

# THE ROSTROCONCH MOLLUSC *EUCHASMA* BILLINGS, 1865 FROM THE LOWER ORDOVICIAN CATOCHE FORMATION, WESTERN NEWFOUNDLAND

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## ABSTRACT

*The distinctive rostroconch* *Euchasma blumenbachi* (Billings, 1859), the type species of *Euchasma* Billings, 1865, occurs within the Catoche Formation of western Newfoundland. Well-preserved, silicified specimens are illustrated, and the distribution of the species within the Catoche Formation is documented.

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## INTRODUCTION

Lower Ordovician platform carbonate rocks are widely exposed in western Newfoundland (Figure 1). They are collectively included in the St. George Group (Figure 2) and comprise 500 m of subtidal and peritidal limestone and dolostone divided into the Watts Bight, Boat Harbour, Catoche, and Aguathuna formations (Knight and James, 1987, 1988). The Arenig/late Canadian sequence consists of the Barbace Cove Member of the Boat Harbour Formation, the Catoche Formation and the Aguathuna Formation. Detailed biostratigraphic sampling on the Northern Peninsula enabled Boyce (1989, 1997), Boyce and Stouge (1997) and Boyce *et al.* (2000) to recognize seven distinct trilobite zones within the interval encompassed by the Barbace Cove Member of the Boat Harbour Formation, the Catoche Formation and the Aguathuna Formation (Figure 2). In descending order, they are:

### Llanvirn/Whiterockian Series

*Bathyrurus perplexus* Zone

### Arenig/late Canadian Series

#### Cassinian Stage

*Cybelopsis speciosa* Zone

*Gignopeltis rarus* Zone

*Benthamaspis gibberula* Zone

*Strigigenalis caudata* Zone

#### Late Jeffersonian Stage

*Strigigenalis brevicaudata* Zone

*Peltabellia knighti* Zone

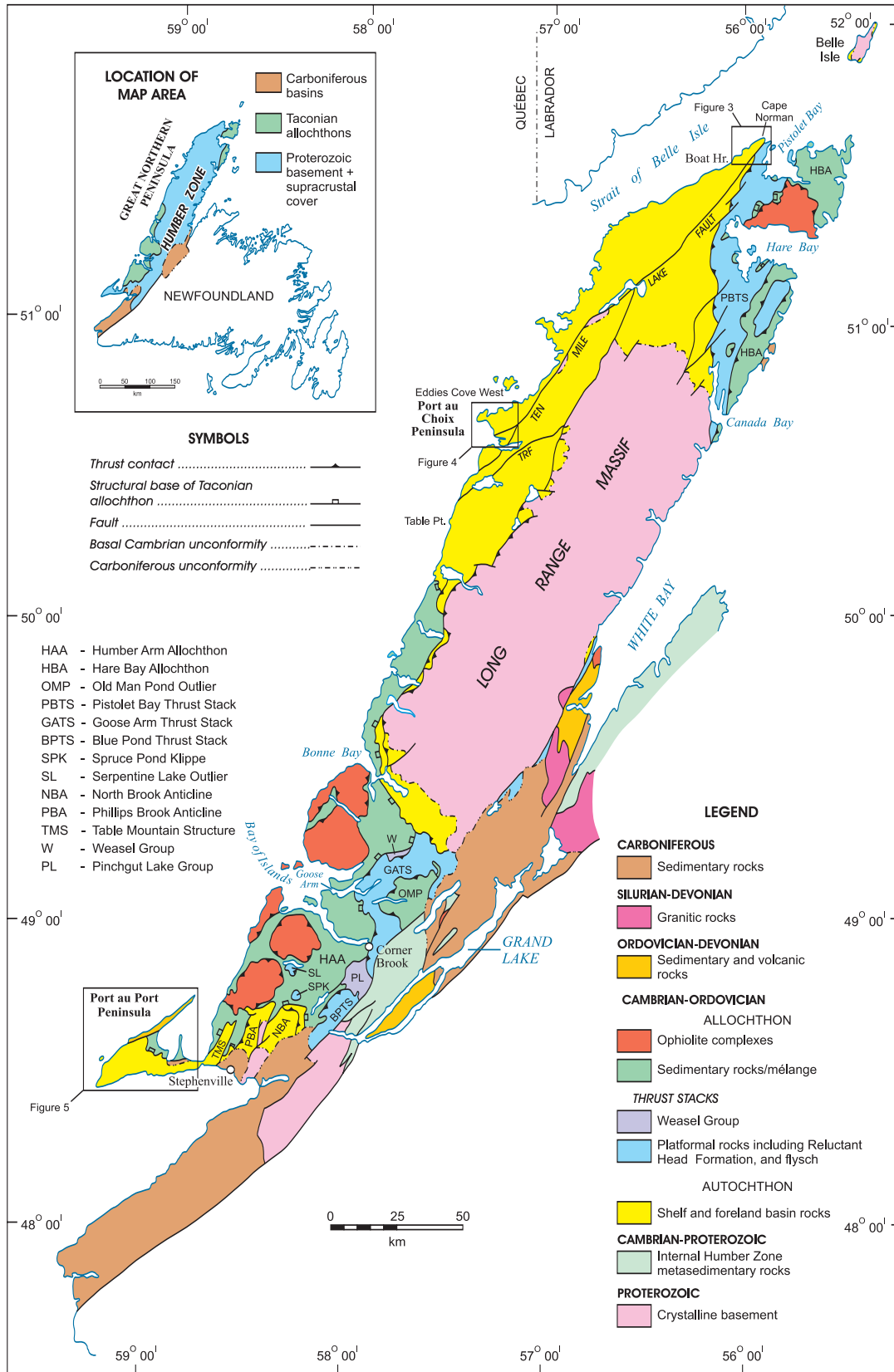
Graptolites are scattered within the Catoche and Aguathuna formations and allow correlation of much of the upper sequence with the *Tetragraptus approximatus*, *Didymograptus* (*Expansograptus*) *nitidus* and *Didymograptus* (*Didymograptellus*) *bifidus* zones (James *et al.*, 1988; Williams *et al.*, 1987, 2000).

Molluscs are the most obvious macrofossils in the Catoche Formation, and gastropods are present in most of the beds (Yochelson, 1964, 1990; Rohr *et al.*, 2000, 2001, 2002, 2003). Many of these taxa were first illustrated by Billings (1865), but because fossil collecting during those early years was not pursued in any systematic fashion (Knight and James, 1988), the stratigraphic ranges of many genera are poorly known. Since Billings' (1865) work on what is now the Catoche Formation, many of Billings' (1865) localities have been recollected with the goal of determining the age ranges of the taxa using established trilobite, conodont and graptolite biostratigraphies (Boyce, 1989, 1997; Boyce and Stouge, 1997; Boyce *et al.*, 2000; Williams and Stevens, 1988; Williams *et al.*, 1987, 2000) within the detailed lithostratigraphic framework established by Knight and others in the Port au Port Peninsula and Port au Choix areas (Knight and James, 1987, 1988; Knight, 1991; Boyce, unpublished data, 2008).

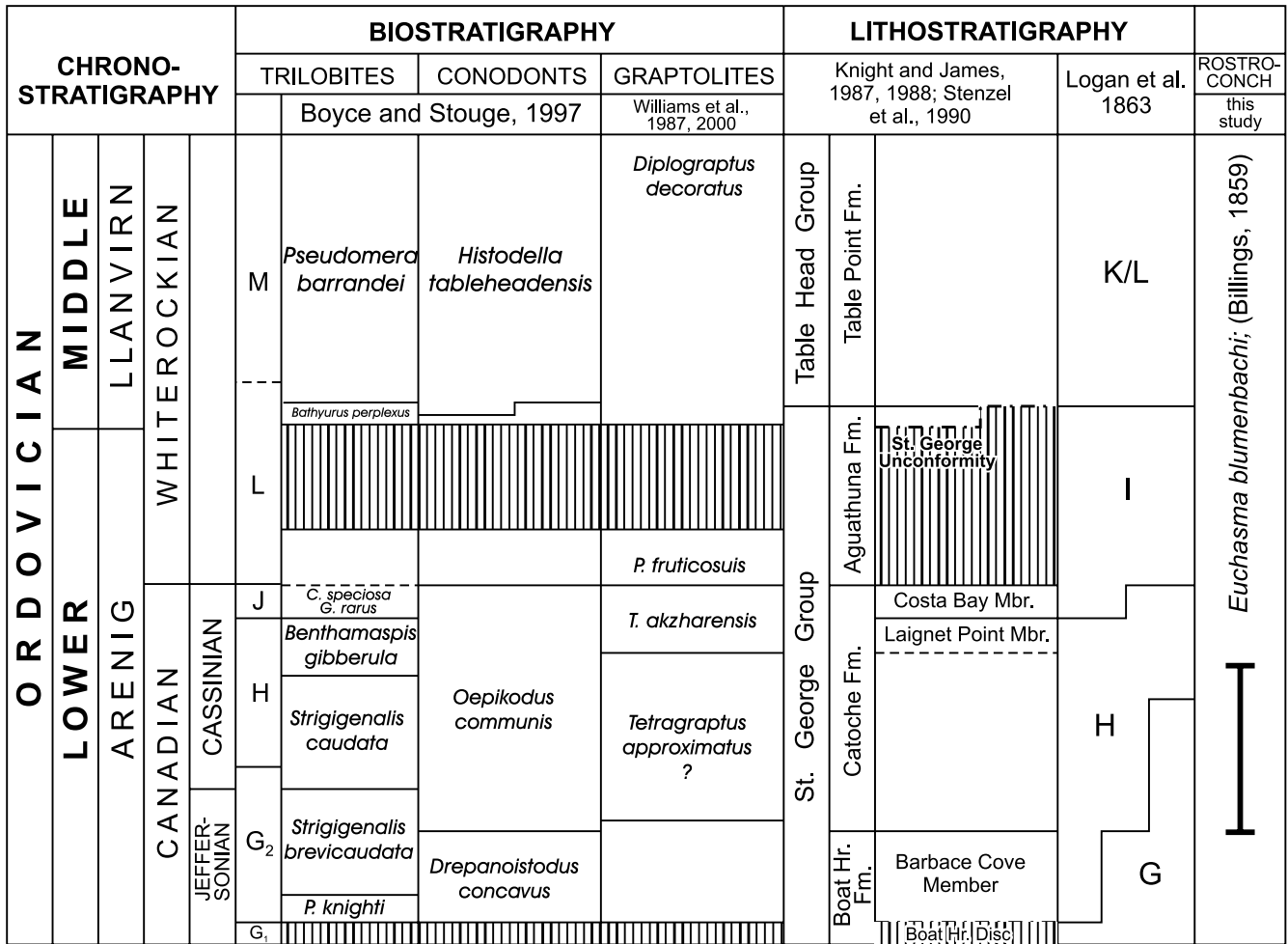
Sections of the Catoche Formation were examined in the Boat Harbour–Cape Norman area (Figure 3), between Hunters Point and Back Arm, St. John Bay (the Catoche Formation Type Section – see Figure 4), between Barbace Cove and Laignet Point on the Port au Choix Peninsula (the Catoche Formation Reference Section – see Figure 4), and

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<sup>1</sup>Regional Geology Section



**Figure 1.** Simplified geological map of western Newfoundland showing the areas where *Euchasma blumenbachi* (Billings, 1859) has been collected. TRF: Torrent River Fault.



**Figure 2.** Chronostratigraphy, biostratigraphy and lithostratigraphy of the upper St. George Group showing the range of *Euchasma blumenbachi* (Billings, 1859). The Laignet Point member is an informal unit (Knight 1977a and b; Stouge, 1982).

at Garden Hill, east of the Cape St. George–Mainland road (Route 463) on the western Port au Port Peninsula (Figure 5).

**SYSTEMATIC PALEONTOLOGY**

**REPOSITORY OF ILLUSTRATED MATERIAL**

The specimens described in this report are housed in the Provincial Museum of Newfoundland and Labrador (NFM) at The Rooms, St. John's.

Class ROSTROCONCHIA Pojeta and Runnegar, 1976

*Discussion.* Rostroconchs are bilaterally symmetrical molluscs, which differ from bivalves in having a fused instead of hinged margin. They range from the Cambrian through the Permian (Pojeta and Runnegar, 1976).

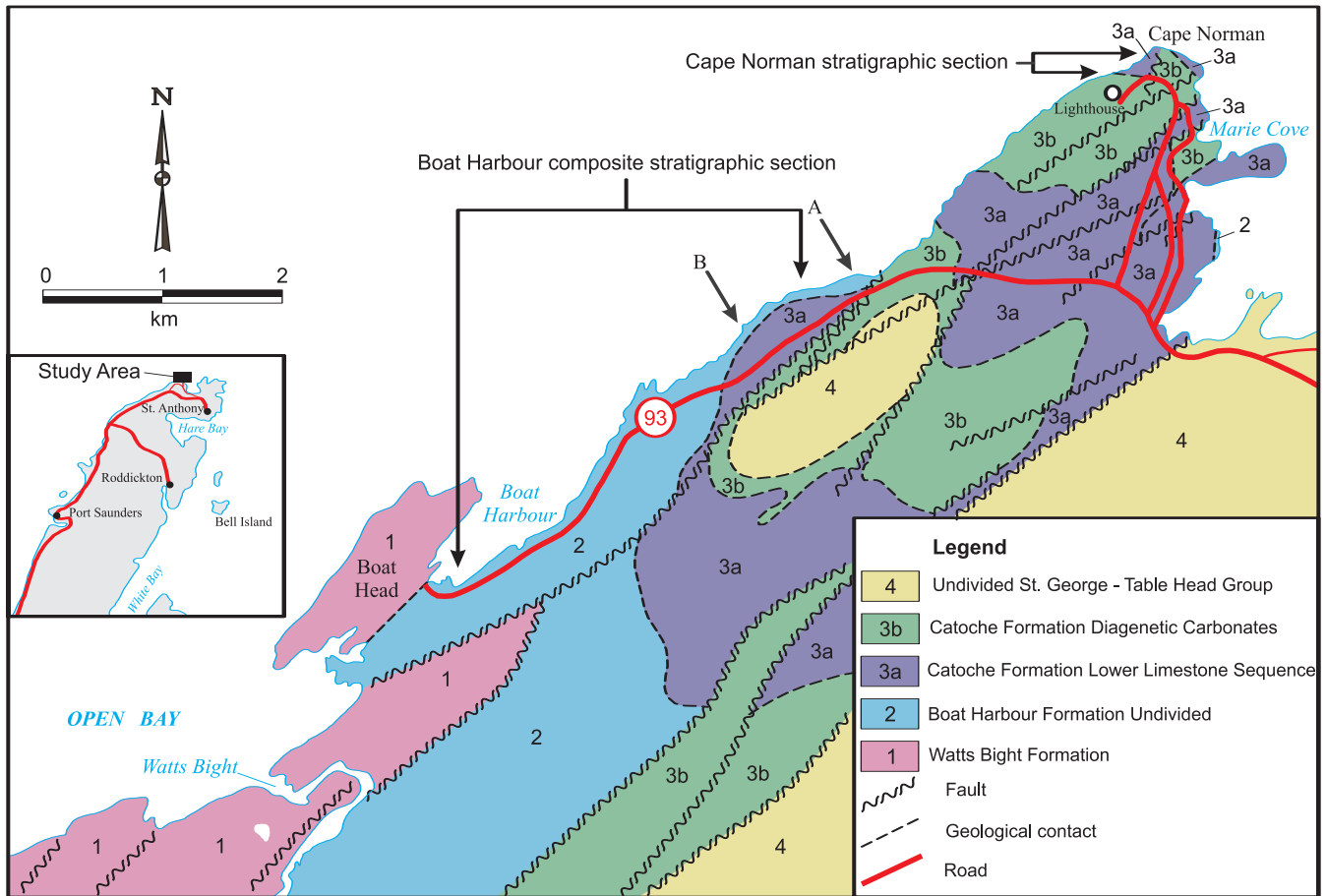
Order CONOCARDIIDA Neumayr 1891  
 Family EOPTERIIDAE Miller 1889  
 Genus EUCHASMA Billings, 1865

*Type species.* *Conocardium blumenbachium* Billings, 1859, from the Romaine Formation, Mingan Islands, Québec (Twenhofel, 1938, pages 55-56; Plate 11, figures 1, 2).

*Type specimen.* GSC 445 by designation of Pojeta and Runnegar (1976, page 67; Plate 27, figures 1-4), from the Romaine Formation, Mingan Islands, Québec (see Figure 6).

*Euchasma blumenbachi* (Billings, 1859)  
 Plate 1, plate figures 1-13

- 1859 *Conocardium blumenbachium* Billings, page 350.
  - 1865 *Euchasma blumenbachia* Billings, page 361; figure 348 (see Figure 6).
  - 1938 *Euchasma blumenbachi* Billings; Twenhofel, pages 55-56; Plate 11, figures 1, 2.
- See Pojeta and Runnegar (1976) for complete synonymy.



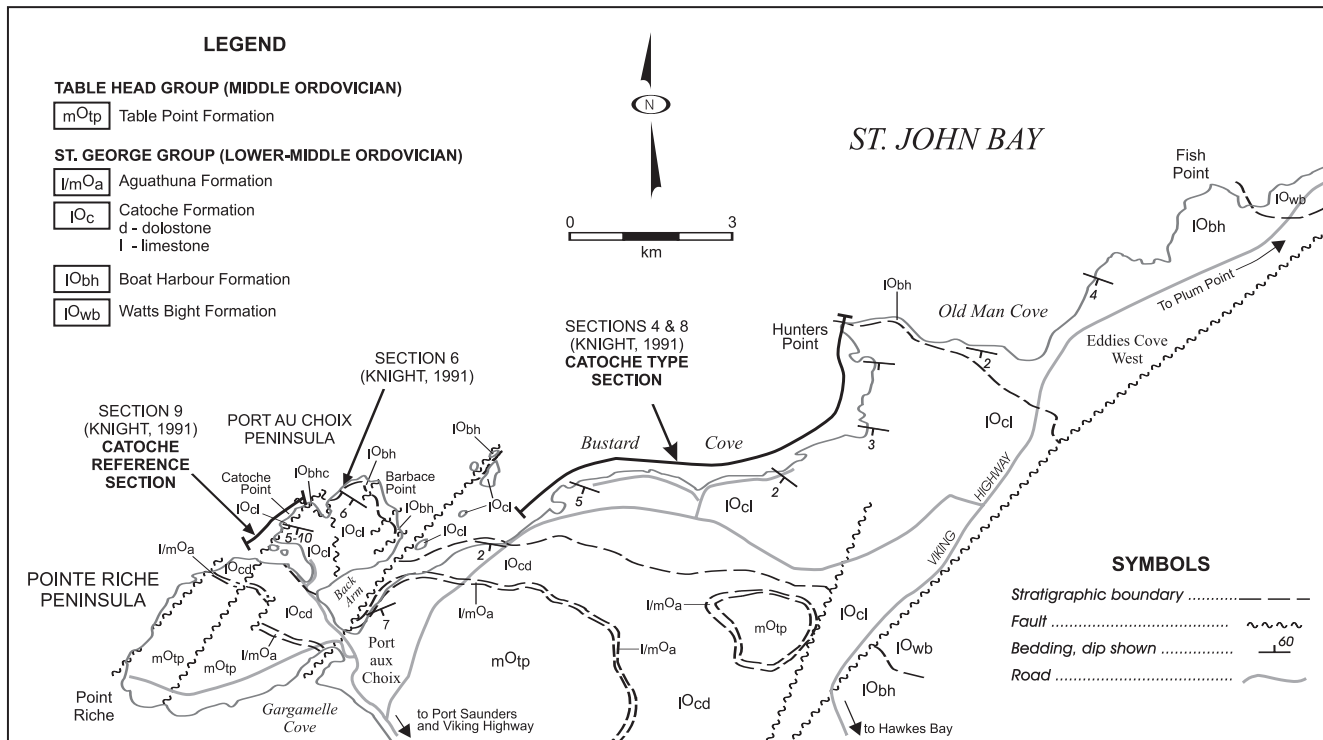
**Figure 3.** Geology of the Boat Harbour–Cape Norman area and location of measured stratigraphic sections (Boyce, 1989, page 5, Figure 3). Geology modified from Knight and Edwards (1978a and b). "A" and "B" indicate sampled conodont localities of Barnes and Tuke (1970).

*Description.* Strongly inflated, moderate sized (up to 33 mm long, 34 mm high, 18 mm wide), about 20 radial ribs that do not increase in number during growth; fine co-marginal ornament intersects ribs at acute angle; prominent anterior lobe, dorsal part of gape elliptical, radial ribs form zigzag commissure. Anterior gape narrow, marginal denticles visible immediately inside commissure. Interior unknown, protoconch not preserved.

*Occurrence and stratigraphic distribution.* Billings (1859, 1865) reported *Euchasma blumenbachi* from "Divisions G and H, at Port au Choix, Table Head and Cape Norman", *i.e.*, the Boat Harbour Formation (Barbace Cove Member) and Catoche Formation of modern stratigraphic usage (see Figure 2). At Cape Norman (Pistolet Bay), the species ranges from 4.88 to 8.64 m above the base of Unit 3 of Boyce (1989, page 88), 15.14 to 18.90 m above the base of Section 1989CNS-001 (Boyce, 1989, page 93), and entirely within the Catoche Formation. In the Catoche Formation Stratotype Section of the Eddies Cove West area (Figure 4), *Euchasma blumenbachi* (Billings, 1859) ranges from 2.31 to 86.80 m

above the base of the Catoche Formation, whereas on the Port au Choix Peninsula, the species ranges from 1.47 to 97.03 m above the base of the formation in the Reference Section (also Figure 4). On the Port au Port Peninsula (Figure 5), the species so far is known only from the Garden Hill locality (1996R017).

*Discussion.* Although *Euchasma* occurs throughout the Catoche Formation, the well-silicified specimens illustrated here were found only at locality 1996R017 on the Port au Port Peninsula. Pojeta and Runnegar (1976) placed all known species of North American *Euchasma* in *E. blumenbachi*. Besides Newfoundland, the species is reported from Québec, Virginia, and central Texas (Pojeta and Runnegar, 1976), as well as west Texas (Flower, 1964). Boyce (unpublished data, 2001) has also identified the taxon from the Cape Weber Formation of Ella Ø, Northeast Greenland. *Euchasma blumenbachi* (Billings, 1859) ranges from the late Jeffersonian *Strigigenalis brevicaudata* Zone to the Cassinian *Benthampsis gibberula* Zone.



**Figure 4.** Detailed geology and locations of upper St. George Group sections studied in the Eddies Cove West–Port au Choix area (map modified from Knight and James, 1988).

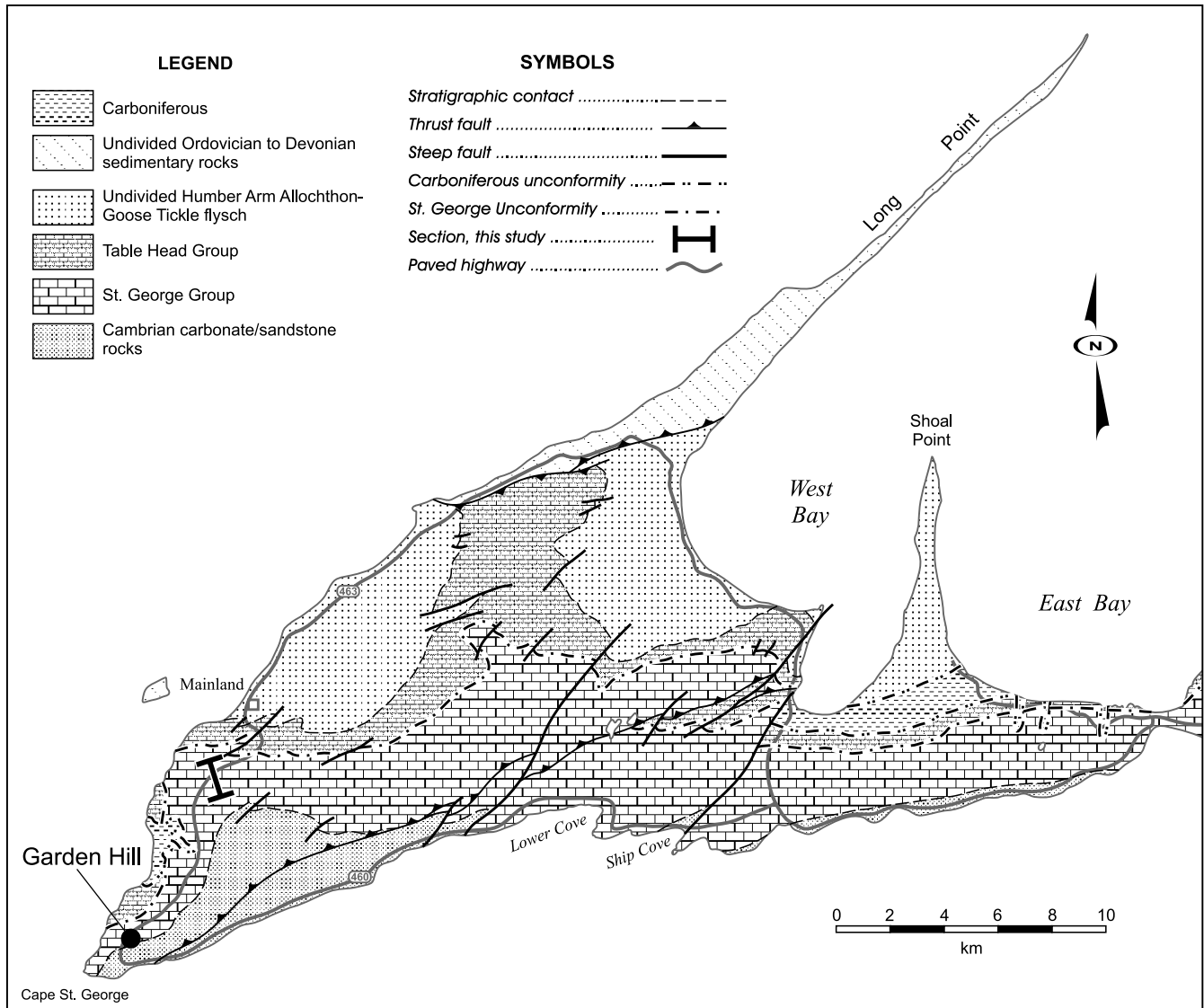
## ACKNOWLEDGMENTS

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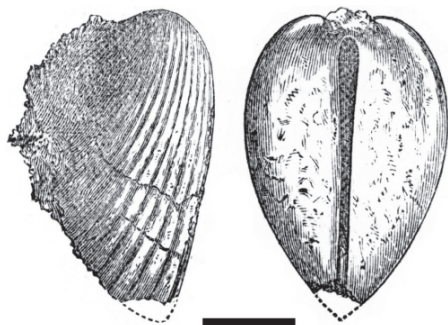
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**Figure 5.** Geological map of the Port au Port Peninsula (after Stockmal and Waldron, 1993) showing the location of Garden Hill.

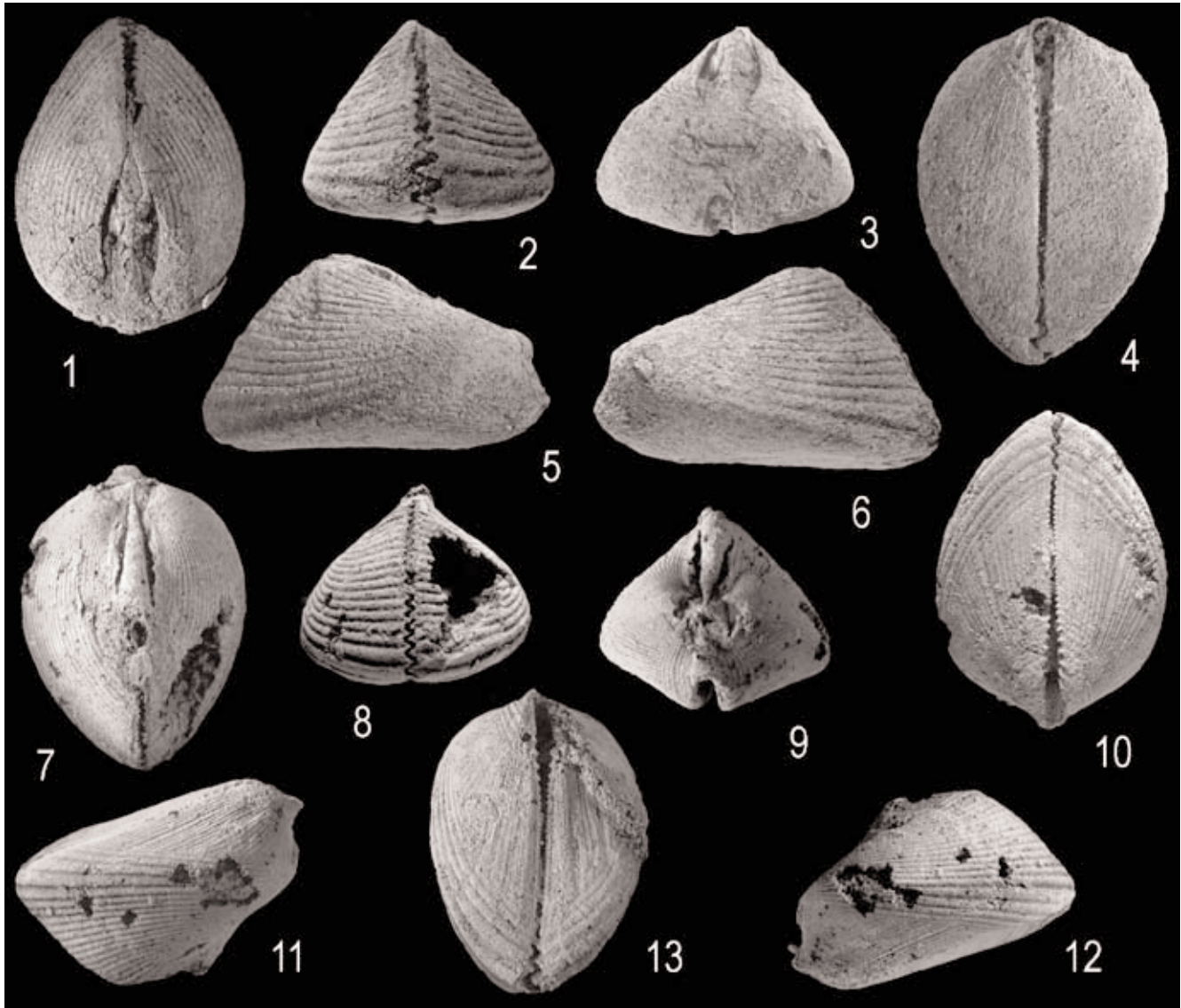


**Figure 6.** *Euchasma blumenbachi* (Billings, 1859). Billings' (1865, page 361; Figure 348) illustration of GSC 445, from the Romaine Formation, Mingan Islands, Québec. Scale bar is 1 cm.

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**Plate 1.** *Euchasma blumenbachi* (Billings, 1859) from the Catoche Formation. Plate figures 1-6. A complete but partially abraded specimen showing dorsal, anterior, posterior, ventral, left lateral, and right lateral views,  $\times 1.5$ , specimen number NFM F-740. Plate figures 7-12. Dorsal view with rostrum; anterior views with radial ribs forming zigzag commissure; posterior view with rostrum and gape of commissure; ventral view with both radial ribs and fine comarginal ornament, denticles visible immediately inside commissure; two views of the same right lateral side to emphasize two types of ornament;  $\times 1.5$ , specimen number NFM F-741. Plate figure 13. Ventral view of fragmentary specimen,  $\times 1.5$ , specimen number NFM F-742.

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**APPENDIX – *Euchasma blumenbachi* (Billings, 1859) Localities in the  
Catoche Formation (St. George Group), western Newfoundland**

Unless otherwise indicated, the datum for the fossil sites is NAD27. The UTM Zone is 21. "1976F", "1982F", "1983F", "1984F", "1985F", "1986F", "1998F", "1999F" & "2000F" = samples collected by W.D. Boyce; "2000R" = samples collected by D.M. Rohr; "2000RB" = samples collected by Rohr and Boyce.

**NTS 02M/12 (Raleigh)**

**Section 1989CNS-001 of Boyce (1989) – Cape Norman, Pistolet Bay**

**CN-033 of Boyce (1989) = 1985F162**

– 8.29 to 8.64 m above the base of Unit 3 of Boyce (1989, page 88), 18.55 to 18.90 m above the base of the section (Boyce, 1989, page 93) – lime mudstone and wackestone: dark blue-grey weathering, thin rubbly bedded, bioturbated; top of bed contains thin lenses of skeletal lime packstone and grainstone and spectacular patches of diagenetic dolostone-pseudobreccia, white weathering. 574800E, 5720200. Canadian Series, earliest Cassinian Stage, *Strigigenalis caudata* Zone.

Arthropoda–Trilobita

- Bathyurellus abruptus* Billings, 1865
- Ischyrotoma anataphra* Fortey, 1979
- Jeffersonia timon* (Billings, 1865)
- Petigurus nero* (Billings, 1865)
- Strotactinus insularis* (Billings, 1865)<sup>1</sup>
- Uromystrum marginiatus* (Billings, 1865)

Mollusca–Rostroconchia

- Euchasma blumenbachi* (Billings, 1859)

**CN-027 of Boyce (1989) = 1985F156**

– 4.88 to 5.13 m above the base of Unit 3 of Boyce (1989, page 88), 15.14 to 15.39 m above the base of the section (Boyce, 1989, page 93) – lime mudstone and wackestone: dark blue-grey weathering, thin rubbly bedded, bioturbated; top of bed contains thin lenses of skeletal lime packstone and grainstone and spectacular patches of diagenetic dolostone-pseudobreccia, white weathering. 574800E, 5720200. Canadian Series, earliest Cassinian Stage, *Strigigenalis caudata* Zone.

Arthropoda–Trilobita

- Bathyurellus abruptus* Billings, 1865
- Bolbocephalus convexus* (Billings, 1865)
- Jeffersonia timon* (Billings, 1865)
- Petigurus nero* (Billings, 1865)

Mollusca–Cephalopoda

- Cassinoceras wortheni* (Billings, 1865)

Mollusca–Rostroconchia

- Euchasma blumenbachi* (Billings, 1859)

**NTS 012B/06 (Cape St. George)**

**1996R017 = 1996F011**

– Garden Hill, western Port au Port Peninsula, east of Hunt Oil–Pan Canadian Petroleum #1 Well Head (Prog. #94 106 01 01). Beds east of well, dipping about 10° W. Lower part of the Catoche Formation. 335490E, 5372856N. Canadian Series, earliest Cassinian Stage, *Strigigenalis caudata* Zone.

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<sup>1</sup> at top of horizon only.

Mollusca–Cephalopoda

*Protocycloceras lamarcki* (Billings, 1859)

Mollusca–Gastropoda

*Ceratopea billingsi* Yochelson, 1964<sup>2</sup>

*Euomphalopsis magnus* Rohr, 2002<sup>3</sup>

*Maclurites* sp. undet.

Billings' second operculum – see Billings (1865, page 243; Figure 229)<sup>4</sup>

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859)

**1996F012**

– Garden Hill, western Port au Port Peninsula, closest up-dip beds to Hunt Oil–Pan Canadian Petroleum #1 Well Head (Prog. #94 106 01 01). Lower part of the Catoche Formation.

Arthropoda–Trilobita

*Jeffersonia timon* (Billings, 1865)

Mollusca–Cephalopoda

*Cassinoceras wortheni* (Billings, 1865)

*Protocycloceras lamarcki* (Billings, 1859)

Mollusca–Gastropoda

*Ceratopea numeria* (Billings, 1865)

*Euconia normani* (Billings, 1865)

*Maclurites oceanus* (Billings, 1865)

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859)

Porifera

*Calathium?* sp. undet.

**NTS 012I/11 (Port Saunders)**

**Section 9 of Knight (1991) – Catoche Point, Port au Choix Peninsula to Blanche Point Section, Pointe Riche Peninsula (Catoche Formation Reference Section)**

**2000R015 = 2000F026 = G of Williams *et al.* (1987, page 458, Figure 2) = 1984F121**

– Laignet Point, above uppermost mound bed. 97.03 m above the base of the Catoche Formation. 473615E, 5618600N. Canadian Series, Cassinian Stage, *Benthamaopsis gibberula* Zone.

Arthropoda–Trilobita

*Bathyurellus abruptus* Billings, 1865

*Bathyurellus platypus* Fortey, 1979

*Benthamaopsis gibberula* (Billings, 1865)

*Grinnellaspis flabelliformis* (Fortey, 1979)

*Ischyrotoma anataphra* Fortey, 1979

*Isoteloides canalis* (Whitfield, 1886)

*Jeffersonia angustimarginata* Boyce, 1989

*Jeffersonia timon* (Billings, 1865)

*Petigurus nero* (Billings, 1865)

*Strotactinus insularis* (Billings, 1865)

*Uromystrum marginiatus* (Billings, 1865)

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<sup>2</sup> Reported by Rohr *et al.* (2000, page 250) and Rohr *et al.* (2001, page 126).

<sup>3</sup> Reported by Rohr *et al.* (2002, page 269).

<sup>4</sup> Reported by Rohr *et al.* (2000, page 250) and Rohr *et al.* (2001, page 126).

## Brachiopoda–Articulata

Gen. et sp. undet.

## Hemichordata–Graptolithina

*Pseudophyllograptus* sp. A of Williams in Williams *et al.* (1987, pages 462-464; Figure 6, I to O)

## Mollusca–Gastropoda

*Maclurites* sp. undet.

## Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859) – seen, not collected**Section 6 of Knight (1991) – Barbace Point to Barbace Cove Section, Port au Choix Peninsula****1983F148A+1983F148 = 1982F048 = 1976F029 (in part)**

– K-1982-307-11 of Knight. 1.47 to 2.05 m above the base of the Catoche Formation, within Unit 3 of Knight (1991, page 1)

– boundstone: rubbly-weathering, skeletal-rich mounds, obscure structure rich in large gastropods, straight cephalopods, eocrinoids. 474750E, 5619475N. Canadian Series, latest Jeffersonian Stage, *Strigigenalis brevicaudata* Zone.

## Arthropoda–Trilobita

*Benthamaspis hintzei* Boyce, 1989*Bolbocephalus convexus* (Billings, 1865)*Grinnellaspis newfoundlandensis* Boyce, 1989*Ischyrotoma parallela* Boyce, 1989 – seen, but not collected*Jeffersonia angustimarginata* Boyce, 1989*Petigurus* sp. nov. A of Boyce (1989, pages 53-54; Plate 29, figure 7) – seen, but not collected*Petigurus groenlandicus* Poulsen, 1937*Peltabellia willistoni* Lochman, 1966*Uromystrum affine* (Poulsen, 1937)

## Brachiopoda–Articulata

*Tritoechia* sp. undet.

## Echinodermata–Crinoidea

eocrinoid gen. et sp(p). undet – fragmentary material

## Mollusca–Cephalopoda

Gen. et sp(p). – curved forms

Gen. et sp(p). – straight forms

## Mollusca–Gastropoda

Gen. et sp(p). undet. – high-spined forms?

Gen. et sp(p). undet. – low-spined forms

## Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859)

## Porifera

*Calathium* or *Receptaculites* sp. undet.**Section 8 of Knight (1991) – Bustard Cove to Back Arm, St. John Bay (Catoche Formation Stratotype Section)****2000F045 = ECW-087 of Boyce and Stouge (1997) = 1986F114 = 1982F037<sup>5</sup>**– K-1982-304-33 of Knight, 1982. Top 0.15 m of Unit 12a of Knight (1991, page 122), 86.65 to 86.80 m above the base of the formation – wackestone with packstone layers and lenses: 4- to 6-cm grainy packstone bed at top; well-bedded, dolomitic, intensely bioturbated in lower beds, scattered gastropods, some flaser of lime mudstone; ripple-marked lenses of skeletal packstone; fossils include large trilobites, gastropods, some brachiopods. 478775E, 5619375N. Canadian Series, Cassinian Stage, *Benthamaspis gibberula* Zone.<sup>5</sup> 1982F037 only sampled 0.00 to 0.10 m below the top of Unit 12a.

Arthropoda–Trilobita

*Bathyurellus abruptus* Billings, 1865  
*Bathyurellus platypus* Fortey, 1979  
*Benthamaaspis gibberula* (Billings, 1865)  
*Bolbocephalus convexus* (Billings, 1865)  
*Ischyrotoma anataphra* Fortey, 1979  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)

Brachiopoda–Articulata

*Tritoechia* sp. undet.

Mollusca–Gastropoda

Gen. et spp. undet. – sampled by D.M. Rohr

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859) – seen, but not collected  
Gen. et sp(p). undet.

**2000F030 = ECW-049A<sup>6</sup>**

– top 0.15 m of 0.80-m-thick limestone bed within Unit 6f (a covered interval) of Knight (1991, page 125), 30.33 to 30.48 m above the base of the formation. Canadian Series, earliest Cassinian Stage, *Strigigenalis caudata* Zone.

Arthropoda–Trilobita

*Bathyurellus abruptus* Billings, 1865  
*Benthamaaspis conica* Fortey, 1979  
*Bolbocephalus convexus* (Billings, 1865) – pygidium (-) seen, but not collected  
*Grinnellaspis flabelliformis* (Fortey, 1979)  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)

Brachiopoda–Articulata

*Tritoechia* gen. et sp. undet.

Mollusca–Cephalopoda

Gen. et sp(p). undet.

Mollusca–Gastropoda

Gen. et sp(p). undet.

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859) – seen, but not collected

**2000RB06E = 2000F029 = ECW-049 of Boyce and Stouge (1997) = 1999F096 = 1986F120**

– top 0.10 m of Unit 6e of Knight (1991, page 125)<sup>7</sup>, 29.92 to 30.02 m above the base of the formation – wackestone – packstone: well-bedded, gastropods, dolomitic burrow mottling; packstone, intraclastic and rich in gastropods; upper 72 cm poorly exposed. 484340E, 5620550N. Canadian Series, earliest Cassinian Stage, *Strigigenalis caudata* Zone.

Arthropoda–Trilobita

*Bathyurellus abruptus* Billings, 1865  
*Catochia ornata* Fortey, 1979  
*Grinnellaspis flabelliformis* (Fortey, 1979)  
*Ischyrotoma anataphra* Fortey, 1979  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)  
*Strotactinus insularis* (Billings, 1865)

Brachiopoda–Articulata

Gen. et sp(p). undet.

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<sup>6</sup> Designated February 13, 2002.

<sup>7</sup> *i.e.*, 1.80 to 1.90 m above the base of Unit 6e.



Mollusca–Cephalopoda  
Gen. et spp. undet. – curved, straight

Mollusca–Gastropoda

*Euconia*

Gen. et sp(p). undet.

*Maclurites* sp. undet.

*Murchisonia*

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859)

#### NTS 012I/14 (St. John Island)

**1999F088 = 1998F032 = ECW-037 of Boyce and Stouge (1997) = 1984F015 = 1983F161 = 1982F007**

– K-1982-304-009 of Knight. Upper 0.80 m of Unit 2 of Knight (1991, page 126), 2.31 to 3.11 m above the base of the formation – boundstone: mounds, obscure internal structure, rich in skeletal remains, trilobites, sponges, eocrinoids, large gastropods and cephalopods; mounds end to south side of Hunters Point and pass into wackestone rich in gastropods. 484250E, 5622600N. Canadian Series, latest Jeffersonian Stage, *Strigigenalis brevicaudata* Zone.

Arthropoda–Trilobita

*Benthamaspis hintzei* Boyce, 1989

*Bolbocephalus convexus* (Billings, 1865)

*Catochia ornata* Fortey, 1979

*Ischyrotoma anataphra* Fortey, 1979

*Ischyrotoma parallela* Boyce, 1989

*Isoteloides peri* Fortey, 1979

*Jeffersonia angustimarginata* Boyce, 1989

*Petigurus* sp. nov. A of Boyce (1989, pages 53-54; Plate 29, figure 7)

*Petigurus groenlandicus* Poulsen, 1937

*Petigurus nero* (Billings, 1865)

*Uromystrum affine* (Poulsen, 1937)

Brachiopoda–Articulata

*Tritoechia* sp. undet.

Echinodermata–Crinoidea

Gen. et sp(p). undet.

Mollusca–Cephalopoda

*Cassinoceras wortheni* (Billings, 1865)

Mollusca–Gastropoda

*Ceratopea canadensis* (Billings, 1865)<sup>8</sup>

*Euconia*

Gen. et sp(p). undet. – high-spired forms

Gen. et sp(p). undet. – planispiral forms

*Maclurites*

Second operculum of Billings (1865, page 243; Figure 229)<sup>9</sup>

Mollusca–Rostroconchia

*Euchasma blumenbachi* (Billings, 1859)

Porifera

*Archaeoscyphia* sp. undet.

Gen. et sp. undet.

<sup>8</sup> Reported by Rohr *et al.* (2000, page 250).

<sup>9</sup> Reported by Rohr *et al.* (2000, page 250).

