

## NEW SILURIAN-DEVONIAN(?) FAUNAS FROM THE GANDER (NTS 2D/15) AND BOTWOOD (NTS 2E/3) MAP AREAS

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### ABSTRACT

Additional collections of bivalves from Careless Brook confirm an upper age limit of Late Silurian (Pridoli) to possibly Early Devonian (Gedinnian) for the Indian Islands Group there. Faunas from the Point Leamington Formation in the Botwood map area (NTS 2E/3) are indicative of a (late) Llandovery C<sub>3</sub> to C<sub>5</sub> (latest Aeronian to medial Telychian) age. The faunas in the Goldson Group at Martin Eddy Point and 'Martin Eddy Point South' are of (late) Llandovery C<sub>5</sub> to C<sub>6</sub> (medial to late Telychian) age. Species of Goniophora recovered from the Wigwam Formation (Botwood Group) near Lewisporte indicate a possible Late Silurian (Ludlow) to Early Devonian (Gedinnian) age for the unit, indicating a possible correlation with the Indian Islands Group along Careless Brook.

### INTRODUCTION

During the summers of 1992 and 1993, a number of important new post-Ordovician fossil localities were discovered by Drs. Tomasz Dec and W. Lawson Dickson, Messrs. David T.W. Evans, Robert Lane, Peter J. Tallman and Barry Wheaton, as well as the authors. These localities occur in the Point Leamington Formation, the Goldson Group, and the Wigwam Formation (Botwood Group) of the Gander (NTS 2D/15) and Botwood (NTS 2E/3) map areas. They have been extensively sampled in the hope of providing reasonable biostratigraphic ages. During the course of our investigations, several previously known localities were resampled, particularly those of Twenhofel and Shrock (1937), Shrock and Twenhofel (1939), and Williams (1962, 1972).

### GANDER (NTS 2D/15)

#### INDIAN ISLANDS GROUP

In 1993, the Careless Brook bivalve localities of Boyce *et al.* (1993) were reinvestigated (Figure 1). Three collections of macrofossils were obtained from sedimentary rocks of the Indian Islands Group of Williams (1993). These rocks were previously assigned to the Botwood Group (Blackwood, 1982; Boyce *et al.*, 1993). All collections were obtained upstream (west) of the logging road bridge, from buff- to rusty-yellow-weathering very fine to fine-grained sandstone exposed on the south side of the brook.

The easternmost and stratigraphically the lowest of the 1992 bivalve collections was obtained from a large, dislodged

block of yellow-weathering, flaggy, fine-grained micaceous sandstone. Because of high water levels, it was not resampled in 1993. However, the following taxa have been identified from the 1992 samples:

Arthropoda-?Eurypterida

Gen. et sp. undet. -- fragments

Mollusca-Bivalvia

*Cuneamyia arata* (Hall, 1860)

*Orthonota simulans* Billings, 1874

*Palaeoneilo attenuata* (Hall, 1860)

The remaining three bivalve localities are basically continuous with each other, and can probably be regarded as one; they are all developed in hard, massive, blocky-weathering fine-grained sandstone. These rocks represent the westernmost exposures of the Indian Islands Group along Careless Brook. Granite outcrops occur a short distance to the west.

The lowest of the three bivalve horizons has yielded only the ubiquitous *Cuneamyia arata* (Hall, 1860). Slightly higher, however, a more diverse fauna was collected, including the following:

Brachiopoda-Articulata

Gen. et sp(p). undet.

Echinodermata-Crinoidea

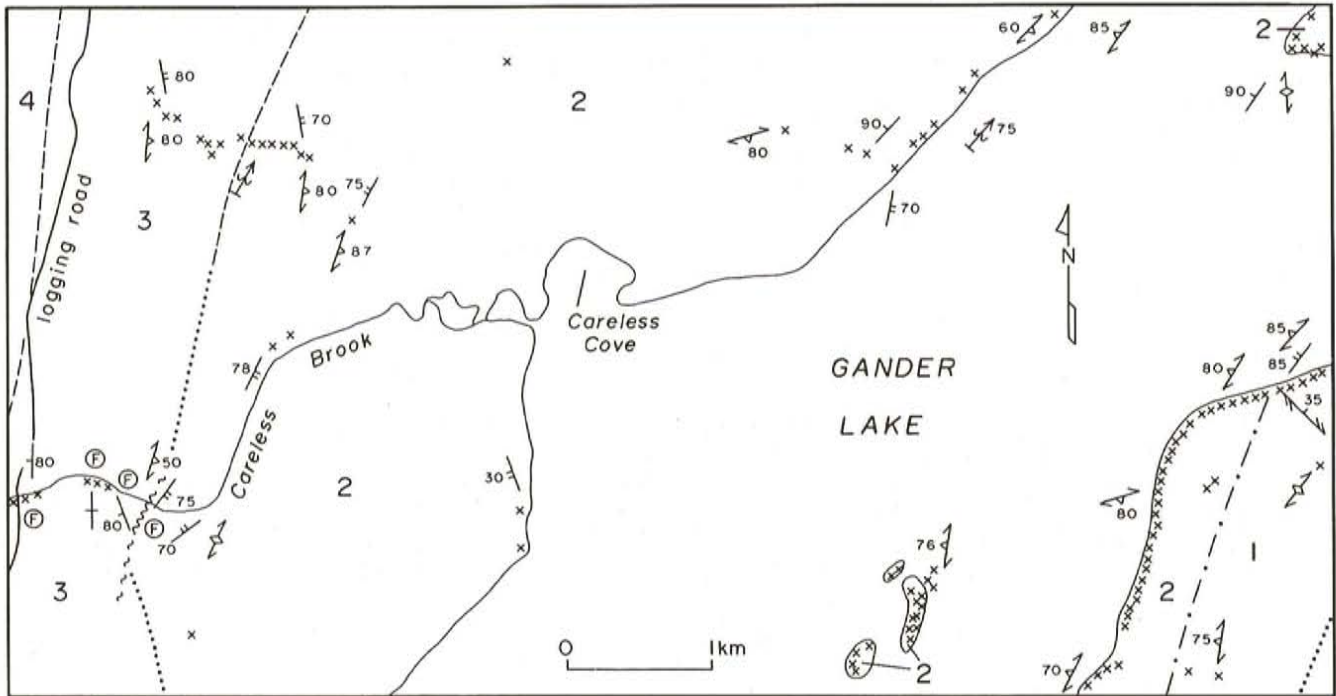
Gen. et sp. undet. -- columnals

Mollusca-Bivalvia

*Cuneamyia arata* (Hall, 1860)

*Goniophora consimilis* Billings, 1874

*Grammysia* sp. cf. *G. macadamensis* McLearn, 1924



**LEGEND**

**DEVONIAN**

4 Fine to medium grained, pink granite

**SILURIAN**

**INDIAN ISLANDS GROUP**

3 Grey sandstone, locally micaceous; minor fossiliferous calcareous beds

**MIDDLE ORDOVICIAN AND LATER**

**DAVIDSVILLE GROUP**

2 Fine- to coarse-grained sandstone, locally with shale intraclasts, interbedded with grey to black siltstone and shale

1 Grey to black slate and siltstone; minor red slate and minor sandstone

**SYMBOLS**

- Geological boundaries (approximate, assumed, gradational).....
- Fault (assumed).....
- Fossil locality..... (F)

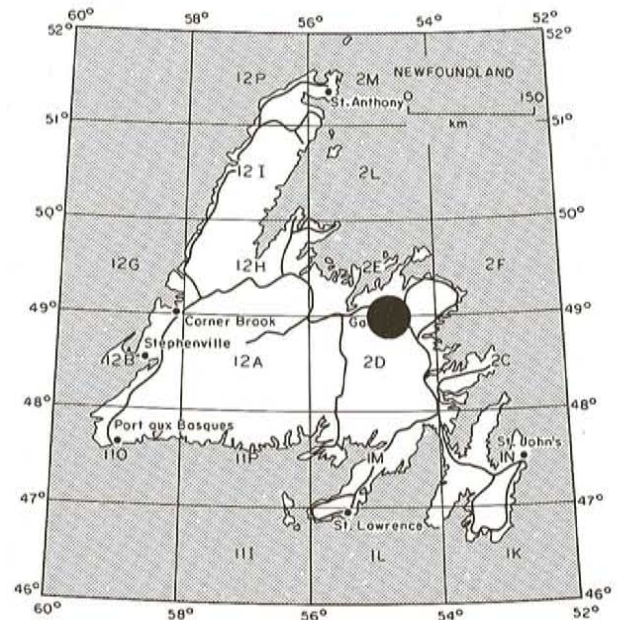


Figure 1. Location and simplified geology map of the Careless Brook area (after Blackwood, 1982); x = outcrop locations.

*Mytilarca amii* McLearn, 1924  
*Orthonota venusta* Billings, 1874  
*Palaeoneilo attenuata* (Hall, 1860)

Mollusca-Gastropoda  
 Gen. et sp. undet.

The westernmost and stratigraphically highest horizon yielded:

Arthropoda-Trilobita

*Homalonotus* / *Trimerus* sp. undet. -- 1 cranidium only

Brachiopoda-Articulata

Gen. et sp(p). undet.

Mollusca-Bivalvia

*Cuneameya arata* (Hall, 1860)

*Modiolopsis* sp. undet.

*Mytilarca amii* McLearn, 1924

*Orthonota venusta* Billings, 1874

Boyce *et al.* (1993, page 187) erroneously reported *Orthonota* ?*simulans* Billings, 1874 from this horizon; this represents a misidentification of *Orthonota venusta* Billings, 1874.

*Cuneameya arata* (Hall, 1860), *Goniophora consimilis* Billings, 1874, *Mytilarca amii* McLearn, 1924, *Orthonota simulans* Billings, 1874, *Orthonota venusta* Billings, 1874 and *Palaeoneilo attenuata* (Hall, 1860) all occur in the Stonehouse Formation of Arisaig, Nova Scotia (McLearn, 1924). The Stonehouse Formation ranges from latest Silurian (Prídolf) to earliest Devonian (Gedinnian) (Harper, 1973; Boucot *et al.*, 1974; Tansathien and Pickerill, 1989). *Goniophora consimilis* Billings, 1874 and *Grammysia macadamensis* McLearn, 1924 occur in the McAdam Brook Formation (Arisaig Group) of Ludlow age (Harper, 1973; Boucot *et al.*, 1974; Tansathien and Pickerill, 1989). In the Arisaig sequence, species of *Homalonotus* occur in the (latest Llandovery to Gedinnian) French River, Doctors Brook, McAdam Brook, Moydart and Stonehouse formations (McLearn, 1924; Harper, 1973; Boucot *et al.*, 1974; Tansathien and Pickerill, 1989).

*Goniophora consimilis* Billings, 1874 also occurs in the West Point Formation of Gaspé, Québec (Northrop, 1939).

On balance, the new collections of bivalves from Careless Brook confirm an upper age limit of Late Silurian (Prídolf) to possibly Early Devonian (Gedinnian) for the Indian Islands Group in this area.

## BOTWOOD (NTS 2E/3)

### POINT LEAMINGTON FORMATION

Fossils have been collected from four localities assigned by Dickson (Figure 2) to the Point Leamington Formation:

- 1) 'Bog Hill' (Locality LD93-0546 of Dickson, *this volume*: UTM 619820 5434460)
- 2) 'Leptaena Hill' (Locality LD93-0555 of Dickson, *this volume*: UTM 619000 5433800).
- 3) Norris Arm Railway Cut (Locality LD93-0549 of Dickson, *this volume*: UTM 618590 5433250)

- 4) Norris Arm Railway Woods (LD93-1236 of Dickson, *this volume*: UTM 618500 5433050)

### 'Bog Hill'

Deformed fossils were collected from well cleaved dark-blue grey siltstone, mudstone and/or slate exposed on a low hill, 200 m north of the abandoned Canadian National Railway line, and 5 km west of Rattling Brook (Locality LD93-0546 of Dickson, *this volume*: UTM 619820 5434460). This is the Jumpers Brook locality of Williams (1962, 1972), who assigned the rocks to the Botwood Group. Cumming (*in* Williams, 1962, page 9 and 1972, page 95) identified the following fossils from here:

Anthozoa-Rugosa

*Rhabdocyclus* sp.

Arthropoda-Trilobita

*Eophacops* sp. cf. *E. marklandensis* (McLearn, 1918)

Mollusca-Bivalvia

*Goniophora* or *Pterinea* sp.

Mollusca-Gastropoda

*Hormotoma* sp.

*Pleurotomaria* sp.

Brachiopoda-Articulata

*Leptaena rhomboidalis* (Wahlenberg, 1821)

*Parmorthis* sp. Schuchert and Cooper, 1931 <-- probably

*Resserella* sp.

*Pentamerus oblongus* Sowerby, 1839

This is also A. J. Boucot's 1965 U.S.N.M. Locality 12905, from which W. S. McKerrow collected (Boucot, written communication, 1993):

?*Resserella*

?*Pentamerus*

*Plectodonta* sp.

?*Howellella*

*Eospiriferid*

*Favositid*

Bryozoan

Trilobite

*Tentaculites*

During the summer of 1993, the authors obtained an extensive collection of deformed fossils from 'Bog Hill'. The following taxa have been identified:

Anthozoa-Rugosa

Gen. et sp. undet.

Anthozoa-Tabulata

*Favosites* sp. undet.

Arthropoda-Ostracoda

Gen. et sp. undet.

*Leperditia* sp. cf. *L. selwyni* Jones, 1891

Arthropoda-Trilobita

*Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939)

aulacopleurid gen. et sp. undet.

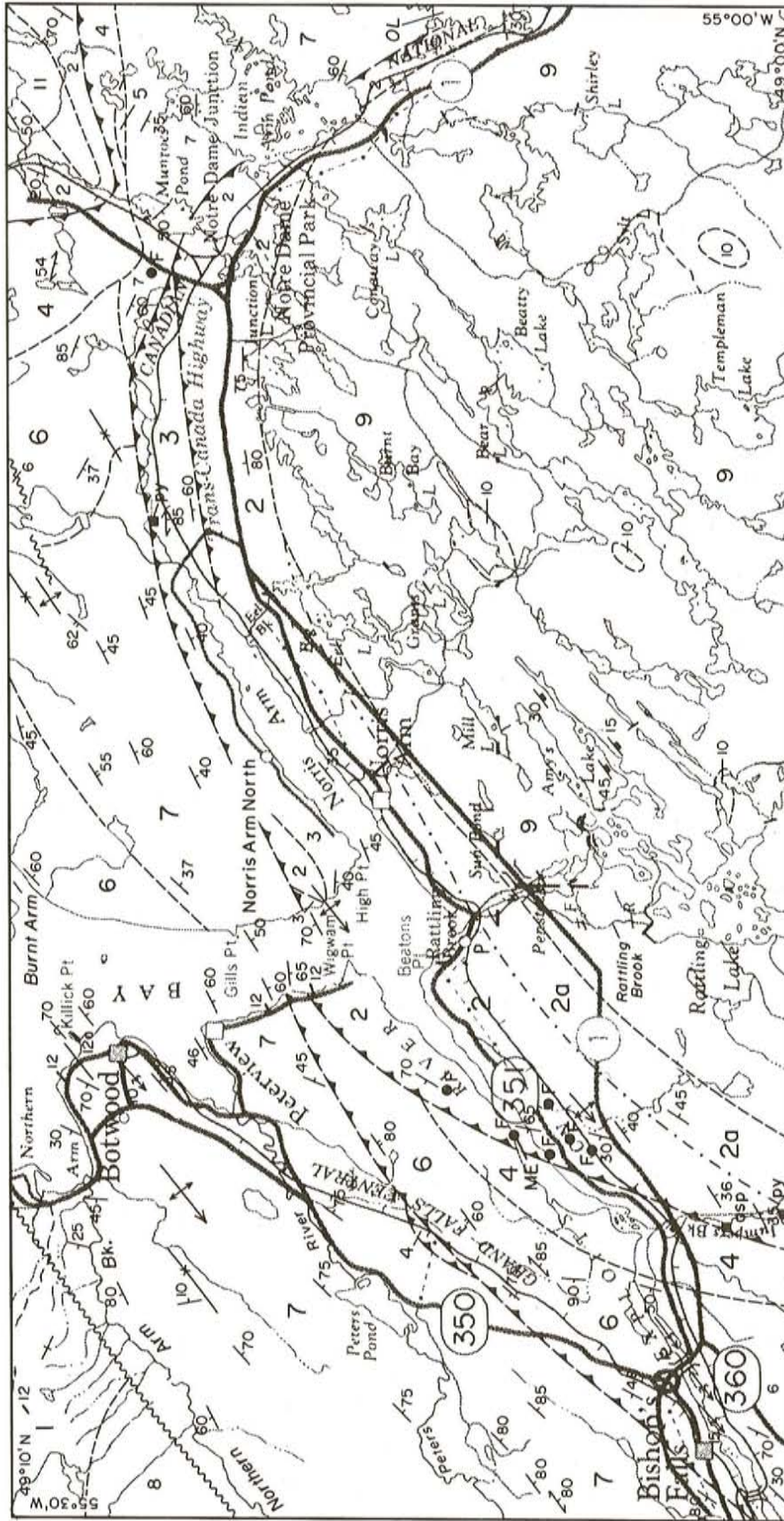
?*Bumastus* sp. undet.

*Calymene* sp. undet.

*Dalmanites* sp. undet.

*Encrinurus anticostiensis* Twenhofel, 1928

Brachiopoda-Articulata



- Fault
- Bedding (tops known, unknown)
- Gradational contact
- Cleavage
- Layering
- Anticline, Syncline
- Geological contact
- Minor fold
- Overturned bedding
- F Fossil locality
- asp Arsenopyrite
- py Pyrite
- ME Martin Eddy Point
- OL O'Brien Lake

## LEGEND

## SILURIAN OR YOUNGER

- 12 Massive, diabase dykes; 12a, composite diabase dykes

## SOUTHWEST BROOK GRANITE

- 11 Massive, alaskitic, biotite granite and minor granodiorite

## LLANDOVERY OR YOUNGER

## MOUNT PEYTON INTRUSIVE SUITE (Units 9 and 10)

- 10 Pink and cream, massive, medium- and fine-grained, equigranular, biotite  $\pm$  hornblende granite  
 9 Grey, massive, dominantly fine-grained, equigranular, pyroxene  $\pm$  biotite  $\pm$  hornblende gabbro; minor layered gabbro

## HODGES HILL INTRUSIVE SUITE

- 8 Grey and buff, massive, medium-grained, biotite  $\pm$  hornblende gabbro and hornblende—biotite granodiorite

## SILURIAN

## WENLOCK OR YOUNGER

## BOTWOOD GROUP (Units 4 to 7)

## Wigwam Formation (Units 6 and 7)

- 7 Red, thick-bedded, variably cleaved sandstone  
 6 Green-grey, medium-bedded, cleaved sandstone and minor felsic volcanic-clast conglomerate

## Lawrenceton Formation (Units 4 and 5)

- 5 Red, laharic breccia of felsic volcanic rocks, felsic-clast conglomerate and felsic tuff  
 4 Grey basalt, including plagioclase-porphyrific, amygdaloidal and massive flows and felsic tuff; minor red sandstone

## LLANDOVERY

## GOLDSON GROUP AND EQUIVALENTS

- 3 Green, grey and minor red, very thick-bedded to medium-bedded, cleaved, pebble conglomerate containing abundant chert and volcanic clasts and locally fossiliferous limestone clasts and interbedded with coarse-grained sandstone and minor siltstone

## LATE ORDOVICIAN AND EARLY SILURIAN

## ASHGILL TO LLANDOVERY

## Point Leamington Formation

- 2 Grey and green, medium- and thin-bedded, cleaved, locally fossiliferous greywacke, siltstone and conglomerate; 2a, black hornfels and contact migmatite

## MIDDLE ORDOVICIAN

## WILD BIGHT GROUP

- 1 Grey, fine-grained, basalt breccia and pillow breccia; minor felsic tuff

Figure 2. Geology map of the southern portion of the Borwood area showing fossil localities (after Dickson, this volume).

*Atrypa reticularis* (Linné, 1758)  
*Dalmanella* / *Resserella* sp.  
*Cyrtia* sp. undet.  
*Eospirifer radiatus* (Sowerby, 1839)  
 Gen. et sp. undet.  
*Howellella elegans* (Muir-Wood, 1925)  
*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823)  
*Pentamerus oblongus* Sowerby, 1839  
*Plectodonta* sp.

## Brachiopoda-Inarticulata

*Orbiculoidea* sp. undet.

## Bryozoa

Gen. et sp. undet.

## Echinodermata-Crinoidea

Gen. et sp. undet. -- columnals

## Mollusca-Bivalvia

Gen. et sp(p). undet. -- 2 species

## Mollusca-Gastropoda

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

Boyce *et al.* (1993, page 192) concluded that the fauna at this site was probably Llandovery C<sub>1</sub> to C<sub>2</sub> (latest Aeronian) in age, although it might be as young as Llandovery C<sub>5</sub> (medial Telychian) in age. This was mainly based on the earlier identification of *Eophacops* sp. cf. *E. markländensis* (McLearn, 1918), which the authors believe to be a misidentification of *Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939). The ostracode identified by the authors as *Lepeditia* sp. cf. *L. selwyni* Jones, 1891 is conspecific with that described and illustrated by Shrock and Twenhofel (1939) from the 'black argillite' of their Pike Arm Formation, exposed along the north side of Burnt Island, Goshens Arm, Notre Dame Bay (Twillingate-NTS 2E/10). According to Boyce *et al.* (1993, page 192), the Burnt Island fauna appears to be indicative of a Llandovery C<sub>3</sub> to C<sub>4</sub> (latest Aeronian to early Telychian) age (Table 1). The 'Bog Hill' fauna is assigned the same age, based on the presence of the identical ostracode species.

## 'Leptaena Hill'

This fossil locality was discovered by Mr. Barry Wheaton in 1993. The site is a low hill, 400 m south of Route 351, and 6 km west of Rattling Brook (Locality LD93-0555 of Dickson, *this volume*: UTM 619000 5433800). Deformed fossils were collected by the authors from the cleaved dark-blue grey siltstone and mudstone exposed on the hill. The following have been identified:

## Arthropoda-Trilobita

*Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939)

*Bumastus* sp.

*Encrinurus anticostiensis* Twenhofel, 1928  
 proetid gen. et sp. undet.

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

*Cyrtia exporrecta* (Wahlenberg, 1821)

*Eospirifer radiatus* (Sowerby, 1839)

Gen. et sp(p). undet.

*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823)

*Plectodonta* sp.

Brachiopoda-Inarticulata

*Orbiculoidea* sp.

Echinodermata-Crinoidea

Gen. et sp(p). undet.

Mollusca-Gastropoda

Gen. et sp. undet. -- only one specimen

From talus on the south side of the hill, the following taxa were recovered:

Arthropoda-Trilobita

Gen. et sp. undet.

Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823)

*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823) was by far the most common fossil at this site. Many of the trilobites and crinoids were partly articulated, indicating relatively undisturbed conditions. The fauna is correlated with that reported by Shrock and Twenhofel (1939, pages 245-246) from the 'fossiliferous argillite' of their Pike Arm Formation exposed on Fossil Arm, Pike Arm, New World Island (Twillingate-NTS 2E/10).

## Norris Arm Railway Cut

Fossils were only discovered at this site in 1993 by Dr. W.L. Dickson, despite its being along a major access route. The locality is a rock cut along the abandoned Canadian National Railway, 6.5 km west of Rattling Brook (Locality LD93-0549 of Dickson, *this volume*: UTM 618590 5433250). The rocks are predominantly light-grey to white and buff-weathering, massive- to planar-bedded fine-grained sandstones. The authors measured a stratigraphic section through just over 13 m of nearly continuous exposure on the southeast side of the railway cut. As a result, other fossiliferous levels were recorded below the discovery horizon.

The basal unit consists of 4.2 m of massive-bedded fine-grained sandstone. Thirty centimetres below the top, a 10- to 24-cm-thick interbed of dark-grey-weathering, light-grey coarse-grained pebbly sandstone yielded the following:

Anthozoa-Rugosa

Gen. et sp(p). undet.

Arthropoda-Trilobita

*Encrinurus anticostiensis* Twenhofel, 1928

?proetid gen. et sp. undet.

Brachiopoda-Articulata

Gen. et sp(p). undet.

Brachiopoda-Inarticulata

*Trimerella* sp. undet.

Echinodermata-Crinoidea

Gen. et sp(p). undet.

Mollusca-Gastropoda

Gen. et sp(p). undet. -- at least 3 species, including tightly coiled low spired form

Along strike, on the northwest side of the railway cut, the equivalent bed yielded:

**Table 1.** Correlation of faunas discussed in this paper

STANDARD SUBDIVISIONS OF THE SILURIAN SYSTEM		PORT AU PORT PENINSULA	SOPS ARM, WHITE BAY	BOTWOOD (2E/3)	GANDER (2D/15)	
Prídolf Series	(Stages not defined)	Clam Bank Formation				
Ludlow Series	Ludfordian Stage		Natlins Cove Formation (upper sandstone member)	Wigwam Formation (Botwood Group) Camp Emmanuel	Indian Islands Group Careless Brook	
	Gorstian Stage					
Wenlock Series	Homerian Stage		Natlins Cove Formation (Sops Arm volcanic member)			
	Sheinwoodian Stage					
Llandovery Series	Telychian Stage		C <sub>6</sub>	Natlins Cove Formation (lower sandstone member)		Goldson Group
			C <sub>5</sub>			Point Leamington Formation
		C <sub>4</sub>				
	Aeronian Stage	C <sub>1-3</sub>	Simms Ridge Formation			
		B <sub>3</sub>				
		B <sub>2</sub>				
	Rhuddanian Stage	B <sub>1</sub>				
		A <sub>4</sub>				
		A <sub>3</sub>				
	A <sub>2</sub>					

## Arthropoda-Trilobita

*Encrinurus anticostiensis* Twenhofel, 1928

## Brachiopoda-Articulata

Gen. et sp(p). undet.

*Leptaena* sp. cf. *L. rhomboidalis* (Wahlenberg, 1821)

## Brachiopoda-Inarticulata

*Trimerella* sp. undet.

## Echinodermata-Crinoidea

Gen. et sp(p). undet.

## Mollusca-Gastropoda

Gen. et sp(p). undet.

The basal unit is overlain in turn by 1.5 m of planar-bedded very fine-grained sandstone and/or siltstone. This is succeeded by 2.1 m of massive sandstone with two pebbly, fossiliferous layers, within which *Atrypa reticularis* (Linné, 1758) was seen but not collected. Above this unit is a covered interval of 2.1 m, which is overlain by 3.1 m of coarse-grained pebbly sandstone. This is the unit in which Dr. W.L. Dickson discovered fossils and from it, the authors have identified the following:

## Anthozoa-Rugosa

Gen. et sp(p). undet.

## Anthozoa-Tabulata

*Favosites* sp(p). undet.

*Halysites* sp(p). undet.

## Arthropoda-Trilobita

*Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939)

*Calymene* sp. cf. *C. niagarensis* Hall, 1843

*Encrinurus anticostiensis* Twenhofel, 1928

?proetid gen. et sp. undet. -- pygidium

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

*Dalmanella* / *Resserella* sp.

*Eospirifer radiatus* (Sowerby, 1839)

*Howellella elegans* (Muir-Wood, 1925)

*Leptaena* sp. cf. *L. rhomboidalis* (Wahlenberg, 1821)

## Brachiopoda-Inarticulata

*Orbiculoidea* sp.

*Trimerella* sp. undet.

## Bryozoa

Gen. et sp(p). undet. -- stick form

## Echinodermata-Crinoidea

Gen. et sp(p). undet.

## Mollusca-Bivalvia

Gen. et sp. undet.

## Mollusca-Gastropoda

*bellerophontid* sp. undet.

Gen. et sp(p). undet. -- at least 4 species, including tightly coiled low spired form, smooth high spired form, and 2 distinctive ornamented species.

## Porifera-Stromatoporoidea

Gen. et sp. undet.

Along strike, on the northwest side of the railway cut, the equivalent bed yielded:

## Arthropoda-Trilobita

*Encrinurus anticostiensis* Twenhofel, 1928

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

Gen. et sp(p). undet.

*Leptaena* sp. cf. *L. rhomboidalis* (Wahlenberg, 1821)

## Brachiopoda-Inarticulata

*Trimerella* sp. undet.

## Echinodermata-Crinoidea

Gen. et sp(p). undet.

## Mollusca-Gastropoda

Gen. et sp(p). undet.

The sequence is capped by 25 cm of massive, fine-grained sandstone.

The outcrop is notable for its relative abundance of gastropods and trimerellid brachiopods, which are rare to absent elsewhere. In fact, the major find here was the trimerellid brachiopods, which until they were identified by Dr. D.A.T. Harper (University of Galway) (personal communication, 1993), puzzled everyone. Because the fauna is stratigraphically higher than those of 'Bog Hill' and 'Leptaena Hill', a more likely age is Llandovery C<sub>5</sub> (medial Telychian) (Table 1).

## Norris Arm Railway Woods

Fossils were also discovered by Mr. D.T.W. Evans, Mr. R. Lane and Mr. P.J. Tallman in the woods 250 m southwest of and along strike with the railway-cut locality (LD93-1236 of Dickson, *this volume*: UTM 618500 5433050). Three closely spaced localities collectively yielded:

## Anthozoa-Rugosa

Gen. et sp. undet.

## Anthozoa-Tabulata

*Halysites* sp(p). undet.

## Arthropoda-Trilobita

*Calymene* sp. undet.

*Encrinurus anticostiensis* Twenhofel, 1928

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

Gen. et spp. undet. -- at least 2 species

*Howellella* sp. undet.

*Leptaena* sp. undet.

## Brachiopoda-Inarticulata

*Trimerella* sp. undet.

## Bryozoa

Gen. et sp. undet.

## Echinodermata-Crinoidea

Gen. et sp(p). undet.

## Mollusca-Gastropoda

Gen. et sp. undet. -- high spired form

The fauna above is interpreted to be exactly the same age as that exposed along the railway cut, as they are from equivalent beds along strike.

## GOLDSON GROUP

Fossils have been collected from two localities assigned by Dickson (*this volume*) to the upper part of the Goldson Group:

- 1) Martin Eddy Point (LD93-0786 of Dickson, *this volume*: UTM 618910 5435190)
- 2) 'Martin Eddy Point South' (Locality LD93-0808 of Dickson, *this volume*: UTM 618590 5434150)



*Martin Eddy Point*

Fossils were first reported from Martin Eddy Point (on the north side of Exploits River—LD93-0786 of Dickson, *this volume*: UTM 618910 5435190) by Murray and Howley (1881). Twenhofel and Shrock (1937, page 1755) subsequently measured the sequence of conglomerate and interbedded limy shale, siltstone and hard, greyish-blue argillite. Twenhofel and Shrock (1937, page 1755) and Shrock and Twenhofel (1939) reported the following fossils from both the boulders and matrix of the conglomerate:

## Anthozoa-Rugosa

*Zaphrentis* sp. cf. *Z. stokesi* Milne-Edwards and Haime, 1851

## Anthozoa-Tabulata

*Favosites gothlandicus* (Fought)  
*Favosites hisingeri* Milne-Edwards and Haime, 1854  
*Favosites* sp. cf. *F. pyriformis*  
*Halysites catenularius* (Linné, 1767)  
*Heliolites interstinctus* (Linné, 1767)

## Arthropoda-Ostracoda

*Leperditia* sp. and some small ostracodes

## Arthropoda-Trilobita

*Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939)  
*Dicranopeltis norrisensis* Shrock and Twenhofel, 1939  
*Encrinurus anticostiensis* Twenhofel, 1928

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)  
*Eocoelia hemisphaerica* (Sowerby, 1839)  
*Chonetes exploitensis* Shrock and Twenhofel, 1939  
*Lissatrypa atheroidea* Twenhofel, 1928  
*Mendacella uberis* (Billings, 1866)  
*Pentamerus oblongus* Sowerby, 1839  
*Resserella elegantula* (Dalman, 1828)  
*Rhyncotrete cuneata americana* Hall, 1879  
*Zygospira? exploitensis* Shrock and Twenhofel, 1939

## Bryozoa

*Hallopora?* sp.

## Echinodermata

Echinoderm columnals, probably crinoidal

## Mollusca-Gastropoda

*Diaphorostoma?* sp.  
*Pleurtomaria* sp.

## Porifera-Stromatoporoidea

*Clathrodictyon vesiculosum* Nicholson and Murie, 1892

## Trace Fossils

Fucoids, probably algal  
 Worm? tubes

Cumming (*in* Williams, 1962, page 9) and Boucot (*in* Williams, 1972, page 95) subsequently identified the following from limestone pebbles in conglomerate:

## Anthozoa-Rugosa

*Zaphrentis* sp.

## Anthozoa-Tabulata

*Favosites* sp. cf. *F. gothlandicus* (Fought)

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)  
 ?*Dalmanella* sp.  
*Resserella* sp. cf. *R. elegantula* (Dalman, 1828)

## Mollusca-Bivalvia

*Nuculites* sp.

From grey shale interbedded with the conglomerate, Cumming (*in* Williams, 1962, page 9) also identified the following fossils:

## Anthozoa-Rugosa

*Zaphrentis* sp.

## Arthropoda-Trilobita

*Octobronteus* sp.

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)  
 ?*Idiorthis* sp.

During the summer of 1990, the authors accompanied Dr. B.H. O'Brien and Mr. E. Wheaton to Martin Eddy Point. The fossils collected were re-examined in 1993. The following have been identified:

## Anthozoa-Rugosa

*Zaphrentis* sp.

## Arthropoda-Trilobita

*Acernaspis newfoundlandensis* (Shrock and Twenhofel, 1939)  
*Encrinurus anticostiensis* Twenhofel, 1928

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)  
*Pentamerus oblongus* Sowerby, 1839  
*Resserella elegantula* (Dalman, 1828)

## Echinodermata

Echinoderm columnals, probably crinoidal

## Hemichordata-Graptolithina

Gen. et sp. undet.

## Mollusca-Bivalvia

*Tancrediopsis* sp. cf. *T. altistriata* McLearn, 1924

## Mollusca-Cephalopoda

Gen. et sp. undet.

## Mollusca-Gastropoda

*Diaphorostoma?* sp.  
*Pleurtomaria* sp.

The bivalve *Tancrediopsis altistriata* McLearn, 1924 occurs in McLearn's 'zone d' of the Ross Brook Formation (Arisaig Group). Boucot *et al.* (1974, pages 6-7; Table 1) indicated a Llandovery C<sub>6</sub> age for this 'zone'.

Boyce *et al.* (1993, page 192) concluded that the Martin Eddy Point fauna was probably Llandovery C<sub>3</sub> to C<sub>5</sub> (latest Aeronian to medial Telychian) in age. Because of the presence of *Tancrediopsis* sp. cf. *T. altistriata* McLearn, 1924, and the fact that the fauna stratigraphically overlies that of 'Bog Hill' and 'Leptaena Hill', a more likely age is Llandovery C<sub>5</sub> to C<sub>6</sub> (medial to late Telychian) (Figure 3).

*'Martin Eddy Point South'*

One kilometre southwest of Martin Eddy Point, on the south side of the Exploits River (Locality LD93-0808 of Dickson, *this volume*: UTM 618590 5434150), fossils were discovered by Dr. W.L. Dickson in sandstone and pebbly conglomerate. At the northeast end of the outcrop, the authors obtained the following from pebbly conglomerate:

## Anthozoa-Rugosa

Gen. et sp(p). undet.

## Anthozoa-Tabulata

*Favosites* sp. undet.*?Halysites* sp. undet.

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

Gen. et sp(p). undet.

*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823)

## Echinodermata-Crinoidea

Gen. et sp(p). undet. -- columnals

At the southwest end of the outcrop, the following were collected:

## Anthozoa-Rugosa

Gen. et sp(p). undet.

## Anthozoa-Tabulata

*Favosites* sp. undet.*Halysites* sp. undet.

## Arthropoda-Trilobita

*Calymene* sp.

## Brachiopoda-Articulata

*Atrypa reticularis* (Linné, 1758)

Gen. et sp(p). undet.

*Leptaena* sp. cf. *L. depressa* (Sowerby, 1823)

## Bryozoa

Gen. et sp. undet.

## Echinodermata-Crinoidea

Gen. et sp(p). undet. -- columnals

## ?Porifera-Stromatoporoidea

Gen. et sp. undet. -- may actually be algal mat

The beds exposed here lie directly along strike with those exposed at Martin Eddy Point. Consequently, they are interpreted to be the same age.

## WIGWAM FORMATION

Fossils have been collected from one locality assigned by Dickson (*this volume*) to the Wigwam Formation:

- 1) Camp Emmanuel (Locality LD93-0124 of Dickson, *this volume*: UTM 639640 5444450)

*Camp Emmanuel (Emmanuel Convention Centre)*

In 1992, Dr. T. Dec discovered fossils in red sandstone of the Wigwam Formation (Botwood Group), exposed on the east side of Camp Emmanuel, 2 km north of Notre Dame Junction, Route 340 (UTM 639640 5444450). These fossils were collected by Dr. B.H. O'Brien, who brought them to our attention in the spring of 1993. The fossils turned out to be poorly preserved bivalves but had the potential of dating the Wigwam Formation. On August 10, 1993, four fossiliferous horizons within an interval of 8 m were found. The horizons ranged in thickness between 1.5 and 15 cm. The following have tentatively been identified:

## Mollusca-Bivalvia

*Goniophora consimilis* Billings, 1874*Goniophora transiens* Billings, 1874

Both of the above species occur in the Stonehouse Formation (Arisaig Group) of Arisaig, Nova Scotia (McLearn, 1924). The Stonehouse Formation ranges from latest Silurian

(Prídolí) to earliest Devonian (Gedinnian) in age (Harper, 1973; Boucot *et al.*, 1974; Tansathien and Pickerill, 1989). However, *Goniophora consimilis* Billings, 1874 also occurs in the underlying McAdam Brook Formation of Ludlow age (McLearn, 1924; Harper, 1973; Boucot *et al.*, 1974; Tansathien and Pickerill, 1989). The Wigwam Formation at this locality is therefore tentatively dated as being anywhere from Late Silurian (Ludlow) to Early Devonian (Gedinnian) in age. This indicates a possible correlation with the bivalve faunas of the Indian Islands Group at Careless Brook (this report).

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## REFERENCES

- Blackwood, R.F.  
1982: Geology of the Gander Lake (2D/15) and Gander River (2E/2) area. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 82-4, 56 pages.
- Boucot, A.J., Dewey, J.F., Dineley, D.J., Fletcher, R., Fyson, W.K., Griffin, J.G., Hickox, C.F., McKerrow, W.S. and Ziegler, A.M.  
1974: Geology of the Arisaig area, Antigonish County, Nova Scotia. Geological Society of America, Special Paper 139, 191 pages.
- Boyce, W.D., Ash, J.S. and Dickson, W.L.  
1993: The significance of a new bivalve fauna from the Gander map area (NTS 2D/15) and a review of Silurian bivalve-bearing faunas in central Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 93-1, pages 187-194.

- Dickson, W.L.  
*This volume*: Geology of the southern portion of the Botwood map area (NTS 2E/3), north-central Newfoundland.
- Harper, C.W., Jr.  
1973: Brachiopods of the Arisaig Group (Silurian-Lower Devonian) of Nova Scotia. Geological Survey of Canada, Bulletin 215, 163 pages.
- Murray, A. and Howley, J.P.  
1881: Report for 1871. *In* Geological Survey of Newfoundland. Edward Stanford, London, 536 pages.
- McLearn, F.H.  
1924: Palaeontology of the Silurian rocks of Arisaig, Nova Scotia. Geological Survey of Canada, Memoir 137, 180 pages.
- Northrop, S.A.  
1939: Paleontology and stratigraphy of the Silurian rocks of the Port Daniel-Black Duck region, Gaspé. Geological Society of America, Special Paper 21, 302 pages.
- Shrock, R.R. and Twenhofel, W.H.  
1939: Silurian fossils from northern Newfoundland. *Journal of Paleontology*, Volume 13, pages 241-266.
- Tansathien, W. and Pickerill, R.K.  
1989: The Siluro-Devonian Arisaig Group of Nova Scotia. Geological Association of Canada, Canadian Paleontology and Biostratigraphy Seminar (Dartmouth, 1989), Field Trip Guide Book, 36 pages.
- Twenhofel, W.H. and Shrock, R.R.  
1937: Silurian strata of Notre Dame Bay and Exploits Valley, Newfoundland. Geological Society of America Bulletin, Volume 48, pages 1743-1772.
- Williams, H.  
1962: Botwood (west half) map-area, Newfoundland (2E W1/2). Geological Survey of Canada, Paper 62-9, 16 pages.  
  
1972: Stratigraphy of the Botwood map-area, northeastern Newfoundland. Geological Survey of Canada, Open File Report 113, 103 pages.  
  
1993: Stratigraphy and structure of the Botwood Belt and definition of the Dog Bay Line in northeastern Newfoundland. *In* Current Research, Part D. Geological Survey of Canada, Paper 93-1D, pages 19-27.