THE AGE OF THE DEVONIAN LIMESTONE AT McMURRAY, ALBERTA

By P. S. WARREN

ENTERING the Mackenzie River area by the usual route, the first appearance of Devonian limestone is at McMurray at the confluence of the Athabaska and Clearwater Rivers. The outcrops of limestone on Athabaska River below McMurray have, doubtless, been examined by many geologists entering the northern area but so far there has been no mention made of the exact age of these beds. Camsell and Malcolm, in their treatise on the Mackenzie River basin, state that they "appear to belong to the Upper Devonian series but represent a very different faunal and lithological facies from that shown in the sections to the west and north.[1]" The writer agrees with these authors as to the age and difference in facies of the strata and their contained fauna. The purpose of this paper is to define more accurately the age of the beds and to correlate them with other Devonian sections.

The fossils on which this study is based were collected by various geologists at different times. The principal collections were made by Dr. J. A. Allan of the Department of Geology, University of Alberta, and Dr. K. A. Clark, Research Council of Alberta. No attempt was made to collect systematically, the fossils being obtained from various beds in different localities. The total collections were probably obtained from a considerable thickness of strata. The species identified by the writer in these collections are given below:—

Spirorbis omphaloides Goldfuss
Schizophoria striatula (Schlot.)
Stropheodonta demissa (Conrad)
" *perplana* (Conrad)
" *inequiradiata* Hall
" *inflexa* Swallow
" *subdemissa* Hall
Chonetes sp.
Productella callawayensis Swallow
" *hallana* Walcott
Pugnax pugnus (Martin)
Atrypa reticularis (Linn.)
" *spinosa* Hall
" *gregeri* Rowley
Spirifer tullia Hall, varieties
Cyrtina billingsi Meek
" *hamiltonensis* Hall?
Athyris angelica var. *occidentalis* Whiteaves
Modiomorpha sp.
Paracyclas elliptica Hall
Aviculopecten cf. *flabellum* (Conrad)

[1] Camsell, C. and Malcolm, W., The Mackenzie River basin: Geol. Surv., Can., Mem. 108, p. 66. 1921.

Before discussing the age of this fauna it is best to review briefly our knowledge of the Upper Devonian faunas of the Mackenzie Valley area. Two distinct faunas have been delimited in the Upper Devonian rocks:—[2] Firstly, an upper fauna containing *Spirifer disjunctus* or *whitneyi* occurring in the Hay River limestones and shales to the south and west of Great Slave Lake and in beds of similar age in the lower Mackenzie valley. This fauna has been correlated with that of Chemung of New York State. Secondly, a lower fauna of Portage age contained in the Simpson shale lying below the Hay River shale and outcropping along Mackenzie valley south of Simpson. This latter fauna is characterized by such forms as *Buchiola retriostriata*, *Ontaria clarkei* and *Entomis variostriata*. A fauna of Portage age but of a different facies occurs on Peace River at Peace Point where Kindle[3] has collected the following species:—

Crinoid stems
Aulopora cf. *adnascens* Fenton
Spirorbis omphaloides Goldfuss
Crania sp.
Schizophoria striatula (Schlotheim)
Camarotoechia sp.
Pugnax pugnus Martin var.
Leiorhynchus mesacostale Hall
Atrypa reticularis (Linn.)
Atrypa cf. *spinosa* Hall
Cyrtina hamiltonensis Hall var.
" *billingsi* Meek
" *billingsi* var. *symmetrica* Kindle
Spirifer tullia var. Whiteaves
Palaeoneila filosa (Conrad)
Leda cf. *diversa* (Hall)
Modiomorpha sp. undet.
Leptodesma cf. *naviforme* Hall

This fauna was contained in blue shale and thin-bedded limestone considerably different in lithological character from the Simpson shale, the main difference being the introduction of limestone beds.

It is with the Portage fauna at Peace Point that our collections are to be correlated. Though some of the typical Portage elements of that fauna are missing in the McMurray fauna, other species are sufficiently typical to warrant the correlation. The numerous Atrypas and large Schizophorias, varieties of *Spirifer tullia*, *Cyrtina billingsi* and

[2] Kindle, E. M., A Portage fauna in the Mackenzie River valley: Geol. Surv. Can., Mus. Bull. No. 29, 1919.

[3] Kindle, E. M., The occurrence and correlation of a Devonian fauna from Peace River, Alberta: Geol. Surv., Can., Bull. 49. pp. 14-18, 1928.

Pugnax pugnus are common to both faunas. The absence of *Spirifer whitneyi* at both localities also strengthens the correlation. The differences between the two faunas are probably due to differences in environment. The McMurray fauna occurs largly in limestone beds with a minor amount of shale whereas the Peace Point fauna occurs in the shale with thin limestone beds.

It is our conclusion, therefore, that the limestone beds on the Athabaska River at McMurray correspond in age to the Devonian beds at Peace Point and to the Simpson shale on the Mackenzie River.

The thickness of the limestone and shale containing the Portage fauna on the Athabaska River is accurately known through the log of the salt well drilled at McMurray.[4] The log shows a thickness of 405 feet of limestone and shale overlying gypsum beds. The upper boundary is an erosion surface. The fauna obtained from the well core has previously been examined by the writer.[5] It is characterized by large numbers of Atrypas and Schizophorias and, in certain beds, by numerous examples of *Spirifer tullia* var., *Cyrtina billingsi* and *Productella hallana*. Towards the base of the formation *Lingula spatulata* occurs in great abundance. This is the same fauna that occurs in the limestones outcropping on the Athabaska River.

Cameron gives the thickness of the Simpson shale on the Mackenzie River as 250 feet.[6] The strata containing the Portage fauna, therefore, not only change to a more calcareous facies in a southeasterly direction but thicken considerably also. Kindle considers that the change in faunal facies from the Mackenzie River to the lower Peace as being due to nearer shore-line conditions at the latter locality.[7] This is probably a correct interpretation but it seems preferable to consider the Peace Point and Athabaska River faunules a limey facies and the Simpson shale faunule a shaly facies of the same fauna.

The relationships of the Devonian beds on the Athabaska River and at Peace Point appear to be identical, both sequences overlying gypsum beds which have been proved to be of Silurian age at Peace Point.[8] On the Mackenzie, on the other hand, the Simpson shale overlies Middle Devonian limestone. The Upper Devonian sea was, therefore, much more widespread in this area than that of the Middle Devonian.

It is proposed to name the limestone and shale on the Athabaska River, carrying the Portage fauna and correlative with the Simpson shale on Mackenzie River, the Waterways formation. The name is derived from the town of Waterways at the end of steel about three miles from McMurray.

The fauna of the Waterways limestone, so far as it is known, seems to bear a considerable resemblance to that of the Snider Creek shale of Missouri.[9] The numerous Atrypas, Schizophorias and Strophecdonts as well as *Productella callawayensis* and *Atrypa gregeri* are common features of both faunas. It should also be mentioned that a variety of *Spirifer tullia* from the Waterways limestone appears to be identical with *Spirifer annae* of the Snider Creek shale, and *Cyrtina billingsi* from the northern locality is a very closely allied form of *Cyrtina missouriensis* of the Missouri formation.

The Waterways fauna does not seem to be quite so closely allied with the Hackberry fauna of Iowa.[10] It should be mentioned, however, that *Spirifer tullia* and its varieties from Athabaska River are quite closely allied with the Hackberry *Spirifer orestes* and appear to be nearly as variable as the Iowa species.

A fauna of similar age to that of the Waterways formation is found throughout the Canadian Rockies. Though the resemblance is not striking, it is interesting to note the occurrence in the mountains of *Spirifer jasperensis*, a variable form which has much in common with certain varieties of *Spirifer tullia*.[11] It is notable that the *Spirifer jasperensis* fauna is more closely allied with the Iowan Hackberry fauna than with the Waterways or Snider Creek faunas.

An interesting fauna of similar age has been noted in cuttings from the Duvernay well drilled by the Alberta Pacific Consolidated Oils, Ltd. near North Saskatchewan River in sec. 34, tp. 55, rg. 12, W. 4th Mer., being nearly due south of McMurray. In a series of limestones and shales at depths between 2,240 and 2,330 feet the following fossils were identified:—*Lingula spatulata* Vanux., *Buchiola retriostriata* Von Buch, and *Tentaculites* cf. *mackenziensis* Kindle. This fauna has more resemblance to that of the Simpson shale than it has to the Waterways fauna, but the formation from which it was obtained strongly resembles the Waterways.

[4] Allan, J. A., Second Ann. Rept., Min. Res. of Alta., pp. 102-114. 1920.

[5] In Allan, J. A., loc. cit.

[6] Cameron, A. E., Hay and Buffalo Rivers, Great Slave Lake and adjacent country: Geol. Surv. Can., Sum. Rept., pt. B, pp. 1-44, 1921.

[7] Kindle, E. M., loc. cit.

[8] Kindle, E. M., loc. cit.

[9] Branson, E. B., The Devonian of Missouri: Missouri Bureau of Geology and Mines, Vol. 17, 1923.

[10] Fenton, C. L. and M. A., The stratigraphy and fauna of the Hackberry stage of the Upper Devonian: Contributions from the Museum of Geology, Univ. of Mich. Pub., Vol. 1, 1924.

[11] Allan, J. A., Warren, P. S., Rutherford, R. L., Geology of the Eastern ranges of the Rocky Mountains, Jasper Park, Alta.: Roy. Soc., Can., Trans., Vol, 26, sec. 4, 1932.