

N O T E S

ON THE

GOLD OF EASTERN CANADA:

BEING

A REPRINT OF PORTIONS OF VARIOUS REPORTS

OF THE

GEOLOGICAL SURVEY OF CANADA

FROM 1848 TO 1863.



MONTREAL:

DAWSON BROTHERS.

1864.

Price 25 Cents.

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P R E F A C E.

Public attention having lately been called to the deposits of gold in south-eastern Canada, it has been thought advisable to reprint from the various Reports of Progress of the Geological Survey, the observations made and published by its officers at different times from 1848 to 1863, and chiefly during the first five years of this period. These earlier Reports, although published at the time of their several dates, by order of the Government, have now become so rare and difficult of access that many persons now interested in the gold of Canada do not appear to be aware of their existence, and take for novelties the facts long ago made known to the public by the Geological Survey. The extracts from the several Reports are arranged in chronological order, and a few notes have been added.

W. E. LOGAN.

OFFICE OF THE GEOLOGICAL SURVEY,
Montreal, Canada, January 1864.

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NOTES

ON THE

GOLD OF EASTERN CANADA.

FROM THE REPORT OF MAY 1, 1848.

PAGES 73—80.

It appears from the Reports of some of the State Geological Surveys of the American Union, from various papers which have come before the public in Silliman's Journal of Science and Art, and from the statements of Mr. James D. Dana and Professor Charles Upham Shepard in their works on Mineralogy, that the existence of gold in North America, occurring in more or less quantity in veins and alluvial deposits, has been traced at intervals, some of which are considerable, from Georgia, the Carolinas, Virginia and other Southern States, and even from Mexico to the Chaudière in Lower Canada. It is not improbable it may follow the run of one and the same geological formation through the whole distance, and will ultimately be traced to Gaspé. Along the whole line it seems to be associated with, or in the vicinity of rocks strongly characterised by magnesia, such as dolomite, serpentine, talc and chlorite slates, and at the same time marked by the presence of chromic iron, titaniferous iron and rutile. It is found in similar association in other countries; and the description of the Ural Mountains, for which we are indebted to Sir R. I. Murchison and his companions, shews that these characteristics are conspicuously displayed in that auriferous region of Russia, where the gold is accompanied also by platinum; which is stated in Silliman's Journal for September last, to have been observed very recently in one of the gold mines of North Carolina.

What has already been said of the rocks of the Eastern Townships* is sufficient to show that the general types above alluded to are legibly imprinted on the Canadian prolongation of the Green Mountains; and the geological analogy between the Canadian strata, and those of the more Southern States is drawn still closer by the discovery of gold in the district under description, not only in alluvial deposits, but also (in mere traces however,) in a vein. In the different localities in which vein gold has been found in the Southern States, the metal appears in most instances to be in a matrix of white quartz, as a vein-stone, sometimes associated with either iron or copper pyrites, or with galena or blende; and it is remarked that the pyrites is often found decomposed and converted into hydrated peroxyd of iron, strongly marking the outcrop of the vein. The metal however is not in all cases confined to the quartz veins; sometimes it extends into the rock bounding the quartz on each side. But the gold, whether in the quartz, in the metallic sulphurets, in the hydrated peroxyd of iron, or in the rock of the country, is always native, and it is disseminated in grains, which though sometimes visible to the naked eye, are most frequently so fine as not to be discernible in the matrix, notwithstanding it may be pure milk-white quartz, even with the assistance of a powerful magnifying glass, until the matrix has been bruised to a powder, and a separation effected by washing. "In far the greater number of cases, the eye detects nothing but quartz, or sometimes metallic sulphurets (of iron, zinc or lead); and the observer, unless instructed in the case, would never suspect the presence of gold, either distinct or in the metallic sulphurets." The veins are of various breadths, from one foot and less to five feet and more, and the rocks in which they occur appear in general to be talcose slates, or clay slates not far removed from them. The veins seem in almost every case to coincide with the stratification both in strike and dip, thus assuming the semblance of beds. Professor Silliman, in his "Remarks on the Gold Mines of Virginia," (Journal, vol. 32, p. 98,) from which the above facts are taken, states that the expense of working the auriferous quartz is from 30 to 35 cents per 100 lbs., and the produce

* In a previous part of this Report, pages 30—58.

of 100 lbs., leaving out fractions and extraordinary results, from \$1 and \$2 to \$10 in value, the gold being estimated at $4\frac{1}{2}$ cents per grain; which in round numbers may be said to equal from 25 to 250 grains of gold to 100 lbs. of the vein-stone. In Somerset County in Vermont, gold has been met with in a quartz vein with hydrated peroxyd of iron, coinciding with the stratification, in talcose slates; but it is not stated by Professor Hitchcock, who has given an account of it in his Report on the Geology of the State of Massachusetts, that the quantity is of economic value.

The only locality of a vein with traces of gold, yet determined in the Eastern Townships, is in the vicinity of Sherbrooke, the metal being found associated with the copper pyrites in the vein which has already been noticed* for the latter ore, on the seventeenth lot of the seventh range of Ascot. In the quartz gangue, the hydrated peroxyd of iron, the quality of the rock to which it belongs, and its conformity with the stratification, it agrees with the southern localities already mentioned. The quantity of the precious metal however appears to be insignificant. But it is to be remarked, that the gold in the matrix being invisible to the eye, even assisted by a magnifying glass, the examination of the vein was not made with a knowledge of its presence; and it was only in assaying the copper obtained by smelting a washed sample of copper-pyrites resulting from 74 lbs. of the vein taken indiscriminately, that the existence of the gold was ascertained. According to this trial, 100 lbs. of the vein would yield $12\frac{1}{2}$ ounces of copper; 180 grains of which copper yielded 0.031 of a grain of gold. The 100 lbs. of the vein would thus give 1.03 grain of gold; and the value of the metal in a ton of the rock would be about \$1. The 180 grains of copper yielded also 0.162 of a grain of silver; so that 100 lbs. of the vein, in addition to the gold, contains 5.40 grains of silver.

It is unnecessary to mention that these results are valueless in an economic point of view, and no allusion to them would have been made beyond a passing notice in stating the produce of the copper, did not the presence of the precious metal in a vein come in aid to illustrate the general character of the region, and in particular of

* Page 72 of this Report.

an alluvial deposit, where the quantity may probably prove of more importance. This deposit is in the Seigniorship of Rigaud-Vaudreuil,* the property of the heirs of the late Charles Etienne Chaussegros de Léry, Esq. The spot is on a small stream called the Touffe des Pins, † a tributary, falling in on the right bank of the Chaudière, about fifty-eight miles from Quebec. Mr. C. de Léry, one of the present proprietors, who six years ago exhibited to me the specimens of gold he had obtained, has informed me that the first piece of the metal was discovered about thirteen years ago by a daughter of one of the *gens de bien*, and the fact coming to his knowledge, he himself made search, and found another piece in the bed of the stream. The discovery was communicated to the public, through Silliman's Journal, vol. 28, p. 112, in April, 1835, by Capt. F. H. Baddeley, of the Royal Engineers, whose zeal in Canadian geology is well known in the Province and elsewhere. The weight of the piece is stated in the Journal to have been 10.63 grains, but this was only a fragment separated from one of the pieces, the remainder of which now weighs 1056 grains. Subsequently to this, Mr. de Léry from time to time continued to meet with small lumps and grains. in and about the same spot in the channel of the brook, and up to the autumn of 1846, the value of the whole he had collected by hand, without any process whatever of washing, may have amounted to \$130. The largest three pieces have been weighed by Mr. Hunt, and their weights are 1068 grains, 1056 grains, and 744 grains, Since that period, a slight examination has been made of the deposit, and last season, previous to my visit to the locality, which was late in the autumn, the alluvium had been washed experimentally in small quantities in several places along the banks of the stream, with more or less success. But owing to freshets and other circum-

* Some confusion may arise on account of the various names which in these pages and elsewhere, are applied to this seigniorship. It is designated on some of the seigniorship maps as Rigaud-Vaudreuil, apparently to distinguish it from another seigniorship of Vaudreuil, on the Ottawa. For a similar reason it is often designated Vaudreuil, Beauce; the latter name being that of the county. This seigniorship constitutes the parish of St. Francis; and this is sometimes called St. Francis, Beauce, and St. Francis, Vaudreuil, to distinguish it from other parishes bearing the same saint's name.

† Since sometimes called the Gilbert.

stances, the amount of work done was insignificant. One washing (the only regular day's work) of sixty bushels, by means of a rocker, or species of shaking-table, in common use in the Southern States, produced 440 grains of gold; which would be equal to about $7\frac{1}{3}$ grains to a bushel, the weight of which bushel would be about 100 lbs. About 75 lbs. of gravel, washed in my presence by one of my own men, produced a quantity equal to about 2 grains to a bushel. The metal however is so unequally distributed, and so little has been done, that it would be premature to consider the above an average return. I am informed by Mr. de Léry that it has been ascertained by the examination, that the deposit, in parts close upon the brook, presents indications of being auriferous for nearly two miles up the valley, which for that distance has a bearing to the north-east, coincident with the general strike of the stratification; and that in one place near the spot where the first discoveries were made, a few particles of gold were found, on the south side of the valley, about fifty feet above the bed of the stream, and about 100 yards removed from it. He informs me, also, that a few particles were met with near the road which is on the right bank of the Chaudière, on a small tributary brook, called the Ruisseau Lessard, also running with the stratification, about two miles below the Touffe des Pins; and one piece is reported to have been found higher up on the Chaudière, beyond the Seigniory. The total quantity obtained from the first discovery up to the end of October last year, equals a value of about \$300. In an assay of a small piece of the gold obtained from Mr. C. de Léry, Mr. Hunt finds it to contain 13.27 per cent. of silver, so that the fineness of the gold would be $20\frac{1}{2}\frac{3}{4}$ carats.

Distinguishing between the vein-mines and deposit-mines of Virginia, Professor Silliman remarks:—

“The latter contain only alluvial gold, or gold at least disengaged from rock or vein-stones; it is obviously not in its original connection, and has doubtless proceeded from the destruction of regular veins or beds, and of the rocks which contained them; the gold has either remained mixed with the ruins of the rocks and of the veins, or has been transported and scattered, sometimes far and wide, by the moving power of water, and buried at depths more or less considerable, in loose materials. Sometimes

“ the gold is found immediately under the turf or sod ; this happens most frequently on hills, but more commonly it is in lower situations, under several feet, or even yards, of soil, clay and gravel, and it is most abundant next the slate which underlies the whole of the loose materials, and which slate is sometimes soft, being in the state of decomposition. When the slate rocks are solid, and their strata stand nearly perpendicular, the gold has been sometimes found in the crevices between natural layers of the rock ; at the Whitehall mines, in Spotsylvania County, the gold extended downwards in this manner, sometimes to the depth of three feet.”.....“ The largest masses of gold have been discovered near rivulets, brooks, or runs of water, called in the language of the country, branches. In such situations, pieces have been found weighing several ounces, and in North Carolina, several pounds. On a branch at the Whitehall mines, gold to the value of \$10,000 was found in the course of a few days, in a space of twenty feet square ; and \$7,000 value of gold was found in Tinder’s mine, in Louisa County, in the course of one week. It happens not unfrequently that the vein mines are discovered in consequence of washing the earth, particularly in the branches.”

The deposit on the Seigniory of Rigaud-Vaudreuil is of the character above described, and a full investigation of it would probably lead to the discovery of the vein from the destruction of which it is derived. The deposit occupies the centre of the valley in which it exists, which is deep and not very broad, and the amount of detritus varies considerably in different parts of its distribution, while the brook has cut down through it in many places, exposing the glossy surfaced clay slates, and occasional quartzose bands on which it rests. The detritus is a gravel or shingle, of which the pebbles are derived from the various rocks composing the country, at least as far north-westward across the strata as the band of serpentine described as traversing the Chaudière in the north-west part of the Seigniory, the distance to which is six miles ; and it is not improbable some of it may be derived from sources still farther in the same direction, One class of pebbles consists of talcose and chloritic slates, and glossy surfaced clay slates ; another, of the various kinds of the

rocks which have been described as mixtures of corneous quartz* and diallage, or hornblende, or feldspar; a third are of vein-stone quartz, and a fourth are of serpentine. In the finer parts of the gravel are found grains of chromic iron and crystals of rutile. The serpentine pebbles are often in a decomposed condition on the exterior, giving an adhesive, unctuous, and partially ferruginous clay. A clay of this description is occasionally seen among the pebbles in a thin layer not far removed above the slates, and in some places a deposit of peroxyd of iron or of manganese, coating the pebbles and filling up the interstices among them, runs in thin horizontal patches. The pieces and particles of gold are almost all found towards the lower part of the deposit, and many are discovered in the clefts of the slate, where the plates have been loosened by external causes; but the extent to which the plates have been so loosened is sometimes so small that it would scarcely be supposed they had been separated at all, yet scales of the metal will be found between them. Some pieces are found in the unctuous clay, and among the iron and manganese-coated pebbles; and the gold itself, is sometimes partially covered with a closely adhering film of the hydrated peroxyd of manganese. The pieces of gold are all more or less rounded, their original sharp angles and corners, resulting from the mode in which they laid in the vein, having been worn away by attrition. In some of the largest however, small portions of the vein-stone quartz remain firmly adhering.

Unless the gold were scattered to a considerable distance from its source, it would be expected that the deposit would observe a general course in some degree paralld with the parent vein; and conversely, the deposit running in a general line for a considerable distance parallel with the strike of the stratification, which coincides with the direction of the veins, it is to be inferred that the vein from which it is derived is not very far removed from the deposit. It is worthy of remark that the positions of the gold-bearing vein of the vicinity of Sherbrooke, and of the auriferous deposit of the Seigniory of Rigaud-Vaudreuil, bear directly for one another in the general strike of the stratification of the intervening

* Since found to be a compact feldspar, which with diallage and hornblende forms varieties of diabase and diorite rocks common in this region.

country, and that they stand at an equal distance from the outcrop of what is considered the base of the Famine and St. Francis fossiliferous limestone. The general character of the rocks of the two localities is not unlike; there appears to be less chlorite on the Chaudière, and more talcose clay slate, but there is little doubt they belong to the same formation.* The corneous rocks are much nearer the auriferous position on the Chaudière than on the St. Francis, but there is between the Touffe des Pins and the Famine a band of the same peculiar dingy olive-green translucent serpentine mentioned in the general description as occurring on the line of section not very far from the Georgeville limestone †; the place of which serpentine on the St. Francis would be between Sherbrooke and Lennoxville, standing there in the same relation to the auriferous vein, that it does to the deposit in the vicinity of the Chaudière. One or two small quartz veins run under the auriferous deposit of Rigaud-Vaudreuil, and it is not improbable that in these or other quartz veins that may be near, the source of the gold will be found. Those displaying hydrated peroxyd of iron should be especially examined.

FROM THE REPORT OF MAY 1, 1850.

PAGES 67—69.

The occurrence of gold in the gravel of the valley of the Touffe des Pins, a tributary of the Chaudière, has already been mentioned in a previous Report; and on revisiting the Seigniorie of Vaudreuil Beauce, a few days were spent in endeavoring to ascertain over what breadth across the stratification the auriferous gravel might extend. Seven different places were tried, and the metal found in five of them; no attempt was made to determine in what quantity it existed, as without a greater expenditure both of time and money

* It has since been ascertained that the copper and gold-bearing rocks at Sherbrooke belong to a lower member of the Silurian series than the clay-slates on the Touffe des Pins.

† The serpentine-like mineral from both of these localities has since been shown to be agalmatolite (Geology of Canada, page 484).

than the funds devoted to the Survey would permit, no such result as might have been considered a just criterion could possibly have been arrived at. We were satisfied to establish the fact of its presence merely, and the smallest particle of the metal was deemed sufficient for the purpose; two of the spots were indicated to us by Mr. Angers as localities in which he had himself met with traces; one of them was on a small brook, tributary to the Rivière à la Famine, entering it on the south side about four or five miles from its mouth. About a mile and a-half above the fall on the Famine, there commences an extensive deposit of clay, sand and gravel; we followed the section made through it by the river for about a mile and a-half, and constantly found the clay beneath and the gravel resting on it; towards the top of the gravel, the bank often presented a horizontal deposit of the mingled oxyds of iron and manganese, in some parts from six to eight inches thick, filling the interstices among pebbles of various kinds, many of them being clay and talcose slate, quartz rock, chloritic sandstone, and some of them of white vitreous quartz, with grains of black magnetic iron sand in the finer parts. The same deposit, with the same arrangement, exists on a small brook, which gives a section through it at right angles to the main stream, on the S. E. side, ascending this about the third of a mile, and trying a few pounds of the gravel at the top, which had not previously been moved, a small particle of the metal was immediately met with. Another locality was about a mile up the stream which discharges into the Chaudière, opposite the Famine, on the Seignory of Aubert-Gallion, being on the twenty-second lot of the domain, where the metal was first observed by Mr. Fortier, one of the *cessitaires*, in a narrow ravine with steep precipices of clay slate on each side; it occurs in the clefts of the slate constituting the bed of the stream, and in the clay and gravel immediately on the top of the rock, mingled with magnetic and chromic iron; the quantity of gravel at the spot is but small, in consequence of the narrowness of the ravine, through which the water rushes with great violence during the freshets of spring; about a grain weight of gold was here obtained. I have since been informed by Mr. Fortier that he has traced it two miles farther up the stream. The metal was also met with close by the

side of the river-road, where it is crossed by the brook next below the previous stream. Mr. Hunt found traces of it in the gravel at the foot of the precipice of serpentine, just below the fall of the Guillaume River, where it was associated with grains of magnetic and chromic iron, as well as of rutile and ilmenite. He also discovered it about a mile below the great Fall on the Bras, in similar gravel lying close on clay slate, where it could not be far removed from the band of serpentine constituting the rock of the fall.

These five localities, as well as that of the Touffe des Pins above mentioned, the Ruisseau Lessard, and the Ruisseau du Lac (or du Moulin), in both of which particles have been met with, are all included in an area of about sixty or eighty square miles, with a breadth of about ten miles across the stratification, and I have been informed that traces of the metal have been found on the River Metgermet, flowing into the Rivière du Loup about fifteen miles still farther to the south-east than the Rivière à la Famine. Without a much more detailed and expensive examination than can be given to any one locality, on a Survey that is expected to embrace within a reasonable period an inspection of the whole Province, it would be premature either to assert or deny, that the precious metal may be held in sufficient quantities to yield a profitable return.

Appended to the Report for May 1, 1850, from which we have just quoted, was given a *Catalogue of some of the Economic Minerals of Canada*, prepared to serve as a guide for those who wished to collect specimens to be sent to the Great Exhibition held in London in 1851. The following localities of NATIVE GOLD are there mentioned (page 109):

- GOLD IN GRAVEL.....Vaudreuil Seigniory, Beauce; Rivière Guillaume; Rivière Bras; Ruisseau Lessard; Rivière Touffe des Pins for three miles up; Ruisseau du Lac.
 Aubert de l'Isle Seigniory, Rivière Famine.
 Aubert-Gallion Seigniory, Ruisseau —, Pozer's River for 3 miles up.
 Rivière Metgermet opposite Jersey
- GOLD IN VEIN.....Lake Superior, Prince's location, (traces).
 Ascot, range 7, lot 17. (with *copper* and *silver*; value of *gold* \$1 per ton of rock.)

In a subsequent Report, that of May 14, 1852, there is given a list of the mineral products of Canada shown at the Crystal Palace in 1851, among which are (page 40) :

NATIVE GOLD..... Specimens from washings on the Touffe des Pins, Vaudreuil, Beauce. Exhibited by the *Chaudière Mining Company, Quebec.*

NATIVE GOLD..... Specimens from Lake Etchemin, Rivers Chaudière, Du Loup, Famine, Pozer's Stream, Bras, Guillaume, Des Plantes, Metgermet, St. Francis, &c. &c. Exhibited by the *Geological Survey.*

It is further added, on page 47 : “ The specimens of gold from the Chaudière Mining Company's washings on the Touffe de Pins were not equalled by any in the Exhibition (with the exception of a mass weighing eighteen pounds from California) ; and with other *pepites* less in size and fewer in number from several of the localities which were cited in last year's Report as affording indications of gold, were eagerly inspected by the public. As already stated, honorable mention is made of the specimens of gold exhibited by the Chaudière Mining Company.”

FROM THE REPORT OF AUGUST 20, 1851.

PAGES 6—11.

In the Report of Progress preceding this, mention is made of a partial examination of the gold-bearing drift of the Chaudière. This examination was continued last season, and the facts resulting from it constitute the only additional topic to which I have to invite your Excellency's attention. The auriferous district was found to spread over an area probably comprising between 3000 and 4000 square miles. It appears to occupy nearly the whole of that part of the Province which lies on the south-east side of the prolongation of the Green Mountains into Canada, and extends to the boundary between the province and the United States. Two general lines of exploration were followed, one of them up the Chaudière and Rivière du Loup from the seigniory of St. Mary to the Province

Line, and the other from Lake Etchemin to Sherbrooke on the St. Francis. The former, running tranverse to the rock-ranges, measured about forty-five miles, and the latter with them, about ninety miles. The transverse line was more closely examined than the other, and traces of the precious metal were met with at moderate intervals throughout the whole distance. They were not confined to the channels of the main streams merely, but those of various tributaries furnished indications sometimes for a considerable distance up.

The lowest point in the valley of the Chaudière, at which the drift yielded traces of gold, was on a small stream falling in on the left side of the river, not far within the south-eastern boundary of the seigniory of St. Mary. They were found to occur on four tributaries in the seigniory of St. Joseph, for distances of one and two miles from their mouths. One of these joins the main stream on the left bank, about a quarter of a mile below the parish church and the other three are on the right. The lowest of them is abou, two miles below the church, the next about the same distance above it, and the fourth is the Rivière des Plantes, about half a mile farther up, and near the south-eastern boundary of the seigniory. In Vaudreuil, Beauce, they were discovered on the Guillaume much farther up than previously stated, and on the Bras opposite to it; on this and some of its tributaries the metal was traced to the centre of the township of Tring, a distance of about twelve miles. Three other streams which yield it in Vaudreuil, Beauce, have heretofore been mentioned; they are the Ruisseau Lessard, Ruisseau du Moulin, and the Touffe des Pins, on which it was first discovered. In Aubert d'Isle it was found on the Famine, and traced to Harbottle's Settlement, and beyond the seigniory into Waterford, a distance altogether of about ten miles. Some particles were obtained on the Ruisseau d'Ardoise, about a mile above the Famine, and it was followed about three miles up the brook commonly called Pozer's Stream, in Aubert-Gallion. On the Rivière du Loup, in addition to its occurrence in a multitude of spots, in fact almost continuously from its mouth across Jersey and Marlow, it was found in nearly all its tributary brooks, such as the Ladyfair, the Grande Coude, the Metgermet for four miles up, the Traveller's Rest, the

Portage, Kempt's Stream, Oliver's Stream for four miles up, and another stream between it and the boundary of the Province. Above the Loup, on the Chaudière, it occurred at successive intervals in twenty places in sixteen miles, as far as the south-western boundary of Dorset Township.

The localities of its observed presence on the other line of exploration were on Lake Etchemin, and along the Famine in Aubert d'Isle, and Pozer's Stream in Aubert-Gallion, towards Tring; and again on the St. Francis, in Dudswell, in Westbury, and near the joint corners of Westbury, Stoke, Eaton and Ascot, as well as in this last township near Sherbrooke.

It is not supposed that the limits of the auriferous district have been ascertained, but that it very probably extends much farther to the north-east, and attains the valley of the river St. John; while to the south-west it is known to reach Vermont, and to be traceable at intervals through the United States, even, it is said, as far as Mexico.* In its breadth however, it does not appear to cross the range of mountains with which it runs parallel, and no traces of it have been met with on their north-western flank. The deposit in which the gold occurs is part of an ancient drift, probably marine: and supposed to be of higher antiquity than that which, from the extent to which it occupies the valley of the St. Lawrence and some of its tributaries, Mr. Désor, who has recently bestowed much attention on the detrital deposits of North America, is disposed to give the name of Laurentian.† In this, alluded to in various Reports as tertiary and post-tertiary, the remains of whales, seals, and two species of fish, the capeling and the lump-sucker, and many marine shells of those species still inhabiting the Gulf of St. Law-

* Although gold occurs on the western coast of this continent in rocks similar to those of the Appalachian chain, and probably belonging to the same geological formation, the continuous outcrop of these rocks to the south-west is traced no farther than Georgia, where they disappear beneath newer strata; so that it is not at present possible to define the connection between the gold-bearing rocks of the two sides of the continent.

† This designation, which has not been generally adopted, is not to be confounded with the term Laurentian, applied to the oldest rocks of Canada and other parts of the world.

rence, are found. These shells on the Mountain of Montreal attain a height of about 470 feet above tide-level in Lake St. Peter, which is their greatest altitude known to me ; none of the remains have yet been found in the Canadian gold drift, and as this appears in its lowest undisturbed parts to be at a height of about 500 feet above the sea, it is probable what is now exposed of it, had emerged from the ocean before the Laurentian drift was placed, while in lower levels it would be covered up by it.

In the localities in which the gold occurs, the coarser material of the drift are made up in a large degree of the debris of rocks similar to the clay slates and interstratified grey sandstones on which it rests, but these are accompanied by fragments and pebbles of fine conglomerate, talcose slate, and serpentine ; which with magnetic, specular, chromic, and titaniferous iron (none of them absent when the gold is present,) are derived from the mountain range, bounding it on the north-west ; pebbles and fragments of white quartz are abundant, which may be derived from veins of the mineral prevailing in the mountain range or from others on the south-east of it. With these materials there occasionally occur in the valley of the Chaudière and its tributaries, large boulders of limestone conglomerate, similar to the beds of St. Giles and St. Mary, and more rarely boulders of gneiss identical in character with known kinds of the rock on the north side of the St. Lawrence. Not only is the gold absent from the drift on the north-west flank of the mountain range, but so also are the chromic iron and the serpentine ; notwithstanding that the two have been traced in association 135 miles, constituting a marked band accompanying the range from Potton to Cranbourne. On the north-west flank however, boulders of northern gneiss are frequent, and a few of limestone have been met with even pretty high up on the hills, showing by their fossils their derivation from the Trenton limestone ; the nearest exposures of which are on the north side of the St. Lawrence. In fact, in respect to the drift of the whole country, it may be said, that on southern formations are found resting the ruins of northern ; but no northern rocks are met with overlaid to any extent by debris derivable exclusively from southern. The auriferous drift shows no exception to this ; and there is little doubt that causes

connected with northern currents, when the rocks were beneath the surface of an ocean, have placed the whole. Ever since the surface however, has risen from beneath this ocean, causes similar to those now in operation in the district have been working in a contrary course. The rivers of the district emptying into the St. Lawrence flow north. In so far therefore as their forces modify the distribution of the drift, the materials of which it is composed are carried in that direction. This no doubt has some effect on the finer and lighter materials, and occasionally with the assistance of ice and great freshets, on some of the coarser and heavier, but the streams washing away the former in larger proportions than the latter, concentrate these in the valleys and channels. The gold being the heaviest substance is moved the least. It may occasionally be pushed along the bottom, when this is smooth, but it seeks every hole and crevice in its course, and when it has once obtained shelter there, it remains protected. Where the edges of the slates come to the surface, the plates have all been moved by superficial forces, and they therefore lie more or less loosely on one another, and the fine particles of gold gradually work themselves down between them, reaching sometimes so deep as three feet.

Although it is probable the whole of the drift on the south-east of the mountain range, both that in high and that in low places, may be auriferous, it appears certain that the metal will be most concentrated in the valleys and the channels of streams; the larger the stream, the more frequently it has broken down its banks, the oftener and more extensively it has changed its course, the more important the auriferous deposit is likely to be, and it is probably only in some such situations, if anywhere, that it will be worked to advantage. From the combination of the materials associated with the gold in the drift, there appears a strong probability that the metal is derived, through the agency of some southward-moving causes, from quartz veins situated in the mountain range; and even if traces were found north of this range in the channels of the main streams, such as the Chaudière and the St. Francis, the circumstance would not militate against the supposition; as traces in such positions may be expected from the fluvial re-modification of the drift; but with the exception of one vein in talcose slate near Sher-

brooke, no auriferous quartz veins have yet been discovered, and in this one there was merely a trace of the metal ; so that the facts of this gold district as yet offer no contradiction to Sir Roderick I. Murchison's theory,* that the gold, when it was originally placed in the veins, occupied only that part of them which was towards the then existing exterior of the earth's crust, and that this part having been subsequently worn down by various destructive causes, the productive portion of the veins has been wholly or in a great degree removed, leaving only their more quartzose continuation behind *in situ* ; while the gold, the vein-stone and the rock enclosing it have been carried away to form the drift. In this way it is his opinion that the drift will always be more productive than the veins ; but whether this is to be borne out by the facts of California and Australia remains yet to be proved.

The object of this examination has not been so much to ascertain quantity as distribution, but an effective experiment being now in operation on the Rivière du Loup, under a letter of license from the Government, one condition of the lease being that a correct return shall be made of the quantity obtained, I am in hopes by the end of the present season to have a few such facts as will afford some criterion to determine whether there is reasonable ground for supposing the deposit in that vicinity can be worked advantageously.

FROM THE REPORT OF MAY 18, 1852.

PAGES 21—27.

No farther examination was last season made in the distribution of the auriferous drift on the south-east side of the mountain range of the Eastern Townships ; but the Government having granted a letter of license to Mr. Richard Oatey, giving him permission to

* This theory, although advocated by Murchison, was we believe first put forward by Humboldt. Though true in the case of veins of great depth, it appears to be inapplicable to regions in which the metal belongs to the stratification.

collect the metal over a strip of five miles on the Rivers Chaudière and du Loup, at their junction, with a breadth of a quarter of a mile on each side, and a number of men having been employed by him, *streaming* for it during several months of the summer and autumn, an opportunity was taken to visit the locality, with a view of obtaining facts to form some estimate of the quantity of gold which the deposit might produce.

The working had been confined to a spot in the bed of the Rivière du Loup, about ten acres from its junction with the Chaudière. The stream is here about forty or fifty yards wide, and like the rest of the country for a considerable breadth in this part, it is underlaid by clay slates, interstratified with occasional beds of more or less calcareous sandstone, varying in thickness from a few inches to a foot. The slates at the spot cleave in the direction of the bedding, and the dip is about S. S. E., with a slope of from sixty to seventy degrees. The ravine in which the river runs is generally narrow and deep, with some few open spaces, and the immediate banks often constitute precipices of 100 or 150 feet. At the spot chosen for working, the higher banks recede a little as they turn towards those of the Chaudière, and a flat extends between them and the edge of the stream. The chief part of the work had been limited to a space in the bed of the stream, extending from the left bank to a distance of about twenty yards towards the middle, with a length of about a hundred and twenty yards along it. Here the slates crossed the channel obliquely, and the river-drift was accumulated upon the uneven surface formed by them, to various degrees of depth. In some parts the rock was bare, and in others covered to the depth of a few inches, and in no part did the deposit exceed three feet, the average being about two feet. The whole of this loose material was removed, particular care being taken to scrape it from all crevices and deep holes; but of the rock itself, in the cleavage joints of which scales of the metal sometimes descend two or three feet, little more than one fifth had been taken from its place, and none of it during my presence; an intention being entertained, as I understood, to work the top of the slate, when a convenient quantity of it had been cleared. The detritus consisted largely of coarse materials, with which sand and clay were

mixed in various proportions in different parts. Many vast boulders lay on the rock, or protruded from among the detritus, which were too heavy to be removed; smaller ones were still large enough to be removed with difficulty, and others of all sizes occurring among the drift, when they were seven or eight pounds in weight, the finer material being shaken from them, were thrown aside; but all of a smaller size were left in the detritus, to be washed with it. As shown after washing, the coarser material consisted chiefly of pebbles and fragments of slate and sandstone exactly resembling those on which the gravel rested; many both ragged and rounded, consisted of white quartz, such as composes veins that are met with in the clay slates, and in the more talcose slates of the mountain range to the north; not a few were of serpentine, and some were of red slate, and of the peculiar mixture of epidote and jasper, described in a former Report as existing on the Rivière des Plantes in St. Joseph Seigniory, and other places; while many were identical with the various other kinds of rock, such as corneous quartz,* talcose quartz rock, and diallage rock, also described as present in the mountain range; several were of a fine quartzose conglomerate, similar to beds which occur north of the serpentine of Vaudreuil Beauce, and some few of gneiss similar to that met with to the north of the St. Lawrence. Of the heavier component parts of the detritus, pebbles of magnetic iron occurred of twenty-five pounds weight, chromic iron of one or two pounds, and iron pyrites of four pounds; and of these in smaller pebbles and in grains, with titaniferous iron and rutile of the like smaller sizes, there was a considerable quantity, though I cannot pretend to estimate the per centage. Among the fine materials that could be examined after the washing, (the finest of all, such as the clay, having been carried away down the stream by the water,) silicious sand was in the greatest abundance, and among the heavier fine materials could be seen a considerable amount of very small red, pink, and lighter colored grains, which so far as their nature could be determined by microscopic examination, were chiefly garnets, a few of them zircons, and some were supposed to be spinels.

* See the note on page 11.

In washing the detritus, the Cornish *tye* was used, which consists of a rectangular box about twelve feet long, two feet broad, and from eight to ten inches high, open above, and supplied a few inches from the upper end with a division forming a well for the contrivance of a small side-slucice to let off the stream of water when necessary; and at the other with a groove in which could be let down a number of successive stops, required as the box filled with the material operated on, to keep the surface of it an even inclined plane. The box being placed at a proper slope, with a proper platform of plank alongside of it, even with the top, a gutter made to convey the water to the upper end from the main run, and the water let on and allowed to fall over from the well into the box, a man with a shovel supplied the upper end with the gravel and other materials; which were brought from the excavations and laid down on the platform near him by two others. The water acting on the gravel, which was slightly adjusted with the shovel, to loosen it and give an even surface, carried away the lighter particles, while another workman, behind the first, assisted the progress of the larger washed pebbles by the light and rapid movement of a rake; by this means also keeping an even inclined surface on the accumulating material in the box, and thereby preventing unequal action of the water. The box being filled by this procedure, some nine or ten feet of the lower part of the contents, called the *tail*, were thrown out of the box as of no more use; the remaining two or three feet were divided into two parts of a foot or eighteen inches each; the lower one, or the *second crop*, was added to the pile coming from the excavations, and the upper or *first crop* was made a separate pile of. When, by repeating the operation many times, a sufficient pile was made of the first crop, this was washed over by itself in the same way; the tail was thrown away, the second crop put with the first crop of the first *running* or washing, and the first crop of the second running again piled separately. These first crops of the second running were again washed separately, the tails thrown away, and the second crops added to the first crop-pile of the second running, and the first crop placed by itself to be the subject of a different operation. This was washing it on what is called a *copper bottom*. The copper bottom consists of a small two-eared or

handled tub about fifteen inches in diameter, and six inches deep, the bottom of which is a finely perforated sheet of copper; with the burr inside, the holes being sufficiently large to allow the point of a pin to go through, but not the head. The pile of the crops from the third running being placed by portions in this tub or sieve, the sieve is forced down into water held in a *keeve*, a large tub or species of vat; in this it is by a jerking motion raised and depressed, and turned partially round; the water driving up through the holes of the sieve has a tendency to push up the material lying on the bottom, the lightest the farthest up, and the jerking movement assists this. The gold being the heaviest substance, soon gets to the bottom, and whatever is lightest to the top; the top is every now and then scraped off and thrown aside, to be sent to the *tye*; more stuff is added to that in the sieve, and the operation continued until all the material from the third running is exhausted, or until it becomes necessary to empty the sieve. The reduced material taken from the sieve, among which the gold is now very perceptible, is subsequently placed on a shovel, and *vanned*, or separated by means of a little water and a peculiar motion given to the shovel, which only a person dexterous from long practice knows how to wield. Through the small holes of the copper bottom a large quantity of fine black iron-sand escapes into the vat or keeve over which the instrument is used, and a quantity of fine gold escapes with it, which must be subsequently separated by another process.

The whole quantity of gold obtained during the season was about 1900 penny-weights, and fifteen men were employed in the work, but it is not easy to state the exact time devoted to streaming. The full period of work was five months; but a considerable deduction must be made for accidents. The whole gang was for some time employed in constructing a dam, which when it was nearly complete, was carried away by a freshet, and many difficulties were experienced when the river was lowest, (which should have been the best period for working,) through the want of a proper supply of water at the height required to keep the *tyes* in full action. Something is to be allowed for broken time occasioned by rainy days, and much more for all those difficulties which are unavoidable

in starting a new work in a new place, where a knowledge of the natural local impediments is only to be gained by experience, and where none of those conveniences exist, which rise up only after operations have been carried on regularly for some time.

My visit lasted a week, during one day of which a heavy fall of rain prevented work ; but for the remainder of the time a regular account was kept by me of the gold collected and the wages paid. The quantity of gold amounted to $14\frac{3}{4}$ penny-weights, the price of which, stated to me subsequently by dealers in London, to whom a sample was submitted, was £3 10s. 6d. sterling per ounce, or about four shillings and fourpence currency per penny-weight. This would give a total value of £31 3s. ; the wages paid were £15, leaving a margin for profit of £16 3s. ; by which it would appear that the deposit was yielding about double wages.

Resulting from the season's work on the Rivière du Loup there was about a ton of fine black iron-sand in the keeve or vat, over which the copper bottom was used. The unseparated quantity of gold in this, after repeated trials, was ascertained to be 1.77 grains per pound avoirdupois ; this would give $165\frac{2}{3}$ penny-weights to the ton, the gross value of which would be about £36. From among a few ounces of fine gold obtained from the sand, there were collected some small grains both of platinum and iridosmine, the value of the former being below, and of the latter double that of gold. Almost all of this fine gold was at first of so white a color that it was considered probable the circumstance might be owing to the presence of a very large proportion of silver ; some of the larger pieces also obtained from the copper bottom were spotted white from the same supposed cause ; but Mr. Hunt, on heating this white gold, found that it quickly turned to a good golden yellow, and that the discoloration was occasioned by a thin coating of mercurial amalgam. As the spots were perceived on some of the larger pieces immediately on their being first obtained by vanning on the shovel, it is supposed they must have been spotted with the mercury while still undisturbed in the drift ; and as no mercury had been used on the ground, it leads to the supposition that some ore of mercury may possibly be one of the mineral products of the country ; though not a grain of cinnabar, the commonest form of

the ores of mercury, has been observed in the gravel. Among the substances obtained in separating the gold, lead shot of various sizes, from partridge to swan shot, has been nearly as abundant as the gold. Not a vanning was made of the concentrated material without obtaining some of it; its presence is no doubt due to the operations of those who have followed the chase; and to judge from the quantity of the shot the place must have been one of favorite resort. Whether the hunters may at any time have brought quicksilver with them and spilt it, is a question that cannot be determined.

It is impossible to say, without more widely distributed effective trials, whether this place is better or worse than others in regard to the quantity of gold. Several *prospectors*, as they are called, both Canadian and American, traversed the country during the season, but I have not heard of any that paid their expenses, though of many that met with the precious metal. Their modes of washing however, were of the rudest description, and were scarcely continued long enough and with sufficient regularity in any one place, to give fair results; but it appears evident that what is known of the deposit is sufficient to authorise the opinion that it will not, in general, remunerate *unskilled* labor; and that agriculturists, and others engaged in the ordinary occupations of the country, would only lose their time by turning gold hunters.

Some regular work has been tried on the Touffe des Pins, in the Seigniorie of Vaudreuil, Beauce, but I am not aware of the quantity of gold obtained or the cost paid. I have however seen many pieces of the metal from the locality; and it appears to me there is a greater number of large pieces procured there than on the Rivière du Loup; the largest I have seen from the Touffe des Pins lacks two penny-weights of four ounces. The largest piece obtained on the Rivière du Loup weighed under two ounces.

FROM THE REPORT OF MAY 16, 1852.

PAGE 121.

The specific gravity of several worn fragments of the gold from the Rivière du Loup, was found to be as follows:—15·761—16·490—16·654—17·60—17·77. The third specimen (1) after being hammered out to a thin plate and twice annealed, had a specific gravity of 17·024, and the fifth (II) after the same process, 17·848. These two were analysed by solution in aqua-regia and determining the amount of chlorid of silver. The gold was calculated from the loss; the solutions containing besides only traces of iron and copper. A third specimen of gold in fine scales (III) had a specific gravity of 16·57. The results of the three analyses are as follows:—

	I.	II.	III.
Gold.....	86·40.....	87·77.....	89·24
Silver.....	13·60.....	12·23.....	10·76
	100·00	100·00	100·00

In these specimens there does not appear any proportion between the specific gravity and the amount of alloy. The condensation on hammering seems to be by no means alike in the two specimens. Perhaps the previous fusion of the gold would render more evident the relation between its purity and specific gravity. A fragment of 7·5 grammes weight, which appeared to be free from cavities or foreign impurities, had a specific gravity of 15·761, and by a prolonged fusion with nitre and carbonate of soda, lost 1·76 per cent of its weight, and acquired a specific gravity of 17·43. The pure gold from the previous assays, precipitated from its solution by oxalic acid, and fused with nitre, had a specific gravity of 18·685.

FROM THE REPORT OF MAY 1, 1853.

PAGES 70—73.

In the month of December,* a few days were devoted to a farther examination of the distribution of this metal in the Eastern Townships, and particles of it were found in the valley of the St. Francis, at various intervals from Richmond to Hunting's mills on the Salmon river flowing into the Massawippi a little above Lennoxville. Though the weather was rather adverse to the examination, on account of cold and frost, yet the results were much the same as those of similar previous explorations farther to the east. One of the positions examined was on the road passing to the north of the mill-pond on the Magog river above Sherbrooke, where particles were met with in an ancient hard-bound gravel, which probably has never been disturbed since the time when the surface arose from beneath a tertiary sea. The position is about 156 feet above the level of the St. Francis at Sherbrooke, and would probably be over 600 feet above the St. Lawrence in Lake St. Peter; this fact serves to shew that the metal is not confined to the lowest parts of the valleys, but will have a distribution co-extensive with the original drift of the district.†

It may be considered that the auriferous drift has now been shown to exist over 10,000 square miles on the south side of the St. Lawrence, comprehending the prolongation of the Green Mountains into Canada, and the country on the south-east side of them. In following the range of this drift north-eastwardly, the researches of the Survey have not extended beyond Etchemin Lake; but the general similarity of the rocks beyond, renders it probable that little change will be found for a distance extending much farther, perhaps to the extremity of Gaspé. It may be proper to remark that though the ascertained auriferous area is thus so much increased beyond the measure given to it in a previous Report, no fact has come to my knowledge of sufficient importance to authorise any change in the opinion that has already been expressed, that the

* Of the preceding year, 1852. † See page 17.

deposit will not in general remunerate *unskilled* labor; and that agriculturists, artisans, and others engaged in the ordinary occupations of the country, would only lose their labor by turning gold hunters.

In the examination of the valley of the St. Francis, one of the spots tried was in the immediate vicinity of the quartz vein holding copper pyrites, mentioned in the Report for 1847-48, as occurring in the seventeenth lot of the seventh range of Ascot, belonging to Mr. Moes. In that Report it was stated that the copper pyrites was auriferous, and in corroboration of the fact, a small unworn but loose octohedral crystal of gold was on this occasion, obtained from a crevice, in a two-inch string of quartz spotted with copper pyrites, which appears to be subordinate to the principal vein.

This vein occurs in a mass of talcose slate, supposed to belong to the Lower Silurian series; but from a vein on the river Du Loup, specimens of quartz and iron pyrites have lately been brought me derived from the clay slates of the Upper Silurian series, and in some of these, traces of gold have been met with. The metal thus appears to belong to the veins of both the lower and upper series.

FROM THE REPORT OF 1853—56.

PAGES 370, 371.

A vein which occurs at the rapids of the Chaudière, in the parish of St. François (Beauce), contains in a gangue of quartz, galena, blende, arsenical sulphuret of iron often well crystallized, besides cubic and magnetic iron pyrites, and native gold in minute grains. A portion of galena from the assorted and washed ore, still containing a mixture of blende and pyrites, gave by assay 69.0 p. c. of lead, and thirty-two ounces of silver to the ton (2240 pounds) of ore. Another sample of the galena more carefully dressed, gave at the rate of thirty-seven ounces of silver. The button of silver obtained by cupellation from this lead, contained a small but appreciable quantity of gold. The assay of a second portion of the sample of ore which gave 69.0 per cent. of lead, afforded by cupellation a quantity of silver equal to not less than

256 ounces of silver to the ton. This amount of silver was probably due to the presence of a fragment of some silver ore, perhaps a sulphuret, in the mixture of crushed and dressed galena. These assays were each made upon 500 grains. 1000 grains of the pyrites from this vein, mixed with a little blende, galena, and arsenical ore, were roasted; and then being mingled with litharge, borax and salt of tartar, were fused with the addition of fragments of iron, and a button of lead obtained; which left by cupellation a globule of 0.15 grains of an alloy of gold and silver. 700 grains of the impure blende were then roasted and treated in a similar manner, and gave by cupellation 0.19 grains of a pale yellow alloy; the buttons thus obtained contained a large proportion of gold, especially that from the blende, which retained its form and assumed a deep yellow color, when after having been beaten out, it was boiled with nitric acid, which dissolved a portion of silver.

A quantity of gold dust from the washing of the sands of the Rivière du Loup, was submitted to amalgamation, and left one-third of its weight of black ferruginous sand, of which eighteen per cent. were separable by the magnet; the non-magnetic portion was dissolved by the successive action of hydrochloric acid and bisulphate of potash, leaving 4.8 per cent. of silicious residue. The solutions contained iron and chromium, and gave by prolonged ebullition, 23.15 per cent. of titanitic acid. The mingled solutions afforded no trace of tin by hydrosulphuric acid, and were examined without success for uranium, cerium and the rarer bases. The frequent presence of tin ore in the auriferous gravel of different countries, should encourage us to search for that valuable metal in our own gold-bearing region. Samarskite, monazite, and other minerals containing uranium, cerium, etc., are also sometimes met with in this association, and hence these bases were sought for in the above examination.

The gold obtained by the distillation of the amalgam, lost 4.27 per cent. by fusion with borax, and the assay of the resulting ingot gave 12.87 per cent. of silver. Thirty grammes of this alloy were dissolved in aqua regia, and the solution examined without success for copper and palladium; a minute portion of platinum, amounting to .0012 per cent., was however obtained. The remaining portion of the alloy was pure gold.

FROM THE GENERAL REPORT, 1863.

PAGES 518—520.

The existence of gold in the sands of the Chaudière valley was first made known by Lieutenant, now General Baddeley, R. E., in 1835 [Am. Jour. Sci. (1), xxviii, p. 112]; and within the last twelve years repeated examinations have shown that the precious metal is not confined to that region, but exists in the superficial deposits of a wide region on the south side of the St. Lawrence extending from the St. Francis to the Etchemin River, and from the first line of hills on the north-west to the province line on the south-east. The source of the gold appears to be the crystalline schists of the Notre Dame range; and the materials derived from their disintegration, not only constitute the superficial material among the hills of this range, but are spread over a considerable area to the south of them. These same gold-bearing rocks may be traced south-westwardly, along the great Appalachian chain to the southern United States, and are supposed to belong for the most part to the Quebec group. Native gold has however been found in small grains with galena, blende, and pyrites, in a well defined quartz vein, cutting slates which are supposed to be of Upper Silurian age, at the rapids of St. Francis, on the Chaudière.* In Leeds, at Nutbrown's shaft, masses of native gold of several pennyweights are found with copper-glance and specular iron ore, in a vein of bitter-spar; and small grains of the metal have also been found imbedded in the white garnet-rock described

* In 1862, another quartz vein was opened about 100 yards from the last, and has yielded fine specimens of native gold, associated with arsenical pyrites. In 1863, native gold was discovered in a quartz vein with vitreous copper ore, at what is called the Chaudière copper mine, in the rear part of the seigniory of St. Giles. An assay of this quartz by Dr. Hayes of Boston yielded only $6\frac{1}{2}$ pennyweights of gold to the ton. Gold has also recently been found in a vein at the Halifax copper mines, by George Pierce, Esq., and an assay of the vein-stone from this place gave about the same proportion of the precious metal as the quartz from St. Giles. Traces of gold have also been found in a decomposing pyrites from Moulton Hill in Ascot, and it has recently been met with in Ditton.

on page 496.* These latter localities belong to the rocks of the Quebec group; but the precious metal has rarely been found in place, and the working of it in Canada has been confined to the superficial deposits of clay, sand, and gravel already mentioned. The occasional occurrence in these of pieces of gold partially imbedded in quartz, shows that it was derived, in part at least, from beds or veins of this mineral, which are common among the talcoïd slates of the region. The observations among the gold-bearing rocks of the Southern States seem to show that the precious metal was originally deposited in the beds of various sedimentary rocks, such as slates, quartzites, and limestones, and that by a subsequent process it has been, in some instances, accumulated in the veins which intersect these rocks. The formation of these veins would seem, from the one above described at St. Francis, to be subsequent to the Silurian period. The same considerations apply to the copper and lead ores of the Eastern Townships.

The gold is found very generally disseminated throughout the diluvial deposits over the region already designated in Canada, and is not confined to the river-beds; the action which distributed the gravel over the surface being anterior to the formation of the present water-courses. When, by the process of washing, the heavier portions of the auriferous gravel have been brought together, they are found to contain abundance of black ferruginous ores, consisting of magnetic iron, hematite, both specular and compact, chromic iron and ilmenite; with occasional grains of garnet, rutile, and more rarely zircon and corundum. The gold is in grains, sometimes angular, but more often rounded, and varying in size from masses of half a pound weight to a fine dust, which last is separated by amalgamation from the black iron-sand. [Here follow the chemical examinations, which have already been given on pages 27, 29, and 30.]

* This rock occurs with serpentine on the river Guillaume, the most northern tributary of the right bank of the Chaudière in Vaudreuil. The next one, being in the southern part of St. Joseph, is named on Bouchetta's map the Rivière des Plantes.

FROM THE GENERAL REPORT, 1863.

PAGES 739-745.

The principal facts known with regard to the geological distribution of gold in Canada will be found on pages 518-520.* Mention is there made of a quartz vein at St. Francis, on the Chaudière; where small grains of native gold have been found imbedded in quartz, together with argentiferous galena, and sulphurets of zinc and iron, both containing gold, and with arsenical pyrites. Since writing the above pages, much larger specimens of gold have been found in quartz, about one hundred yards from the locality just mentioned. It is probable that this, and similar quartz veins, may be wrought with profit; but the gold hitherto obtained from this region has been from the superficial deposits of clay, sand, and gravel, which abound there, and appear to be derived from the breaking up of the rocks that contain the gold-bearing veins. These deposits probably belong, in part to the ancient glacial drift, or boulder formation, and in part to newer stratified clays and gravels, which consist of the materials of this, modified and arranged by the subsequent action of water. On the Magog River, above Sherbrooke, particles of gold occur in a hard-bound gravel, 156 feet above the level of St. Francis, near by. On the Famine River, there is met with an extensive deposit of clay, every where overlaid by sand and gravel. Along the banks of the river, a stratum of the oxyds of iron and manganese, in some parts six or eight inches thick, is seen near the top of the gravel, filling interstices among pebbles of the rocks of the region. Gold is found in this overlying gravel, as well as in the clay beneath; both of which deposits appear to belong to the modified drift. It is met with in similar conditions throughout the banks of stratified material on the Metgermet, which attain a height of fifty feet above the bed of the river. Gold also occurs still more abundantly in the recent alluvions found in the beds and along the flats of the streams which traverse this region, and in time of floods wash down the clay and sand from their banks, depositing the heavier

* See pages 31 and 32 of this pamphlet.

portions along their course. In this way the gold is often caught in the fissures of the clay-slates, which frequently form the underlying rock, and are rich in alluvial gold.

The auriferous drift of Eastern Canada is spread over a wide area on the south side of the St. Lawrence, including the hill-country belonging to the Notre Dame range, and extending thence south and east to the boundary of the province. These wide limits are assigned, inasmuch as although gold has not been everywhere found in this region, the same mineralogical characters are met with throughout; and, in its continuation southward, in Plymouth and elsewhere in Vermont, considerable quantities of gold have been obtained from the alluvial deposits. In Canada, gold has been found on the St. Francis River from the vicinity of Melbourne to Sherbrooke, in the townships of Westbury, Weedon, and Duds-well, and on Lake St. Francis. It has also been found on the Etchemin, and on the Chaudière and nearly all its tributaries, from the seigniory of St. Mary to the frontier of the state of Maine; including the Bras, the Guillaume, the Rivière des Plantes, the Famine, the Du Loup, and the Metgermet. Several attempts have been made to work these alluvial deposits for gold, in the seigniories of Vaudreuil, Aubert-Gallion, and Aubert de l'Isle, but they have been successively abandoned, and it is difficult to obtain authentic accounts of the result of the various workings, although it is known that very considerable quantities of gold were extracted. The country people still, from time to time, attempt the washing of the gravel, generally with the aid of a pan, and are occasionally rewarded by the discovery of a nugget of considerable value. In the years 1851 and 1852, an experiment of this kind, on a considerable scale, was tried by the Canada Gold Mining Company, in the last named seigniory, on the Rivière du Loup, near its junction with the Chaudière. The system adopted for the separation of the gold from the gravel was similar to that used in Cornwall in washing for alluvial tin, and the water for the purpose was obtained from a small stream adjoining. Great difficulties were however met with, from a deficient supply of water during the summer months. The gravel from about three eighths of an acre, with an average thickness of two feet, was washed during the summer of 1851, and yielded 2,107 pennyweights of gold; of which 160 were in the

form of fine dust, mingled with about a ton of black iron-sand, the heavy residue of the washings. There were several pieces of gold weighing over an ounce. The value of this gold was \$1,826, and the whole expenditure connected with the working \$1,643; leaving a profit of \$182. In this account is however included \$500 lost by a flood, which swept away an unfinished dam; so that the real difference between the amount of the wages and the value of the gold obtained should be stated at \$682. The average price of the labor employed was sixty cents a day. In 1852 about five eighths of an acre of gravel were washed at this place, and the total amount of gold obtained was 2,880 pennyweights, valued at \$2,496. Of this, 307 pennyweights were in the form of fine dust mixed with the iron-sand. A portion was also found in nuggets or rounded masses of considerable size. Nine of these weighed together 468 pennyweights, the largest being about 127, and the smallest about 11 pennyweights. Portions both of native platinum and of iridosmine were obtained in the washing, but the quantity of these was too small to be of any importance. The washing season lasted from the twenty-fourth of May to the thirtieth of October, and the sum expended for labor was \$1,888, leaving a profit of \$608. A part of this expenditure was however for the construction of wooden conductors for bringing the water a distance of about 900 feet from the small stream. As this work would be available for several years to come, a proper allowance made for it would leave a profit in the year's labor of about \$680. It thus appears that from an acre of the gravel, with an average thickness of two feet, there were taken \$4,323 of gold; while the expenses of labor, after deducting, as above, all which was not directly employed in extracting gold, were \$2,957, leaving a profit of \$1,366. The result of a week's working at this place, under the inspection of a member of the Geological Survey, in 1852, showed a yield of 143 pennyweights of gold, valued at \$124; while the amount paid for wages to the miners during that time was \$60. In a previous trial on the Touffe des Pins, a small tributary of the Chaudière, sixty bushels of the gravel from the bed of the stream were washed in a day, by means of a rocker, or kind of shaking-table, and yielded 440 grains of gold; or about seven or one third grains to

the bushel. The gold of this region is, as usual, alloyed with a portion of silver. The fineness of the gold-dust was 871 thousandths. Another sample of gold, in thin scales, gave 892, and small masses 864; while a nugget from Vaudreuil yielded 867 thousandths of gold.

The composition of the heavy black sand, which is obtained in the washing of the gravel, has been noticed on page 520.* It is a mixture of magnetic oxyd and peroxyd of iron, with chromic and titanitic iron ores. Rolled masses of these ores, sometimes several pounds in weight, are also met with in the gravel. Small crystals of rutile were obtained in the washings; and grains of red and pink sand, chiefly composed of grains of garnets, but including a few minute crystals having the form of zircon. The gold was not unfrequently incrustated with an earthy coating of black oxyd of manganese; and some specimens were white on the surface, from a coating of mercury; which is however at once driven off by heat, leaving the gold of its natural color. A single well-worn and rounded mass of native copper, several ounces in weight, was found in the gravel in this region; and in the washings at the Rivière du Loup, were large quantities of leaden shot of various sizes, probably scattered by sportsmen.

Although the greater part of the gold at the Rivière du Loup was extracted from the gravel on the alluvial flats by the river-side, a portion was obtained by washing the material taken from the banks above. As has been before remarked, the distribution of the gold-bearing drift over the surface of the country took place before the formation of the present water-courses; and the greater richness of the gravel from their beds is to be ascribed to the fact that these rapid streams have subjected the earth to a partial washing, carrying away the lighter materials, and leaving the gold with the heavier matters behind. According to Mr. Blake, it is found in California that the gold in the diluvial deposits, which has not been subsequently disturbed by the streams, is not uniformly distributed, but is accumulated here and there in quantities greater than in other places. During the first deposition of the

* See pages 30 and 32.

earth and gravel, the precious metal became accumulated in depressions of the surface-rock, constituting what are there called pockets by the miners.

It would appear from the facts here given that the quantity of gold in the valley of the Chaudière is such as would be remunerative to skilled labor, and should encourage the outlay of capital. There is no reason for supposing that the proportion of the precious metal to be found along the St. Francis, the Etchemin, and their various tributaries, is less considerable than that of the Chaudière. What is called the hydraulic method of washing such deposits is adopted on a great scale in California, and to some extent in the states of Georgia and North Carolina. "In this method, the force of a jet of water, with great pressure, is made available both for excavating and washing the auriferous earth. The water, issuing in a continuous stream, with great force, from a large hose-pipe, like that of a fire-engine, is directed against the base of a bank of earth and gravel, and tears it away. The bank is rapidly undermined, the gravel is loosened, violently rolled together, and cleansed from any adhering particles of gold; while the fine sand and clay are carried off by the water. In this manner hundreds of tons of earth and gravel may be removed, and all the gold which they contain liberated and secured, with greater ease and expedition than ten tons could be excavated and washed in the old way. All the earth and gravel of a deposit is moved, washed, and carried off through long sluices by the water, leaving the gold behind. Square acres of earth on the hill-sides may thus be swept away into the hollows, without the aid of a pick or a shovel in excavation. Water performs all the labor, moving and washing the earth in one operation; while in excavating by hand, the two processes are of necessity entirely distinct. The value of this method, and the yield of gold by it, as compared with the older one, can hardly be estimated. The water acts constantly, with uniform effect, and can be brought to bear upon almost any point, where it would be difficult for men to work. It is especially effective in a region covered by trees, where the tangled roots would greatly regard the labor of workmen. In such places, the stream of water washes out the earth from below, and tree after tree falls before the current, any

gold which may have adhered to the roots being washed away. With a pressure of sixty feet, and a pipe from one and a half to two inches aperture, over a thousand bushels of earth can be washed out from a bank in a day. Earth which contains only one twenty-fifth part of a grain of gold, equal to one fifth of a cent in value to the bushel, may be profitably washed by this method; and any earth or gravel which will pay the expense of washing in the old way, gives enormous profits by the new process. To wash successfully in this way requires a plentiful supply of water, at an elevation of fifty to ninety feet above the bed-rock, and a rapid slope or descent from the base of the bank of earth to be washed, so that the waste water will run off through the sluices, bearing with it gravel, sand, and the suspended clay."

The above description has been copied from a report on the gold mines of Georgia, by Mr. William P. Blake, who has carefully studied this method of mining in California, and by whose recommendation it has been introduced into the Southern States. He tells us that in the case of a deposit in North Carolina, where ten men were required, for thirty-five days, to dig the earth with pick and shovel, and wash it in sluices, two men, with a single jet of water, would accomplish the same work in a week. The great economy of this method is manifest from the fact that many old deposits in the river-beds, the gravel of which had been already washed by hand, have been again washed with profit by the hydraulic method. He tells us that in California the whole art of working the diluvial gold-deposits was revolutionized by this new method. The auriferous earth, lying on hills, and at some distance above the level of the water-courses, would, in the ordinary methods, be excavated by hand, and brought to the water; but by the present system, the water is brought by aqueducts to the gold-deposits, and whole square miles, which were before inaccessible, have yielded up their precious metal. It sometimes happens, from the irregular distribution of the gold in the diluvium in California, that the upper portions of a deposit do not contain gold enough to be washed by the ordinary methods; and would thus have to be removed, at a considerable expense, in order to reach the richer portions below. By the hydraulic method however, the

cost of cutting away and excavating is so trifling, that there is scarcely any bank of earth which will not pay the expense of washing down, in order to reach the richer deposits of gold beneath.

The aqueducts or canals for the mining districts of California are seldom constructed by the gold-workers themselves, but by capitalists, who rent the water to the miners. The cost of one of these canals, carrying the waters of a branch of the Yuba River to Nevada County, was estimated at a million of dollars; and another one, thirty miles in length, running to the same district, cost \$500,000. The assessed value of these various canals in 1857, was stated to be over four millions of dollars, of which value one half was in the single county of Eldorado. The Bear River and Auburn Canal is sixty miles in length, three feet deep, and four wide at the top, and cost in all \$1,600,000; notwithstanding which, the water-rents were so great that it is stated to have paid a yearly dividend of twenty per cent.; while other similar canals paid from three to five and six per cent., and even more, monthly. The price of the water was fixed at so much the inch, for each day of eight or ten hours. This price was at first about three dollars, but by competition it has now been greatly reduced.

From these statements, it will be seen that the great riches which have of late years been drawn from the gold mines of California, have not been obtained without the expenditure of large amounts of money and engineering skill. This last is especially exhibited in the construction of these great canals, and the application of the hydraulic method to the washing of auriferous deposits which were unavailable by the ordinary modes of working, on account of their distance from water-courses, or by reason of the small quantity of gold which they contain.

In order to judge of the applicability of this method of washing to our own auriferous deposits, a simple calculation based upon the experiments upon the Rivière du Loup will be of use. It has been shown that the washing of the ground over an area of one acre, and with an average depth of two feet, equal to 87,120 cubic feet, gave in round numbers, about 5000 pennyweights of gold, or one and thirty-eight hundredths grains to the cubic foot; which is equal

to one and three-quarters grains of gold to the bushel. Now, according to Mr. Blake, earth containing one forty-fourth part of this amount, or one twenty-fifth of a grain of gold, can be profitably washed by the hydraulic method ; while the labor of two men, with a proper jet of water, suffices to wash one thousand bushels in a day ; which, in a deposit like that of Rivière du Loup, would contain about seventy-three pennyweights of gold. It is probable however that a certain portion of the finer gold dust, which is collected in the ordinary process, would be lost in working on the larger scale. It has already been shown that the gold in Canada is not confined to the gravel of the river channels, and the alluvial flats ; but it is found on the Metgermet and St. Francis Rivers, at from fifty to a hundred and fifty feet above their beds ; and although its proportion were to be many times less than in the gravel of the Rivière du Loup, these thick deposits, which extend over great areas, might be profitably worked by the hydraulic method. The fall in most of the tributaries of the Chaudière and of the St. Francis, throughout the auriferous region, is such that it would not be difficult to secure a supply of water with a sufficient head, without a very great expenditure in the construction of canals ; and it may reasonably be expected that before long the deposits of gold-bearing earth, which are so widely spread over south-eastern Canada, will be made economically available.

