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NOTES ON THE GEOLOGY AND FOSSIL FLORA OF PRINCE
EDWARD ISLAND.

BY FRANCIS BAIN AND SIR WILLIAM DAWSON.*

[In the CANADIAN NATURALIST, the predecessor of this Journal (Vol. IX, No. 9, New Series) Mr. Bain published some notes on the geology of Prince Edward Island; and the following additional note is intended to be supplementary thereto, and to refer more especially to the evidence of fossil plants in relation to the arrangement of the formations of the Island previously proposed by Mr. Bain.]

The rocks of Prince Edward Island seem to me to be divisible on the evidence of superposition and fossils into three sections, as follows:—

First.—The lower series of grey, brown, and red sandstones and shales, termed by Sir William Dawson Permo-Carboniferous, presenting a thickness of about 800 feet. This series contains all the more decidedly Carboniferous plants found on the Island,

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as *Calamites suckovii*, *C. cistii*, *C. cannaeformis*, *Dadoxylon acadianum* and *Trigonocarpum*, associated, however, with plants of a Permian character.

Secondly.—A middle series, reposing conformably, or nearly so, on the last, and consisting of 2,000 feet of red sandstones and shales,—the shales, and also calcareous sandstones, predominating in the lower part. This series is distributed over the greater part of the Island. It is of greatly reduced thickness in the western parts. It contains plants of a decidedly Permian character, as *Walchia*, *Calamites gigas*, *Pecopteris arborescens*, great numbers of stems of *Araucarites* evidently allied to *Walchia*, and the impressions of large, thick leaves that look like *Noeggerathia*, with *Dadoxylon edvardianum* of Triassic affinity. The beds are disturbed slightly by three lines of anticlinal, running parallel with the Cobequid range of mountains. The disintegration of the great shale beds of the lower part of this series has caused the separation of Prince Edward Island from the mainland. At what appears to be the summit of the series is a bed of quartzose conglomerate, which is pretty extensively distributed, being found in the synclinal on the Murray Harbor road, about the head waters of North River, and other localities in the centre of the Island.

Thirdly.—A horizontal series of red sandstones and shales, not distinguishable lithologically from the last, except it be by more regular bedding, and appearing to repose unconformably on the denuded strata of the most northern anticlinal of the Permian. Greatest thickness observed, 150 feet.

So far as yet ascertained, the plants found in this series are mostly specifically distinct from those of the lower rocks. But there is a generic relationship, especially with those of the middle series. This is seen in the few better preserved specimens, and also in the numerous fragments and obscure markings. Adding to the general specific distinctness of its plants the fact, that this series yielded the remains of *Bathynathus borealis*, we are inclined to consider it the representative of the Triassic. Its beds are best seen on the north shores of the Island, about New London and eastward; but their exact distribution is very difficult to determine, owing to their general conformability to the underlying Permian. A good and typical exposure of this series occurs at Cape Turner on the north shore of the Island.

* The rocks at Cape Turner belong to a horizontal series of strata which stretches along the north shore from New London to Tracadie Harbor, lying unconformably on a denuded anticlinal of the Permian, at least they occupy the place where we ought to find indications of the eastward extension of the Tryon anticlinal. The Report of Drs. Dawson and Harrington, 1871, states that at Tryon appears to be "the beginning of a synclinal." At Campbell's Cove, I found the centre of the anticlinal, the beds dipping both ways from it. To the west its influence can be traced for a considerable distance on the Irish Town Road, though not seen at Darnley and its vicinity; but eastward it is lost under the horizontal series mentioned.

This Cape Tryon anticlinal is the third of a series parallel to the Cobequids, which disturbs our Island beds. Two have been mapped out in the Report above referred to, and this third, and most distant one, though irregular and broken, is of great interest.*

The horizontal beds of Cape Turner, I think, must be called truly Triassic. Their westward extension into New London contained the *Bathygnathus*, and all the remains that I have found in them are dissimilar from those of the south side of the Island, except, perhaps, one doubtful fucus.

In looking at the little group of plants from Cape Turner it is to be observed, that while the groups from Gall's Point, St. Peter's Island, Miminigash, and localities on the south side of the Island all have a decided relationship among themselves, this C. Turner group has no relationship to any of them. Even the fucoids of the Cape Turner beds are distinct, with, perhaps, one exception.

Remarks on the above by Sir William Dawson:—

The geology of Prince Edward Island, though somewhat simple, has been the subject from time to time of diverse opinions. It was natural that the earlier observers, influenced merely by mineral character and superposition, should relegate all the sandstone deposits, mostly of red colors, overlying the coal-measures of eastern Nova Scotia and extending across the

* See also Mr. Ells' Report, Geol. Survey of Canada, 1883-4.

Northumberland Strait into Prince Edward Island, to a "new Red Sandstone" formation, including in the geology of that time both the Permian and Triassic. As early, however, as 1842 * the writer was able to announce the existence of Carboniferous fossils in these beds, and in 1845, in two papers published in the Journal of the Geological Society of London, to refer the whole of the Red Sandstone of the south side of Northumberland Strait and a portion of that of Prince Edward Island to the "Newer Coal formation," a name afterwards changed, in so far as the upper beds were concerned, to "Permo-carboniferous."

In 1871, in conjunction with Dr. Harrington, the writer instituted a geological examination of the whole Island, at the instance of the local Government, and published a report of fifty pages, with a map, sections, and figures of fossils. In this report were described and catalogued twenty species of fossil plants, of which sixteen were referred to the Permo-carboniferous and four to the Triassic. In the Report referred to, it was proposed to arrange the strata of the Island in two groups, Permo-carboniferous and Triassic, and to divide the latter into a lower and upper series, and in our map we limited the distribution of the former group to those regions in which it was distinctly characterised by infra-position and by fossils, thus leaving the greater part of the surface to appear as Triassic. Since 1871, Mr. Bain has been able to discover fossil plants of Permo-carboniferous types in several places in which they were not found by us, thus extending the range of that formation. These facts he published in the paper in the *CANADIAN NATURALIST* above referred to. More recently, he suggests a three-fold division of the beds, and would refer to Permian that part of the Series which we designated Lower Trias. Mr. Ellis of the Geological Survey of Canada, who has recently re-examined the rocks of Prince Edward Island (Report of Survey, 1883-4), not only extends the limits of the lower series, but regards the Trias as very limited, and not clearly distinguishable from the Permo-carboniferous; but in this last respect I cannot but think he exaggerates the difficulty occasioned by the low dips of all the beds, and the strong mineral resemblance of the Trias to the underlying Permo-carboniferous, from whose disintegration it has undoubtedly been derived.

* Notes on Geology of Prince Edward Island, *Hazard's Gazette*.

The object of these remarks is, however, more especially to consider the testimony of the fossils recently collected by Mr Bain when added to that previously obtained. On this I would remark:—

1. That the beds at Miminigash, Gallas Point, St. Peter's Island, Governor's Island, Rice Point, and other places on the south coast contain plants which elsewhere characterise the Upper Carboniferous and Lower Permian.

2. At certain points in the interior of the Island and in the bays of the north coast, which represent troughs between the Permo-carboniferous anticlinals, there are found plants indicating a higher horizon. Here the characteristic Carboniferous species are absent, and their place is taken by others, either Permian or Triassic. For

1. *Permo-carboniferous.*

The species catalogued from this Formation in my Report of 1871, and my paper of 1874 in the Journal of the Geological Society of London, were the following:—

- Daloxylon materiarium, Dn.
- Walchia gracilis, Dn.
- “ robusta, Dn.
- Calamites suckovii, Brongt.
- “ cistii, Dn.
- “ gigas, Dn.
- Neuropteris rarinervis, Bunbury.

Alethopteris nervosa, Brongt.

“ *massilionis* (?), Lesq.

Pecopteris oreopteroides, Brongt.

“ *arborescens*, “

“ *rigida*, Dn.

Cordaites simplex, Dn.

Trigonocarpum, Sp.

To these Mr. Bain adds *Calamites cannaformis* or specimens very closely resembling that species, and stems of the genus *Tylo dendron*, while he seems to think that *Walchia* of the type of *W. gracilis*, *Calamites gigas* and certain *Noeggerathia*-like leaves as well as the conifer, *Dadoxylon edvardianum*, are more particularly Permian and characteristic of the second member above referred to.

The ferns of the Permo-carboniferous merit a careful re-examination in the light of recent publications in Europe and America.

2. Permian and Triassic.

The *Walchia* found by Mr. Bain in the second or Permian group is very near to my *W. gracilis*, and probably the same. Weiss has, however, described and figured in Germany,

* Flora der Rothliegenden in Saar-Rhein-Gebiete, 1872.

in a memoir published about the same time with my Report,* a species which he names *Walchia linearifolia*, and which is very near to *W. gracilis*, and especially to the variety of that species figured by Mr. Bain. Knorria-like stems and specimens of Sternbergia, obtained by Mr. Bain in the same beds, may all belong to this species. Large Noeggerathia-like leaves, such as those referred to by Mr. Bain, are not infrequent in the Permian elsewhere, and have been variously referred to ferns, to palms, and to taxine trees of the type of *Salisburia*. I have not seen Mr. Bain's specimens of these leaves.



Fig. 1. Branch of *Walchia*? Trias, Prince Edward Island. From a drawing by Mr. Bain.

The few plants collected by Mr. Bain in the Upper Trias, or Trias proper, are especially interesting in consequence of the paucity of well-preserved fossils in this formation. He finds in these beds a *Calamites* with very fine ribs of the type of *C. arenaceus*, and which may be an internal cast of that Triassic species, which, when perfect, is really an *Equisetum* rather than a *Calamite*, also certain Knorria-like branches different from *Tylodendron* but probably branches of coniferous trees (Fig. 1), and a species of *Walchia* apparently distinct from that of the lower beds. It has very stout and straight branches, marked with interrupted furrows. Its branchlets are long, slender and crowded, and at right angles to the branch. The leaves are closely appressed, triangular and scale like. Detached branchlets have thus the aspect of the Mesozoic genus *Pachyphyllum*, but the

* I may remark here that I have obtained from the Permo-carboniferous of Cape John, on the Nova Scotia coast, a leafy branch with long parallel-sided obtuse leaves, and which may indicate a species of *Ulmannia* or *Voltzia*, but is not sufficiently perfect for precise description.

habit of growth is that of *Walchia*. The species is near to *W. imbricata* of the European Permian, but sufficiently distinct to deserve a name, and I have therefore called it *W. imbricatula* (Fig. 2).

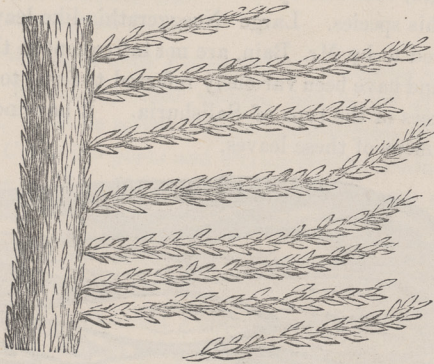


Fig. 2. *Walchia imbricatula*, S. N., Trias, Prince Edward Island. From a drawing by Mr. Bain.

It is to be observed that, in the red sandstones of Prince Edward Island, all the more delicate plants, and even twigs of coniferous trees, have completely lost their organic matter and are represented by mere impressions, stains, or casts in clay or sand, so that it is very difficult to ascertain their minute characters.

The general result, in so far as the subdivision of the beds is concerned, would seem to be that the lower series is distinctly Permo-carboniferous, that its extent is considerably greater than we supposed in 1871, that there is a well-characterised overlying Trias, and that the intermediate series, whether Permian or Lower Triassic, is of somewhat difficult local definition; but that its fossils, so far as they go, lean to the Permian side. The further researches of local observers like Mr. Bain may be expected to throw new light on these points, and to enable a more exact separation to be made of the several deposits.