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Résumé de l'article

D'âge devonien inférieur, la formation de Temiscouata (nord-ouest du Nouveau-Brunswick, comté de Madawaska) fait partie d'une vaste bande d'ardoises qui s'étend de l'est de la péninsule gaspésienne jusqu'au détroit de Long Island. Auparavant, on datait les couches d'ardoises basales, corrélatives avec la formation de Temiscouata, comme étant d'âge new Scotland (gedinnien tardif). Jusqu'à présent, basé sur la présence du brachiopode *Leptooelia flabellites* le plus jeune âge attribué aux ardoises était oriskany (siegenien tardif). La découverte de deux genres précédemment inconnus au Nouveau-Brunswick, *Eodevonaria* et *Plioanoplia*, ainsi que la reclassification taxonomique de *Leptooelia flabellites*, prouvent que la formation de Temiscouata remonte jusqu'aux Sges esopus ou Schoharie (bas à moxen emsien). Une corrélation régionale fixe l'âge supérieur de la formation de Temiscouata comme pré-onondagien (pré-eifélien). L'attribution de ce nouvel âge permet d'élever la limite d'âge inférieure de l'orogénèse acadienne dans cette partie des Appalaches jusqu'aux temps post-esopus ou schoharie.

[Traduit par le journal]

Age and regional significance of Brachiopods from the Temiscouata Formation of Madawaska County, New Brunswick

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The Lower Devonian Temiscouata Formation of Madawaska County, northwestern New Brunswick forms part of a more extensive slate belt that extends from eastern Gaspé Peninsula to Long Island Sound. The age of the basal beds of slates correlated with the Temiscouata Formation has been previously dated as New Scotland (late Gedinnian). Until now, the youngest age assigned to the slates has been Oriskany (late Siegenian) based on the brachiopod *Leptocoelia flabellites*. The discovery of two previously unreported genera in New Brunswick — *Eodevonaria* and *Plicanoplia* — and the taxonomic reclassification of *Leptocoelia flabellites* indicates that the Temiscouata Formation extends upwards into the Esopus or Schoharie (early to middle Emsian). Regional correlation fixes the upper age of the Temiscouata as pre-Onondagan (pre-Eifelian). The new age assignment allows the lower age limit of the Acadian Orogeny in this part of the Appalachians to be raised to post-Esopus or Schoharie time.

D'âge dévonien inférieur, la formation de Témiscouata (nord-ouest du Nouveau-Brunswick, comté de Madawaska) fait partie d'une vaste bande d'ardoises qui s'étend de l'est de la péninsule gaspésienne jusqu'au détroit de Long Island. Auparavant, on datait les couches d'ardoises basales, corrélatives avec la formation de Témiscouata, comme étant d'âge new scotland (gédinnien tardif). Jusqu'à présent, basé sur la présence du brachiopode *Leptocoelia flabellites*, le plus jeune âge attribué aux ardoises était oriskany (siégénien tardif). La découverte de deux genres précédemment inconnus au Nouveau-Brunswick, *Eodevonaria* et *Plicanoplia*, ainsi que la reclassification taxonomique de *Leptocoelia flabellites*, prouvent que la formation de Témiscouata remonte jusqu'aux âges ésopus ou schoharie (bas à moxen emsien). Une corrélation régionale fixe l'âge supérieur de la formation de Témiscouata comme pré-onondagien (pré-eifelien). L'attribution de ce nouvel âge permet d'élever la limite d'âge inférieure de l'orogénèse acadienne dans cette partie des Appalaches jusqu'aux temps post-ésopus ou schoharie.

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INTRODUCTION

Reconnaissance mapping (sponsored by the New Brunswick Department of Natural Resources and Department of Regional Economic Expansion) of Ordovician, Silurian and Devonian sedimentary rocks was carried out in Madawaska and western Restigouche Counties, northwestern New Brunswick during the summer of 1975. Significant fossil discoveries were made in the Lower Devonian Temiscouata Formation. The relationship of the Temiscouata strata to its bounding rocks is reviewed and the regional implications of the new fossils are discussed.

REGIONAL STRATIGRAPHY

The bedrock geology of Madawaska and western Restigouche Counties,

New Brunswick (Fig. 1) was examined in an attempt to delineate rock formations previously defined in the Restigouche River area to the northeast (St. Peter 1978). These formations comprise a sequence of Ordovician to Devonian sedimentary rocks within the Gaspé Trough (Poole 1967, 1976) that form lithological belts known to extend as far northeast as eastern Gaspé Peninsula (Skidmore 1967) and as far southwest as Long Island Sound (Boucot 1970, Williams 1978).

In New Brunswick, the base of the section is defined by the Ordovician Grog Brook Group — a clastic turbidite sequence of slate, sandstone, minor greywacke and conglomerate. The Grog Brook strata interfinger with, and are gradationally overlain by calcareous flysch (limestone and calcareous slate) of the Upper Ordovician to

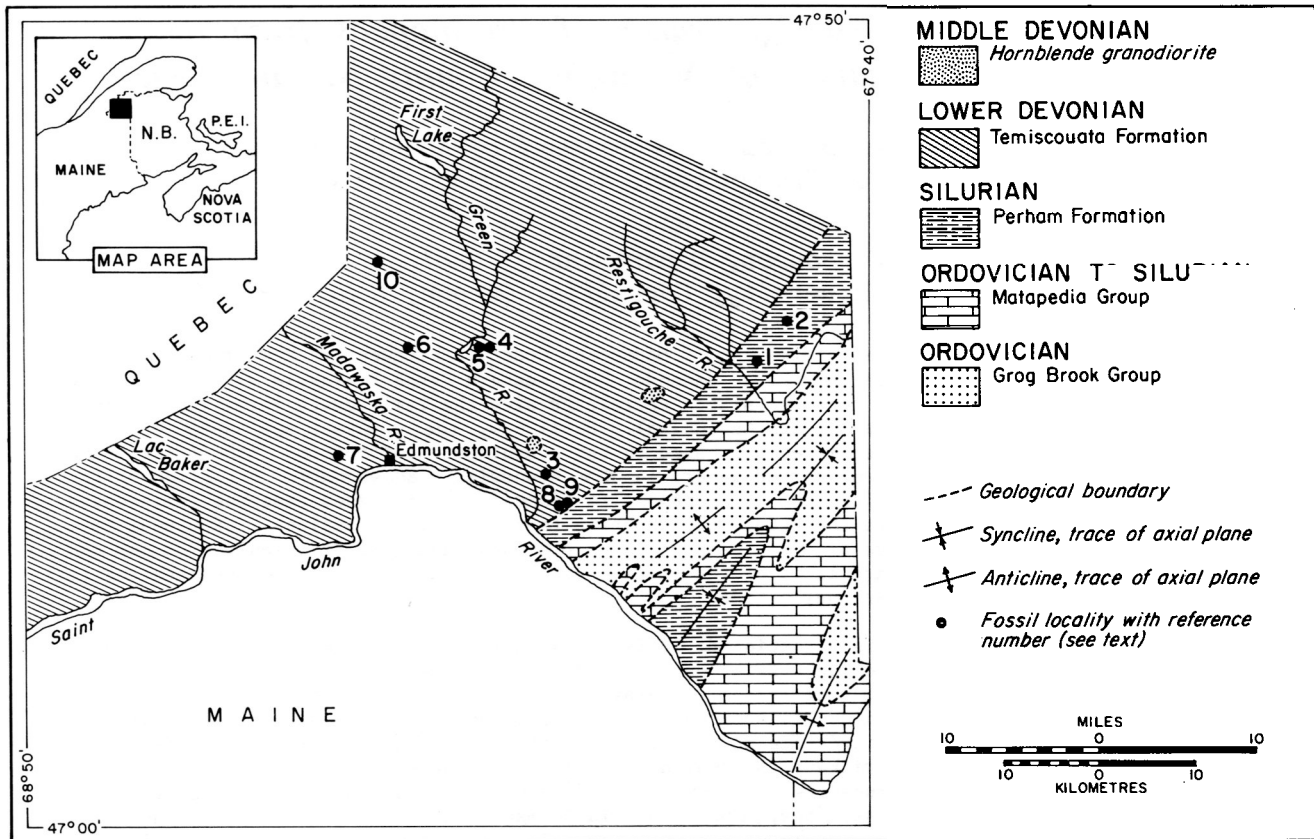


Fig. 1 - Geology of Madawaska County, New Brunswick.

Lower Silurian Matapedia Group. The Matapedia rocks are overlain by green slate, sandstone, minor red slate, lithic wacke and limestone of the Silurian Perham Formation. The Devonian Temiscouata Formation, comprising grey slate, siltstone, minor sandstone and conglomerate, overlies the Perham Formation. The Temiscouata rocks are intruded by two small stocks of hornblende granodiorite.

Perham Formation

The distribution of the Perham Formation in Madawaska County is outlined on Figure 1. The formation comprises mostly green slate and fine-grained calcareous sandstone with minor beds of red slate, dark grey slate, coarse-grained volcanogenic sandstone, graptolitic siltstone and argillaceous limestone. Iron- and manganese-rich slate is commonly associated

with red slate in the lower part of the section (Hamilton-Smith 1970).

Graptolites collected several hundred metres below the upper contact indicate a Ludlow age for the Perham Formation. At locality 1 (Fig. 1), *Pristiograptus* cf. *P. tumescens* is middle to late Ludlovian (Rickards 1976). At locality 2, an early Ludlovian age is indicated by *Colonograptus* cf. *C. roemeri* (Barrande), *Saetograptus* cf. *S. varians* (Wood), and *Saetograptus* cf. *S. incipiens* (Wood).

The Perham Formation in northwestern New Brunswick can be correlated with lithologically similar rocks in the Ashland Synclinorium immediately to the southwest in Maine. There, the Perham rocks, which have been examined in detail and elevated to group status by Roy and Mencher (1976),

are divided into the basal Middle Llandoveryan to Wenlockian New Sweden Formation and the overlying Wenlockian to early Ludlovian Jemtland Formation. In the same area, the Perham Group is conformably overlain by the Fogelin Hill Formation comprising green and red slate, and interbedded fine-grained greywacke and siltstone. The Fogelin Hill rocks range in age from early Ludlovian to possibly Siegenian.

It now seems clear that the Perham Formation of St. Peter (1978) comprises beds of both the Perham Group and Fogelin Hill Formation. Red slate mapped as Perham Formation in northwestern New Brunswick occupies the proper stratigraphic position (above the Ludlovian graptolitic beds) to suggest correlation with the red slate-bearing Fogelin Hill Formation in Maine.

The uppermost beds of the Perham Formation in New Brunswick consist of green slate and inter-layered quartzose sandstone. These beds pass gradationally into interbedded dark grey slate and feldspathic sandstone of the Lower Devonian Temiscouata Formation. Hence, the presence of a disconformity between the Perham and Temiscouata Formations, as suggested by the lack of Pridolian and Gedinnian fauna (St. Peter 1978), is not supported by the stratigraphic evidence.

Temiscouata Formation

The Temiscouata Formation is part of a widespread northeast-trending belt of Devonian slates which occupy the axial zone of the Gaspé Trough. Several names have been used in different parts of the belt to designate this essentially homogeneous suite of rocks. The term "Temiscouata Group" was introduced by McGerrigle (1934) to describe the sequence in the Lake Temiscouata area of Quebec. The

name was later changed to Temiscouata Formation by Lespérance and Greiner (1969) and has been extended to incorporate lithologically similar rocks underlying northwestern New Brunswick (St. Peter 1978). East of the Matapeia Valley in Gaspé the slates are included in the Fortin Group; in northwestern Maine, equivalent slates are referred to as the Seboomook Formation, and in the Eastern Townships of Quebec the name St. Juste Group (Béland 1957) is applied.

In New Brunswick, the major rocks in the belt are dark grey slates and siltstones that weather dark grey or rusty brown. Both rock types have vague, light grey silty or sandy, discontinuous parallel laminations or color bands. The rocks are locally calcareous; some are argillaceous limestone, the carbonate content of which weathers readily leaving the rocks with a silty texture.

Light grey to medium grey interbeds of greywacke and feldspathic sandstone are common in the New Brunswick section. The greywacke beds are typically graded and contain angular clasts of slate, felsic igneous rock fragments, feldspar and quartz. Feldspathic sandstone layers are typically ungraded and have parallel, black, carbonaceous laminations and disc-shaped clasts of dark grey slate.

A few interbeds of conglomerate are also associated with greywacke and slate. The conglomerate is polymictic with pebbles and cobbles of quartz, quartzite, chert felsic rock fragments, slate, greenstone, granite, and gneiss set in a matrix of sandy mud. Most of the pebbles are well rounded but flattened parallel to the cleavage.

Determination of the internal stratigraphy of the Temiscouata

Formation, as pointed out by Lespérance and Greiner (1969) in the Squatec-Cabano area and by Skidmore (1965) in correlative rocks of the Fortin Group of east-central Gaspé, is a difficult problem. This is largely a result of widespread penecontemporaneous deformation (contortions, convolutions), slump structures and the absence of marker horizons. The problem is further complicated in many areas by the presence of small-scale tectonic folds.

The Seboomook Formation in the Matagamon Lake area of northern Maine is lithologically similar to the Temiscouata Formation of New Brunswick (Hall *et al.* 1976). The bedforms and penecontemporaneous deformational structures of the rocks in that area led Hall *et al.* (*op. cit.*) to conclude that the slates represented prodelta marine slope deposits.

AGE OF MADAWASKA COUNTY TEMISCOUATA FORMATION FOSSILS

The Temiscouata slates of Mada-

waska County are dated by new brachiopod discoveries located in beds possibly several hundreds or even thousands of metres above the base of the formation. The extreme penecontemporaneous and tectonic folding the rocks have undergone renders it impossible to determine the exact stratigraphic position of the fossils. The important genera *Plicanoplia* and *Eodevonaria* (Fig. 1, localities 6 and 10, and Table 1) are known only from beds of Esopus and Schoharie (early Emsian) age in eastern North America (Fig. 2). *Plicanoplia* is not known with certainty elsewhere in the world. *Eodevonaria* is common in the Lower Devonian of Europe where it is characterized by a large species that cannot be confused with the small specimens present in North America, including the single specimen found by St. Peter at locality 6. *Pacificocoelia* (localities 5 and 8) has a much longer Devonian range from mid-Helderbergian through a large part of the Onondaga (late Gedinnian to Eife-

TABLE I

List of Brachiopods from Temiscouata Formation of New Brunswick

Locality No. (Figure 1)	G.S.C. Locality No.	Coordinates	Fauna
4	93036	47°28'28"N 68°11'30"W	leptocoelid
5	93037	47°28'20"N 68°12'15"W	<u>Pacificocoelia</u> sp.
6	93049	47°28'10"N 68°18'30"W	<u>Eodevonaria</u> sp., unidentified brachiopod fragments
7	93051	47°22'15"N 68°23'50"W	large spiriferid which is possibly <u>Howellella gaspensis</u>
8	93052	47°19'15"N 68°05'40"W	<u>Pacificocoelia</u> sp., stropheodontid, crinoidal debris
9	93053	47°19'25"N 68°20'55"W	leptocoelid, gastropod, stropheodontid. <u>Discomyorthis</u> , sp., <u>Howellella</u> cf. <u>gaspensis</u>
10	93055	47°33'12"N 68°20'55"W	<u>Plicanoplia</u> sp. large spiriferid which is possibly <u>Howellella</u> <u>gaspensis</u> , large rhynchonellid

		Standard Section	American Section	Range of Temiscouata Formation Brachiopod Taxa										
DEVONIAN	LATE	Famennian	Conewangoan		Plicanoplia	Eodevonaria	Leptocoelia	Pacificoeolia	Discomyorthis					
			Cassadagan											
		Frasnian	Chemungian											
			Fingerlakesian											
	MIDDLE	Givetian	Hamilton											
		Eifelian	Onondaga											
	LOWER	Emsian	Disconformity							I	I	I	I	I
			Schoharie											
			Esopus											
		Siegenian	Oriskany											
			Helderbergian	Becraft										
		New Scotland												
		Manlius-Coeymans												
	Gedinnian													

Figure 2 - Standard and American Sections of the Devonian, showing ranges of the Temiscouata Formation brachiopods.

lian) time interval, which makes the genus of far less value for dating the Temiscouata Formation. *Discomyorthis* (locality 9) has a known range of early Helderbergian through the Schoharie which is of use in helping to support an Early rather than Middle Devonian age. The large spiriferid which resembles *Howellella gaspensis* (localities 7, 9 and 10) is consistent with an Esopus or Schoharie age assignment.

Highly carbonized plant remains and one recognizable spore, tentatively *Retusotriletes* sp., were documented by D.C. McGregor of the Geological Survey of Canada from poorly preserved plant debris sent to him. McGregor (personal com-

munication 1976) believes the *Retusotriletes* (locality 3) is certainly no older than Late Silurian and is probably not older than Devonian.

REGIONAL AGE OF THE SLATE FORMATIONS

Throughout the northern part of the Gaspé Trough, the Temiscouata Formation and correlated slaty rocks overlie a variety of Devonian, Silurian and pre-Silurian formations. The age of the basal slate beds has been well-established in two locations. Firstly, by the southeast margin of the Trough at Fish River Lake in northern Maine, the contact between the Seboomook Formation and the

underlying Fish River Lake Formation is exposed and seen to be conformable. Just below the basal Seboomook, on the west shore of Fish River Lake, an extensive assemblage of brachiopods establish a New Scotland (middle Helderbergian) age for the upper beds of the Fish River Lake Formation (Boone 1970). Secondly, in the Moose River Synclinorium, 200 km to the southwest of Fish River Lake, the basal beds of the Seboomook Formation contain *Atrypina* sp., *Spinoplasia gaspensis*, *Orthostrophia* cf. *O. strophomenoides*, and *Levenea* cf. *L. subcarinata* suggesting a New Scotland age (Boucot and Heath 1969).

A coral-bearing limestone bed at Rivière Bleue, about 25 km southwest of Lake Temiscouata, has in the past been used to date the base of the Temiscouata Formation (cf. Lajoie et al. 1968). The limestone bed occurs near the base of the "Temiscouata Formation" and contains *Tryplasma* cf. *T. loveni* and *Halysites*, indicating a Silurian age. The Rivière Bleue rocks apparently strike to the southwest, where only 6 km away in northern Maine they merge with Siluro-Devonian strata that Boucotte et al. (1976) correlated not with the Temiscouata Formation, but with the Upper Silurian Mount Wissick Group.

In the past, rocks along the central part of the Devonian slate belt were dated as no younger than mid Lower Devonian (Becraft-Oriskany) primarily on the presence of *Leptocoelia flabellites*. Until recently, later Lower Devonian fossils were unrecorded in the slates. However, the presence of *Eodevonaria* and *Plicanoplia* now allows the age of the slates to be extended upward into the late Lower Devonian (Esopus or Schoharie). New information has also arisen from more careful consider-

ation of the brachiopods previously assigned in the Appalachians to *Leptocoelia flabellites*. In the past this species was thought to indicate a mid Lower Devonian (Becraft-Oriskany) age for the enclosing Temiscouata slates. Although found chiefly in beds of Oriskany (late Siegenian) age, it was thought that *Leptocoelia* was present throughout older Lower Devonian beds in the central and northern Appalachians. Recently, however, Boucot and Rehmer (1977) have reviewed the occurrences of *Leptocoelia* and *Pacificocoelia* in eastern North America. They find that *Leptocoelia* is restricted to beds of Oriskany and Esopus age but that *Pacificocoelia* ranges from the mid-Helderbergian well into the Onondaga (Fig. 2). Prior to 1975 when Boucot (1975) separated the genus *Pacificocoelia* from *Leptocoelia* it was unfortunately common practice in the northern Appalachians to assign almost every leptocoelid brachiopod to *Leptocoelia* and even to *L. flabellites*. Therefore, occurrences of *L. flabellites* reported prior to 1975, and used as justification for a Becraft-Oriskany age, should be reviewed if they have not been included in the list of occurrences included in Boucot and Rehmer (1977). For example, *L. flabellites* reported from the Seboomook Formation near Fort Kent, Maine (Nylander 1940) can no longer be accepted, particularly now that *Pacificocoelia* is known in the nearby Temiscouata Formation at localities 5 and 8 (Fig. 1 and Table 1).

Some further confusion has arisen regarding the upper age limit of the Temiscouata slates. On the northwestern margin of the Gaspé Trough, fossiliferous shallow water Middle Devonian (Onondaga) limestones were believed to stratigraphically underlie the much

deeper water flyschoid slates (Lespérance and Greiner 1969, p. 82). These limestones (the Mountain House Wharf Limestone in the Lake Memphremagog area, the Famine Limestone in the Lake Etchemin area, and the Touladi Limestone in the Lake Temiscouata area) are now known to be overthrust by the older Temiscouata slates (Lespérance and Greiner 1969, p. viii; St. Julien and Hubert 1975). Thus, the most reliable fossil dates indicate that the Temiscouata Formation and correlated slates range from basal beds of New Scotland (late Gedinnian) age to upper beds of Esopus or Schoharie (early or middle Emsian) age.

The newly discovered Temiscouata brachiopods establish a lower age for penetrative Acadian deformation within northwestern New Brunswick as Esopus or Schoharie (*cf.* Donohoe and Pajari 1974).

SUMMARY

The basal beds of the Temiscouata Formation are assigned a Helderbergian (New Scotland) age for the following reasons: 1- The formation conformably overlies the Perham Formation, the upper beds of which can be correlated with the Ludlovian to Siegenian(?) Fogelin Hill Formation in Maine. 2- Correlated slates of the Seboomook Formation in Maine conformably overlie the Fish River Lake Formation, the latter bearing New Scotland age brachiopods in its upper beds. 3 - the basal beds of the Seboomook Formation in the Moose River Synclinorium in Maine contain a brachiopod assemblage suggesting a New Scotland age.

The discovery of two new brachiopod genera in Madawaska County - *Eodevonaria* and *Plicanoplia* - indicates that the Temiscouata Formation ranges upwards into the Esopus or Schoharie (early to mid-

dle Emsian). The taxonomic reclassification of *Leptocoelia flabellites* is cited as supporting evidence for the Emsian age assignment.

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