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OCCURRENCE OF THE COLLINGWOOD
FORMATION IN MICHIGAN

BY

R. RUEDEMANN AND G. M. EHLERS



UNIVERSITY OF MICHIGAN
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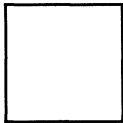
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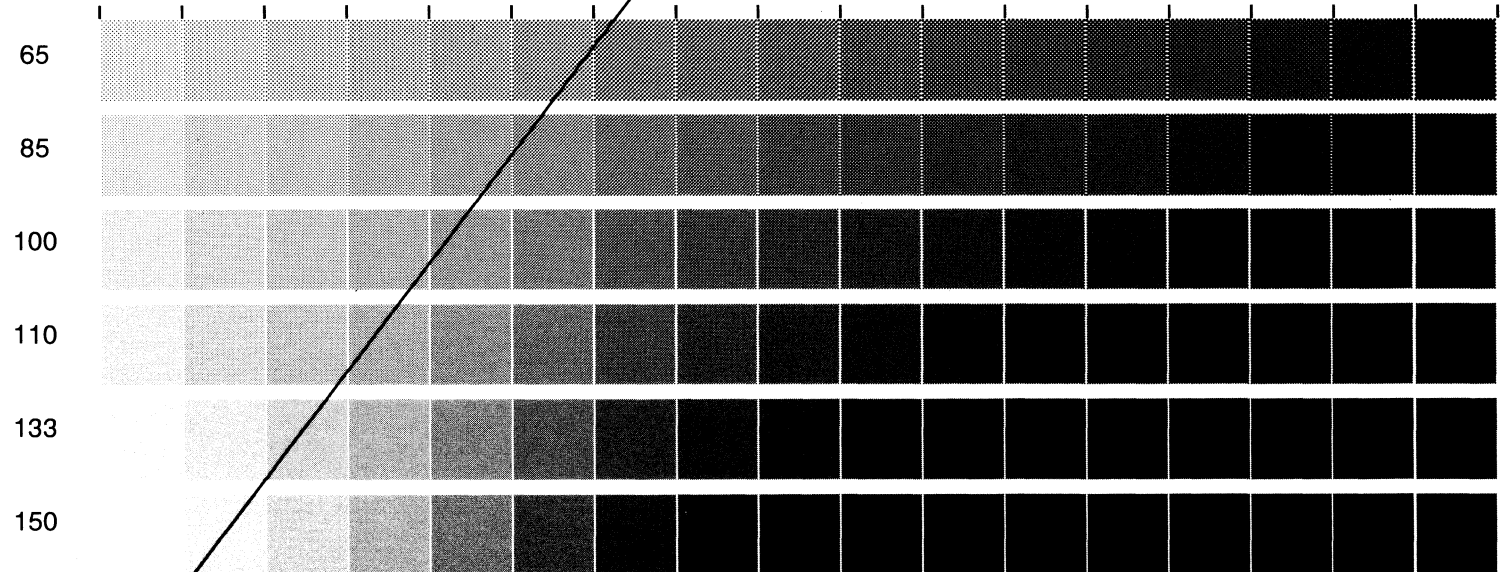
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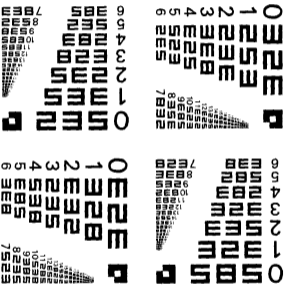
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CONTRIBUTIONS FROM THE MUSEUM OF GEOLOGY
UNIVERSITY OF MICHIGAN

Editor: EUGENE S. McCARTNEY

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VOLUME I

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2. Occurrence of the Collingwood Formation in Michigan, by R. Ruedemann and G. M. Ehlers. Pages 13-18. Price, \$.15.
3. Silurian Cephalopods of Northern Michigan, by Aug. F. Foerste. Pages 19-120, with 17 plates. Price, \$1.00.

OCCURRENCE OF THE COLLINGWOOD FORMATION IN MICHIGAN

R. RUEDEMANN AND G. M. EHLERS

THE Collingwood formation is typically exposed at Ottawa and in southwestern Ontario. This formation, including the overlying, dark-brown to black, carbonaceous shale of these regions, was formerly correlated with the Utica shale of New York State. It was differentiated by Professor P. E. Raymond¹ in 1913 and described as having a thickness of 25 to 50 feet and consisting of alternate beds of limestone and shale, each about a foot in thickness. According to this writer, it represents in its lithological character a transition between the underlying Trenton limestone and the overlying, carbonaceous shale, which Professor Raymond² subsequently stated was younger than the Utica shale and distinguished as a separate unit, the Gloucester formation.

The fauna of the Collingwood is quite distinct from those of the Trenton and Gloucester; its most characteristic fossils, as pointed out by Professor Raymond,³ belong to types more common in Europe than in America, as notably its index fossil *Ogygites latimarginatus* (Hall) [syn. *Ogygites canadensis* (Chapman)].

The most western exposures of the Collingwood strata, which so far have been noted, occur in the vicinity of Little Current on Manitoulin Island, Ontario. According to Dr. A. F.

¹ Raymond, P.E., *Ordovician of Montreal and Ottawa: Twelfth Intern. Geol. Cong., Guide Book No. 3*, p. 144, 1913 (issued by the Canada Geol. Surv.).

² Raymond, P.E., *Correlation of the Ordovician Strata of the Baltic Basin with Those of Eastern North America: Bull. Mus. Comp. Zool.*, Vol. 56, No. 3, p. 255, July 1916.

³ For reference see note 1.

Foerste,⁴ who described these exposures, the Collingwood at this locality is overlaid by strata of Eden age, the Utica shale of New York being absent.

The presence of the Collingwood strata farther westward in the Northern Peninsula of Michigan is indicated by fossils, collected by Dr. W. I. Robinson of the Michigan Geological Survey and the junior author of this paper, from blocks of shale and limestone occurring in the drift near the southern limits of Newberry, Luce County, Michigan. The fossils obtained from the shale, which varies in color from grayish to brownish-black in the unweathered state and splits upon weathering into very thin layers having a drab color and "sandy" feel, have been identified as follows:

Climacograptus pygmaeus Ruedemann Mss.

Diplograptus amplexicaulis uticanus Ruedemann Mss

Leptobolus insignis Hall

Lingula cf. *progne* Billings

Triarthrus eatoni (Hall, *T. becki* auct. in part)

Ogygites latimarginatus (Hall)

Primitiella unicornis Ulrich

From a few blocks of sparingly fossiliferous limestone of very light, grayish-brown color and very finely crystalline texture, a smaller number of fossils were collected and determined as follows:

Climacograptus pygmaeus Ruedemann Mss.

? *Cheirocrinus* sp.

cf. *Oxoplecia cathouini* Wilson

Ogygites latimarginatus (Hall)

A larger number of fossils which were found in several blocks of more fossiliferous limestone of darker, grayish-brown color have been identified as follows:

Diplograptus amplexicaulis uticanus Ruedemann Mss.

Lingula: cf. *whitfieldi* Ulrich and *cobourgensis* Billings

⁴ Foerste, A.F., *The Geology of the Clay Cliffs, Cape Smyth, Manitoulin Island: Twelfth Intern. Geol. Cong., Guide Book No. 5*, p. 77 (table showing succession of formations), pp. 78 and 89, 1913 (issued by the Canada Geol. Surv.), and *Upper Ordovician Formations in Ontario and Quebec: Mem. 83, Canada Geol. Surv.*, pp. 85-86, 1916.

Dalmanella emacerata (Hall) var.

Plectambonites sericeus (Sowerby) var.

Conularia trentonensis var. *latior* Ruedemann Mss.

cf. *Ogygites latimarginatus* (Hall) — glabella

Isotelus sp.

Calymene senaria Conrad

Primitiella sp. — similar to or identical with an undescribed species, which is common in the Collingwood shale of Ontario.

Tetradella subquadrans Ulrich var.

The Collingwood age of the blocks of shale and limestone, found in the drift near Newberry, is suggested by their lithological character as well as by their faunal content. This is particularly true in the case of the blocks of shale. In Ontario the Collingwood consists of alternate beds of shale and limestone. It seems very possible that this lithological character of the Collingwood may hold westward as far as the region a short distance north of the southern limits of Newberry, where, unfortunately, the formation is covered by drift.

The correlation of the Collingwood shale is of considerable interest and importance. As noted in the first part of this paper, the Collingwood, including the overlying shales in Ontario, was formerly correlated with the Utica of New York and later differentiated by Professor Raymond from the overlying shales, which he distinguished as a separate unit, the Gloucester. Dr. E. O. Ulrich⁵ in 1914 considered the Collingwood as being of Trenton age, mapping the formation as a late Trenton invasion from the northeast. Dr. R. S. Bassler⁶ in 1915 held the same view. These views seem to be based on the position of the Collingwood below the Gloucester shales, which contain a fauna of Utica age. In 1916, Professor Raymond⁷ placed the Collingwood above the

⁵ Ulrich, E.O., *The Ordovician-Silurian Boundary: Compte-Rendu of Twelfth Intern. Geol. Cong.*, p. 662 (See Map 3 on p. 662), 1914.

⁶ Bassler, R.S., *Bibliographic Index of American Ordovician and Silurian Fossils: Bull. U.S. Nat. Mus.*, 92, Vol. 2, p. 1513 and Pl. 2, 1915.

⁷ Raymond, P.E., *Correlation of the Ordovician Strata of the Baltic Basin with Those of Eastern North America: Bull. Mus. Comp. Zool.*, Vol. 56, No. 3, p. 257, July 1916.

New York Utica and correlated it with the overlying Frankfort of the Trenton Falls, New York region. This correlation is clearly based on the fact that the Collingwood in Canada rests upon the Picton limestone, which is not present at Trenton Falls, but farther northward appears to hold the position of the Utica shale. In a more recent paper, however, Professor Raymond⁸ has placed the Collingwood in the Trenton group, correlating it with the Utica of northern New York. Furthermore, he considered the Utica as a shaly phase of the Trenton and not as a separate unit. In a forthcoming monograph on the Utica by the senior author of this paper, the Collingwood is regarded as being of upper Utica age.

In view of the fact that the senior author's paper will not appear at once, it is advisable to publish at this time the evidence supporting the upper Utica age of the Collingwood.

In presenting this evidence, it seems best to note first the apparent, physical relationships of the upper Utica to the Collingwood. At Holland Patent, New York, the shale, which contains the typical Utica fauna, has turned out to be upper Utica. At this locality it rests directly upon the Trenton limestone; the sharp boundary there observable between the Trenton and Utica marks a disconformity and a hiatus, in which the lower and middle Utica appear to have been lost in going north from the region in the Mohawk Valley where the Trenton and Utica are connected by transitional beds. Assuming — on good grounds — that the Canajoharie shale corresponds to the whole of the "*Prasopora* beds" or true Trenton, the whole of the missing Utica may be represented by the *Rafinesquina deltoidea* beds, which occur at the top of the Trenton section and which Professor Raymond⁹ places in the lower Picton beds (now designated Lower Cobourg by Raymond) of Ontario. This is quite possible if one considers that the lower and middle Utica, in spite of its great thickness, is largely a local swelling up of the formation in a sinking basin. Furthermore, if the upper Utica is replaced northward by the

⁸ Raymond, P.E., *A Contribution to the Description of the Fauna of the Trenton Group: Mus. Bull. 31, Canada Geol. Surv.*, p. 1 (See Table 1), 1921.

⁹ *Op. cit.*

Picton limestone, the Collingwood may properly be considered as post-Utica in age.

There are, however, certain biological facts, which can not be made to agree with these purely stratigraphic considerations. One is the appearance of the Gloucester shale fauna in the upper Utica at Holland Patent and in the still younger Atwater Creek shale. The well-known typical Utica shale at Holland Patent contains in *Triarthrus spinosus* and *Leptograptus flaccidus*, and the superjacent Atwater Creek shale in the typical *Glossograptus quadrimucronatus* the most characteristic fossils of the Gloucester shale. The last two forms are North Atlantic types, which are well known in Europe. They, combined with the aberrant form *Triarthrus spinosus*, seem clearly to place the Gloucester shale into upper Utica time; the shale represents, however, an independent invasion from the North Atlantic where the characteristic fossils of the Gloucester shale had their undoubted center of dispersion. If, however, the upper Utica shale, at its base, is of the same age as the Gloucester shale of Canada, then the Collingwood is older than the upper Utica. This inference seems also to be borne out by other fossil evidence, such as the abundance of *Primitiella unicornis* or a very closely related ostracod — this species being a Fulton and upper Canajoharie form — and of still other types such as *Conularia trentonensis* mut. and *Lingula trentonensis* (besides *Lingula prognè*) in the Canadian shale. It then seems proper to infer that the Collingwood shale also falls within the hiatus marked by the disconformity at Holland Patent and lies between the Picton limestone and the upper Utica, the Picton limestone being equivalent only to the lower and middle Utica.

A few days after the foregoing conclusion as to the position of the Collingwood had been reached on conjectural grounds, typical upper Utica graptolites, *Glossograptus quadrimucronatus* and *Climacograptus pygmaeus*, were found in association with *Ogygites latimarginatus* and other characteristic Collingwood fossils on a slab of Collingwood shale, thus proving by direct evidence that the Collingwood still falls within the boundaries of the upper or third zone of the Utica shale. It is a corollary of

this conclusion that the Collingwood shale can not be represented in either the Deer River or Atwater shale¹⁰ of the Black River Valley but is older than either. One must rather see in them late stages of the Gloucester invasion.

It thus appears that the Collingwood shale represents a differential development of a part of the upper Utica, which may indicate either a provincial separation from the Utica sea farther south, or, more probably, a separate invasion from another (northeastern) direction.¹¹ According to the evidence presented in this paper, this invasion extended farther west — at least to the Newberry, Michigan region — than has been hitherto believed.

¹⁰ These minor stratigraphic divisions will be defined by the senior author in a later paper.

¹¹ See Ulrich, E.O., *The Ordovician-Silurian Boundary: Compte-Rendu of Twelfth Intern. Geol. Cong.*, Map 3 on p. 662, 1914.

