FURTHER DEVELOPMENTS IN WESTERN NEWFOUNDLAND CAMBRO-ORDOVICIAN BIOSTRATIGRAPHY

by W.D. Boyce[1]

INTRODUCTION

The Cambro-Ordovician carbonate deposits of the Great Northern Peninsula are the object of a continuing regional taxonomic-biostratigraphic study aimed at correlating the western Newfoundland trilobite faunas with the standard Cambrian and Ordovician trilobite zonal schemes of North America (Palmer, 1977; Ross, 1951; Hintze, 1953). This report discusses material collected in 1978 from the St. Barbe Coast, which pertains to (1) the position of the Cambro-Ordovician boundary in the carbonate sequence and (2) the question of a disconformity in the Lower Ordovician rocks of the Boat Harbour region.

CAMBRIAN FAUNAL STUDIES

The identification and correlation of Middle Cambrian species collected at Eddie's Cove East (Boyce, 1977, 1978) have been refined by comparison to type trilobites from North America and Greenland.

The trilobite which Boyce (1977, 1978) identified as *Blainia* is now considered to be a species of *Blainiopsis* similar to *B. holtedahli* Poulsen (Poulsen, 1946). Poulsen (1964) maintains this trilobite is indicative of the uppermost *Bathyuriscus-Elrathina* Zone. A diverse fauna occurs in beds stratigraphically below this trilobite in Eddies Cove East. This includes *Ehmania borealis* Howell, *Ehmaniella (Ehmania) cloudensis* (Howell), *?Elrathia cf. ?E quebecensis* Rasetti and *Glyphaspis* sp. (Boyce,1978). *Kochina* cf. *K. artica* (Poulsen, 1946) and *Ehmaniella* cf. *E. waptaenis* (Rasetti, 1951) also occur but were only recently identified. The former is what was called *Solenopleurella* by Whittington and Kindle (1966, 1969).

POSITION OF THE CAMBRO-ORDOVICIAN BOUNDARY IN THE ST. BARBE REGION

Well preserved silicified gastropods from three separate outcrops within the Unfortunate Cove formation (Knight, 1977a, b; 1978) occur in the St. Barbe Region near Brig Bay. Two of these outcrops occur within a half kilometre of each other along the road near Ten Mile Lake. The other outcrop is on the southwest side of Mutton Island, 7 km south-southeast of Anchor Point.

The gastropods all belong to the genus *Sinuopea*. They are the only identifiable fossils so far discovered in a 250 m thick dolomite sequence which includes the upper member of the Dolomite formation and the base of the Unfortunate Cove formation. The gastropods occur stratigraphically above a Dresbachian (lower Upper Cambrian) trilobite locality at Deadmans Cove (Boyce, 1978) and below deposits of the Watts Bight formation which are probably lower Canadian (Ordovician) in age.

Fossils of the genus *Sinuopea* range from Trempealeauan (uppermost Cambrian) to lower Canadian (Ordovician) in age (Moore, 1960). If these gastropods are Trempealeauan in age, then the Cambro-Ordovician boundary occurs near the contact of the Unfortunate Cove and Watts Bight formations. If they are Ordovician in age, then the boundary occurs near the contact of the Dolomite and Unfortunate Cove formations.

[1] Department of Geology
Memorial University of Newfoundland
St. John's A1B 3X5

LOWER ORDOVICIAN FAUNAL STUDIES

Boat Harbour

The limestone sequence in the Boat Harbour area has been subdivided into two formations by Knight (1978): (1) a lower formation, Unit 6 (Knight, 1978), and (2) an upper formation of rubbly limestones, the Catoche formation.

Sampling of the limestone sequence was continued in 1978, when the sequence was sectioned and sampled bed by bed. This added considerably to the knowledge of the faunas and significantly altered previous ideas (Boyce, 1978) concerning the biostratigraphic sequence represented.

A "pebble bed" forms a marker horizon in the sequence. A single trilobite fauna was found below the "pebble" bed. Two faunas occur above the pebble bed; namely, one at the top of Knight's Unit 6 and the other in the basal rubbly limestones of the overlying Catoche formation.

The fauna below the "pebble bed" is a hystricurid trilobite fauna including, in approximate order of appearance in the section: *Hystricurus* cf. *H. oculilunatus* Ross, "*Parabellefontia*" sp. (which actually may be a new genus and species of a nileid trilobite), *Pachycranium* sp., *Hystricurus* sp., *Hyperbolochilus* sp., "*Hystricurus*" *cordai* (Billings), *Parahystricurus* sp., cf. "*Jeffersonia*" *mediacrista* Cullison and cf. genus and species undetermined Ross ((1951), plate 28, figures 16, 20, 25-28). Planispiral gastropods, the brachiopod *Diaphelasma* sp., also occur, with the cephalpod *Bassleroceras* sp. and echinoderm debris.

Immediately above the "pebble bed", a bathyurid trilobite fauna occurs, including in approximate order of appearance: *Peltabellia* sp. nov., *Strigigenalis* sp. nov., *Grinnelaspis* sp., *Bolbocephalus convexus* (Billings), gen. et. sp. nov., *Petigurus nero* (Billings), *Bathyurina timon* (Billings), *Isoteloides peri* Fortey (in press), *Benthamaspis* cf. *B. conica* Fortey (in press), *Bolbocephalus* cf. *B. seelyi* Whitfield, and *Strigigenalis caudata* (Billings).

The next fauna, beginning in the first rubbly limestone beds of the Catoche formation, contains "Benthamaspis" cf. *B. conica* Fortey (in press), *Strigigenalis caudata* (Billings), *Uromystrum* sp. nov., *Ischyrotoma anataphra* Fortey (in press), as well as *Petigurus nero* (Billings) and *Bolbocephalus convexus* (Billings).

Cape Norman

A 15 m section in limestones exposed on the shore below the lighthouse at Cape Norman was measured and sampled for trilobites. The following trilobites were obtained: *Petigurus nero* (Billings), *Uromystrum* sp. nov., *Bathyurina timon* (Billings), *Ischyrotoma anataphra* Fortey (in press), *Bathyurellus abruptus* Billings, *Bolbocephalus* cf. *B. seelyi* Whitfield, *Benthamaspis* cf. *B. conica* Fortey (in press), and *Isoteloides* sp. Whittington and Kindle (1969) also report *Carolinites* sp.

Brig Bay

Trilobites were collected from Knight's Unit 6 at a number of localities in the Brig Bay area. *Hystricurus* cf. *H. oculilunatus* Ross was obtained at Beach Point on the Dog Peninsula. The same species plus "*Parabellefontia*" sp., and *Pachycranium* sp. was collected from the northwest side of Old Ferrolle Island. "*Parabellefontia*" and *Hystricurus* sp. were collected at the northern tip of the island. "*Hystricurus*" *cordai* (Billings) was collected from a thrombolitic limestone bed forming the top of Moyrac Island, which lies just north of Old Ferrole Island.

Discussion of Lower Ordovician faunas

The trilobite fauna originally obtained below the "pebble bed" of Unit 6 (Knight) and the Catoche Formation at Boat Harbour and Eddies Cove West was previously assigned by Boyce (1978) to the Lower Canadian trilobite zones B to D of Ross (1951) and Hintze (1953). Boyce (1978) considered the "pebble bed" in Boat Harbour to reflect the lack of record of Zones E and F (Ross, 1951; Hintze, 1953). More extensive sampling and collection of superior material in 1978 suggest that the fauna below the "pebble bed" in Boat Harbour and below the Catoche Formation in Eddies Cove West represents zones E and F.

The presence of the trilobites *Hystricurus* cf. *H. oculilunatus* Ross, cf. genus and species undetermined (Ross, 1951; plate 28, fig. 16, 20 p. 25-28) and the genera *Pachycranium*, *Hyperbolochilus* and *Parahystricurus* suggests the fauna below the "pebble bed" compares to that of zones E and F of the type Orodvician reference sections in Utah and Nevada (Ross, 1951; Hintze, 1953; Terrell, 1973). This is supported by Flower's (1978) suggestion that the cephalopod fauna from beds in the immediate vicinity of Boat Harbour is Middle Canadian in age. The articulate brachiopod genus *Diaphelasma* is also typically Middle Canadian.

This suggests a Demingian (Middle Canadian/ Upper Tremadoc) age (Barnes *et al.*, 1976) for the sequence below the pebble bed and that no Gasconadian

fauna occurs in the unnamed unit (Knight, 1978). However, rocks of Gasconadian age are probably represented by the Watts Bight formation (Knight, 1977a, b; 1978), which contains cyrtoconic nautiloids and large planispiral gastropods.

The exact age of the faunas above the "pebble" bed at Boat Harbour is not certain. However, the lower fauna immediately above the "pebble" bed contains *Peltabellia* and *Strigigenalis*, which occur together in zone G2 in Utah (Ross, 1951; Hintze, 1953). The upper fauna, which occurs at the base of the Catoche Formation, compares to a fauna that underlies a zone H fauna in the Catoche Formation at Port au Choix (Fortey, in press). This fauna is probably transitional between zone G2 and zone H faunas. A fauna equivalent to the zone H fauna of Port au Choix occurs in the Catoche Formation at Cape Norman, a few kilometres north of Boat Harbour.

The presence of zone G2 and H faunas indicates a Cassinian (Upper Canadian/Lower Arenig (Barnes *et al.*, 1976)) age for the rocks above the "pebble" bed.

The significance of the "pebble" bed

The pebble bed, which is now recognized from Boat Harbour to Eddies Cove West, a distance of 120 km (Knight, personal communication), represents a "disconformity". This coincides with a lithological change and with the absence of trilobite zone G1 (Ross, 1951, Hintze, 1953). It affects a shorter time interval than previously believed (Boyce, 1978).

Acknowledgements: *I would like to thank Ian Knight, the provincial Department of Mines and Energy, and the National Research Council for M.Sc. thesis field support. In addition, I would like to thank Dr. Richard Fortey for supervision and discussion, and Gary Snow and Lester Greene for new fossil finds and assistance in collecting. Many thanks are due the numerous people who loaned me trilobite specimens, showed me various trilobite localities, and engaged me in fruitful discussion. Special thanks to the many people in the communities of Cape Norman, Boat Harbour and Cooks Harbour, who gave companionship and help during the work in the Boat Harbour - Cape Norman area.*

Special thanks to Dr. J.W. Cowie (Bristol, England) and Drs. R.A. Fortey and S.F. Morris (British Museum), who allowed me to study the C. Poulsen and Rasetti trilobite collections during a recent visit to the United Kingdom made possible by Dr. D. Skevington.

REFERENCES

Barnes, C.R., Jackson, D.E. and Norford, B.S.

1976: Correlation between Canadian Ordovician zonations based on graptolites, conodonts and benthic macrofossils from key successions. *In* The Ordovician System. *Edited by* M.G. Bassett. University of Wales Press, Cardiff. Pages 209-226.

Billings, E.

1861-65: Paleozoic Fossils, Volume 1. Geological Survey of Canada, 426 pages.

Boyce, W.D.

1977: New Cambrian trilobites from Western Newfoundland. Unpublished B.Sc. Honours Thesis, Memorial University of Newfoundland, St. John's, 66 pages.

1978: Recent developments in Western Newfoundland Cambro-Ordovician trilobite biostratigraphy. *In* Report of Activities for 1977. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 78-1, pages 80-84.

Cullison, J.S.

1944: The stratigraphy of some Lower Ordovician formations of the Ozark Uplift. Bulletin of the University of Missouri School of Mines and Metallurgy, **15**, number 2, 112 pages.

Flower, R.H.

1976: Ordovician cephalopod faunas and their role in correlation. *In* The Ordovician System. *Edited by* M.G. Bassett. University of Wales Press, Cardiff. pages 523-552.

1978: St. George and Table Head cephalopod zonation in Western Newfoundland. Geological Survey of Canada, Paper 78-1A: Current Research, Part A, pages 217-224.

Fortey, R.A.

in press: Lower Ordovician trilobites from the Catoche Formation (St. George Group), Western Newfoundland. Geological Survey of Canada.

Hintze, L.F.

1953: Lower Ordovician trilobites from Western Utah and Eastern Nevada. Utah Geological and Mineralogical Survey, Bulletin 48, 249 pages.

Knight, I.

1977a: The Cambro-Ordovician platformal rocks of the Northern Peninsula. *In* Report of Activities for 1976. *Edited by* R.V. Gibbons. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 77-1, pages 27-34.

1977b: The Cambro-Ordovician platformal rocks of the Northern Peninsula, Newfoundland. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 77-6, 27 pages.

1978: Platformal sediments on the Great Northern Peninsula: Stratigraphic studies and geological mapping of the North St. Barbe District. *In* Report of Activities for 1977. *Edited by* R.V. Gibbons.

Newfoundland Department of Mines and Energy, Mineral Development Division, Report 78-1, pages 10-150.

Moore, R.C. (Editor)
1960: Treatise on Invertebrate Paleontology, Part I, Mollusca 1, New York and Lawrence, Kansas. Geological Society of America and University of Kansas Press, 351 pages.

Palmer, A.R.
1977: Biostratigraphy of the Cambrian System-A progress report. Annual Review of Earth and Planetary Sciences, **5**, pages 13-33.

Poulsen C.
1946: Notes on Cambro-Ordovician fossils collected by the Oxford University Ellesmere Land Expedition, 1934-1935. Quarterly Journal of the Geological Society of London, **102**, pages 299-337.

Poulsen, V.
1964: Contribution to the Lower and Middle Cambrian paleontology and stratigraphy of northwest Greenland. Medd. om Gronland, **164**, pages 1-165.

Rasetti, F.
1951: Middle Cambrian stratigraphy and fauna of the Canadian Rocky Mountains. Smithsonian Miscellaneous Collections, **116**, number 5, pages 1-227.

Ross, R.J., Jr.
1951: Stratigraphy of the Garden City Formation in northeastern Utah and its trilobite faunas. Yale University, Peabody Museum of Natural History, Bulletin 6, 161 pages.

Terrell, F.M.
1973: Silicified trilobite zonation in the Lower Fillmore Formation in western Utah. Brigham Young University, Geology Studies, **20**, number 4, pages 67-91.

Whitfield, R.P.
1889: Observations on some imperfectly known fossils from the calciferous sandrock of Lake Champlain and descriptions of several new forms. American Museum of Natural History Bulletin, **2**, pages 41-65.

Whittington, H.B. and Kindle, C.H.
1966: Middle Cambrian strata at the Strait of Belle Isle, Newfoundland, Canada. Geological Society of America Northeastern Section, Annual Meeting, Abstracts, page 46.
1969: Cambrian and Ordovician stratigraphy of Western Newfoundland. *In* North Atlantic Geology and Continental Drift. *Edited by* M. Kay. American Association of Petroleum Geologists, Memoir 12, pages 655-664.