

THE MIDDLE ORDOVICIAN MOLLUSC *ARCHINACELLA* FROM THE TABLE POINT FORMATION (TABLE HEAD GROUP), WESTERN NEWFOUNDLAND

D.M. Rohr, W.D. Boyce¹ and E.A. Measures
Sul Ross State University, Alpine, TX USA

ABSTRACT

The symmetrical, cap-shaped mollusc, Archinacella instabilis (Billings, 1865) is redescribed from a chert horizon within the Uromystrum validum trilobite zone and the Histiodella tableheadensis conodont zone in the Middle Ordovician (Whiterockian) Table Point Formation. The considerable variation in the shell shape is interpreted to be intraspecific. Some of the other thirty North American species of Archinacella Ulrich and Scofield, 1897, are likely junior synonyms of the Newfoundland species.

INTRODUCTION

The Table Point Formation is a thick sequence of peritidal to subtidal carbonate rocks of Middle Ordovician (Whiterockian) age that is widely exposed in western Newfoundland. The type section is exposed just north of Bellburns, at Table Point, within the Table Point Ecological Reserve (Figure 1). The formation has attracted a lot of scientific attention since the pioneering work of Billings (1865), because of the richness of the contained macrofaunas and microfaunas. Most recently, numerous species of gastropods have been described by Rohr and Measures (2001) and Rohr *et al.* (2004) from the Table Point Ecological Reserve. The specimens of *Archinacella instabilis* (Billings, 1865) described herein are from the most prolific locality (1996R003 - see Appendix).

Richardson in Logan *et al.* (1863, pages 287-292 and 865-871) provided the first stratigraphic division of the succession at Pointe Riche and Table Point, based on his 1861 and 1862 reconnaissance mapping of western Newfoundland. Divisions K to N (Richardson in Logan *et al.*, 1863, page 865) were first referred to as the Table Head Series by Schuchert and Dunbar (1934, pages 16 and 38), who divided it into three parts. The Table Head Formation subsequently was proposed by Whittington and Kindle (1963), who identified Schuchert and Dunbar's three divisions as the lower, middle and upper Table Head Formation. These later became the Table Point, Table Cove and Black Cove forma-

tions, respectively, when Klappa *et al.* (1980) elevated the Table Head Formation to group status; Ross and James (1987) established the Spring Inlet Member for the lower 10 to 40 m of the Table Point Formation. Finally, Stenzel *et al.* (1990) removed the Black Cove Formation from the Table Head Group and assigned it to the overlying Goose Tickle Group.

The Table Point Formation consists of thick to massive, bioclastic limestone, algal sponge wackestone to packstone, and algal oncolitic wackestone (Stenzel *et al.*, 1990). The upward-deepening environments of deposition include tidal flat, lagoon, shoal, and sponge bioherms (Klappa *et al.*, 1980). Ross and James (1987) correlated the brachiopod fauna with that of the *Anomalorthis* zone of the Great Basin.

At Table Point, three cherty intervals are developed in the Table Point Formation (Stouge, 1984, page 16, figure 16) – see Figure 2. Silicified fossils occur in all three intervals, but they are most common in beds of the lower Table Point Formation at locality 1996R003 in the Spring Inlet Member of Ross and James (1987). The locality, which is situated in Unit A2 of Stouge (1984), lies within the *Histiodella tableheadensis* conodont zone (Stouge, 1984) and the *Uromystrum validum* trilobite zone (Rohr *et al.*, 2004) – see Figure 2. *Archinacella instabilis* (Billings, 1865 – see figure 3 and Plate 1) occurs with other gastropods in dolomitic wackestone to packstone, which are interbedded with laminated and crosslaminated dolomitic mudstone.

¹Regional Geology Section

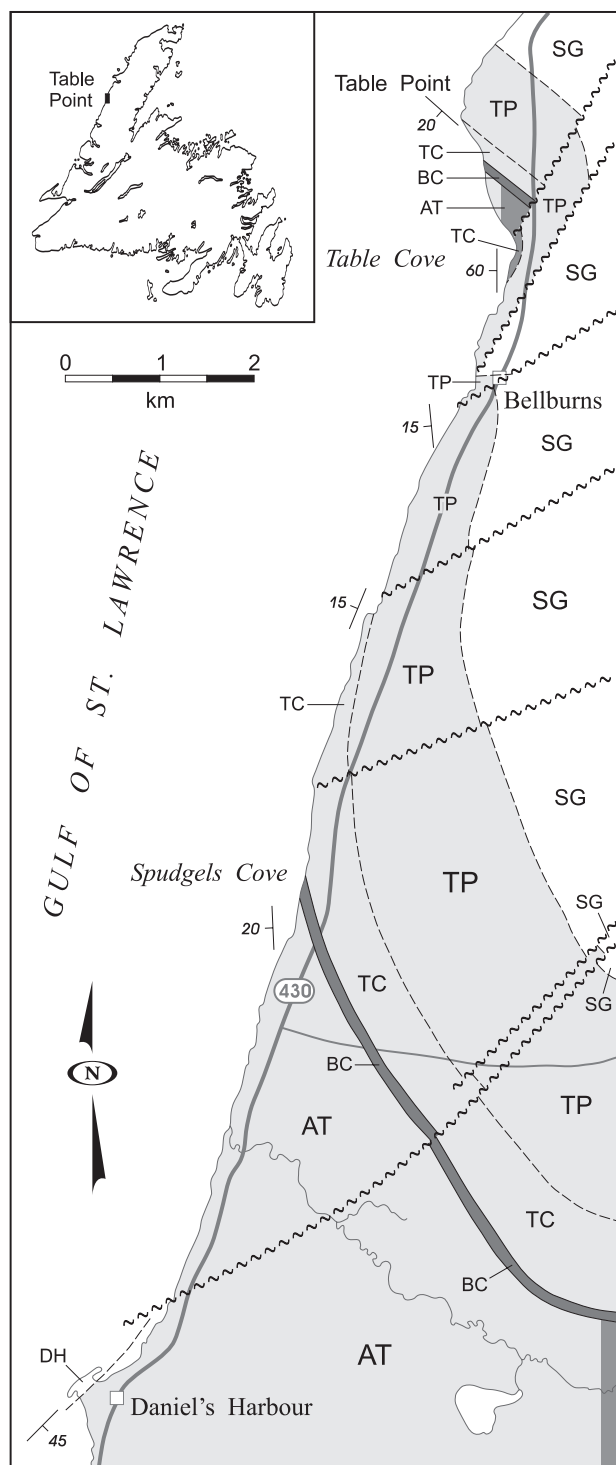


Figure 1. Geological map of the Table Point Ecological Reserve and environs (from Stenzel et al., 1990). SG – St. George Group; TP – Table Point Formation (Table Head Group); TC – Table Cove Formation (Table Head Group); BC – Black Cove Formation (Goose Tickle Group); AT – American Tickle Formation (Goose Tickle Group); DH – Daniels Harbour Member, American Tickle Formation (Goose Tickle Group).

ARCHINACELLA

The cap-shaped mollusc *Archinacella* is a widely distributed Ordovician genus, and Wahlman (1992) recorded 32 species from eastern North America. The genus is also a sparse but characteristic part of the Lower to Upper Ordovician faunas of Europe (Peel and Horný, 1999). Since *Archinacella* was established by Ulrich and Scofield (1897) as a gastropod, the genus has been transferred back and forth between the Class Gastropoda and the Class Tergomya ("monoplacophorans") as summarized in Peel and Horný (1999). If *Archinacella* and other similar archinacelloids are interpreted as gastropods, then the question follows whether the archinacelloids are early forms of patellogastropods. Modern limpets have a lineage that can be traced back with confidence to the Triassic (Hedegaard et al., 1997). The Paleozoic record of limpet-like shells is sparse, and Peel and Horný (1999) concluded that archinacelloids are gastropods, but they are not patellogastropods. Nothing in this current study contributes to solving this particular question.

Archinacella includes a heterogeneous assemblage of shell forms (Wahlman, 1992), and the great variability within individual species of *Archinacella* has been noted by Horný (1963) and Wahlman (1992). This variability suggests that it is likely that a great deal of synonymy is present among the 32 species (Wahlmann, 1992) that have been named in North America. Because *A. instabilis* (Billings, 1865) is one of the earliest-named species, it may be the senior synonym of several other North American species. However, that determination must await the collection and study of larger samples.

SYSTEMATIC PALEONTOLOGY

REPOSITORY OF ILLUSTRATED MATERIAL

The specimens described in this report are housed in the Provincial Museum of Newfoundland and Labrador (NFM) at The Rooms, St. John's.

SYSTEMATIC DESCRIPTIONS

Class GASTROPODA? Cuvier, 1797

Discussion. The systematic position of the Archinacellidae is uncertain, and it has been assigned to the Gastropoda (Knight, 1960; Starobogatov, 1970; Peel and Horný, 1999) and the Monoplacophora (Runnegar and Jell, 1976; Wahlmann, 1992). It is not known if the Archinacellidae were torted or untorted. Descriptive terminology can be confusing, because the anterior and posterior directions change 180° depending on whether the shell is assigned to the Class Gastropoda or the Class Tergomya. The genus is here placed tentatively in the Gastropoda.

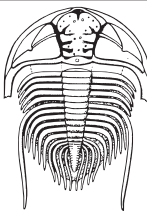
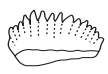

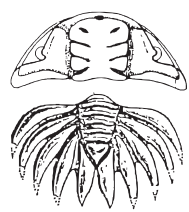



LITHOSTRATIGRAPHY		TRILOBITE ZONES		CONODONT ZONES	
TABLE HEAD GROUP	Table Cove Formation		<i>Cybelurus mirus</i>		<i>Histiodella bellburnensis</i>
					<i>Histiodella kristinae</i>
	Table Point Formation	▲ 	<i>Pseudomera barrandei</i>		<i>Histiodella tableheadensis</i>
		▲			
		▲ 	<i>Uromystrum validum</i>		
ST. GEORGE GROUP	Aguathuna Formation		<i>Bathyrus perplexus</i>		

Figure 2. Lithostratigraphy and trilobite and conodont biostratigraphy of the uppermost St. George Group and the Table Head Group within the Table Point Ecological Reserve (from Rohr et al., 2004). The trilobite and conodont zonations follow Boyce (1997) and Stouge (1984), respectively. The base of each zone is the FAD (First Appearance Datum) of the nominate species. The black triangles indicate the chert horizons. 1996R003 was obtained from the lowest chert horizon, within the Spring Inlet Member of Ross and James (1987).

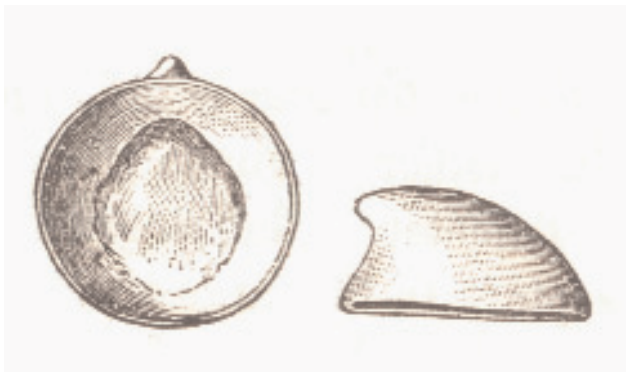


Figure 3. *Archinacella instabilis* (Billings, 1865), as originally illustrated by Billings (1865, page 251; Figure 236) - (x 2, GSC 615).

Family ARCHINACELLIDAE Knight 1956
Genus ARCHINACELLA Ulrich and Scofield, 1897

Type species. *Archinacella powersi* Ulrich and Scofield, 1897, from the Platteville Limestone (Middle Ordovician) of Minnesota. Known from only one specimen (Knight, 1941).

Range of genus. Middle Ordovician (Chazy Series) to Late Ordovician (Cincinnatian Series, Richmondian Stage) (Wahlman, 1992).

Archinacella instabilis Billings, 1865
Plate 1, plate figures 1-17; Plate 2, plate figures 1-5

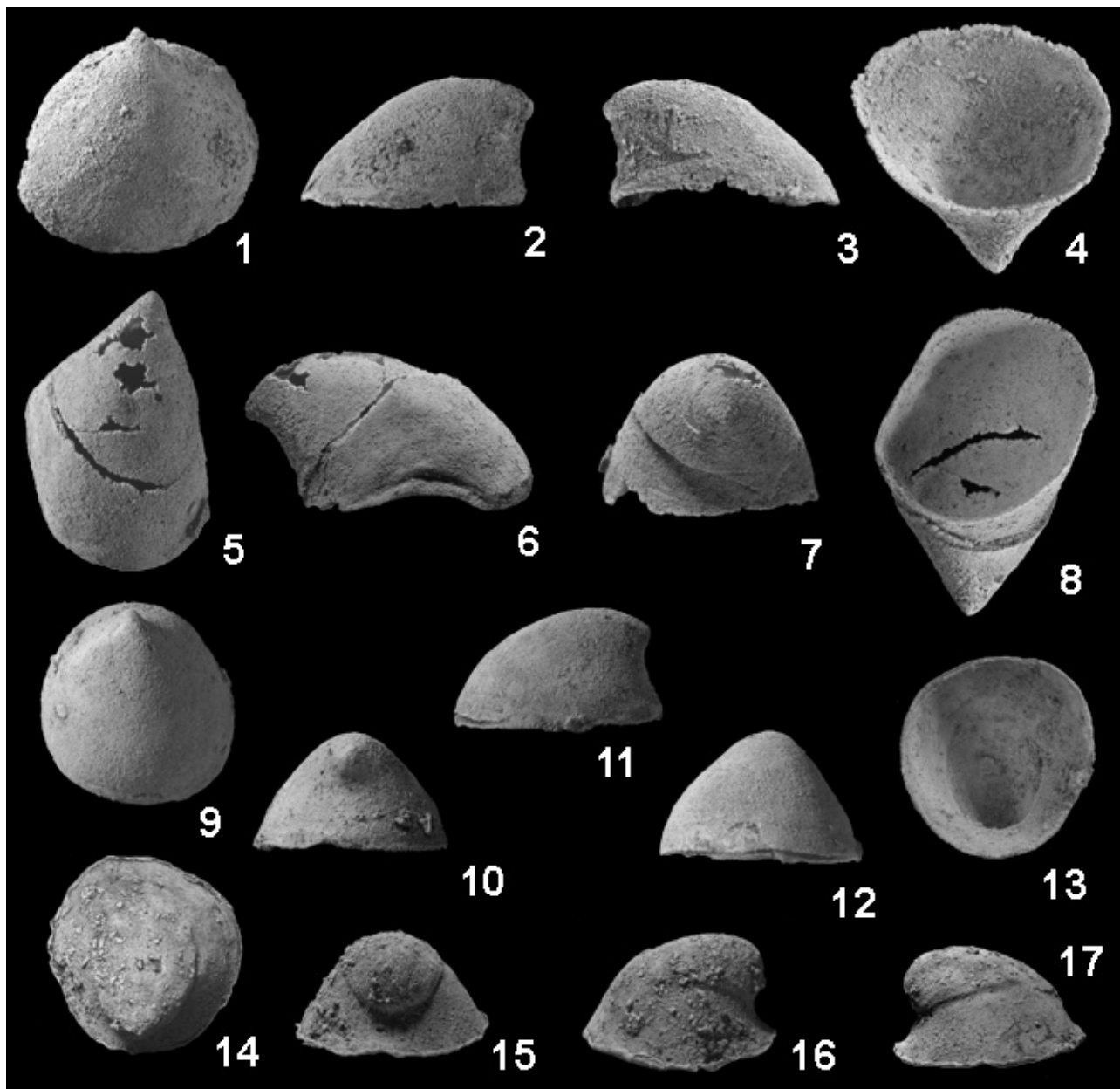


Plate 1. *Archinacella instabilis* (Billings, 1865) from the Spring Inlet Member of the Table Point Formation, Table Point Ecological Reserve, western Newfoundland. All specimens are from locality 1996R003 – the lowest chert horizon. Plate figures 1-4. Apical, side and apertural views of a subcircular specimen. (x 2, NFM F-728). Plate figures 5-8. Apical, side and apertural views of an elongated specimen (x 2, NFM F-729). Plate figures 9-13. Apical, side and apertural views of a subcircular specimen. Note that the apex does not overhang the margin. (x 2, NFM F-730). Plate figures 14-17. Latex replica of interior of previous specimen. Apical and side views with muscle scar. (x 2, NFM F-730a).

1865 *Metoptoma instabilis* Billings, page 251; Figure 236.

1897 *Archinacella instabilis* var. *incurvata* Ulrich and Scofield, page 835; Plate 51, figures 21-23.

Description. Cap-shaped, symmetrical to nearly symmetrical, subovate shell; rapidly expanding from apex through

one quarter to one half revolution; dorsum convexly arched, apex overhangs the margin on some specimens; apertural margin planar; surface smooth or with growth stoppages on some specimens; repair of broken shell evident on one specimen. Continuous interior muscle scar present around apex, no accessory muscle scars observed. Because the shell is silicified, nothing is known of the internal shell structure.



Plate 2. *Archinacella instabilis* (Billings, 1865). An unusual, deformed shell, possibly due to crowding during growth. Plate figures 1-5. Apical, side, opposite side, oblique and apertural views, (x 2, NFM F-749). Bar is 1 cm.

Variation in the shape of the shells is shown in Plate 1 and Table 1. An unusually deformed specimen is shown in Plate 2.

Discussion. The description is based on 41 complete and 57 fragmentary silicified specimens. Billings (1865) observed that while the illustrated specimen is symmetrical, some specimens have the apex turned to the right or left. The present collection contains asymmetrical specimens as well as several wider specimens. Based on 41 complete specimens, we conclude that a considerable amount of variation is present within the species. The forms seem to grade from one into another (Plate 1; Table 1; Figures 4-6). The great variability of other species of *Archinacella* has been noted by Horný (1963) and Wahlman (1992).

Although only 41 complete specimens were recovered from several hundred kilograms of limestone, two pairs of shells were found adhering to each other, which suggests that the organisms may have lived in groups. Plate 2 illus-

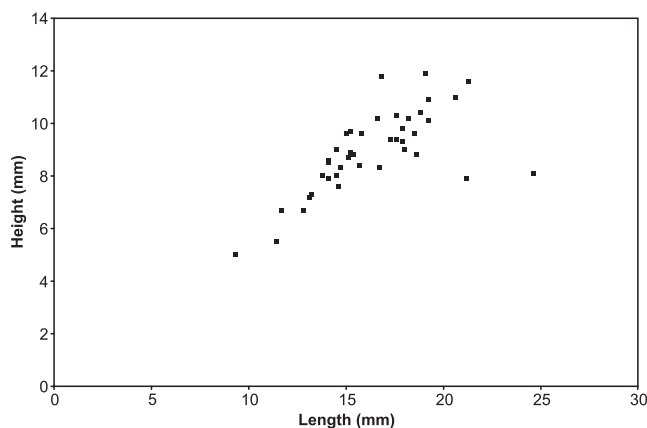


Figure 4. Plot of height versus length of 41 complete specimens of *Archinacella instabilis* (Billings, 1865).

Table 1. Measurements of 41 specimens of *Archinacella instabilis* (Billings, 1865)

Specimen	L	H	W
1	24.6	8.1	14.1
2	17.9	9.8	11.5
3	18.6	8.8	16.9
4	13.2	7.3	11.4
5	14.5	8	12.9
6	14.6	7.6	10.4
7	15.2	8.9	12
8	11.4	5.5	10.1
9	21.3	11.6	15
10	9.3	5	7.8
11	13.1	7.2	9.9
12	14.5	9	9.4
13	19.2	10.1	20.7
14	18.2	10.2	16
15	18.8	10.4	14
16	16.8	11.8	14.2
17	17.6	10.3	16
18	18.5	9.6	11.1
19	17.6	9.4	16.6
20	18	9	15.8
21	16.7	8.3	15.4
22	15.2	9.7	15.5
23	21.2	7.9	17.1
24	15.8	9.6	13.3
25	14.7	8.3	14.9
26	15.7	8.4	13.9
27	19.2	10.9	14.3
28	20.6	11	16.1
29	16.6	10.2	11.5
30	14.1	8.6	11.2
31	12.8	6.7	12.2
32	17.3	9.4	11.7
33	15	9.6	14.1
34	14.1	8.5	13.2
35	15.4	8.8	14.4
36	14.1	7.9	13.3
37	17.9	9.3	11.4
38	19.1	11.9	11.6
39	13.8	8	10.2
40	11.7	6.7	10.8
41	15.1	8.7	11.1

trates a deformed specimen that might have been the result of crowding with other shells. If so, the organism did not move during the latter stages of growth.

Occurrence. Table Point Ecological Reserve, locality 1996R003. Upper part of the Spring Inlet Member; lowest chert horizon within the Table Point Formation (Table Head Group).

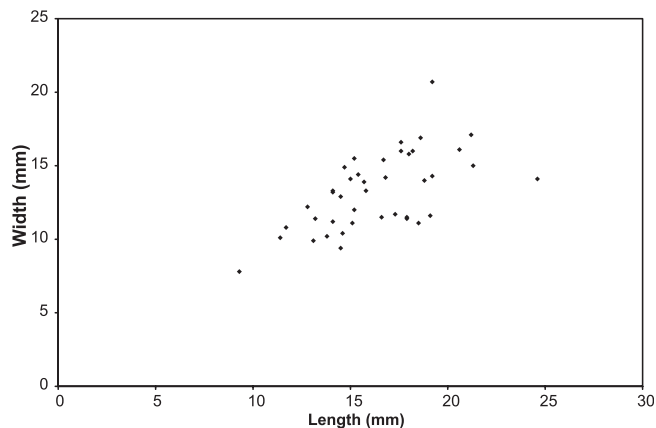


Figure 5. Plot of width versus length of 41 complete specimens of *Archinacella instabilis* (Billings, 1865).

Figured specimens. NFM F-728 to NFM F-730, NFM F-749. Additional un-illustrated specimens NFM F-731 to NFM F-739.

ACKNOWLEDGMENTS

The Parks and Natural Areas Division (Department of Environment and Conservation, Government of Newfoundland and Labrador) is gratefully acknowledged for the provision of a Scientific Research Permit for the Table Point Ecological Reserve. Field work for DMR and EAM in Newfoundland was supported by National Geographic Society Research Grant 5669-96. Extraction, preparation, and photography of specimens were supported by a Faculty Research Enhancement Grant from Sul Ross State University. We are grateful to Dr. A.J. Boucot, Oregon State University, for the use of his sample-processing facility. Randy Batten (Provincial Museum of Newfoundland and Labrador at The Rooms) kindly provided specimen numbers.

REFERENCES

- Billings, E.
1865: Palaeozoic Fossils. Volume I. Containing descriptions and figures of new or little known species of organic remains from the Silurian rocks, 1861-1865. Dawson Brothers, Montreal. Geological Survey of Canada, Separate Report, 426 pages.
- Hedegaard, C., Lindberg, D.R. and Bandel, K.
1997: Shell microstructure of a Triassic patellogastropod limpet. *Lethaia*, Volume 30, Issue 4, pages 331-335.
- Horný, R.J.
1963: *Archaeopruga*, a new problematic genus of monoplacophoran molluscs from the Silurian of Bohemia. *Journal of Paleontology*, Volume 37, Issue 5, pages 1071-1073.
- Klappa, C.F., Opalinski, P.R. and James, N.P.
1980: Middle Ordovician Table Head Group of western Newfoundland: a revised stratigraphy. *Canadian Journal of Earth Sciences*, Volume 17, pages 1007-1019.
- Knight, J.B.
1941: Paleozoic gastropod genotypes. *Geological Society of America, Memoir 32*, 510 pages.
- 1956: New families of Gastropoda. *Journal of the Washington Academy of Sciences*, Volume 46, pages 41, 42.
- Knight, J.B., Cox, L.R., Keen, A.M., Batten, R.L., Yochelson, E.L. and Robertson, R.
1960: Systematic descriptions. *In* *Treatise on Invertebrate Paleontology, Part I, Mollusca 1. Edited by R.C. Moore.* Geological Society of America and University of Kansas Press, Lawrence, pages I169-I331.
- Logan, W.E., Murray, A., Hunt, T.S. and Billings, E.
1863: Geology of Canada. Geological Survey of Canada. Report of Progress from its Commencement to 1863; illustrated by 498 wood-cuts in the text, and accompanied by an atlas of maps and sections. Dawson Brothers, Montreal, 983 pages.
- Peel, J.S. and Horný, R.J.
1999: Muscle scars and systematic position of the Lower Palaeozoic limpets *Archinacella* and *Barrandicella* gen. n. (Mollusca). *Journal of the Czech Geological Society*, Volume 44, pages 97-115.
- Rohr, D.M. and Measures, E.A.
2001: Middle Ordovician (Whiterockian) gastropods of western Newfoundland: Macluritoidea and Euomphaloidea. *Journal of Paleontology*, Volume 75, pages 284-294.

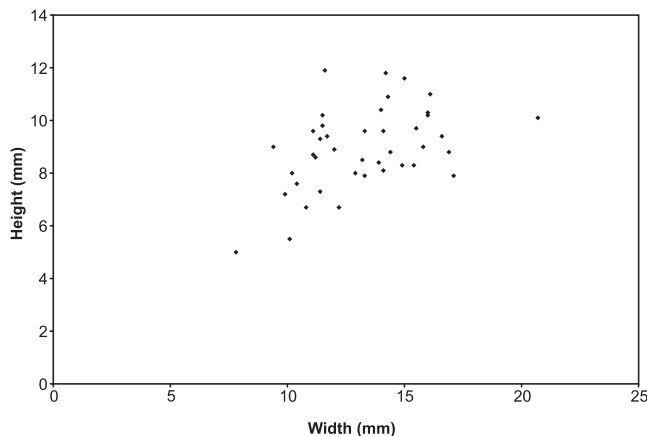


Figure 6. Plot of height versus width of 41 complete specimens of *Archinacella instabilis* (Billings, 1865).

- Rohr, D.M. Measures, E.A. and Boyce, W.D.
2004: Middle Ordovician (Whiterockian) gastropods from the Table Point Formation, western Newfoundland. Newfoundland. *In* Current Research. Newfoundland Department of Mines and Energy, Report 04-1, pages 225-234.
- Ross, R.J., Jr. and James, N.P.
1987: Brachiopod biostratigraphy of the Middle Ordovician Cow Head and Table Head groups, western Newfoundland. *Canadian Journal of Earth Sciences*, Volume 24, pages 70-95.
- Runnegar, B. and Jell, P.
1976: Australian Middle Cambrian molluscs and their bearing on early molluscan evolution. *Alcheringa*, Volume 1, Issue 2, pages 109-138.
- Schuchert, C. and Dunbar, C.O.
1934: Stratigraphy of western Newfoundland. *Geological Society of America, Memoir 1*, 123 pages.
- Starobogatov, Ya. I.
1970: K sistematike rannepaleozoyskikh Monoplacophora (The systematics of early Paleozoic Monoplacophora). *Paleontologicheskii Zhurnal*, Volume 3, pages 6-17.
- Stouge, S.
1984: Conodonts of the Middle Ordovician Table Head Formation, western Newfoundland. *Fossils and Strata*, Number 16, 145 pages.
- Stenzel, S.R., Knight, I. and James, N.P.
1990: Carbonate platform to foreland basin: revised stratigraphy of the Table Head Group (Middle Ordovician), western Newfoundland. *Canadian Journal of Earth Sciences*, Volume 27, pages 14-26.
- Swainson, W.
1840: *A Treatise on Malacology; or, Shells and Shell Fish*. Longman, Orme, Brown, Green, and Longmans, London, 419 pages.
- Ulrich, E.O. and Scofield, W.H.
1897: The Lower Silurian Gastropoda of Minnesota. *In* The Geology of Minnesota, Paleontology. Harrison and Smith, Minneapolis, Volume 3, part 2, pages 813-1081.
- Wahlman, G.P.
1992: Middle and Upper Ordovician Symmetrical Univalved Mollusks (Monoplacophora and Bellerophonina) of the Cincinnati Arch Region. *United States Geological Survey Professional Paper 1066-O*, 213 pages; 45 plates.

APPENDIX – *Archinacella instabilis* (Billings, 1865) Locality – NTS 121/05 (Bellburns), UTM Zone 21, 50°21.96N, 57°32.12W

1996R003

Table Point Ecological Reserve, Table Point, western Newfoundland. Upper part of the Spring Inlet Member; lowest chert horizon within the Table Point Formation (Table Head Group). Whiterockian Series, *Anomalorthis* brachiopod zone, *Uromystrum validum* trilobite zone, *Histiodela tableheadensis* condont zone.

- Mollusca–Gastropoda? (this study)
Archinacella instabilis Billings, 1865
- Mollusca–Gastropoda (Rohr and Measures, 2001; Rohr *et al.*, 2004)
Cataschisma typica Branson, 1909
Donaldiella cicelia (Billings, 1865)
Helicotoma gubanovi Rohr, 1994
Hormotoma angustina (Billings, 1865)
Lophospira sororcula (Billings, 1865)
Maclurites emmonsii (Billings, 1865)
Maclurites? acuminatus (Billings, 1865)
Malayaspira rugosa Kobayashi, 1958
Malayaspira speciosa (Billings, 1865)
Monitorella crenulata (Billings, 1865)
Raphistomina hortensia (Billings, 1865)
Rossospira harrisae Rohr, 1994
Scalites angulatus Emmons, 1842
Straparollina pelagica Billings, 1865

