

CONTINUING STRATIGRAPHIC AND TRILOBITE STUDIES OF THE WATTS BIGHT FORMATION (ST. GEORGE GROUP), PORT AU PORT PENINSULA, WESTERN NEWFOUNDLAND

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ABSTRACT

Thick-bedded, stylonodular lime mudstone and wackestone, encasing thin sheets and lenses of grainstone and rudstone, and locally impressive, but isolated thrombolitic boundstone mound complexes midway along the southern coast of the Port au Port Peninsula, host Skullrockian trilobites and other macrofossils. The subtidal shelf facies of the Tremadocian Watts Bight Formation (St. George Group), deposited during transgression through early high-stand, likely were deposited during the Stonehenge transgression defined in the central Appalachians.

*Trilobites from the lower to middle Watts Bight Formation, 1.5 km west of Ship Cove and at Pigeon Head, are dominated by the genera *Millardicurus* and *Symphysurina*. *Symphysurina* sp. cf. *S. convexa*, is recorded for the first time, as is an indeterminate genus, increasing the known diversity of the trilobite fauna from the formation, and strengthening correlation with the Tribes Hill Formation of New York State amongst other co-eval shelf sequences along the eastern and southern margin of Laurentia.*

INTRODUCTION

The trilobite genus *Symphysurina* is long established as an important faunal presence in Furongian to Lower Ordovician rocks of the allochthonous successions of the Cow Head Group (Kindle and Whittington, 1958; Whittington, 1968; Fortey and Skevington, 1980; Kindle, 1982; Fortey *et al.*, 1982; Fortey, 1983; James and Stevens, 1986; Karim, 2008) and the Cooks Brook Formation (Boyce *et al.*, 1992). It is also well represented in co-eval autochthonous platform carbonate shelf sequences throughout the Caledonian–Appalachian–Ouachitan orogenic belt of eastern and southern Laurentia, from Greenland (Poulsen, 1927, 1937; Cowie and Adams, 1957; McCobb and Owens, 2008; McCobb *et al.*, 2011, *in revision*), through Scotland (Ingham *et al.*, 1985), to northwestern Vermont (Shaw, 1951), the Champlain Valley and Mohawk Valley of New York–Vermont (Cleland, 1900, 1903; Fisher, 1954; Landing *et al.*, 2003; Westrop *et al.*, 1993), New Jersey (Weller, 1903; Westrop *et al.*, 1993), Pennsylvania (Raymond, 1910; Butts and Moore, 1936), Maryland (Sando, 1957), West Virginia (Woodward, 1951), Virginia (Orndorf *et al.*, 1988; Taylor *et al.*, 1992), and Oklahoma (Stitt, 1971, 1977, 1983) in the United States. *Symphysurina* and other trilobites, along with brachiopods,

cephalopods, corals, echinoderms and gastropods, were lately discovered in western Newfoundland in the autochthonous Watts Bight Formation, St. George Group along the south coast of the Port au Port Peninsula near Ship Cove (Boyce *et al.*, 2011; McCobb *et al.*, 2011) and in 2012 at Pigeon Head a little farther to the west (Figure 1 and Plate 1). Collectively, the Port au Port Peninsula fossils fill a significant gap in the distribution of Skullrockian faunas in the Ordovician shelf along the Appalachian Orogen.

LITHOSTRATIGRAPHY

The Watts Bight Formation on the Port au Port Peninsula belongs to the older of two long-lived, third-order sequences of Tremadocian and Floian age, separated by the Boat Harbour Disconformity (Knight and James, 1987; Section 2 of Ji and Barnes, 1994; Knight *et al.*, 2007, 2008). Knight *et al.* (2008), supporting the work of Ji and Barnes (1993, 1994), argued that the Tremadocian rocks consist of two sequences lying on either side of an older disconformity within the lower part of the Boat Harbour Formation (*see* Figure 2). A long-lived sequence including the upper Berry Head Formation, the Watts Bight Formation and the lower member of the Boat Harbour Formation, form a deepening

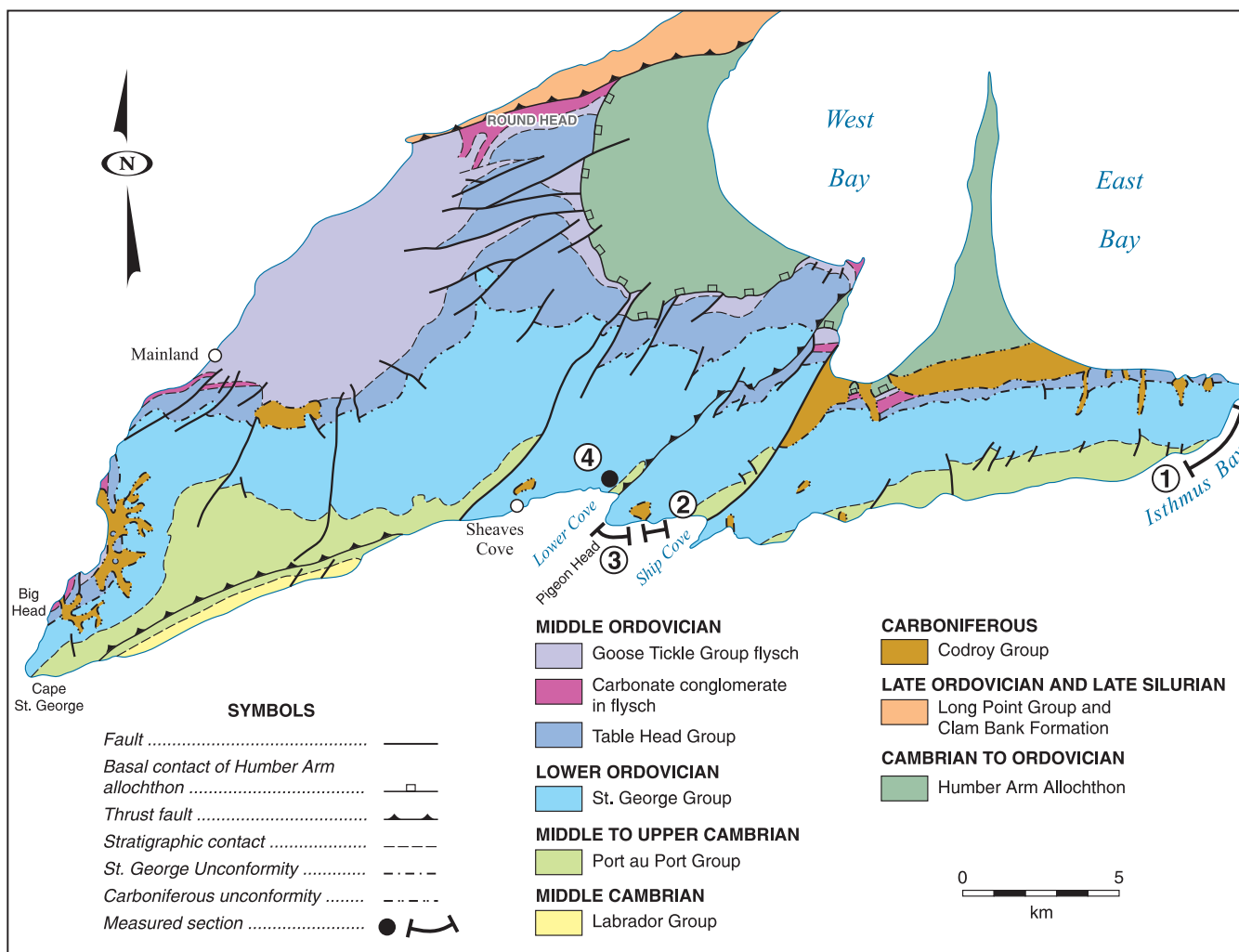


Figure 1. Geology of the Port au Port Peninsula and location of sections studied in the Watts Bight Formation.



Plate 1. The Pigeon Head composite section with Lower Cove in the background. Arrows indicate the locations of measured sections.

to shallowing Skullrockian succession that is terminated at the older disconformity. Stairsian peritidal carbonate parasequences of the Middle Boat Harbour Formation occur above

the lower disconformity and terminate at the Boat Harbour Disconformity (Knight *et al.*, 2008).

The Watts Bight Formation has now been studied in four sections along the south coast of the Peninsula (Knight *et al.*, 2008; Boyce *et al.*, 2011; see Figure 1). In its reference section at Isthmus Bay, it comprises three parts (Knight *et al.*, 2008), a lower boundstone-dominated interval, which includes the celebrated Green Head mound complex (Pratt and James, 1982), a middle interval of burrowed limestone that grades upward into partially dolomitized lime grainstone and an upper interval, once more dominated by a thrombolite–stromatolite mound complex. A markedly incised erosion surface overlain by conglomerate marks the top of the upper interval to separate the Watts Bight Formation from the overlying lower Boat Harbour Formation. The Watts Bight Formation spans the deeper-water (DW) *Cordylodus lindstromi* to *Cordylodus angulatus* Lineage Zones (Ji and Barnes, 1994, figures 18, 19 and 20); the lower member

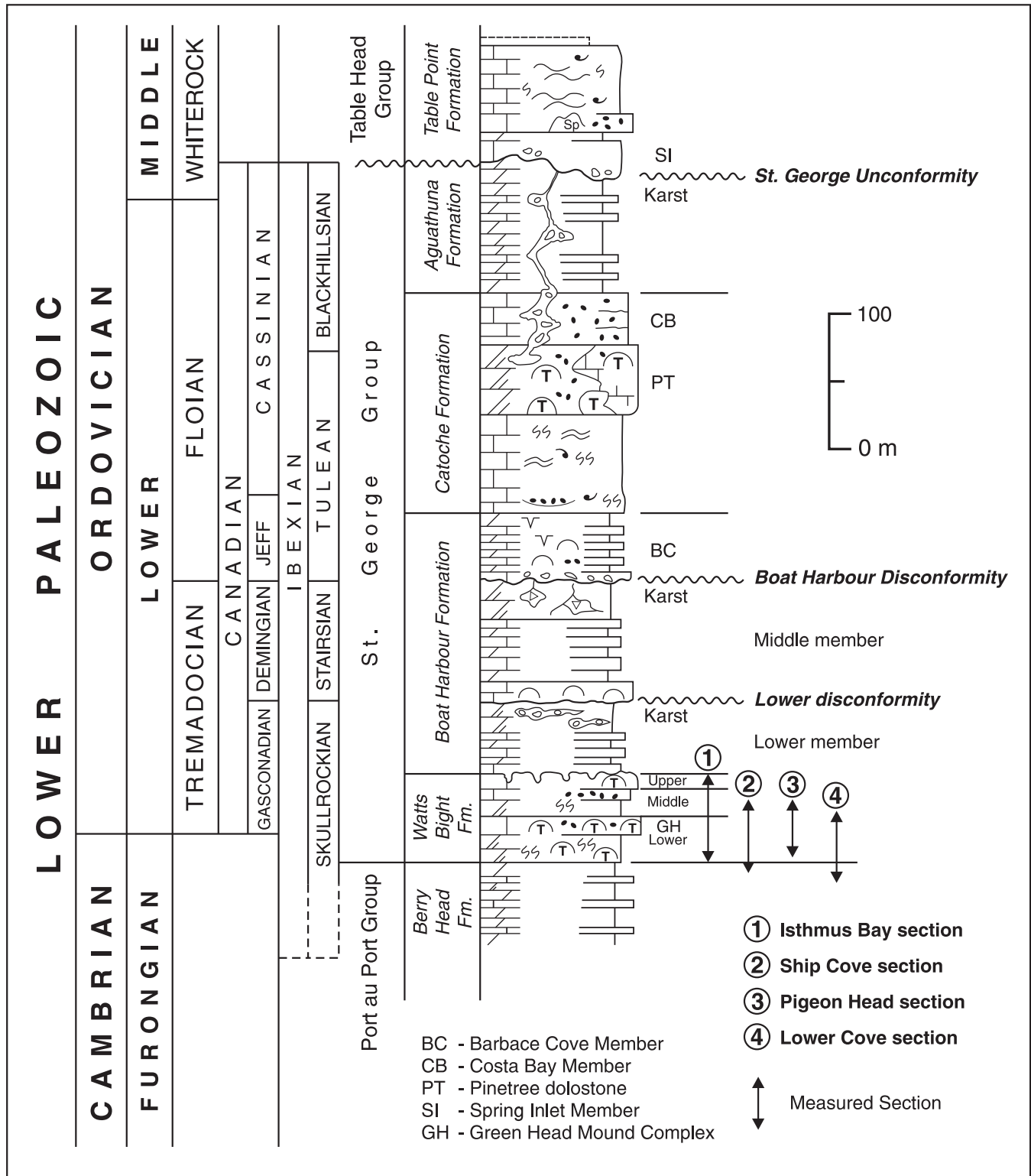


Figure 2. Stratigraphy of the St. George Group, Port au Port Peninsula from Knight et al. (2008) showing stratigraphic intervals discussed in the text.

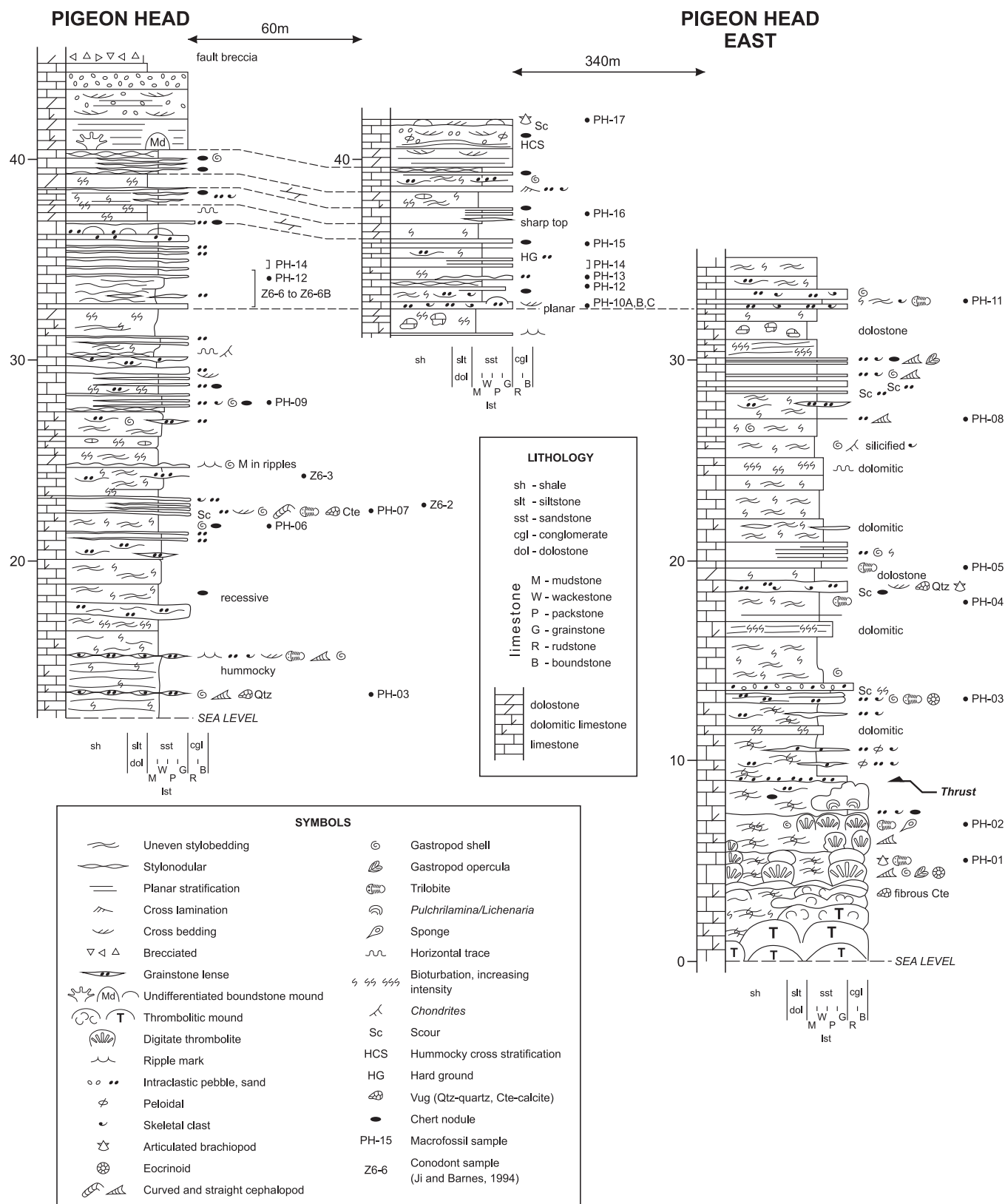


Figure 3. Detailed graphic logs of sections through the incomplete Watts Bight Formation at Pigeon Head, showing trilobite localities and conodont localities of Ji and Barnes (1994).

of the Boat Harbour Formation is dated as *Rossodus manitouensis* Zone.

The Watts Bight succession along the mid-southern shore of the Port au Port Peninsula at Ship Cove, Pigeon Head and Lower Cove (*this report* and Boyce *et al.*, 2011) is less structured. Thrombolitic mounds are only present, locally, close to the base of the formation. At Ship Cove and Pigeon Head, stratified muddy limestones abut against, and onlap the mounds, suggesting isolated mound complexes of various sizes. At Lower Cove, mounds are reduced to a few thin beds. Instead, bedded muddy limestone dominates the sections in this area.

At Pigeon Head, the Watts Bight Formation is incomplete and difficult to trace along the cliff and foreshore due to access and several, often subtle, faults. The base of the Watts Bight Formation in the east is covered at sea level, whereas the top of the formation at the Head is cut off by a fault that juxtaposes the middle Watts Bight Formation against rocks of the lower Boat Harbour Formation.

The more easterly of the two sections begins close to the base of the formation (Figure 3). There, massive, clotted and digitate thrombolitic microbial mounds are enclosed within bedded muddy limestone at the base of a cliff. Large cephalopods and gastropods, many partly silicified, and cavities filled by fibrous calcite epitomize the mounds that also host trilobites, articulate brachiopods and silicified gastropod opercula. Macrofossils are also common in limestone flanking the mounds. Well-bedded limestone in the overlying succession in this cliff and at the foreshore to weakly cliffed section at Pigeon Head itself consists of muddy to grainy limestone with some interbeds of burrowed dolostone capped, at Pigeon Head, by a largely dolomitized unit of grainstone that is truncated by the fault mentioned above.

The stratified limestone ranges from decimetre-thick beds of stylonodular lime mudstone to stylolitic to unevenly stratified, variously bioturbated, dolomitic lime wackestone–mudstone with discontinuous lenses of intraclastic and bioclastic grainstone, to beds of intraclastic–bioclastic grainstone, pebbly grainstone and rudstone intercalated, on a fine scale, with burrowed wackestone. Razor sharp, planar erosion surfaces in these grainy beds are likely hardgrounds. The grainy beds locally enclose small isolated microbial mounds. Dolostone beds that are commonly burrow-mottled are interspersed in the interval. The muddy to grainy rock types are repetitively arranged in coarsening-upward parasequences. Trilobites are scattered predominantly in the grainy beds suggesting that they are allochthonous and likely reworked from adjoining muddy sediment into the dominantly intraclastic grainstone during storms. These skeletal beds can be traced for hundreds of metres along strike, and include, in one case, abundant *Symphysurina* pygidia scat-

tered in a fine-grained matrix that hosts millimetre eocrinoid ossicles.

Overlying the 29 m of bedded muddy to grainy limestone at Pigeon Head, is a prominent unit of grainstone, 4 m thick. This grainstone, which is predominantly dolomitized, likely correlates with a similar unit overlying burrowed carbonate at the Isthmus Bay section (the middle interval of Knight *et al.*, 2008). The grainstone is dominantly intraclastic, consisting of well-rounded, very coarse to granular carbonate sand grains, some small pebbles and a scattered bioclast. Horizontal thin stratification marks the base of the unit. It also locally encloses domal microbial mounds as well as large, non-rounded mounds consisting of radial-digitate fan-like structures that project irregularly into the grainstone. Crossbedded to massive grainstone enclosing small mounds overlie the basal bed; scour surfaces are also present.

The Watts Bight succession likely deepened through the lower interval, and commenced shallowing in the middle to culminate at the incision surface as seen at Isthmus Bay. At Ship Cove, the section spans the base through the middle interval of the formation whereas at Pigeon Head except for the mounds from the very top of the lower interval, the succession dominantly belongs to the middle limestone interval.

TRILOBITE BIOSTRATIGRAPHY OF THE WATTS BIGHT FORMATION

A varied trilobite fauna including *Bellefontia*, “*Hystriacurus*”, *Millardicurus* and *Symphysurina* has been collected from the Watts Bight Formation on the Port au Port Peninsula at Isthmus Bay, Ship Cove and Pigeon Head. The trilobites occur together with the articulate brachiopod *Finkelnburgia* sp. undet., various unidentified ellesmeroceratid cephalopods, gastropods that include *Ecculiomphalus* sp. undet., *Lytospira*, *Ophileta* sp. cf. *O. supraplana*, *Rhombella* sp. undet. as well as unidentified forms. Very small eocrinoid ossicles are scattered to locally abundant in the grainstones. The trilobites recovered from the formation at Ship Cove and Pigeon Head occur predominantly in rocks equivalent to the middle interval of the formation and the very top of the lower mound interval.

ISTHMUS BAY

A small pygidium of “*Hystriacurus*” *ellipticus* (Cleland, 1900) (Plate 2A–D) was recovered from a single horizon approximately 20 m above the base of the Watts Bight Formation at Isthmus Bay, 3 m above the base of the Green Head Mound Complex (*see* Boyce *et al.*, 2011, page 220, Figure 4). A cranidium of *Millardicurus* sp. undet. (Plate 3A) was also discovered during recent re-examination of

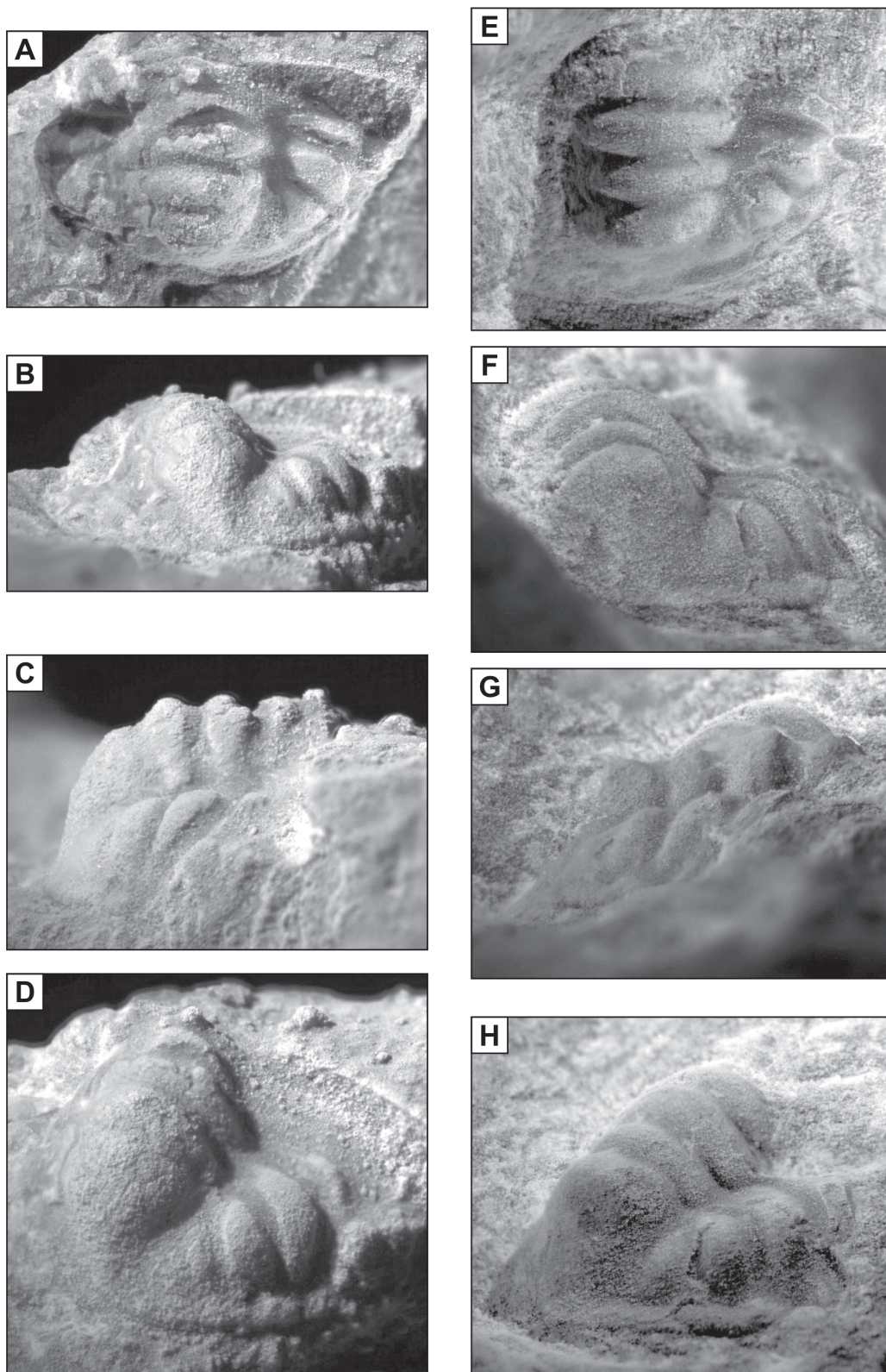


Plate 2. “*Hystricurus*” *ellipticus* (Cleland, 1900)?, pygidia. A – D) 2010F001, Isthmus Bay section (NFM F-803); see also Boyce et al. (2011; Plate 19B). Length is about 3mm. A) Dorsal view. B) Posterior view. C) Lateral view. D) Oblique posterior view. E-H). PH-10A, Pigeon Head. Pygidium (NFM F-1001). E) Dorsal view. F) Posterior view. G) Lateral view. H) Oblique posterior view.

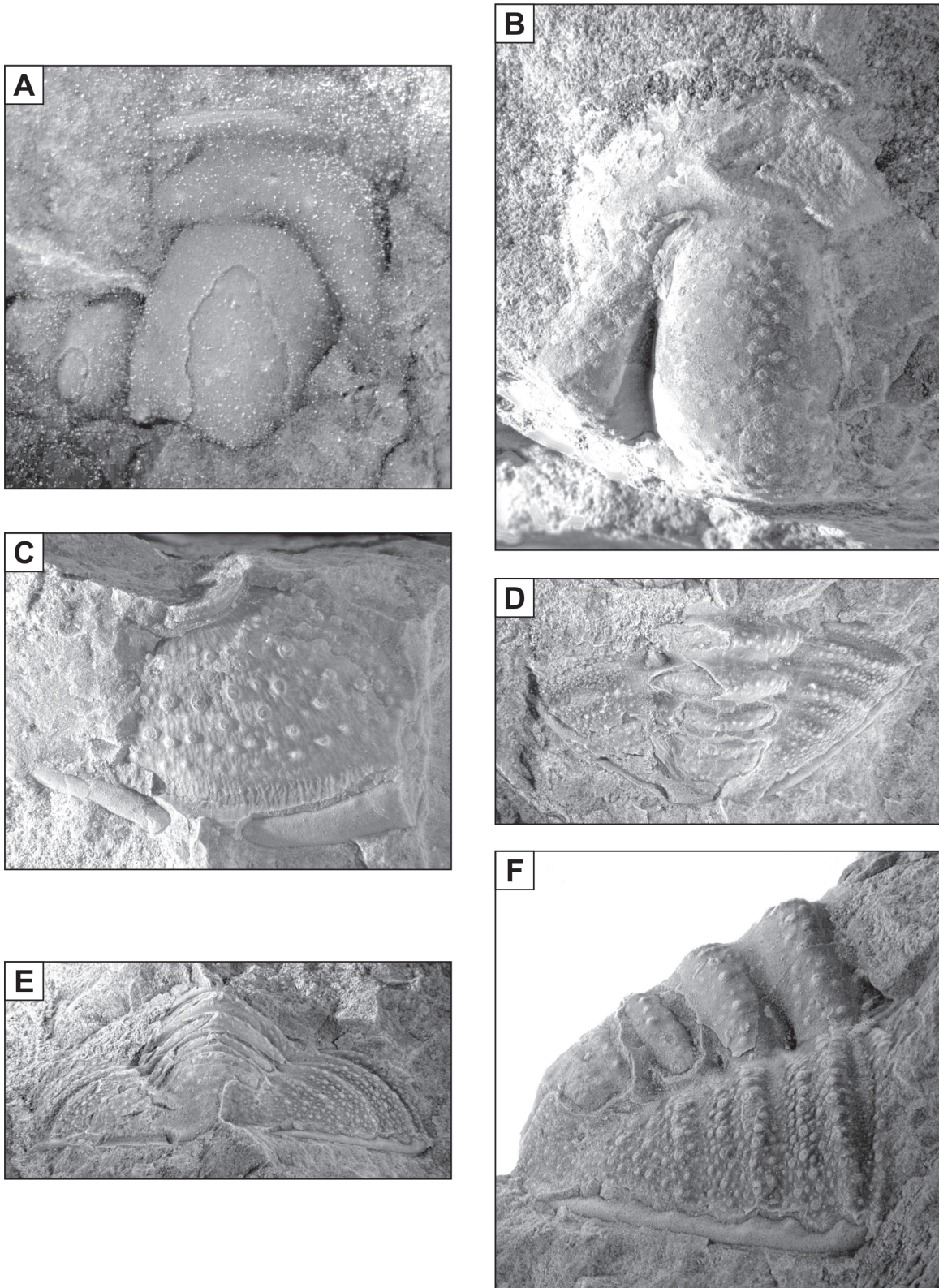


Plate 3. *A)* *Millardicurus* sp. undet. from 2010F001, Isthmus Bay section. Latex replica of cranium (NFM F-994). Dorsal view. *B – F)* *Millardicurus* sp. cf. *M. armatus* (Poulsen, 1937) from 2012F02 = 2010F025, Ship Cove section. *B)* Cranium, dorsal view (NFM F-995). *C)* *Librigena*, dorsal view (NFM F-996). *D – F)* Pygidium (NFM F-997). *D)* Dorsal view. *E).* Posterior view. *F)* Lateral view.

material from this locality. The trilobites are from the same bed as Z2-3B of Ji and Barnes (1994), which marks the bases of the shallow-water (SW) *Polycostatus falsioneotensis*–*Rossodus tenuis* Assemblage Zone and the deeper-water (DW) *Cordylodus angulatus* Lineage Zone.

SHIP COVE SECTION

An abundant, trilobite fauna occurs in association with brachiopods, cephalopods and gastropods in the Watts Bight Formation, 1.5 km west of Ship Cove (Boyce *et al.*, 2011; Figure 3). Recovered between 11.5 and 33 m above the base of the formation, it comprises the following:

Bellefontia gyracantha (Raymond, 1910)?

“Hystricurus” ellipticus (Cleland, 1900)?

Millardicurus sp. cf. *M. armatus* (Poulsen, 1937)

Symphysurina myopia Westrop in Landing *et al.*, 2003

Although no new species were discovered in 2012, better material of *Millardicurus* sp. cf. *M. armatus* (Poulsen, 1937) was obtained from locality 2010F025 (Boyce *et al.*, 2011, Figure 5), including a cranidium (Plate 3B), librigena (Plate 3C), as well as the only pygidium (Plate 3D–F); a librigena of *Symphysurina myopia* Westrop in Landing *et al.*, 2003 was also found at locality 2010F031 (Plate 4). Both the librigena and pygidium of *Millardicurus* sp. cf. *M. armatus* are more similar to equivalent sclerites of *M. armatus* than to any other known species of *Millardicurus*, supporting our earlier identification of this species in the formation (Boyce *et al.*, 2011).

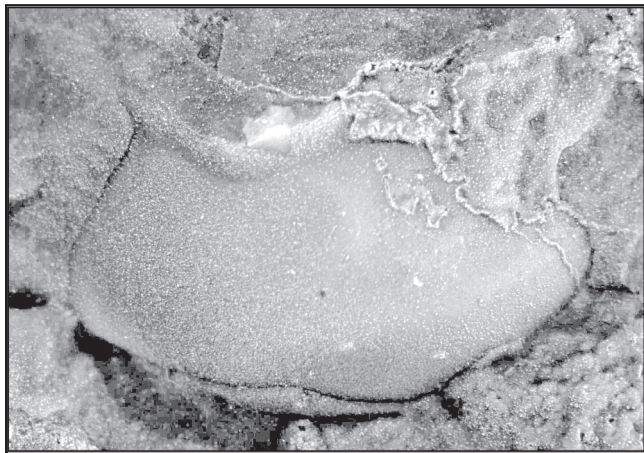


Plate 4. *Symphysurina myopia* Westrop in Landing *et al.* (2003) from 2010F031, Ship Cove section. Librigena (NFM F-998), dorsal view.

PIGEON HEAD SECTION

Two sections at, and just east of, Pigeon Head (Figure 3



Plate 5. Grainstone beds at Pigeon Head that host fossil horizons PH10A = 2012F008 and PH-10C = 2012F010 (arrows).

and Plates 1, 5; Appendix) that lies 1.95 km west of the Ship Cove section, have yielded new fossil horizons. The Pigeon Head section overlaps with the lower part of Section 6 of Ji and Barnes (1994, page 78). The two sections collectively yielded the following trilobites:

Gen. et sp. undet. (Plate 6)

“Hystricurus” ellipticus (Cleland, 1900)? (Plates 2E–F and 7)

Millardicurus sp. undet.

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) (Plates 8–10)

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) – previously unknown in the Watts Bight Formation – ranges throughout the section at Pigeon Head. At least one of its horizons (PH-14) is a prominent bedding plane replete with scattered pygidia. The bedding plane can be traced over 100 m along strike. A single, unidentified, fragmentary cranidium (Plate 6) from horizon PH-10B in the upper part of the section is also new to the formation. It comprises the occipital ring and posterior glabella with parts of the interocular fixigenae, and has a prosopon of fine pustules/tubercles suggesting it may be a hystricurine.

CONODONTS

Ji and Barnes (1994) marked their sample sites in the field with blue painted numbers; of these, Z6-2, Z6-3 and Z6-6 remain visible at the Pigeon Head section. These samples, integrated into the logged section, show that the trilobite fauna overlaps with a collection of conodonts that Ji and Barnes (1994) placed in their shallow-water (SW) *Polycostatus falsioneotensis*–*Rossodus tenuis* Assemblage Zone, which is equivalent to the deeper-water (DW) *Cordylodus angulatus* Lineage Zone of Ji and Barnes (1994). The abun-

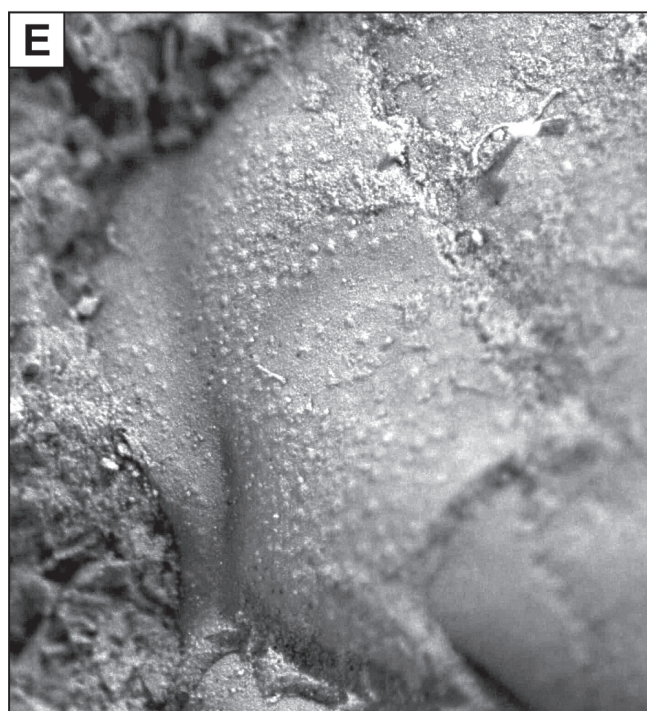
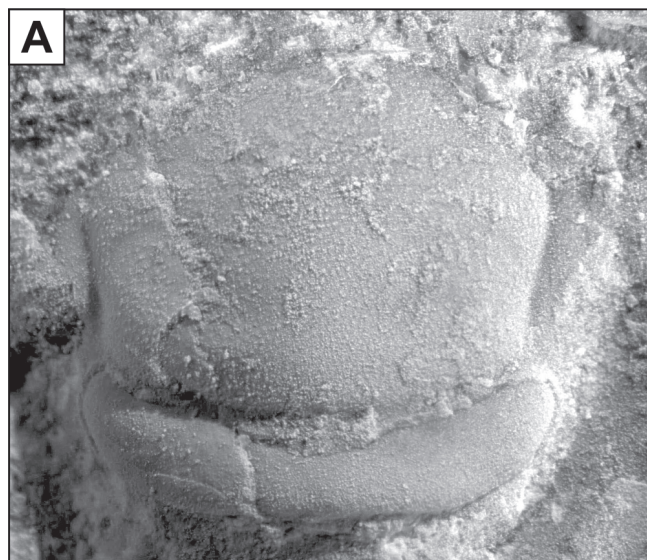


Plate 6. *Trilobite* gen. et sp. undet. from PH-10B, Pigeon Head. Cranidial axis (glabella and occipital ring) with prosopon of fine pustules / tubercles (NFM F-999). A) Dorsal view. B) Posterior view. C) Lateral view. D) Oblique anterior view. E) Closeup of latex replica, showing the prosopon of fine tubercles / pustules.

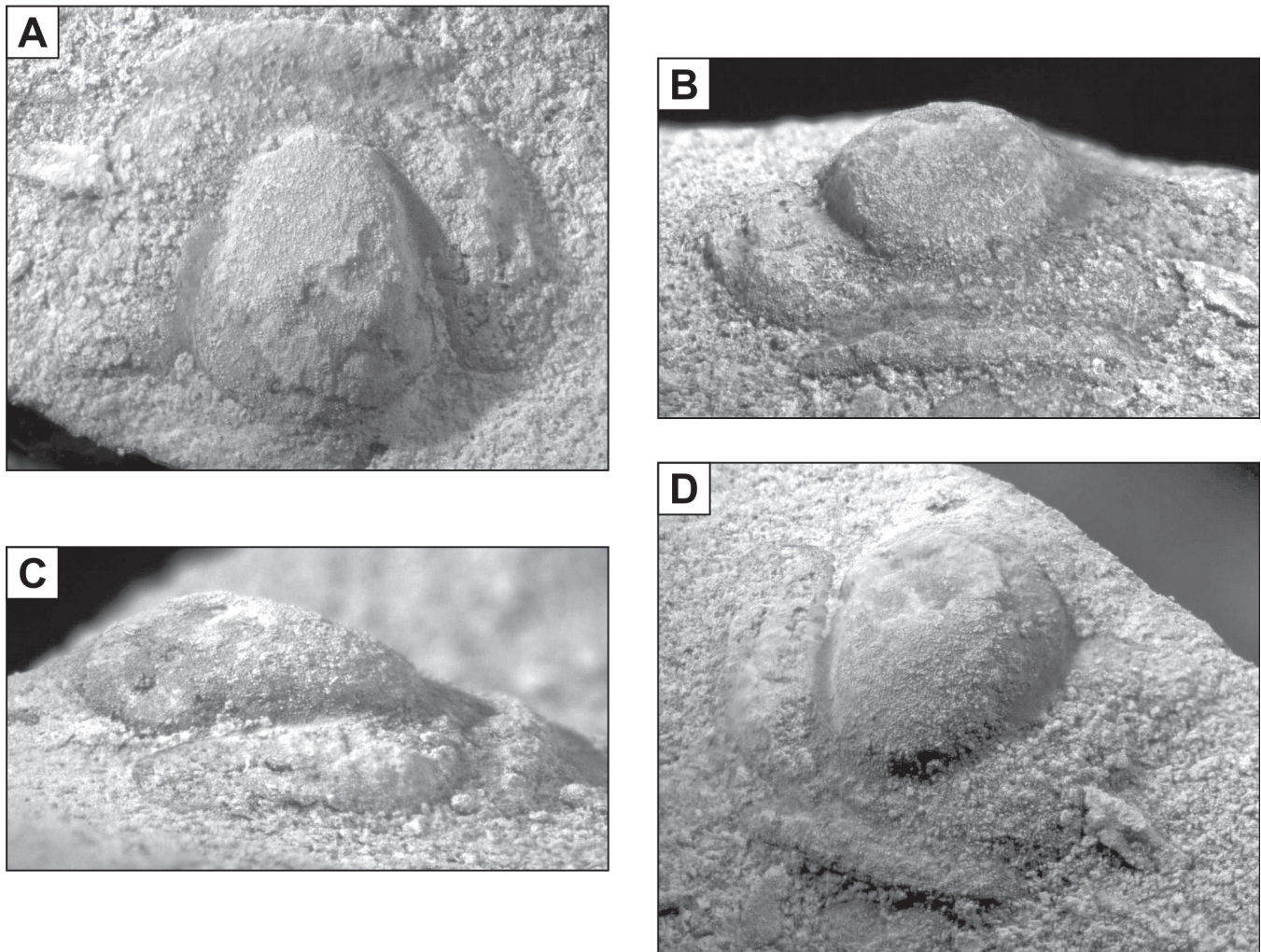


Plate 7. “*Hystricurus*” *ellipticus* (Cleland, 1900)? from PH-14, Pigeon Head. Cranidium (NFM F-1000). A) Dorsal view. B) Anterior view. C) Lateral view. D) Oblique anterior view.

dance of *Polycostatus falsioneotensis*¹ in the bedded limestone of the Pigeon Head section mimics that seen in the middle burrowed carbonate and grainstone interval at Isthmus Bay.

DISCUSSION

The presence in the Watts Bight Formation of *Bellefontia gyracantha* (Raymond, 1910)?, “*Hystricurus*” *ellipticus* (Cleland, 1900)? and *Symphysurina myopia* Westrop in Landing *et al.* (2003), support a correlation with the Tribes Hill Formation of New York State, USA (Fisher, 1954) that allows a link with the McKenzie Hill Formation of Oklahoma (see Boyce *et al.*, 2011); *Millardicurus* sp. cf. *M. arma-*

tus (Poulsen, 1937) provides a correlation with the Antiklinabugt Formation of North-East Greenland (Boyce *et al.*, 2011; McCobb *et al.*, 2011).

Symphysurina sp. cf. *S. convexa* (Cleland, 1900), which ranges from PH-02 to PH-14 in the Pigeon Head composite section, strengthens previous correlations, as the type material of *S. convexa* occurs in the Tribes Hill Formation (Fisher, 1954; Westrop *et al.*, 1993). *Symphysurina convexa* also occurs in the Kittatinny Formation of New Jersey where, according to Westrop *et al.* (1993, page 1625), it was originally described as *Illaenurus columbiana* by Weller (1903, pages 133-134; Plate V, figures 1-4); the species has also been reported in West Virginia by Woodward (1951, page

¹ Landing in Landing *et al.* (1996, page 676) regards *Polycostatus falsioneotensis* Ji and Barnes, 1994 as a junior synonym of *Semiacontiodus iowensis* (Furnish, 1938).

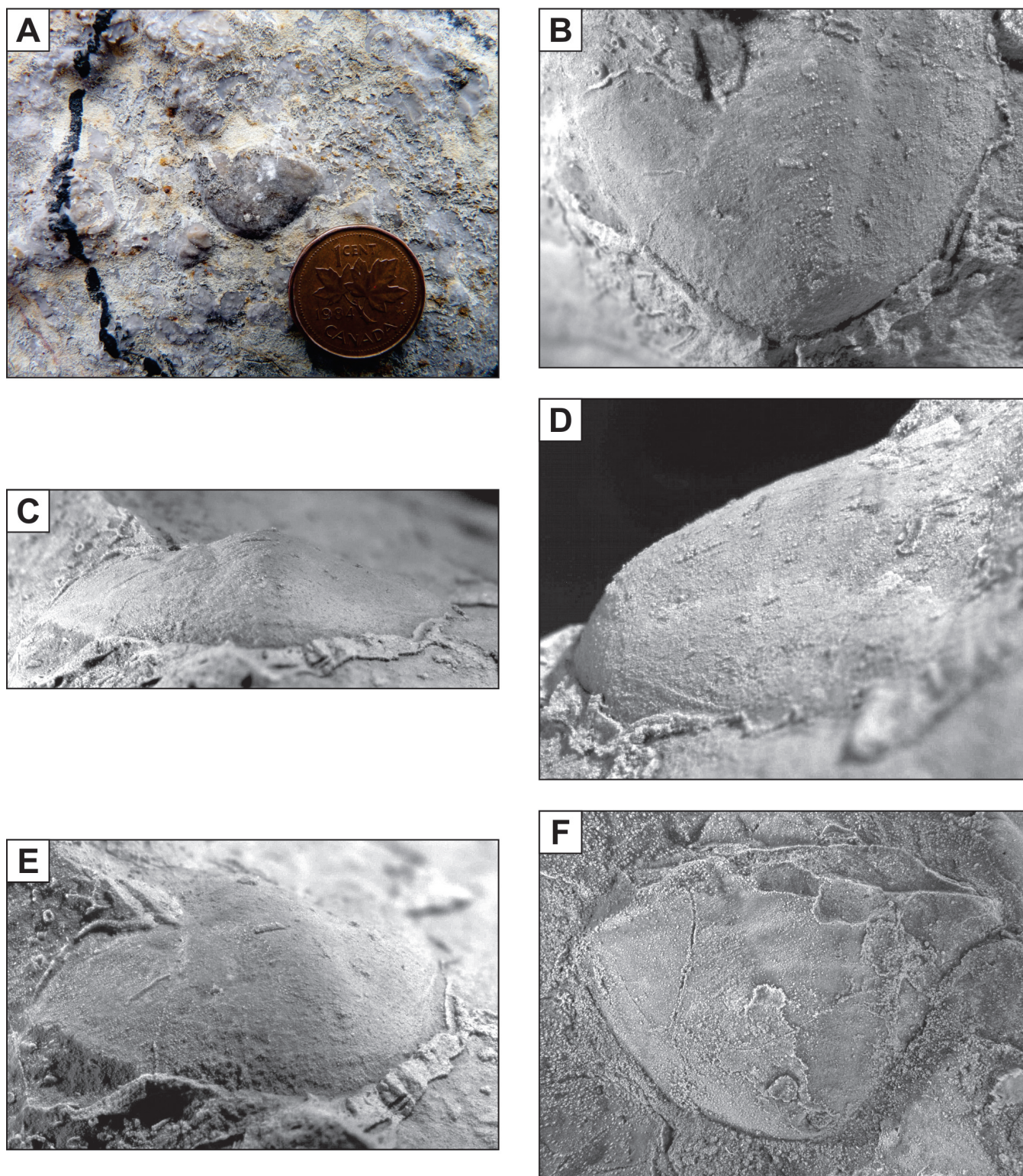


Plate 8. *Symphysurina* sp. cf. *S. convexa* (Cleland, 1900). A) PH-14, outcrop, Pigeon Head. Pygidium, dorsal view. B – F). PH-11, Pigeon Head. B – E) Pygidium (NFM F-1002). B) Dorsal view. C) Posterior view. D) Lateral view. E) Oblique posterior view. F) Pygidium (NFM F-1003), silicon cast of external mold, dorsal view.

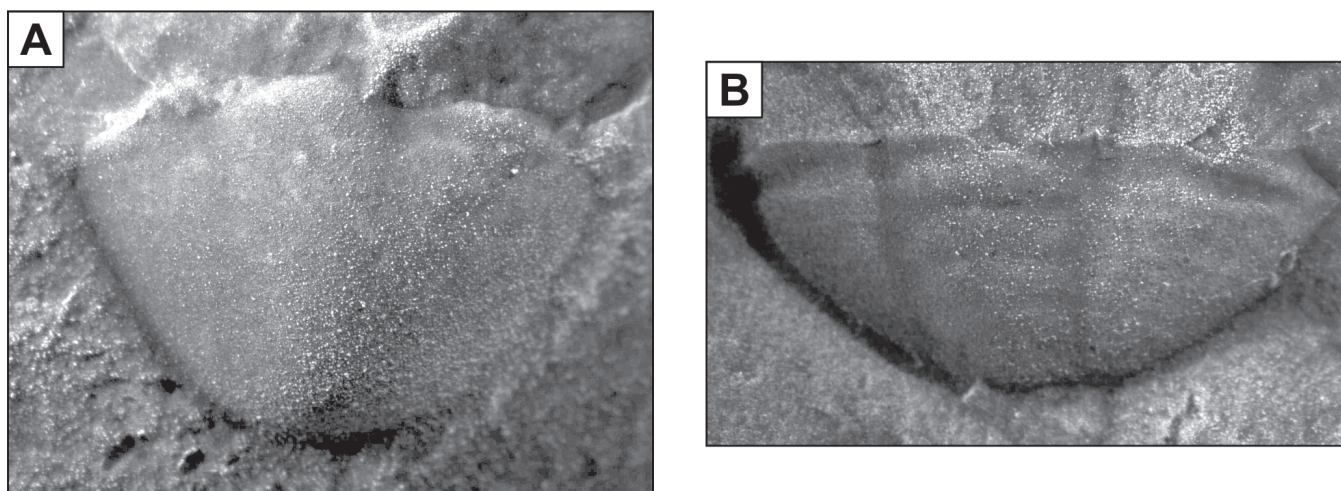


Plate 9. *Symphysurina* sp. cf. *S. convexa* (Cleland, 1900) from PH-05, Pigeon Head. A) Pygidium (NFM F-1004), clay cast of external mold, dorsal view. B) Pygidium (NFM F-1005), clay cast of external mold, dorsal view.

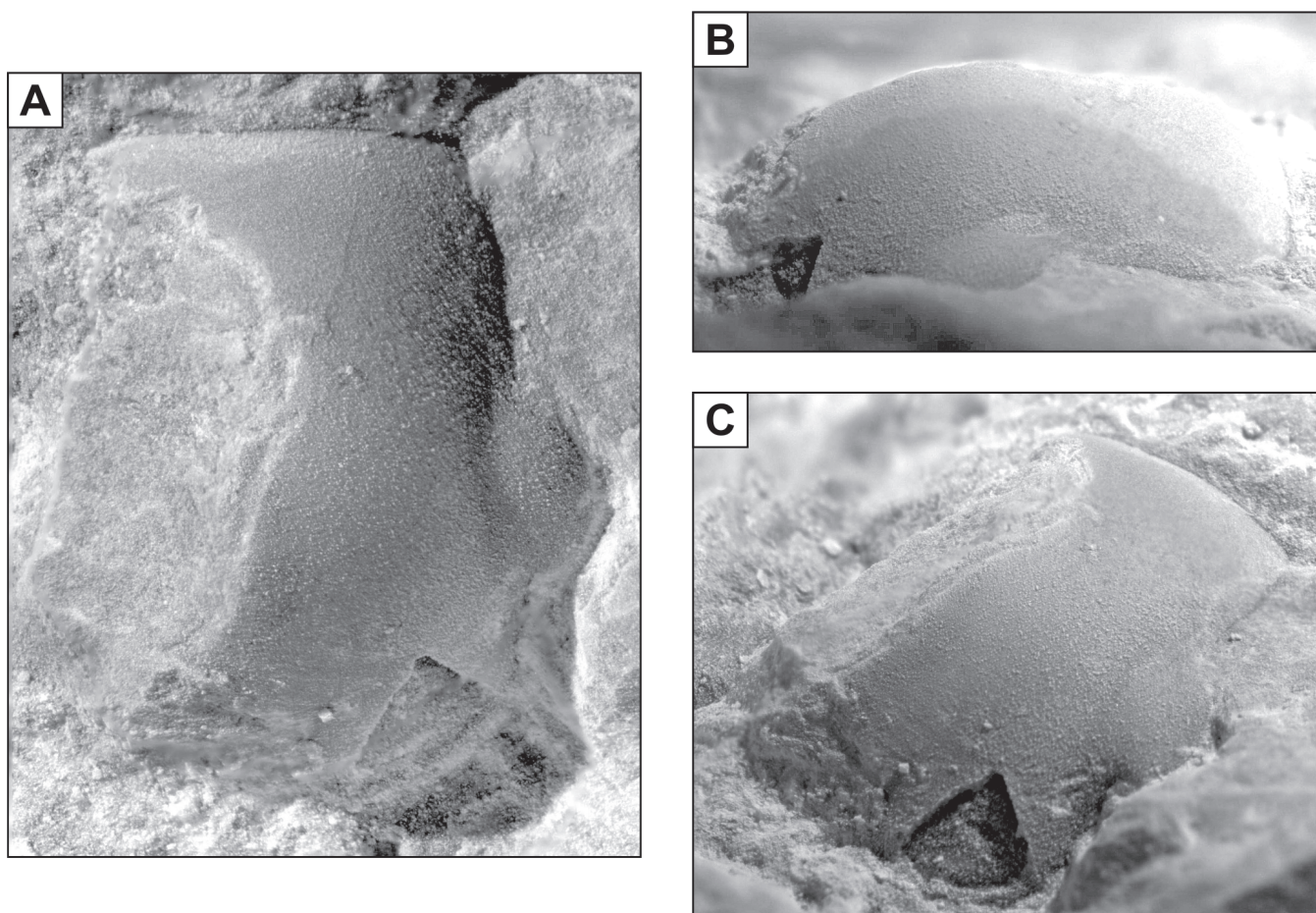


Plate 10. *Symphysurina* sp. cf. *S. convexa* (Cleland, 1900) from PH-02, Pigeon Head. Cranidium (NFM F-1006). A) Dorsal view. B) Lateral view. C) Oblique posterior view.

67) from the “Chepultepec–Stonehenge limestone”. Butts and Moore (1936, page 23) report “one pygidium of a trilobite resembling *Tsinania columbiana* (Weller)” from the Stonehenge Formation of the Bellefonte Quadrangle, Pennsylvania. The unidentified fragmentary cranidium collected from Pigeon Head (see Plate 6) together with *S. sp. cf. S. convexa* indicates greater diversity of the Watts Bight trilobite fauna than suggested by prior studies.

CONCLUSIONS

1. New fossil horizons in the lower Watts Bight Formation on Port au Port Peninsula has yielded two previously unrecorded species, including an indeterminate genus and *Symphysurina sp. cf. S. convexa*.

2. *Symphysurina sp. cf. S. convexa*, *S. myopia*, *B. gyra-cantha?* and “*H. ellipticus?*”, strengthen the correlation of the lower half of the Watts Bight Formation with the Tribes Hill Formation of New York State, USA.

3. The *Millardicurus sp. cf. M. armatus* from the Watts Bight Formation compares well to *M. armatus* from the Antiklinalbugt Formation in North-East Greenland (McCobb *et al.*, in revision). This reinforces a likely correlation between the two formations, which is also indicated by the presence of *Symphysurina* species.

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APPENDIX — Macrofossil horizons in the Watts Bight Formation (St. George Group), Pigeon Head composite section, Port au Port Peninsula, NTS 12B/10 (Stephenville) and NTS 12B/11 (Mainland), UTM Zone 21, NAD27

The fossil horizons are listed in descending order and prefixed by “PH-”. “2010F”, “2012F”, “K-2011-” and “K-2012-” refer to the field collection numbers. “(+)” and “(-)” signify fossil casts and molds, respectively.

PH-17 = 2012F007

Brachiopoda—Articulata

Gen. et sp. undet. — sulcate

PH-16 = 2012F006

Arthropoda—Trilobita

Symphysurina? sp. undet. — questionable pygidium

Echinodermata—Crinoidea

Gen et sp(p). undet. — debris.

PH-15 = 2012F004

Brachiopoda—Articulata

Gen. et sp. undet. (-)

PH-14 = K-2011-F14 = K-2011-F15 = K-2012-003A-5 = 2012F001 = 2012F003 = 2012F005 = 2012F012 = 2012F013

Arthropoda—Trilobita

“Hystricurus” ellipticus (Cleland, 1900)? — see Plate 7

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) — flattened and weathered cranidia (+), librigenae (+), thoracic segments (+), pygidia (+) — see Plate 8A

Brachiopoda—Articulata

Gen. et sp. undet.

Echinodermata—Crinoidea

Gen et sp(p). undet. — abundant ossicles

Mollusca—Gastropoda

Gen. et sp. undet.

PH-13 = K-2011-F13

Undetermined skeletal material

PH-12 = K-2011-F12 = K-2011-F12A = 2012F002 = 2012F011

Arthropoda—Trilobita

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) — cranidium (+), internal mold of a pygidium (-), incomplete pygidium (+)

Ichnofauna

Thalassinoides sp(p). undet.

Mollusca—Gastropoda

Gastropod gen. et sp. undet. — robust, planispiral

Z6-6 of Ji and Barnes (1994, page 92)

PH-11 = K-2011-F04 = 2012F016

Arthropoda—Trilobita

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) — 1.9 cm long pygidium (+, -) — see Plates 8B-F

Echinodermata—Crinoidea

Gen. et sp(p). undet. — ossicles

Mollusca—Cephalopoda

Gen. et sp. undet. — cross-section of straight form

Mollusca—Gastropoda

Gen. et spp. undet. — cross-sections of large, robust, low spiraled forms

PH-10C = 2012F010 (see Plate 5)

Mollusca–Gastropoda

Gen. et sp. undet.

PH-10B = 2012F009

Arthropoda–Trilobita

Gen. et sp. undet. – glabella (+,-) – see Plate 6

Millardicurus sp. undet. – fragmentary cranidium (+)

PH-10A = 2012F008 (see Plate 5)

Arthropoda–Trilobita

“Hystricurus” ellipticus (Cleland, 1900)? – pygidium (+) – see Plates 2E-H

PH-09 = 2012F026

Brachiopoda–Articulata?

Gen. et sp. undet.

Mollusca–Cephalopoda?

Gen. et sp. undet. – possible straight form

Mollusca–Gastropoda

Gen. et spp. undet. – specimen clusters were photographed, but not collected

PH-08 = 2012F017

Mollusca–Cephalopoda

Gen. et spp. undet. – straight forms (cross-sections)

PH-07 = 2012F025

Mollusca–Gastropoda

Rhombella sp. undet. – photographed, but not collected

Z6-3 of Ji and Barnes (1994, page 92)

Z6-2 of Ji and Barnes (1994, page 92)

PH-06 = K-2011-F11

Arthropoda–Trilobita

Gen. et sp. undet. – fragments

PH-05 = 2012F018B

Arthropoda–Trilobita

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) – pygidia (+) – see Plate 9

PH-04 = 2012F018A

Arthropoda–Trilobita

Symphysurina sp. cf. *S. convexa* (Cleland, 1900)

PH-03 = K-2011-03-01 = 2012F021 = 2012F024

Arthropoda–Trilobita

Millardicurus sp. undet. – cranidium (-), librigenae (+, -)

Symphysurina sp. cf. *S. convexa* (Cleland, 1900)? — external mold of cranidium

Mollusca–Gastropoda

Gastropod gen. et sp(p). undet. – photographed, not collected

PH-02 = 2012F020

Arthropoda–Trilobita

Symphysurina sp. cf. *S. convexa* (Cleland, 1900) – cranium (+) – see Plate 10

Brachiopoda–Articulata

Finkelburgia? sp. undet.

PH-01 = 2012F019

Brachiopoda–Articulata

Gen. et sp. undet.

Echinodermata–Crinoidea

Gen. et sp(p). undet. – debris, including ossicles

Mollusca–Cephalopoda

Gen. et sp(p). undet. – cross-sections

Mollusca–Gastropoda

Gen. et sp(p). undet. – cross-sections of large, robust, low spiraled forms