

Silurian—possibly Lower Silurian strata, and therefore that that they are of “pre-Middle Silurian” age. I have also demonstrated that a Gneissoid connection of this Granite and *phenomena* are precisely similar to what are observed at Halifax, and that there is not sufficient grounds for assigning one age to one and another age to another.

All our Granites seem to be of *Archæan Age*. In the case of the Halifax Granites, as well as those of Nictaux, there seems to have been a *re-metamorphism* effected during Upper Cambrian and part Lower Silurian time.

In a paper which I am preparing “on the Geology of Halifax” I will give my reasons for the conclusion stated.

ART. XI.—FISH CULTURE.—BY JOHN T. MELLISH, M. A., *Principal of Albro Street School, Halifax, N. S.*

(Read May 12, 1879.)

THE subject of fish culture, or the propagation of various kinds of fish by artificial means, has within the past few years received considerable attention on both sides of the Atlantic. As a branch of economic industry, the culture or breeding of trout, shad, oysters, salmon and other kinds of fish used by man as food, cannot be too carefully attended to by the State, and especially so, when such artificial breeding seems to be the only remedy for re-stocking depleted rivers and streams. My object in preparing this paper is to place on record in connected form a short history of fish culture in our own country. In doing this, I shall touch very briefly on the subject as referring to other countries. The culture of the salmon, and, to some extent, the white fish, is all that has been attempted as yet in Canada. As the Institute was favored a short time since with a most excellent paper on the Salmon by a distinguished member of this body, Dr. J. B. Gilpin, it is not at all necessary that on the present occasion I should refer, except incidentally, to the various stages of growth and development through which the fish passes, from the time it leaves the ova till it becomes the full grown salmon, beautiful to the eye, delicious to the taste. The peculiar instinct of the

salmon, shad, and some other fish, in seeking the river where they emerged from the egg and were deposited after being hatched, in order to spawn, after having acquired their wonderful growth in salt water, renders it possible not only to re-stock a depleted river, but to introducé a larger run of fish than originally frequented the river. Salmon will seek their native water, even if only a small stream. It is computed that 90 p. c. of the ova *is lost* when the spawn is deposited in the river, and that 90 p. c. is hatched when deposited in charge of the fish breeder.

Fecundated fish spawn has been an article of traffic among the Chinese from time immemorial. The Romans, who, as their old writers inform us, used fish at their tables of various kinds and of the choicest quality, resorted to artificial culture to supply the demand. We are told that Lucullus, at his house at Tusculum, on the shores of the Bay of Naples, dug canals for his fish ponds to the sea; that fresh water streams were led into these canals; that sea fish having passed up into the ponds and deposited their ova were prevented from returning to the sea by flood gates; and that the yearly value of the fish kept in these ponds amounted to a sum equal to \$250,000. After the fall of the Roman Republic fish culture does not seem to have been practiced until the 14th century, when Dom Pinchon, a monk of the Abbey of Reome, bred fish in wooden boxes. He was the first who expressed the ova and applied the male milt to it. The ends of these boxes were of wicker work, their bottoms being covered with sand on which the ova were deposited. An interim seems to have ensued when no interest was taken in the art. In 1763, Jacobi, a German, began experiments which he carried on for thirty years. Others soon took an interest in the matter, and about the year 1834 Messrs. Shaw and Young, of Scotland, bred salmon in wooden boxes. Joseph Remy, a French peasant, successfully experimented in 1849 in re-stocking with young fish many depleted rivers and streams. During the past twenty years salmon culture has been carried on with great success in Scotland and Ireland. In many cases large fortunes have been accumulated in the business by private individuals. Consider-

able attention has also been given to the subject in the United States, but the Americans are free to confess that the facilities in Canada for salmon culture are much greater than in their own country. In several of the Eastern States the culture of the common brook trout has been carried on successfully.

Artificial fish culture was first introduced into Canada by Mr. Samuel Wilmot, a native of the Province of Ontario. Having been brought up in the immediate vicinity of a once famous salmon producing river, and having observed the gradual decline in the numbers of this fish entering the stream, Mr. Wilmot conceived the idea of endeavoring to re-stock it by artificial means, somewhat after the manner practised at Stormontfield in Scotland, and at Huningen in Germany. His first attempt was made in the year 1866. Having then no practical knowledge of the details of the work, his operations were necessarily limited and rather unsuccessful. The art of manipulating the fish and of impregnating the ova obtained from them required close study and experience. Mr. Wilmot, being exceedingly ingenious and a man of great determination, was nothing daunted by failure, but continued year after year to renew his attempts to overcome the difficulties before him, and was highly gratified to find in the year 1870 that he had mastered the art and was able to take the ova from the mother fish without injuring her, and after fecundating them by the milt or impregnating fluid obtained from the male fish, was able to keep them safely during their long period of incubation, and finally to deposit them safely in the river. Having accomplished this much entirely at his own expense, and being convinced of the practical utility of the work in re-stocking the almost depleted rivers of his native Province, he brought the matter before the Dominion Government and asked for a small appropriation which would enable him to perfect and extend his scheme. Up to this time Mr. Wilmot's operations and experiments had been carried on in his own cellar, through which a small stream of water passed, but as no extensive results could be secured in so limited a space, he was anxious to obtain more suitable accomodation. Mr. Wilmot then succeeded in obtaining a sufficient sum from the Dominion Government

to permit of his erecting a suitable hatchery in which to prosecute his experiments on a more extensive scale. The first salmon hatchery, built in 1870, was located on Wilmot's creek, near the village of Newcastle, Ontario. In this building a number of hatching troughs were placed, in which were laid the impregnated ova, each trough being fed by a small stream of water supplied from a large tank or reservoir placed at one end of the building. Previous to this time Mr. Wilmot's experiments had been confined to comparatively small numbers of ova, but now, having increased space and better facilities, he was anxious to deal with hundreds of thousands of them. By the most determined effort and diligent labour, he succeeded in procuring about 250,000 ova. Having been very successful in hatching this number and depositing them in several of the rivers in the vicinity of the hatchery, additional means were furnished him still further to increase the facilities for carrying on the work. The then Minister of Marine and Fisheries being convinced of the great utility of the scheme, decided to carry the work into the Maritime Provinces, where the most valuable fisheries existed. He accordingly, in the year 1872, had \$20,000 placed in the estimates for the year for fish breeding and fish ways, and in 1873 was completed the first hatchery built in these Provinces. This was situated on the far famed Restigouche river, the boundary between the Provinces of Quebec and New Brunswick. During this year another hatchery was commenced at Gaspé in the Province of Quebec, and still another on the Miramichi in New Brunswick. In 1874 these three establishments were fully completed, and each year since they have turned out their quota of salmon and other fish. Encouraged by the success attending these hatcheries, the Fisheries Department in 1875 extended the work to Nova Scotia, and erected on the Sackville river, at the head of Bedford Basin, another establishment. This hatchery was located by Mr. Samuel Wilmot who had previously been appointed superintendent of Fisheries for the Dominion, and was completed and opened by Mr. A. B. Wilmot, one of the oldest apprentices at the work. Mr. A. B. Wilmot's extensive and varied experience gained

while in the work at the older institution in Newcastle, Ontario, and afterwards while in charge of the hatcheries at Gaspe and Miramichi, has enabled him to introduce into the Bedford establishment the most improved and serviceable appliances for prosecuting the work on a large scale. Among these appliances which are as yet only used in his establishment, but which will shortly be introduced into the others, are 1st, a set of filterers for preventing the foul sediment from coming in contact with the ova, and thereby injuring them; 2nd, a new description of tray or hatching grill, upon which the ova are placed during the season of incubation; these trays are of the ordinary earthenware, covered with a thin salt glazing, and were introduced to prevent the possibility of any chemical action which might injure the young fish, between the iron and sulphur contained in the water and the zinc of the trays previously introduced by Mr. Samuel Wilmot, and which up to this date were the only trays used; 3rd, a simple but most serviceable escape or overflow pipe, which will permit any required quantity of water to pass through the hatchery trough, while no young fish can possibly escape. Aided by these improvements, Mr. A. B. Wilmot has been enabled to achieve a degree of success comparatively greater than that attained in any of the older establishments. As it was impossible to obtain from the Sackville River a sufficient number of the parent fish, from which to obtain a full stock of ova, recourse was had to some remote rivers of this province, principally River Philip in Cumberland county, West River in Pictou county, and the Annapolis and Musquodoboit Rivers. Those rivers producing the largest salmon were chosen in preference to the others, the object being to restock the depleted rivers with a larger run of fish than formerly frequented them. At convenient points auxiliary establishments or reception tanks and spawning sheds are erected, in which to confine the salmon and perform the delicate and important work of manipulating. The result of Mr. Wilmot's labours for the three years this establishment has been in operation, has been the hatching and distributing among thirty-five rivers of this Province, the large number of 3,000,000 Salmon, 160,000

White Fish, and 8000 Salmon Trout, the latter having been obtained from the lakes of Ontario. He has at the present time (April, 1879) 1,800,000 Salmon hatched, and in a few days will commence to distribute them among the most suitable rivers within reach of the hatchery. This will make a total of 4,800,000 salmon distributed from this one hatchery, in the short space of four years. The Bedford Establishment, although one of the smallest in the Dominion, has a hatching capacity of 2,500,000. There are at present eight fish-breeding establishments in the Dominion: two in Ontario, four in Quebec, one in New Brunswick, one in Nova Scotia; and it is proposed to erect an additional one, during the present summer, in New Brunswick. P. E. Island is certainly entitled to one. There will probably be distributed during the next four weeks from the hatcheries now in operation, within the Dominion, about 40,000,000 young fish, of which about 30,000,000 are the White Fish of the great lakes of the west. No doubt the culture of the Trout, the Oyster and the Shad will receive attention in Canada at an early day.

ART. XII.—EXPERIMENTAL MICROSCOPY.—BY J. SOMERS, M. D.,
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(Read May 12th, 1879.)

THIS short essay owes its existence to a wish expressed by members of the Council of the Institute.

It contains nothing original, or what any person familiar with the use of the Microscope, does not already understand. It was prepared to accompany a series of experiments presented to the members, and it does not pretend even to explain the nature of these, nor of the specimens exhibited.

The writer feels complimented in that he has been requested to fill at the final meeting of this season, a vacancy which has occurred for the first time for many years. One who never failed to present the results of his observations at the final meeting of the session, has closed his earthly labors. Endeared as he was to us all, not only for his zeal and arduous toil in the cause