

THE GEOLOGICAL AGE OF PRINCE EDWARD ISLAND.—BY  
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The exact position of Prince Edward Island in geological time has long been a matter of uncertainty. That it was limited in one direction by the Upper Carboniferous and in the other by the Trias, was recognized by all the Canadian geologists who have examined the rocks of the island, notably Gesner, Sir William Dawson, Dr. Ellis of the Geological Survey of Canada, and the native naturalist, Francis Bain; but the general similarity of the rocky constituents, the conformability of the strata and the scarcity of fossils rendered the recognition of possible plurality of formations difficult, if at all possible.

The lowest beds, with outcrop on St. Peter's and Governor's Islands in Hillsborough Bay, and on the still more easterly extension of the same anticline at Gallows or Gallas Point, were early recognized as similar in character and geological horizon with the Upper Carboniferous beds of the northern coast of Nova Scotia, and of parts of New Brunswick opposite to Prince Edward Island.

Along the western shore of Prince Edward Island, from Cape Wolfe to Nail Pond, the lowest strata disclose rocks of an almost equally ancient origin as those of the Hillsborough Bay anticline above mentioned.

In some places on the mainland, as about Cape Tormentine, these lowest beds of dark red or brown sandstones with conglomerates and grey streaks (indicating the elimination of colouring matter by vegetable organisms), with plant fossils characteristic of the Upper Carboniferous formation, pass, without stratigraphical demarcation into the red sandstones, impure limestones, and shales which form the bulk of the rocks of Prince Edward Island.

Because of the want of distinct demarcation between the Upper Carboniferous and the next succeeding Lower Permian systems, Sir William Dawson assigned the lowest and middle rocks to his "Permo-Carboniferous" system, but, from the finding at New London of the fossil jaw of an animal, named by Dr. Leidy *Bathygnathus borealis*, which he (as now ~~transpires~~, erroneously), concluded was a triassic dinosaur—a conclusion accepted by the great palæontologist Cope—Sir William Dawson assigned the district in which the fossil was found to the Trias, the age next succeeding to the Permian.

Sir William Dawson's latest expressed opinions as to the red sandstones of Prince Edward Island are contained in his *Handbook of Canadian Geology* (1889), pages 97 to 101, from which the following summary is compiled:

*The Permian System.* The Permo-Carboniferous red sandstones of Prince Edward Island and eastern Nova Scotia are typical of the Lower Permian. Their fossils are for the most part generically similar to those of the Carboniferous. The Upper Permian is not represented in Canada. The Permian, or Permo-Carboniferous of Prince Edward Island does not yet admit of any division into distinct groups and it rests conformably on the upper coal formation without any stratigraphical break. It is characterized by a prevalence of sandstones and shales coloured by the red oxide of iron.

*The Triassic System.* The Bunter sandstone (the lowest of the three divisions which gave its name—Trias—to the system) is represented in Canada by the lower new red sandstone of the Bay of Fundy and Prince Edward Island, associated with trappean rocks. Its fossils are conifers and cycads, and the footprints of dinosaurs. The limestones of the Middle Trias of Germany and eastern France are not found in eastern America. To the Keuper sandstone (the uppermost of the triad series) belong the upper sandstones of Prince Edward Island and the Bay of Fundy, where its trappean beds form

the North Mountain of Cornwallis and Annapolis counties. In both Nova Scotia and New England the triassic age was remarkable for the deposition of red sandstone in shallow bays and straits, and for the ejection of great dykes of basaltic and amygdaloidal basic volcanic ash. In Prince Edward Island, "owing to the slight dips of the Permian and Triassic, and their mineral-similarity, it has proved difficult to define their boundaries; but the Trias appears to rest in slight troughs of the Permian and to be partly composed of its rebris."

Thus Dawson's accrediting to Prince Edward Island, beds of Triassic origin was doubtless due to the opinion of Leidy (endorsed by Cope) that the fossil, *Bathynathus borealis*, Leidy found at New London, was a dinosaur characteristic of the Trias. In a letter to Francis Bain, Sir William wrote as follows: "Look well to the north side of the island for the true Trias." Bain was such an enthusiastic believer in the existence of Triassic deposits in Prince Edward Island, that he contributed to the *Canadian Science Monthly*, in 1885, an article, entitled, "Bounding the Trias," in which he defines the supposed limits of the formation, using, as a strong claim, the surface configuration of the country. According to this writer, the surface of the Permian districts is "like the gentle swelling of the summer sea," while that of the Triassic is "like a sea torn by the wildest conflict of contending winds and currents." He further defines the different characters of the sandstones of the two systems: "The Triassic consists of thick-bedded sandstones, and where rests on similar beds of the Middle Permian, it is difficult to distinguish between the two. But where it rests upon the uppermost beds of shale and fissile sandstones, the distinction is quite marked, and especially in scenic effect. . . . The Triassic sandstones are distinguished from the Permian by having less dark carbonaceous markings in them. There are fewer shales and no calcareous conglomerates, although some of the sandstones are indurated with lime. There are few well preserved fossils in the system so far as we have yet discovered. My fieldbook

contains drawings of over thirty different varieties of plants, but so indifferently preserved that not more than three or four of them could with certainty be referred to their proper species. Yet the group is readily recognized as distinct from similar remains in the Permian strata below . . . . *But these [Triassic plant fossils] would not have been sufficient to characterize the system if they were not associated with an undoubted Mesozoic dinosaur, Bathygnathus borealis.*" (The italics are mine. L. W. W.)

In view of the considerations submitted by Bain, Dawson in 1885 (*Canadian Record of Science*, vol. i, no. 3) wrote thus: "The general result, as 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-characterized overlying Trias*" (italics, L. W. W.), and that the intermediate series, whether Permian or Lower Triassic, is of somewhat difficult local definition, but that its fossils, as far as they go, lean to the Permian side.

Dr. Ells, of the Canadian Geological Survey, in his report of his observations made in 1902, writes as follows: "With the exception of this fossil (*Bathygnathus*) from the New London area, it may be said that all the available evidence points to the opinion that the red sandstones and shales, of which the island is largely composed, may all be assigned to the Carboniferous horizon, or as some geologists prefer to call them, Permian.

In this somewhat uncertain state rested the information as to the age of the latest rocks until 1905, when, in an article published in *Science* (new series, vol. xxii, no. 550, p. 52) E. C. Case, an eminent authority upon the fauna of the Permian beds of North America, disputed the identity assigned to the New London fossil, and stated his conviction that the fossil *Bathygnathus* instead of being the *lower* jaw of a Triassic dinosaur was the *upper* jaw of one of the most specialized

of the Pelycosaur, such as occur in the Texas region, probably a *Demetrordon* or *Nausaurus*, "characteristic of, and not surviving the permian age."

Simultaneously, and independently, Dr. Von Huehne published a paper (*N. Jahrb. f. M. G. u. P. Beilage*, band xx., p. 343) in which he arrived at the same conclusion as to the nature of the fossil and the age of the beds in which it was found. In his "Revision of The Pelycosauria," published by the Carnegie Institution of Washington (1907), Mr. Case restates his conviction that the animal was a dinosaur characteristic of the Trias, but one of the Pelycosauria, "a highly specialized, primitive side branch of the Rhyncocephalia, which seemingly became extinct at the end of the Permian age."

Thus, as the existence of Triassic deposits in the northern and central parts of Prince Edward Island depends, even according to the enthusiastic champion of the theory, Francis Bain, entirely upon the supposition that *Bathygnathus borealis*, Leidy, was a dinosaur, and, as the animal has been adjudged a pelycosaur of Permian time by indisputable authorities, the conclusion is inevitable that, in the present state of our knowledge, Triassic deposits cannot be said to occur in this region, and that the whole rock system of the island is referable to the Permo-Carboniferous age.