

EARLY MIDDLE ORDOVICIAN CONODONTS OF NORTH ATLANTIC PROVINCE  
FROM NORTHEASTERN ELLESMERE ISLAND, ARCTIC CANADA

Project 500029

R.S. Tipnis

Institute of Sedimentary and Petroleum Geology, Calgary

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**Abstract**

An early Middle Ordovician North Atlantic conodont fauna from the Franklinian Miogeocline includes the first record of *Pygodus* from Arctic Canada. The finding is consistent with the previously noted restriction of conodonts of the North Atlantic faunal Province to strata marginal to the North American craton.

**Introduction**

Barnes (1974) pointed out the close similarity of the Ordovician conodont faunas of the Franklinian miogeocline to those of the Midcontinent. Nowlan (1976) supported this conclusion but recognized two incursions of North Atlantic conodonts; the first in the late Canadian to earliest Middle Ordovician when elements of *Oepikodus communis* (Ethington and Clark), became abundant, and the second in the Late Ordovician when elements of *Amorphognathus* and *Periodon* flourished.

This note provides evidence for the presence of North Atlantic forms in lower Middle Ordovician beds of the Franklinian miogeocline, and for the first time records the occurrence of *Pygodus* in the Canadian Arctic region.

**Occurrence of Conodonts**

The conodont fauna under consideration was recovered from samples collected from Judge Daly Promontory (Fig. 13.1), about 10 km east of the head of Ella Bay at 81°05.7'N, 69°24.3'W (UTM Zone 19 X; 9903800 N, 493200 E) by H.P. Trettin who reports as follows:

"The conodonts occur 16 to 32 m above the base of a 40 m thick unit that is composed mainly of massive lime wackestone with minor amounts of slaty, silty and argillaceous lime mudstone. The wackestone contains abundant echinoderm fragments, and lesser amounts of micritized or recrystallized ostracodes and bryozoans; coated grains and peloids are also common.

"The limestone overlies the Hazen and underlies the Imina, two formations that normally succeeded each other in this region without intervening carbonates. The Hazen Formation is composed of resedimented carbonate deposits ranging in grade from lime mudstone to boulder conglomerate and dark grey mudrocks and radiolarian chert beds both containing a sparse graptolitic fauna. The formation was deposited in progressively deeper slope and bottom environments of the Hazen Trough. The fossil locality lies close to the southeastern facies boundary of the formation where it grades into shelf carbonate deposits of the miogeocline. The Imina Formation consists of clastic sediments with flysch-like primary structures and was deposited by sediment gravity flows in submarine fan and bottom environments of the Hazen Trough.

"Fossil collections from nearby other localities indicate that the base of the Imina Formation is close to the Ordovician-Silurian boundary in this general area. Graptolites of the late Ashgillian *Dicellograptus ornatus complanatus* Zone were found in uppermost parts of the Hazen Formation in the vicinity of Ella Bay and St. Patrick

Bay, Archer Fiord, 11 km to the west and 118 km to the northeast respectively (unpub. identifications by B.S. Norford and J. Riva, 1977). About 8 km to the southeast (vicinity of section 1 of Kerr, 1968), where the Imina Formation oversteps the miogeoclinal carbonate succession, the index coral *Bioghornia* sp. of Ashgillian age occurs in the upper part of the latter. The oldest graptolites from the Imina Formation, which is very poor in autochthonous fossils, generally are not older Llandoveryan (e.g. *Cyrtograptus canadensis* Jackson and Etherington and *Stomatograptus* sp. cf. *S. grandis* (Suess) from Caledonian Bay, Cañon Fiord, etc.; Trettin, in press). The lowermost part of the Hazen Formation at Ella Bay is dated as late Early Cambrian on the basis of *Olenellus* sp. (unpub. identif. by W.H. Fritz, 1977).

"The occurrence of a shelf-type limestone unit with echinoderms, bryozoans and Middle Ordovician conodonts between these two formations is anomalous with respect to age, lithology, and depositional environment. A fault relationship can probably be ruled out but field and laboratory observations are compatible with the hypothesis that the limestone originally was deposited in an outer shelf environment of the miogeocline and transported into the Hazen Trough as part of an extensive submarine slide in a northwestward direction. Age and lithology are compatible with derivation from the Eleanor River Formation (cf. Kerr, 1968, Section 1). Although it appears that the slide was emplaced just prior to the onset of flysch deposition in the latest Ordovician or Early Silurian, the underlying strata are not necessarily of that age because they probably were structurally disturbed by the slide.

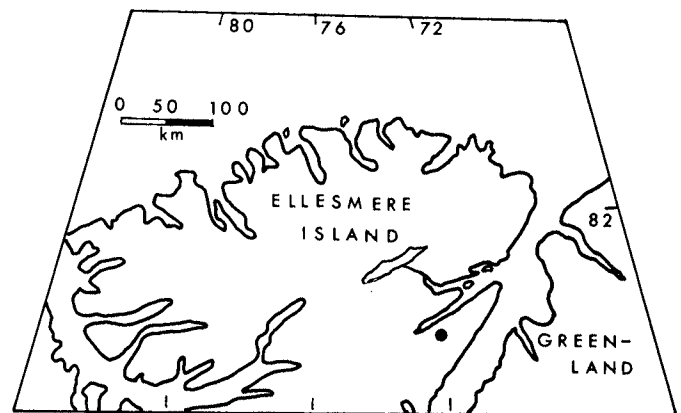
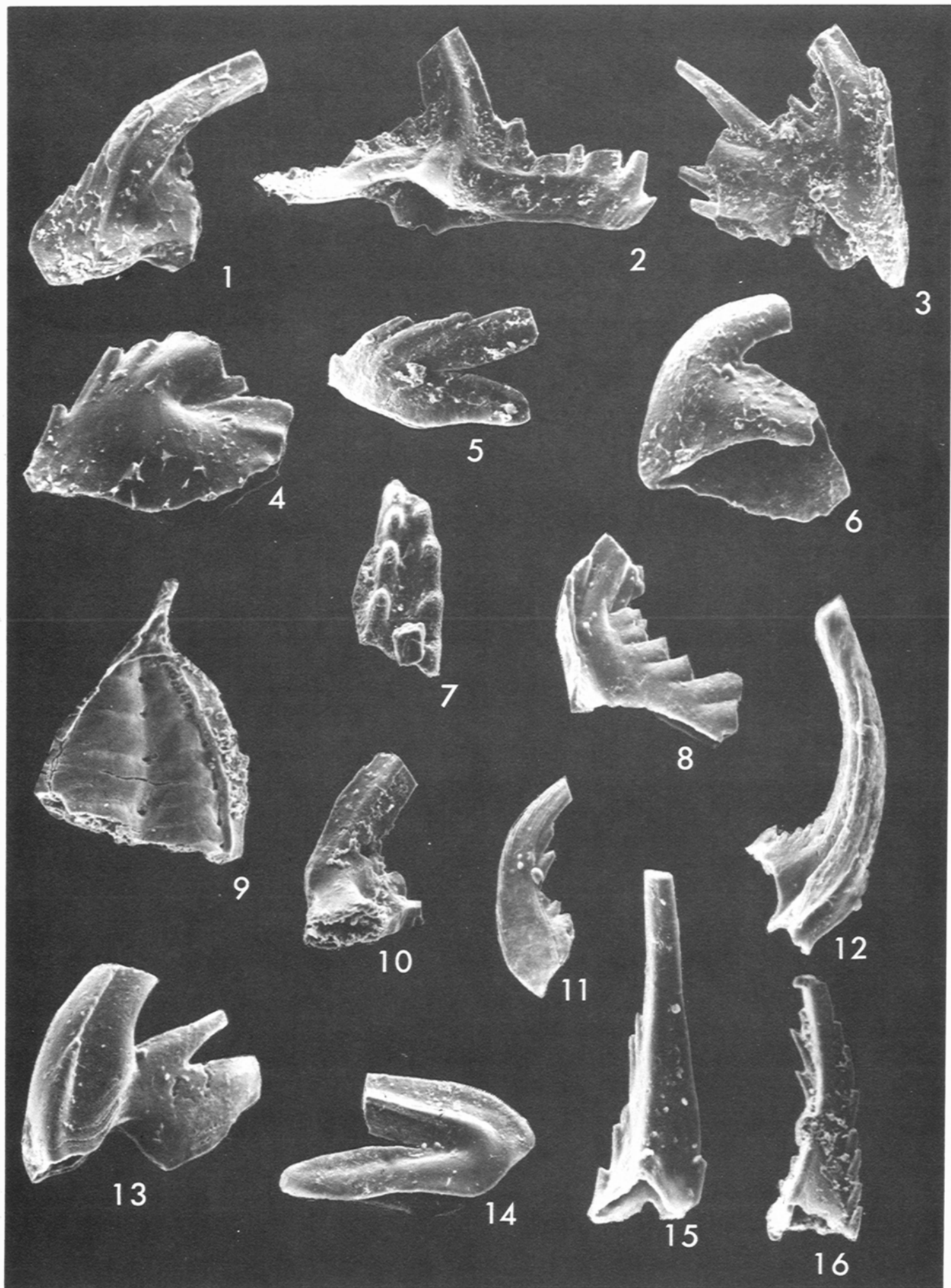


Figure 13.1. Map of northern Ellesmere Island, Arctic Canada, with the black dot indicating the location of samples.

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"A problem with this interpretation is that most submarine slides known from the Franklinian Geosyncline are of about the same age as the enclosing strata, but there are exceptions. The Lower Devonian Svartevaeg Formation of northern Axel Heiberg Island, for example, a deep-water deposit composed mostly of proximal mass flow deposits and volcanics, includes a large limestone block with a shelf fauna of Early or Middle Silurian age (Trettin, 1969, p. 25). The field investigation of the postulated slide has not yet been completed".

### Conodont Fauna

Plate 13.1 illustrates some of the North Atlantic Province conodonts in the collection studied. Only the more significant taxa are included here, namely the multielement taxa *Pygodus* sp. (7), *Periodon aculeatus* Hadding (15) and *Phragmodus* sp. (3) and the form taxa "*Tetraprioniodus*" cf. "*T.*" *lindstroemi* Sweet and Bergström (1), "*Roundya*" *pyramidalis* Sweet and Bergström (3), "*Belodina*" *monitorensis* *monitorensis* Ethington and Schumacher (2), "*Oistodus*" *venustus* Stauffer (5) and "*O.*" sp. aff. "*O.*" *nevadensis* Ethington and Schumacher (1). (The figures in brackets indicate the number of specimens recovered.)

### Plate 13.1

(All magnifications are approximately  
X 200 unless otherwise stated)

All illustrated material comes from GSC collection C-74618 unless otherwise noted separately. Locality of the samples is NTS-120 C, UTM-19X, 900300 mN; 493200 mE. Specimens stored in the GSC Invertebrate Type Collection, Ottawa.

- Figures 1-5. *Periodon aculeatus* Hadding. 1. Lateral view, cladognathiform element, GSC 58226. 2. Lateral view, prioniodiniform element, GSC 58227. 3. Lateral view, ligonodiniiform element, GSC 58228. 4 and 5. Lateral views, falodiform elements, GSC 58229 and GSC 58230 respectively.
- Figure 6. "*Oistodus*" sp. aff. "*O.*" *nevadensis* Ethington and Schumacher. Lateral View, GSC 58231.
- Figures 7-9. *Pygodus* sp. 7, 9. Inner and upper views of pygodiform elements, GSC 58232 and GSC 58233 respectively. 8. Lateral view, haddingodiform element, GSC 58234.
- Figures 10, 13. *Phragmodus* sp. 10. Lateral view, dichognathiform element, GSC 58235, x 80. 13. Lateral view, phragmodiform element, GSC 58236.
- Figure 11. "*Belodina*" *monitorensis* *monitorensis* Ethington and Schumacher. Lateral view, GSC 58237; collection C-74617.
- Figure 12. "*Tetraprioniodus*" cf. "*T.*" *lindstroemi* Sweet and Bergström. Lateral view, GSC 58238, x 80.
- Figure 14. "*Oistodus*" *venustus* Stauffer. Lateral view, GSC 58239.
- Figures 15, 16. "*Roundya*" *pyramidalis* Sweet and Bergström, GSC 58240 and GSC 58241 respectively, x 80 and x 200 respectively.

Sweet and Bergström (1974) have noted that only four Middle Ordovician genera, namely *Eoplacognathus*, *Periodon*, *Prioniodus* and *Pygodus* may be regarded as truly North Atlantic. All of the elements of the multielement taxa *Pygodus* and *Periodon* appear to be present in the collections, and probably there was little destruction of elements or winnowing during the taphonomy of these samples. Bergström (1971) remarked that elements similar to the form taxa "*Tetraprioniodus*" cf. "*T.*" *lindstroemi* and "*Roundya*" *pyramidalis*, which frequently occur with *Pygodus* spp., could be tetraprioniodiform and roundyaform elements of the *Pygodus* apparatus but decided that the evidence was insufficient. This association was based on the criteria of frequent co-occurrence as well as matching morphology with the haddingodiform element of the *Pygodus* apparatus.

In most cases, excepting those described by Bergström et al. (1974), "*Roundya*" *pyramidalis* and "*Tetraprioniodus*" *lindstroemi*, either together or singly, have been associated with *Pygodus anserinus* (Hamar, 1964; Sweet and Bergström, 1962; Bergström et al., 1974; and Viira, 1974). Tipnis et al. (in press) reported the occurrence of over 100 elements of *Pygodus serrus*, but failed to find a single specimen of either the roundyaform element or the tetraprioniodiform element noted above. Therefore it is possible that *P. serrus* and *P. anserinus* differed in elemental composition, with *P. serrus* lacking roundyaform and tetraprioniodiform elements for at least part of its stratigraphic range.

The three taxa "*Belodina*" *monitorensis* *monitorensis*, "*Oistodus*" *venustus* Stauffer and *Phragmodus* sp. are all known to occur in the Road River Formation, Llanvirnian in age, from the southwestern Mackenzie Mountains (Tipnis et al., in press), which also contains conodonts of the North Atlantic Province (Tipnis et al., 1975). "*Oistodus*" sp. aff. "*O.*" *nevadensis* has been reported from *Pygodus* bearing strata in the Copenhagen Formation (Ethington and Schumacher, 1969).

### Discussion

The occurrence of North Atlantic Province conodonts in marginal deposits of the North American continent is well established from such widely separated areas as Texas-Oklahoma (Bradshaw, 1969), the eastern Appalachians (Bergström, 1971), Newfoundland (Fähræus and Nowlan, 1978), the southern Mackenzie Mountains (Tipnis et al., 1975), and the Great Basin of Utah and Nevada (Bergström, 1971). In all these regions the North Atlantic Province conodonts occur in outer shelf or slope settings, and the Midcontinent faunas in adjacent shallower environments (Barnes et al., 1973). The present occurrences fits quite well into this pattern.

Following the discussion above, the age of the collection that includes *Pygodus* sp. is suggested to be Late Llanvirnian to Llandeilian (the complete range of *Pygodus* however includes also an early Llanvirnian age).

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## References

- Barnes, C.R.  
1974: Ordovician conodont biostratigraphy of the Canadian Arctic; in J.D. Aitken and D.J. Glass (ed.), *Geol. Assoc. Can. - Can. Soc. Petrol. Geol., Spec. vol.*, p. 221-240.
- Barnes, C.R., Rexroad, C.B., and Miller, J.F.  
1973: Lower Paleozoic conodont provincialism; in F.H.T. Rhodes (ed.), *Conodont Paleozoology, Geol. Soc. Am., Spec. Paper 141*, p. 157-196.
- Bergström, S.M.  
1971: Conodont biostratigraphy of the Middle and Upper Ordovician of Europe and eastern North America; *Geol. Soc. Am., Mem.* 127, p. 83-157.
- Bergström, S.M., Riva, J., and Kay, M.  
1974: Significance of conodonts, graptolites, and shelly faunas from the Ordovician of western and north-central Newfoundland; *Can. J. Earth Sci.*, v. 11:12, p. 1625-1660.
- Bradshaw, L.E.  
1969: Conodont from the Fort Péna Formation (Middle Ordovician), Marathon Basin, Texas; *J. Paleontol.*, v. 43, p. 1137-1169.
- Ethington, R.L. and Schumacher, D.  
1969: Conodonts of the Copenhagen Formation (Middle Ordovician) in central Nevada; *J. Paleontol.*, v. 43, p. 440-484.
- Fåhraeus, L.E. and Nowlan, G.S.  
1978: Franconian (Late Cambrian) to Early Champlainian (Middle Ordovician) conodonts from the Cow Head Group, western Newfoundland; *J. Paleontol.*, v. 52, p. 444-471.
- Hamar, G.  
1964: The Middle Ordovician of the Oslo region, Norway, 17: Conodonts from the lower Middle Ordovician of Ringerike; *Norsk Geol. Tidsskrift.*, v. 44, p. 243-292.
- Kerr, J.Wm.  
1968: Stratigraphy of central and eastern Ellesmere Island, Arctic Canada, Part II Ordovician; *Geol. Surv. Can., Paper 67-27*.
- Nowlan, G.S.  
1976: Lake Cambrian to Late Ordovician conodont evolution and biostratigraphy of the Franklinian Miogeosyncline, eastern Canadian Arctic Islands; unpubl. Ph.D. dissertation, Dept. Biology, Univ. Waterloo, Ontario.
- Sweet, W.C. and Bergström, S.M.  
1962: Conodonts from the Pratt Ferry Formation (Middle Ordovician) of Alabama; *J. Paleontol.*, v. 35, p. 1214-1252.  
1974: Provincialism exhibited by Ordovician conodont faunas; in *Paleogeographic Provinces and Provinciality*, C.A. Ross, ed., Soc. Econ. Paleontol. Mineral. Tulsa, Spec. Publ. 21, p. 189-202.
- Tipnis, R.S., Chatterton, B.D.E., and Ludvigsen, R.  
1975: The paleoecological and paleobiogeographic significance of some Early and Middle Ordovician conodont faunas from the southern Northwest Territories, Canada; *Geol. Soc. Am., Abstr. Prog., North-Central section, Waterloo*, p. 872.  
Biostratigraphy of Ordovician conodonts from the southern Mackenzie Mountains; in C.R. Stelck and B.D.E. Chatterton, ed., *P.S. Warren Biostratigraphy Symposium, Geol. Assoc. Can., Special Paper 18*. (in press)
- Trettin, H.P.  
1969: Pre-Mississippian geology of northern Axel Heiberg and northwestern Ellesmere Islands, Arctic Archipelago; *Geol. Surv. Can., Bull.* 171.  
1971: Geology of Lower Paleozoic Formations, Hazen Plateau and Southern Grant Land Mountains, Ellesmere Island, Arctic Archipelago; *Geol. Surv. Can., Bull.* 203.  
Middle Ordovician to Lower Devonian deep-water succession at southeastern margin of Hazen Trough, Cañon Fiord, Ellesmere Island; *Geol. Surv. Can., Bull.* 272. (in press)
- Viira, V.  
1974: Ordovician conodonts of the east Baltic (in Russia); *Eesti NSV Tead. Akad. Geol. Inst.*, 140 p.