and hard-working ministers—Hon. P. Mitchell of the Marine and Fisheries—who successfully carried through Parliament at its present Session a grant of $37,000 for meteorology; and under the chief directorship of G. T. Kingston, M. A.,—head of Toronto Observatory—whose guidance and extensive scientific attainments are sufficient guarantees for our future successful progress.

Art. XI. The History of a Boulder. By the Rev. D. Honeyman, D. C. L., F. G. S., &c.

(*Read May* 12, 1873.)

Our Boulder lies partially interred on the side of the road, between New Glasgow and Antigonish, about a mile and a half east from Sutherland's River Bridge. It is nearly thirteen years since this boulder first attracted my attention. Its hard weather-beaten face was traversed by a dark brown line which led me to suspect that it had a history to relate, which had yet been untold. In shorter time than I have taken to pen these sentences, my hammer and chisel had verified my conjecture. A familiar hieroglyphic appeared which at once informed me that the boulder was not a thing of yesterday,—that it had been clay deposited at the bottom of the ocean,—that it had been deposited there in an age long gone.

The hieroglyphic was the pygidium of a trilobite—*Dalmania Logani*—which lived, died, and was buried at nearly the close of the Upper Silurian Period,—which is known by English Geologists as the Upper Ludlow, by American Geologists as the Lower Helderberg, and by ourselves as the upper part or D, of the Upper Arisaig Series. I observed that this boulder was not solitary; many smaller ones were scattered on the sides of the road and in the fields: all were alike weather-beaten. Many enclosed beautiful forms—beautiful, but brittle. Trilobites, *Phacops* and *Prœtus* and *Homalonotus*, of a new and undescribed species. There were heads of *Phacops* having eyes in a beautiful state of preservation.

All told the same story as the tail of the *Dalmania Logani*—

Hall. The abundance of boulders led to the belief that the rocks which produced them were at no great distance. Shortly after the discovery of the boulder, I had made another discovery. In a road cutting, at the bridge of a branch of French River, east from the site of our boulder, are soft shales locally known as "pencil stone." In these I found *Graptolithus Clintonensis*—Hall. This is the only locality where this fossil has been found away from Arisaig. It indicates the Clinton age of New York, or Middle Silurian. In addition these shales produce several trilobites—several braehiopods, *e. g. Leptocoelia intermedia*—Hall, *Leptaena depressa*, *Lingula oblonga*, *Discina*, *Cornulites*, or tubiculous worms, a *Conularia*, *Pteropods*, and an *Orthoceras*, a cephalopod. This, I have elsewhere named Upper Clinton, B'.—In another road cutting at Barney's River, and yet another on a branch of the same river, to the east, I found abundance of nodules—all with one or two exceptions encasing beautiful *Linguloe* of several species. This is the second of three localities where beds of *Lingula* nodules have been found. The first is Arisaig, the second is Barney's River, and the third Sutherland's River. These shales I have in my "Geology of Arisaig" characterized as B, and elsewhere as Lower Clinton.

In the bed of French River and at the road side at Barney's River, I found boulders with *Petraia*, and trumpet-shaped *Cornulites*. Here was evidence of the existence of still lower strata, or the A strata of Arisaig. After search the strata whence these were derived, were found up Barney's River. Here was bold and solid strata, forming flanks of the mountains. Here I found nearly as great a variety of fossils, as in the corresponding strata A of Arisaig.—These are found extending eastward to Marshy Hope, and westward to French River. They underlie the Lower Clinton and Upper Clinton shales, already referred to, and overlie Crystalline rocks—Syenites, Lower Arisaig Series.

The Clinton strata from Marshy Hope to French River, westward, are overlaid by Lower Carboniferous. Here, then, there is an irregularity in succession—the Upper Silurian and Devonian being absent.

The strata which produced our boulder yet remained undiscovered.

When surveying the Precarboniferous rocks of the Pictou Coal Field, in 1869, I found strata to the east of Sutherland's River, about three miles south of the boulder. These dip northerly at a very low angle, and are of the age of the boulder, having the same fossils. It is doubtless from some part of these that the boulder came. Their extension in the direction of their dip would underlie the boulder at no great depth.

The *Homalonotus* which I have already referred to is characteristic of the part of the Upper Arisaig Series, which has been determined by Mr. Salter, the late distinguished Palæontologist of H. M. Geological Survey, to be the equivalent of the Aymestry limestone of Wales. There is probably the other member of the upper part of the Upper Arisaig Series in the locality yet undiscovered. So that between Sutherland's River and Marshy Hope* we have probably the whole of the Upper Arisaig Series with the exception of the lowest, or Arisaig Pier portion, which I have regarded as the *possible* equivalent of the Oneida conglomerate of the United States.

Our boulder strata and those underlying them, were formed in the bed of the ocean, at ever varying depths, from the *detritus* of the Crystalline rocks of the Lower Arisaig Series, which I have already referred to as underlying the *Petraia* strata up Barney's River.

The boulder also tells us that it has undergone great hardships since it was deposited at the bottom of the ocean. When trying to detach a piece of the rock along with the fossils, I found that it would only break at right angles to the line containing the fossils. This tendency is called *slaty cleavage*.

Now this indicates that the original strata of the boulder with those underlying it, had been *let down* deeper than when deposited and subjected to heat as well as hydraulic or other pressure, and had consequently been metamorphosed. The preservation of the

*At the entrance to the Marshy Hope there is an outcrop of Arisaig A. (Mayhill sandstone) belonging to the Antigonish Mountain, a Marshy Hope Series. This is overlaid directly by part of the conglomerate of the Merigomish Carboniferous formation. So that along the line of junction of the Precarboniferous and Carboniferous formations of Merigomish, we have an irregularity of a accession corresponding with that observed in the Pictou Coal Field. Vide "Transactions" 1870-71.

fossils, however, shews that this metamorphism has not been of the highest degree. Having been subjected to this process for a long period, or while the Devonian age lasted, the hardened strata were raised from the depths before the commencement of the Lower Carboniferous Period.

The *Boulder* strata form the eastern extremity of the Precar boniferous strata, underlying the Carboniferous area of Merigomish.

I have already stated that the Carboniferous formation directly succeeds the Clinton strata, between Marshy Hope and French River. We have now the same directly overlying the Upper Silurian. Here then is another irregularity in succession.

The strata of our subject were thus exposed to the stormy seas of the Lower Carboniferous Period—their detached fragment, rolled on the shore, aided in the formation of the materials of the conglomerate which now overlie these strata. This conglomerate is very ferruginous and contains a bed of spathic iron ore, which is considered to be of economic importance.

Outcrops of trap rising in the conglomerate show that our boulder had a narrow escape from local metamorphism. If it had been subjected to this ordeal in addition to regional metamorphism, the line which distinguishes it might have been converted into a streak, and an important part of its history would have been wholly illegible, also the boulder itself would have failed to attract particular attention.

The absence of the usual Lower Carboniferous Lime and Gypsum, appears to indicate that the existing conditions were unfavorable for their deposition.

The coal beds of Merigomish Island show that a Tropical vegetation once crowned the succeeding strata, while the thinness of the beds seems to indicate that the vegetation was far from being luxuriant or lasting.

The extension of these Palæozoic strata became the foundation of a new order of things, the New Red Sandstone, Mesozoic or Triassic formation of Prince Edward Island.

Previous to this, however, or during the Carboniferous Period, time of incalculable length had passed. Elsewhere the Carboniferous

formation exhibits many oscillations of level, alternations of water and land, aquatic Fauna and terrestrial Fauna and Flora, periods of vegetation of tropical character and marvellous luxuriance, forming beds of coal varying from extreme thinness to enormous thickness.

After the formation of these beds, there appear to have been troublesome times, especially in the vicinity of our boulder position. These times have left enduring memorials in the adjoining Carboniferous area, the Pictou Coal Field. The map of the Geological Survey of Canada indicates a network of faults and troubles in this locality.

One consequence of all this appears to have been a limitation of conditions favorable to the formation and distribution of the deposits of the Triassic Era; as the only area possible from the boulder point of view, is that of Prince Edward Island.

In this Triassic region, there lived, died, and were buried, *Dinosaurs*—formidable reptiles, having "ornithic or bird affinities;" one of these the *Bathygnathus borealis*—Leidy—has left a jaw armed with formidable teeth, to tell of its existence and character.

Dreadful shakings are now felt—the earth reels and staggers—volcanic thunders are heard in the west. The western Triassic region is convulsed, lavas are poured over it throughout a length of 139 miles, forming trappean mountains throughout, among which Blomidon stands conspicuous. All becomes still and silent. From this time our boulder would seem to have had a respite from trouble for a long, long period.

Nova Scotia is at rest while Europe, Asia, and other parts of America, are sinking and rising, becoming sea bottoms and dry land, in numerous alternations, being alternately peopled by monsters of sea and land—becoming their cemetries, and then their monumental mountain elevations.

Now—

> "Like a whirlwind o'er the deep
> Comes desolation's blast."

It rains, it snows, it hails; it snows, it rains, it hails; it hails, it snows, it rains; it freezes,—long, long winters,—short, short summers,—alternations interminable,—glaciers, wide spread and

of enormous thickness—thundering, tearing, levelling, plowing —flowing slowly, majestically, continuously, while ages roll.

It is now the climax of desolation and destruction.—Slowly, but surely the dismal Empire declines, and after the lapse of ages, it passes away. Mountains have become plains, plains have become lake basins, and river channels. Around are *roches montonnés* and *blocs perchés*—rock surfaces polished and striated. Drift accumulations cover the sides of mountains, obscure the rocks of plains and valleys. Our boulder has now an individuality—the result of glacial action, although it is still obscured by overlying drift. The glacial *debris* becomes the soil of noble forests. These with lakes and rivers adorn the scene of former desolation. A colony of giant mammals, from the south, descendants of the pre-glacial races, roam through the forests, and recline on the lake margins. The red man appears, and possibly exterminates the *Mastodon Ohioticus* of Cape Breton, becoming the lord of the forest, with its new race of mammals—Moose, Carribou, Foxes—black and red—Bear, Wolf, Loupcervier and Wild Cat.

Acadians arrive and divide occupation with the Micmac. The Briton comes and assumes the supremacy. He takes possession of the land, builds a city, erects towns and villages, constructs roads and railways, exposes our boulder to the eye and hammer of the Geologist, who having read its history, leaves it. *Henceforth*, "*Requiescat in pace.*"

Art. XII. The Economy of Timber and Preservation of Structures from Fire and Decay. By A. P. Reid, M. D., M. R. C. S., Edin. &c. &c. &c.

ECONOMY OF TIMBER.

This subject should receive the greatest consideration from us at present, as our lands are being rapidly cleared of their timber, and more for foreign than home use. This though helping to swell our exports, and bring financial wealth into the country, is not an unmixed benefit, for we are squandering a patrimony in a way that