Ordovician Gastropoda from Northeast Greenland

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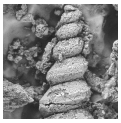

Nine gastropod genera are described from the Ordovician (upper Ibexian portion) of the Narwhale Sound Formation of Hudson Land in Northeast Greenland. The gastropods have Laurentian affinities, and eight of the Greenland genera described here also occur in the Catoche, Aguathuna or Table Point formations of western Newfoundland. Taxa include *Maclurites acuminatus* (Billings, 1865), *Helicotoma* sp. indet., operculum and shell of *Ceratopea* cf. *unguis* Yochelson & Bridge, 1957, *Lophospira* aff. *perelegans* Stauffer, 1937, *Turritoma* aff. *acrea* (Billings, 1865), *Hormotoma augustina*? Billings, 1865, *Straparollina* sp., *Lophonema taneyensis* (Cullison, 1944), and *Boucotspira antelopensis* (Rohr, 1996). • Key words: Ordovician, Narwhale Sound Formation, Greenland, Newfoundland, Hudson Land, gastropod.

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Ordovician gastropods were described from eastern Greenland on Ella Ø by Yochelson (1964) and from northern Greenland by Peel (1980), Fortey & Peel (1988), Poulsen (1927), Troelsen (1949), and Peel & Yochelson (1974). Poulsen & Rasmussen (1951) identified, but did not illustrate or describe *Eccyliopterus, Lophospira, Pagodispira* and *Trochonema* from the lower unit of the Narwhale Sound Formation on Ella Ø and farther south on the eastern coast of Greenland.

The main purpose of this paper is to systematically describe new material of Ordovician gastropods collected from part of the Narwhale Sound Formation of the Fimbulfjeld Group (Stouge *et al*. 2013).

Location and regional geology

The material was collected from the Narwhale Sound Formation at the type section for the Heim Bjerge Formation (*e.g*. Cowie & Adams 1957), Albert Heim Bjerge in Hudson Land (Fig. 1; N 74° 04´ 46.0˝; W 23°05´ 56.4˝). The localities (Fig. 1) are in UTM zone 27: AB05 (0436966 mE, 8222212 mN), AB07 (0436115 mE, 8222248 mN), AB08 (0438105 mE, 8222225 mN) and AB09 (0438035 mE, 8222194 mN).

The Narwhale Sound Formation was first named by Poulsen (1930) based on the outcrops on Ella Ø, where the formation is incompletely developed. The succession of the Narwhale Sound Formation is completely exposed in the Albert Heim Bjerge region and the formation was redescribed by Cowie & Adams (1957), under the name Narhvalsund Formation. The 350 to max 600 m thick Narwhale Sound Formation (Fig. 2) of the Fimbulfjeld Group (Kong Oscars Fjord Supergroup) is dominated by carbonates and has been subdivided into three subunits (Stouge *et al*. 2013). The lower subunit is about 65 m thick; it is composed of outer-shelf siliciclastic, mainly argillites and open-marine, grey to dark-brown, parted to ribbon limestone. A six m thick stromatolite- and chert-bearing horizon divides the lower unit, and it forms a marker horizon, and probably is a response to a brief drop in sea level. The second subunit is 160 m thick and is composed of interbeds of mainly wackestone-grainstone together with stromatoporoid patch reefs representing a shallow open-shelf depositional environment. The third subunit, 125 m thick, consists of inner-shelf to tidal-flat dolomitic carbonates composed of stromatolites, laminated dolostones, and massive fine-grained dolostones. Macrofossils are generally sparse in the lower and middle subunits of the formation and of little or no biostratigraphical value; stromatolite

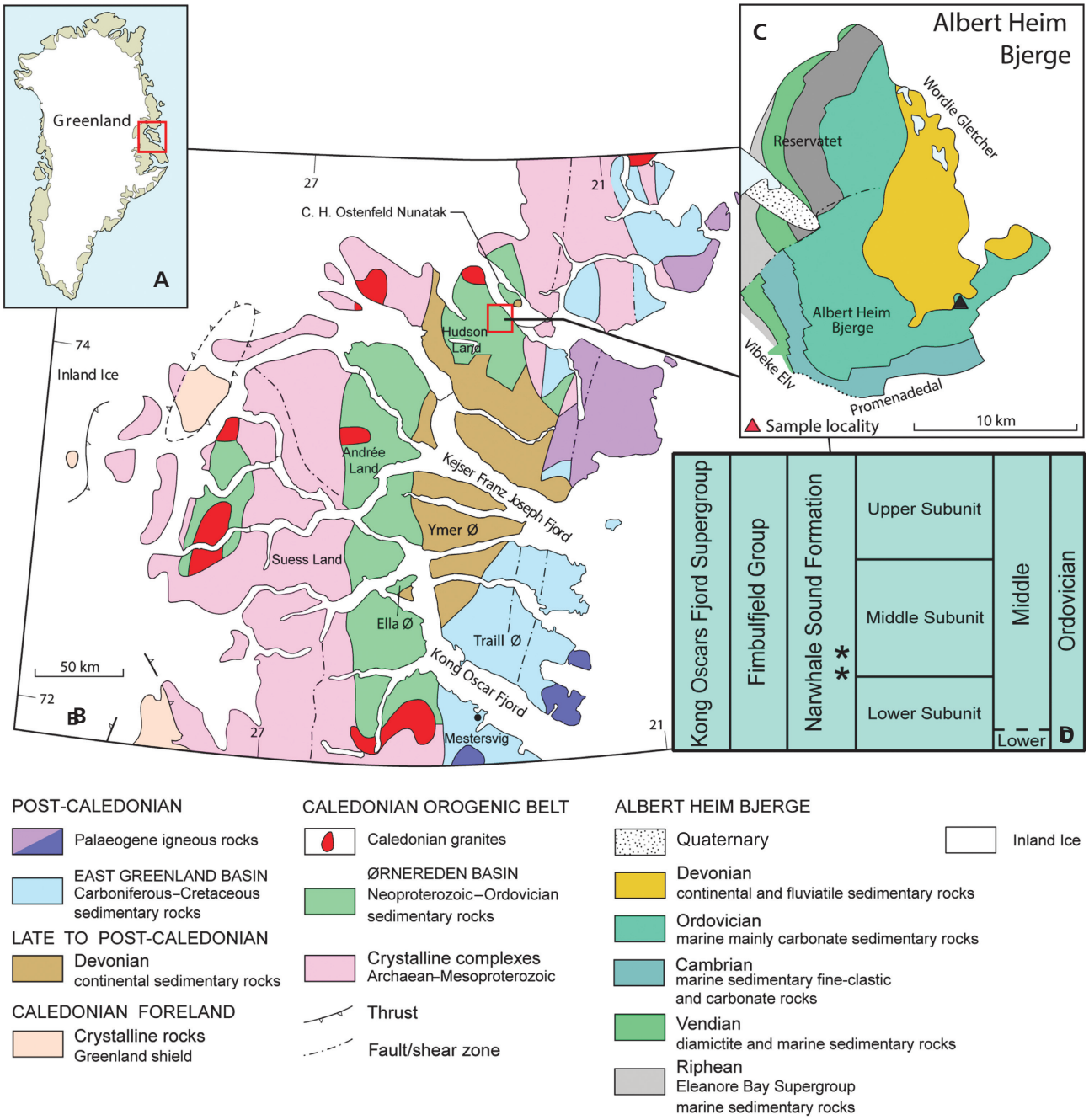


Figure 1. Gastropod locality and horizons in the Narwhale Sound Formation. • A – general location of study area in Northeastern Greenland. • B – geology of Northeast Greenland. • C – geology of Albert Heim Bjerge region, Hudson Land showing gastropod locality. • D – Narwhale Sound Formation and subdivision of the Narwhale Sound Formation proposed by Stouge *et al.* (2013). * = Stratigraphic position of collected gastropods. Fig. 1A, B is modified from Stouge *et al.* (2002); Fig. 1C is based on Cowie & Adams (1957).

beds and oncolites are common in the upper part of the succession. In the lower subunit, the fauna is composed mainly of rare gastropods [*Hormotoma* sp. and *Ceratopea* opercula (Yochelson, 1964)]. From the base of the second subunit, a significant faunal change occurs and abundant stromatoporoids and gastropods associated with some solitary corals appear. Lower in the succession, patch reefs and mounds were constructed exclusively by stromatolites and thrombolites.

Material

The gastropods that form the basis of this study were col-

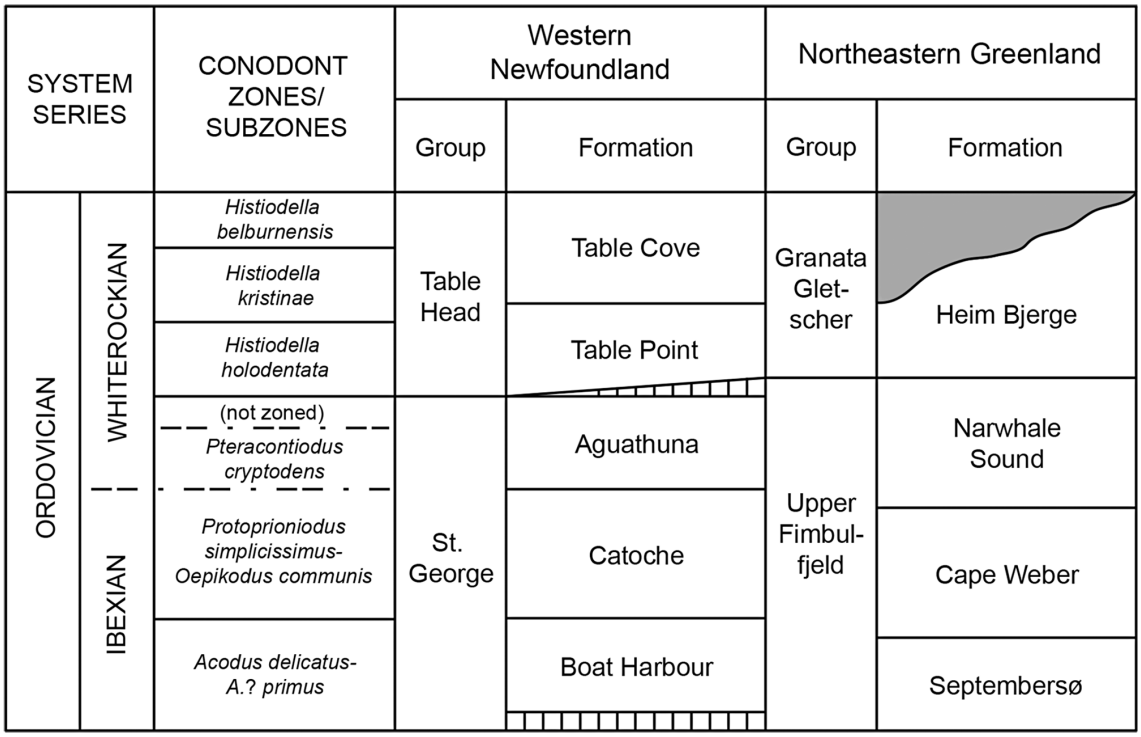


Figure 2. Stratigraphy and correlation of Western Newfoundland and Northeastern Greenland. Conodont zones of Ji & Barnes (1994).

lected by D.A.T. Harper, S. Stouge and J.L. Christiansen in 2008 from the Narwhale Sound Formation exposed in Hudson Land, Northeast Greenland (Fig. 1). The specimens were collected from two beds at the top of the lower subunit and the base of the middle subunit of Stouge *et al*. (2013). The specimens are heavily silicified, and they were handpicked individually from weathered limestone surfaces and later acidized from the matrix. Secondary concentric silicification structures (beekite rings) are abundant on some specimens and obscure the ornamentation.

Age of fauna

Ordovician gastropods are generally of limited value for biostratigraphy; however, the presence of *Ceratopea billingsi* (not found during this study but reported by Yochelson 1964) suggests an uppermost Lower Ordovician assignment for the lower part of the Narwhale Sound Formation. Also found in these four localities in the Narwhale Sound, *Ceratopea unguis* is a younger species of *Ceratopea* (Yochelson & Wise, 1957), but it is also latest Ibexian. According to Stouge *et al*. (2013), the Lower-Middle Ordovician boundary is probably conformable in the area and occurs within the lower part of the Narwhale Sound Formation.

The associated conodont fauna and faunal succession of the Narwhale Sound Formation is typical Laurentian. In the lower fine-grained clastic subunit, an assemblage first composed of *Tripodus* cf. *laevis*, is followed by *Pteracontiodus cryptodens* and *Histiodella altifrons*; the higher subunits of the formation have yielded a diagnostic fauna composed of Middle Ordovician hyaline conodonts of Midcontinent affinity, and the upper unit includes *Discidognathus primus* and *Multioistodus subdentatus*. These biostratigraphic data suggest that the formation extends from the upper Ibexian (Smith 1991) to middle Whiterockian (Smith 1991, Stouge *et al*. 2013).

Comparison to the Ordovician of Newfoundland

Lower and Middle Ordovician shallow-water platform carbonate rocks are widely exposed in western Newfoundland, and they were connected to a carbonate platform succession that extended to eastern Greenland, northern Scotland and Svalbard (Poulsen 1951, Swett & Smit 1972, Stouge *et al.* 2013). The Barbace Cove Member of the Boat Harbour Formation, the Catoche and Aguathuna formations of the St. George Group form an unconformity-bounded, upper Ibexian to lower Whiterockian sequence. The Table Point Formation (Whiterockian) is the lower formation in the Table Head Group and unconformably overlies the St. George Group (Fig. 2). The Aguathuna Formation, the top formation of the St. George Group, is within the *Pteracondiotus cryptodens* conodont Zone (Ji &

Barnes 2004), whereas the lower part of the Table Point Formation is referred to the *Histiodella holodentata* conodont zone (Stouge 1984, 2012). Gastropods are abundant and diverse (*see* Billings 1865; Rohr *et al.* 2000, 2001, 2002) and occur in most beds of all the Ordovician formations in western Newfoundland.

Eight of the nine Greenland genera described here also occur in Catoche, Aguathuna or Table Point formations. Six are assigned to the same species: *Maclurites acuminatus* (Billings, 1865), *Lophonema taneyensis* (Cullison, 1944), operculum and shell of *Ceratopea unguis* Yochelson & Bridge, 1957, *Lophospira* aff. *perelegans* Stauffer, 1937, *Turritoma* aff. *acrea* (Billings, 1865), and *Hormotoma augustina*? Billings, 1865.

Most of the genera are also found in the rest of eastern North America. *Boucotspira*, *Lophonema*, *Turritoma* and *Ceratopea* provide a unique eastern North America biogeographic signal (Ebbestad *et al*. 2013).

Repository. – Gastropods in this report are deposited in the Geological Museum (a part of the Natural History Museum of Denmark), University of Copenhagen (MGUH).

Systematic palaeontology

Family Macluritidae Carpenter, 1861

Genus *Maclurites* Lesueur, 1818

Type species. – *Maclurites magnus* Lesueur, 1818, U.S.A.; Tennessee, Middle Ordovician, Chazyan.

***Maclurites acuminatus* (Billings, 1865)**
Figure 3A–C

1865 *Maclurea acuminata*; Billings, p. 240, fig. 215.
1890 *Maclurea acuminata* Billings. – Whitfield, p. 32, pl. 3, figs 1, 2.
1910 *Maclurea acuminata* Billings. – Seely, pl. 57, figs 9, 10.
1957 *Maclurites florentinensis*; Banks & Johnson, p. 635, pl. 74, figs 4, 5, 10.
1961 *Maclurites acuminatus* (Billings, 1865). – Yu, p. 34, pl. 1, figs 1, 2.
2001 *Maclurites*? *acuminatus* (Billings, 1865). – Rohr & Measures, p. 268, figs 5.19–5.21.

Material. – Two fragmentary silicified specimens from locality AB08. Illustrated specimen MGUH 31246.

Description. – Small, incomplete specimens 1.5 cm in diameter, planar base, convex upper surface with narrow, steep-sided umbilicus, which slightly exposes previous whorls. Outer edge of whorl acute, about 45°. Width of whorl on base about doubles per volution.

Remarks. – The species is distinguished by its base, its narrow umbilicus, and absence of previous whorls exposed within the umbilicus. The Greenland species is also similar to *Maclurites* sp. 1 of Rohr *et al.* (2001) from the Catoche Formation, which has a narrow umbilicus but a taller shell.

Occurrence. – Cosmopolitan. Blackhillsian of Vermont (Whitfield 1890), Whiterockian Table Point Formation of Newfoundland (Rohr & Measures 2001), Darriwilian of Tasmania (Banks & Johnson 1957), upper Lower or lower Middle Ordovician (Arenig) of China (Yu 1961).

Family Helicotomidae Wenz, 1938

Genus *Lophonema* Ulrich *in* Purdue & Miser, 1916

Type species. – *Lophonema peccatonica* Ulrich *in* Purdue & Miser, 1916; U.S.A., Missouri, Blackhillsian.

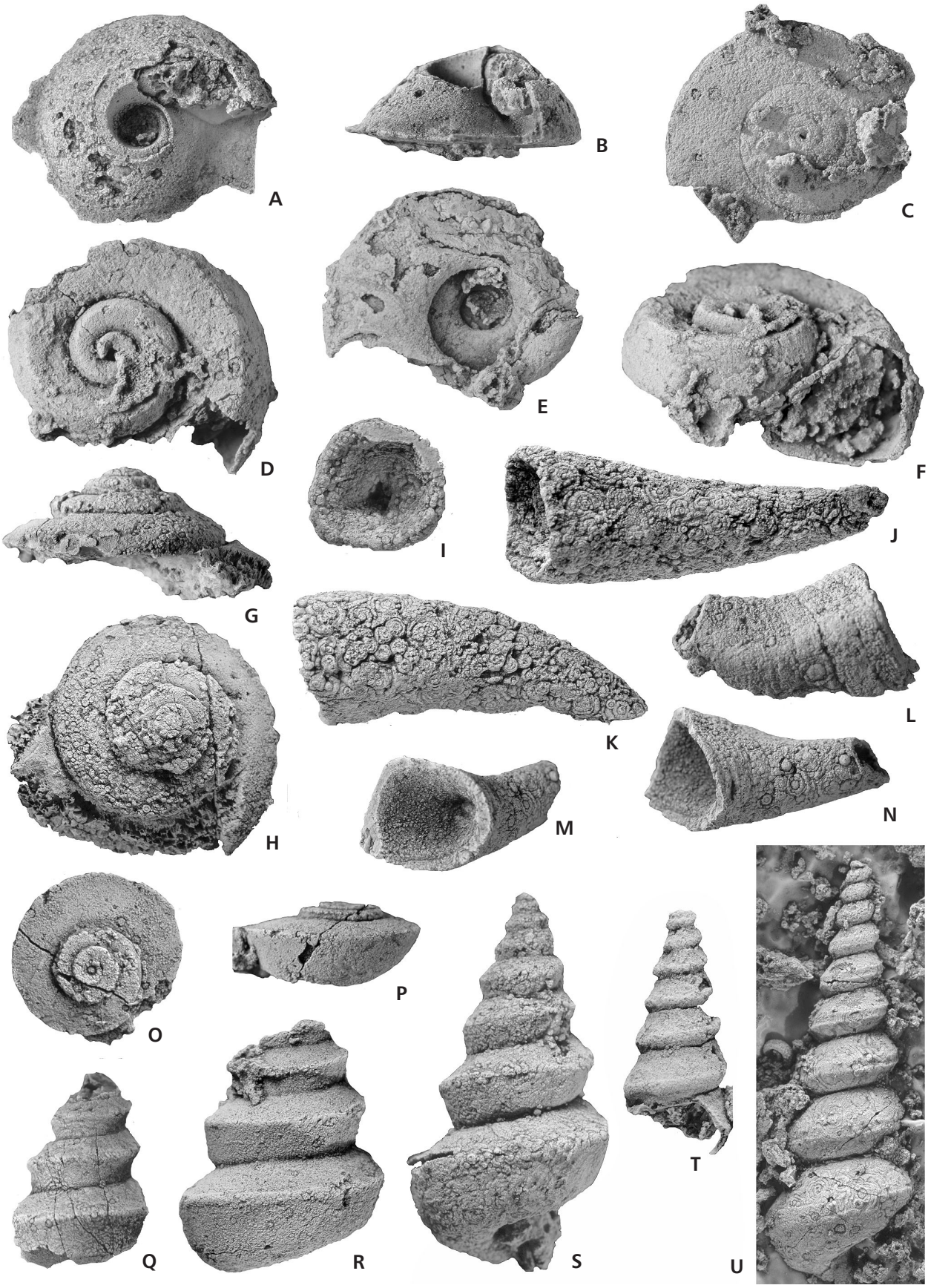
***Lophonema taneyensis* (Cullison, 1944)**
Figure 4G–I

1944 *Polhemia taneyensis*; Cullison, p. 55, pl. 26, figs 6–10.
2002 *Polhemia taneyensis* Cullison, 1944. – Rohr *et al*., p. 272, figs 6.1–6.12.

Material. – A single specimen from locality AB08. Illustrated specimen MGUH 31261.

Description. – Small, 7 mm in diameter, low-spired, gradate, phaneromphalous gastropod, sub-hexagonal cross

Figure 3. A–C – *Maclurites accuminatus* (Billings, 1865); top, apertural and basal views, MGUH 31246, × 3, loc. AB08. • D–F – *Helicotoma* sp. indet., top, basal, and oblique apertural views, MGUH 31247, × 3, loc. AB09. • G–H, O, P – *Ceratopea* cf. *C. unguis* Yochelson & Bridge, 1957; G–H – side and top views of a fragmentary specimen, MGUH 31248, loc. AB07; O, P – top and abapertural view, MGUH 31249, × 3, loc. AB04. • I–N – operculum of *Ceratopea unguis* Yochelson & Bridge, 1957; I–K – apertural and side views, MGUH 31250, × 2, loc. AB08; L–N – apertural and side views, MGUH 31251, × 3, loc. AB07. • Q–S – *Lophospira* aff. *L. perelegans* Stauffer, 1937; side views, MGUH 31252, × 3, loc. AB08; MGUH 31253, × 3, loc. AB09; MGUH 31254, × 3, loc. AB08. • T – *Turritoma* aff. *acrea* (Billings, 1865); side view, MGUH 31255, × 3, loc. AB08. • U – *Hormotoma augustina*? Billings, 1865; side view, MGUH 31256, × 3, loc. AB09.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section, with three angulations present: at whorl shoulder, at midwhorl and around base of whorl.

Remarks. – The shape of the specimen appears to be nearly identical to, *L. taneyensis. Lophonema frydai* (Rohr, 1996) is higher spired. The small Greenland specimen does not display any the spiral cords of *L. taneyensis*. The poorly known *Lophonema peccatonia* Ulrich *in* Purdue & Miser, 1916, appears to be more rounded.

Occurrence. – *Lophonema taneyensis* is a distinctive and relatively abundant gastropod known from the Lower Ordovician (Blackhillisan) Cotter Formation of Missouri (Cullison 1944), and throughout the Blackhillsian portion of the Catoche Formation in Newfoundland (Rohr *et al.* 2002). A similar species, *L. frydai* (Rohr, 1994) occurs in the Whiterockian Antelope Valley Formation of Nevada.

Family Helicotomidae Wenz, 1938

Genus *Helicotoma* Salter, 1859

Type species. – *Helicotoma planulata* Salter, 1859; Canada, Quebec, Upper Ordovician, Blackriverian.

***Helicotoma* sp. indet.**
Figure 3D–F

Material. – Three silicified specimens from locality AB09. Illustrated specimen MGUH 31247.

Description. – Moderately small (up to 18 mm in diameter) discoidally coiled dextral gastropods having a circular to laterally compressed oval cross section with an angulation at the shoulder. Loosely coiled, deep sutures, flat spire and broad umbilicus exposing about half of the previous whorl; no ornament present.

Remarks. – The shell is low-spired and similar in profile to *Helicotoma* sp. from the Whiterockian of Nevada (Rohr 1996, fig. 5.8). The type species, *H. planulata,* is higher-spired. Poulsen (1937, pl. 4, figs 7–10) illustrated four poorly preserved, low-spired specimens from the Cape Weber Formation that appear similar to these specimens, although the illustration by Sardeson (1903, fig. 18) shows it to be a very discoidal shell. Billings (1865) named three species from western Newfoundland, but all are poorly preserved.

Occurrence. – *Helicotoma* is a common (at least 22 named species) and widespread gastropod of the Middle and Upper Ordovician.

Family Euomphalidae de Koninck, 1881

Genus *Boucotspira* Rohr, 1980

Type species. – *Boucotspira fimbriata* Rohr, 1980; U.S.A., California, Ordovician, Whiterockian?.

***Boucotspira antelopensis* Rohr, 1996**
Figure 4J–L

1996 *Trochonemella antelopensis*; Rohr, p. 59, fig. 3.14–3.17.
2002 *Boucotspira* aff. *fimbriata.* – Wagner, p. 77, fig. 15.

Material. – One fragmentary silicified specimen from locality AB08. Illustrated specimen MGUH 31262.

Description. – Small, single incomplete specimen 1.4 cm in diameter, apical angle 120°, two strong angulations, one high on whorl and other at periphery. Upper suture shallow, whorl convex to upper angulation; midwhorl broadly convex, sloping at an angle of about 65° to lower angulation, curving convexly into base. Base not preserved, nature of umbilicus unknown. Growth lines not observed.

Remarks. – The shell profile is similar to *Euomphalopterus* Roemer, 1876, but lacks the large peripheral frill. Wagner (2002) included Ordovician shells with this shape as "euomphalopterines". *Boucotspira* has a sinus at the upper angulation, but growth lines are not present on this specimen.

Occurrence. – Whiterockian of northern California (Rohr 1980), Nevada (Rohr 1996) and Greenland.

Family Raphistomatidae Koken, 1896

Genus Ceratopea Ulrich, 1911

Type species. – *Ceratopea keithi* Ulrich, 1911; U.S.A., Virginia, Ordovician, Ibexian.

Remarks. – *Ceratopea* is one of only a few gastropod genera established on the calcareous operculum and not the shell. The operculum is commonly found disassociated, and for many years the nature of the shell itself was unknown (Yochelson 1975). Yochelson & Bridge (1957, pl. 38, figs 8, 9) illustrated an artificial association of *C. unguis* with its presumed shell made years earlier by E.O. Ulrich & J. Bridge (E.L. Yochelson, written comm. 2003). Rohr *et al.* (2004b) illustrated the first life association of the operculum with a complete shell of *C. unguis*.

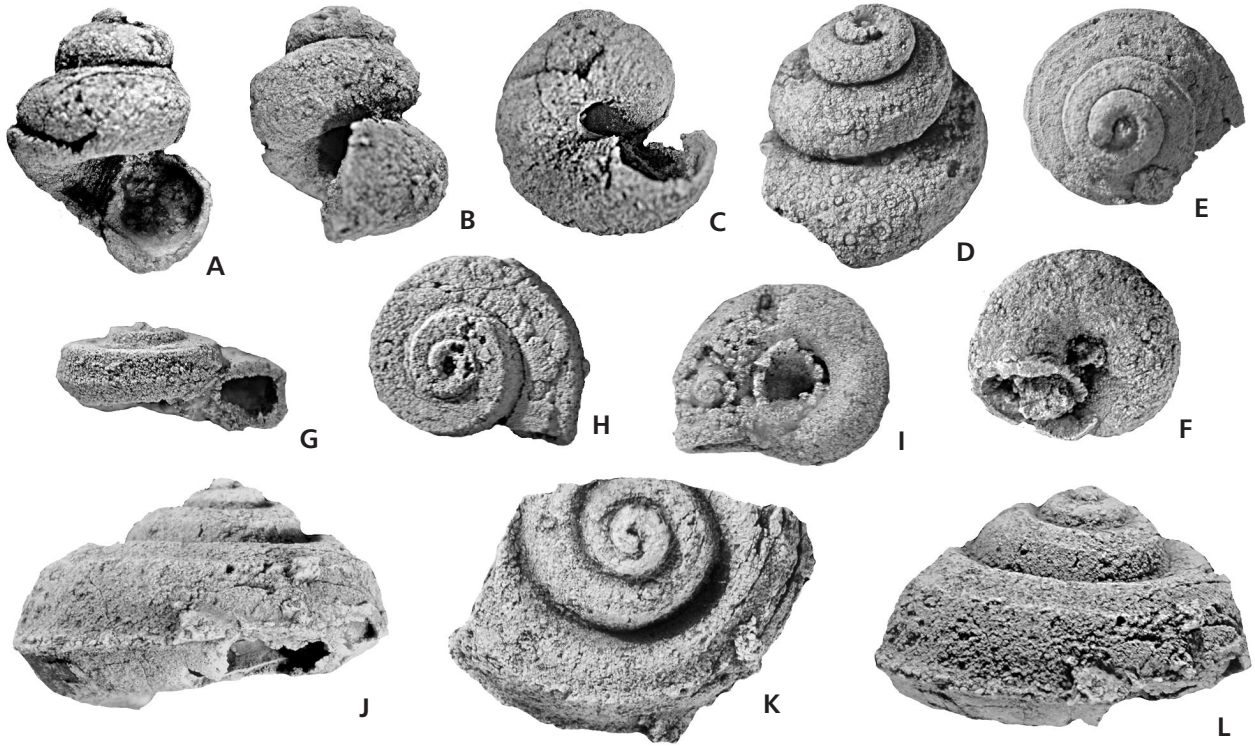

Figure 4. A–F – *Straparollina* sp.; A–C – apertural, side and basal views, MGUH 31257, × 3, loc. AB08; D – side view with bilineate peripheral band, MGUH 31258, × 3, loc. AB09; E – top view with peripheral band, MGUH 31259, loc. AB07; F – umbilical view, MGUH 31260, × 3, loc. AB04. • G–I – *Polhemia taneyensis* Cullison, 1944; apertural, top and umbilical views, MGUH 31261, × 3, loc. AB08. • J–L – *Boucotspira antelopensis* (Rohr, 1996); side views, MGUH 31262, × 3, loc. AB08.

Shell of *Ceratopea* cf. *C. unguis* Yochelson & Bridge, 1957

Figure 3G–H, O, P

1957 *Ceratopea unguis*; Yochelson & Bridge, pp. 300–301, pl. 38, figs 8, 9.
1972 *Ceratopea unguis.* – Yochelson & Wise, p. 681, fig. 1a–c.
2004b *Ceratopea unguis.* – Rohr, Fix & Darrough, p. 218, fig. 1.

Material. – One specimen from locality AB07 and one from AB08. Illustrated specimens MGUH 31248 and 31249.

Description of shell. – Lenticular with bulk of whorl below periphery, dextral shell up to 2.5 cm in diameter, apical angle 110 to 130°; upper suture incised, slightly gradate, upper whorl surface broadly convex, sharp periphery, convex base; umbilicus present but not well preserved.

Remarks. – The Greenland shells have a shape very similar to *Ceratopea unguis*. Since the Greenland shells do not preserve the base of the shell well, it is not known if the circum-umbilical cord of *C. unguis* is present. Several species of *Ceratopea* occur in western Newfoundland (Rohr *et al*. 2000, 2001). *Ceratopea normani* (Billings, 1865), which is a synonym of *C. canadensis* Yochelson & Copeland (1974), is known from an internal mold from Billing's (1865) Unit G (Catoche Formation). Shells probably of *C. canadensis* occur in the Catoche Formation (Rohr *et al*. 2000, 2001).

Other shells (not opercula) assigned to the genus include *Ceratopea buttsi* Yochelson & Bridge, 1957, and *C. hami* Yochelson & Bridge, 1957. *Ceratopea canadensis* (Billings, 1865) from the Oxford Formation (Cassinian) of Ontario, was illustrated by a line drawing (Billings 1865, fig. 328). This species was re-described by Yochelson & Copeland (1974, p. 205), and they noted, "...no close correspondence between the syntypes and the line drawings." Yochelson & Copeland (1974) noted the similarity of *C. unguis* and *C. canadensis* and suggested that they might be placed in synonymy, although they did not. No operculum has been associated with *C. canadensis.* Wagner (2002) included *C. hami* (Stauffer, 1937), *C. laurentia* (Billings, 1865), and *C. pygmaea* (Stauffer, 1937), and none of these shells have a spiral cord on the base.

Occurrence. – See below.

Operculum of *Ceratopea unguis* Yochelson & Bridge, 1957

Figure 3I–N

1957 *Ceratopea unguis*; Yochelson & Bridge, pp. 300–301, pl. 37, figs 11–14, 19–24, 28; pl. 38, fig. 8.
1972 *Ceratopea unguis.* – Yochelson & Wise, p. 681, fig. 1a–c.
1972 *Ceratopea unguis.* – Yochelson & Barnett, pp. 685, fig. 1a–j.
1975 *Ceratopea unguis.* – Yochelson & Peel, pp. 230–231, fig. 7d, e.
1979 *Ceratopea unguis.* – Peel & Yochelson, pp. 88–91, fig. a–j.
1995 *Certaopea unguis.* – Rohr, Norford & Yochelson, p. 1052, figs 4.1–4.4.
2004 *Ceratopea unguis.* – Rohr, Fix & Darrough, p. 218, fig. 1.

Material. – Twenty-two specimens from locality AB05, seven from AB07, and four from AB08, and one from AB09. Illustrated specimens MGUH 31250 and 31251.

Description. – Curved, horn-shaped operculum with a pit at the apertural end; vertically compressed with cross section reflecting shape of aperture of shell; growth lines mostly regular and normal to the axis of the operculum.

Remarks. – *Ceratopea unguis* is the youngest and most common species of the genus and its operculum expresses the greatest variability (Yochelson & Bridge 1957). The species can be distinguished from *C. buttsi* Yochelson & Bridge, 1957, by its lack of a sharp carina. The growth lines on the operculum do not necessarily reflect the reentrants along the shell aperture, since the operculum was withdrawn inside the aperture (Yochelson & Bridge 1957, Rohr *et al*. 2004b). Yochelson & Copeland (1974) suggested that *C. canadensis* may be a synonym of C. *unguis*, but no operculum is associated with it.

Occurrence. – *Ceratopea unguis* is restricted to the upper Ibexian of eastern Laurentia. Opercula of *C. unguis* occur in the Nigerbreen Limestone at Spitsbergen (Birkenmajer & Yochelson 1998), Nunatami and Wandel Valley formations of North Greenland (Peel & Yochelson 1979), the Aguathuna Formation of western Newfoundland (Yochelson 1992, Rohr *et al*. 2000), the Providence Island Dolomite (*Didymograptus protobifidus* Zone) of New York (Yochelson & Barnett 1972), the Smithville Formation of Arkansas (Yochelson & Wise 1972, Rohr *et al.* 2004b), the upper part of the West Spring Creek Formation (Yochelson 1973) in Oklahoma, the Rockdale Run Formation of Virginia (Butts 1941) and Maryland (Sando 1957), and the Skoki Formation of British Columbia (Rohr *et al*. 1995).

Yochelson (1964) illustrated the operculum of *Ceratopea billingsi* Yochelson, 1964, from the lowest unit of the Narwhale Sound Formation on Ella Ø, as well as fragmentary specimens that were not assigned to species. The operculum of *C. billingsi* is easily distinguished by its greater degree of curvature in the early stages of growth. *Ceratopea billingsi* also occurs in the the Wandel Valley Formation in Kronprins Christian Land, eastern North Greenland (Peel 1980), the Durness Limestone, Scotland (Yochelson 1964) and the lower part of the Catoche Formation in Newfoundland (Rohr *et al*. 2001).

Family Lophospiridae Wenz, 1938

Genus *Lophospira* Whitfield, 1886

Type species. – *Murchisonia bicincta* Hall, 1847; U.S.A., New York, Middle Ordovician, Chatfieldian.

***Lophospira* aff. *L. perelegans* Stauffer, 1937**

Figure 3Q–S

1937 *Lophospira perelegans*; Stauffer, p. 57, pl. 10, figs 5, 8, 14, 15.

Material. – Eight specimens from locality AB07, five from AB08, and five from AB09. Illustrated specimens MGUH 31252–31254.

Description. – High-spired, apical angle 35–40°, anomphalous with peripheral angulation slightly above mid-whorl; whorl convex above and below angulation; no ornament preserved.

Remarks. – *Lophospira* is a common and widespread Ordovician genus with many synonyms (Tofel & Bretsky 1987). The Greenland species differs from *L. perangulata*, which is concave between angulations and has a sharp lower angulation. *Lophospira perelegans,* from the Cassinian of Minnesota has a similar profile with a rounded base, but has an apical angle about 65°. *Lophospira elegans* (Billings, 1865) and *L. sorocula* (Billings, 1865) are more similar to *L. perangulata* and are common in the Table Point Formation (Whiterockian) of Newfoundland. Because the ornament and growth lines are not preserved, a more precise assignment is not possible.

Family Hormotomidae Wenz, 1938

Genus *Hormotoma* Salter, 1859

Type species. – *Murchisonia gracilis* Hall, 1847 (p. 181); U.S.A., New York, Middle Ordovician, Chatfieldian.

***Hormotoma augustina*? Billings, 1865**
Figure 3U

1865 *Murchisonia augustina*; Billings, p. 234, fig. 221.
1897 *Lophospira augustina*? (Billings, 1865). – Ulrich & Schofield, p. 987, pl. 71, figs 1, 2.
2004 *Hormotoma augustina* (Billings, 1865). – Rohr, Measures & Boyce, p. 232, pl. 2, figs 26–28.

Material. – Two specimens from locality AB09. Illustrated specimens MGUH 31256.

Description. – High-spired, apical angle about 20°, up to 3 cm tall with rounded whorls and impressed suture; band at midwhorl bounded by two spiral cords; no other ornament present.

Remarks. – *Hormotoma* is a common, high-spired genus in the Table Point Formation of Newfoundland. The shell has the same profile as *H. augustina*, but does not preserve any growth lines and is much smaller that the specimen illustrated by Billings (1865). This species was included by Wagner (2002) in his genus *Eroicaspira,* but it is retained here in *Hormotoma* because it does not preserve the characteristic aperture of *Eroicaspira.*

Family Eotomariidae Wenz, 1938

Genus *Turritoma* Ulrich & Scofield, 1897

Type species. – Murchisonia acrea Billings 1865; Canada, Newfoundland, Lower Ordovician, Blackhillsian.

***Turritoma* aff. *acrea* (Billings, 1865)**
Figure 3T

aff. 1865 *Murchisonia acrea*; Billings, p. 231, fig. 216.
1975 *Murchisonia (Turritoma)* cf. *acrea* Billings, 1865. – Fix, pl. 3, fig. 1.

Material. – Three silicified specimens from localities AB08. Illustrated specimen MGUH 31255.

Description. – Small, high-spired, apical angle about 25°, upper whorl nearly planar from suture down to subangular periphery; periphery projects slightly over the next whorl.

Remarks. – None of the known specimens preserve any ornamentation.

Occurrence. – Narwhale Sound Formation, Greenland. Billings (1865) described *Turritoma acrea* from the Catoche Formation (his unit G) at Port au Choix, Newfoundland. Rohr *et al.* (2001) reported the species from 2 m above the base of the Catoche Formation. Fix (1975) illustrated the species from the Smithville Formation of Missouri.

Family Straparollinidae Wagner, 2002

Genus *Straparollina* Billings, 1865

Type species. – Straparollina pelagica Billings, 1865; Canada, western Newfoundland, Catoche, and Aguathuna formations, Ordovician, Blackhillian–Whiterockian.

***Straparollina* sp. indet.**
Figure 4A–F

Material. – Thirty specimens from AB07, 45 from locality AB08, and 30 from AB09. Illustrated specimens MGUH 31257–31260.

Description. – Small, rounded turbinate, apical angle about 50°, narrow umbilicus, with some specimens becoming uncoiled in later whorls. Bilineate peripheral band above midwhorl, sinus and other ornament unknown.

Remarks. – *Straparollina* is one of the most common specimens in the Greenland material. The shell is like *Sinuopea* Ulrich, 1911 [for example, *P.* (?) *floweri* Fortey & Peel, 1990, from the Poulsen Cliff Formation, North Greenland] but that genus lacks a peripheral band. *Straparollina pelagica* from the Whiterockian of Newfoundland, has a circum-umbilical funicle but lacks a peripheral band. Since many features of the shell are not preserved, it is not assigned to a species.

Occurrence. – Late Ibexian–Whiterockian of Newfoundland, Nevada and Greenland.

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