

# A LOWER CAMBRIAN LENALDANIAN SERIES (STAGE 4 – LATE DYERAN) OLENELLID TRILOBITE FROM THE FORTEAU FORMATION (LABRADOR GROUP), MAN O’WAR I-42 WELL, WESTERN NEWFOUNDLAND

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## ABSTRACT

*An incomplete, articulated dorsal shield of the trilobite Olenellus cf. gilberti has been recovered from the Middle shale of the Forteau Formation (Labrador Group) at the subsurface 588.24 m level of Inglewood Resources’ abandoned Man O’War I-42 slimhole well. A correlation is indicated with the informal Bonnia biozone in southern Labrador and western Newfoundland, placing it within the upper part of (Cambrian) Stage 4 of the recently proposed Lower Cambrian Lenaldanian Series.*

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## INTRODUCTION

The dominantly siliciclastic Dyeran to Delamarian Labrador Group (Schuchert and Dunbar, 1934) comprises, in ascending order, the Bradore, Forteau and Hawke Bay formations. The Bradore and Forteau formations are not exposed at the surface on the Port au Port Peninsula; the latter (Kippens Formation of Riley, 1962) is restricted to the subsurface in Inglewood Resources’ Man O’War I-42 well (see Figure 1). Preliminary work on the lithostratigraphy, sedimentology, systematic trilobite paleontology and biostratigraphy of the group began in the late 1970s (see Knight, 1977a, b, 1978; Stouge and Boyce, 1983), and continued with the work of Knight and Boyce (1987), Knight (2013), Knight *et al.* (2017a, b) and Skovsted *et al.* (2017).

## BIOSTRATIGRAPHY

The Canada–Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB) data (<https://www.cnlopb.ca/wp-content/uploads/nl1303/manowari42.pdf>) states:

1. The Inglewood Resources’ Man O’War I-42 well at Campbell’s Creek was spudded on November 20, 1997 and terminated on March 11, 1998; data (LMX Resources Ltd., 1998) was released on March 11, 2000.
2. Total depth of the hole was 677 m; tops of the Hawke Bay Formation<sup>1</sup> and the Forteau Formation<sup>2</sup> were encountered at 171 and 380 m depth, respectively.

3. Well status: Abandoned.

The Man O’War well was an atypical petroleum exploration well. Instead of retrieving rock cuttings – being a slimhole well – continuous rock core was recovered. In mid-July, 1998, Mr. Roland Strickland (East Coast Drilling well-site geologist, Inglewood Man O’War I-42) requested the identification of an incomplete articulated trilobite specimen that fortuitously<sup>3</sup> had been recovered from shale at 588.24 m drillhole depth, *i.e.*, 208.24 m below the top of the Forteau Formation. Originally identified as *Olenellus thompsoni* (Hall, 1859) by Boyce (1998, unpublished field notebook), it is now identified as *Olenellus cf. gilberti* Meek in White, 1874 (see next section Remarks). Its occurrence in the Middle shale of the Forteau Formation places it within the informal *Bonnia* biozone of southern Labrador and western Newfoundland (see Knight *et al.*, 2017a, b; Skovsted *et al.*, 2017). In the Great Basin, USA, *Olenellus gilberti s.s.* ranges from the upper part of the *Bolbolenellus euryparia* Biozone to the top of the *Nephrolenellus multinodus* Biozone, *i.e.*, uppermost Dyeran (Webster, 2011, page 141, figure 12), placing it within the upper part of (Cambrian) Stage 4 of the recently proposed Lower Cambrian Lenaldanian Series (Landing *et al.*, 2020) – see Figure 2.

## SYSTEMATIC PALEONTOLOGY

The specimen is curated in the Paleontology Lab, The Rooms Natural History Annex, Provincial Museum. It is

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<sup>1</sup>209 m thick

<sup>2</sup>297 m thick

<sup>3</sup>trilobites most commonly are preserved as disarticulated, molted sclerites, rather than as complete, articulated individuals

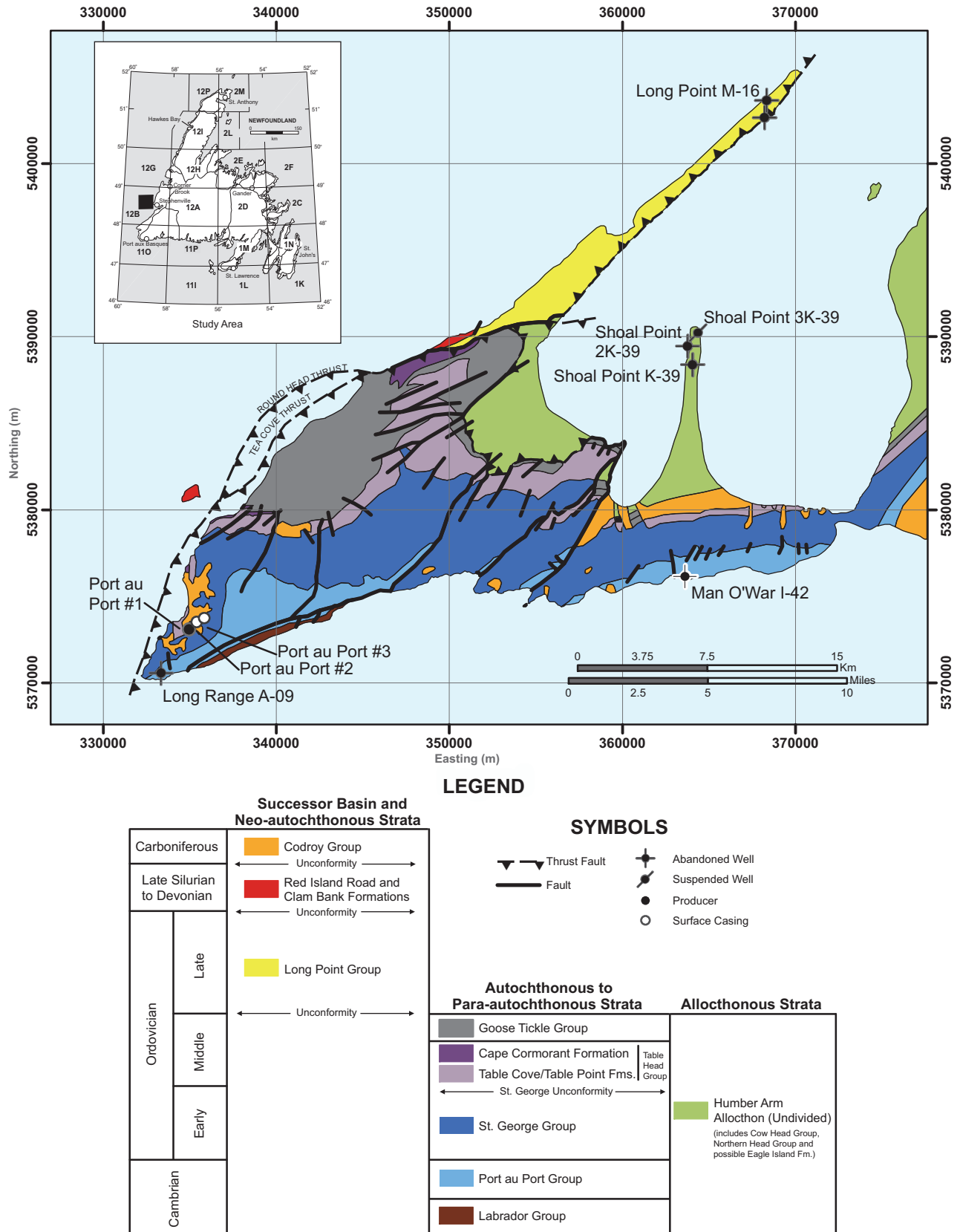


Figure 1. Port au Port Peninsula surface geology and location of hydrocarbon exploration wells (modified from Hogg et al., 2015, figure 15 – after Stockmal et al., 1998 and Knight et al., 2007).

GLOBAL		LAURENTIA		PREVIOUS BIOZONE	CURRENT BIOZONES
SERIES	STAGES	SERIES	STAGES		
LENALDANIAN (proposed)	STAGE 4	WAUCOBAN	DYERAN	Bonnia-Olenellus	Nephrolenellus multirincodus
					Bibololenellus euryptaria
					Peachella iddingsi
					~508 Ma Bristolia insolens
					Mesonacis n.sp.
					Bristolia mohavensis
					Arcuolenellus arcuatus
					~515.3 Ma

**Figure 2.** Chronostratigraphic nomenclature of Lower Cambrian Series and Stages. Global Series and Stages after Zhao et al. (2019), Geyer (2019) and Landing et al. (2020). Laurentian Series and Stages after Palmer (1998) and Hollingsworth (2011). Mesonacis n. sp. Biozone from Hollingsworth (2011). Radiometric age dates after Karlstrom et al. (2018, 2020) and Sundberg et al. (2020).

prefixed by ‘NFM F-’. The morphological nomenclature is after Palmer and Repina (1993, page 5, figure 2), but the glabellar nomenclature follows Fritz (1991, page 11, figure 2) and Lieberman (1998, 1999) – see Figure 3.

Phylum ARTHROPODA Siebold and Stannius, 1845

Class TRILOBITA Walch, 1771

Order REDLICHIIIDA Richter, 1933

Suborder OLENELLINA Walcott, 1890

Superfamily OLENELLOIDEA Walcott, 1890

Family OLENELLIDAE Walcott, 1890

Subfamily OLENELLININAE Walcott, 1890

Genus *Olenellus* Hall in Billings, 1861<sup>4</sup>

1885 *Mesonacis* – Walcott, page 328.

1910 *Paedeumias* – Walcott, page 304.

1925 *Fremontia* – Raw, page 243.

*Type species.* *Olenus thompsoni* Hall, 1859 from the Parker (Slate) Formation of Georgia, Vermont, USA.

*Diagnosis.* See Lieberman (1999, pages 11-13).

*Olenellus cf. gilberti* Meek in White, 1874

Plate 1

*Stratigraphic occurrence.* Forteau Formation, Campbell’s Creek (12B/10 – Stephenville).

Middle shale

Inglewood Resources’ Man O’ War I-42 well (see Figure 1), 588.24 m drillhole depth, 208.24 m below the top of the formation:

1998F037 (5376235.9N, 363166.3E<sup>5</sup>)

*Figured material.* One incomplete dorsal shield (NFM F-2662).

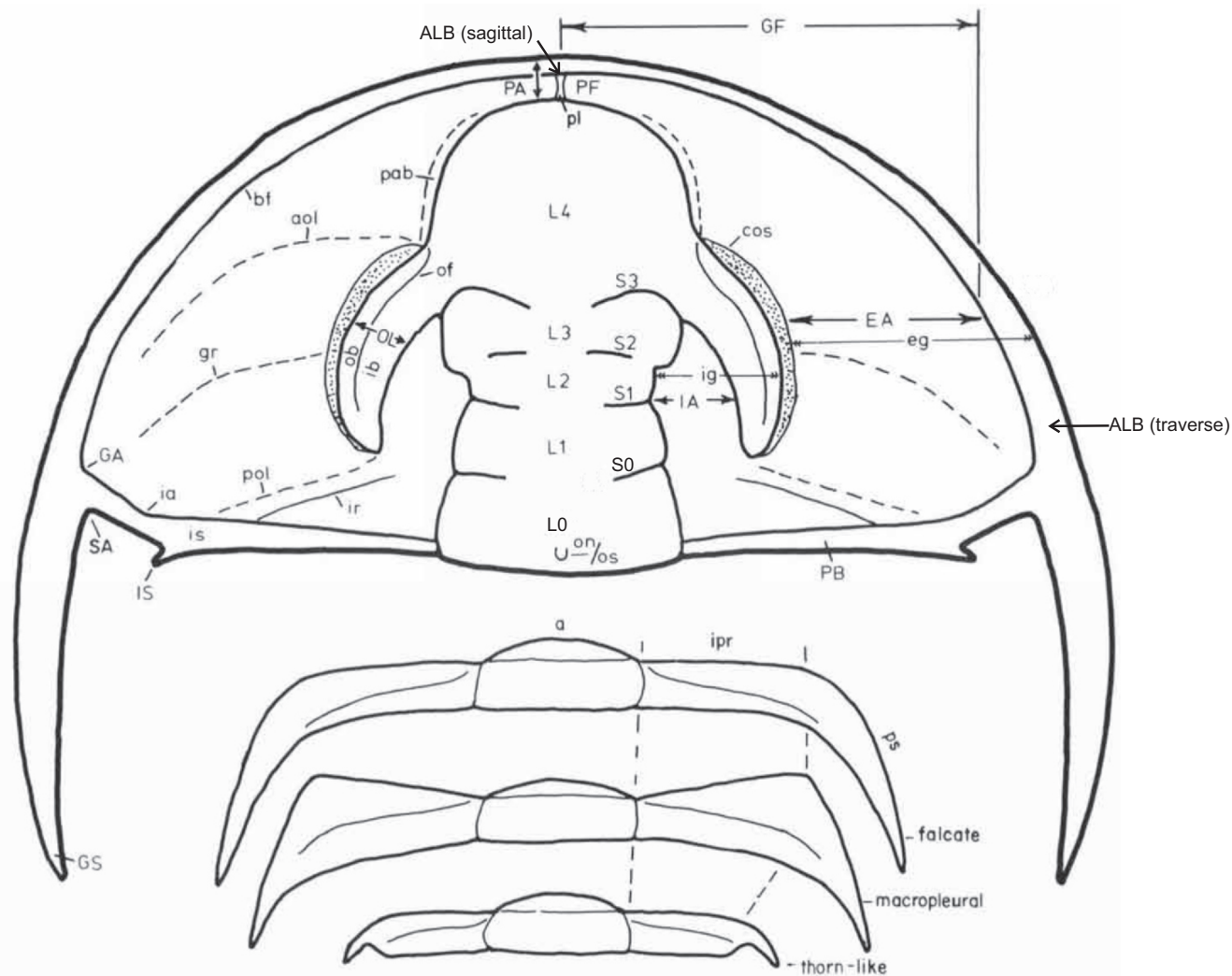
*Description.* Cephalon is marginally semi-elliptical; the cephalic length–width ratio is 53%. Anterolateral border is distinct, moderately convex, narrow, abaxially expanding to genal angle. Anterolateral border–cephalic length ratio (sag.) is 6%; anterolateral border–cephalic width ratio (tr.) is 6%. Anterolateral border furrow is narrow, shallow in front of glabella; anterolateral border furrow–cephalic length ratio (sag.) is 3%. Plectrum is not developed. Preglabellar field is narrow; preglabellar field–cephalic length ratio (sag.) is 7%. Glabella is weakly convex, anteriorly abruptly rounded, transversely weakly vaulted; glabellar length–width ratio is 178%. Glabellar–cephalic length ratio (sag.) is 84%; glabellar–cephalic width ratio (tr.) is 25%. S0 to S3 are faint, shallow, and directed backward; they are not conjoined. Intersections of imaginary lines through S0, S1, S2 and S3 with sagittal line are 72°, 75°, 78° and 70°, respectively. Ocular lobe–cephalic length ratio (exsag.) is 49%. Line joining ocular lobes’ midpoints crosses sagittal line at 38% of cephalic length from posterior margin and 45% of glabellar length from posterior margin; *i.e.*, ocular lobes are posteriorly situated. The posterior ends of the ocular lobes intersect the glabella at S0. L0<sup>6</sup> length–width ratio (tr.) is 29%. L0–cephalic length ratio (sag.) is 14%; L0–cephalic width ratio (tr.) is 25%. L4–L0 width ratio (tr.) is 93%, indicating that the glabella is weakly tapering anteriorly. A large posteriorly situated occipital node occurs on L0. Posterior border furrow is faint, narrow, shallow (exsag.). Posterior border is narrow (exsag.) adjacent to the glabella, but expands to the intergenal angle, where the posterior border–cephalic length ratio (exsag.) is 7%; at the intergenal angle, the posterior border is anteriorly deflected at 20° with respect to imaginary transverse line. Intergenal spine is not developed. Poorly preserved, incomplete genal spine probably extends back to T2 and probably T3 (the macropleurae). Prosopon is not preserved.

The incomplete thorax comprises at least six falcate segments with well-developed furrows. Axial nodes are absent. Macropleural (T3) spines extend past T6; T7 and upward are not preserved.

<sup>4</sup>see Webster and Landing (2016, page 209)

<sup>5</sup>original coordinates: 48°31’34.6” N, 58°51’11.7” W

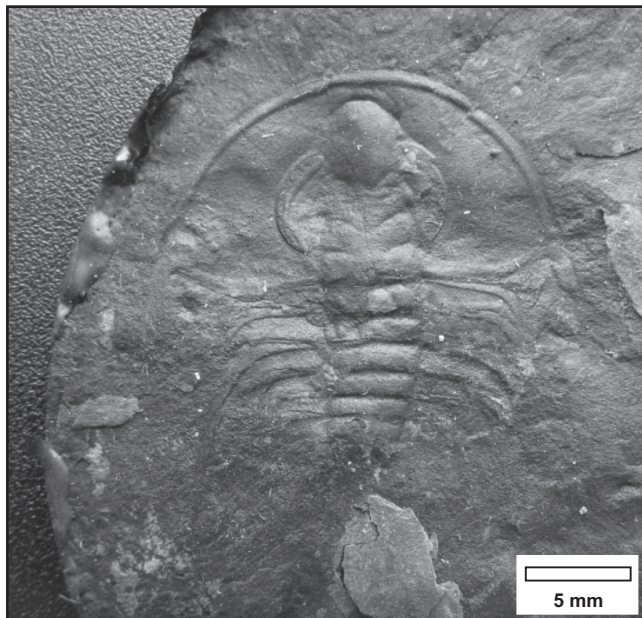
<sup>6</sup>occipital ring



**Figure 3.** Morphological nomenclature for the cephalon and thorax of *Olenellina* (modified from Palmer and Repina, 1993, figure 2). Abbreviations: a, axis; ALB (sagittal), anterolateral border (sagittal); ALB (transverse), anterolateral border (transverse); aol, anterior ocular line; bf, border furrow; cos, circumocular suture; EA, extraocular area; eg, extraocular gena; GA, genal angle; GF, genal field; gr, genal ridge; GS, genal spine; IA, interocular area; ia, intergenal angle; ib, inner band (of ocular lobe); ig, interocular gena; ipr, inner pleural region; ir, intergenal ridge; IS, intergenal spine; is, intergenal swelling; L0 to L4, glabella segments; ob, outer band (of ocular lobe); of, ocular furrow; OL, ocular lobe; on/os, occipital node or occipital spine; PA, pleglabellar area; pab, parafrontal band; PB, posterior border; PF, pleglabellar field; pl, plectrum; pol, posterior ocular line; ps, pleural spine; SA, genal spine angle; S0 to S3, glabella furrows. Thoracic segments are numbered T1, etc., from the anterior to the posterior; T3 commonly is a macropleural segment.

**Remarks.** Boyce (1998, unpublished field notebook) originally identified this material as *Olenellus thompsoni* (Hall, 1859). However, the glabella of *O. thompsoni* reaches the anterior border, whereas that of NFM F-2662 does not. The author more recently entertained an identification with *Olenellus transitans* (Walcott, 1910), but the posterior ends of NFM F-2662's ocular lobes intersect the glabella at S0, rather than in front of S0, and thoracic axial nodes are absent – compare with Webster *in* Webster and Landing (2016, pages 215-219; figures 8 and 9) – the most recent description

of *O. transitans*. The Newfoundland material is judged to be most similar to *Olenellus gilberti* Meek *in* White, 1874. In both, the posterior borders are deflected anteriorly at the intergenal angle; in *O. thompsoni* and *O. transitans*, the posterior borders are not anteriorly deflected (*see* Webster and Landing, 2016, figures 6 and 7 and figures 8 and 9, respectively). Furthermore, the posterior ends of the ocular lobes intersect the glabella at S0, and there are small posteriorly situated occipital nodes on L0. The author is reluctant to assign the specimen to *O. gilberti*, because the latter has a



**Plate 1.** *Olenellus cf. gilberti* Meek in White, 1874. Forteau Formation, Middle shale, Inglewood Man O'War I-42 well, 588.24 m level. Incomplete dorsal shield (latex cast, NFM F-2662b).

plectrum, and S0 to S3 have different orientations. For these reasons NFM F-2662 is designated *O. cf. gilberti*.

## ACKNOWLEDGMENTS

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