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FOSSIL DECAPOD CRUSTACEANS OF CANADA

R.M. FELDMANN
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Foreword

For nearly 100 years, decapod crustaceans have been collected from Canada and the studied material is stored in the National Type Fossil Collection at Geological Survey headquarters. Almost invariably, this material has been collected incidental to some other paleontological or stratigraphic work - decapods are almost always exceedingly rare. The taxonomic treatment of these organisms has been the subject of numerous short papers describing the material, most of which were written 75 to 100 years ago. This present work is an attempt to compile all of the information available on decapods that have previously been described from Canada and to relate it to current stratigraphic and biologic concepts.

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FOSSIL DECAPOD CRUSTACEANS OF CANADA

Abstract

Examination of type and non-type material of fossil decapod crustaceans collected from Canada has resulted in the description of two new species, Glyphea robusta and G. jeletzkyi from Lower Jurassic and Lower Cretaceous rocks of Arctic Canada; reassignment of three taxa to other genera, Erymastacus bordenensis Copeland to Eryma, Eryma dawsoni Woodward to Phlyctisoma, and Hoploparia westoni Woodward to Palaeonephrops; and suppression of one taxon, Palaeastacus(?) ornatus Whiteaves as a nomen oblitum. One of the newly described species, Glyphea robusta exhibits not only the complete exoskeleton but also an exceptionally well preserved endoskeleton, the second such known to be described in decapod literature. A total of thirteen species of decapods, arranged in nine genera and seven families, are recorded from Canada.

Résumé

L'examen d'éléments, types et hors types, de crustacés décapodes fossiles ramassés au Canada a eu pour résultats: la description de deux nouvelles espèces Glyphea robusta et G. jeletzkyi appartenant au Jurassique inférieur et au Crétacé inférieur de l'Arctique canadien; le changement de genre de trois taxons, Erymastacus bordenensis Copeland attribué au genre Eryma, Eryma dawsoni Woodward au genre Phlyctisoma, et Hoploparia westoni Woodward au genre Palaeonephrops; la suppression d'un taxon, Palaeastacus(?) ornatus Whiteaves, qui devient nomen oblitum (nom supprimé). Une des espèces nouvellement décrite, Glyphea robusta, possède, non seulement un exosquelette complet, mais aussi un endosquelette exceptionnellement bien conservé; c'est la seconde espèce connue décrite dans la documentation concernant les décapodes. On a enregistré au Canada un total de treize espèces de décapodes, qui ont été groupées en neuf genres et sept familles.

FOSSIL DECAPOD CRUSTACEANS OF CANADA

INTRODUCTION

Decapod crustacean fossils have been collected from Canada over a span of nearly 100 years. In the late 19th and 20th centuries, associated with early geological investigation of the Cretaceous of the Rocky Mountain front and the Pacific coast, three workers - Whiteaves, Woodward, and Whitfield - examined all of the decapod material that had been collected until that time and erected ten species to embrace the material. As late as 1960, no new taxa had been added to the group. In that year, Copeland described the first Jurassic form to be collected from Canada, a result of the exploration of the Arctic Islands. In 1975, Richards described a new genus and species of crab from Cretaceous rocks on Vancouver Island. The purpose of this present work is to catalog and restudy the decapod material in the collections of the Geological Survey, to supplement the descriptions of the taxa that have not been completely described, to illustrate those that previously have been illustrated only by line drawings, to assemble a list of occurrences of these taxa, and to reassign taxa where earlier generic placement is inconsistent with modern decapod taxonomy.

AGE

The taxa and their ages are summarized in Table 1. The known specimens now can be arranged in thirteen species, two of which, Glyphea robusta and G. jeletzkyi, are described as new. Both these species result from examination of extensive collections of decapod material collected in Arctic Canada over the past 20 years. Only one of the earlier named taxa, Palaeastacus(?) ornatus Whiteaves, 1887 has been suppressed. It is apparently the senior synonym of Palaeonephrops browni (Whitfield, 1907) but is properly considered a nomen oblitum because the name has not been cited in the primary taxonomic literature for over 50 years.

Because many of the early records of collecting sites offer only sketchy information, it is difficult to upgrade stratigraphic or geographic data. Where this has been possible, with the aid of the staff of the Geological Survey of Canada, it is appended to the original data. It is interesting to note that all but two of the forms, Eryma bordenensis and Glyphea robusta, have been collected from Cretaceous strata; those two were collected from Jurassic sediments. This temporal distribution is consistent with the geologic distribution of decapods in the rest of North America where only a few taxa have been described from pre-Cretaceous rocks (van Straelen, 1936; Schram, 1971; Herrick and Schram, 1978; Feldmann, 1979).

In southern Alberta (Fig. 1), decapods occur almost exclusively in grey marine shale either in the Bearpaw Formation or the Alberta Group, both of Late Cretaceous age. Details of the stratigraphy of this sequence have recently been described by Wall and Rosene (1977). On the islands near Vancouver, British Columbia, decapods seem to be restricted to the Nanaimo Group, also of Late Cretaceous age. The Nanaimo Group consists of sediments accumulated in marine, brackish water and fluvial environments. Most of the fossil decapods probably are preserved in the Spray Formation, of marine origin, although some probably come from the Haslam and the Extension-Protection Formations (Jan Muller, pers. com., 1979). The stratigraphy of this sequence is described by Muller and Jeletzky (1970).

In northern Canada, decapods have been collected from the Arctic Islands and the Richardson Mountains, District of Mackenzie. On the Arctic Islands, Lower to Middle Jurassic rocks of the Borden Island and Wilkie Point Formations have yielded numerous specimens. The age of these units, based primarily on ammonite associations, has been determined by Tozer and Thorsteinsson (1964) and Frebold (1975). The Richardson Mountains area has yielded a few decapods of Early Cretaceous age in rocks of the Upper Sandstone Division, a unit informally designated by Jeletzky (1958).

PRESERVATION

Typical of decapods collected in the remainder of North America, specimens of nearly all the taxa are exceedingly rare. Those that are known have been preserved in concretionary structures similar to those described by Feldmann et al. (1977). The concretions are typically cemented by calcium carbonate and consist of a matrix of fine sand or calcareous material.

Richards (1975) noted the relationship between the concretions in which specimens of Longusorbis cuniculosus were preserved and occasional burrow structures. He suggested that the concretions were formed early in diagenesis as burrow fillings. Although the evidence for this mode of origin is compelling in the case of this taxon, there is little evidence to support the notion that other forms, in other rock units, were preserved by similar processes. Examination of concretions from other units shows no evidence of burrow structures and, in fact, the shape of the concretions would argue against it. Most are spherical or elliptical and give the impression of having formed as an aureole around the organism. In this regard, the concretions are quite similar to those described by Waage (1964) and others in the Fox Hills Formation in North and South Dakota, United States. Waage (1964, p. 546) suggested the possibility that they formed by organically induced precipitation of calcium carbonate very soon after burial of the animal.

This mode of origin appears to describe more closely the mode of formation of concretions surrounding most lobster specimens. Most decapod specimens preserved in concretions have been disarticulated to some degree, in contrast to the specimens of Longusorbis cuniculosus, almost all of which are complete. Some, such as a few specimens of Glyphea robusta, are clearly molt remains because they are in Salter's position (Schäfer, 1972, p. 435) but for most specimens there is no clear evidence that the remains are molts. Disarticulation of specimens would seem to argue that the organism was not protected within a burrow structure but, rather, was moved around on the substrate prior to entombment.

The general scarcity of decapod remains probably can be attributed to several factors. Decapods are never the most abundant invertebrate organisms in an assemblage so that there is relatively less likelihood of finding them

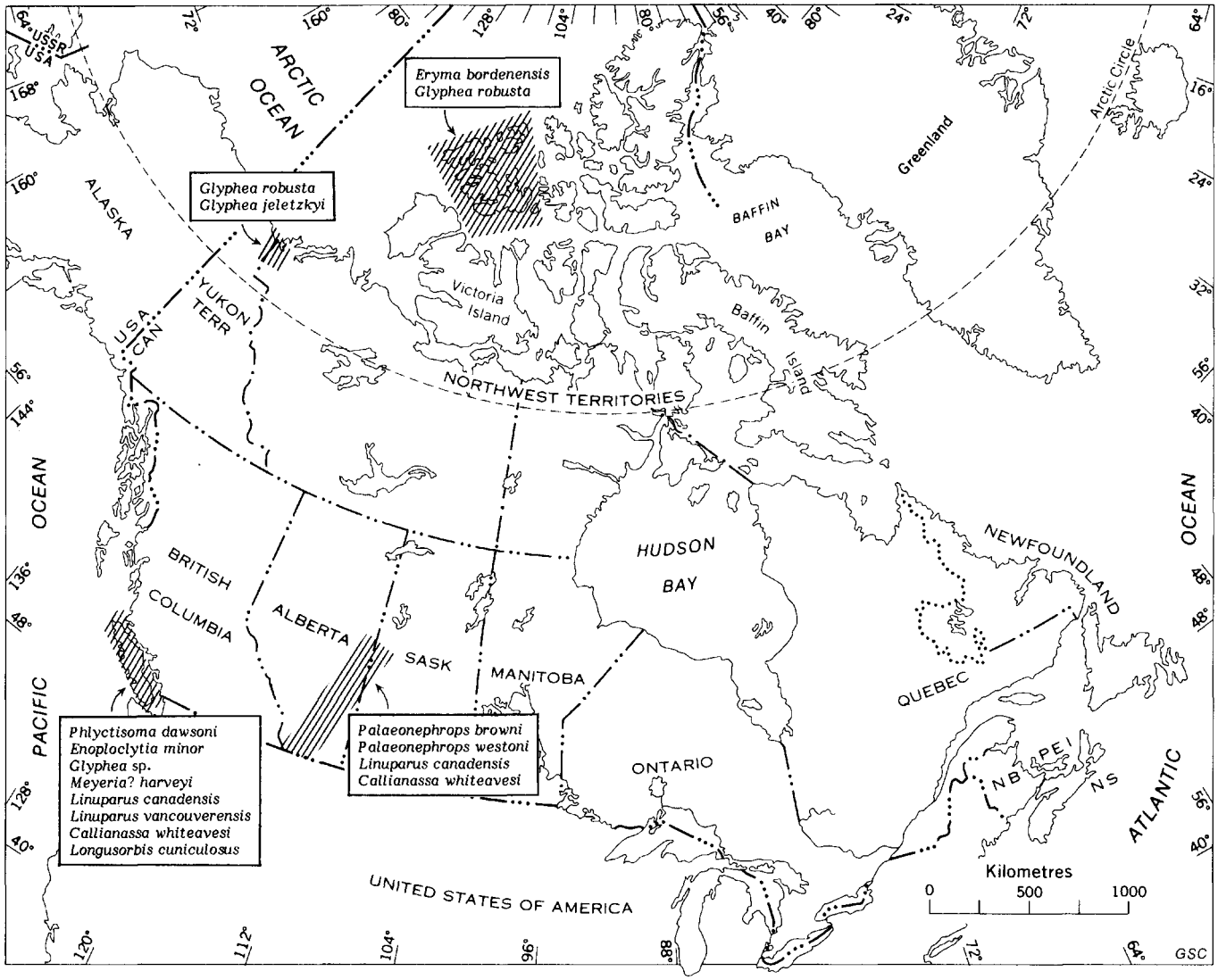

FIGURE 1. *Map showing generalized regions of Canada from which decapod fossils have been collected. The taxa listed adjacent each area have been collected at one or more sites within those areas.*

preserved as fossils than of the more abundant molluscs, for example. Additionally, the skeleton of lobsters is typically rather fragile, particularly when molted, further reducing the probability of preservation. Finally, predators and scavengers feeding on decapods would tend to break up the skeletal material when feeding on the organisms rather than extracting the soft tissues and discarding the hard parts as would be the case with most molluscs. The result appears to be that, unless the specimen is rapidly removed from the area of scavenging and abrasion by burial, the chances of preservation of recognizable material are negligible.

REPOSITORY

All type, figured and studied material is housed in the National Type Fossil Collection, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8, with the exception of the syntype of Palaeonephrops browni, AMNH 9572, deposited in the American Museum of Natural History, New York, New York.

ACKNOWLEDGMENTS

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TABLE 1

Systematic list of decapods from Canada with geological ranges.
Generalized locations from which these taxa have been collected are shown in Figure 1.

Order DECAPODA
- Suborder PLEOCYEMATA
  - Infraorder ASTACIDEA
    - Family ERYMIDAE
      - Eryma bordenensis (Copeland), 1960 - Early Jurassic (Sinemurian)
      - Phlyctisoma dawsoni (Woodward), 1900 -Late Cretaceous (late Campanian - early Maastrichtian)
      - Enoploclytia minor Woodward, 1900 -Late Cretaceous (late Campanian - early Maastrichtian)
    - Family NEPHROPIDAE
      - Palaeonephrops browni (Whitfield), 1907 -Late Cretaceous (Cenomanian - early Maastrichtian)
      - Palaeonephrops westoni (Woodward), 1900 -Late Cretaceous (Campanian?)
  - Infraorder PALINURA
    - Family GLYPHEIDAE
      - Glyphea robusta n. sp. - Early Jurassic (Sinemurian) to Early Cretaceous (early-mid Neocomian)
      - Glyphea jeletzkyi n. sp. - Early Cretaceous (late Barremian or Aptian)
      - Glyphea sp. - Late Cretaceous (middle Campanian)
    - Family MECOCHIRIDAE
      - Meyeria? harveyi Woodward, 1900 - Late Cretaceous (late Campanian - early Maastrichtian)
    - Family PALINURIDAE
      - Linuparus canadensis (Whiteaves), 1884 - Late Cretaceous (Cenomanian - early Maastrichtian)
      - Linuparus vancouverensis (Whiteaves), 1895 - Late Cretaceous (Santonian - early Maastrichtian)
  - Infraorder ANOMURA
    - Family CALLIANASSIDAE
      - Callianassa whiteavesi Woodward, 1896 -Late Cretaceous (late Santonian - Campanian, Maastrichtian?)
  - Infraorder BRACHYURA
    - Family CARCINERETIDAE
      - Longusorbis cuniculosus Richards, 1975 -Late Cretaceous (late Campanian - early Maastrichtian)

SYSTEMATIC PALEONTOLOGY

Order DECAPODA Latreille, 1803

Infraorder ASTACIDEA Latreille, 1803

Family ERYMIDAE van Straelen, 1924

Genus Eryma von Meyer, 1840

Eryma bordenensis (Copeland, 1960)

Plate 1, figure 3

Erymastacus bordenensis Copeland, 1960, p. 56.

Remarks. This species has been well described and illustrated by Copeland and the additional material cited below, and not described by Copeland, adds nothing new to the description. The additional material is even more fragmentary than the holotype but does show enough of the groove pattern and ornamentation in the cephalothorax to permit certain placement in the species. This new material was collected very near the type locality.

It is of note that Förster (1966, p. 106) considered Glyphea ornati to be properly referred to the genus Eryma thereby rendering Erymastacus Beurlen, 1928 the junior synonym of Eryma. The arguments of Förster are convincing and that classification is followed here.

Occurrences. Specimens of this taxon have been collected from the following localities in Canada:

1. East-central Borden Island, Northwest Territories, approximate Latitude 78°28'N, Longitude 110°07'W; holotype GSC 14496; sandstone, probably Early Jurassic (Sinemurian) (Frebold, 1975); collected by R. Thorsteinsson and E.T. Tozer, 1958. Locality 87 of Tozer and Thorsteinsson (1964).

2. Oyster River, Latitude 78°23'N, Longitude 110°41'W; GSC locality C-76362; GSC 61397, hypotype; Borden Island Formation, Sinemurian.

3. Oyster River, Latitude 78°25'N, Longitude 110°58'W; GSC locality C-76353; Borden Island Formation, Sinemurian.

Genus Phlyctisoma Bell, 1863

Phlyctisoma dawsoni (Woodward, 1900)

Plate 1, figures 4, 5, Figure 2

Eryma dawsoni Woodward, 1900, p. 400; Whiteaves, 1903, p. 321; Rathbun, 1926a, p. 128.

Remarks. The holotype of this species is the sole specimen referable to the taxon. Most of the left side of the cephalothorax and fragments of the abdomen and some of the chelae are visible. Re-examination of the holotype suggests that the species should better be referred to Phlyctisoma than to Eryma. Although he apparently did not see the holotype of this species, Förster (1966, p. 145) first noted this relationship and should be credited with the observation.

The characters displayed on P. dawsoni that confirm its placement in that genus relate to details of the groove pattern and ornamentation. The carapace on phlyctisomids is densely granular or nodose, as it is on P. dawsoni, and the groove pattern differs from that of representatives of Eryma by having a much reduced branchiocardiac groove and broad, strong hepatic, antennar, cervical and postcervical grooves (Fig. 2). In these regards, P. dawsoni very closely resembles P. tuberculata Bell, type species of the genus (Förster, 1966, p. 136).

Occurrence. Northwest side of Hornby Island, British Columbia; GSC 5969, 5969a, part and counterpart of holotype; Late Cretaceous; collected by J.B. Bennett, 1898. [Probably the marine Spray Formation but possibly the older Northumberland Formation; late Campanian to early Maastrichtian.]

Genus Enoploclytia M'Coy, 1849

Enoploclytia minor Woodward, 1900

Plate 1, figures 1, 2

Enoploclytia minor Woodward, 1900, p. 434; Whiteaves, 1903, p. 321; Rathbun, 1926a, p. 128.

Remarks. The single specimen of the species that was described by Woodward (1900, p. 434) as providing, "little comfort to the investigator" remains as the hypodigm. The specimen is extremely fragmentary but enough material is available to confirm its placement in the genus. The first three appendages are chelate, the first being the largest, which places the species in the Astacidea. The first cheliped appears to be entirely covered by rather coarse nodes and the fingers of the same appendage are extremely long and slender, confirming placement in the genus.

The integument of the cephalothorax must have been very thin because the specimen broke along the midline of the organism rather than along the exterior of the carapace. X-ray examination of the specimen does not show the presence of the carapace, and attempts to remove some of the enclosing concretion were unsuccessful; therefore, additional information regarding this species must await more, and better, material.

Occurrence. Hornby Island, British Columbia; GSC 5971, 5971a, part and counterpart of holotype; Late Cretaceous; collected by W. Harvey, 1893. [Probably Spray Formation but possibly older Northumberland or intervening Geoffrey Conglomerate; late Campanian to early Maastrichtian.]

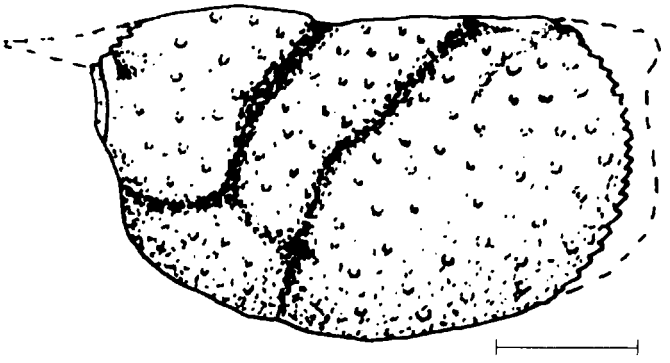

FIGURE 2. *Diagrammatic sketch of the cephalothorax of Phlyctisoma dawsoni showing groove pattern, distribution of ornamentation, and inferred outline. Bar scale = 1 cm.*

Family NEPHROPIDAE Dana, 1852

Genus Palaeonephrops Mertin, 1941

Palaeonephrops browni (Whitfield, 1907)

Plate 2, figures 1, 10

Palaeastacus(?) ornata Whiteaves, 1887, p. 161E; 1889, p. 183, Pl. 25, fig. 3; nomen oblitum.

Palaeastacus(?) ornatus Whiteaves, Woodward, 1900, p. 399.

Hoploparia browni Whitfield, 1907, p. 459, Pl. 36; Glaessner, 1929, p. 217; Jensen and Varnes, 1964, p. 8, 10.

Hoploparia westoni Woodward, Rathbun, 1930, p. 181.

Palaeonephrops browni (Whitfield), Mertin, 1941, p. 168; Woods, 1957, p. 156; Glaessner, 1969, p. R458, Fig. 264, 2; Feldmann et al., 1977, p. 1161, Pls. 1, 2.

Remarks. Specimens referable to this species have been collected from several Upper Cretaceous localities in Alberta and two of these, hypotypes GSC 45739, 45740, were incorporated in an earlier, extensive study (Feldmann et al., 1977) of Palaeonephrops browni. The additional material listed below extends the geological and geographical range of the taxon slightly but adds no new information to our understanding of the morphology.

Rathbun (1930, p. 181) referred a single specimen, University of Alberta 409, to Hoploparia westoni Woodward. Her description and illustrations (ibid., Figs. 1–3) clearly indicate that this specimen is better referred to P. browni.

PLATE 1

All figures x1, unless otherwise indicated

Figure 1, 2. Enoploclytia minor Woodward
Part and counterpart of holotype GSC 5971a, fig. 1; GSC 5971, fig. 2.

Figure 3. Eryma bordenensis (Copeland)
Latex cast of hypotype GSC 61937, showing right lateral view of cephalothorax and part of first pereiopod, x1.5.

Figure 4, 5. Phlyctisoma dawsoni (Woodward)
Part and counterpart of holotype GSC 5969a, fig. 4; GSC 5969, fig. 5.