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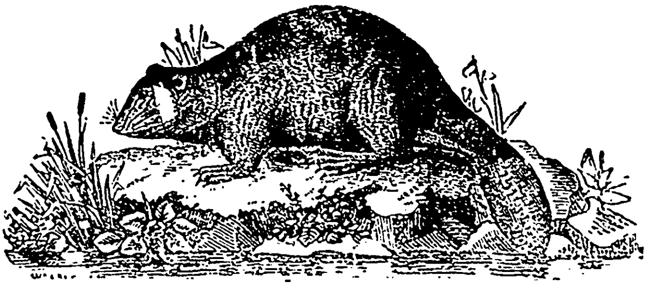

THE BEAVER *(Castor Canadensis,* Kuhl*).*

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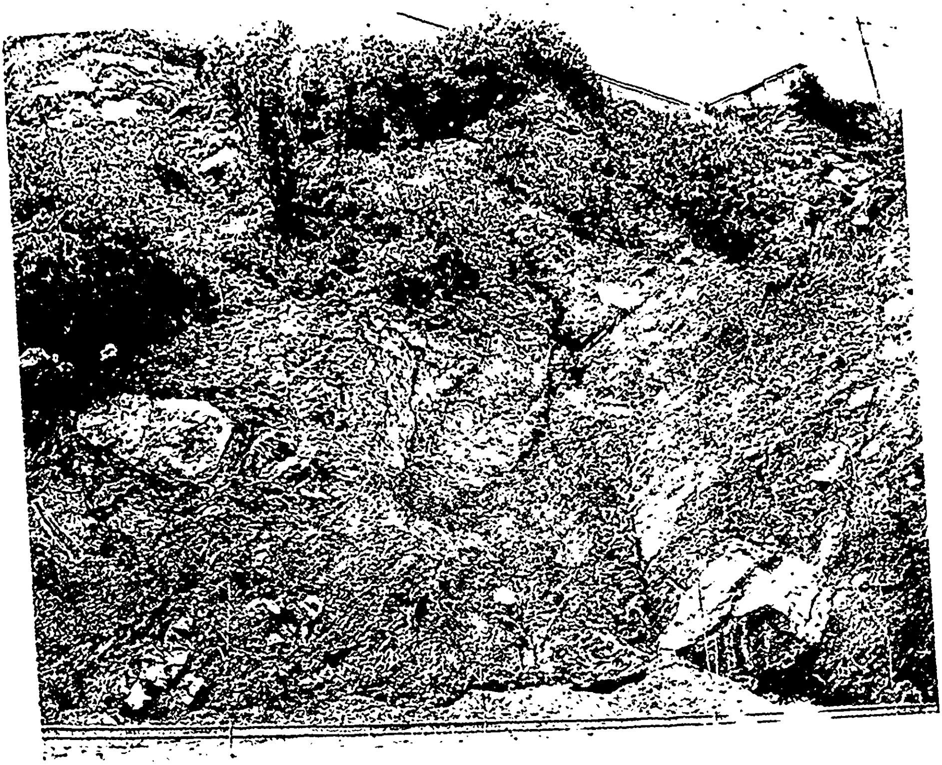

CLIFF ON MOUNTAIN HILL, QUEBEC CITY,

Shewing masses of fossiliferous limestone imbedded in contorted shales

(To illustrate Mr. Weston's and Dr. Ami's paper.)

NOTES ON THE "QUEBEC GROUP."

By T. C. WESTON, Esq., F.G.S.A., of the Geological Survey of Canada.

Out of the 12,000 feet or more of strata which form the much discussed "Quebec Group," there are several interesting escarpments and sections which have hitherto not received the attention they deserve. One of these escarpments is the Mountain Hill cliff, * which forms a portion of the heights over which the ramparts of the City of Quebec are built.

The only reference I can find, at the present time, to this special locality, is Dr. Ami's paper on "the Geology of Quebec and environs," published in the "Bulletin of the Geological Society of America," Vol. II., pp. 477-502, 1891, from which I quote the following. "Alongside and up the Mountain street, a bold cliff of conglomerate occurs, containing large boulders, imbedded in a shaly and calcareo-argillaceous paste, with an admixture of quartz grains. This deposit, as well as most of the exposures in Quebec city, deserves very special attention, and will no doubt afford interesting notes and material."

A close examination of the cliff immediately facing Mountain Hill House, on the lower part of the hill, shows it to be composed of a coarse grey nodular limestone; in places, bedded structure may be seen, while the principal portion, (which is the matrix of the conglomerate), is compact, and sometimes flinty, with seams of carbonaceous or bituminous matter.

This portion of the cliff is prolific in fossils, but they are chiefly fragmentary, and might readily be overlooked. This is probably the reason why in the early study of the geologic structure of the city portion of the 'Quebec Group,' these were included in the Levis division of the same.

No fossil remains had been found or observed in the Mountain Hill cliff until the summer of 1877, at which time the writer discovered a number of interesting species. In 1892, another opportunity was afforded me to examine that portion of the exposure immediately back of the Express office and adjoining the book-binding establishment. On that occasion there were found some remarkably well-preserved fossils,

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*See Plate accompanying this and next paper.

some of which were immediately recognized as being characteristic Trenton forms. Dr. Selwyn arriving in the city at that time, accompanied me to this locality, and several new species were added to our former collection.

In conjunction with this paper will be found a list of the genera and species of fossil remains determined by Dr. H M. Ami, of the Survey. It will be readily seen from the lists prepared that a good proportion of them are common Trenton forms—a gratifying circumstance to the Director of the Geological Survey of Canada—Dr. Selwyn—who was the first to recognize the Quebec city rocks as a portion of the Trenton zone, and not *Levis*, as originally supposed.

However, as the formation under consideration contains large boulders of dolomitic limestone, which were evidently derived from the Levis limestone conglomerates, in which we may find Levis fossils in the shaly portion of the cliff, as in the shales and limestones at the back of the St. John street (Montcalm) market, we must not take the whole as typical Trenton, but as a mixture of Trenton, Utica, and Hudson River.

Quebec City, Que., May, 1894.

NOTES ON FOSSILS FROM QUEBEC CITY, CANADA.

By Henry M. Ami, M.A., F.G.S., &c.

The environs of Quebec city have long been regarded as classic ground to the student of North America Geology.

From the numerous rock-formations around the city, some of the most interesting and important specimens were obtained by various members of the Geological Survey staff, under the '*old régime*' and under the present administration.

The faunas entombed in the rocks of the so-called 'Quebec Group' at Point Levis and elsewhere, have been described by Billings, Hall, and other palæontologists. Strange to say, however, for some reason that cannot be accounted for, the sedimentary rocks forming the Citadel Hill and massif of Quebec city, remained for a very long time a *terra incognita*. It is only during recent years, that the veil has been drawn away from these obscure and difficult portions of the region in question through the researches of Mr. T. C. Weston, F.G.S.A., of our Geological Survey. It was in 1877, that, for the first time, Mr. Weston discovered fossil remains in the strata of Quebec city, and amongst the specimens collected on that occasion there were noted the obscure remains of *Leptæna sericea*, Sowerby, and of a species of *Ampyx*, closely related to *Ampyx rostratus*, together with crinoidal fragments. These came from the limestone rocks of Mountain Hill.

The purpose of this paper is mainly to note the interesting discovery of fossils made this summer by Mr. Weston, in the rocks of Mountain Hill, of which Mr. Weston gives a description in the foregoing pages of the NATURALIST. There is added to the notes on the fossil remains collected this season, a few more on the small but likewise important collection made by Mr. Weston and Dr. Selwyn in 1892. The determinations are of course preliminary and dependent upon the mode of preservation, etc.

MOUNTAIN HILL FOSSILS.

Inasmuch as the collections of 1892 and 1894 were both made by Mr. Weston—and at the very same locality, there is no practical reason for keeping them separate at this time, and for the sake of brevity they will all be grouped together under the heading of Mountain Hill fossils, Quebec City. The collections comprise in all about 125 specimens and embrace an assemblage of forms which are for the most part new to the massif of Quebec city, whilst not a few are probably new to Canada.

PRELIMINARY NOTES ON THE FOSSILS.

PROTOZOA.

1. *Nidulites favus*, Salter, var. A rather crushed and imperfectly preserved specimen of what appears to be a variety of Salter's species, *Nidulites favus*, a Rhizopod with marked affinities for such genera as *Pasceolus*, Billings; *Sphærospongia*, Salter, and *Cyclocrinus*, Eichwald. The hexagonal character of the "plates," the presence of the 'central papilla' or styliform projection in the central portion of the plate are

features which the Quebec specimen shows distinctly. The main difference is of size. The plates in the Canadian example of *Nidulites*, are considerably smaller than those in the type of Salter's species from Europe* : there being ten plates in the space of one centimetre in the former and six plates in the same space in the latter. This species has not heretofore been recorded in Canada, and forms an interesting addition to our fauna.

Note. The occurrence of this species along with many of its associates also points to the close relation which probably exists between the rock formations of the Girvan succession in Scotland, and those of the fossilferous 'Quebec group' in Canada, a correlation which had already been made apparent to the writer on account of the similarity of the faunas.

CŒLENTERATA.

2. *Streptelasma corniculum*, Hall. A small and rather obscure turbinate coral occurs in the collection. From its characters and affinities it appears to be closely related to the ordinary Trenton form described by Hall from the New York series. The Quebec specimen is here referred to in this species with some uncertainty.

3. *Diplograptus*, cf *D. rugosus*, Lapw. Among the specimens collected on Mountain Hill only one graptolite occurs, and that appears to be a diplograptid, allied to Prof. Lapworth's *D. rugosus*. It is not well preserved, and the hydrothecæ are somewhat irregular and recall *D. amplexicaulis* of the Trenton.

BRYOZOA.

4. *Pachydictya acuta ?* Hall. A number of broken and more or less imperfectly preserved stipes of this species occur on the weathered surfaces of the limestone. *Note.* Besides the above species of Polyzoa (Bryozoa)—doubtfully referred to *P. acuta*, Hall, there are several fragments of branching Bryozoa which require to be examined microscopically in thin sections before they can be determined with any degree of accuracy. From a mere superficial examination of the zoœcial aper-

*See Nicholson and Etheridge, Jr., "A Monograph of the Silurian fossils of the Girvan District in Ayrshire, I., p. 18, 1874."

tures and characters of the polyzoary, the following genera appear to be represented :—*Monotrypella*, *Batostoma*, *Homotrypa*, etc., forms similar to those from the Trenton rocks of Canada and elsewhere.

BRACHIOPODA.

5. *Acrotheta* sp. A small but interesting specimen of this genus occurs in the collection, but its specific relations are not yet definitely ascertained.

6. *Acrotheta* sp. indt.

7. *Discina* or *Lingula*, sp. indt.

8. *Schizotreta* cf. *S. minutula*, Winchell and Schuchert. Two valves, one a brachial and the other a pedicle-valve of this interesting genus, occur associated with numerous other species of brachiopoda. They closely resemble the above species to which they are referred with some doubt whilst they also indicate close relation to *Discina Pelopea*, Billings, a true species of *Schizotreta*.

9. *Paterula*, sp. nov. An interesting form of this genus rare in America was collected in the limestones at Mountain Hill, Quebec. In general outline and leading characters it resembles closely *P. Bohemica*, Barrande, but is probably distinct. This species is certainly distinct from another species discovered by Mr. Weston in the rocks adjoining the Montcalm market, Quebec, and figured by Hall in his Vol. VIII. of Pal. N. Y. State, on Brachiopoda. This species of *Paterula* very closely resembles a form collected by Prof. L. W. Bailey in the black limestones of the Becguimic Valley, in New Brunswick, in 1884, but is much smaller, being only one millimetre in length.

10. *Lingula Nympha*, Billings. A rather large individual of what appears to be a species identical with the above which was originally described from Newfoundland. The septum, central scars and other characters of generic importance are clearly visible, and the general outline of the shell make it very probable that this "Quebec Group" species occurs at Quebec also. With this species compare *L. Elderi*, Winchell and Schuchert.

11. *Lingula*, sp. Resembles one of the forms from the "market rocks" of Quebec—probably "species No. 1" of my appendix to Dr.

Ells's report for 1888, published in 1889. This species also resembles one from the limestones of the Beccaguimic, N.B., collected by Dr. Bailey.

12. *Lingulepis*, sp. With exceedingly fine radiating striæ. Shell: ovate, elliptical, anterior margin rounded; greatest breadth at about three-fourths distance from beak to anterior margin. Beak rather prominently pointed.

13. *Leptæna (Plectambonites) sericea*, Sowerby, sp. Two or three typical examples of this characteristic Trenton species occur in the collection from Mountain Hill. One form resembles the Hudson River or Lorraine variety, being large and quadrangular.

14. *Leptæna (Plectambonites)* sp. A diminutive form of Leptæna closely resembling *L. sericea*, but probably distinct also occurs in the collection.

15 *Strophomena Aurora*, Billings.

16. *Strophomena* (*Rafinesquina*) *alternata*, (Conrad, MS.) Emmons.

17. *Strophomena* (*Rafinesquina*), sp. nov.

18. Strophomena or Leptænoid shell, similar to the form occurring at the Montcalm market exposures. Probably new generic type.

19. *Orthis* (*Dalmanella*) *testudinaria*, Dalman.

20. *Orthis* (Plectorthis) *plicatella*, Hall. Probably the above species. The specimen is not sufficiently well preserved to state definitely. May be Orthis (Dinorthis) pectinella, Conrad.

21. *Orthambonites ?* sp

22. *Camerella* or *Anastrophia*, *sp.*

Gasteropoda.

23. *Metoptoma*, sp. There appear to be two forms of this genus in the collection from Mountain Hill, one a comparatively large form the other much smaller. The smaller ones shows concentric zones. Beak in both eccentric pointing anteriorly.

24. *Murchisonia ?* sp.

Cirripedia.

25. *Turrilepas*, sp. nov. Several specimens of a species of Tur-

rilepas occur in both the 1892 and 1894 collections. This species is identical with another found in a lot of Newfoundland fossils, labelled "Port aux-Choix," and collected by Mr. Richardson. The species is very closely related to one of the forms described by Nicholson and Etheridge from the Girvan district (*loc. cit. ante.*)

ENTOMOSTRACA.

26. *Primitia* sp. No. 1.
27. " sp. No. 2.
28. *Isochilina* sp. indt.

TRILOBITA.

29. *Ampyx*, cf. *A. normalis*, Bill., or its near ally. *A. rostratus*, Sars. The latter species occurs in the rocks of the Girvan succession, and this is abundant in the rocks of Mountain Hill. It was collected in 1877, in 1892 and 1894.

30. *Amphion ?* sp. indt. An imperfectly preserved or obscure pygidium of a trilobite, which is most probably referable to this genus.

31. *Bathyurus*, sp. No. 1.

32. " sp. No. 2.

33. *Dolichometopus ?* sp. or *Symphysurus*, sp.

34. *Remopleurides*, sp. No. 1. Apparently new. Differs somewhat from *D. Schlothimi*, Billings, and from *D. Canadensis* and *D. affinis*, already described from Canadian rocks. It belongs to the typical or smooth form, of which the last two mentioned are types.

The Mountain Hill specimens, which are tolerably abundant, are not unlike in general outline to *Remopleurides Barrandii*, Nicholson and Etheridge Jr., good specimens of the cephalon of this species occur in both the 1892 and 1894 collections.

35. *Remopleurides*, sp. No. 2. Smaller form.

36. *Dalmanites callicephalus ?* Green.

37. *Calymene senaria*, Conrad. (= C. tuberculata, of European authors, also *C, Blumenbachii*)

38. *Asaphus canalis*, Conrad.

39. *Asaphus*, sp. cf. *A. megistos*, Locke.

40. *Ceraurus pleurexanthemus*, Green.

41. *Phacops Brongniarti*, Portlock, or a very closely related species.

42. *Microdiscus ??* sp. indt., or *gen. nov.* A very diminutive form of trilobite occurs with *Nidulites favus ?* Salter, and *Remopleurides* sp. No. 1. It is more closely related to the genus Microdiscus.

43. *Trinucleus concentricus*, Eaton. Very fine and numerous examples of this typical Trenton species occur in Mr. Weston's collection. These are precisely like those which occur at Montmorency Falls, above the Falls, near Quebec

44. *Trinucleus*, sp. indt. A much smaller but prolific form of this genus occurs with many of the foregoing species. It differs from the other chiefly in size, in being strongly tuberculated and in other subordinate characters. Head and pygidium *four* millimetres and scarcely *four*, respectively.

45. *Illænus*, sp.

Note.

(*a.*) Besides the above there appear to be indications of the presence of such forms as *Agnostus*, *Staurocephalus*, *Dicranopora*, and numerous fragments of crinoidal and cystidean remains.

(*b.*) It may not be uninteresting here to note the discovery made by Mr. Weston this summer, in the rocks on Valier street, Quebec city viz. a portion of a large crinoidal column *eight* millimetres in diameter. A length of 7.5 mm. of the column is preserved.

This specimen strongly resembles similar crinoidal fragments sent to Mr. Whiteaves, of the Geological Survey, in 1882, and belonging to the "Wappinger limestone" of the vicinity of Poughkeepsie, N.Y.

(*c.*) It will thus be seen, that so far, from the interesting collections made by Mr. Weston in 1877, 1892 and 1894, respectively, we have no less than *forty-five* species of fossil remains. These will, no doubt, be supplemented by new and in such cases, probably better specimens, so that this preliminary report will probably be superseded before very long. A great deal of credit is due Mr. Weston for his perseverance in the work he has accomplished, and the present paper brought out in connection with the announcement of this discovery by

Mr. Weston, is prepared in the hope that it will help to throw some light upon a district which, although in the midst of a large and growing population, is still almost entirely unknown and unwritten.

(*d.*) The following is a recapitulation of the species included in the paper :

Rhizopoda.

1. Nidulites favus ? Salter.

Cœlenterata.

2. Streptelasma corniculum, Hall.
3. Diplograptus, cf. D. rugosus, Lapworth.

Bryozoa.

4. Pachydictya acuta ? Hall.

Brachiopoda.

5. Acrothele, sp.
6. Acrotheta, sp. indt.
7. Discina or Lingula, sp.
8. Schizotreta cf. S. minutula, W. and S.
9. Paterula, sp. nov. cf. P. Bohemica, B.
10. Lingula Nympha, Billings.
11. Lingula, sp.
12. Lingulepis, sp.
13. Leptæna (Plectambonites) sericea, Sow.
14. Leptæna, sp.
15. Strophomena Aurora, Bill.
16. Strophomena (Rafinesquina) alternata, Emmons.
17. " " sp. nov.
18. Strophomena or Leptæna ?
19. Orthis (Dalmanella) testudinaria, Dalm.
20. " (Plectorthis) plicatella ? Hall.
21. Orthambonites ? sp.
22. Camerella or Anastrophia, sp.

Gasteropoda.

23. Metoptoma, sp.
24. Murchisonia ? sp.

Cirripedia.

25. Turrilepas, N. sp.

Entomostraca.

26. Primitia, sp. No. 1.
27. " sp. No. 2.

28. Isochilina, sp. indt.

Trilobita.

29. Ampyx, cf. A. normalis, Bill., and A. rostratus, Sars.
30. Amphion ? sp. indt.
31. Bathyurus, sp. No. 1.
32. " sp. No. 2.
33. Dolichometopus ? sp., or Symphysurus, sp.
34. Remopleurides, sp No. 1. (n. sp.)
35. " sp No 2. (n. sp.)
36. Dalmanites callicephalus ? Green.
37. Calymene tuberculata, (= C. senaria), Conrad.
38. Asaphus canalis, Conrad.
39. " sp. cf. A. megistos, Locke.
40. Ceraurus pleurexanthemus, Green.
41. Phacops Brongniarti, Portlock.
42. Microdiscus ? ? sp. indt.
43. Trinucleus concentricus, Eaton.
44. Trinucleus sp. indt probably n. sp.
45. Illænus, sp.

Ottawa, August, 1894.

SUGAR AND ITS MANUFACTURE.

By Adolf Lehmann, B.S.A., late Asst. Chemist, Dominion Experimental Farms.

The manufacture of sugar is an art which, like many others, has come to us from the far East. Its beginning is somewhat obscure, but probably it was first carried on, in a primitive and very limited way, by some of the tribes or nations of India. It has since, with the successive strides of civilization, assumed greater and grander dimensions. The Persians, Arabians and Spaniards, have in their turn been improving and extending cane-sugar manufacture. Other nations, notably the English, and in former days the Italians, especially the Venetians, have materially assisted in this work.

In Persia, the industry was relatively at its height during the eleventh century. At this time the product was especially prized as a medicine: in fact it was manufactured for this purpose until the extended use of tea and coffee made its use more universal. Shortly after the discovery of America, the industry was planted in the West Indies. Soon these islands began to supply the principal portion of this commodity, a position they retained for centuries. But during the past thirty or forty years, cane sugar has found a strong competitor in beet sugar. Now, Germany stands at the head of the sugar producing nations, and the beet furnishes the principal portion of the sugar on the market. This position has not been attained through the superiority of the beet as a sugar producing plant--for it is more difficult to manufacture sugar from it than from the cane—but through the energy, perseverance, and almost endless work of men of science.

In 1747, Marggraf, a German chemist, the director of the Academy of Science at Berlin, discovered sugar in different members of the beet family. His pupil and successor, Karl Achard, built in 1799 the first beet sugar factory near Berlin. He spent a fortune and a large portion of his time in developing the industry, and he may be said to be the father of it. Shortly before Achard's death, Napoleon I. placed such restrictions on the importation of sugar into the continent of Europe that at one time it reached the price of about 75 cents a pound. In addition to this import tax he compelled farmers to plant a definite area with sugar beets, and in other ways assisted the beet sugar industry. It flourished for a time, but appeared to be almost dead, especially in Germany, after these favourable legislations were removed. However, improved methods of manufacture and a careful attention to the cultivation of the beet, together with reduced prices in other farm crops, have made it an industry which, instead of receiving a bounty, pays a handsome revenue to the state in the form of an excise duty.

It is largely to the promoters of the beet sugar industry that we are indebted for the great reduction in the price of sugar. They have placed it within the reach of all, and transformed the luxury of yesterday into the necessity of life of to-day. They have also revolutionized the cane sugar industry—an industry which, although perhaps a hundred times as old as its young rival, still looks to it for instruction.

The plant from which sugar was almost exclusively made till the introduction of the sugar beet is the sugar cane, *Saccharum officinarum*. It is a plant which in appearance is not unlike Indian corn. The stalk is from one to two inches in diameter at its base, and generally from five to eight feet in height, although occasionally, especially in the more southern countries, it reaches fully double that length. The colour varies from a greenish yellow and a yellowish green to a deep purple, depending upon the variety. Some varieties are striped, others are uniform in colour. The leaves are somewhat narrower, but otherwise resemble those of Indian corn. In Louisiana, the seed never ripens, in fact the flowers are never seen. In more southern latitudes where its growth is not interfered with by frost, it matures in about 18 months. It is a perennial. Its seeds are small and its flowers form an open panicle.

On the North American continent, Louisiana has ever held the position of the sugar manufacturing centre. The centennial of the first manufacture of sugar was celebrated at the sugar experimental station of Louisiana on June 30th, 1894. The southern half of the State is almost exclusively devoted to this industry, and but little cane is grown north of this. The sugar cane is propagated by a modified form of cuttings. The stalks, or sometimes portions of them, are laid in a horizontal position, generally two along side of each other, in furrows from four to eight inches deep and covered with finely pulverized earth. These stalks serve the same purpose as the planted potato. The buds develop into the new plants and the stalks serve to supply nutrition to them till they are able to draw food from the soil. The rows of cane are generally about five or six feet apart, formerly they were from three to five feet. In the rows the plants appear about every six to twelve inches; but, as the season advances, these multiply by stooling, tillering, or suckering, in direct proportion to the fertility of the soil. With favourable conditions an acre will produce upwards of 30 tons of cane, and each ton gives 175 to 200 lbs. of sugar.

In Louisiana, where frost that injures the cane, frequently occurs in the latter part of December, harvesting is generally begun about the middle of October, and continued for two or three months. The cane is cut by hand with very wide thin-bladed knives about 18 inches long. The leaves and top of the cane are removed at the same time and the and the stalks conveyed by carts, or on the larger plantations, by cars to the sheds of the factory. Here it must not be allowed to accumulate too much; for, like sorghum (and other plants from which sugar is occasionally made), cane deteriorates soon after it is cut. At present, the majority of planters have their own sugar houses. These are, however, gradually being replaced by central factories, and in the course of time the manufacturing of sugar and the growing of cane may become separated, like the producing of milk and the making of cheese have become in Ontario.

As in other plants, the sugar of the cane is found dissolved in the juice. In Louisiana, this juice contains about 9% 14% of sugar, sucrose, 1% to 2% glucose, and about an equal quantity of other solids. Two methods are at present used, on a large scale, to extract the juice. The one most generally employed for cane is that of pressing it out by passing the stalks as they come from the field between large iron rollers which almost touch each other. These rollers are frequently almost three feet in diameter, and six to seven feet long, and five, six, or even nine of them are placed in successive sets of three near each other. In the case of a five roller mill, the front set has three rollers and the one behind the remaining two. The stalks of cane in passing through these successive sets of rollers are, of course, pressed twice in each set of three; for two rollers are lying side by side at the bottom and the third is placed above and between these, in such a position that it almost touches the second one of the lower rollers but allows a little more space to be between it and the first of the lower rollers. This enables the cane to pass easily into the mill and to be at the same time thoroughly pressed. In order to make the extraction of the sugar from the cane as complete as possible, the cane is generally moistened with water while passing from one set of rollers to the next. When the stalks leave the mill they are practically dry and torn into comparatively small pieces, and present a somewhat spongy appearance. They are now largely used as fuel under the boilers of the sugar houses. The other method for extracting the sugar from the cane is called the diffusion process. It is the method almost exclusively employed in obtaining the sugar from beets. In it the cane is first cut transversely into pieces not more than an inch long, subsequently sliced, or shredded longitudinaly as fine as possible, and packed tightly into a battery of iron cylinders or cells all connected with each other by pipes. Water is pressed into the first cell and from it to each succeeding one, remaining about ten minutes in each. Fresh water is passed through in this way several times, or until the chips in the first cell are practically free from sugar. These chips are then thrown out. After the cell has been refilled with fresh chips of sugar cane it becomes the last instead of the first of the chain. All the cells are successively treated in like manner. Thus as little water as possible is used to dissolve out the sugar—a very important factor, since all the water will have to be evaporated off. This so-called diffusion juice contains approximately two thirds the percentage of sugar found in the mill juice of the same cane; or in other words, two thirds of the "diffusion juice" may be considered as pure juice and the remaining third as water added to it.

The juice, no matter how obtained, contains in addition to water and sugar, a considerable portion of other compounds. Among these are albuminoids, amides, colouring matter, organic acids, gums and mucilages. All these have to be removed as much as possible before the evaporation of the water is begun. Frequently sulphur dioxide, produced by burning sulphur, is first used as a bleaching agent; but unless it is decided to produce the highest grades of sugar directly at the sugar house, the advisability of its use may be somewhat questionable, since it has a tendency to reduce the sugar yield. Lime is invariably used as a clarifying agent, either alone or directly after the use of sulphur dioxide. It is generally added, suspended in water, to the juice, in large iron tanks—generally enough to make the juice slightly alkaline. The mass is slightly boiled and the skum removed from the top several times, or rather just as the scum forms The precipitate is allowed to settle and the clear liquid drawn off. A further clarification and the removal of any excess of lime by the use of phosphoric acid will probably be adopted in the near future. The skimmings and setlings are pressed through heavy canvas filters, and the liquid separated from them, which of course contains a considerable percentage of sugar, is added to the other portion of clarified juice, which is now ready to be boiled into sugar. The solid portion is thrown away or used as a fertilizer.

The evaporation of the juice is generally carried on in two stages. The first, to near the point of saturation; and the second to such a consistency that it will still run readily out of the vessel in which it has been boiled. Both these concentrations are almost invariably conducted in a partial vacuum. The vacuum is increased with the concentration of the juice. The initial evaporation is generally done in two or three separate vessels, the steam of the first being used to heat the second and that of the second to heat the third. The final concentration is accomplished in a large iron vessel containing seldom less than five to six tons of sugar, or rather of a mixture of molasses and sugar, when the boiling is completed.

The molasses is separated by centrifugal force from the crystals c sugar suspended in it. In making the finer grades of sugar, the molasses still clinging to the sugar crystals is washed off either with steam or by the use of water. If a weak solution of stannous chloride is used in place of the water a sugar having a rich amber colour (Demarara sugar) is obtained. By great care in the manufacture and a liberal use of water in the centrifugal it is possible to make a sugar directly from the juice.

This sugar would be difficult, if not impossible, to distinguish from a product refined with animal charcoal. To get rid of the water still clinging to the crystals, the sugar is dried in a slightly inclined, horizontal, heated, rotating cylinder called a granulator. The sugar is called granulated and contains over 99% of sucrose. However, comparatively little sugar is made of this grade in the sugar houses, there being considerable loss by washing in the centrifugal. The greater portion is sold to the refiners. Here it is redissolved, filtered through animal charcoal and again boiled into sugar.

To produce a good quality of sugar, it is necessary to have the crystals of uniform size and as large as they can conveniently be made. Small crystals are liable to choke the sieve of the centrifugal, and prevent the easy and perfect separation of the molasses from the sugar, and this of course reduces the quality. The preliminary evaporation to near the point of saturation, gives the sugar maker a more perfect control of the crystallization. The process is briefly as follows: The pan in which the boiling is done is partially filled with the already concentrated juice, called syrup. This is boiled down till the crystallization has just begun. A small quantity of additional syrup is then drawn in. Thus by very slightly diluting the boiling mass the tendency to prevent any further crystals from forming is brought about. The amount of syrup added from time to time must be enough to do this but not so much as to redissolve the crystals already formed. The evaporation going on all the time, and no new crystals being allowed to form, those already there must increase in size, and that uniformly. The smaller the number of crystals relative to the size of the pan, the larger they can be made to grow.

The sugar obtained from the sugar beet, the sugar cane, the maple and the sorghum, differs only in the kind and quantity of impurities it contains. The pure sugar from all of these sources is identical. It is commonly called cane sugar, *sucrose*, the name being derived from the plant from which it was in the past principally made. In addition to sucrose, several other, however, less important kinds of sugar are on the market. The two principal of these are *dextrose* and *lævulose*, sugars resembling each other in many respects. The former is now extensively made from Indian corn by transforming the starch in it with dilute sulphuric acid and neutralizing the excess of acid with lime. It is largely used in compounding the various mixtures sold as syrup on the market—few of which are now pure concentrated cane juice. Honey is a mixture of both these sugars, dextrose generally predominating. All sweet fruits contain one or other or both of them. Cane sugar when treated with a dilute acid yields an equal quantity of both of them in invert sugar. Even continuous heating at the boiling point of water has a tendency to transform ordinary sugar into invert sugar. Both dextrose and lævulose crystallize with great difficulty. If present in a solution of sucrose they probably exercise a retarding influence on the crystallization of that sugar. Any agent, therefore, having a tendency to invert any of the sugar in the juice or syrup is doubly objectionable. Sulphur dioxide in solution has this tendency, especially when hot. Long boiling at high temperatures has also the same tendency. Both should be avoided as much as possible on this account.

In addition to the three sugars already named, at least seven others occur in nature, among these are milk sugar and malt sugar, *lactose* and *maltose*. But several times the number are known to chemists, some of them are fermentation or decomposition products, others have been made by the synthetical method. However, so far as I know, no cane sugar has ever been made by either of these ways. The stories sometimes heard that cane sugar is now made for commercial purposes from rags and sawdust are a myth. Perhaps they have arisen from the fact that dextrose is made from starch and possibly, at times, from such sub stances as I have just named.

Sugars belong to the carbohydrates, a class of compounds ably treated by Mr. F. T. Shutt, M.A., in a lecture on the Chemistry of

Foods, delivered before the Field Naturalists' Club during the winter of 1892. The sugars are the most soluble and the simplest members of this group. Their study from a chemical standpoint is exceedingly interesting, especially in relation to plant life, since it is highly probable that the other carbohydrates are formed from them.

REPORT OF THE CONCHOLOGICAL BRANCH, 1893.

Presented at the Annual Meeting, March 20, 1894.

To the Council of the Ottawa Field Naturalists' Club.

The leaders of this branch beg to report that while they have not during the year given as much attention to the study of the shells of this vicinity, as they, in duty, were probably bound to do, they have nevertheless something of interest to report as the result of their observations. Two new shells were added to the Ottawa list during the year, both discoveries having been made by the Rev. G. W. Taylor. *Pupa curvidens* was noticed among a number of small shells taken at Hull. In ponds near St. Louis Dam, the small English *Planorbis nautileus* var. *cristatus* was taken for the second time on this continent. It had previously been found in America only at Hamilton, where it was collected three years ago by Mr. A. W. Hanham. The occurrence of this shell at Ottawa, nearly 4,000 miles from its home, indicates how readily, in modern days, shells may become widely distributed. Its presence in the ponds at St. Louis Dam is in great probability due to the large quantity of refuse packing material, such as straw envelopes, marsh grass, etc., which have for years been thrown into these ponds. It may be that the shells themselves could not withstand the changes to which the straw and grass would be exposed from the time it was gathered in England until it was thrown into the ponds, but from the extraordinary vitality which the eggs of molluscs are well known to possess, these might continue unimpaired even under the trying circumstances that must have obtained in this case.

An important find of the exceedingly minute and rather rare *Vertigo milium* was made in Billings's bush, one wet afternoon in August on the bark of a fallen oak. Here, in ten minutes, many more specimens of this shell were found than the collector had previously seen in ten years. The large *Planorbis*, usually called *trivolvis*, but which, in the opinion of the leaders, is quite a distinct species, was found in abundance in the Rideau River west of Billings Bridge. The shells are easily obtained in the month of May, when like all other *Planorbes*, they are very active. Observations on this shell from the egg through various stages of growth to the adult shell may be stated at some future time and a description ventured.

The trip to Meech's and Harrington Lakes, of which an account is given in number 7, vol. vii, of The OTTAWA NATURALIST, although undertaken under adverse circumstances, was attended with very happy results. An excursion to Lake Bernard, in still more inclement weather, met with little success, as but few shells could be collected. The Gatineau River, owing to its rapidity and the few bays which it contains, is noted for the absence of molluscan life. At Farrelton, however, in September, when the water was very low, a surprisingly large number of shells were obtained. Our three Margaritanas were found in abundance, and several others of the Unionidæ. The Ottawa River was too high throughout the summer to admit of successful collecting. The famous shoals at Duck Island, on one occasion, however, yielded a number of shells which amply compensated for the long row up and down the river.

A remunerative method of collecting small shells was found to be the gathering of moss during the autumn from woods and swamps. This moss is then sifted during the winter. In this way no less than 14 species were collected in one bag of moss taken from the edge of the swamp to the south of the St. Louis Dam.

The leaders will be pleased at all times to assist members either with instructions as to the best methods and localities for collecting, or in the naming of species.

F. R. LATCHFORD, } *Leaders.*
J. FLETCHER, }

EXCURSION No.

Will be held on Saturday, September 15th, to Galetta on the O. and P. S. Railway.

The Train leaves at 8 A.M. Tickets, 60 cts. and 50 cts.; Children half-price.

SUMMARY

— OF —

Canadian Mining Regulations.

NOTICE.

THE following is a summary of the Regulations with respect to the manner of recording claims for *Mineral Lands*, other than Coal Lands, and the conditions governing the purchase of the same.

Any person may explore vacant Dominion Lands not appropriated or reserved by Government for other purposes, and may search therein, either by surface or subterranean prospecting, for mineral deposits, with a view to obtaining a mining location for the same, but no mining location shall be granted until actual discovery has been made of the vein, lode or deposit of mineral or metal within the limits of the location of claim.

A location for mining, except for *Iron*, shall not be more than 1500 feet in length, nor more than 600 feet in breadth. A location for mining *Iron*, shall not exceed 160 acres in area.

On discovering a mineral deposit any person may obtain a mining location, upon marking out his location on the ground, in accordance with the regulations in that behalf, and filing with the Agent of Dominion Lands for the district, within sixty days from discovery, an affidavit in form prescribed by Mining Regulations, and paying at the same time an office fee of five dollars, which will entitle the person so recording his claim to enter into possession of the location applied for.

At any time before the expiration of five years from the date of recording his claim, the claimant may, upon filing proof with the Local Agent that he has expended $500.00 in actual mining operations on the claim, by paying to the Local Agent therefor $5 per acre cash and a further sum of $50 to cover the cost of survey, obtain a patent for said claim as provided in the said Mining Regulations.

Copies of the Regulations may be obtained upon application to the Department of the Interior.

A. M. BURGESS,
Deputy of the Minister of the Interior.

DEPARTMENT OF THE INTERIOR,
Ottawa, Canada, December 1892.