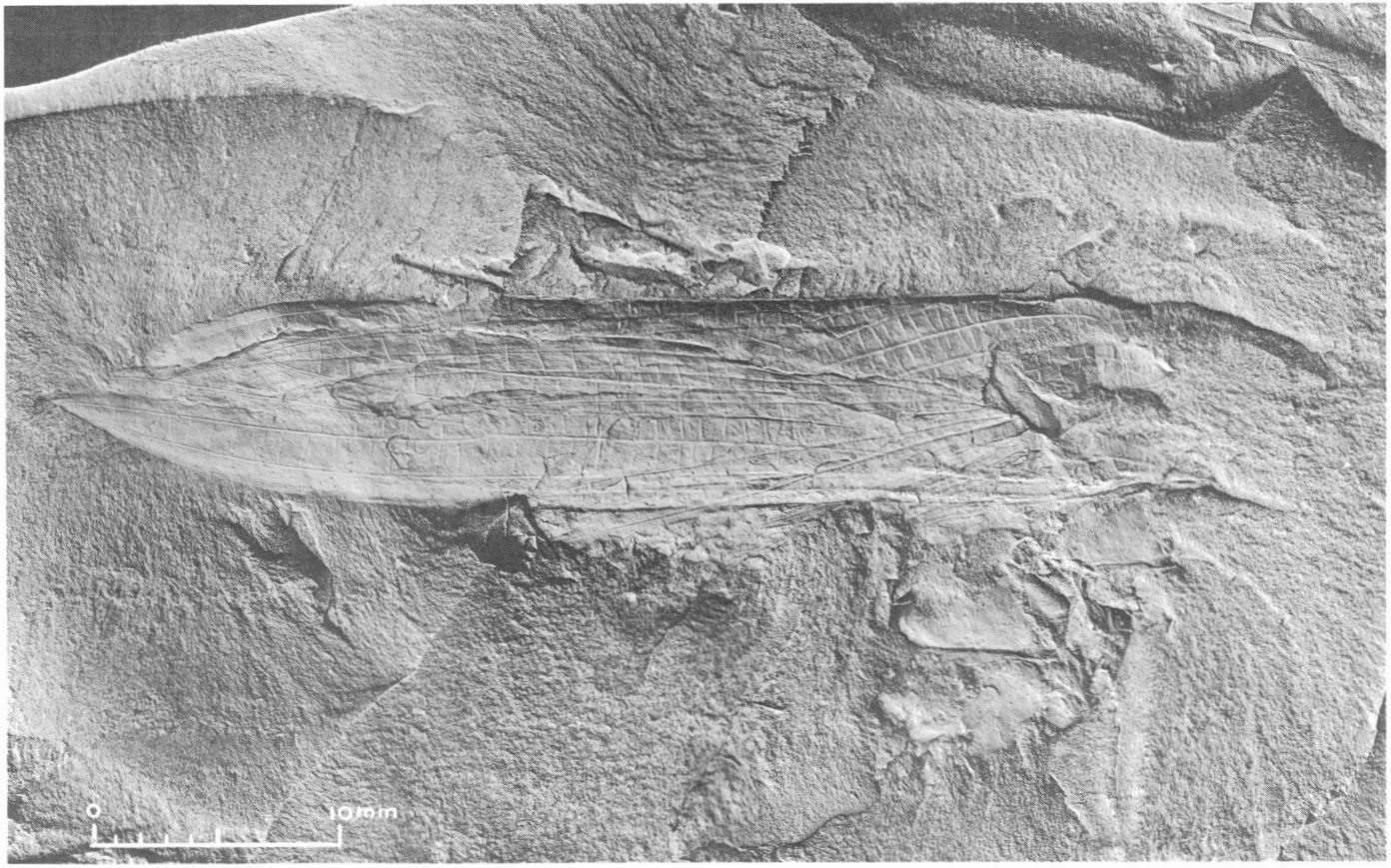

Plate II. Palaeopteron complexus n. sp. Holotype, G.S.C. No. 22189

place reasonably well, except that there seems to be an unusual number of veins in the cubital and anal areas. There is however no suggestion of undue expansion of this area nor of any special folding.

All other features visible in the specimen are depicted in Plate I and Figures 2 and 3.

Occurrence. In fine-grained, deep red argillite of early Upper Cretaceous age, from the Redmond iron deposit, Labrador, Newfoundland, southwest of Schefferville, Quebec.

Holotype. G.S.C. No. 22188, and reverse.

PLECOPTERA

This specimen and its reverse is of the dorsal aspect of a large insect, at least 60 mm long. The wings were evidently folded flat over the back and have been so compressed that the thick veins of any wing have been impressed on the wings below and above (Pl. II; Fig. 4). To add to the confusion, parts of the overlying wings have flaked off, although the impression of some of their veins on the underlying wings may be visible. The writer has therefore been able to decipher the venation only of part of the right fore wing (Fig. 5) and less certainly the central part of the left hind wing (Fig. 6; illustrated reversed for comparison).

In the upper part of Plate II the poorly preserved head and pronotum can be made out twisted to the right of the wings. No vestige of the abdomen or any appendages can be seen, unless the indeterminate schlerites visible in the lower left corner of Plate II belong to it. These are no clearer under the microscope than in the illustration.

The general shape of the insect strongly resembles that of a Plecoptera and the wing venation, as far as it can be made out, is in no way inconsistent. It seems safe therefore to place it in this order.

Furthermore it seems equally certain that it belongs in the family Pteronarcidae. A diagnostic feature of this family is the reticulation that extends across the fore wing, and through the anal area (Needham and Claassen, 1925, p. 32). The anal area of the fore wing of the specimen cannot be recognized for certain, but the reticulated area visible in the lefthand parts of Plate II and Figure 4 can scarcely belong to anything but the basal part of a fore wing, so that the assignment seems almost sure.

Palaeopteron n. gen.

Type species: *Palaeopteron complexus* n. sp.

Description. Robust; prothorax probably quadrate, head wide.

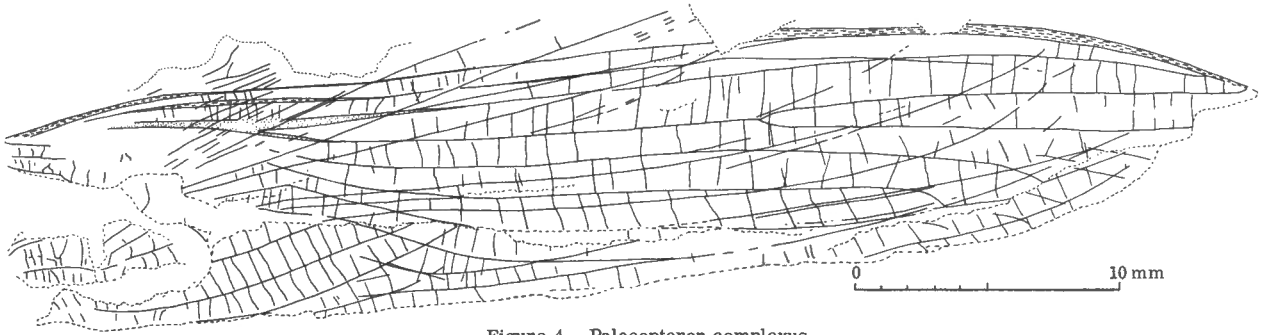

Figure 4. Palaeopteron complexus

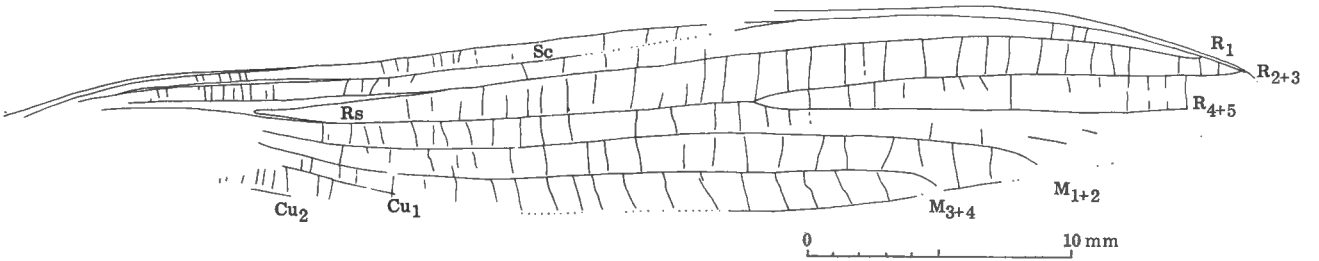

Figure 5. Palaeoleon complexus

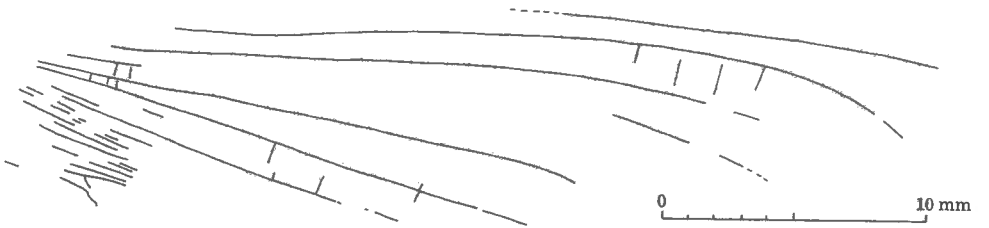

Figure 6. Palaeoleon complexus

Fore wing long and narrow, about six times as long as wide; longitudinal veins strong and straight or gently curved. Little or no angulation; cross-veins present in all cells.

Hind wing probably as long as fore wing; longitudinal veins strong and without angular irregularities; cross-veins present but probably neither numerous nor strong; anal area expanded with many longitudinal folds and veins.

Palaeopteron complexus n. sp.

Plate II; Figures 4, 5, and 6

Description. Robust insect; pronotum quadrate, 8 mm or more wide; head at least as wide; rest of body unknown: total length probably about 50 mm. Wings folded flat over abdomen when at rest.

Fore wing. Length about 47 mm; maximum width 7.3 mm, a little beyond mid-point of wing. Apical third of costa a distinct flat chitinous strip, maximum width 0.4 mm, tapering to end near apex of wing; strip bounded on both sides by a vein-like thickening. Basad from junction with subcosta, area obscured for a short distance, where wing margin again visible thickened strip apparently absent; possibly it results from fusion of costa and subcosta.

All longitudinal veins, at least of the radial and medial systems, strong and straight or uniformly curved; some angulation at cross-veins but much less than in modern species. Course of Sc not quite certain. Along most of its length it apparently occupies the same position as the vein of another wing, which eventually curves to cross R_1 of the wing being discussed. What appears to be the tip of Sc joins the costa at a small angle just beyond the obscured area mentioned above. Basad from this area, along the presumed course of Sc, is a vein of the hind wing shown in Figure 6, but there are marks in the rock that suggest the line of another vein, but cannot certainly be so regarded. These pass into the line of the combined veins mentioned, as indicated in Figure 5. Although clear proof is lacking, there seems little doubt that Sc is as drawn. If so this is not normal for modern Plecoptera. There is no sign of the abrupt forking at the end of Sc which sends short branches to the costa and R_1, instead Sc seems to curve anteriorally without dividing, to merge gradually with the costa. The area of the costal cell is not well preserved but most of the cross-veins shown in Figure 5 are certainly present.

Figure 4. Camera lucida drawing of Palaeopteron complexus n. sp. All veins visible are shown regardless of to which wing they belong. Holotype G.S.C. 22189.

Figure 5. Reconstruction on fore wing, except for anal area, of Palaeopteron complexus.

Figure 6. Reconstruction of mid-part of hind wing of Palaeopteron complexus. Not all veins shown certainly belong to one wing, but the general nature of the venation is reasonably assured.

R_1 is very clearly discernible, and indeed is plainly visible in Plate II. The basal part, particularly around the point of origin of the radial sector, is considerably thickened but the rest of the vein is no stronger than the other longitudinal veins identifiable. In cell R_1 cross-veins are present in the basal part and appear again near the apex of the wing, but for the third quarter of the wing certainly absent. The writer must emphasize that he is here describing a single specimen, and which of these characters are of specific importance must await the recovery of further specimens.

Rs separates from R about one-fifth of the distance to the apex, unusually far back. It forks once only, dichotomously, with no sign of the pectinate branching common in the family. This Comstock (1918, p. 249) regarded as a primitive condition. Cross-veins are present in cell Rs except near the base and in cells R_{2+3} and R_{4+5}.

The basal part of the wing posterior to the radius is obscure so that the forks of the medial vein cannot be observed. As interpreted the primary forking is basad of the origin of the radial sector and from these two simple veins proceed to the wing margin. M, like Rs, is two-branched only, also a condition that Comstock regarded as primitive. Cross-veins are numerous and strong in cells M_{1+2} and M_{3+4}.

The cubital area of the wing is poorly preserved, but parts of Cu_1 and Cu_2 can be recognized, enough to show that cross-veins are present between the medial and cubital systems and between Cu_1 and Cu_2. This feature Comstock (1918, p. 246) regarded as very characteristic of Plecoptera. The anal area cannot be recognized with certainty, but near the base of the wings are some isolated wing fragments (Pl. II; Fig. 4) with a reticulation that is unlike that in the body of the wing and very like the reticulation characteristic of the anal area in the fore wing of modern Pteronarcidae. It is reasonable to conclude that the anal area of the fore wing of this specimen is reticulated in the manner depicted in Figure 4, although the orientation of the veins is uncertain. Cross-veins are therefore general throughout the fore wing but are all of about the same strength so that the transverse cord so characteristic of other families of Plecoptera is not developed.

Hind wing. Recognition of any of the elements of the hind wing was most difficult but the careful piecing together of fragmentary clues enabled the writer to produce Figure 6. Although it is doubtful if every vein portrayed belongs to the same wing, and the anterior margin of the wing and most of the anal area are missing, the general appearance of this part of the hind wing is probably correct. It is not possible to identify any particular veins but it is clear that, as in the fore wing, the longitudinal veins are strong and straight or uniformly curved, without the angular irregularity so common in modern Plecoptera. Cross-veins are present but less numerous than in the fore wing, although this is not quite certain. The length of the wing is not known but probably is the same as that of the fore wing; width unknown. There is little doubt that the anal area is greatly expanded, with many fine longitudinal veins and complexly folded when at rest.

Remarks. Palaeopteron complexus almost certainly belongs in the family Pteronarcidae. Needham and Claassen (1925, p. 32) gave the two following distinguishing characters: the reticulated venation in the fore wing extending rearward from the front all the way

across the anal veins; no distinct transverse cord. Both of these characteristics are present in this specimen. P. complexus however differs markedly from either of the genera comprising this family Pteronarchys and Pteronarcella. It most closely conforms to the definition for the former, but the termination of the subcosta is different and probably more primitive, Rs originates much more basally, the forking is less complex, and cross-veins are present in cell R_1 instead of characteristically absent.

It can therefore be concluded that this is a primitive Pteronarcid Plecopterid with both radial sector and medius forking but once and with many more cross-veins than in the modern species.

Occurrence. In fine-grained argillite from the Redmond iron deposit in Labrador, Newfoundland, southwest of Schefferville, Quebec.

Holotype. G.S.C. No. 22189, and reverse.

REFERENCES

Blais, Roger. A
1959: L'origine des minerais Crétacés du gisement de fer de Redmond, Labrador; Le Naturalist Canadien, vol. 86, No. 12, pp. 265-299.

Brues, C. T., Melander, A. L., and Carpenter, F. M.
1954: Classification of insects; Bull. Mus. Comp. Zool. Harvard College, vol. 108.

Comstock, J. H.
1918: The wings of insects; The Comstock Publishing Company, Ithaca, New York.

Dorf, Erling
1959: Cretaceous floras from beds associated with rubble iron-ore deposits in the Labrador Trough; Abstract; Bull. Geol. Soc. Am., vol. 70, No. 12, p. 1591.

Needham, J. G., and Claassen, P. W.
1925: A monograph of the Plecoptera or Stoneflies of America north of Mexico. Ent. Soc. Am., Thomas Say Foundation, vol. II, La Fayette, Ind.