

CAMBRIAN-ORDOVICIAN TRILOBITE BIOSTRATIGRAPHY IN CENTRAL NEWFOUNDLAND

W.D. Boyce
Newfoundland Mapping Section

ABSTRACT

Gasconadian (i.e., early Tremadoc) age ellesmeroceratid cephalopods are confirmed to occur at Reddett's Head, Village Cove, New World Island as reported by Flower (in Kay, 1967).

The Spruce Brook Formation in the Through Hill area has yielded a rich, previously unreported trilobite fauna consisting of at least sixteen species. The generic composition of the fauna and the presence of the distinctive cephalopod Gorboceras maro (Billings)? indicate a late Whiterock (formerly Chazy), late Llanvirn to Llandeilo (Middle Ordovician) age. Comparable faunas occur in the Cobbs Arm Formation on New World Island, the Table Cove Formation of western Newfoundland, the Mingan Formation of the Mingan Islands, Quebec, and the Chazy Group of New York.

Wonderley and Neuman's (1984) report of the trilobite Annamitella at Indian Bay Big Pond is confirmed.

INTRODUCTION

In general, the Lower Paleozoic trilobite faunas of central Newfoundland are not as well known as those of the rest of Newfoundland. With the notable exceptions of Bruton and Harper (1985), Dean (1970, 1971, 1973, 1976, *in press*), Kay and Eldredge (1968) and Shaw and Fortey (1977), most paleontological research into non-graptolitic Cambrian-Ordovician faunas of central Newfoundland (including review papers) has dealt with brachiopods (Boucot, 1973; Gibbons, 1985; McKerrow and Cocks, 1976, 1977, 1978, 1980, 1981, 1986; Neuman, 1968, 1971, 1972, 1976, 1984, 1985; Wonderley and Neuman, 1984), cephalopods and gastropods (Blackwood, 1978; Kay and Williams, 1963; Stouge, 1979; Strong and Kean 1972; Williams, 1963) and conodonts (Bergstrom *et al.*, 1974; Hibbard *et al.*, 1977; Fahraeus and Hunter, 1981, 1985; Hunter, 1978; Nowlan and Thurlow, 1984; Stouge, 1979, 1980a, b, c). This is probably because, in central Newfoundland, trilobites are generally small and less easily spotted in outcrop than other macrofossils. Secondly, when limestones are dissolved in acid for conodonts, all but silicified macrofossils are destroyed. Furthermore, the sedimentary rock types are more favorable for finding graptolites than most other kinds of fossils, including conodonts, and the rocks of central Newfoundland are structurally more disturbed and metamorphosed than those elsewhere on the island.

Notwithstanding the above, however, one of the most critical reasons for the relative lack of trilobites (and other macrofossils) in central Newfoundland is that they have not been looked for. What follows is a summary of current

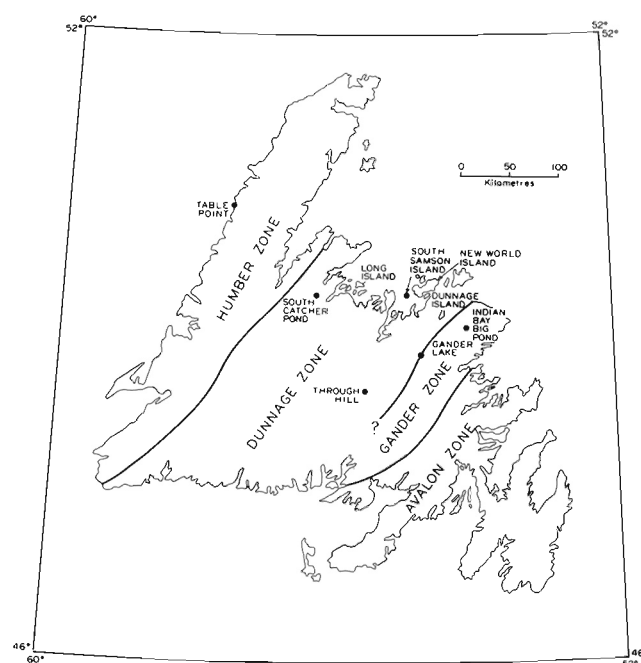


Figure 1: Trilobite collection areas discussed in this report.

knowledge of central Newfoundland trilobite faunas drawn from the literature and personal experience. Figure 1 shows the trilobite collection areas discussed in this report.

DUNNAGE ZONE BIOSTRATIGRAPHY

Cambrian

Middle Cambrian

Dunnage Island. Middle Cambrian fossils were discovered by Kay and Eldredge (1968) in the Dunnage Formation on Dunnage Island. The fossils were collected from a boulder in a cove along The Reach near the middle of the southeast shore of the island (2.4 km northeast of the southwestern point—NTS area 2E/7). The boulder consisted of a 60-cm-thick bed of limestone interbedded with tuff and agglomerate. The following trilobites were obtained:

Bailiella/Bailiaspis
Kootenia

Bailiella / *Bailiaspis* is typical of the Middle Cambrian Acado-Baltic faunal province. *Kootenia*, on the other hand, occurs in the North American—Pacific faunal province, where it ranges from the late Early Cambrian to the late Middle Cambrian. The Dunnage Island trilobites thus represent a mixed Middle Cambrian fauna.

As these trilobites and the associated brachiopods were, unfortunately, never illustrated, Kay and Eldredge's (1968) fossil identifications and age determination require confirmation. Further collecting from the locality is advisable because of its importance in unraveling the complex geological history of central Newfoundland.

Ordovician

Early Tremadoc

Village Cove, New World Island. Fossils were discovered by Kay (1967) in the lower volcanic unit (Unit Z) of the Summerford Group (Horne, 1970) exposed at Reddett's Head, Village Cove, New World Island (NTS area 2E/7—grid reference 572831). The fossils were obtained from limestone incorporated in pillow breccia, and consisted of the following:

Cephalopoda:
ellesmeroceratids (Flower, *in* Kay, 1967, page 588)

Trilobita:
pliomerid—single specimen, incomplete and inconclusive (Whittington, *in* Horne, 1970; Dean, 1976)

The presence of ellesmeroceratid cephalopods was confirmed when the locality was revisited in 1985. However, no more trilobites were found.

Based on the cephalopods, Flower (*in* Kay, 1967, page 588) assigned the rocks a Gasconadian (i.e., early Tremadoc) age. Ellesmeroceratids are characteristic of the Gasconadian Stage of the Canadian Series (Flower, 1964).

Late Tremadoc—Early Arenig

South Catcher Pond. Dean (1970) described and illustrated the following trilobites from the Catchers Pond

Group (Dewey and Bird, 1971) in the vicinity of South Catcher Pond (NTS area 12H/9):

Geragnostus sp.
Ischyrophyma marmorea Dean, 1970
Leiostegium sp.
Scotoharpes sp. of Bruton and Harper (1985) (equals *Selenoharpes* ? sp. of Dean, 1970)

Dean (1970, pages 8 and 9) assigned the fauna an early Arenig age based on the generic assemblage. Conodont species indicate a late Tremadoc to early Arenig age (Bergstrom *et al.*, 1974).

Late Arenig—Early Llanvirn

Gander Lake. Jenness (1963) and McKerrow and Cocks (1977, pages 493 and 494) reported *Annamitella* sp. undet. from the Davidsville Group (Kennedy and McGonigal, 1972) on the north shore of Gander Lake (NTS area 2D/15), 2 km west of Little Harbour. McKerrow and Cocks (1977, page 494) assigned the locality an Arenig to Llanvirn age based on brachiopods.

Virgin Arm, New World Island. Dean (1973) described and illustrated a diverse trilobite fauna from the middle volcanic unit (Unit B) of the Summerford Group (Horne, 1970) exposed at Virgin Arm, New World Island (NTS area 2E/10). The fauna contained the following species:

Annamitella insulana Dean, 1973
Apianurus sp. of Bruton and Harper (1985) (equals odontopleurid gen. et sp. undet. of Dean, 1973)
Bergamia ? sp. (equals *Botroides* of Shaw, 1980)
Encrinuroides hornei Dean, 1973
Geragnostus sp.
Ischyrophyma sp.
Illaeus (s. l.) sp.
Metapolichas sp. cf. *M. verrusosus* (Eichwald)
Paratretaspis terranova Dean, 1973
Pseudosphaerexochus (s. l.) sp.
Scotoharpes sp.

Based on the generic assemblage, the fauna was assigned a late Arenig to early Llanvirn age (Dean, 1973, page 22).

Fairbanks East—Main Cove, New World Island. Dean (*in* Neuman, 1976, page 13) identified a correlative fauna from the same lithologic unit at the Fairbanks East—Main Cove locality (NTS area 2E/10) of Neuman (1976). It contained the following trilobites:

Annamitella ? sp.
encrinurid gen. et sp. undet.
harpid gen. et sp. undet.

Brachiopods from this locality also indicated a late Arenig to early Llanvirn age (Neuman, 1976, page 13).

Rushy Pond Road Intersection, New World Island. Neuman (1968, 1971) and McKerrow and Cocks (1981, page 672) reported trilobites from Unit B tuff exposed at the junction to Rushy Pond Road on New World Island (NTS area 2E/7—grid reference 576846). The following were identified:

Annamitella ? sp.
Calyptraulax sp.
 harpid gen. et ap. undet.
Illaeus sp.

McKerrow and Cocks (1981) assigned this fauna a Llanvirn age.

Cottles Arm Road, New World Island. McKerrow and Cocks (1981) identified another fossil locality of probable Llanvirn age northeast of the Cottles Arm Road (NTS area 2E/7—grid reference 569850). The following were reported:

? *Amphilichas* sp.
 cheirurine gen. et sp. undet.
Illaeus sp.
Nileus sp. aff. *N. affinis* (Billings)

These trilobites were collected from calcareous tuff and tuffaceous limestone.

Through Hill Area. The Spruce Brook Formation (Colman-Sadd and Swinden, 1984) of the Through Hill area (NTS area 2D/12) has yielded fossils in two areas. From a small outcrop on the Northwest Gander River (grid reference 087746)—the eastern locality of Colman-Sadd and Russell (1982, Figure 1) and Colman-Sadd and Swinden (1984, Figure 2)—Neuman (*in* Colman-Sadd and Russell, 1982, pages 35 and 36) and Neuman (*in* Colman-Sadd and Swinden, 1984, page 1358) reported undetermined trilobite pygidia along with a diverse brachiopod fauna.

Based on the generic composition of the brachiopod fauna, Neuman (*in* Colman-Sadd and Russell, 1982, pages 35 and 36) and Neuman (*in* Colman-Sadd and Swinden, 1984, page 1358) indicated that the Spruce Brook Formation here could range in age from late Arenig to early Caradoc, but most likely was Llanvirn.

The fauna of this locality is considered older than that of the western locality of Colman-Sadd and Russell (1982) and Colman-Sadd and Swinden (1984), on the basis of Neuman's interpretation of the brachiopod assemblages. The brachiopods here differ from those in the Cobbs Arm Formation (Neuman, personal communication, 1986), whereas the Spruce Brook Formation at the western locality correlates with the Cobbs Arm Formation based on trilobites (see below).

This locality requires collecting for trilobites.

Late Llanvirn—Early Llandeilo

The Cobbs Arm Formation limestone of the Summerford Group (Horne, 1970) has yielded trilobites at several localities on New World Island.

Squid Cove, New World Island. Dean (1971) described the following trilobites from the Cobbs Arm Formation at Squid Cove (NTS area 2E/10):

Amphilichas sp.
Ampyx sp.

Atractopyge condylosa Dean, 1971
Bergamia sp. nov. (equals *Botroides* of Shaw, 1980)
Bronteopsis sp.
Carrikia sp. cf. *C. pelagia* Tripp, 1965
 Gen. et sp. undet.
Illaeus sp.
Illaeus (*Parillaenus*) sp.
Nileus nesiotus Dean, 1971
Otarion sp.
Piomerella sp.
Raymondaspis arcuata Dean, 1971
Remopleurides sp.
Sphaerexochus costabilis Dean, 1971
Symphysurus sp.
Trinodus sp. cf. *T. doulargensis* Tripp, 1965

Cobbs Arm Road, New World Island. From a road cut along Cobbs Arm Road (Route 34), 0.8 km east of Burnt Arm Head (2E/10), Bergstrom *et al.* (1974, page 1646) reported the following trilobites from the Cobbs Arm Formation:

Calyptraulax ? sp. (equals *Calliops* ? of Bergstrom *et al.*, 1974)
Isotelus sp.

From the same road cut 700 m east of the head of Burnt Arm (NTS area 2E/10—grid reference XE 712963), Fortey (*in* McKerrow and Cocks, 1977, page 493) identified the following:

Calyptraulax sp. (equals *Calliops* of McKerrow and Cocks, 1977).
Homotelus sp. aff. *H. bromidensis* Esker

The Squid Cove trilobite fauna was assigned a Llandeilo age based on the generic assemblage (Dean, 1971, page 31). Bergstrom *et al.* (1974, page 1642, figure 7) assigned the fauna from the Cobbs Arm roadcut a Llandeilo age, whereas a late Llandeilo or early Caradoc age was favored by McKerrow and Cocks (1977, page 493).

Conodont species indicate a late Llanvirn to early Llandeilo age for the Cobbs Arm Formation (Bergstrom *et al.*, 1974; Fahraeus and Hunter, 1981, 1985; Hunter, 1978).

Through Hill Area. A rich trilobite fauna consisting of at least sixteen species was discovered in the Spruce Brook Formation (Colman-Sadd and Swinden, 1984) of the Through Hill area (NTS area 2D/12) in 1985. Brachiopods, bryozoans, cephalopods, echinoderms and gastropods were also obtained. The fossils were collected from two adjacent small exposures of the formation on a small tributary of the Northwest Gander River, the western locality of Colman-Sadd and Russell (1982, Figure 1) and Colman-Sadd and Swinden (1984, Figure 2).

The eastern exposure consists of three small outcrops, which yielded the following fossils:

Cephalopoda:
Gorbyoceras maro (Billings, 1859)?

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Gastropoda:

Gen. et sp. undet.

Trilobita:

Atractopyge sp. undet. —pygidium (+)

Bergamia sp. undet. (equals *Botroides* of Shaw, 1980) —cephalon (+)

Calyptaulax sp. undet. —cranidium (—), pygidium (+)

Gorbyoceras (equals *Spyroceras*) *maro* (Billings) was described by Foerste (in Twenhofel, 1938, pages 93 to 95; plate 18, figure 4; plate 20, figures 1 and 10) from zones A3 to A5 of the Mingan Formation (Schuchert and Twenhofel, 1910) exposed on the Mingan Islands, Quebec. The Mingan Formation is late Whiterock (formerly Chazy), late Llanvirn to Llandeilo in age (Barnes *et al.*, 1981; Shaw, 1980; Shaw and Fortey, 1977). The Spruce Brook Formation exposure is probably the same age, based on the occurrence of *Gorbyoceras maro* (Billings)? and the generic composition of the trilobite fauna.

The second exposure occurs 15 m west of the first. It is a small cliff exposure and was the richest in fossils, yielding the following:

Trilobita:

Amphilichas sp. —pygidium (—)

Ampyx sp. undet. —cranidium (—), pygidia (+, —)

? *Annamitella* sp. undet. —pygidium (+, —)

Atractopyge sp. undet. —cranidia (+, —), librigenae (+, —), pygidia (+, —)

Bergamia sp. undet. (equals *Botroides* of Shaw, 1980) —cephalon (—)

Calyptaulax sp. undet. —pygidia (+, —)

Ceraurina sp. undet. —cranidium (+, —)

Illaenus sp. undet. —pygidia (+, —)

Gen. et sp(p). undet.

Geragnostus/Trinodus sp. undet. —cephalons (+, —)

Niobe sp. undet. —pygidium (+, —)

Pliomerops sp. undet. —cranidium (+, —), pygidia (+, —)

Raymondaspis sp. undet. —cranidium (+, —)

Remopleurides sp. undet. —cranidium (—)

Triarthrus sp. undet. —cranidium (+, —)

Vogdesia ? sp. cf. *V. ? obtusus* (Hall) —hypostoma (+, —)

The generic composition of the fauna indicates a late Whiterock, late Llanvirn to Llandeilo age for this exposure of the Spruce Brook Formation as well. Closely comparable faunas occur in the Cobbs Arm Formation of New World Island (Dean, 1971), the Table Cove Formation (Table Head Group) of western Newfoundland (Whittington, 1965), the Mingan Formation of the Mingan Islands, Quebec (Shaw, 1980) and the Chazy Group of New York (Shaw, 1968), which fall into the same age range (Shaw and Fortey, 1977). In fact, *Vogdesia ? obtusus* (Hall) occurs in the Chazy Group (Shaw, 1968).

The rich brachiopod fauna of these two exposures has been sent to R.B. Neuman (United States National Museum—Smithsonian Institution) for study.

Long Island. Barnes *et al.* (1981, pages 11 and 12) report abundant undescribed brachiopods, crinoids, gastropods and trilobites (largely fragmentary) from the Cutwell Group (Kean and Strong, 1975) on Long Island (NTS area 2E/12). These were obtained from limestone a few metres below late Llandeilo to early Caradoc graptolitic shale. Strong and Kean (1972) earlier documented cephalopods, conularids, crinoids and ostracodes from the Cutwell Group on Long Island. The cephalopods they illustrated (Strong and Kean, 1972, Figure 4) resemble the late Whiterock, late Llanvirn to Llandeilo species *Gorbyoceras maro* (Billings).

Caradoc—Ashgill

Intricate Harbour, New World Island. The Sansom Formation (McKerrow and Cocks, 1978, 1981) has yielded trilobites on the northwest shore of Intricate Harbour, New World Island (NTS area 2E/7). McKerrow and Cocks (1981, pages 759 and 761) reported the following:

dalmanitinid gen. indet.

Erratencrinurus

Flexicalymene

trinucleid gen. indet. —fringe fragment

Based on the generic composition of the associated brachiopod fauna, Neuman (1968, pages 42 to 44) and McKerrow and Cocks (1981, pages 759 to 761) assigned the Sansom Formation here an Ashgill (Cautleyan to Rawtheyan) age.

South Samson Island, Bay of Exploits. Neuman (in Karlstrom, 1985, page 100) identified Caradoc to Ashgill brachiopod genera from the Sansom Formation in the southeast part of South Samson Island, Bay of Exploits (NTS area 2E/7).

In 1985 a new fossil locality was discovered by Bruno LaFrance (University of New Brunswick, Fredericton) in the formation in the northeast part of South Samson Island (NTS area 2E/7—grid references 497825 to 498826). He subsequently revisited it with S.P. Colman-Sadd, R.B. Neuman, J.S. Ash and W.D. Boyce. Besides brachiopods, solitary and colonial corals, and echinoderm fragments, the following trilobites were collected:

Calymene sp. cf. *C. marginata* (Shirley) of Ingham (1977)?

Isotelus sp. undet.

trinucleid gen. et sp. undet. —fringe

Calymene sp. cf. *C. marginata* (Shirley) of Ingham (1977) indicates an Ashgill (Cautleyan) age. R.B. Neuman (personal communication, 1985) while in the field, assigned an Ashgill age to this locality, based on the generic composition of the brachiopod fauna that was obtained. As mentioned above, the locality yielded solitary and colonial corals. These have been sent to R.J. Elias (University of Manitoba) and T.E. Bolton (Geological Survey of Canada), respectively, for study. Neuman is studying the brachiopods.

GANDER ZONE BIOSTRATIGRAPHY

Ordovician

Late Arenig–Early Llanvirn

Indian Bay Big Pond. Wonderley and Neuman (1984, page 528) reported probable *Annamitella* from the Indian Bay Formation at two localities on Indian Bay Big Pond (NTS area 2E/1 – grid references 721382 and 725377). Wonderley and Neuman (1984, page 529) assigned the two localities a late Arenig age, based on the brachiopod assemblage.

In 1985 these localities were revisited with R.F. Blackwood, S.P. Colman-Sadd and R.B. Neuman. The previous identification of *Annamitella* was confirmed. The southeast locality of Wonderley and Neuman (grid reference 725377), after close examination, was judged by all to be close to outcrop rather than definite outcrop as previously reported.

The above faunas correlate with the Dunnage Zone brachiopod and trilobite faunas from the Davidsville Group on Gander Lake and Unit B of the Summerford Group (Horne, 1970) on New World Island.

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