

## BIOSTRATIGRAPHIC STUDIES OF ORDOVICIAN CARBONATE ROCKS IN WESTERN NEWFOUNDLAND, 1987

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### ABSTRACT

Early Ordovician trilobite faunas, poorly known prior to this work, are documented from the Boat Harbour and Catoche formations (St. George Group) of the Pistolet Bay area. These faunas are correlative with the Ross (1951)–Hintze (1953) trilobite zones G<sub>2</sub> to I and are indicative of the Late Jeffersonian Stage and the Cassinian Stage of the Canadian Series.

Previously unreported Early Ordovician trilobites were discovered in the St. George Group of Hare Bay. These new faunas correlate with Ross–Hintze Zones C, E, F, G<sub>2</sub> and H and are indicative of the Late Gasconadian, Demingian, Late Jeffersonian and Cassinian stages of the Canadian Series.

The widespread western Newfoundland trilobite *Bathyurus perplexus* Billings, 1865 occurs in a distinctive horizon within the *Aguathuna* Formation at Big Spring Inlet, Hare Bay. Previous reports of *Acidiphorus* sp. cf. *A. pseudobathyurus* Ross, 1967 from there are incorrect.

### INTRODUCTION

The Ordovician carbonate deposits of the Great Northern Peninsula are the target of regional taxonomic-biostratigraphic studies aimed at correlating their trilobite faunas with those of the standard Ross (1951)–Hintze (1953) trilobite zonation of Utah and Nevada. This report discusses new trilobite material obtained from Schooner Island and Burnt Island in Pistolet Bay and the Brent Islands in Hare Bay (Figure 1). The fossil material was obtained from the Watts Bight, Boat Harbour, Catoche and *Aguathuna* formations (St. George Group) of Knight and James (1987).

Detailed biostratigraphic sampling of the St. George Group on Schooner Island and Burnt Island was completed in 1987. The sampling results augment and update the work of Boyce (1983b, 1985, 1986). Addition of the previously obtained biostratigraphic information from sections at Boat Harbour and Cape Norman will finally allow the succession of St. George Group trilobite faunas in the Pistolet Bay area to be established.

Reconnaissance biostratigraphic sampling of the St. George Group in Hare Bay was started in 1987.

### DETAILED BIOSTRATIGRAPHIC WORK

#### Schooner Island, Pistolet Bay

Johnson (1949, pages 44 and 45) reported the following trilobite species from St. George Group strata exposed on the northwest shore of Schooner Island:

*Bathyurellus fraternus* Billings, 1865—probably  
*Uromystrum affine* (Poulsen, 1937)  
*Bolbocephalus* sp.—probably *Bolbocephalus convexus*  
(Billings, 1865) or *B. kindlei* Boyce, *in press*  
*Gignopeltis gibberulus* (Billings, 1865)—probably  
*Benthamaspis gibberula* (Billings, 1865)  
*Jeffersonia timon* (Billings, 1865)  
*Illaeus fraternus?* Billings, 1865—probably *Illaeus* sp.  
nov.  
*Petigurus nero* (Billings, 1865)

Biostratigraphic sampling of the St. George Group was completed on Schooner Island in 1987. Seventeen new macrofossil collections were made, augmenting the twelve collections made in 1985.

A total of twenty-nine fossiliferous levels have been sampled on Schooner Island for trilobites and conodonts. The collections were obtained from the Barbace Cove Member of the Boat Harbour Formation and the lower three members of the Catoche Formation, which are exposed in sections on the eastern side of the island.

The Barbace Cove Member of the Boat Harbour Formation yielded the following trilobite species:

*Bolbocephalus convexus* (Billings, 1865)  
*Bolbocephalus stevensi* Boyce, *in press*  
*Isoteloides peri* Fortey, 1979  
*Jeffersonia angustimarginata* Boyce, *in press*  
*Peltabellia knighti* Boyce, *in press*

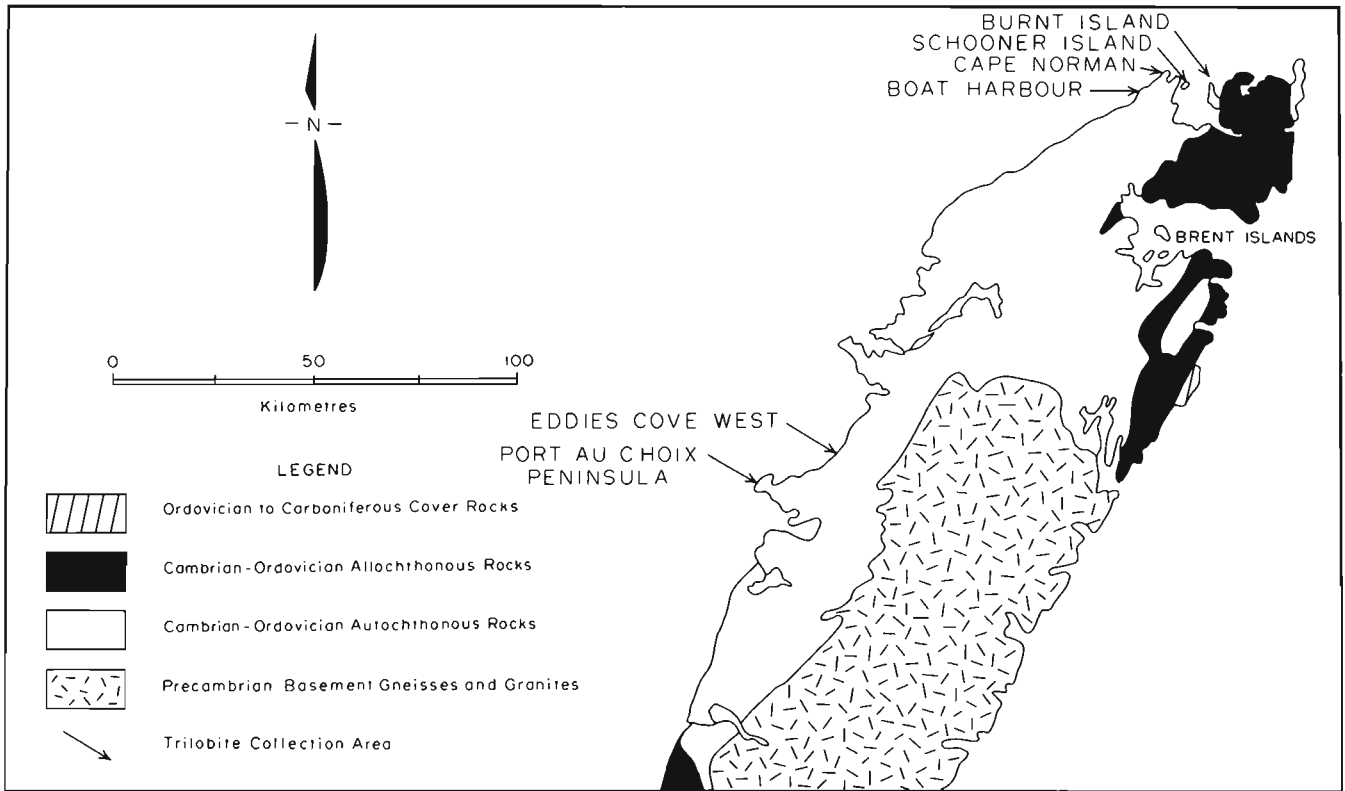


Figure 1. Geological elements of the Great Northern Peninsula and trilobite collection areas discussed in this report.

*Strigigenalis brevicaudata* Boyce, in press  
*Strigigenalis caudata* (Billings, 1865)

*brevicaudata* Zone of the Boat Harbour–Cape Norman area (Figure 2). It is also correlative with Ross–Hintze Zone G<sub>2</sub> and the upper part of the Jeffersonian Stage of the Canadian Series (Figures 3 and 4).

The fauna correlates with that of the *Strigigenalis*

LEGEND (Figure 2)

CARBONATE ROCK TYPES

- Dolostone
- Dolostone, *Ilmy*
- Limestone
- Limestone, *dolomitic*

PRIMARY DEPOSITIONAL TEXTURES

- Mudstone
- Wackestone
- Packstone
- Grainstone
- Boundstone

DIAGENETICALLY ALTERED TEXTURES

- Crystalline
- Sucrosic

PARTICLES

- Ooids
- Intraclasts
- Tabular pebbles (conglomerates)
- Chert

BIOTURBATION

(Including burrows, trails, etc.)

- Sparsely bioturbated
- Moderately bioturbated
- Extensively bioturbated

ORGANIC BUILDUPS

- Algal mounds
- Stromatolite mounds
- Thrombolite mounds

FOSSIL COLLECTIONS

- Single sampled horizon
- Sampled interval

SEDIMENTARY STRUCTURES

- Interference ripples
- Symmetric ripples
- Mud cracks

EPIGENETIC STRUCTURES

- Pseudobreccia

DISCONFORMITY

- Base of pebble bed

NOTE: Major rock types indicated on left side of column; minor/associated rock types indicated on right side.

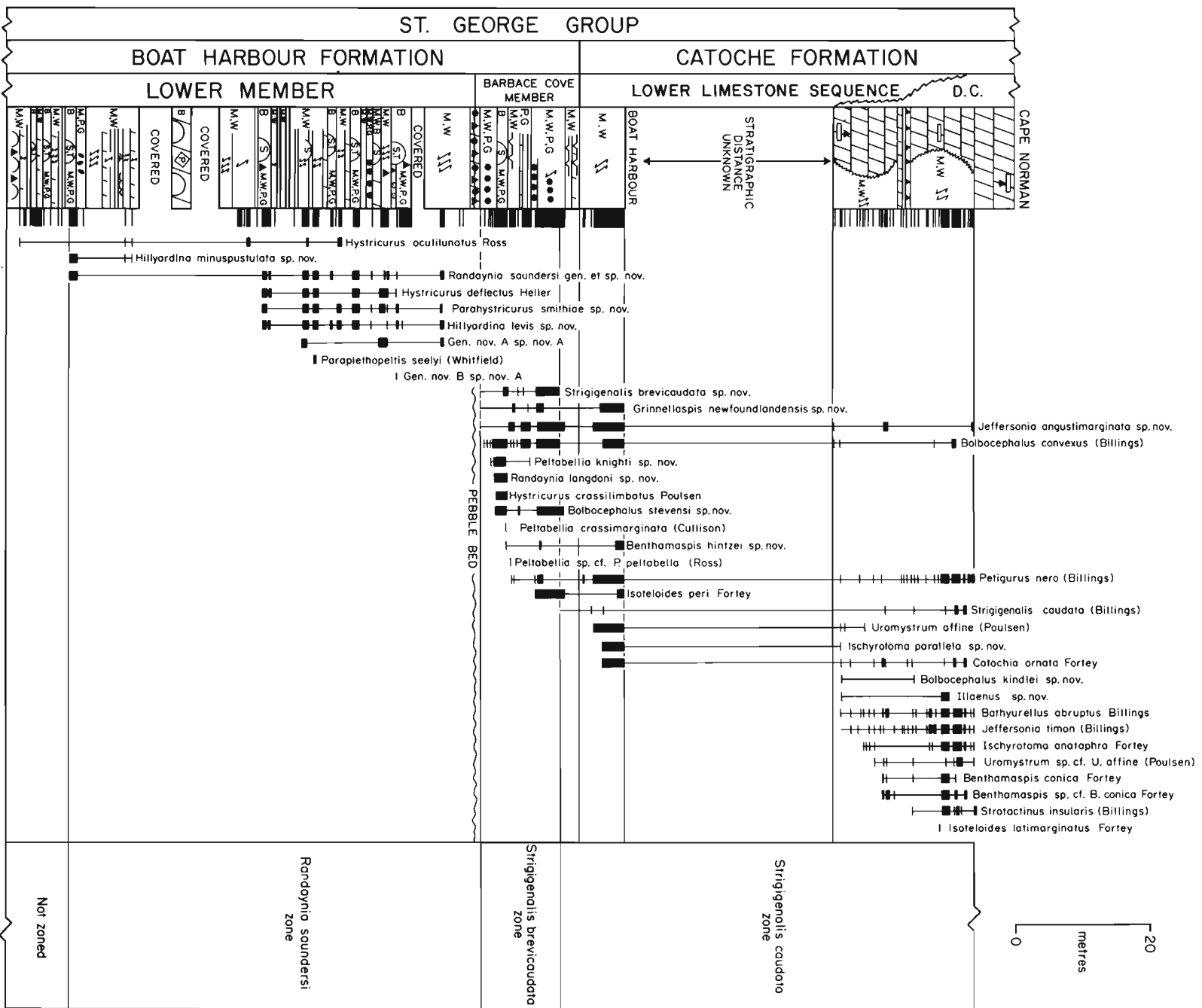


Figure 2. Biostratigraphic zonation of the Boat Harbour and Catoche formations (St. George Group) in the Boat Harbour—Cape Norman area (Boyce, in press).

IBEX, UTAH			WESTERN NEWFOUNDLAND									
FM.	TRILOBITE ZONES	CONODONT INTERVALS	FM.	MBR.	TRILOBITE ZONES	CONODONT FAUNAS	CEPHALOPOD ZONES					
FILLMORE	H	?Reutterodus andinus	CATOCHE	LOWER LIMESTONE SEQUENCE	Strigigenalis caudata Zone	Fauna 4	Cassinoceras wortheni					
		Oepikodus communis — "Microzarkodina" marathonensis										
	G <sub>2</sub>	Acodus deltatus						BOAT HARBOUR	B. C.	Strigigenalis brevicaudata Zone	Fauna 3	Pycnoceras apertum
		—								HIATUS		
	G <sub>1</sub>	Macerodus dianae	PEBBLE BED	LOWER MEMBER	Randaynia saundersi Zone	Fauna 2	Bassleroceras-Lecanospira					
	F	Glyptoconus quadruplicatus — aff. Solopodus rex			Not zoned	Not zoned						
	E											
	?											
	D											

Figure 3. Correlation of western Newfoundland trilobite zones, conodont faunas and cephalopod zones with the standard trilobite zones and conodont intervals of Ibex, Utah (Boyce, in press).

The lower bioturbated member (Knight, 1986) of the Catoche Formation yielded the following trilobites:

- Bathyurellus abruptus* Billings, 1865
- Benthamaspis hintzei* Boyce, in press
- Bolbocephalus convexus* (Billings, 1865)
- Isoteloides peri* Fortey, 1979
- Jeffersonia angustumarginata* Boyce, in press
- Petigurus nero* (Billings, 1865)

*Punka* sp. nov.  
*Uromystrum affine* (Poulsen, 1937)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Boat Harbour-Cape Norman area (Figure 2). It is also correlative with Ross-Hintze Zones G<sub>2</sub> to H and the lower part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

NORTH AMERICA				
SERIES	STAGES	TRILOBITE ZONES	CONODONT INTERVALS	
CANADIAN	CASSINIAN	H	? <i>Reutterodus andinus</i>	
			<i>Oepikodus communis</i>	
			— "Microzarkodina" marathonensis	
		G <sub>2</sub>		
			<i>Acodus deltatus</i>	
	JEFFERSONIAN			— <i>Macerodus diana</i>
		G <sub>1</sub>		
		F		
	DEMINGIAN		E	<i>Glyptoconus quadruplicatus</i>
			?	— aff. <i>Scolopodus rex</i>
		D		
IBEXIAN				

**Figure 4.** Correlation of stages of the Canadian Series and trilobite zones and conodont intervals of Ibex, Utah (Boyce, in press).

The middle mound member (Knight, 1986) of the Catoche Formation yielded the following:

*Bathyurellus abruptus* Billings, 1865  
*Bolbocephalus convexus* (Billings, 1865)  
*Illaeus* sp. nov.  
*Jeffersonia* sp. undet.  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)  
*Uromystrum affine* (Poulsen, 1937)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Boat Harbour—Cape Norman area (Figure 2). It is also correlative with Ross—Hintze Zones G<sub>2</sub> to H and the lower part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

The upper bioturbated member (Knight, 1986) of the Catoche Formation yielded the following trilobites:

*Bathyurellus platypus* Fortey, 1979  
*Illaeus* sp. nov.  
*Ischyrotoma anataphra* Fortey, 1979  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Boat Harbour—Cape Norman (Figure 2) and Eddies Cove West—Port au Choix (Boyce, 1986, Figure 2) areas. It is also correlative with Ross—Hintze Zones G<sub>2</sub> to H and the lower part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

#### Burnt Island, Pistolet Bay

On Burnt Island, detailed biostratigraphic sampling of the upper bioturbated and white limestone members (Knight, 1986) of the Catoche Formation was completed. Two sections were investigated. One was on the plateau on the west side of Burnt Island; the other was along the northwest shore.

Twenty-eight new macrofossil horizons were sampled in 1987 on Burnt Island, augmenting the eighteen collections made in 1985. The latter horizons were also resampled.

Altogether, forty-six collections have been made on Burnt Island for trilobites and conodonts. Of these, thirty were obtained from the plateau section. The remaining sixteen were obtained from the shoreline section. The plateau section was more intensely studied than the shoreline section because it was apparently the more fossiliferous of the two. Furthermore, Kindle (1945) and Johnson (1949) obtained their specimens from the plateau section. Figure 5 shows the composite lithostratigraphic and biostratigraphic section constructed from the plateau and shoreline sequences.

Johnson (1949, page 45) reported the following trilobite species from white limestone beds of the St. George Group exposed on the west side of Burnt Island:

*Bathyurellus fraternus* Billings, 1865—probably *Uromystrum affine* (Poulsen, 1937)  
*Bathyurus glandicephalus* Whitfield, 1890  
*Bolbocephalus* sp. 1—probably *Bolbocephalus convexus* (Billings, 1865)  
*Bolbocephalus* sp. 2—probably *Bolbocephalus kindlei* Boyce, in press  
*Gignopeltis rara* (Billings, 1865)  
*Illaeus fraternus?* Billings, 1865—probably *Illaeus* sp. nov.

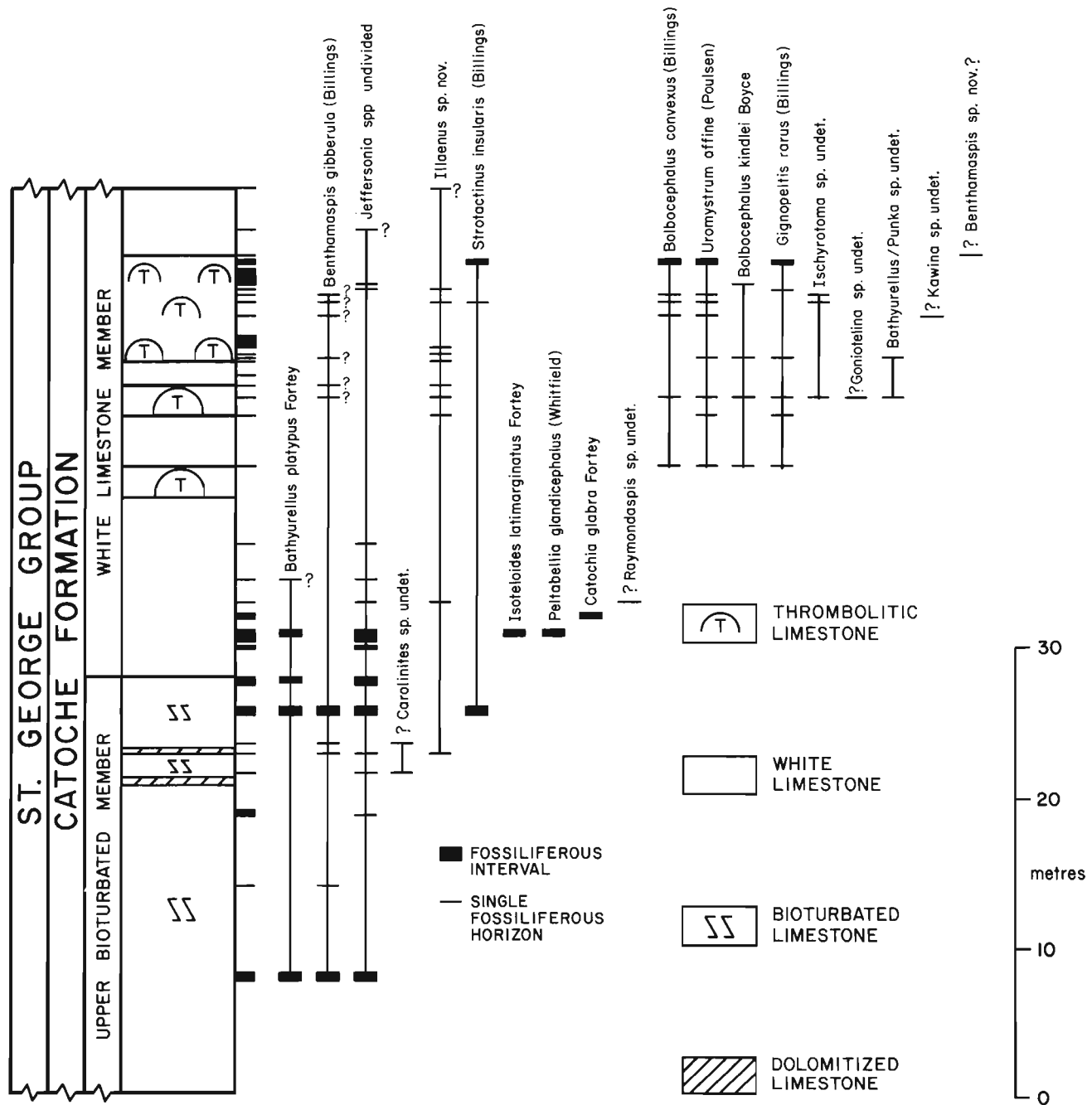


Figure 5. Composite lithostratigraphic and biostratigraphic section through the upper bioturbated and white limestone members of the Catoche Formation, western side of Burnt Island, Pistolet Bay.

*Jeffersonia timon* (Billings, 1865)

*Niobe?* sp.—possibly *Isoteloides latimarginatus* Fortey, 1979

*Onchonotus globosus* (Billings, 1860)—possibly *Ischyrotoma anataphra* Fortey, 1979

The upper bioturbated member of the Catoche Formation yielded the following trilobites:

*Bathyurellus platypus* Fortey, 1979  
*Benthamaspis gibberula* (Billings, 1865)

*Bolbocephalus kindlei* Boyce, in press

?*Carolinites* sp. undet.

*Illaeus* sp. nov.

*Isoteloides latimarginatus* Fortey, 1979

*Jeffersonia angustimarginata* Boyce, in press

*Jeffersonia timon* (Billings, 1865)

*Petigurus nero* (Billings, 1865)

*Strotactinus insularis* (Billings, 1865)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Boat Harbour–Cape Norman (Figure 2) and Eddies Cove West–Port au Choix (Boyce, 1986, Figure 2) areas. It is also correlative with Ross–Hintze Zones G<sub>2</sub> to H and the lower part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

The white limestone member of the Catoche Formation yielded the following trilobites:

- Bathyrellus platypus* Fortey, 1979
- Benthamaspis gibberula* (Billings, 1865)
- ?*Benthamaspis* sp. undet.
- Bolbocephalus convexus* (Billings, 1865)
- Bolbocephalus kindlei* Boyce, *in press*
- Gignopeltis rarus* (Billings, 1865)
- ?*Goniotelina* sp. undet.
- Iliaenus* sp. nov.
- Ischyrotoma* sp. undet.
- Isoteloides latimarginatus* Fortey, 1979
- Jeffersonia angustimarginata* Boyce, *in press*
- Jeffersonia timon* (Billings, 1865)
- ?*Kawina* sp. undet.
- Peltabellia glandicephalus* (Whitfield, 1890)
- ?*Punka* sp. undet.
- ?*Raymondaspis* sp. undet.
- Strotactinus insularis* (Billings, 1865)
- Uromystrum* sp. nov.
- Uromystrum affine* (Poulsen, 1937)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Eddies Cove West–Port au Choix area (Boyce, 1986, Figure 2). It is also correlative with Ross–Hintze Zones H to I and the upper part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

### Eddies Cove West

Biostratigraphic sampling of the Boat Harbour Formation (St. George Group) for trilobites and conodonts near Eddies Cove West (Figure 1) was completed in 1987. Addition of previously obtained biostratigraphic information (Boyce, 1983a, 1985) from there, and the Port au Choix Peninsula (Fortey, 1979; Boyce 1983a, 1985, 1986; Williams *et al.*, 1987) will finally allow the succession of St. George Group trilobite faunas of that area to be established.

## RECONNAISSANCE BIOSTRATIGRAPHIC WORK

### Pistolet Bay

On the south shore of Pistolet Bay, three fossiliferous limestone units were sampled in the vicinity of Triangle Point, near the old St. Anthony airport. These units occur in the upper part of the Middle Ordovician Goose Tickle Formation (L. Quinn, personal communication, 1987). Articulate brachiopods, echinoderms (eocrinoid columnals), ostracodes and one trilobite were obtained and remain to be identified.

### Hare Bay

Murray (*in Murray and Howley*, 1881) was the first worker to report Ordovician trilobites from Hare Bay. He reported the occurrence of the trilobite *Petigurus nero* (Billings, 1865). Since then, biostratigraphic investigations have been sporadic and little has been published.

Reconnaissance sampling of the Watts Bight, Boat Harbour, Catoche and Aguathuna formations (St. George Group) commenced in 1987 on the southern shore of the Brent Islands in Hare Bay. Twenty-six *previously unsampled* horizons in three sections yielded macrofossils. These were also sampled for conodonts. Another nineteen conodont samples were taken from horizons lacking macrofossils—chiefly in the Watts Bight and Boat Harbour formations.

The top of the Watts Bight Formation on South Brent Island yielded the trilobite *Parahystricurus* sp. cf. *P.* sp. I (Ross, 1951; Plate 17, Figures 1–3). In Utah, *Parahystricurus* sp. I occurs in Ross–Hintze Zone C (Ross, 1951).

Trilobites were recovered for the first time from the lower member of the Boat Harbour Formation on North Brent Island. The following trilobite species were collected:

- Hystricurus oculilunatus* Ross, 1951
- Leiostegium proprium* Boyce, *in press*
- Parahystricurus smithiae* Boyce, *in press*
- Paraplethopeltis seelyi* (Whitfield, 1889)

The fauna correlates with that of the *Randaynia saundersi* Zone of the Boat Harbour–Cape Norman area (Figure 2). It is also correlative with Ross–Hintze Zones E to F and the Demingian Stage of the Canadian Series (Figures 3 and 4).

The Barbace Cove Member of the Boat Harbour Formation on North Brent Island yielded the following trilobite species:

- Bolbocephalus convexus* (Billings, 1865)
- Bolbocephalus stevensi* Boyce, *in press*
- Grinnellaspis newfoundlandensis* Boyce, *in press*
- Isoteloides peri* Fortey, 1979
- Jeffersonia angustimarginata* Boyce, *in press*
- Peltabellia knighti* Boyce, *in press*
- Strigigenalis brevicaudata* Boyce, *in press*

The fauna correlates with that of the *Strigigenalis brevicaudata* Zone of the Boat Harbour–Cape Norman area (Figure 2). It is also correlative with Ross–Hintze Zone G<sub>2</sub> and the upper part of the Jeffersonian Stage of the Canadian Series (Figures 3 and 4).

Dr. R. A. Fortey of the British Museum (Natural History) identified the following trilobites from the basal beds of the Catoche Formation on North Brent Island (N.P. James, personal communication, 1979):

*Bolbocephalus convexus* (Billings, 1865)  
*Illaeus* sp.  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)

Boyce has also identified the following from collections obtained by Dr. R.K. Stevens (Memorial University of Newfoundland) from the Catoche Formation of Hare Bay:

*Bathyurellus abruptus* Billings, 1865  
 ?*Bolbocephalus* sp. undet.  
*Illaeus* sp. nov.  
*Ischyrotoma* sp. undet.  
*Jeffersonia* sp. undet.  
*Jeffersonia timon* (Billings, 1865)  
*Petigurus nero* (Billings, 1865)  
*Punka flabelliformis* Fortey, 1979  
*Strigigenalis* sp. undet.  
*Uromystrum* sp. cf. *U. affine* (Poulsen, 1937)

The above fauna correlates with that of the *Strigigenalis caudata* Zone of the Boat Harbour—Cape Norman area (Figure 2). It is also correlative with Ross—Hintze Zones G<sub>2</sub> to H and the lower part of the Cassinian Stage of the Canadian Series (Figures 3 and 4).

The Catoche Formation has also yielded trilobites at other localities in Hare Bay. Beds exposed at the community wharves in Main Brook have yielded *Jeffersonia timon* (Billings, 1865), *Petigurus nero* (Billings, 1865) and *Uromystrum* sp. cf. *U. affine* (Poulsen, 1937) have been collected on the north shore of Pradet Island (Boyce, *in Stouge*, 1981). *Petigurus nero* (Billings, 1865) has also been collected on Maria Island (Boyce, 1983b, *in press*).

The writers visited an important monospecific trilobite horizon in the Aguathuna Formation at Big Spring Inlet (south shore of Hare Bay). From there, Ross and James (1987), Williams *et al.* (1987) and Knight and James (1987) reported *Acidiphorus* sp. cf. *A. pseudobathyurus* Ross, 1967. However the only trilobite found at the locality in 1987 was the widespread western Newfoundland species *Bathyurus perplexus* Billings, 1865. The previous reports of *Acidiphorus* sp. cf. *A. pseudobathyurus* are therefore judged as misidentifications. *Bathyurus perplexus* Billings, 1865 probably indicates a Ross—Hintze Zone L (Early Whiterock) age (Williams *et al.*, 1987).

A sample for conodonts was also taken at the Big Spring Inlet *Bathyurus perplexus* horizon. Knight collected at least ten other samples for conodonts at Big Spring Inlet from the Catoche, Aguathuna and Table Point formations.

## SUMMARY

Ordovician trilobite faunas from the Boat Harbour and Catoche formations on Schooner Island and Burnt Island in Pistolet Bay range in age from Ross—Hintze Zone G<sub>2</sub> (Late Jeffersonian) to Zone I (Late Cassinian).

Newly discovered Ordovician trilobite faunas from the Brent Islands in Hare Bay range in age from Ross—Hintze Zone C (Late Gasconadian) to Zone H (Cassinian).

Previous reports of *Acidiphorus* sp. cf. *A. pseudobathyurus* Ross, 1967 from the Aguathuna Formation in Big Spring Inlet, Hare Bay represent misidentifications of *Bathyurus perplexus* Billings, 1865.

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*Note: Mineral Development Division file numbers are included in square brackets.*