

T. magna, Speng.—Common ; sandy beaches, a few inches below the surface at low water. Dead valves found with those of the former species, in sandy bays.

T. radiata, Linn.—Common ; in similar positions.

T. interrupta, Wood.—Not uncommon ; in similar positions.

Gen. CAPSA.

C. spectabilis, Hanley.—Very common ; Flatt's harbour ; at low water.

Gen. SEMELE.

S. ————— ?—Very common ; Flatt's harbour.

S. ————— ?—Rare. One valve only ; found on sandy beaches.

Fam SOLENIDÆ. Gen. SOLECURTUS.

S. ————— ?—Common ; Somerset bays.

Fam. PHOLADIDÆ. Gen. PHOLAS.

P. striata, Linn.—In pieces of drift timber.

Gen. TEREDO.

T. ————— ?—On the reefs and rocks under water ; Harrington Sound ; tubes standing upright above the rocks.

NOTE.—Supply omission at commencement. (*Read December 7, 1863.*)

ART. IV. ON THE WATERS OF THE MINERAL SPRINGS OF WILMOT, N. S. By Prof. How, D. C. L., *University of King's College, Windsor, N. S.*

[*Read January 4, 1864.*]

IN a paper "On some Mineral Waters of Nova Scotia," read before the Natural History Society of Montreal, last summer, and published in its journal, "*The Canadian Naturalist*," for October last, I put together nearly all the information in my possession respecting the Mineral Springs of this Province ; and though I had the tolerably complete analysis of two only of the waters (published in newspapers here and in Cape Breton at the time they were made) to present, I was enabled by means of these and by general descriptions in other cases, to show that the waters of Nova

Scotia “are of varied character ;” and it was remarked that “there would be much scientific interest in an extended and thorough investigation into their qualities and composition. At the same time, if the results were duly published, the medicinal virtues which reside in some of the waters would be made generally known ; it is probable, too, that new medicinal springs might be discovered. This is obviously a matter of sufficient importance to the Province, both in a sanitary and economic point of view, to demand the care and attention of an enlightened Government. Mineral Springs have been, and are still so frequently the sole means of rendering localities famous and wealthy, by attracting residents for more or less lengthened seasons, that it is well worth while to possess any water of great curative value, and to make its merits known as extensively as possible. Nova Scotia appears to be able to add valuable medicinal waters to her mineral productions, awaiting exploration and development.”

Among the waters mentioned were those of Wilmot, better known probably by reputation than any others in the Province ; concerning which I gave only part of the information conveyed in the following letter, obligingly written last April, in reply to a note requesting particulars with regard to the Springs, by Rev. Dr. ROBERTSON, rector of the parish in which they are situated :—

“The water of the Wilmot Springs is cold, with an abundant flow, and is highly charged with mineral solutions, chiefly of iron and copper. No *correct* analysis of it, I rather think, has as yet been made. It is said to contain a small proportion of Iodine.

“In former times the Springs were much frequented ; but of late years very few visitors have been near them. The water, however, is remarkably efficacious in curing *cutaneous* complaints, or eruptions, and has the singular property of resisting all tendency to stagnation ; for I have myself kept a bottle of it for a whole year in this house, and on opening it the water was found to be as sweet as when it was bottled.

“In my own opinion, the Wilmot Springs deserve to be better known, and more frequented than they are at present. If the proprietors were men of substance and energy, I have not a doubt but that their locality would be one of the best known in Nova Scotia.”

Finding it, contrary to my expectation, to be the case that no

analysis was accessible, even if any had been made, of waters so esteemed, I was curious to get at their composition, and being at Margaretville, about five miles from the Springs, last July, I came round to Windsor by land, and took the Springs on my road, so as to be able to examine the spot and collect some of the water for analysis. On the journey I found that their reputation had extended to the United States, people of property having come thence and resided for months at Wilmot, for the purpose of using the water; also, that the proprietors were once, if they are not still, in the habit of exporting the water to order, either to the States or New Brunswick. My informant, a very intelligent young man from Margaretville, had himself drunk the water for a twelvemonth or more, and though he found it rather unpleasant at first, he came to prefer it to any other; the effects were described as being decidedly purgative to those unaccustomed to its use.

Arrived at the Springs, I found them situated under lofty trees, a few feet off an excellent road, and filling two basins. One of these was perhaps six feet in diameter, affording a considerable overflow of water, conducted away along a trough, from which an uninterrupted and rapid stream of about an inch in diameter (speaking from memory) enabled me to procure a supply with the greatest ease. The second was situated at a distance of some three or four yards from the other; it was, perhaps, one-third the size, and was not furnished with a trough, whence I conclude that it is not, generally, at any rate, made use of. However, thinking it possible that the two waters, though so close at their outlets, might really be dissimilar, I filled some bottles from the smaller basin also: both appeared beautifully clear, and in neither did I perceive any odour or particular taste. As I had no thermometer, I can only say that as regards temperature, they seemed moderately cold. I observed several bathing chambers close to the larger basin, and, unless my memory deceives me, there was provision for hot baths; but the whole arrangements bore the air of not being much called into requisition. I can vouch, however, that the water is believed in, for, as I may mention, not only as evidence of the faith in it, but also of the different modes in which the water is employed, I observed a young man rising from near the larger basin, with one leg swathed in apparently numerous wet bandages, so that the lower part of his limb

appeared about twice or three times its natural size; and he told me that he had cut his leg badly with an axe, and had just put on a thick coat of mud from the Spring, in hopes of deriving benefit from the application.

I think it proper to record, that the summer season of 1863 was well known to be wet, and that for a day or two before my visit there had been very heavy intermittent rain, which, however, had entirely ceased for seven or eight hours when I collected the waters. How far this rain-fall would affect copious springs, having their origin possibly considerably below the surface, would only be shown by the results of analysis made in a dry season being compared with mine; probably it would not produce any sensible effect; but still I think it as well to make the statement, because differences are often found in the composition of waters, from time to time, and it is right that all the possible causes of alteration should be taken into consideration.

On proceeding to examine the water from the larger basin, in September, I found that during the two months it had been kept it had undergone great change; although clear and without odour when collected, it had become, in a closely stoppered bottle, impregnated with sulphuretted hydrogen, and smelt strongly of this gas; it was opalescent, and a white sediment was forming. Analysis, however, was made with the following results; the quantities of ingredients being calculated for the imperial gallon:—

Contents of the Water of the Larger Basin in 70,000 grains.

	Grains.
Lime.....	54·69
Magnesia.....	2·74
Soda and Potash.....	6·00
Sulphuric Acid.....	78·03
Chlorine	1·09
Silica.....	0·70
Phosphoric Acid.....	traces
Organic Matter }	undetermined
Carbonic Acid }	undetermined
Iron	traces

143.25

Specific Gravity at 62°.....1002·012

The organic matter was considerable in amount, as the residue left on evaporation of the water at a low heat turned decidedly

brown on ignition, and its presence accounts for the change in the water, which consisted in the reduction of the sulphates by the organic matter to the state of sulphides. The sulphuretted hydrogen was evolved by the action of carbonic acid on the sulphides, and the sediment appeared to be chiefly sulphate of lime; it did not effervesce sensibly with hydrochloric acid. As this decomposition had taken place, of course there is less sulphuric acid than there ought to be given in the analysis; and the results are to be taken as not closely expressing the composition of the water, which is evidently one having sulphate of lime for the leading ingredient. A mere trace of deposit was formed on boiling the water for two hours. On comparing the results with the contents of Dr. ROBERTSON'S letter, it is obvious that analysis is necessary to bring out the real character of waters; there were but traces of iron, and copper was absent, as the water remained colourless though full of sulphuretted hydrogen: as for the presence of this gas contradicting the statement that the water remains sweet, it may be that Dr. ROBERTSON had the water from the smaller basin, which, as I shall shew presently, remained perfectly sweet in one bottle, and gave but a trace of sulphuretted hydrogen in others; or there may have been organic matter accidentally present at the basin, or in the bottle in which the water was collected in my case, the bottle was one procured at the hotel at Margaretville, but well washed there, and at the Spring, by myself; or the gas may have been formed and decomposed during the year Dr. ROBERTSON kept his sample.

The water from the smaller basin was examined in November, and three out of four bottles were found to contain a mere trace of sulphuretted hydrogen, the fourth being quite free from the gas; the water in all was perfectly transparent and without sediment. Assuming that the cause of the change above-mentioned was in the larger basin itself, we see that there is a difference in the two waters; but analysis shews that they belong to the same class, the chief variation in composition being in the amount of organic matter. That waters found close together often vary much in character, is shewn by Hunt,* who mentions various cases;—to quote but one—he says, “At Caledonia, three waters are found within a few feet of each other; one of them being sulphurous, while the others are not so, and are much more strongly saline.”

* Geology of Canada, 1863, page 562.

The following ingredients were found in a gallon of the water; for comparison with that of the larger basin the results are stated in the same way.

	Grains.
Lime	51·74
Magnesia	2·94
Soda and Potash.....	4·65
Sulphuric Acid.....	79·07
Chlorine	·76
Silica	·55
Phosphoric Acid.....	traces
Organic Matter	traces
Iron, Oxide.....	·09
	139·80

These, properly calculated and arranged, the carbonate being determined by boiling the water, stand as follows:—

Contents of the water of the Smaller Basin in 70,000 grains.

	Grains in Imperial Gallon.
Carbonate of Lime	2·70
Carbonate of Magnesia	0·37
Carbonate of Iron	·14
Sulphate of Lime	121·98
Sulphate of Soda	8·35
Sulphate of Magnesia	5·35
Chloride of Potassium.....	1·60
Silica	0·55
Phosphoric Acid.....	traces
Organic Matter.....	traces
	141·04

Free Carbonic Acid.....undetermined.

In making the calculations it was found that after combining the bases with sulphuric acid, 1·44 grain of magnesia remained over; this was added to the sulphate of magnesia, as the phosphoric acid and any other acids present in small quantities, were not determined. I tried in both waters for Iodine but could not detect any in the residues of 7,000 grains in each case. I thought I detected a trace of nitric acid in the water of the larger basin; but it is impossible to decide with certainty on the presence of such small amounts of constituents as frequently exist in waters, unless a much larger quantity of material is operated on than I had at command. As before mentioned, the waters from the two basins are seen to differ essentially only in the amount of organic matter;

and apart from this they may be considered alike in composition. They are seen to be poor in carbonates and chlorides, and comparatively rich in sulphates, while of the latter the sulphate of lime is by far the most abundant ingredient; although the solubility of salts is much modified by the presence of other salts, I may mention as a guide, that cold water can only contain about 163 grains of sulphate of lime, while we have about 123 present in the Wilmot water without any large quantity of other salts to render it more soluble. Such waters are uncommon; for example, in the extensive series of Canadian waters examined by Hunt, there are none which at all closely resemble those now described; there are two* mentioned as forming the sixth class in his description, viz. those neutral saline waters in which the sulphates of lime, magnesia, and the alkalies predominate, chlorides being present only in small amounts; in each case brought forward there are only 77 grains of *Sulphate of Lime* in the gallon; and on looking over the analysis of many waters from other countries, I find very few at all like them; but there is one in Nova Scotia not very dissimilar, viz., that flowing from the Spa Spring, at Windsor, of which the following is my analysis, made in 1858, showing the

Contents of Spa Spring Water in a gallon of 70,000 grains.

	Grains.
Carbonate of Lime	17·50
Carbonate of Iron	0·40
Carbonate of Magnesia	0·31
Sulphate of Lime	106·21
Sulphate of Soda	0·68
Sulphate of Potassium ...	0·38
Chloride of Sodium.....	0·80
Silica	0·60
Phosphoric Acid	traces
Organic Matter.....	traces
Sulphate of Magnesia	11·02
	137·90

in which we observe a pretty close general resemblance to that given of the Wilmot water, and particularly in the same great preponderance of sulphate of lime. This is so marked, that a separate class might almost be made of such waters.

* Those of Charlotteville and Hamilton.—*Geology of Canada*, 1863, pp. 532-7, 8.

However this may be, when we consider the geological character of the two places, and attempt to discover the origin of the contents of the waters arising in each, the comparison just instituted becomes very interesting. Windsor is in a gypsiferous district of lower carboniferous age, sulphate and carbonate of lime being its characteristic rocks; and in describing* the Spa Spring water I did not hesitate to attribute its curious composition to this circumstance, considering it to have been long in contact with, if not to have originated in gypsum: but Wilmot Springs are in a district held to belong to the new red sandstone formation, in which gypsum has not been yet found in this Province in any quantity, the trap rocks adjoining the valley of the Annapolis, thought to be of the same age, only containing it in thin veins, as at Blomidon, and probably in quite small isolated deposits, as I have found it imbedded, as selenite, in the same rock at Two Islands. Gypsum is abundant in the upper new red sandstone in England, and it would be interesting if it should prove to be so here. It is curious to observe the small quantity of chlorides found in both these gypsiferous waters of this Province, as the gypsum of England, and of Virginia also, is closely associated with vast deposits of rock salt; and in many, if not most waters which contain much sulphate of lime, there is a larger quantity of chlorides.

As before remarked, such waters as those of Wilmot Springs (and of Spa Spring, Windsor,) are uncommon, and their medicinal qualities may depend on the presence of the large quantity of sulphate of lime they contain, although this salt has not, I believe, been hitherto considered valuable as a medicine; it is not to be kept out of view, however, that an elaborate analysis executed on large quantities of the waters, might reveal the presence of other bodies more generally recognised as of medicinal value. This would be one of the points to be taken up in a Geological Survey of the Province.

* Canadian Naturalist, Oct. 1863, p. 373.