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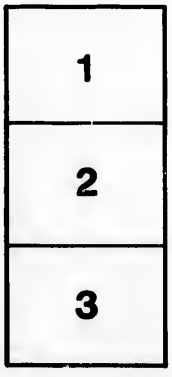

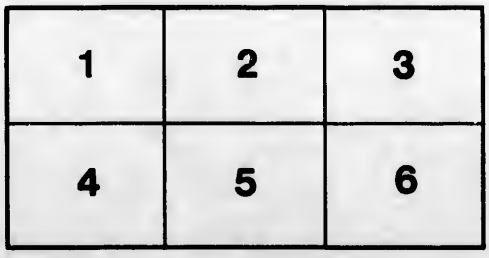

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Art. III.—Sketch of the Carboniferous District of St. George's Bay, Newfoundland.

By Edwin Gilpin, M. A., F. G. S., *Member of the Newcastle Institute Mining Engineers.*

(*Read December* 9, 1873.)

The south shore of Newfoundland, from Isle Aux Morts to Cape Ray, is composed of dark slates and quartzites, pitching at a heavy angle to the south, and much disturbed by veins and masses of coarse feltspathic granite. The metamorphism has been very great, and the action violent, the intrusive rock being often twisted into curious knots containing fragments of the resisting slates. I was unable to form any idea of the age of these strata, but they closely resemble our Lower Silurian rocks in the neighbourhood of their trap.

Since my return, a small crystal was given to me as coming from Port au Basque. It is of a bluish colour, containing phosphorous and a large proportion of iron; it hardly answered the description of Vivianite as given by Dana, but seems to correspond more closely with the mineral Triphyline. Any of the phosphates occurring here in sufficient quantity would be of great economic value, as the locality is one of the most accessible in Newfoundland.

The long narrow reefs and islands that skirt the shore, forming the ports of Channel and Deadman's Harbour, have been worn out by the action of the waves upon the beds whose strike is generally parallel to the line of the coast. About six miles inland from Port au Basque is a high range of hills, forming a spur of the great interior plateau of the island, and running parallel to the shore until it terminates in Cape Ray. The land rises gradually to their foot in small hills, many of which are composed of granite. The width of the hill range is about ten miles at this point, but it already exhibits the distinctive features of the plateau, being covered with swamps and spruce underwood draining into large ponds and lakes. The rivers rising in this water shed, flow in all directions toward the sea; leaving the highlands in a series of cascades and rapids, their

windings among the boulder strown valleys afford capital breeding ground for the salmon so abundant on this shore. At Cape Ray the lowland diminishes in width to three miles. And in front of the Cape supports three large conical hills called the Sugar loaves. Their bare granitic flanks, thrown into relief by the dark background, form fitting portals to the great silurian plain of the St. Lawrence. Behind rises the precipitous front of Cape Ray, its dark slates relieved by the patches of perennial snow in the deep ravines. Between the highland and the most northerly of the Sugar loaves are traces of a great fault, which Professor Murray of the Geological Survey claims to have traced across the island.

As we pass to the Cape we see the dark line of the plateau trending away inland to the eastward, till its scarpement grows dim and is lost to the eye beyond the head of Bay St. George.

The next highland that we notice is Cape Auguille, an enormous ridge of intrusive rock running obliquely toward the plateau, but sinking beneath the carboniferous strata before reaching the Codroy River. Between these two Capes is the carboniferous district of the Codroy Valley, triangular in shape, its base resting on the sea, and its apex pointing to the east. The measures on the shore dip inland, and consist of red sandstones and shales with at least two large deposits of gypsum. Were the dip of the measures undisturbed we would expect to find the productive coal strata at no great distance from the shore, but the gradual approach of the boundary rocks continually brings up lower beds. This accounts for the large development of Lower Carboniferous measures exposed in following the Codroy River to the eastward.

Two small seams of coal with beds of black shale are said to crop near its source, but no systematic exploration has yet been made. From the facts observed on the Barasois Rivers, it is possible however, that they may indicate the commencement of an area of productive measures.

On rounding Cape Auguille we are at the mouth of St. George's Bay, a magnificent sheet of water 30 miles long, and 40 wide at its entrance. We again meet the carboniferous strata affording a beautiful section at their point of junction with the older rocks of the Cape. The dark slates pitching steeply to the north, are

overlaid by the unconformable carboniferous, whose dip is to the north-east, but at an easy angle. In the cliff close to the point of contact are seen signs of an upheaval of unknown extent; a little further to the north is another of about fifty feet, followed by three more with from twenty to forty feet of dislocation. The strata are red and brown sandstones with beds of black shale; the force of the upthrow has carried the latter through the lighter coloured stones, so that the lines of fault are marked on the cliff in narrow gores of black pulverized shale.

From this point to the head of the Bay are frequent exposures of the Lower Carboniferous, in many places disturbed, but with a general dip to the south-east. As the strike of the beds approaches to a parallelism with the shore, measures are made slowly, so much so that opposite St. George's Town, a distance of fifty miles, we still find beds of conglomerate, whose warm color recalls their counterparts when of triassic age. A clear idea of the measures of the district can be obtained by ascending the Barasois River, which pursues a general south-east course towards the interior. At its mouth is a large cliff of red sandstone, succeeded by their limestones and conglomerates; about three miles from salt-water the river has cut its way through an immense bed of gypsum and red marl. Although identification is rendered impossible owing to distance and intervening dislocations, it is probable these deposits are on the same horizon as those of the Codroy Valley. The gypsum crops again five miles to the westward and is exposed on Fissels River ten miles east of this point. A line drawn from the gypsum of Kippens Brook, north side of the Bay, to the mouth of the Codroy River follows closely the line of crop of these beds and furnishes an important key to the whole district. Still ascending the River we pass beds of Conglomerate, some of which appear to be repeated by faults. In certain of the beds are found large fragments of magnetic iron ore, plainly derivable from the great deposit of black oxide in the older rocks. Gradually they pass into finer grits with beds of sandstone and bluish fireclay. About eight miles from the shore is the crop of a small coal seam in the vertical measures of a fault. The next four miles is through a series of anticlinals with signs of many dislocations, pursuing a general north-east and south-west

course, and occasional crops of very small coal seams from two to ten inches thick, with underclays bearing stigmaria. The first regular coal seam is now met, its thickness is two feet nine inches, with a band of ironstone balls in the roof, as it is between sandstones there is not much probability of any increase in thickness. The measures are lying at a very heavy angle, with a strike approaching north and south. Higher up the measures become flatter with another seam three feet thick, then follow coarse gritty sandstones for about two miles.

Beyond this point the current of the river slackens, the banks become low and afford no exposures. Thickets of alder and long grass shelter the wild geese which at the time of my visit were breeding in great numbers. We are now at the foot of the plateau and find the river leaping in a cascade from the side of the Silurian mountains.

Climbing the nearest hill we endeavour to trace the course of the river and imagine its source far up in the Table Land. As we gaze into the unknown interior, range after range of hills rise up before us; their flanks, covered with spruce underwood, and bare storm swept summits looking down upon the little lakes, each set in a soft green swamp, over which the Carriboo can scarce pick his way. The dark bitter waters unmoved by any wind, reflect only the wild fowl and clear cut hill tops. Such is the source of nearly all the Newfoundland rivers. In spring they pour from the snow fed swamps an impassable torrent, and dwindle away in summer to a mere thread.

Retracing our steps to the sea coast we find a similar section exposed on Fissel's River, ten miles to the eastward. Between this point and St. George town are large hills of drift, sometimes over one hundred feet high, and pointing towards the gap in the hills through which the Main River flows. South of the town about six miles from the shore, is a spur of the older rocks containing an immense deposit of *Magnetite*, identical in appearance with the fragments mentioned as found in the conglomerate. The specimen of Magnetite in the Museum, given by Mr. Bishop, is from this locality.

The prevailing indraft of westerly wind, and the contour of the Bay causing a tide to flow in on one side and out on the other, have deposited huge sand banks at the mouth of the Main River. In many places these banks show beds of black sand, varying from one to thirty inches; doubtless research would expose thicker beds in localities not now subjected to the action of water.

The origin of these iron sand ores is to be found in the crystalline rocks, from the disintegration of which they have been derived. The action of the waves, by virtue of the greater specific gravity of these sands, effects a process of concentration, so that considerable layers of black sand are often found on shores exposed to wind and tide. The composition of these black sands vary according to locality, but as found on the St. Lawrence consists of magnetic oxide of iron, with a large mixture of titanic iron ore, and more or less of garnet. The purest specimens hold about forty-five per cent. of black oxide.

Indian Head is a mass of trap forming the south side of the coal field of that name. A visit to the measures exposed on the Indian Brook was impracticable, but on the authority of Prof. A. Murray, Chief of the Geological Survey, undoubted coal measures are found there. A small seam is known to crop near the shore, but the coal is of very inferior quality, hard and full of stone.

Five miles to the westward at the mouth of Kippens Brook, is one of the most magnificent exposures of gypsum in the world. The brook flowing obliquely across the crop of the bed, has bared a great cliff, four hundred yards long and one hundred feet high, of soft white gypsum of the finest quality. Parts of the cliff contain alabaster of unusual clearness. The specimens sent from this locality to Boston and Philadelphia were much admired.

Following the brook upwards, the measures which at the gypsum pitch to the east, gradually bend round to the south, and we find ourselves in the bed of a synclinal which has been frequently shifted to and fro by upheavals. The measures consisting of sandstones and shales with beds of grit, rise towards the hills on each side. After a few miles the measures become level and are connected with those of Indian Brook. There is a large tract of level land extending for several miles beyond this point, as yet unexplor-

ed. Here search should be made for coal, as the measures already passed are evidently those of the horizon underlying the productive strata.

The next object of interest is the peninsula of Port a Port, forming the north side of the bay.

From Cape St. George to the Gravels the south shore presents an almost unbroken wall of limestone, dipping to the north at an easy angle in a series of lateral undulations, varying in length from a quarter to two-thirds of a mile. The profile of the shore on the south side is a perfect contrast to that of East and West Bays. Long continued action of waves on rocks dipping inland does not make a shelving beach, as the undermined cliff falls into the sea, and the outline of the shore becomes straight.

Crossing to East Bay we find the limestones still dipping to the north, and the action of the sea against their pitch has made long beaches cut into numberless small coves. Part of the limestone has been worn away more slowly, and gives the shore a very strange appearance. At first one would imagine the massive ruins of some colossal building had been piled along the beach. At one point we see a number of detached pillars standing at intervals of almost mathematical regularity; sometimes capped with a round ball of the same material, or squared as if they were the lower part of some huge portal. Then come great rounded blocks piled one above the other, forming a perforated mass through which a carriage could be driven. The solid background of the cliff has been cut into circular semi-detached columns, marking a future row of these sculpturers of the sea. Such is the appearance of the shore for miles, every change of position bringing out fresh and stranger forms.

In one place there are two large caves hollowed out just above the level of low water. We explored the larger of the two. After following a narrow low gallery of over two hundred feet, we found ourselves in a spacious vault, worn perfectly smooth by the water, and glistening in the light of our torches. Another gallery led further into the cliff but could not be followed more than a few yards, as the roof grew too low to allow our passage. The other

cave is about thirty yards long, very low in places, and terminating in a similar vault.

Close to the cave a large deposit of barytes is exposed on the beach. The vein is several feet wide, running north and south; its quality is excellent, being compact and free from impurity. The whole of this district is crossed by small veins of crystallised calc spar, sometimes containing galena; they are of workable size only at one place, in East Bay, where a mine has been opened and vigorous operations pushed forward. The vein is exposed in a land locked cove, worn out by the action of the sea on the soft bed rock. The foot wall of the richest portion of the vein, yielding about fifteen per cent of lead, has been defined. The total width of the plumbiferous rock is over twenty The ore is the common sulphuret of lead, with copper pyrites, calc and fluorspar. I was informed that the per centage of silver present was inconsiderable. The limestones on the east side of the cove contain a beautiful shell bed, affording the characteristic Lower Carboniferous fossils, and near this is an argillaceous sandstone filled with indistinct fragments of broken plants.

On the point of land separating East and West Bays are found abundant indications of petroleum; it oozes from crevices in the rock, and can be secured in considerable quantities. No attempt has yet been made to trace it to its source.

In this connection, a notice of the position of the Pennsylvania Petroleum may be interesting. Beneath the conglomerate are a series of thin bedded sandstones and shales, the latter often an olive green color. These may be readily recognized as belonging to the Chemung and Portage groups of the New York Geologists, and known in Ohio as the Waverley series. Under this is a bed of bituminous shale from two hundred to three hundred feet thick, called in New York the Hamilton shale, and known in Ohio as the black slate. Much oil is found in this bed. Dr. J. S. Newberry considers that the indications of oil in higher measures are derived from this reservoir by percolation through the more porous strata.

I have glanced over the more prominent geological features of the Bay, they are of unusual interest both to the geologist and miner. Almost the whole series of the carboniferous measures are

exposed, and can be studied under every condition of disturbance. The lowest of the measures passed over are those of Long Point, then come the East Bay limestones. The exposures from Cape Auguille to the Barasois Rivers fill the interval between the Gravels and Kippens Brook. The gypsums of Codroy, Barasois and Kippens form an important horizon. Above this come the sections of the rivers and Mr. Murray's coal fields of Indian Brook, which may be represented by the imperfect exposures of coal measures fourteen miles from the mouth of the Barasois River.

Although the deposits of coal have not yet equalled the expectations of investigators, the presence of iron and lead in unusually large deposits, together with the indications of other minerals, marks this Bay as the future scene of extensive mining operations. The summer is clear of fog, and the winter ice lasts only from January to April, so that St. George's Bay has a material advantage over many places lying further to the south.

ART. IV.—ON CANADIAN SPECIES OF RUBI AND THEIR GEOGRAPHICAL DISTRIBUTION.

By GEORGE LAWSON, PH. D., LL. D., *Dalhousie College.*

(*Read January* 12, 1874.)

(ABSTRACT.)

RUBUS was described as a genus of plants belonging to the natural order *Rosaceæ*, an order which embraces about a thousand species and a countless number of varieties of artificial origin. An unusually large number of these plants are natives of temperate countries in the northern hemisphere. *Rosaceæ* has furnished our gardens with numerous ornamental plants, such as the hawthorns, pyrus, roses, sweet briars, almonds, spiræas, potentillas, amelanchier, geums, &c., whilst our orchards are indebted to the order for the varieties of apple and pear, cherry, plum, peach, quince, and many others. To the botanist some groups of the *Rosaceæ* have a specially vexing interest, on account of their proneness