

Type material of *Paraconularia planicostata* (Dawson) from the Upper Mississippian of Nova Scotia, Atlantic Canada

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Paraconularia planicostata (Dawson, 1868) is one of two species in this genus (Sinclair, 1940) of conulariid cnidarian currently known from Mississippian strata in the Maritimes Basin in Atlantic Canada (Babcock and Feldmann, 1986). A salient characteristic of the species is the presence of a low and narrow internal carina at or near the longitudinal midline of each of the four faces of the gently tapered periderm (Van Iten et al., 2020). *Paraconularia planicostata* occurs in marine carbonates in the Upper Mississippian lower Windsor and lower Codroy groups in Nova Scotia and western Newfoundland, respectively (e.g., Bell, 1929; Stacy, 1953; Dix and James, 1988; Boehner et al., 1989; Boehner and Prime, 1993; Lavoie and Sami, 1998; Jutras et al., 2006; Ryan and Giles, 2017; Van Iten et al., 2020). The species is exceptionally abundant, with richly fossiliferous biohermal limestones containing up to approximately 20 specimens per 1000 cm³ of host rock (Van Iten, unpublished observations)—a volumetric density matched by few other conulariid-bearing rock units.

There are five previously figured type specimens of *Paraconularia planicostata*, all from unspecified members and formations in the lower Windsor Group of Nova Scotia (Fig. 1). However, only the holotype specimen and an unnumbered platholotype are listed as type material of *P. planicostata* in the most recent description of the species (Babcock and Feldmann, 1986). The four additional specimens comprise two hypotypes and two plesiotypes, three of which (one hypotype and two plesiotypes) are included in the synonymy of Babcock and Feldmann (1986). According to the International Code of Zoological Nomenclature (ICZN, 1999), a plesiotype is a specimen used in the redescription of an existing species (Foote and Miller, 2007), while a hypotype, although not currently recognized in the ICZN, has previously been understood to be a figured specimen collected after the publication of the original description of the species it represents. The hypotype specimen not included in the synonymy of Babcock and Feldmann (1986) has been transferred from its original repository and given a new catalogue number. The purpose of the present taxonomic note is thus to update and clarify the repositories, catalogue numbers, and

locality and stratum of all five, previously designated type specimens of *P. planicostata*.

The holotype specimen, originally described and figured in an unscaled line drawing (Dawson, 1868, 1878, 1891, fig. 117), before the advent of the holotype concept (Schuchert, 1897), is still housed in the paleontological type collection of the Redpath Museum at McGill University, Montréal, Québec (catalogue number RM(MU) 2749; see also Alison and Carroll, 1972; Babcock and Feldmann, 1986, fig. 27.1–27.4; Fig. 1.1). The hypotype specimen not included in the synonymy of Babcock and Feldmann (1986) was originally figured (but not described) by Moore and Ryan (1976, pl. V, fig. 10), who identified it, correctly, as *P. planicostata* (Dawson). This specimen (Fig. 1.2) was first housed in the paleontological collections of the Department of Earth and Environmental Science of Acadia University at Wolfville, Nova Scotia, under catalogue number 2141. It then was transferred from Acadia University to the Nova Scotia Museum of Natural History in Halifax, where it was renumbered NSM023GF017.141. This transfer and renumbering is reported here for the first time.

The other three type specimens are housed in the paleontological collections of the Geological Survey of Canada in Ottawa, Ontario. The hypotype, GSC 21767, was first illustrated (but not described) in Bamber and Copeland (1970, pl. XV, fig. 3; incorrectly cited as Bamber and Copeland, 1976, in Babcock and Feldmann, 1986) and is illustrated here in Figure 1.3. The plesiotypes, GSC 7672a and GSC 7672, were first illustrated in Bell (1929, pl. XXXII, figs. 1 and 2) and are figured here in Figure 1.4 and 1.5. Together with Dawson's (1868) original description, Bell (1929, p. 99) provided detailed descriptions of the two plesiotype specimens in his section titled "remarks." These three specimens, originally identified as *Conularia planicostata*, were included in the synonymy of *P. planicostata* by Babcock and Feldmann (1986), who therefore recognized them as belonging in this genus and species. Curiously, GSC 21767 is not listed as a type specimen in Bamber and Copeland (1970), even though the official GSC collection label accompanying the specimen designates it as a hypotype. Thus, the status of GSC 21767 as a hypotype specimen of *P. planicostata* is announced here for the first time.

The holotype (RM(MU) 2749) and two hypotypes (NSM023GF017.141 and GSC 21767) were collected at Irish

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Figure 1. Light photographs of the previously designated holotype, hypotype, and plesiotype specimens of *Paraconularia planicostata* (Dawson, 1868) from the lower Windsor Group (Upper Mississippian, mid-late Visean) of central Nova Scotia and Cape Breton Island, Atlantic Canada. All specimens oriented with the apertural (oral) end at the top. (1) Holotype RM(MU) 2749; (2) hypotype NSM023GF017.141; (3) hypotype GSC 21767; (4) plesiotype GSC 7672a; (5) plesiotype GSC 7672. Scale bar = 5 mm.

Cove in southwestern Cape Breton County, Cape Breton Island, Nova Scotia (Dawson, 1868, 1878, 1891; Bamber and Copeland, 1970; Moore and Ryan, 1976; Fig. 2). The two plesiotypes (GSC 7672 and 7672a) were discovered near the town of Windsor, central Nova Scotia (M. Coyne, written communication, 2023), and thus they may have been collected from the Avon River and/or Miller's Quarry localities of Bell (1929). The

stratigraphical provenance of the plesiotypes is also uncertain but could be one or two of several formations in the Windsor–Kennetcook Sub-basin (see Waldron et al., 2017). Specimens from Irish Cove occur in the biohermal B₁ limestone member of the late Visean (Asbian) Enon Formation (P.S. Giles, written communication, 2023; see also Stacy, 1953, Bohner and Prime, 1993, and Waldron et al., 2017), which is exposed along about

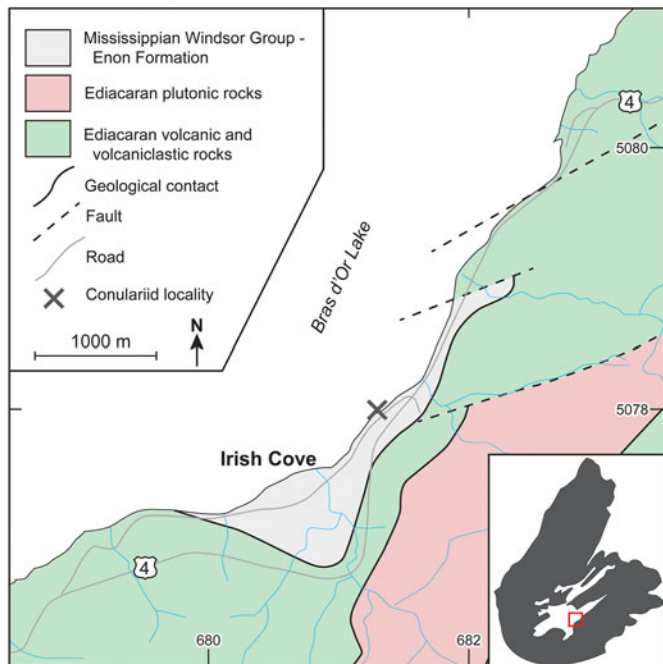


Figure 2. Geological map of Irish Cove and surrounding area (modified after Barr and White, 2017). Location in UTM coordinates in Easting and Northing $\times 1000$. Inset shows Cape Breton Island with red box showing map location.

250 m of the southern shore of Bras d'Or Lake, immediately northwest of Lakeshore Drive (Fig. 2). Interestingly, Barr and White (2017) mapped this limestone as belonging in the Hood Island Formation, which is slightly younger (Brigantian) than the Asbian Enon Formation (Waldron et al., 2017). However, this interpretation is not supported by faunal evidence, which, while placing the Irish Cove limestone in the B macrofaunal zone of Bell (1929) and subsequent authors (P. S. Giles, written communication, 2023), places the Hood Island Formation in the C macrofaunal zone (Waldron et al., 2017).

In conclusion, then, Irish Cove (Fig. 2) may be designated as the type locality of *P. planicostata*, even though Dawson (1868, 1878, 1891) listed the species as being present at this locality as well as at Windsor and Shubenacadie, two towns in central Nova Scotia. The type stratum, never previously designated at the level of member or formation, may now be listed as the B₁ Member of the Enon Formation (lower Windsor group).

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the collections of the GSC and for information regarding where the two plesiotypes specimens were collected. Light photography of the conulariids was conducted by A. Howell (the holotype specimen), T. Fedak (hypotype specimen NSM023GF017.141), and G. García-Martín (Complutense University of Madrid, Spain; GSC specimens). Finally, review comments by J. Bruthansová (National Museum of Natural History and Charles University, Prague, Czech Republic) and N.C. Hughes (University of California, Riverside) improved the quality of the original manuscript substantially.

Declaration of competing interests

The authors declare none.

References

- Alison, D., and Carroll, R., 1972. Catalogue of type and figured fossils in the Redpath Museum, McGill University: Montréal, Redpath Museum, McGill University, 173 p.
- Babcock, L.E., and Feldmann, R.M., 1986. Devonian and Mississippian conulariids of North America. Part B. *Paraconularia*, *Reticulaconularia*, new genus, and organisms rejected from Conulariida: *Annals of Carnegie Museum*, v. 55, p. 411–479.
- Bamber, E.W., and Copeland, M.J., 1970. Carboniferous and Permian faunas, in Douglas, R.J.W., ed., *Geology and Economic Minerals of Canada: Geological Survey of Canada, Economic Geology Report No. 1*, p. 623–632.
- Barr, S.M., and White, C.E., 2017. Bedrock geology of the Grand Narrows area, NTS 11F/15, Cape Breton, Inverness, Richmond and Victoria counties, Nova Scotia: Nova Scotia Department of Natural Resources, Geoscience and Mines Branch, Open File Map ME 2017-014, scale 1:50,000.
- Bell, W.A., 1929. Horton–Windsor district, Nova Scotia: Geological Survey of Canada, Memoir 155, 268 p.
- Boehner, R.C., and Prime, G., 1993. Geology of the Loch Lomond Basin and Glengarry Half Graben, Richmond and Cape Breton counties, Cape Breton Island, Nova Scotia: Nova Scotia Department of Natural Resources Memoir, v. ME 009, 71 p.
- Boehner, R.C., Giles, P.S., Murray, D.A., and Ryan, R.J., 1989. Carbonate buildups in the Gays River Formation, Lower Carboniferous Windsor Group, Nova Scotia, in Geldsetzer, H.H.J., James, N.P., and Tebbutt, G.E., eds., *Reefs: Canada and Adjacent Areas: Canadian Society of Petroleum Geologists, Memoir 13*, p. 609–621.
- Dawson, J.W., 1868. Acadian Geology: The Geological Structure, Organic Remains, and Mineral Resources of Nova Scotia, New Brunswick, and Prince Edward Island. Second edition: London, MacMillan and Co., 694 p.
- Dawson, J.W., 1878. Acadian Geology: The Geological Structure, Organic Remains, and Mineral Resources of Nova Scotia, New Brunswick, and Prince Edward Island. Third edition: London, MacMillan and Co., 694 p.
- Dawson, J.W., 1891. Acadian Geology: The Geological Structure, Organic Remains, and Mineral Resources of Nova Scotia, New Brunswick, and Prince Edward Island. Fourth edition: London, MacMillan and Co., 694 p.
- Dix, G.R., and James, N.P., 1988. Stratigraphy and depositional environments of the Upper Mississippian Codroy Group: Port au Port Peninsula, western Newfoundland: *Canadian Journal of Earth Science*, v. 26, p. 1089–1100.
- Foote, M., and Miller, A.I., 2007. *Principles of Paleontology*. Third Edition: New York, W.H. Freeman and Co., 354 p.
- ICZN, 1999. *International Code of Zoological Nomenclature*. Fourth Edition: London, The International Trust for Zoological Nomenclature, 306 p.
- Jutras, P., Ryan, R.J., and Fitzgerald, R., 2006. Gradual encroachment of a rocky shoreline by an invasive sea during the Mississippian at the southeastern margin of the Maritimes Basin, Nova Scotia, Canada: *Canadian Journal of Earth Science*, v. 43, p. 1183–1204.
- Lavoie, D., and Sami, T., 1998. Sedimentology of the lowest Windsor carbonate rocks: base metal hosts in the Maritimes Basin of eastern Canada: *Economic Geology*, v. 93, p. 719–733.
- Moore, R.G., and Ryan, R.J., 1976. Guide to the invertebrate fauna of the Windsor Group in Atlantic Canada: Nova Scotia Department of Mines, Paper 76-5, 57 p.
- Ryan, R.J., and Giles, P.S., 2017. Preliminary report of the revised paleontology of the Windsor Group and its stratigraphic implications, in MacDonald, D.R., and MacDonald, E.W., eds., *Geoscience and Mines Branch, Report of Activities 2016-17: Nova Scotia Department of Natural Resources, Report ME 2017-001*, p. 79–84.

- Schuchert, C., 1897, What is a type in natural history?: *Science*, n. s., v. 5, p. 636–640.
- Sinclair, G.W., 1940, The genotype of *Conularia*: *Canadian Field Naturalist*, v. 54, p. 72–74.
- Stacy, M.C., 1953, Stratigraphy and paleontology of the Windsor Group (Upper Mississippian) in parts of Cape Breton Island, Nova Scotia: Province of Nova Scotia, Department of Mines, Memoir No. 2, 143 p.
- Van Iten, H., Tollerton, V.P., Ford, R.C., and Hunter, K., 2020, Taphonomy and paleoecology of *Paraconularia planicostata* (Cnidaria, Scyphozoa) from the Late Mississippian Big Cove Formation (Newfoundland) and lower Windsor Group (Nova Scotia): *Geological Society of America, Northeast/Southeast Sections, Richmond, Virginia, Abstracts with Programs*, v. 52, n. 2, p. 49, <https://doi.org/10.1130/abs/2020SE-343661>.
- Waldron, J.W.F., Giles, P.S., and Thomas, A.K., 2017, Correlation chart for the Late Devonian to Permian rocks of the Maritimes Basin, Atlantic Canada: Nova Scotia Department of Energy, Open File Report 2017-02.

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