

REPRINTS OF RARE ARTICLES ON MOLLUSCA. -- Robert BELL, ON THE OCCURRENCE OF FRESHWATER SHELLS IN SOME OF OUR POST TERTIARY DEPOSITS. --- Canadian Naturalist and Geologist, vol. 6, pp. 42-51, 1861.

(page 42)

ARTICLE IV, -- On the occurrence of Freshwater shells in some of our Post Tertiary Deposits. By ROBERT BELL.

(Presented to the Natural History Society of Montreal)

The various deposits described in the following paper are of different ages and have been formed under very different circumstances, but are arranged under the same head for the sake of convenience.

MONTREAL

Early in the spring of 1858 I accompanied Mr. D'Urban, who has done much for the cause of Natural History in Canada, on several excursions to collect fossils at the localities in the vicinity of Montreal where drift shells had been discovered. In examining the sides of Mr. Peel's clay pits, which are excavated in the 120 feet terrace, we discovered a few specimens of *Limnaea caperata* Say, in place, in a thin layer of sand immediately above the Leda clay and more than three feet below the surface of the ground, which is level at the place. In the same bed with these fresh water shells *Saxicava rugosa*, *Tellina groenlandica*, *Mya arenaria*, *Mya truncata* and *Mytilis edulis* are associ-

ated; and in the clay immediately underlying it *Leda Portlandica* was found, but not in any abundance.

About the same time that this *Limnaea* was found at Mr. Peel's

(page 43)

brick yard, I received a fine specimen of *Limnaea umbrosa*, Say, from Sir Wm. Logan, who obtained it from the thin bed of sand at the same locality. A *Cyclas* and *L. umbrosa* were found by Dr. Dawson amongst marine shells thrown out of a ditch on Logan's Farm.* I have collected specimens of the latter at the same place and believe them to be contemporaneous with the marine shells.

I might mention that the ponds on the highest part of Montreal Mountain, about 700 feet above the level of the sea, teem with *Limnaea umbrosa* and *L. caperata*, besides numerous other species of our common fresh water Gastropods. Ponds, with all these species living in them, may have existed in the same situation when Montreal Mountain was an island in the sea which covered the surrounding plain, and from them the rills running down its sides may have carried the specimens found in the sand which was then being deposited around its base.

*Canadian Naturalist, vol. iv, p. 36, vol. 11, p. 422.

GREEN'S CREEK.

Green's Creek enters the Ottawa in the Township of Gloucester, on the south side, about ten miles below Ottawa City. Here, the Leda clay has afforded a larger number and more interesting variety of fossils than at any other locality. At low water, which is generally in the month of September, the shore of the Ottawa for about two miles from the mouth of the creek upwards, is strewn with nodules of all manner of curious shapes washed from the base of the steep bank of clay which rises from high water mark.

In looking over the collection of nodules from this locality in the Museum of the Geological Survey, I found two specimens of *Limnaea stagnalis*, one of our commonest living species. Both had been partially filled with clay, now a hard stone, while they still retained their original shape. With the exception of the splendid *Limnaea megasoma*, which inhabits the Ottawa valley, this is the largest species in Canada. It was called *L. jugularis* by Say, but is identical with the European *L. stagnalis*. One meets with these shells in almost every warm marsh or pond on the south side of the Ottawa, and it is interesting to know that their progenitors lived in this country while the Leda clay was being deposited and a deep sea covered their present abode.

(page 44)

Not only have marine shells and this fresh water species been found at Green's Creek, but also the remains of two seals, three kinds of fish, leaves, wood and nuts of land plants, three or more species of marine algae and specimens of *Asteracanthion polaris* Mill, the most abundant starfish now inhabiting the Lower St. Lawrence, and future researches at this locality will no doubt add many more fresh water, as well as marine species, to our Post Pliocene fauna.

TERRACES AROUND LAKE ONTARIO

On the south side of Lake Ontario a remarkable ridge* composed of loose materials, ex-

tends from Sodus in Wayne County westward to Lewiston on the Niagara River, a distance of 100 miles, and a continuation of the same ridge has been traced to the head of the lake. The general contour of this "Lake Ridge," as it is called, is parallel to the present shore of the lake, its extreme variations being three miles at its least and eight at its greatest distance from the shore. A carriage road runs along its summit, the general elevation of which is so uniform, that when the road is tolerably straight, a traveller can be seen as far as the eye can reach. A remarkable feature of this ancient boundary of the lake is that it declines more or less on the inland, as well as the lake side, thus constituting a true ridge, which damming the surface water, forms marshes on the upper side. This fact can be no objection to the supposition of its marking a former boundary of the lake, for we find similar ridges now forming along low exposed shores. The rarity of shells in it, is perhaps as a circumstance in favour of the supposition of its being of fresh water, and not marine origin, as shells are very scarce along the open shores of the great lakes, and one might search a long time in similar ridges now forming without finding any.

The elevation of the summit of the ridge above Lake Ontario opposite Middleport is 185 feet, opposite Albion and Brockport it is 188 feet. The distance comprised within these three observations is thirty miles, in which the elevation of the ridge varies only three feet; in Wayne County it is estimated at 200 feet. Fragments of wood, shells, &c., are found embedded in it; the shells were not collected by Mr. Hall himself but he has no doubt

(page 45)

of their occurrence. In his annual report of 1838 he remarks that *Uniones* are said to have been found in the ridge. Should the shells of this deposit prove to be of fresh water origin, and since no marine shells have been found in it, we might be induced to believe that Lake Ontario once stood

*The facts here given in regard to the "Lake Ridge" are derived from Hall's *Geology of New York*, Part IV.

far above its present level, and that a barrier which kept it at that level has since been removed; but on the contrary, as there is no actual proof that such a barrier did exist, we have reason to conjecture that it was formed while the sea stood at that level. Allowing the water by which the Lake Ridge was thrown up to have been 175 feet over the present level of Lake Ontario, we should have about 410 feet as its elevation above the present sea level; this corresponds exactly with that of the littoral deposit in Nepean on the Ottawa, in which Sir Wm. Logan has found marine shells, and it would not be surprising if future researches prove them to be contemporaneous - perhaps also with the terrace on the back of Montreal Mountain which is 50 or 60 feet higher, - for littoral deposits at considerable distances apart may be of the same age though at different elevations, as these differences may be due to an unequal amount of upheaval or to a difference in the heights to which the tides rose.

One of the numerous terraces which run along the north side of the lake will no doubt be found to mark an elevation corresponding to that of the "Lake Ridge" on the south; probably the "Pine Ridge" which is so well marked is the one. The late Mr. Roy, who long ago levelled the terraces behind Toronto, gave 108, 208, 280, 308, 344, 420, 680 and 762 feet as the elevations there of ancient beaches above Lake Ontario.

Dr. Dawson the other day showed me two specimens of a *Melania* and one of *Unio ellipsis* from a sandy deposit not far from Toronto.* They are described as having been found immediately above the Silurian rock in the drift about five miles from the Asylum. Both the *Melanias* are filled with sand but on the back of the *Unio* there is a thin layer of clay which again is impregnated with sand. The deposit from which these shells are derived may be of the same age as the ridge on the other side of the lake.

Professor Chapman informs me that he has collected specimens of a *Planorbis* in sand

and gravel about 46 feet above the lake in the neighbourhood of Belleville.

(page 46)

Although some of the lower terraces behind Toronto might have been formed by the lake when at a greater elevation, the higher ones were doubtless formed during the period of the glacial drift.

I will mention a circumstance which may be one reason for inferring that Lake Ontario was filled with fresh water at the time when the sea stood at one of the best marked zones of the Post Pliocene formation to the eastward. It is well known that the very common little bivalve *Tellina groenlandica* delights in salt water which is largely mixed with fresh and is most abundant in friths or bays where rivers enter the sea. In descending the St. Lawrence from Quebec, it is the first marine shell one meets with and is extremely abundant when the upper limit of other marine species is reached. When the salt water extended up the valley of the St. Lawrence to some point between Montreal and Kingston, we should naturally expect the same state of things to have existed. Now, in the drift deposits at Prescott, at about 250 feet above the sea, *Tellina groenlandica* is very abundant and I did not observe any other species; from this fact, and considering the situation of the locality, it appears evident that the estuary was here diluted with fresh water when the sea stood at this level, but the argument is open to many objections.

NIAGARA FALLS.

In 1859 an opportunity was afforded me of examining the ancient bed of the Niagara River near the Falls. Between the Clifton House and the toll-gate below, a deposit of gravel and sand, rich in fluviatile shells, occurs between the ancient bank of the river, and the cliff overhanging the present gorge. At a spot on the road-side where a quantity of the sand and gravel had been excavated, I collected the following species: -

1. *Planorbis bicarinatus*.
2. *Physa heterostropha*.

* Collected by B. Workman, Esq., M.D.

3. *Limnaea caperata*.
4. " *stagnalis*.
5. *Melania Niagarensis*.
6. " *conica*.
7. " *acuta*.
8. *Paludina decisa*.
9. *Amnicola porata*.
10. *Unio gibbosus*.
11. " *complanatus*.
12. " *ellipsis*.
13. " *rectus*.
14. *Margaritana marginata*.
15. *Cyclas similis*.
16. *Pisidium dubium?*

A portion of a land snail, probably *Helix albolabris* was also

(page 47)

found. Many of the bivalves were perfect, having the valves closed, and from the position in which they were found, appeared to have lived on the spot where they are buried. These shells may have lain here for thousands of years, although their geological date is extremely recent.

Similar terraces occur on Goat Island, and along the American side of the river from the Falls to the whirlpool. A mastodon's tooth was found in this fluvial terrace opposite Goat Island, at a depth of nine feet below the surface, but it does not follow from this, that the mastodon lived at the time of its formation, for the tooth might have been washed from an older deposit. These terraces being all on the same level, and the *Unio*'s occurring in them in the position in which they had lived, are facts which imply that they were once connected so as to form a continuous stratum, extending over the position occupied by the present gorge, and also that they have been deposited in a tranquil widening of the river, like that between Chippawa and Buffalo. They also afford a conclusive proof that the Falls have receded. These terraces are described by Hall, Lyell, and Ramsay.

TERRACES AROUND GEORGIAN BAY.

The more inaccessible parts of the Province have naturally received less of the attention of scientific men, than those in the vicinity of her cities or along her great thoroughfares. I am not aware of anything having yet been published in regard to the lake terraces of the region under notice, with the exception of a paper by Sandford Fleming, C. E., on "The Valley of the Notawasaga,"⁸ from which I extract the followings-

⁸There are appearances in various parts of this region which lead us to infer that the waters of Lake Huron like those of Ontario, formerly stood at higher levels than they at present occupy. Parallel terraces and ridges of sand and gravel can be traced at different places winding round the heads of bays and points of high land with perfect horizontality, and resembling in every respect the present lake beaches; one of them particularly strikes the attention in the Bay of Penetanguishene, at a height of about 70 feet above the level of the lake; it can be seen distinctly on either side from the water, or by a spectator standing on one bank while the sun shines obliquely on the other, so as to throw the deeper parts of the terrace in shadow. The accompanying section, sketched † from a cutting a little below Jeffrey's tavern, in the Village of

(page 48)

Penetanguishene, will serve to show the manner in which the soil has been removed from

⁸Read before the Canadian Institute in 1853, and published in the first volume of the *Canadian Journal*.

† This sketch resembles a cross section of a side-hill road, where the earth has been excavated on the upper and thrown to the lower side.

the side hill and deposited in a position formerly under water, by the continued mechanical action of the waves. Not only does the peculiar stratification of the lower part of the terrace confirm the supposition that it was deposited on the shore of an ancient lake, but the fact that such excavations have been made in this landlocked position, where the waves could never have had much force, goes far to prove that the lake stood for a long period at this high level.

"Another ancient beach mark about 15 miles inland, and as far as yet ascertained, about the same level as the one at Penetanguishene, can be traced for a long distance in the township of Tosorontio. It passes through the tract of burnt land already described, the soil of which being pure sand, in all probability formed the shoals of a lake extending to the north and east, the outline of which is approximated by the dotted line* marked from 70 to 80 feet high on the accompanying map. Nor are these the only traces of old lake beaches met with in this region, although the dense forest nearly everywhere covering the surface is a great impediment to their easy discovery. In the Township of St. Vincent, near the village of Meaford, besides a very conspicuous one, corresponding in level with those already mentioned, several others of lesser note are found at various heights; at Owen Sound, also, they are remarkably well defined; while Cape Croker, on the western side of Georgian Bay, viewed even from a distance and the well remembered shape of the Giant's Tomb, on the eastern, show striking evidences of having been acted on for ages by the storms of Lake Huron, when at a higher level.

* This line encloses a subtriangular space, having one corner in the north of Nottawasaga, another in the centre of Essa, and the third in the north-east corner of Vespra.

"It has been said that some of these terraces are estimated at 70 or 80 feet above the level of the lake; by drawing a contour line coinciding with this height around the lower part of the valley, it is found that the high ridge of sand now in some parts blown up into dunes near the mouth of the River (Nottawasaga), will form a narrow neck of land (supposing the lake at its former level), stretching across from shore to shore, and resembling in many respects the "Burlington Beach," on Lake Ontario, and also "Fond-du-Lac," on Lake Superior; like the first it encloses a bay of considerable depth of water, but of far greater area. That this ridge has been formed in a manner precisely similar to those two, by the sand washed from the adjoining shores, there is great probability, in fact there is good reason to believe that the same natural agents, at present in active operation moving the outlet of the river eastward, have also formed this upper ridge by transporting the materials of which it is composed, from the base of the escarpment in Collingwood.

"In attempting to arrive at the geological age of these ancient beaches, it will be necessary to show whether their position, at a consi-

(page 49)

derable height above the level of the lake may be attributable to a gradual elevation of the land or to a subsidence of the water. The last hypothesis seems the most tenable, since the first would involve a local upheaval only, and an inclination of the plane of the terraces at variance with their apparent horizontality. Should further researches prove the existence of terraces or other indications of old beaches on the western margin of Lake Huron corresponding in height with those discovered along the eastern shore, the supposition that the level of the water has been lowered by the wearing away of some barrier will be strongly supported;

and if this be allowed as a reasonable explanation for these geological monuments, we have then, by drawing contour lines coinciding with their level the means of discovering the probable position of this barrier. From all that I can learn regarding the relative levels of the country these lines would pass over the peninsula between Lakes Huron and Erie at some distance inland from the River St. Clair and would if continued eastward along the shores of Lake Erie fall within the summit of the neck of land through which the chasm of the Niagara River is cut."

The northern part of the Township of Notawasaga is situated on the extensive sandy plain above alluded to, which was no doubt formerly covered by an extension of Georgian Bay to the south-eastward. The whole has a general slope up from the bay, but here and there a ridge of gravel or coarser sand interrupts its general uniform aspect. Hurontario Street, running from Collingwood Harbour almost due south through the township, was carefully levelled by Wm. Gibbard, C. E., and it appears from his profile section of the street, that from Collingwood to the north side of the Pretty River at the Village of Melville or Notawa Mills, a distance of two and a half miles, the ground rises very regularly from the edge of the water to an elevation of 138 feet, or at the rate of about 55 feet per mile. At the Pretty River a change begins both in the character of the surface and in the rate of its inclination, which continues regularly for three and a half miles further at 47 feet per mile. Thus, at a distance of six miles from the present shore, the surface has attained an elevation of more than 300 feet above the level of the lake; beyond this it rises irregularly and much more rapidly. It is evident that the bank of sand and gravel on the north side of the Pretty River continued for a long time to be the shore of the lake. The layers of sand and gravel are arranged exactly as on a modern beach, and among them I noticed several thin irregular beds of a light gray or white colour, composed principally of carbonate of lime. In the cutting through the

top of this ridge the common land shells *Helix al-*

(page 50)

bolabris, *H. tridentata*, *H. Sayii*, *H. alternata*, and *H. fuliginosa* were collected, at from three to four and a half feet below the surface.

About a mile south of Collingwood, a shallow cutting for the road, exhibits the arrangement of the beds of sand and gravel, which at the base of the exposure dip southward at an angle of 35° and are overlaid to the surface by unconformable horizontal layers. Here, from the surface to a depth of three feet, *Planorbis trivolvis* and *Helix fuliginosa*, *H. tridentata* and *H. thyroides?* were found. The summit of this rise is 78 feet above the level of the lake, and from its plotted section appears to have been thrown up by the waves when the edge of the lake ran along the base of its northern slope.

There are a few specimens of *Melania conica* in the Geological Museum, from a railway cutting in sand near Collingwood.

The greater part of the town of Owen Sound is built on a loose deposit of gravel and fine sand at the head of a long arm of the Georgian Bay of the same name. The flat formed by this deposit slopes gradually up from the head of the bay towards the falls of the Sydenham River, which has cut its way through it, and is bounded on either side by terraces of Silurian limestone or marl. Fresh water shells were observed in abundance wherever a section of the sand was exposed, and also, in one place, *Helix alternata* the most abundant land shell on the shores and islands of Lake Huron.

The following species were collected in different places in the most central part of the town. One of these, on the bank of the river was about nine feet above the level of the lake; the others appeared to be a little higher.

1. *Limnaea umbrosa*.
2. *Planorbis campanulatus*.
3. *Planorbis bicarinatus*.
4. " *parvus*.
5. *Melania acuta*.
6. " *Niagarensis*.

7. *Melania conica*.
8. *Paludina decisa*.
9. *Valvata sincera*.
10. " *tricarinata*.
11. *Amnicola porata*.
12. *Cyclas similis*.

About a mile from the mouth of the river, or following the upward course of the valley, the road is cut through a slight elevation in this lacustrine deposit and here also fresh water shells were found embedded in the sand, but neither the species nor individuals

(page 51)

were so numerous as in the same deposit nearer the head of the bay. I had no means of ascertaining the elevation of this spot above the lake, but it seemed to be more than 30 feet and the shells bore evidence of great antiquity.

The terraces before alluded to as bounding this flat are capped with fine sand and their summits appeared to exceed 80 feet above the level of the lake. They are well marked, and

extend for miles along each shore of the Sound. At Peiatt's Harbour, or the French Village on the west side of Owen Sound and about twelve miles from the town of the same name, two steep and very well marked lake terraces rise, one above the other, near the water's edge. They are both composed, as far as I examined them, of shingle mixed with a little silt. The summit of the upper one appeared to be about 100 feet above the lake and is in all probability the continuation of the upper terrace running round the head of the Sound, while the lower one corresponds to that on which the town is built.

When Lake Huron was at a sufficient elevation to form the higher of these terraces, it was probably connected by a wide expanse with Lake Erie, which is also proved to have stood at this high level from the fact of a ridge holding fragments of decayed wood and fresh water shells, running along its southern side at an elevation of 150 feet above its present level.

MONTREAL, Feb. 4th, 1861.

RECORDS OF GASTROPODS COLLECTED IN WESTERN OHIO -- A CORRECTION

CLARENCE F. CLARK

On page 21 of STERKIANA No. 6, 1962, is a small error. Miami County should have listed under it Union Township, Section 7, August 12, 1944, Ludlow Creek. At this site, *Goniobasis livescens* (Menke) ... 7. The next county title should be Paulding, and under it Paulding Township, Section 20, June 24, 1945, as it now appears.