

## GRAPTOLITES FROM THE BAIE D'ESPOIR GROUP, SOUTH-CENTRAL NEWFOUNDLAND

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### ABSTRACT

*Graptolites are reported from four localities in the Baie d'Espoir Group. Both the assemblages and rock types suggest a correlation with the Middle–Upper Ordovician Lawrence Harbour Formation ('Caradoc black shale') and the overlying Point Leamington Formation of the Badger–Grand Falls–Notre Dame Bay region. The faunas described in this article double the number of known fossiliferous localities in the Baie d'Espoir Group; this suggests that many more remain to be discovered despite the intense tectonic deformation present throughout the area, and that these will prove invaluable in refining the stratigraphy of the region.*

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### STRATIGRAPHY AND PREVIOUS FOSSIL RECORDS OF THE BAIE D'ESPOIR GROUP

The Baie d'Espoir 'Series' was first proposed by Jewell (1939); it was subsequently given group status by Anderson (1967), then redefined and subdivided into five formations by Colman-Sadd (1976, 1980, 1985), including the Salmon River Dam, St. Joseph's Cove, North Steady Pond, Riches Island and Isle Galet formations. The Isle Galet Formation is present only in the southern part of the region (Colman-Sadd, 1974, 1976; Dickson, 1987), but is considered to rest conformably on the Riches Island Formation; of the remaining units, the Salmon River Dam Formation is considered the oldest, followed by the St. Joseph's Cove and Riches Island formations, which appear to be lateral equivalents at least in part, whereas the North Steady Pond Formation is thought to gradationally overly the St. Joseph's Cove Formation (Colman-Sadd, 1980).

Despite the substantial geographical area covered by the Baie d'Espoir Group, paleontological data from the unit is sparse, presumably due mainly to the ubiquitous tectonic deformation. Middle Ordovician graptolites were reported by Baird *et al.* (1951) and Anderson and Williams (1970) from 'Grpto Lake' (Middle Ridge Pond) in the Great Gull Map area. They were identified by A.E. Wilson and L.M. Cunning (*in* Anderson and Williams, 1970) as '*Climacograptus bicornis*, *Climacograptus* sp. cf. *C. styloideus* and *Climacograptus* sp. cf. *C. scharenbergi*'. Dunlop (1954) reported a single, poorly preserved gastropod identified as

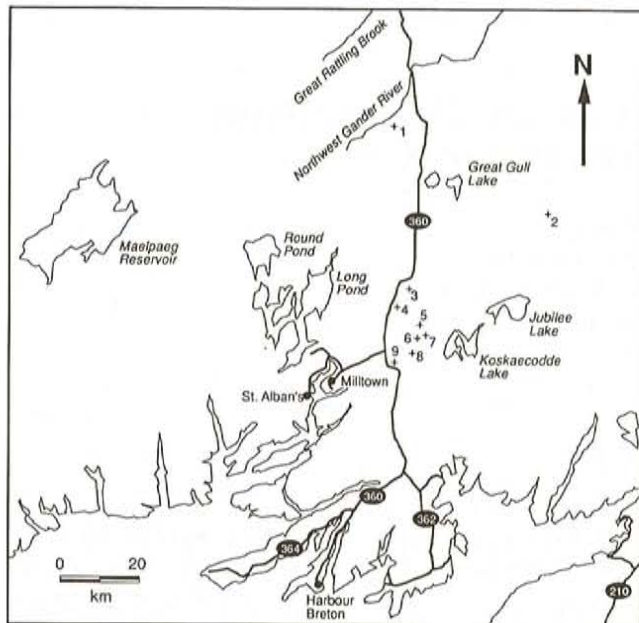
*?Eotamaria* sp. from near the mouth of Little River opposite the southern end of Riches Island, which was considered to indicate an Ordovician (probably Middle Ordovician) age. A fragment of a trilobite pygidium was also recorded from the Isle Galet Formation near Barasway de Cerf, which was tentatively dated as Late Cambrian to Early Ordovician. Anderson (1967) recorded *Streptelasma* and crinoidal debris from near St. Alban's, which probably originated from the St. Joseph's Cove Formation and indicated an Ordovician or younger age (Colman-Sadd, 1976). Brachiopods (identified as orthids, cf. *Orthambonites* and cf. *Productorthis* by R.B. Neuman *in* Colman-Sadd, 1976), bryozoans and pelmatozoans were subsequently discovered near the mouth of the Conne River by Colman-Sadd (1976) from the Riches Island Formation close to its contact with the St. Joseph's Cove Formation. An Ordovician age, somewhere between late Arenig and early Caradoc inclusive, was deduced. During exploration by Esso Minerals Canada (M. Lenters, written communication to S.P. Colman-Sadd, 1987), additional crinoidal material was recorded from metamorphosed calcarenite along the Southeast Pond logging road near the junction between Highway 360 and the Milltown–St. Alban's junction, which could possibly have originated from the same unit collected by Colman-Sadd (1976).

In conclusion, it may be stated that the only reliable age recorded previously was provided by the Middle Ordovician graptolite fauna at Middle Ridge Pond, indicating the *N. gracilis* or *D. multidentis* zones of the standard British sequence. The remaining evidence appeared to suggest an Ordovician age, but even that was not certain in some cases.

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\* Lithoprobe contribution #216





**Figure 1.** Map of Baie d'Espoir region, showing position of localities discussed in text.

## DESCRIPTION OF NEW LOCALITIES AND FAUNAS

During the summers of 1989 and 1990, a number of localities were visited where black, graphitic phyllites or schists had been recorded by previous workers (Anderson and Williams, 1970; Colman-Sadd, 1976, 1980; T. Rivers, personal communication, 1989; M. Lenters, written communication to S.P. Colman-Sadd, 1987). Surprisingly, several of these yielded graptolites which, although mostly too poorly preserved to allow full taxonomic identification, were sufficient to permit an approximate age identification of the units.

### NORTHWEST GANDER RIVER (Figure 1, Locality 1)

**Location.** Exposures in a 1 km length of logging road running 500 m south of the Northwest Gander River, 3 km southeast of the Little Gull River and accessible from the Baie d'Espoir highway (Geographic location 48°20'N 55°30'W).

**Lithology.** A transitional (but tectonically broken) section is present, from siliceous black shale to the west, through more fissile, silty black shale to alternating black and grey shale and fine grey sandstone to the east. The shales are deformed, but lack a penetrative cleavage.

**Graptolites.** A variety of forms seem to occur, but further collecting is required before distinct biostratigraphic intervals may be demonstrated. The most fossiliferous interval, about halfway along the outcrop, yielded distal dicranograptid fragments (i.e., *Dicranograptus* or *Dicellograptus*), *Climacograptus* sp., *Orthograptus calcaratus* and *Corynoides* sp. cf. *C. calicularis*.

**Age and Correlation.** The assemblage indicates a Middle Ordovician age of *D. clingani* Zone or earlier. The succession of rock types along the section is identical to that found in the Lawrence Harbour Formation and in the transition to the overlying Point Leamington Formation (Williams, *in press*). No outcrop was present at this location when mapped by Colman-Sadd (1985); his inferred assignment of the area to Unit 8 of the Coy Pond Complex (brecciated and sheared serpentinite and magnesite-rich rock) is thus, clearly in need of revision, the shale probably belonging to the same unit seen at Middle Ridge Pond and elsewhere.

### MIDDLE RIDGE POND (Figure 1, Locality 2)

**Location.** Small outcrops along lakeside at extreme southern end of Middle Ridge Pond (Geographic location 48°16'N 55°8'W).

**Lithology.** The graptolitic material is composed of heavily cleaved, fissile black shale, and is apparently in gradational contact with sandstone. Other outcrops ca. 100 m to the east include more siliceous black shales, which did not yield graptolites.

**Graptolites.** The deformation makes specific identification impossible. Forms present include *Dicellograptus* sp., *Climacograptus* sp. and *Orthograptus* sp. cf. *calcaratus*.

**Age and Correlation.** The fauna listed above indicates a middle or upper Ordovician age. If the assemblage recorded previously by Baird *et al.* (1951) and Anderson and Williams (1970) was identified correctly, it would give a more precise correlation with the Middle Ordovician *N. gracilis* or *D. multidentis* zones. However, the different rock types present at the locality do suggest that more than one stratigraphic interval is exposed.

### CONNE RIVER (Figure 1, Locality 3)

**Location.** Exposures on southwest river bank of Conne River 400 m southeast of Baie d'Espoir highway (Grid Ref. XD 120 329).

**Lithology.** Black fissile shale heavily cleaved at a high angle to bedding, with extensive secondary pyritization indicating thermal metamorphism. Some paler grey sandstone also present.

**Graptolites.** None recovered.

**Age and Correlation.** Although no graptolites were recovered, the lithology is similar to that present at localities 1 and 2. A tentative correlation with the upper part of the Lawrence Harbour Formation and its equivalents is therefore suggested on purely lithological grounds.



**TWILLICK BROOK (Figure 1, Locality 4)**

*Location.* Exposures along river 50 to 100 m east of the Baie d'Espoir highway (Geographic location 48°4'N 55°34'W).

*Lithology.* Siliceous and fissile black shale exposed for over 150 m oblique to strike, with slightly developed cleavage apparently parallel to bedding and structural slices of paler grey, coarse sandstone in the southern part of the outcrop.

*Graptolites.* None recovered.

*Age and Correlation.* The reason for the absence of graptolites is unclear, as both rock types and lack of intense structural deformation would seem ideal for their preservation, although it is possible that thermal metamorphism was responsible for their destruction. The black shale lithology is identical to the lower part of the Lawrence Harbour Formation, and occurs adjacent to the (underlying?) felsic pyroclastic rocks of the Twillick Brook Member of the St. Joseph's Cove Formation (Colman-Sadd, 1980).

**NO NAME HILLOCK (Figure 1, Locality 5)**

*Location.* Small hill 2 km north of Little River Lake (Grid Ref. XD 118 198).

*Lithology.* Highly deformed, dark grey 'pencil slate' having crenulation cleavage.

*Graptolites.* Surprisingly, poorly preserved graptolites are discernable on some surfaces; however, identification is impossible.

*Age and Correlation.* Little can be deduced from the graptolites, but the unit is lithologically similar to that seen at the other localities.

**LITTLE RIVER LAKE (Figure 1, Locality 6)**

*Location.* Southern tip of small peninsula along northwest shore of lake (Grid Ref. XD 118 174).

*Lithology.* Highly deformed slate associated with crenulation cleavage.

*Graptolites.* None recovered.

*Age and Correlation.* Lithologically identical to unit seen at locality 5.

**LITTLE RIVER LAKE (Figure 1, Locality 7)**

*Location.* Southern tip of elongate island at northeast end of lake (Grid Ref. XD 122 168).

*Lithology.* Mostly grey sandstone and sheared conglomerate associated with minor heavily cleaved grey shale.

*Graptolites.* None recovered.

*Age and Correlation.* Unknown, although the rocks look very similar to the sandstones and conglomerates of the Point Leamington Formation (Williams, *in press*).

**POWERLINE NEAR LITTLE RIVER (Figure 1, Locality 8)**

*Location.* Under power line 1.5 km southwest of Little River Lake (Grid Ref. XD 092 108).

*Lithology.* Black and grey phyllites associated with crenulation cleavage.

*Graptolites.* None recovered.

*Age and Correlation.* Unknown, but exposure is along strike from localities 5 and 6.

**SOUTHEAST POND ROAD (Figure 1, Locality 9)**

*Location.* Two outcrops on the northwest side of Southeast Pond Road, 1.5 km north-northeast from its junction with the Baie d'Espoir highway, 2 km south of junction with highway 361 (Geographic location 47°57.15'N 55°36.30'W).

*Lithology.* Grey, heavily cleaved, fissile shale, crenulation cleavage locally present.

*Graptolites.* Despite intense deformation, graptolites are clearly visible including dicranograptid fragments (i.e., *Dicranograptus* or *Dicellograptus*) and large diplograptids reminiscent of *Climacograptus tubuliferus*.

*Age and Correlation.* The unit is Middle or Late Ordovician in age, and once again is probably a correlative of the Lawrence Harbour Formation. The shales are adjacent to metamorphosed limestones containing crinoid ossicles; these possibly belong to the same unit from which Colman-Sadd (1976) recovered articulate brachiopods.

**CONCLUSIONS**

All the fossiliferous localities described here are of middle Ordovician age, with similar graptolite zonal range to those present in the Lawrence Harbour Formation of the Badger-Grand Falls and Notre Dame Bay regions (Williams, 1988, *in press*). With the exception of that near the Northwest Gander River, all localities fall within areas previously mapped as St. Joseph's Cove and Riche Island formations; they probably represent a single lithostratigraphic unit, which is almost certainly a lateral equivalent of the Lawrence Harbour Formation, and should probably be given distinct formational status within the Baie d'Espoir Group. All outcrops are apparently structurally isolated from adjacent rock units, except for that near the Northwest Gander River, which exhibits a gradational change from black siliceous shale, through black silty shale, to alternating black shale and



fine, grey sandstone; this is identical to the transition from Lawrence Harbour Formation to Point Leamington Formation as described and redefined by Williams (*in press*). Therefore, it is suggested that the outcrops discussed here demonstrate that black shale deposition of the Lawrence Harbour Formation was even more extensive than previously recognized, occurring throughout the entire Exploits Subzone of the Dunnage Zone. Furthermore, the frequent structural repetition seen in the Baie d'Espoir Group is very similar to that suggested by Williams (1989) for the Grand Falls-Badger-Red Indian Lake region to the northeast and confirmed in part by Evans *et al.* (1990).

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