

## A new Lower Silurian fossil locality in the northeastern Mascarene-Nerepis Belt, southern New Brunswick

*S.R. McCutcheon\* and A.J. Boucot\*\**

*\*Department of Natural Resources, Geological Surveys Branch  
P.O. Box 1519, Sussex, N.B. E0E 1P0*

*\*\*Department of Geology, Oregon State University  
Corvallis, Oregon 97331*

A new fossil locality from the northeastern part of the Mascarene-Nerepis Belt, previously mapped as "Ordovician or Silurian", gives a precise Llandoveryian C5 age. It occurs in a sedimentary sequence that underlies, and in part is laterally equivalent to, volcanic rocks of the Long Reach Formation. It establishes an approximate upper age limit to the Queen Brook Formation and is about the same age as the oldest fossiliferous rocks (Back Bay and Quoddy Formations) in the southwestern Mascarene-Nerepis Belt.

Un nouveau site fossilifère, daté avec précision comme Llandoveryien C5, a été découvert dans la partie nord-est de la zone Mascarene-Nerepis autrefois cartographiée comme "Ordovicien ou Silurien". Le site fait partie d'une séquence de roches sédimentaires qui sont recouvertes par des roches volcaniques appartenant à la Formation de Long Reach, et auxquelles elles sont également en partie équivalentes. Cette découverte précise la limite supérieure de l'âge de la Formation de Queen Brook et correspond à peu près à l'âge des plus anciennes roches fossilifères (Formations de Back Bay et de Quoddy) de la partie sud-ouest de la zone Mascarene-Nerepis.

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### INTRODUCTION

The discovery of a new Upper Llandoveryian, C5 age, fossil locality in the northeastern part of the Mascarene-Nerepis Belt of southern New Brunswick has resulted in a reinterpretation of the stratigraphy of this area. The purpose of this note is to report this discovery and to discuss its implications.

#### Northeastern Mascarene-Nerepis Belt

The Mascarene-Nerepis Belt, named by Ruitenberg (1972), is bounded by the Pendar Brook, St. George and Belleisle Faults (Fig. 1). Most of the northeastern part of the Mascarene-Nerepis Belt is shown on the provincial geology map of Potter et al. (1979) as "Ordovician" (C<sub>1</sub>), "Silurian" (S), and "Ordovician and/or Silurian" (OS<sub>1</sub>), sedimentary and volcanic rocks. It is now known that this northeastern part is composed mainly of three

formations: the Queen Brook, Long Reach and Jones Creek Formations (Table 1).

The Queen Brook Formation (SQ on Fig. 1), a new unit described by McCutcheon and Ruitenberg (1984), comprises part of MacKenzie's (1964) "Dark Argillite Division", a name that since has been abandoned (Ruitenberg and Ludman 1978). It is characterized by light to dark greenish grey, dusky green, and locally, dusky purple, thinly bedded siltstone and fine-grained sandstone. No fossils have been found in the unit to date but in the type area it is conformably overlain by the Long Reach Formation.

The Long Reach Formation (SL<sub>1</sub> on Fig. 1), named by MacKenzie (1964), is mainly a mafic volcanic unit, that commonly has a distinctive magnetic signature. It is either dominated by massive flows and breccias (massive facies) or hyalotuffs and interbedded sedimentary rocks (tuff facies). These two contrasting facies grade into one another along strike.

TABLE I

## Stratigraphic column for the northeastern part of the Mascarene-Nerepis Belt

System/Series	Formation or Map Unit	Lithology
Upper Silurian (Pridoli-Ludlow?)	Jones Creek Fm. 2000 m +	Greenish grey, thinly bedded, very fine-grained sandstone interbedded with dark greenish grey to dusky green siltstone; abundantly fossiliferous particularly toward the top of the unit; red and grey, flow-banded, massive to porphyritic dacite
Gradational contact with Jones Creek Formation		
Lower and Upper Silurian (Llandovery C6-Ludlow?)	Long Reach Fm. 800 m ±	Green and purple mafic flows, breccia, hyalotuff and tuff, locally with minor intercalated limestone; felsic volcanic rocks; greenish grey and dark grey to black, rusty weathering, thinly bedded, fine-grained sandstone and interbedded siltstone
Contact concealed but probably conformable with Long Reach Fm.		
(Llandovery C5)	Unnamed Unit (unit Ss)	Greenish grey and dark grey to black, rusty weathering, thin to very coarse grained sandstone and interbedded siltstone; polymictic, granule to pebble conglomerate
Conformable and locally disconformable (?) contact with Long Reach Fm.		
Lower Silurian and Ordovician?	Queen Brook Fm. (new name) 800 m ±	Dark greenish grey plus minor dusky purple, thinly bedded siltstone and dusky green, greenish grey to greyish green, very fine grained sandstone. Minor fine- to very coarse-grained sandstone and dark greenish grey to greenish black siltstone with thin, very fine-grained, greenish grey sandstone
Fault contact with unnamed unit		
Ordovician?	Unnamed Unit	Dark grey to black, rusty weathering, fine- to medium-grained lithic sandstone, siltstone and graphitic slate

The massive facies of the Long Reach Formation locally exhibits oxidized flow tops indicating that parts of the volcanic pile were subaerially exposed. In places minor limestone is intercalated in the upper part of the massive facies and these rocks and the associated hyalotuffs are generally fossiliferous. It is in these beds that the previously known fossil localities occur (MacKenzie 1964; Boucot et al. 1966; Porter 1973). The Long Reach Formation faunas at these localities are of Late Llandoveryan, C6 to Wenlockian age.

The tuff facies of the Long Reach For-

mation is typically hyalotuff and is interbedded with parallel-laminated, dark bluish grey to greenish black siltstone, and thinly-bedded medium grey to dark greenish grey, fine-grained sandstone. Pillow basalts occur locally. Limestone and evidence of subaerial exposure are absent. The new fossil locality occurs in sedimentary rocks that are, in many respects, similar to the ones in the Long Reach Formation, but they apparently underlie the volcanic pile. The Long Reach Formation is conformably overlain by the Jones Creek Formation.

The Jones Creek Formation (SJ on Fig.

l) is typically thinly interbedded, greenish grey, very fine-grained sandstone and dark greenish grey to dusky green siltstone. In the type area a felsic volcanic member, Bacon Lake Dacite (McCutcheon and Ruitenberg 1984) divides the formation into lower and upper sedimentary members. The upper member appears to be more abundantly fossiliferous than the lower one. The fauna in these rocks indicates a Pridolian age (Boucot, in Berry and Boucot 1970). The Jones Creek Formation, unlike the other two units, is restricted to the area southwest of the Saint John River (Fig. 1).

**The New Locality**

The new locality is situated northeast of the Saint John River (Figs. 1 and 2). The fossil-bearing outcrop, a small, easily overlooked exposure, lies in the bed of Henderson Brook, 200m north of the Irish Settlement Road (Long. 65°43'02", Lat. 45°46'57"). This outcrop is part of a

lithologically distinct sedimentary unit ( $S_s$  on Fig. 2) that underlies Long Reach volcanics.

The rocks in the  $S_s$  unit (Fig. 2) consist of medium grey to dark greenish grey, fine-grained sandstone and greenish black siltstone interbedded with coarse-grained sandstone and granule to pebble conglomerate. Characteristically these rocks have rusty weathered surfaces except for the conglomerates which, in places, have a white to light grey weathered surface.

The lithologic character of the  $S_s$  rocks makes their recognition easy but a paucity of outcrop (Fig. 2) does not permit a reconstruction of the original stratigraphic section. Therefore, the exact position of the fossil-bearing rocks within this sequence is unknown. The contact between unit  $S_s$  rocks and Long Reach volcanics to the north is interpreted to be conformable based upon field relationships southwest of this locality.

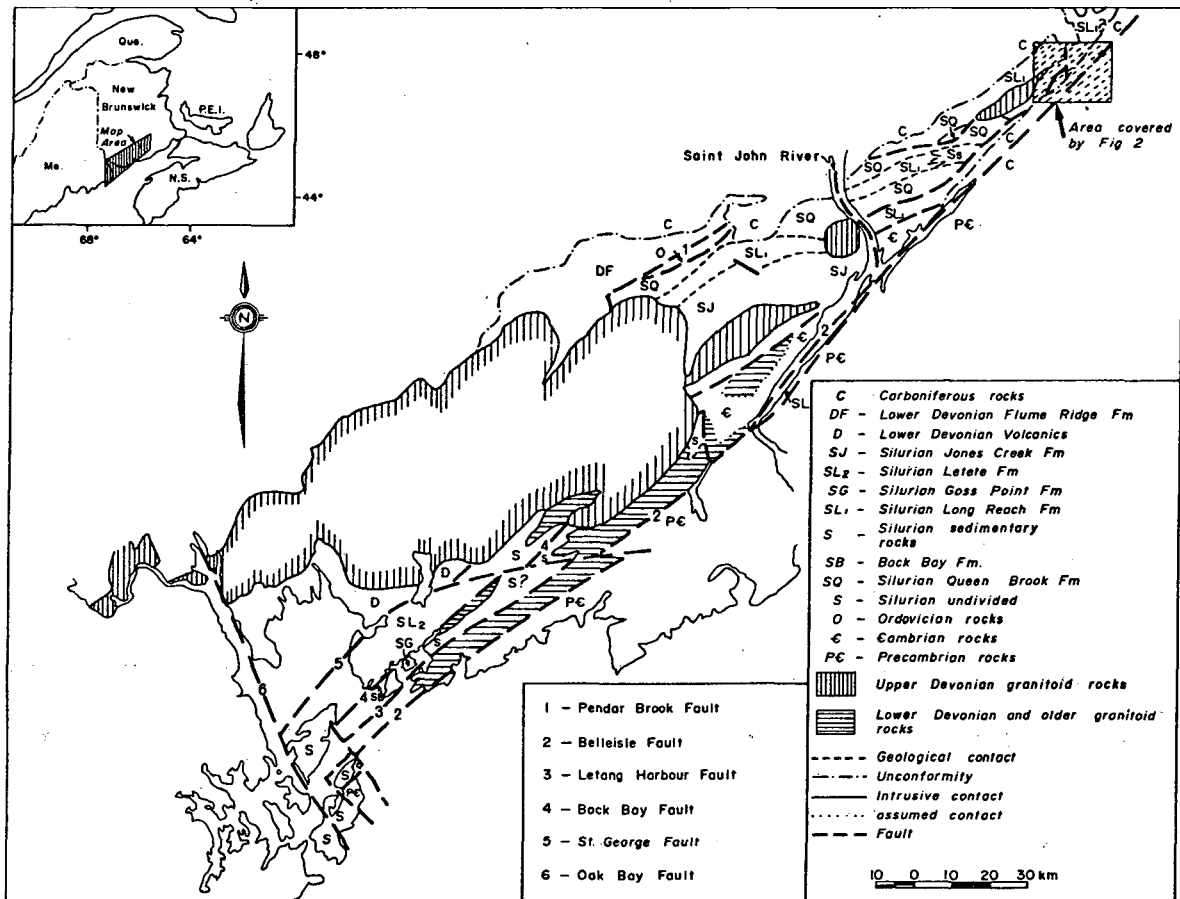


Fig. 1 - Location map and generalized geology of the Mascarene-Nerepis Belt.

TABLE 2

## Stratigraphic column for the southwestern part of the Mascarene-Nerepis Belt

System/Series	Formation or Map Unit	Lithology
Upper Silurian (Pridoli)	Letete Fm. 4760 m	Member C: grey siltstone, quartz wacke, lithic and crystal tuff. Member B: rhyolitic ash flows and lava flows, agglomerate, crystal tuffs, and grey siltstone. Member A: grey quartz wacke, siltstone, rhyolite and intermediate tuff in lower part; grey siltstone, agglomerate, andesitic tuffs and flows, crystal tuffs in upper part.
		fault contact
	Unnamed Volcanic wacke 50 m	Tan to purple, green, volcanic wacke, quartz wacke, siltstone; polymict conglomerate (with clasts of limestone).
		fault contact
	Unnamed Tuff 250 m	Dark green andesitic tuff; some parts of tuff are polymict lithic tuff with very poor sorting in some layers; on north shore Letang Harbour, andesitic lava flows.
Lower and Upper Silurian Late Llandovery to Ludlow	Goss Point Fm. 850 m	Member C: calcareous siltstone, shale. Member B: quartz arenite, quartz wacke, quartz pebble conglomerate, siltstone. Letang Limestone Member A: limestone and dolomitic limestone, green calcareous siltstone and shale
	Unnamed Tuff and Agglomerate 300 m	Dark green andesitic tuff with orange rhyolite clasts; generally coarse-grained; and grades upward into calcareous siltstone
		fault contact
Lower Silurian (Llandovery C4-6)	Back Bay Fm. 300 m.	Quartz wacke, arenite and siltstone at base; polymict lithic tuff and agglomerate; grey calcareous siltstone, basalt flow, quartz wackes, green and red sedimentary polymict breccia in upper part

### Age of the Henderson Brook Fossil Locality

A fossil collection from this locality yielded the following taxa:

*Stricklandia lens ultima* (31 specimens)  
*Eocoelia curtisi* (128 specimens)  
*Protomegastrophia* (15 specimens)  
 "Dolerorthis" flabellites (3 specimens)  
*Resserella?* sp. (2 specimens)  
*Atrypa "reticularis"* (9 specimens)  
*Pentameroides* sp. (47 brachial valves; 75 pedicle valves, including 6 with Ziegler's blisters)  
 poleumitid gastropod (rare)

other gastropods (rare)  
*Tentaculites* sp. (rare)  
 trilobite fragment (rare)  
*Porpites porpita* (2 specimens)  
 other tetracorals (rare)

The presence of *Eocoelia curtisi* and *Stricklandia lens ultima*, plus *Porpites porpita* indicates a C5, Late Llandoveryan age. *E. curtisi* is restricted to the C5 interval, *S. lens ultima* occurs no higher than C5, and *Porpites porpita* no lower than C5.

**Correlation with Southwestern Mascarene-Nerepis Belt**

Table 2 shows the stratigraphic section, as determined by Donohoe (1978), for the southwestern part of the Mascarene-Nerepis Belt. Some of Donohoe's units have close correlatives in the northeastern part of the belt. For example, the Back Bay Formation contains quartz arenites that are lithologically similar to unit S<sub>s</sub> rocks and contains fossils indicating a Llandoveryan C4 to C6 age. Also, the "unnamed tuff" units and the Goss Point Formation contain fossils that are Llandoveryan C4 to Ludlovian in age (Noble in Helmstaedt 1968). This compares very favourably with the Llandoveryan C6 to Wenlockian age fossils obtained from limestone in the middle part of the Long Reach Formation.

The Letete Formation is anomalously thick compared to the thickness estimates for the units in the northeastern Mascarene-Nerepis Belt (Table 1). This could be accounted for if the lower part of Member A actually includes Long Reach equivalent rocks. This is suggested because part of Member A has a distinct

magnetic signature (GSC Map 7037 G), a feature that it shares with much of the Long Reach Formation.

**Significance of the New Fossil Locality**

This new locality is important for the following reasons:

- 1) To date it is the only locality in the Mascarene-Nerepis Belt that lies northeast of the Saint John River. More importantly it gives a precise Llandoveryan C5 age, which is the only paleontologic control on the age of the rocks in this area.
- 2) This fossil locality is older than any previously reported (Llandoveryan C6) from the northeastern Mascarene-Nerepis Belt and it is as old as the oldest known rocks in the southwestern Mascarene-Nerepis Belt (Llandoveryan C4 to C6).
- 3) The fossil locality occurs in a sedimentary sequence that is believed to be conformably overlain by Long Reach volcanics. This establishes an approximate upper age limit for the Queen Brook For-

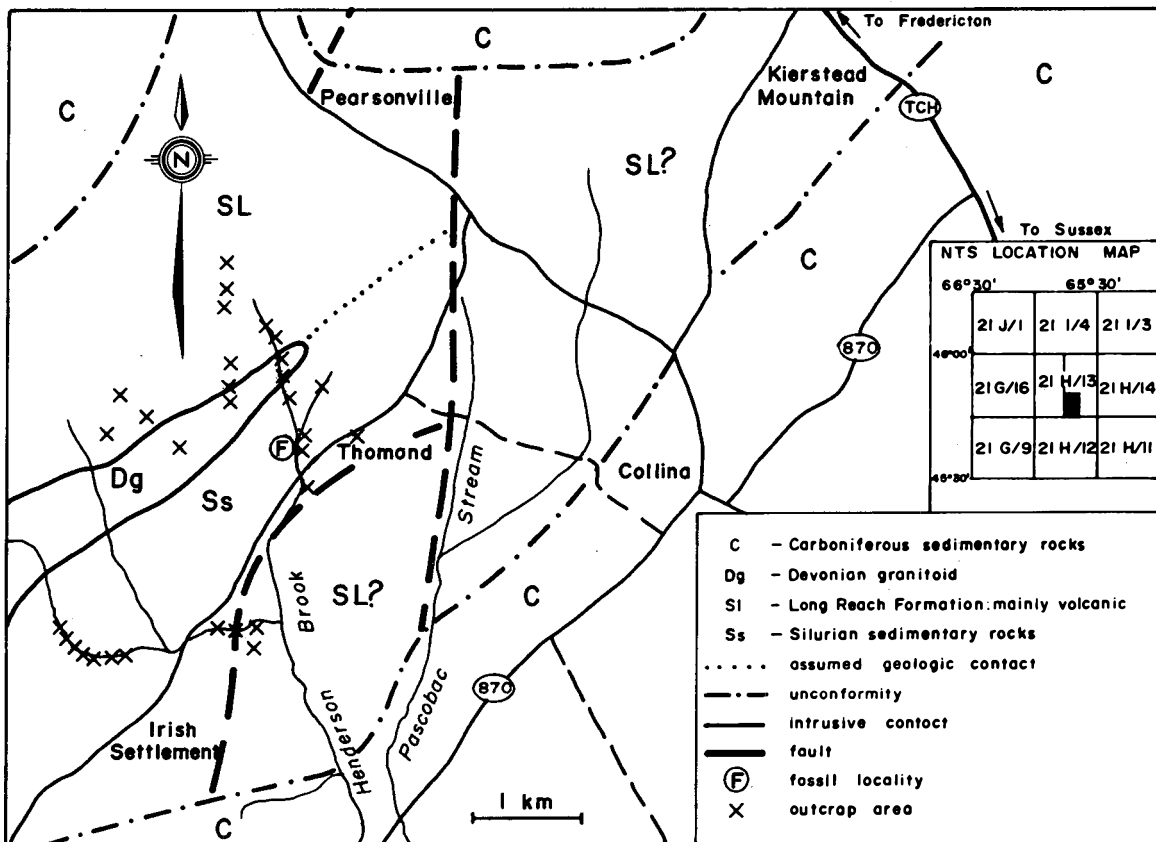


Fig. 2 - Geologic map in the vicinity of the new fossil locality.

mation because it conformably underlies the Long Reach Formation in the Queen Brook holostatotype.

- BERRY, W.B.N. and BOUCOT, A.J. (eds.) 1970. Correlation of the North American Silurian rocks. Geological Society of America, Special Paper 102, 289p.
- BOUCOT, A.J., JOHNSON, J.G., HARPER, C.W., Jr. and WALMSLEY, B.G. 1966. Silurian brachiopods and gastropods of southern New Brunswick. Geological Survey of Canada, Bulletin 140, 45p.
- DONOHUE, H.V., Jr. 1978. Analysis of structures in the St. George area, Charlotte County, New Brunswick. Ph.D. thesis, University of New Brunswick, Fredericton, New Brunswick.
- HELMSTAEDT, H. 1968. Structural and metamorphic analysis in Beaver Harbour region, Charlotte County New Brunswick. Unpublished Ph.D. Thesis, University of New Brunswick, Fredericton, New Brunswick.
- MACKENZIE, G.S. 1964. Geology, Hampstead, New Brunswick. Geological Survey of Canada, Map III4 a.
- MCCUTCHEON, S.R. and RUITENBERG, A.A. 1984. Geology and mineral deposits, Annidale-Nerepis area. Mineral Resources Division, New Brunswick Department of Natural Resources, Memoir 2. In Press.
- PORTER, R.A. 1973. The sedimentology, paleontology and paleoecology of the Jones Creek and Long Reach Formations (Silurian) southern New Brunswick. M.Sc. thesis, University of New Brunswick, Fredericton, New Brunswick.
- POTTER, R.R., HAMILTON, J.B. and DAVIES, J.L. 1979. Geological map of New Brunswick. Mineral Resources Division, New Brunswick Department of Natural Resources, Map NR-1, second edition.
- RUITENBERG, A.A. 1972. Metallization episodes related to tectonic evolution, Rolling Dam and Mascarene-Nerepis Belts, New Brunswick. Economic Geology, vol. 67, pp. 434-444.
- RUITENBERG, A.A. and LUDMAN, A. 1978. Stratigraphy and tectonic setting of Early Paleozoic sedimentary rocks of the Wirral-Big Lake area, southwestern New Brunswick and southeastern Maine. Canadian Journal of Earth Sciences, vol. 15, pp. 22-32.

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L. Ferguson