## A VALUABLE PAPER.

### "Some Evidence of a Glacial Epoch;" by Charles R. Fisher.

**Read by the Author Before the Natural History Society, St. John, October 9th, 1894.**

This evening it is purposed to give some account of that comparatively short, but remarkable, recent geological time, known as the Glacial Period, or Great Ice Age. The immediate reason for giving this description is because we have before us a quantity of the material, accumulated by ice action during that period. These specimens were found in England, not in Canada, although in many respects, the northern portion of America is undoubtedly one of the finest fields extant in which to study the phenomena resultant upon Glacial action, and especially is this the case in the vicinity of St. John. Above your Canadian Drift you often find clays of a more or less grey or reddish color, known as the Leda Clay, so called because amongst other marine shells, the Leda Glacialis is found extensively in it. Examples of this clay are to be found along the coast of the Bay Shore, near Fort Howe, in the valley between St. John and Portland, (St. John north) along the Red Head Road, in the Horticultural grounds at Seely street, and elsewhere. This clay is undoubtedly of sedimentary origin, and one which accumulated very quickly, probably at the time when the immense amount of glacial ice was re-converted into water. I am not aware that the equivalent of, this is found in England, though some of the Eastern counties' Boulder Clay contain many broken portions of marine shells.

Our president, Mr. Matthew, is such an authority upon all connected with geology in this city and province, that I will not attempt to give any account of the evidences in the immediate vicinity of St. John, which tend to prove that at one time this entire region was covered with ice, perhaps to a depth of from one to two thousand feet. My work in this special field has been very desultory, not so much, I hope, from want of inclination as from absence of opportunity. For many interesting facts in connection with your local formations, I am much indebted to the kindness of my friend Mrs. Bowden.

Ice action has been the formative agent of various deposits. During the Pleistocene age, accumulations were laid down upon the older rocks, without any apparent order, often ending very abruptly, and in a manner which indicates the work of quite a different force from any which built up the more ancient strata. The evidences of this action are found in the Boulder Clays, Tills and Gravels of the early Pleistocene period. The clay sometimes has one or more layers of sand, peat, or fine clay, sandwiched in, showing either the action of water, or the accumulation of a vegetable deposit. The interlayers must have been caused by an intermittingly warmer climate. The peat deposit shows that a considerable period of warm weather must have intervened, for such an accumulation to accrue, as that found in this particular stratum.

Where sand or gravel is found, it is probably consequent upon the depression of the land to below the point of submergence; this portion becoming subsequently re-elevated and subject to re-glaciation. The great weight and power of the moving ice has in some places crumpled the shales and other rocks over which it passed, in the line of their lamination. The Glacial Clays partake largely after the nearest rocks over which they passed, with regard to color.

The geographical extent of the ice in the northern hemisphere was, roughly speaking, bounded by the 50th degree north latitude in Europe, whilst in America it was bounded by parallel 39. It England it does not seem to have reached further south to any extent, than the north of the Thames basin. During this time the British Isles were united with the European continent by a vast ice sheet, the whole of the land surface, both in Europe and America, being then, probably, of considerably greater elevation than at present. South of parallel 50 in Europe, immense glaciers would be produced on the Alps, Carpathians, and Pyrenees. In fact, the present Swiss and Pyrenean glaciers are the pigmy remains of once immeasurably larger ice fields. In Asia we find proofs that far larger glaciers existed in the Himalaya range than those of the present day, occupying the southern slope even down to within some 2,500 feet of the sea level. Similar evidences of large glaciers in New Zealand are obtained, whilst traces of proof of former glacial action are found in both Australia and South America.

Geological exploration has, as yet, been confined to so comparatively few regions, that anything like a complete knowledge of the range of ice during the glacial age, has not been attained. One fact should be very clearly borne in mind, that the occupation of a certain area by ice does not necessarily imply that that particular district has a so much lower mean temperature than other places in the same latitude where no ice exists. Through local causes, the precipitation of moisture in the form of snow is so much greater in some districts than in others, that the supply so far exceeds the melting power of the atmosphere as to cause such an accumulation that a glacier is the result. We know that there are districts where moisture seldom or never falls, in cold, as well as in hot districts. Take Siberia as an instance. If any very large quantity of snow fell over that immense territory, it would become one huge glacier, and be totally uninhabitable. Most certainly would this be the case north of parallel 60; yet at Yakutsk it is possible to live, notwithstanding the fact that the ground is permanently frozen to a depth of 700 feet.

Some geologists consider that there has been a succession of Glacial Ages, ranging from Cambrian Times, onward through the Devonian, New Red Sandstone, Lias, and Cretaceons, to the Pleistocene. The evidences, however, are not definite enough to be considered conclusive; although Sir A. C. Ramsey and other writers, hold the opinion that there are traces of glacial action in some of the deposits of those ages.

The ice age which wrought upon so considrable a portion of the earth's surface, such important and remarkable changes, that often the entire contour was altered, took place at a comparatively recent date. Various causes have been assigned for the lowered temperature of the globe at that time. In many places the land was much higher than now, and high ridges of land would act as condensors for the moisture, causing it to fall as snow, in sufficient quantities for glacier building.

The astronomical deductions made by Herschel, Arago, and later by Croll and others, have been of much value to geologists, by giving them data which shews that a much lower temperature was probable at the time assigned for the glacial period. This, at any rate, would be the case in the northern hemisphere. Then we have the suggestions that the warm ocean currents were so deflected from the countries whose climatic rigors they now so much modify, that a great change of temperature would ensue. As an instance :—If the Gulf Stream were to have its course turned, say into the Pacific Ocean through an opening in the Isthmus of Panama, London would have a mean temperature about 40 degrees below the present one.

The prevalence of certain winds might prove another possible factor; though these would probably be the result of a changed temperature, rather than the producer of it.

I have, of course, only touched upon the possible causes which might aid in bringing about the epoch of frigidity; to attempt even to sketch out the different theories, would need much more time than I now have at my disposal.

The particular specimens brought to illustrate the subject of this paper, came from what is known as the Upper Glacial Boulder Drift. They were collected from that deposit during the excavations made for a new railway tunnel, which was being constructed in Bedfordshire, East Mid-England.

The organic remains, of which some 55 species were found, belong almost entirely to the Mesozoic period, and consist of fossils derived principally from the Lias, Oilite and Cretaceous formations. These are in a much more perfect condition than fossils of the drift usually are. Cephalopoda, especially Ammonites, of which some 20 varieties were collected, were abundant. A piece of wood was found in good preservation; it was probably a portion of some Pilocene conifer. One specimen of Trigonia Pulchella was unearthed; this bivalve has only before been found in the Upper Lias clay near Lincoln, some 70 miles north of the tunnel. Quite a heterogeneous collection of rock fragments were gathered, igneous, metamorphic, and sedimentary, with numbers of septaria.

Such a mass of debris has sufficient internal evidence to show that it was not laid down in the ordinary stratified form; either by the action of denudation, or by the aid of the remains of a marine or a terrestrial flora or fauna, as is the case with the rocks of the Laurentian age, leading onward through all the Paloeozoic, Mesozoic, and Tertiary periods, and still upward to the immediate preglacial age, represented by such beds as that of the Norfolk Forest deposit of East Anglia.

Some of the earliest geologists considered such accumulations to be the result of ice action, in the form of bergs. To this theory there are weighty objections. These are the two most important :—

1st. There is no trace of stratification in the deposit.

2nd. There are no remains of the inhabitants of the sea in which the ice would float when it deposited its gleanings, as all fossil remains belong to clearly defined strata of a much more ancient date; so much so, that we may speak of the ice age as belonging to yesterday, by comparison with the deposits from which the fossils were derived, which in that case, might be spoken of as pre-historic. The one exception, is the fossil wood which was found, but this is terrestrial, not marine.

It seems from all the evidence that can be adduced, that the vast accumulations of clay, known as the Upper Glacial Boulder Drift, must have been deposited by the direct action of moving ice upon the land. Today the same force may be seen at work in Switzerland, the Canadian Rockies, and in other localities. In fact, wherever glaciers exist, some such deposits must be made to a greater or less extent. The moraines of the Swiss glaciers being the modern equivalent of the ancient ice deposits.

Undoubtedly England, at the time of the glacial period, was united to Scandinavia, and probably to Ireland also. One immense glacier moved southward, being fed by ice-streams branching out, both east and west, in the manner of river tributaries. You may ask "How is this proved ?"

Why, by the contents of the clay. The Bedfordshire drift clay is undoubtedly obtained in a great measure from the Liassic and Oolitic Argillaceous deposits, which lie comparatively near at hand. In fact, both are found in various localities not far distant, the Oxford clay lying in the immediate neighborhood to the north and north-east. These facts are important, as the number of fossils found in this particular drift, which are characteristic of either the Oolitic or Liassic clays, show that the bulk of the material must have been obtained from these sources.

Those fossils and rocks derived from material lying at a greater distance, are naturally much fewer in number, although some must have been brought a long way, as for example the Trigonia Pulchella, whilst some of the rock fragments would seem to be of Scandinavian origin.

There has been much speculation as to the chronology of the glacial period. Sir Charles Lyell and his disciples gave a practically unlimited time to life, as we know it in geology.

More modern geologists, guided in a great measure by astronomers and physicists, have arrived at conclusions strikingly different from those of the older school of writers. Here is the contrast, if figures of such magnitude can be sufficiently grasped to appreciate their import.

500,000,000 years ago the Eozoon would be flourishing, according to Sir Charles Lyell. Of course, it is very possible that you do not accept the evidence as sufficient to show that any organism existed, prior to the reign of the Trilobites. Anyway, that is the age given when the Laurentian rocks were being formed.

Young and Wallace, two more modern mathematical geologists, give about 30,000,000 years only, as the time of the "Dawn of Life."

Dana, in his geology, gives this proportional ratio : Palaeozoic, 22; Mesozoic, 6; Tertiary, (together with the Post-Tertiary) 2. From this you will gather that the whole of the deposits ranging from the Lower Eocene to the Pliocene, onward through the Pleistocene to the present time, is only 1-15 of the geological life period. Some authorities give a much less proportionate time value than this even, for the Kainozoic age. Out of this time, only a small portion can be taken for the Glacial Period, occurring, as it does, after all the great deposits of the Tertiary Age were laid down. Prestwich gives about 25,000 years, as the time for the existence of the age of ice.

Next arises the question: How much time has elapsed since the close of the Glacial Epoch? From Cumulative evidence a fairly near date can be attained.

The Niagara Falls form, perhaps, the best geological clock in existence, for the purpose of giving the approximate date when this period ended. It took years to work out a satisfactory result, and such men as Sir Charles Lyell, James Hall, and Woodward all aided in solving the problem. It is a very well authenticated fact that the river Niagara is of post-glacial date, as is also Lake Erie, and a large number of the Canadian lakes. Lake Ontario was probably pre-glacial, the Grand River and its tributaries being the means by which the whole of the valley which is now Lake Erie was drained. This river course was completely diverted by ice-action, as befor the ice age, it entered Lake Ontario at its western extremity at the point where Hamilton now stands.

The calculations as to the length of time since the glacial period, are based upon the wearing away of the rock at the falls of Niagara. The yearly loss of rock by denudation is, roughly speaking, some three or four feet, or even more, as it does not wear evenly, hence its horseshoe form. Take this length and divide into the length of the gorge, and we have a quotient giving from 8,000 to 10,000 years as the age of the river, in other words, as the river is an outcome of the ice-age, it must be that length of time since the glaciers disappeared from the Niagara district. Undoubtedly we must assume in this case that the same continuity of the volume of water has existed since the glacial age.

In the upper part of the Mississippi River is another post-glacial gorge, which forms a valuable indicator as to the time of the glacial age. The results here about coincide with those arrived at with regard to Niagara. Other similar cases of denudation give approximately the same results.

The silting up of lakes, whose beds were formed by the agency of ice, show that the Glacial Era could not have been much more remote.

Take your own lakes near St. John, which are all of glacial origin. They are small, and receive a quantity of mineral and organic matter, brought down from the hills by the various streams, and deposited in them, by which means they gradually become filled up. Both Lily and Ashburn lakes have already become nearly filled with silt, in their shallower portions. In a comparatively short time, geologically speaking, both will become swamps, while only a little while afterwards they will be flat grass-land, just as the old rifle-range land now is. That ground was undoubtedly a lake at one time, but became filled up with mineral and organic matter, brought down by the streams from the hills around.

You may ask, "What has this to do with the glacial age?" Well, simply this : A computation of the amount of silt there is in the lake, before the hard rock-bed is reached, will give the age of the lake, if the average yearly deposit can be obtained. Calculations based upon such data, approach very nearly in results to those deduced from the erosion of rivers.

It is a moot point amongst geologists whether the age we are now speaking of, was really a time when whole continents were under glacial ice, or whether local climatic influences, coupled with changes of land elevation, would be sufficient to produce this phenomenon. Further, Sir William Dawson has shown that a species of drift deposit is being accumulated at the present time in some of the openings of the Canadian coast, this deposit being formed by the agency of floating ice, in the shape of either bergs or drift-ice. Moreover, the rocks are often much striated. It will be well to remember the fact here, that an iceberg has only about an eighth of its entire mass above the water, the rest being submerged. You can imagine at what a depth some would be in the water, when I mention that I have, myself, seen icebergs some 200 feet high, in and near the Straits of Belleisle. So soon as such a mass of ice gets into comparatively shallow water even, it would run aground, and be swayed about by either the wind or current, in some particular direction, when any stones sticking underneath would be scraped across the sea-floor, by which means they would become striated. Notwithstanding the proofs that in particular instances floating ice may lay down drift beds, the consensus of opinion shows that such a deposit as the one particularly described tonight, must have been laid down by glacial action, and for the rsasons already mentioned, but which it might be well now to recapitulate.

1st. THe formation is completely devoid of stratification.

2nd. The striated stones are very often elongated in shape, showing that they were worn by being pushed along by some solid force.

3rd. The character of the whole of the contents of the clay—both organic and inorganic, point to the fact that some land force must have been at work, to glean such a heterogeneous mass of debris together.

4th. The manner in which the accumulation was laid down shows a difference in the method employd, from that used to produce the sedimentary deposits.

5th. No marine life remains are found in the clay of the age in which it was formed.

6th. Similar deposits are now actually in process of formation in some parts of the world, being laid down by glacial agency.

In conclusion, it may be remarked that it is still a debatable question, as to whether man's existence was coeval with the glacial period. It probably depends upon what is meant by coeval.

If it means with the later ice age, which occurred after the warm interglacial period, then, perhaps, the query may be answered in the affirmative, as considerable evidence has been collected which tends to show that man was in existence then, but no trace of his remains were found in the Bedforshire drift. The cave and other deposits contain evidences, such as chipped flints and stones, which seem to indicate that he may have retreated before the advancing ice which produced the Upper Boulder Clay.

If man's advent did not occur until after the drift was deposited, yet the men who chipped palaeolithic stones or polished neolithic flints must have lived at a period very remote from us, if we gage the time of their existence simply by the measure of historic chronology.



### GERMAN SUGAR HERE.

Some ten tons of German granulated sugar has arrived on this market and more is on the way. This sugar is put up in bags. It will probably sell lower than Canadian granulated. The samples of the German article that were shown here compared favorably in appearance with the home product. As best Canadian granulated can be got in large lots close down to 4c., the new competition will probably be offered below that figure. As the price abroad has declined further since this lot left Germany, later arrivals will perhaps sell still lower. Whether the new article will prove as satisfactory as Canadian can only be decided by trial. But sugar will be cheap. The Canadian refineries handled some $2,000,000 worth of German raw sugar in 1892, and now the refined article is here.

The total production of sugar in the world in 1893 was calculated to be as follows: Beet sugar (Europe), 3,400,000 tons; cane sugar, 2,760,000, or a total of 6,160,000 tons. This year the production of beet sugar, which was expected to be large, has proved, as already stated in the Sun, far larger than anticipated, reaching the surprising figures of 5,100,000 tons, an excess of more than 1,000,000 tons over the actual production of 1893, which was 3,900,000 tons. The latest quotations for raw beet sugar are about 8s. 10d. stg. per cwt. in London. With these facts in view, there is no cause for astonishment at the present low price of refined sugars.

She—Speaking of brave deeds, I once prevented a man from committing suicide. He—How? She—I married him.



## EUROPEAN POLITICS.

### Role of the Prince of Wales in the Rapprochement Between England and Russia.

**The New Russian Loan will be Handled by the Rothschilds—The Reported Trouble Between France and Germany—Press Scandals in Paris.**

Paris, Dec. 8.—The important fact in European international politics this week is the return of the Prince of Wales to England. I am certain that the prince's sojourn in Russia has brought about a rapprochement between Russia and England.

The first proof of this is the emission of a Russian loan of 400,000,000f., through the intermediation of the Rothschilds. Up to the present time the Rothschilds had refused to handle the Russian loan, because of Russia's persecution of the Jews. The Russian government on its side also refused to enter into business relations with the Rothschilds. But, in Europe, a government loan in which the Rothschilds do not participate runs a great chance of not succeeding, and it was necessary for Russia's financial salvation to secure a reconciliation with this great banking house.

The Prince of Wales, who is on very intimate terms with Baron Rothschild of London, has succeeded in bringing this about, and the gratitude of both parties—of the king of the banking world and of the Emperor of Russia—is very great.

THE PRINCE A FRIEND OF FRANCE.

In the same way as the Prince's influence was called into play in the financial question, it has also been made use of in the political question. The Prince of Wales has always shown himself friendly to France, and the eventual entrance of France into the Anglo-Russian understanding is very probable.

This week has been an exciting one because of the rumored tension in the rlations between France and Germany. These rumors have been exaggerated and even false. There is in Europe a veritable clique of people who have an interest in starting pessimistic rumors. The American reader should beware of giving any credence to these reports, for there is nothing more ridiculous than the idea that a war is at all likely to break out just now between these two great countries.

PARIS JOURNALISTS IN TROUBLE

The Paris press scandals continue, and it is evident that a clearing out of the bad elements that have found their way into the profession has become necessary. It is said that the government has decided that this time it will not interfere with the action of the courts of justice, as it did in the Panama affair. Everybody is mentioning the names of managing editors who are about to be arrested for blackmail, and although thus far no arrests have been made, the arrest of certain parties is inevitable.

THE CHARGES AGAINST CAPTAIN DREYFUS.

In regard to the affair of Captain Dreyfus, who has been accused of treason, I incline to the belief that his acquittal is probable. The charge against him is solely based on a letter attributed to the captain, who denies that he wrote it. The experts who have examined the letter believe that the entire letter is not in the handwriting of the accused. If he is brought to trial and acquitted the case will very probably have unexpected political results.

### A CORRECTION.

The Rev. J. M. Davenport's Lectures on "The Principles of the English Reformation."

To the Editor of The Sun:

Sir—Your report of my lecture of the 7th has so thoroughly missed the mark in many particulars that I must beg the favor of a little space to set matters right.

The main drift and purport of my course of six lectures is to distinguish between what are so often confounded, viz., the "Principles of the English Reformation" and the "Principles of Puritanism," imported into England from the Religious Revolution of Europe, effected under the leadership of Luther and Calvin, and which culminated in the horrors of the Great Rebellion with its incubus of deadly evil afflicting our dear land and church even till the present day.

In my first lecture I traced the causes which gradually led up to the final great struggle with the usurped jurisdiction of the Papacy and then summarized the history of the Reformation for one hundred and thirty years, namely, from the date of the break with Rome (1534) till the last revision of the Prayer Book at the Restoration, 1662.

I based my investigation on the history of the English Prayer Book as the most convenient method for revealing in a popular manner the subject I have in hand.

In my second lecture I gave a concise history of the First Prayer Book of Edward VI., 1549 ; showed how long the people had craved for a Bible and a Prayer Book in the common tongue—added in evidence Wicliffe's Bible, several contemporary manuals of devotion, Tyndale's New Testament, the Epistles, Gospels and Litany in English, Coverdale's Bible, etc., etc. I showed that the 1549 book was par excellence the English book compiled and prepared most carefully, solely by English divines who steadfastly refused the proffered co-operation of foreign reformers, who had broken away from episcopacy and church order. I pointed out that it was founded chiefly on the reformed editions of the Salisbury use of 1516 and 1541, and was not made up out of their own heads.

I then proceeded to show that the 1552 revision, which contained some grievous errors, was the result of foreign interference, upsetting the mind of the young king and establishing a hold upon the country through his patronage of Calvin's associates—Peter Martyr, Bucer, John a Lasco, and others who hotly inveighed at Oxford, Cambridge and London, by lectures and pamphlets, against the 1549 book then in use, and that Calvin and his chief friends were consulted for its composition. That this book had been aptly called by some the "Foreigner's Book." This book proved to be very objectionable to the bishops, so the young king, who had set his mind on it, threatened to force its use upon the church by means of parliament if convocation refused to sanction it. By the good providence of God such a calamity was averted by the death of Edward VI., July, 1553, when Mary, his sister, swept away all changes and restored papal jurisdiction.

I then dwelt upon the remarkable fact that in spite of the evil influence of foreign preachers and the discontent implanted in the breasts of the rising generation the revisions of the Prayer Book under Elizabeth, James I., and Charles II., though based upon the 1552 book, were all vastly improved in the direction of the 1549 revision and were at one with it in sustaining the Principles of the English Reformation therein contained, viz.:

1. Strict adherence to Catholic consent in doctrine and practice as maintained in the earliest, best and purest times of the church.

2. Apostolic succession, with its dependent doctrine of the sacraments.

I then quoted the Act of Uniformity by which the 1552 book was itself authorized to prove that even the parliament of that day felt bound to apologise for the needless substitution of it for the 1549 revision, which it upheld by the strongest possible testimony as to the soundness of its principles. That act states: (1) That the book of 1549 was a "very godly order, "agreeable to the word of God and "the primitive church, very comfort-"able to all Christian people desiring "to live in Christian conversation, and "most profitable to the state of this "realm."

2. That the persons who "misliked it" were of two classes, viz., those who "followed their own sensuality and lived without knowledge or fear of God," and those who were influenced "rather by curiosity" (the old English for crotchety captiousness) "than any worthy cause," i. e., as Cranmer styled them "glorious" people (as we should say, bumptious or self-conceited people); or as they are described in the preface to our present Prayer Book, "factious, peevish and perverse spirits given to change, who have always discovered a greater regard to their own private fancies and interests than to that duty they owed to the public."

My next lecture (Wednesday) will be based upon the Prayer Book revision under Elizabeth.

Yours truly,
JOHN M. DAVENPORT.

Mrs. Benedict—"Now, what would you do, Mr. De Batch, if you had a baby that cried for the moon?" De-Batch—"I'd do the next best thing for him madam ; I'd make him see stars !" —Kate Field's Washington.