GEOLOGICAL SURVEY OF CANADA.

DESCRIPTIVE CATALOGUE

OF A COLLECTION OF THE

ECONOMIC MINERALS OF CANADA,

AND OF ITS

CRYSTALLINE ROCKS.

SENT TO THE

LONDON INTERNATIONAL EXHIBITION

FOR

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Montreal
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ECONOMIC MINERALS OF CANADA.

BY SIR W. E. LOGAN, F.R.S.

In this Catalogue the classification of the Minerals is wholly technical, each substance being arranged under a heading connected with some one of its more prominent applications. There is given with each material the place from which it comes, and the name of the exhibitor, the latter in Italics. Beneath these is placed a list of the objects presented by each exhibitor, and a short description of the contribution, which is always terminated with an indication of the geological formation from which the substance is derived; reference being made to its Canadian designation, and in general to the English group or system in which the formation is included. These designations are also in Italics. The headings under which the Minerals are classed, are as follows:—

1.

METALS AND THEIR ORES.

IRON.

Bog Iron Ore or Limonite.

1. Radnor Forges, Batiscan .....*A. Larue & Co., Three Rivers.*

a. Three pieces of bog ore of different qualities, ready for the furnace.
b. Washed bog ore, ready for the furnace.
c. Slag from the smelting.
d. Limestone used as flux.
e. Sandstone used for furnace hearths.
f. Moulding sand of the neighborhood.
g. " " imported from Waterford, State of New York.
h. Charcoal used in smelting.
i. Five qualities of pig iron, Nos. 1, 2, 3, 4, 5. No. 3 with a polished face.
k. One piece of pig iron, re-cast from Nos. 2, 3, and 4, using anthracite.
l. One railway wheel, with a piece showing chill.
m. One section of wheel, showing chill.
n. Three nail rods.
o. Two sizes of horse-shoe nails.
p. One piece scythe iron.
q. One " " " beaten with hammer.
r. One pair of railway wheels and axle, which have run 150,000 miles.

Deposits of bog iron ore, in greater or less abundance, are spread out in patches on the north side of the St. Lawrence, and between it and the foot of the Laurentide Hills, all the way from Ste. Anne des Plaines to Portneuf; a distance exceeding a hundred miles. In this area, the ore seems to be most concentrated in the neighborhood of the St. Maurice and Batiscan Rivers, and iron has been smelted in the neighborhood of Three Rivers for upwards of a century. The St. Maurice Forges were established in 1737, and continued in operation until 1858. They were supplied with ore (all of it limonite), and with charcoal, from the seigniory of St. Maurice, including the fief St. Etienne; which were leased to the Smelting Company by the Crown. In 1831, according to Bouchette, from 250 to 300 persons were employed at the establishment, which had always been celebrated for the excellence of its iron; but the ore and wood becoming exhausted, and the Radnor Forges having been erected in the seigniory of Cap de la Madelaine, on the Rivière au Lard, a tributary of the Champlain River, in a vicinity where the ore and wood are still abundant, the St. Maurice forges went out of blast. The ore with which the Radnor furnaces are supplied, is derived from the seigniories of Cap de la Madelaine and Champlain, where it occurs close to the surface, in a multitude of patches distributed over the country, with a thickness of from three to twenty-four inches. It is brought to the furnaces, partly by the workmen of the Company, and partly by the various farmers on whose lands the ore occurs. The chief manufacture of the Company consists of cast-iron car wheels, the price of which at the forges is $2\frac{5}{8}$ cents per lb. A rolling-mill has recently been erected at the establishment for the rolling of malleable iron of superior quality, such as scythe iron, the price of which is $3\frac{1}{2}$ cents per lb., and nail-rod iron, the selling price being $5\frac{1}{2}$ cents per lb. Limestone, as a flux for smelting the ore, is obtained from the Trenton group, at the works; and sandstone for furnace hearths at the Grès rapids, on the St. Maurice, where it used formerly to be obtained by the St. Maurice Company. This quartzose sandstone belongs to

the Potsdam formation, part of the lowest group of the Lower Silurian series of rocks. Being in this locality of a freer texture than the same beds in other parts of the province, it has been found capable of resisting a very strong heat without injury. Blocks of from twelve to fourteen inches thick, four feet long and twenty inches wide, do not require renewal oftener than once in two years. The ore is washed at the smelting works, to free it from soil, and it then contains between forty and fifty per cent. of iron. The quantity used annually is between 4000 and 5000 tons, producing about 2000 tons of pig iron, and the number of workmen employed varies from 200 to 400; a great many hands being required at certain periods, to excavate and bring in the ore, and to prepare and transport the charcoal.—*Alluvion.*

2. Vaudreuil, County of Vaudreuil..... *Geological Survey.*

a. Specimens of bog iron ore.

A bed extending over several lots on the Côte St. Charles, in the seigniory of Vaudreuil, at the confluence of the rivers Ottawa and St. Lawrence. The bed is in many places from four to eight feet thick, and there lies beneath it, in some parts, a thin stratum of blue phosphate of iron. This bog iron ore contains about fifty per cent. of iron, but it has never been worked.—*Alluvion.*

3. St. Vallier, County of Bellechasse .... *Geological Survey.*

a. Specimens of bog iron ore.

An interrupted bed extending over an area of ten or fifteen square miles, near the junction of the two branches of the Rivière du Sud, county of Bellechasse. The patches are from one to ten acres in superficies, and from twelve to twenty inches thick. The specimens are from the property of Capt. Morin, and the ore, which has never been worked, contains about fifty per cent. of iron.—*Alluvion.*

Red Hematite or Oligist Ore.

1. MacNab, lot 6, concessions C and D..... *Geological Survey.*

a. Specimen of red hematite ore.

An unworked bed of thirty feet thick, containing by analysis about fifty-eight per cent. of iron. The bed rests upon crystalline Laurentian limestone, and is limited, at the top, by a magnesian limestone belonging to the Calciferous formation of the Lower Silurian era. It occurs near the Fall of the Dochart, within a quarter of a mile of the shore of Lac des Chats, an expansion of the Ottawa River.—*Laurentian.*

2. Sutton, lot 9, range 11 ..... *Geological Survey.*

a. Specimens of red hematite ore.

A bed of seven feet thick in chlorite slate, on the property of Mr. L. H. Smith. Different portions of the bed yield from twenty to fifty per cent. of iron.—*Quebec group, Lower Silurian.*

3. Sutton, lot 6, range 9 ..... *Geological Survey.*

a. Specimen of red hematite ore.

A bed of seven feet thick, occurring in chlorite slate, and presenting, where exposed, the form of an anticlinal arch, which spans a breadth of thirty feet. The ore is much mixed with chlorite, and has yielded to analysis, about twenty-three per cent. of iron. The bed is on the property of Mr. B. Mudget.—*Quebec group, Lower Silurian.*

4. Brome, lot 3, range 1..... *Geological Survey.*

a. Specimen of hematite ore.

A bed in chlorite slate. The thickness of the bed is five feet, but it presents the crown of a sharp anticlinal fold, which doubles it up, and gives it an apparent breadth of ten feet. The ore may contain about forty per cent. of iron. This bed is on the property of Mr. Reed Sweet, and with a neighboring one of eighteen feet, was formerly quarried for ore, which was conveyed a distance of thirty or forty miles to the town of Troy, on the south side of the province line, in Vermont, and was smelted with the magnetic oxyd, procured from the serpentine in that vicinity.—*Quebec group, Lower Silurian.*

N.B.—Ores similar to those of the last three localities, are exposed in a great number of places in St. Armand, Sutton, and Brome, running in a bearing N. 30° E. The exposures are distributed over a breadth of about a mile, and many of them are repetitions of the same beds, through the effect of undulations. The beds are made up of hematitic iron, mixed with grains of quartz and chlorite; in some the oxyd of iron predominates, constituting a rich iron ore, while in others the earthy minerals are in excess, and the rock passes into the ordinary slates of the country. These iron ores often contain a portion of titanium, as rutile, ilmenite, or sphene; in some the peroxyd is mixed with magnetic oxyd of iron.

Magnetic Iron Ore.

1. Sutton, lot 9, range 9 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed of twelve feet thick, consisting of dolomite abounding in small crystals of the magnetic oxyd of iron, which equals in many specimens, about 56 per cent. of the mass; thus giving an iron ore containing about thirty-eight per cent. of metal. The ore is on the east side of a band of dolomite, varying in thickness from twelve to thirty-two yards, on the west side of which there is an irregular bed of red hematite one foot thick. Two other bands of dolomite run parallel with the one mentioned, all in the space of 100 yards, on the property of Mr. Oramel Stutson.—*Quebec group, Lower Silurian.*

2. Marmora Iron Mine, Belmont, lot 8, range 1..... *Geological Survey.*

a. Specimens of magnetic iron ore.

A mine commonly known as the *Big iron ore bed of Marmora.* It appears, however, not to be a single bed, but a succession of them (one measuring 100 feet in thickness), interstratified with thin bands of crystalline limestone and talcose slate, associated with diallage rock, serpentine, and epidosite. The total breadth of the mass is eight chains, and it is interstratified between gneiss and crystalline limestone, with a dip N. W. $< 25° - 50°$. The ore contains between sixty and seventy per cent. of iron. Many years ago a furnace was erected at Marmora to smelt it, and iron of superior quality was manufactured. More recently, different companies have for short periods renewed smelting operations, with very satisfactory results in respect to the quality of the iron produced; but the distance of the place from a shipping port has proved a serious obstacle to success. At present the furnace is not in blast.—*Laurentian.*

3. Newborough, S. Crosby, lots 26 and 27, range 6 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed of 200 feet thick in gneiss. It is situated on Mud Lake, a part of the Rideau Canal, and is the property of Messrs. G. Chaffey and Brothers, who mine the ore, and supply it at Kingston for $2\frac{1}{2}$ dollars the ton, to vessels which carry it as back freight to Cleveland, on Lake Erie; whence it finds its way to the smelting furnaces at Pittsburg on the Ohio, in the State of Pennsylvania. About 4000 tons of the ore were thus exported in 1859.—*Laurentian.*

4. Hull, lot 11, range 7 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed of about ninety feet in thickness. It is surrounded by gneiss, and appears to present the form of a dome, through the summit of which there protrudes an underlying mass of crystalline limestone. Messrs. Forsyth & Company, smelters, of Pittsburg, commenced mining this ore, in 1854, for the supply of their own furnaces at Pittsburg, exporting the ore by the way of Kingston, on Lake Ontario, to which it was conveyed by the Rideau Canal. Up to 1858 they had exported about 8000 tons of ore, but the opening of the Newborough mine, more favorably situated in regard to the shipping port, induced them to obtain their supply from the latter, and no ore is now exported from Hull. The ore contains between sixty and seventy per cent. of iron. In some parts of the bed it is mingled with a little graphite.—*Laurentian.*

5. Grenville, lot 3, range 3..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed of about ten feet thick in gneiss, on the property of Mr. Thomas Loughran.—*Laurentian.*

6. Grandison..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed of about twenty feet thick in gneiss, on government land.—*Laurentian.*

7. Madoc, lot 11, range 5..... *G. Seymour, Madoc.*

a. Specimens of magnetic iron ore.

A bed of twenty-five feet thick in gneiss, on the property of Mr. Seymour, the exhibitor, who formerly smelted the ore at his own furnace, making from it iron of a very fine quality. The furnace is not now in blast. The ore is very free from sulphur, and yields to analysis about seventy per cent. of iron. The beds of rock in immediate contact with the ore are soft, black, and very micaceous, and thin seams of a similar character appear occasionally to cut the ore bed diagonally. Masses of actinolite are disseminated in the ore, and yellow uranite has been found investing small cracks. The ore is a natural magnet, displaying strong polarity.—*Laurentian.*

8. South Sherbrooke, lot 14, range 1 ..... *A. Cowan, Kingston.*

a. Specimen of magnetic iron ore.

A bed of about twelve feet thick in gneiss. The ore, which contains between sixty and seventy per cent. of iron, is of very uniform character. The proprietor has recently mined about 300 tons, which are about to be drawn to the Rideau Canal. A small quantity of it has been tried at Mr. Gzowski's iron works, at Toronto, and the ore is found to be well adapted for lining furnaces.—*Laurentian.*

9. Hastings Road, N. side ..... *John Orton, Hastings Road.*

a. Specimen of magnetic iron ore.

A bed in gneiss, the property of the exhibitor.—*Laurentian.*

Ilmenite or Titaniferous Iron Ore with Rutile.

1. St. Urbain, Bay St. Paul..... *Geological Survey.*

a. Specimen of Ilmenite.

A bed of ninety feet thick, which is exposed for 300 feet on the strike, and is traceable for about a mile. The ore has yielded to analysis:—

Oxyd of titanium.....	48·60
Protoxyd of iron.....	46·44
Magnesia.....	3·60
	98·64

In some parts of the bed, rutile is disseminated in the ilmenite, in small red crystalline grains. The ore is interstratified in anorthosite rock.—*Laurentian.*

LEAD.

Galena or Sulphuret of Lead.

1. Gaspé, Indian Cove ..... *C. C. Closter, Gaspé Basin.*

a. Undressed lead ore from the lode.

b. Hand-picked prills.

A vein transversely cutting stratified limestone, which dips about S. W. $< 24°$ and rises northward into a hill about 700 feet in height, constituting Gaspé promontory. The vein has a width of about eighteen inches, and is composed of calcspar, holding disseminated masses of galena. A trial shaft of twenty feet in depth, has been sunk on the vein, and from this and from several small veins running parallel with the main one, about six tons of ore of sixty per cent. have been obtained.—*Lower Helderberg group, Upper Silurian.*

2. Upton, lots 50, 51, range 4..... *James Wright & Co.*

a. Undressed lead ore.

A bed composed of dolomite, with irregularly disseminated patches of galena, varying in thickness from one to four inches, but not easily traceable on the strike. The bed occurs in the upper part of a band of dolomite of from 200 to 300 feet thick, which has been followed a long distance through the country.—*Quebec group, Lower Silurian.*

3. Ramsay Mines, Ramsay, lot 3, range 6..... *Foley & Co., Montreal.*

a. Prills of lead ore as taken from the lode.

b. Hand-picked prill.

c. Sorted lead ore, prepared for the crusher.

d. Pig lead run from the furnace.

e. Slag, from the smelting of eighty per cent. ore.

f. A plan of the mine by Mr. E. Banfield.

A vein cutting nearly horizontal beds of grey, geodiferous, brown-weathering dolomite. The vein is composed of calcspar, and has a breadth varying from two and a half to five feet, in which the galena is disseminated in a width of from eight to twenty-four inches. In some portions the vein is almost dead ground, while in others, judging by the eye, it would yield nearly two tons of eighty per cent. ore per fathom. The bearing of the lode is about N. W., and its underlie to the north-eastward, about a foot in a fathom. A trial

shaft has been sunk on the lode to the depth of thirty-seven feet, and the working of seventy-five fathoms of ground, in 1858, yielded twenty-six tons of ore of eighty per cent. A smelting furnace was erected to reduce the ore, and a ten horse-power engine used to give blast to the furnace and dry the shaft, but a considerable spring of water having been struck, it became necessary to erect a more powerful engine, and one of fifty horse-power has just been completed. The dolomite is underlaid conformably by sandstone, which crops out about a mile from the mine, and is unconformably supported by crystalline limestone and gneiss of Laurentian age. About 105 fathoms south-eastward from the main shaft, a counter-lode joins the main one, at an angle of about 20°; its course being nearly N. N. E. and S. S. W. At the junction of the two lodes a shaft has been sunk in sandstone, to a depth of twenty-one feet, and in the excavation of the pit in which the united lodes have a breadth of ten feet, there have been obtained about seven tons of ore of twenty per cent.—*Calciferous formation, Lower Silurian.*

4. Lansdowne, lot 3, range 8..... *Geological Survey.*

a. Undressed lead ore.

b. Plan of lodes by Mr. E. Banfield.

Ore from a vein cutting crystalline limestone, and running N. 60° W. The vein has a thickness of from six to twelve inches, and is composed of calcspar, in which the galena is disseminated in lumps; which, in a trial shaft of about fifty feet, sunk in 1854, on the land of Mr. Buel, were sufficient to pay the expenses. The largest of these lumps may have been five or six inches in width. A counter-lode diverges from the main one near the shaft, and in this neighborhood, there occur four additional lead-bearing veins, running parallel with the main one, all contained in a breadth of about 1000 feet. They run obliquely across the lots, and thus intersect the lands of several proprietors. On lot four of the same range, Messrs. Foley & Co., of Montreal, have sunk a small shaft on one of the lodes.—*Laurentian.*

5. Bedford, lot 19, range 7 ..... *Geological Survey.*

a. Undressed lead ore.

Ore from one of five nearly parallel lodes, cutting crystalline limestone, in a breadth of about a quarter of a mile, on the property of Mr. Weston Hunt, of Quebec. The gangue of the lode is a mixture of heavy spar and calcspar. About a mile to the eastward of these, are other nearly parallel lodes, also cutting crystalline limestone, on land belonging to the same proprietor. Shallow trial shafts were many years ago sunk on some of these, but what quantity of lead ore was obtained in them, is not known. On lot 13, range 5, of Bedford, Messrs. Foley & Co. of Montreal, have sunk a trial shaft to a depth of fourteen feet, on a lead-bearing lode of six inches, of which the gangue is heavy spar. It cuts crystalline limestone, and reaches gneiss, and in both rocks shows good bunches of ore. This lode is about three miles south-west from those first mentioned, and runs parallel with them.—*Laurentian.*

N.B.—The distance between the Lansdowne and Bedford lodes is about twenty-five miles; they bear for one another, and it appears not at all improbable that the veins in the two localities may be identical, or belong to one group. If a line from the Bedford to the Lansdowne lodes were continued twenty-five miles farther, it would cross the St. Lawrence, and strike Rossie in St. Lawrence County, New York, where a well known group of veins of lead ore intersects Laurentian gneiss. Though just now abandoned, some of these are supposed to be still unexhausted, and two of them are known, at one period, to have yielded a great quantity of ore; one of them as much as $142 worth to a fathom. The Ramsay lode belongs to a series of veins which run parallel with those of Bedford, at a distance of about forty miles to the north-eastward, and, although the two groups cut different rocks, both are probably of one age, which would not be older than that of the *Calciferous formation* of the *Lower Silurian* series.

COPPER.

Sulphurets of Copper.

1. Escott, lot 7, range 2, near Brockville..... *Geological Survey.*

a. Yellow sulphuret of copper, with iron pyrites and magnetic oxyd of iron, from a bed running N. E. and S. W.

This bed is interstratified in gneiss, and consists of magnetic oxyd of iron of about six inches thick, which near a cutting, made for the convenience of the Grand Trunk Railway, was ascertained to be underlaid by copper pyrites. This was mined, and found to be a lenticular mass, extending about twelve feet continuously in the bed, with a thickness of ten inches in the middle. This mass was nearly pure copper pyrites, in which thin leaves of hydrated peroxyd of iron ran in cracks and joints. In some parts calcspar was present in short, thin veins and small specks, and iron pyrites was disseminated in others, increasing in quantity as it approached the north-west side; into which the copper pyrites appeared to run for short distances. Traces of cobalt occur in the iron pyrites. About twenty tons of the copper ore were obtained, but after the mass became exhausted, no excavation through the dead ground was made in search of a farther quantity. It is stated that another mass of copper ore has since been found at the surface, a short distance to the S. W. The details relating to it have not been ascertained, farther than that it is said to be three feet thick, and that a sample, which was an average of nine inches of the breadth, yielded ten per cent. of copper to the analysis of Mr. McFarlane. —*Laurentian.*

2. Bruce Mines, Lake Huron ..... *Montreal Mining Co., Montreal.*

a. Yellow and variegated sulphurets of copper, from the lode.
b. " " " rough dressed.
c. " " " jigged.
d. Rough waste from jigging on copper bottom sieves.
e. Plans of the mine, by Mr. C. H. Davie.

At the Bruce mines, a group of lodes traverses the location in a north-westward direction, intersecting a thick mass of interstratified greenstone trap. The strata here present an anticlinal form, the lodes running along the crown of it. All of the lodes contain more or less copper ore, which is disseminated in a gangue of quartz. The main lode, which is worked with another of about the same thickness, is, on an average, from two to four feet wide. In a careful examination made in 1848, about 3000 square fathoms of these lodes were computed to contain about 6½ per cent. of copper. The quantity of ore obtained from the mine, since its opening in 1847, is stated to be about 9000 tons of eighteen per cent. The quantity obtained in 1861 was 472 tons of seventeen per cent. The deepest working is fifty fathoms from the surface. The number of men employed is thirty-four. Smelting furnaces, on the reverberatory principle, were erected at the mine in 1853; the fuel used in these was bituminous coal imported from Cleveland; but after a trial of three years, the Company themselves ceased smelting, and subsequently leased their smelting works to Mr. H. R. Fletcher. At present, the ores are in part sent to the Baltimore market, and in part to the United Kingdom.—*Huronian.*

3. Wellington Mine, Lake Huron,..... *West Canada Mining Co.*

a. Yellow sulphuret of copper, from the lode.
b. Yellow and variegated sulphurets, prills.
c. " " " jigged.
d. " " " buddled.
e. " " " crushed.
f. Rough waste from jigging.
g. Fine waste from tyes.
h. Plans of the mine, by Mr. Plummer.

The lodes of the Wellington Mine are probably a north-westward continuation of those of the Bruce Mine. They are of the same general character, some of them occasionally reaching a thickness of ten feet. They occur on the ground of the Montreal Mining Company, from whom they are leased by the West Canada Mining Company at a royalty and continue into the adjoining set, called the Huron Copper Bay location, where they are worked by the same Company. The quantity of ore obtained by this Company, from the Wellington mine, since 1857, is a little over 6000 tons of twenty per cent. In 1861, the quantity was 1175 tons of nineteen per cent., and from the Huron Copper Bay mine, probably about 1300 tons; making the total quantity obtained by the two mining companies in that year about 3000 tons. The deepest working on the West Canada Company's ground is about twenty fathoms. The number of men employed on the Wellington and Copper Bay mines is supposed to be about 260. All of the ore raised by this Company is sent to the United Kingdom.—*Huronian.*

4. Acton Mine, Acton, lot 32, range 3.... *W. H. A. Davies and C. Dunkin, Montreal.*

a. Variegated sulphuret of copper, from the bed.
b. " " jigged.
c. " " rough dressed.
d. " " tye work.
e. Waste from the tyes.
f. A polished slab of the conglomerate ore.
g. Rock of the country at the mine.
h. Plan of the mine, by Messrs. Willson & Robb.

The ore of the Acton mine occurs in masses subordinate to the stratification, at the summit of a band of greyish-white and reddish-grey compact sub-crystalline dolomite, from 200 to 300 feet thick, belonging to the base of the Quebec group. The dolomite is divided into massive beds; it is associated with a good deal of chert, and encloses mammillated fibrous concretionary forms, resembling those of travertine. At the summit, the dolomite often terminates in a breccia or conglomerate, with angular and rounded masses of limestone, intermingled with ragged, irregular masses of chert. In many places the dolomite is marked by the occurrence of the yellow, variegated and vitreous sulphurets of copper, which are in patches, running with the stratification. In the neighborhood of these, many veins and strings of quartz intersect the rock, in various directions, and hold portions of the sulphurets of copper. The copper ores, which often contain native silver, appear to be more abundant in the upper part of the rock. At Acton, the conglomerate is separated from the main body of the dolomite by between eighty and ninety feet of dark grey or black slates, intermixed with diorite; in these the conglomerate lies in large isolated masses, running parallel with the summit of the main body of the dolomite. On the opening of the mine, the sulphurets, where most abundant, appeared to occupy a position immediately near some of the isolated masses of conglomerate, and partially to surround them; in some parts constituting the paste of the conglomerate. As the work proceeded, many slips and dislocations, of no great magnitude, were found to cut the strata. Some of them appear to run with the strike, and others in two of parallel series, oblique to one another. These disturb the regular continuity of the copper-bearing bed, producing apparent undulations in the dip, and causing the diorite and the limestone to protrude into the copper ore, or unexpectedly to interrupt one another. The ores were found to be concentrated in three large masses, occurring in a length of about 120 fathoms. Proceeding south-westwardly, the space occupied by the most northern mass, from a breadth of a few inches, gradually widened out to about ten fathoms, in a length of about forty fathoms; beyond which it appeared to be thrown about fourteen fathoms, obliquely to the westward. The general bearing of the succeeding two masses was still to the south-west. They were about fifteen fathoms apart, and the larger or more

southward one swelled to a breadth of more than fifteen fathoms. The depth to which the ground has been worked on the general slope of the bed, is about ten fathoms; the cupriferous rock at this depth has a breadth of about twelve feet in a shaft on the northern mass, and shews rich ore in the floor and the parts adjacent; but with the exception of what is called Pike's pit, in the most southern part, the floors of the other masses do not at present exhibit that same abundance of ore which characterized the upper part. The working of the mine, however, up to the present time, has been confined to the extraction of the rich ore which was in sight. Little or nothing has been done for discovery, and it cannot be said how near to the present floor of the mine, may be found other masses similar to those that have been excavated. Beyond these masses, in opposite directions on the surface, the ore becomes more scattered in the strata; but there is evidence of its continuance for several hundred feet, in spots and patches, occasionally aggregated into masses of much less importance than the three principal ones. In the first few weeks' work in 1859, about 300 tons of ore, containing nearly thirty per cent. of copper were quarried, in open cuttings, from two of the masses, without making much apparent impression on the quantity in sight. The total quantity sent from the mine up to the end of 1861, is said to be nearly 6000 tons; holding on the average about seventeen per cent. of copper.—*Quebec group, Lower Silurian.*

5. Upton Mine, Upton, lot 51, range 20..... *G. B. Moore & Co., Montreal.*

a. Yellow sulphuret of copper, from a bed.

The band of dolomite, which sinks with a north-westward dip at Acton, rises again at Upton, on the opposite side of a synclinal form, at a distance of about six miles. Here, about twenty feet in the upper portion of the band are marked by the yellow sulphuret of copper; which is disseminated in the rock, as if in a bed, the ore being most abundant in the lower part. The rock is at the same time cut by many reticulating strings and veins of calcspar, which hold ore. An open cutting has been made on the outcrop of the bed; the quantity of ore obtained, is stated by the proprietors to be forty tons, and a sample, represented by them to be an average one, yielded to the analysis of Mr. C. Robb, fourteen per cent. of copper. The quantity of rock which has been excavated is uncertain.—*Quebec group, Lower Silurian.*

6. Bissonette's Mine, Upton, lot 49, range 20..... *Geological Survey.*

a. Yellow sulphuret of copper, from a bed.

From the position where the rock has been wrought in the previous mine, the band of dolomite runs south-westward for nearly a mile, and then appears to be thrown upwards of half a mile to the south-westward, by a dislocation. Bissonette's mine is on the south-west side of the dislocation, and apparently in the same stratigraphical place in the band, as the Upton mine. The bed is about three and a half feet thick, and the ore lies in disseminated masses of various sizes, up to twenty inches long, by from six to nine inches thick. The bed might probably yield from a half to three fourths of a ton of ten per cent. ore to a fathom.—*Quebec group, Lower Silurian.*

7. Wickham Mine, Wickham, lot 15, range 10.....*Pomroy, Adams & Co., Sherbrooke.*

a. Yellow, variegated and vitreous sulphurets of copper, from a bed.

b. Plan of the mine, by Messrs. Willson & Robb.

This ore occurs in masses, disseminated in what appears to be a bed, of uncertain thickness, in the same band of dolomite as that of the Acton mine. An experimental shaft has recently been sunk on it to a depth of about five fathoms, in which good bunches of ore have been met with. About four tons of thirty per cent. ore have been obtained from the excavation.—*Quebec group, Lower Silurian.*

8. Yale's Mine, Durham, lot 21, range 7 .....*Pomroy, Adams & Co., Sherbrooke.*

a. Yellow sulphuret of copper, from a lode.

b. Plan of the mine, by Messrs. Willson & Robb.

At this mine, several veins, carrying more or less copper, intersect a mass of magnesian limestone, which is supposed to belong to the same band as that of the Acton mine. The veins have a general bearing north-eastward, and trial shafts have been sunk on three of them, the thicknesses of which vary from six to thirty inches. The vein-stone is calcspar, with a little quartz, occasionally mixed with portions of the wall rock. On the most north-western vein, the excavation is two fathoms deep, and reaches black shale beneath the limestone. On the middle one, which is eighteen feet to the south-east, the excavation is six fathoms deep, again reaching black shale; and on the third, twenty-four feet farther to the south-eastward, a shaft sunk about four fathoms, is still in magnesian limestone. In this shaft, the vein has an underlie to the south-eastward of about a foot in a fathom, and in a breadth of from six to twelve inches, shows good lumps of ore, mixed with calcspar and wall rock.—*Quebec group, Lower Silurian.*

9. Black River Mine, St. Flavien.....*Shaw, Bignol & Hunt, Quebec.*

a. Yellow sulphuret of copper, from a bed.

At St. Flavien, about five leagues above the Chaudière, and two leagues from the St. Lawrence, red shales occur, underlaid by a band of amygdaloidal diorite; this appears to occupy the place of the magnesian limestone, to which the band at Acton belongs. It is between a quarter and half a mile wide, and limestones occur both at the summit and at the base of the band, which in those parts appear to be of a concretionary, or conglomerate and brecciated character; being composed, particularly at the base, of rounded and angular masses of amygdaloidal diorite, varying in diameter from two inches to two feet. Many of these are calcareous, and much of the rock is red. The interstices among the masses are filled with calcspar, which is transversely fibrous towards the walls, and incloses crystallized quartz in the centre. This band is highly cupriferous, and ores of copper occur both in the beds, and in veins or lodes which cut them: the bearing of the veins, however being with the strike. The ore in the beds is copper pyrites, large masses of which, similar to the one exhibited, are associated with the limestones at the top. The veins, in addition to copper pyrites, hold the variegated and vitreous sulphurets. In one spot, native copper occurs in small masses, in the conglomerate at the base of the diorite. The whole band has a striking resemblance to some of the rocks of the Upper Copper-bearing series of Lake Superior.—*Quebec group, Lower Silurian.*

N.B.—A band of diorite very similar to the one above mentioned, and perhaps a continuation of it, occurs at Drummondville on the St. Francis, where the band is half a mile wide. On lot 1, range 1, of Wendover, it holds yellow, variegated and vitreous sulphurets of copper, which run in six or seven thin veins or courses, formed by breaks and slips in the diorite, within a breadth of 350 yards.

The rocks of the Quebec group, which are almost wholly on the south side of the St. Lawrence, are distributed in long narrow parallel synclinal forms, running N.E. and S.W. For the convenience of geological description, these have been divided into: 1st, The Lauzon and Farnham synclinal, which is the one most to the N. W.; 2nd, The Shipton and St. Armand synclinal, continued, to the N. E., in the Shipton and Leeds synclinal. Between these two synclinals runs the Bayer and Stanbridge anticlinal, and beyond them, to the S. E., is the Danville and Sutton anticlinal. From this, there branch, in the neighborhood of the St. Francis, the Sutton Mountain anticlinal, and the Melbourne and Potton anticlinal. The six copper-bearing beds and veins that have been mentioned, 4—9, are all included in the Lauzon and Farnham synclinal.

10. Harvey's Hill Mine, Leeds, lot 18, range 15. *English & Canadian Mining Co., Quebec.*

a. Variegated and vitreous sulphurets of copper, from Hall's lode.

b. " " " " from Campbell's lode in Kent's shaft, at thirty fathoms.

c. Yellow, variegated, and vitreous sulphurets of copper, from lowest bed.

d. " " " " " from highest bed.

e. Variegated and vitreous sulphurets, dressed on copper-bottom sieves.

f. A plan of the mine, by Mr. Herbert Williams.

At Harvey's Hill mine, there occur in a breadth of about 1000 feet, eight courses with a north-eastward bearing, composed chiefly of quartz, with various proportions of bitter-spar, chlorite and calcspar. They all cut the strata, with an underlie, at high angles, to the north-westward, and hold, in greater or less quantities, the yellow, variegated and vitreous sulphurets of copper. These quartz courses, which appear to have lenticular forms, occasionally extend upwards of 100 fathoms horizontally; some of them have shown a width of as much as seven feet in the thickest part, occasionally carrying, for short distances, as much as two tons of twenty per cent. ore to a fathom. The rock of the country is a talcoid mica slate, which from its lustre is called nacreous slate. To prove the quartz courses in a downward direction, an adit level is being driven through these slates, from the north side of the hill, at a level of thirty-seven fathoms below its summit. The length of this adit, when complete, will be 220 fathoms. The same sulphurets of copper which characterize the quartz courses, occur also in beds conformable with the stratification. Of these there are three at Harvey's Hill. The lowest one, resting on a six-feet bed of soapstone, is six inches thick; fifteen feet above this there is another, three inches thick, and twenty fathoms, still higher, one varying in thickness from twenty to thirty inches. In these beds, the ore is distributed through the nacreous slate in patches, generally of a lenticular form; they are usually thin, but sometimes attain one half to three-fourths of an inch in the thickest part, and occasionally present, in section, lines of six inches, or even twelve inches in length. The patches interlock, one overlapping another, with variable distances between; while many single crystals and grains of ore are disseminated through the whole thickness of the beds. The quantity of ore obtained from the mine is uncertain; the number of men employed is about fifty.—*Quebec group, Lower Silurian.*

11. St. Francis Mine, Cleveland, lot 25, range 12 ..... *Flowers, Mackie & Co.*

a. Yellow sulphuret of copper, from a vein.

b. Plan of the mine, by Messrs. Willson & Robb.

The ore is disseminated in a vein, slightly oblique to the stratification of a quartzo-chloritic rock, frequently studded with nodules of orthoclase feldspar, often surrounding small centres of quartz; the nodules give to the rock the aspect of an amygdaloid trap. The bed has an average thickness of three feet, and the rock is supposed to occupy a higher stratigraphical place than the Acton dolomite. The vein is traced, running N. E., for ninety fathoms. Five or six small excavations, each of a few fathoms in length, have been made in the outcrop, to the depth of two feet, and in these the variegated and vitreous ores are mixed with the yellow sulphuret.—*Quebec group, Lower Silurian.*

12. Jackson's Mine, Cleveland, lot 26, range 13..... *Griffiths & Brothers.*

a. Variegated and vitreous sulphurets of copper, from a bed.

The bed to which this ore is subordinate, is of the same character as that of the St. Francis mine. It dips north-westward, at a high angle, and is about twelve inches thick; a shaft has been sunk in it to a depth of three and a half fathoms. Ten fathoms to the east, and fifteen fathoms to the west of this, other copper-bearing beds occur, composed of an amygdaloidal chloritic rock like that of the St. Francis mine, one of them three feet and the other five feet thick. In these the ore is sparingly disseminated.—*Quebec group, Lower Silurian.*

13. Coldspring Mine, Melbourne, lot 6, range 2 ..... *Flowers, Mackie & Co.*

a. Variegated and vitreous sulphurets of copper, from a bed.

b. Plan of the mine, by Messrs. Willson & Robb.

The bed from which these specimens are derived, is composed of quartz and nacreous slate, in which the ore is disseminated in thin interlocking lenticular patches, and in grains; as in the beds of Harvey's Hill mine. The dip of the strata is north-westward, at an angle of about forty-five degrees. Last summer, a shaft was sunk to cut the bed at seven fathoms, but none of the ore has yet been *stoped*. In a breadth of 120 feet across the strata, on one side of the shaft, and 80 feet on the other, there are several parallel bands of cupriferous strata, marked chiefly by the green carbonate of copper, but showing occasional indications of the variegated and vitreous sulphurets. What the productiveness of the ground may be, has, however, not yet been ascertained.—*Quebec group, Lower Silurian.*

14. Sweet's Mine, Sutton, lot 8, range 10 ..... *S. Sweet & Co., North Sutton.*

a. Variegated and viteeous sulphurets of copper, from a bed.

b. " " " " "

c. Plan of the mine, by Mr. J. Richardson.

The ore occurs in nacreous slate, in which it is disseminated in thin, lenticular patches and in grains, as in Harvey's Hill mine. The thickness varies from one to about four and a half feet, and the beds dip N. 77° W. $<$ 86°-90°. In this attitude it is visible for 170 yards, and is traceable for a mile, running parallel with a band of dolomite, which is removed from it about half a mile across the strike, to the eastward. Nodules of magnesian limestone are disseminated in the slate, close along the eastern side of the part charged with copper ore. The band of dolomite is supposed to be in the same stratigraphical place as that of Acton, but it occurs on the eastward side of a distinct synclinal form, the axis of which is separated from that to which the Acton band belongs, by about twelve or fifteen miles. A sample of the whole breadth of the bed, where it is four and a half feet, yielded to analysis four and a half per cent. of copper. A pit of ten fathoms deep was, last year, sunk down the incline of the bed, and a small quantity of the ore *stoped* out at the bottom.—*Quebec group, Lower Silurian.*

15. Craig's Range Mine, Chester, lot 8, range 5 ..... *G. D. Robertson & Co.*

a. Vitreous sulphuret of copper, with green carbonate, from a vein.

The vein, which is composed of quartz, has a thickness of about two feet. It runs with the strike, in chloritic slate, and has been uncovered for a fathom or two along it. It shows enclosed masses of the ore, but the work done is not sufficient to authorise any statement in regard to the quantity.—*Quebec group, Lower Silurian.*

N.B.—The six copper-bearing beds and lodes, 10-15, are all within the Shipton and St. Armand synclinal. Indications of copper occur in a great number of localities in this synclinal, in testing a good many of which, there have been expended considerable sums. These indications run through Stukely, Ely, Melbourne, Cleveland, Shipton, Chester, Halifax, Inverness and Leeds, and cross the Chaudière into the seigniory of St. Mary.

16. Nicolet Branch Mine, Ham, lot 28, range 4 ..... *Geological Survey.*

a. Yellow and variegated sulphurets of copper, from a bed.

The ore of this mine occurs at the summit of a band of slaty dolomite about 100 feet thick. At the spot the rock dips S. 10° E. $<$ 46°, and runs thence in a general eastwardly direction. For a thickness of about thirty feet, in which nacreous slate is mixed with the dolomite, the ore is disseminated in lenticular patches of various sizes, sometimes measuring several feet in length, with a thickness of an inch or more in the centre. The patches interlock among one another, and appear to be in sufficient abundance to

be profitably wrought. The dolomite crosses the north branch of the Nicolet River, producing a considerable fall in the stream; which is thirty feet wide, and would afford abundant water-power for crushing and dressing the ore.—*Quebec group, Lower Silurian.*

17. Garthby, lot 22, range (north) 1.....*Geological Survey.*

a. Iron and copper pyrites, from a bed.

This appears to be a large mass of iron and copper pyrites, subordinate to the strata, which here consist of calcareous serpentine, and run N.E. and S.W., with a dip about S. E. $<50°$. The entire thickness of the mass is uncertain, but the breadth in which the sulphurets are more or less mingled with the rock, is probably not less than twenty feet. In some parts sulphuret of iron prevails, almost to the exclusion of that of copper, while in others there is as much as eight per cent of copper; some parts assume the aspect of what, among Cornish miners, is termed *bell-metal ore.* An opening has been made in the mass, eight feet in length, four feet in height, and four feet wide; in this, the two sulphurets occur unequally mixed with one another, but nearly free from the rock of the country. —*Quebec group, Lower Silurian.*

18. Haskell Hill Mine, Ascot, lot 8, range 8.....*Thos. McCaw, Montreal*

a. Yellow sulphuret of copper, from a bed.

b. Plan of the mine, by Messrs. Willson and Robb.

The bed is five feet thick, and occurs in a calcareous chloritic slate. The mine has been opened on a twist in the stratification, giving three courses of ore in the breadth of eighty feet, but the general plane of the bed dips about S. $<65°$. A pit has been sunk on the incline of the bed to a depth of five and a half fathoms from the surface, and the ore obtained from the excavation, without any dressing, has been sent to Boston, where it has yielded on an average about eight per cent. of pure copper. The quantity of such ore obtained from the bed by five men in five months, is about 100 tons. The bed is traceable for a considerable distance in opposite directions from the pit, and carries copper as far as it has been tried. The horizon of the strata of this mine is supposed to be higher than the dolomite of Acton, and to be approximatively equivalent to the chloritic slates of the Shipton and St. Armand synclinal. The rock of Haskell Hill composes a belt of ridgy land, running from Owl's Head to Ham Mountain, forming in its progress the Stoke mountains. It spreads out to a width of about seven miles on the St. Francis, and shows indications of copper near Sherbrooke, on the land of Mr. Sheriff Bowen, and in several other places. A vein on lot 17, range 7, of Ascot, within a mile of Sherbrooke, in addition to the yellow sulphuret of copper, has been found to hold traces of gold.—*Quebec group, Lower Silurian.*

N.B.—Besides the fifteen localities of copper-bearing beds and veins belonging to the Quebec group, which have been described above (4–18), nearly 200 additional localities, on separate lots of 200 acres each, in which indications of the metal occur, are known in the same region.

Native Copper.

1. Harrison's Location, St. Ignace Island, Lake Superior....*Geological Survey.*

a. Mass of native copper from a lode.

On the Chenal Ecarté, at the east end of St. Ignace Island, the vein from which the above specimen is derived, cuts a thick mass of amygdaloidal diorite, which lies conformably with the strata, there dipping S. $<9°$. The vein is about four or five inches wide, and holds masses of native copper, many of them weighing upwards of 100 lbs., accompanied by native silver, in a gangue of calcspar. The underlie of the vein is N. $<70°$.

About forty-seven feet south from this vein, there is another about twelve inches wide, of which the vein stone is calcspar, with a little quartz, associated with fragments of wall rock. Among these substances are disseminated masses of vitreous copper, accompanied with native silver. The underlie of the vein is N. $<$ 60°. These two veins would meet downwards about twenty-five fathoms from the surface, and with a view of testing them, the Montreal Mining Co., to whom the location belongs, in 1846 commenced the sinking of a shaft, about twenty-four feet north of the native-copper vein. It was carried down ten fathoms; a drift from it southward,then intersected the vein at a distance of about twenty feet, thus proving its continuance for a depth of ten fathoms; but the Mining Company, having at that time determined to concentrate all their energy upon the working of the Bruce mine, the experiment was carried no farther. These veins, variously modified, can be traced to the westward for nine miles, along the whole length of St. Ignace Island, carrying native copper and native silver, with the vitreous sulphuret of copper, in greater or less quantity the whole way; and also to the eastward across the northern part of Simpson's Island.—*Quebec group, Lower Silurian.*

2. Michipicoten Island, Lake Superior..... *Geological Survey.*

a. Nodules of native copper, from a bed.

b. Gangue, or rock of the bed.

c. Plan of the Quebec mine, by Mr. D. S. Cutting.

On the north side of Michipicoten Island, there is a considerable mass of greenstone, several bands of which are of an amygdaloidal character, and some of them are associated with beds of sandstone. Towards the west end of the island, these rocks present a low surface for about 400 or 500 feet, and then rise into a cliff of 200 or 300 feet. In the cliff, the greenstone is marked by crystals of analcime and quartz, occurring in druses. The whole mass lies conformably with the strata, dipping south-eastward. Native copper, associated with a little silver, is disseminated in several parts of the mass, and these more particularly characterise an amygdaloidal bed, two feet thick; which is underlaid by a band of sandstone and has been mined to a small extent by the Quebec Mining Company. In this bed, the copper is distributed in irregular nodular masses of various sizes, from grains no larger than snipe shot, to fantastic forms of five and six inches in diameter; the quantity of metal in the bed being, according to Mr. J. L. Willson, equal to about five per cent. Small nodules of calcspar occur with those of copper. About seven miles to the north-eastward, the bed is cut by a vein, in which copper and silver appear to be associated with ores of nickel, in the forms of a silicate of nickel, containing twenty-five per cent. of the metal, and of a mixture of the arseniurets of nickel and copper, containing between seventeen and thirty-seven per cent. of nickel. These ores were detected by Mr. Sterry Hunt in the refuse thrown aside in a crop trial made on the bed, by Mr. Bonner in 1854; and it is said that a considerable quantity of the silicate of nickel was thrown into the lake, after being stamped and washed, for the purpose of extracting from it the native silver.—*Quebec group, Lower Silurian.*

3. Mamainse, Lake Superior..... *Montreal Mining Co., Montreal.*

a. 450 lbs. of native copper in a single sheet, from a vein.

The promontory of Mamainse consists of various layers of coarse conglomerate, and of greenstone, much of which is of an amygdaloidal character. According to the description of Dr. Dawson, one of the bands of greenstone is intersected by a narrow fissure, running nearly in the strike of the beds, or north and south. Its greatest width is about six inches, and in some places, this is found to be nearly filled with native copper, of which the mass now exhibited is a specimen. An excavation on the vein, twenty-seven feet

deep, without galleries, yielded about three tons of the metal. Other veins intersect the same rock, and one of these, six inches in width, holds good bunches of the variegated sulphuret. In ancient shallow holes, sunk at intervals along the course of some of the veins of metallic copper, in this part, there are occasionally found the remains of Indian hammers, consisting of small boulders, usually of trap, having shallow grooves worked around them, to receive the withes or thongs attaching the handles; giving evidence of rude aboriginal attempts at mining, many centuries since.—*Quebec group, Lower Silurian.*

Smelted Copper.

1. Bruce Mines, Lake Huron.....*R. H. Fletcher.*

a. Two ingots of copper.

This copper is smelted at the Bruce mines, from the ore of the neighborhood, and from the native copper procured from the two feet bed at Michipicoten Island.

NICKEL.

Sulphuret of Nickel.

1. Orford, lot 6, range 12.....*Geological Survey.*

a. Specimens of the sulphuret of nickel, millerite.

Associated with a band of serpentine, which runs along the east side of Brompton Lake, in Orford, there is, on the lot indicated above, a pale green pyroxenic rock, in which occur druses, lined with large twin crystals of white pyroxene, and with cinnamon-colored garnets. Large masses of calcspar, probably filling a vein, are here met with, sometimes nearly pure white and cleavable, at others penetrated and filled with small emerald-green crystals of a chrome garnet. This mineral also forms granular masses, mixed with calcareous spar and pyroxene, and containing small quantities of the sulphuret of nickel, millerite. Some specimens of the rock have yielded to analyses as much as one per cent. of nickel. The ore does not appear to be confined to the portion of rock mixed with calcareous spar, but to penetrate into more homogeneous strata, probably pyroxenic, running with the serpentine; where, however, the quantity of the nickel seems to be less.—*Quebec group, Lower Silurian.*

SILVER.

Native Silver.

1. Prince's Location, Lake Superior.....*Geological Survey.*

a. Silver ore from a lode.

The rock of Prince's location is clay slate, interstratified with greenstone, and overlaid by a great mass of it with a columnar structure; the whole dipping south-eastward at a small angle. These rocks are transversely intersected by a vein, which is twenty feet thick on Spar Island, and from four to five feet on the main land, running N. W. It is composed of calcspar, heavy spar, and amethystine quartz; the latter appearing in druses in the calcspar. With these, are associated the yellow, variegated and vitreous sulphurets of copper in promising quantity, with iron pyrites, blende, galena, and silver; the latter occurring both native and as a sulphuret, in addition to cobalt and arsenic, as well as traces of gold. The location is the property of the British American Mining Company, and in a small trial shaft sunk by them to the depth of between six and seven fathoms, on the main land, where the lode is four feet wide, several hundred pounds of the vein, similar to the specimens exhibited, contained three and a half per cent. of silver.—*Quebec group Lower Silurian.*

GOLD.

Native Gold.

1. Fief St. Charles, Seigniory of Aubert de l'Isle..... *Geological Survey.*

a. Stream gold in nuggets, nine among them weighing from ten dwts. to 126 dwts.

b. Stream gold in dust.

It has long been ascertained that the drift clay and gravel of the south side of the St. Lawrence, in Canada, from Lake Champlain to the Etchemin, and probably to the extremity of the province, in Gaspé, is auriferous; the area being about 15,000 square miles. Gold has been washed from this gravel on the St. Francis in Melbourne, at Sherbrooke, in Westbury, Weedon and Dudswell, and on Lake St. Francis; as well as on the Chaudiere and the Etchemin, and their tributaries, from the sources of these rivers nearly to their mouths. Various companies have made trials of this drift in several places, one of the most important having been on the Rivière des Plantes, in the seigniory of Vaudreuil (Beauce); but of this it is not easy to procure authentic details. In 1851, the Canada Gold Mining Company commenced a trial of the drift along the Rivière du Loup, near its junction with the Chaudière, in the seigniory of Aubert de l'Isle; which continued three years. The specimen exhibited is what was obtained by the workings of this Company in 1852, and the following are the results for the years 1851 and 1852:—

	Area. washed.	Gold collected.	Value.	Wages.	Profit.
	Sq. acres.	dwts. grs.	$	$	$
1851.....	⅜	2107·11	1826·46	1644·33	182·13
1852.....	⅝	2880·19	2496·69	1888·35	508·34
		4987·30	4323·15	3532·68	690·47

The chief part of the gold was obtained in the bed of the river, but some of it on the bank, and the average thickness of the drift was about two feet. The average daily wages were sixty cents a man. The system adopted for dressing was that used in Cornwall for obtaining tin from alluvial deposits.—*Drift.*

2. Seigniory of Vaudreuil, Beauce ..... *Geological Survey.*

a. Stream gold, a nugget of eighty dwts. with quartz.

In this specimen the proportion of the gold is sixty-four per cent. It was obtained from the drift of the Rivière des Plantes, a tributary of the Chaudière. Many of the small masses of gold which have been obtained from the drift of the Chaudière valley, being of a character somewhat similar, there cannot be much doubt that the drift gold of the region has been derived from quartz veins, situated probably somewhere not far distant. No quartz so rich in gold as the specimen, has as yet been met with in place in Canada, but the precious metal has been observed in small grains in a quartz vein of between two and three feet thick, which cuts bluish-black slate, and crosses the Chaudière at the St. Francis rapids, about half a mile from their foot, and about three quarters of a mile above St. Francis (Beauce) church.—*Drift.*

3. Rapids of the Chaudière, parish of St. François (Beauce).... *Geological Survey.*

a. Auriferous blende, galena, arsenical, magnetic and cubic iron pyrites, with quartz and bitter spar; from a vein.

This vein, as just mentioned, is between two and three feet thick, and consists principally of quartz, in which native gold has been observed; although none is visible to the eye in

the specimens exhibited. The quartz is associated with bitter spar; and in the gangue are disseminated small quantities of galena, blende, arsenical sulphuret of iron, often well crystallized; besides cubic and magnetic iron pyrites. In an analysis made by Mr. Sterry Hunt, in 1854, a portion of the galena separated by washing, but still containing a small mixture of the blende and pyrites, gave by assay of 500 grains, sixty-nine per cent. of lead, and thirty-two ounces of silver to the ton of ore. Another sample of 500 grains, more carefully dressed, gave thirty-seven ounces of silver to the ton. The silver contained a small quantity of gold. Another portion of 500 grains, of the sample which gave sixty-nine 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 owing to the accidental presence of a fragment of some rich silver ore. 1000 grains of the pyrites, mixed with a little blende, galena, and arsenical pyrites, gave by cupellation 0.15 grains of an alloy of gold and silver. 700 grains of the impure blende gave 0.19 grains of a yellow alloy of the same metals.—*Quebec group, Lower Silurian.*

4. Leeds, lot 15, range 14 ..... *Geological Survey.*

a. Grains of gold in bitter-spar.

On the property of Mr. Nutbrown, of which the mining rights have been purchased by the English & Canadian Mining Company, there occurs a vein cutting a bed of steatite. The vein is composed of a gangue of coarsely crystalline bitter spar, mixed with talc, copper-glance, and specular iron. There is disseminated, principally in the bitter spar, a small quantity of gold in grains, varying in size from mere points to the magnitude of pin heads. Sometimes the metal appears in laminæ in the bitter spar, having a diameter of about one eighth or one fourth of an inch. The vein, which is two feet thick, has been mined to a small extent for copper ore.—*Quebec group, Lower Silurian.*

PLATINUM AND IRIDOSMINE.

Native Platinum.

1. Fief St. Charles, Seigniory of Aubert de l'Isle..... *Geological Survey.*

a. Grains of platinum and of indosmine separated from gold dust.

Among the drift gold of the Chaudière there are met with, in very small quantities, grains of platinum, and of iridosmine; the latter being an alloy of the rare metals iridium and osmium, which is very hard, and is used for pointing gold pens. Some of the gold met with on the Chaudière has been found thinly coated with a mercurial amalgam; but no trace of cinnabar, the commonest form of the ores of mercury, has been observed in the drift. Among the substances met with by the Canada Gold Mining Company, in separating the gold from the drift, lead shot of various sizes, from partridge to swan shot, were nearly as abundant as the gold.—*Drift.*

2.

MINERALS APPLICABLE TO CHEMICAL MANUFACTURES.

Chromic Iron.

1. Mount Albert, Shickshock range, Gaspé..... *Geological Survey.*

a. Specimens of chromic iron from the surface.

Loose masses, traced for half a mile, running with the strike of the serpentine, of which the mountain is composed; the largest masses weighing about twenty pounds.—*Quebec group, Lower Silurian.*

2. Ham, lot 4, range 2 ..... *Geological Survey.*

a. Specimen of chromic iron from a bed.

A bed of about fourteen inches thick in serpentine. The bed has been partially worked by the proprietor, Mr. Leckie, of Acton Vale; who obtained about ten tons of ore, with forty-five per cent. of oxyd of chromium, from seven square fathoms in the plane of the bed. The ore forms a lenticular mass in the serpentine.—*Quebec group, Lower Silurian.*

3. Bolton, lot 23, range 6 ..... *Geological Survey.*

a. Specimen of chromic iron from a bed.

A bed of from twelve to twenty-four inches thick in serpentine, on the property of Mr. L. A. Perkins. The bed dips to the eastward, at an angle of about 80°, and the ore occurs in it in masses of from fifty to 1000 pounds in weight.—*Quebec group, Lower Silurian.*

4. Melbourne, lot 22, range 6..... *Benj. Walton, Montreal.*

a. Specimen of chromic iron from a bed.

A bed of uncertain thickness in serpentine, in which the ore runs in lenticular masses of from six to nine inches thick.—*Quebec group, Lower Silurian.*

Molybdenite or sulphuret of molybdenum.

1. Quetachoo River, Manicouagan Bay, N. shore Gulf of St. Lawrence..... *Geological Survey.*

a. Specimens of molybdenite from a bed.

A bed of six inches thick in gneiss, in which the sulphuret of molybdenum occurs in nodules of from one to three inches in diameter, and also in flakes from one-eighth to one-fourth of an inch thick, and twelve inches in diameter.—*Laurentian.*

Cobaltiferous iron pyrites.

1. Elizabethtown, near Brockville ..... *A. S. Brown, Brockville.*

a. Specimens of pyrites from a bed.

A great irregular mass in gneiss, probably lenticular, running with the stratification. It has been excavated to a breadth of twenty feet, but its length and full thickness have not been ascertained. Assays of the ore have yielded one half of one per cent. of cobalt. This, according to the newest methods of extraction of McFarlane, Roscher and Dahll, would yield a profitable result. The ore is on the property of Mr. Billings.—*Laurentian.*

Dolomite.

1. Brome, lot 16, range 11..... *Geological Survey.*

a. Specimens of dolomite from a bed.

In the Eastern Townships a vast quantity of dolomite occurs. Stratigraphically, it is at the base of the Quebec group, where magnesian rocks of different descriptions are associated with the sulphurets of copper and other metals. The dolomite occurs in bands, which are from 100 to 300 feet thick. These run parallel to one another, on the opposite sides of synclinal and anticlinal forms, by which the bands are repeated in many places. The exposure in Brome, from which the specimen exhibited is taken, is on the east side of the Shipton and St. Armand anticlinal, and has been traced for many miles, running N. E. and S. W.—*Quebec group, Lower Silurian.*

Magnesite or carbonate of magnesia.

1. Sutton, lot 12, range 7 ..... *Geological Survey.*

a. Specimens of magnesite from a bed.

2. Bolton, lot 17, range 9..... *Geological Survey.*

a. Specimen of magnesite from a bed.

One of the rocks associated with or replacing the dolomites of the Quebec group, is magnesite. It is of more rare occurrence than the dolomite. In Sutton, it occurs on the east side of the Shipton and St. Armand anticlinal, where it is often slaty, from a mixture] of feldspar, with a mica colored green by chromium. The purest specimens contain eighty per cent. of carbonate of magnesia; with a portion of carbonate of iron. In Bolton, it occurs on the east side of the Melbourne and Potton anticlinal, where it forms an enormous bed, resembling a crystalline limestone. It contains, like the last, small portion of chromium and nickel, and consists of:

Carbonate of magnesia,.....	60
Carbonate of iron	9
Grains of quartz.....	31
	100

Though the use of this mineral as an economic source of pure magnesia and magnesian salts on a large scale, may be worthy of consideration, its most important application is probably for the fabrication of a cement to resist the action of sea-water.—*Quebec group, Lower Silurian.*

Petroleum or rock oil.

1. Enniskillen, lot 16, range 2..... *Canadian Oil Company, Hamilton.*

a. Gum or mineral tar from the surface.

b. Crude petroleum from a well.

c. Refined or burning oil.

d. Lubricating or machinery oil.

Natural springs of rock oil have long been known in several localities in Western Canada. Two of these are in the township of Enniskillen, in the southern part of which are two patches of an acre or more, covered with a layer of several inches of viscid mineral tar or asphaltum, which has resulted from the drying up of the petroleum of these springs. Wells sunk in their vicinity, to a depth of from forty to sixty feet, through the superficial clays, encounter a stratum of gravel, resting on the surface of the rock beneath, and often filled with oil; giving origin to what are called surface wells. On boring into the underlying soft fossiliferous shales and limestone, fissures are met with at various depths, from which rise abundant supplies of oil, often accompanied with inflammable gas, and with water, which is sometimes saline. These fissures, which also supply the surface wells, are apparently connected with the oil-bearing strata of the Corniferous limestone; which is from 200 to 300 feet below the surface, in Enniskillen. Within an area of about four square miles in the first three ranges of this township, there were supposed to be, in August, 1861, about seventy wells, yielding more or less oil. Of these, forty were surface wells, that is, wells sunk from forty to sixty feet, through the drift clay and gravel, to the rock beneath. Some of these latter, which had yielded but little oil, gave abundant supplies by boring into the rock. The oil-bearing fissures or veins, in adjacent wells, were met with at depths varying from thirty-six to 100 and even 150 feet from the surface of the rock. One of the most abundant occurred at sixty feet. In some few cases, the oil from the borings rises above the surface of the ground, constituting what are called flowing wells.

It is not easy to know the amount of oil which these wells are capable of supplying; since from the great difficulty in getting it to market, arising from the want of good roads, few of the wells are regularly and continuously pumped. Some of those which were bored in July and in August last, are stated upon good authority, to have yielded from 400 to 500 barrels of oil, in a week or two after having been opened; but the reservoirs provided, being filled with oil, the pumping of the wells was suspended. Two bored wells, belonging to Mr. Williams, which were the only ones continuously wrought in August last, are said to have yielded together, during some months, from twenty to twenty-five barrels (of forty gallons each,) daily. About six miles to the northward, on lots thirteen and fourteen, of ranges ten and eleven of the same township, sixteen wells had been sunk last August; of which twelve were surface wells, and had yielded large quantities of oil. Several of these had been wrought for nearly twelve months, and were supposed in that time to have yielded 1000 barrels. Other wells had recently been bored to a depth of nearly 200 feet, but yielded less oil than the surface wells. The wells of this region seem, thus far, to be less important than those in the southern part of the township. The oil from the deep or rock wells, is somewhat lighter and more fluid than that from the superficial wells, which is very dark colored and somewhat viscid.

Great expectations have recently been excited by a flowing well, known as Shaw's, which was sunk to a depth of about 200 feet, and when first opened, a few weeks since, was supposed to yield, for a short time, 2000 barrels of oil in twenty-four hours; which flowed into a stream near by and was lost. This well is however said to have been since closed, so that the discharge is under control. Another recent well, near by, known as Bradley's, nearly as abundant. The experience in Pennsylvania has however shown that the supply from these flowing wells soon diminishes, and eventually fails. Adjacent borings sometimes appear to be connected with the same oil-yielding fissure, and to affect each other's supply; in some cases air passes down one shaft when the other is pumped. — *Corniferous formation, Devonian.*

2. Tilsonburgh..... *Watkins and Inglis, Hamilton.*

a. Crude petroleum from a well.

Near the village of Tilsonburgh, in the township of Dereham, natural oil springs occur, and two wells have been bored in the Devonian limestone, which is here covered by about forty feet of clay and sand. One of these had been sunk thirty-six feet in the limestone, and had furnished, when seen in August, a few barrels of oil.

In the townships of Zone, Mosa, and Orford, on the banks of the Thames, oil springs abound for a distance of about four miles. These, like the other natural springs mentioned above, furnish but small quantities of oil; several wells have however been sunk in the clay, and the rock beneath has been drilled. One of these, at a depth of seventy feet in the clay, had yielded about forty barrels of oil.—*Corniferous formation, Devonian.*

3. Bertie, lot 13, range 1 ..... *Geological Survey.*

a. Specimen of limestone yielding petroleum.

In a quarry on the lot indicated, two oil-bearing beds, one of two and another of six inches, are seen; they are made up in great part of corals of the genera *Heliophyllum* and *Favosites*, in the pores of which the oil is lodged like honey in a comb. Other coral beds in the same series, however, are quite free from oil. The limestone beds above and below these are compact, and not at all impregnated with oil, which, even in the coral beds, is seen, when these are freshly broken, to be confined to the fossils, and not to be uniformly disseminated in the layer. When the rock is quarried, the oil flows out, and may be collected on the water in the bottom of the quarry. The facts observed with regard to the petroleum springs in Canada and the United States, would seem to show that they are always on the lines of anticlinals, along which the oil from its superior levity accumulates, and afterwards, by the pressure of water, is raised to the surface through the natural fissures which generally occur upon anticlinals. The oil-bearing limestone underlies an area of 7000 square miles in Western Canada. This limestone is of marine origin, and contains no organic remains but those of marine animals; so that we are led to conclude that these hydrocarbons have been derived from a peculiar decomposition of their tissues. These, as is well known, differ but little from those of the plants, which in many more recent formations have given rise to bitumens. We may suppose that many soft gelatinous animals, and perhaps even marine plants, whose traces have disappeared, may have contributed to form the petroleum of these coral beds.—*Corniferous formation, Devonian.*

Bituminous shale.

1. Collingwood, lot 23, range 3..... *Geological Survey.*

a. Shale from the bed.

b. Burning oil distilled from the shale.

c. Lubricating oil from "

The shale of Collingwood, on lot 23, range 3, yields, when distilled, from three to four per cent. of tarry oil, which by the usual process of rectification affords oils fitted for illumination and lubrication. Works were erected by Messrs. Pollard & Macdonell, in October, 1859, consisting of twenty-four retorts, and capable of yielding about 250 gallons of oil daily, by the distillation of from twenty to thirty tons of shale. The available bed of shale is seven feet in thickness, and the material was delivered, broken for the retorts, at twenty cents the ton. The cost of the crude oil was said to be fourteen cents the gallon, and for a while the works were carried on successfully, a ready market being found for the oils; but the works were repeatedly destroyed by fire, and the oils from this source coming in competition with petroleum from the oil wells of Enniskillen, the enterprise is for the present abandoned.—*Utica formation, Lower Silurian.*

Phosphate of lime (Apatite).

1. North Elmsley, lot 25, range 8.....*A. S. Brown, Brockville.*

a. Specimen of phosphate of lime from a bed.

This deposit has been traced across lots 24, 25, and 26, range 8 of North Elmsley, for a distance of about a mile, in a direction nearly S. W. It apparently forms an irregular bed in the Laurentian limestone. On lot 25, where it has been somewhat quarried, the breadth of the bed seems to be about ten feet, of which three feet are nearly pure crystalline apatite, with only a small admixture of black mica. The remainder is mingled with the limestone, the phosphate, however, in many parts largely predominating.—*Laurentian.*

2. South Burgess, lot 9, range 5..... *A. Cowan, Kingston.*

a. Specimen of phosphate of lime from a bed.

The deposit of phosphate of lime seen in North Elmsley, appears to be continued southwestwardly through Burgess. Indications of it occur on lot 2, range 7, and the quantity on lots 7, 8, 9, 10, range 5, still farther on, appears to be important.—*Laurentian.*

3.

REFRACTORY MINERALS.

Soapstone (steatite, compact talc).

1. Bolton, lot 24, range 4..... *Geological Survey.*

a. Cut specimens of soapstone.

2. Sutton, lot 12, range 7..... *Geological Survey.*

a. Cut specimens of soapstone.

Among the magnesian rocks at the base of the Quebec group, in that part of its distribution where it is in a metamorphic state, soapstone or steatite occurs in great abundance. Beds of it, varying in thickness from one to sixteen feet, can be traced for long distances, usually not far removed from serpentine, dolomite, or magnesite; or apparently replacing one or other of these rocks. In general the soapstone is remarkably pure, but occasionally there are disseminated in it crystals of bitter spar or of actinolite. The specimens exhibited from Sutton and Bolton are from equivalent bands of twenty and thirty feet respectively, on the opposite sides of Sutton Mountain. In the latter locality the soapstone is interstratified with potstone and dolomite, and in some parts of the band, the three rocks are seen to interlock among one another in lenticular masses. These two bands of soapstone appear to be on the opposite sides of a general synclinal form; yet Sutton Mountain between them, has an anticlinal structure, with a height stated to be four thousand feet.

This mountain occupies a breadth of ten miles at the province line, but gradually narrows, and completely dies down in a distance of thirty miles north-eastward. Its structure may be explained by stating that Sutton valley on the west, Sutton Mountain in the middle, and Potton valley on the east, run upon three anticlinal axes, which converge to the north-eastward, like the sticks of a fan; and while the rocks on the two outside anticlinals have been worn into valleys, those on the middle anticlinal have resisted denudation. Sutton Mountain is continued into Vermont, in Jay Mountain; which appears to stand on one of the main axes of the Green Mountain range.—*Quebec group, Lower Silurian.*

Potstone (compact chlorite).

1. Bolton, lot 26, range 2..... *Geological Survey.*

a. Cut specimens of potstone.

A considerable portion of the rocks of the Quebec group, in their metamorphic condition, consists of chloritic slates; which appear to occupy a somewhat higher stratigraphical place than the more magnesian strata just mentioned, and usually to fill up the middle, and more elevated parts of the synclinal forms of the Quebec series, through the country. There occur also bands of pure compact chlorite or potstone interstratified with the more magnesian strata. Some of these are of considerable thickness, and the one in Bolton, from which the specimens are taken, has a width of about twenty feet.—*Quebec group, Lower Silurian.*

Mica rock.

1. Shipton, lot 18, range 5..... *Geological Survey.*

a. Uncut specimens of mica rock.

In nearly the same stratigraphical place as the potstone, there occurs, in some localities, a compact, hydrous mica, which so much resembles potstone as to have been mistaken for it; and very probably it possesses the same refractory properties. Where the specimens were obtained, a breadth of five feet is exposed; the full thickness of the band, however, is supposed to be much greater.—*Quebec group, Lower Silurian.*

Mica.

1. Grenville, lot 9, range 6 ..... *Geological Survey.*

a. Cut and dressed plates of mica.

2. Augmentation of Grenville ..... *Geological Survey.*

a. Specimen of mica in crystals.

3. North Burgess, lot 17, range 9..... *A. Cowan, Kingston.*

a. Cut and dressed plates of mica.

4. South Burgess, lot 1, range 4 ..... *A. Cowan, Kingston.*

a. Uncut specimens of mica.

Magnesian mica or phlogopite occurs abundantly, in small scales, in the crystalline limestones of the Laurentian system, but sometimes also in crystals sufficiently large to be economically available. These are generally met with near bands of quartzite, or of pyroxenic gneiss, limiting the limestones, or near to some interstratified mass of a similar character, and they are usually associated with other minerals. Among these, in addition to quartz, pyroxene and feldspar, there occasionally occur tabular spar, apatite, sphene, iron pyrites, idocrase, garnet, tourmaline, zircon, and sometimes corundum. In Grenville, where the mineral is imbedded in massive pyroxene rock, close alongside of a band of crystalline limestone, crystals of mica have been obtained, giving sheets measuring twenty-four by fourteen inches. In North Burgess, where it has been mined by Mr. Cowan, on lot 17, range 9, the mica is imbedded in a soft pyroxenic rock, running apparently N. E. and S. W., and limited by a band of quartzite on the southward side. The mica here appears to run for seventy-five yards in pretty regular bands, and some of the sheets, after being dressed, are as much as twenty inches square; some have been obtained measuring twenty by thirty inches.—*Laurentian.*

Plumbago or black lead.

1. Pointe du Chêne Graphite Mine, County of Argenteuil... *Russell & Co., Kingston.*

   a. Specimen of plumbago from a bed.

2. Augmentation of Grenville, lot 3, range 6 ..... *Geological Survey.*

   a. Specimen of plumbago from a bed.

3. Lochaber..... *A. Cowan, Kingston.*

   a. Specimen of plumbago from a bed.

The crystalline limestones of the Laurentian system are very generally marked by the occurrence of graphite or plumbago, in small scales, which are often so thickly disseminated in particular bands of the rock, as to give them a black or dark grey color, distinctly marking its stratified character. It occurs also in beds, in sufficient purity and quantity to be economically available. The workable beds which have been observed, are chiefly in various townships on the north side of the Ottawa. They occur in many localities, at considerable distances from one another, but several of the exposures are probably repetitions of the same bed, or, at any rate, of beds approximately equivalent, in repetitions of the same band of limestone. The whole Laurentian series is so corrugated, that the outcrop of one of these bands of limestone, in the counties of Argenteuil and Two Mountains, followed through all its windings, in an area of fifty miles northward by twenty miles eastward, measures upwards of 200 miles. A bed of pure graphite occurs in the Augmentation of Grenville, and has been traced at intervals, for a distance of about three miles, running a little east of north. One of the exposures, occurring on lot 3, range 2, has been mined, to a small extent, by Messrs. Russell & Co. At the opening of the excavation, it shewed a thickness of about ten inches, but the pure graphite was found to form a lenticular mass, which appeared to be separated from other masses of the same character by intervals, in which the graphite became intermixed with the limestone. It is probable that a number of these, running through the rock at the same horizon, may represent the general character of the workable beds. On lot 3, range 6, the bed becomes three feet thick, but here the quality is impaired by the presence of foreign earthy matters, which, however, can scarcely be detected by the eye.—*Laurentian.*

Asbestus.

1. St. Joseph seigniory ..... *Geological Survey.*

a. Specimen of asbestus from a vein.

Asbestus, generally a fibrous serpentine or chrysotile, occurs in veins cutting the serpentine of the Eastern Townships.—*Quebec group, Lower Silurian.*

Friable Sandstone.

1. Pittsburgh, lot 20, range 1. ..... *A. Cowan, Kingston.*

a. Specimen of sandstone as sent to foundries.

This crumbling sandstone occurs in a bed upwards of twenty feet thick, and is in much demand for iron foundries, being used to protect the sides and bottoms of the furnaces. It is supplied to the founders of Montreal at $3, and to those of Toronto at $2.50 per ton, after being carried about 170 miles, in opposite directions, to these places. About 1500 tons are consumed in the foundries of these two cities.—*Potsdam formation, Lower Silurian.*

Fire-Clay.

1. Dundas ..... *Geological Survey.*

a. Specimen of fire-clay.

This clay is derived from an argillaceous band twenty feet in thickness, near the base of the Clinton formation. The rain washes the clay from the bank, and deposits it in the bottom of pools at its foot. When the water dries up in these, the clay is dug from them, and is used in the iron foundries at Dundas and at Hamilton. From the neighborhood of Dundas, the Clinton formation strikes south-westward, and after folding over an anticlinal axis, which runs southward of west from the extremity of Lake Ontario, it returns on the south side of Lake Ontario, towards the Niagara River. The same clay band is thus again met with in the escarpment near the village of Ancaster. The clay has only lately come into use, and not much is yet known regarding its merits, but it is said to answer a good purpose, and in Mr. Gartshore's foundry, at Dundas, has entirely superseded the fire-clay formerly imported from the United States.—*Clinton formation, Middle Silurian.*

2. St. Foy, near Quebec. ..... *Michael Finley, Quebec.*

a. Specimen of clay.

b. Piece of pottery made from the clay.

This clay, which is represented by the contributor to be of a refractory nature, forms a considerable deposit at Belmont, the property of Mr. J. W. Dunscomb.—*Drift.*

4.

MINERALS APPLICABLE TO COMMON AND DECORATIVE CONSTRUCTION.

BUILDING STONES.

Limestones.

1. Arnprior, MacNab, lot 4, range C..... *Geological Survey.*

a. A foot cube of limestone, dressed.

This building stone is derived from one of the bands of crystalline limestone of the Laurentian series. It occurs on the property of Mr. McLaren, close upon the margin of the Lac des Chats, one of the expansions of the Ottawa; where a great supply of the rock might be obtained. It has been used by the Board of Works in the construction of a bridge over the river Madawaska, the mouth of which is near to this limestone.—*Laurentian.*

2. Phillipsburg, St. Armand ..... *C. R. Cheeseman, Phillipsburg.*

a. A foot cube of limestone, dressed.

The exposure of limestone from which this stone is derived, occurs within a mile of Phillipsburg, Missisquoi Bay, on the land of the exhibitor, near the line of a proposed railway. The rock is compact and crystalline, dresses easily, and appears to have considerable strength. A few obscure fossils are met with in the rock, belonging to the genera *Pleurotomaria* and *Holopea*. Higher in the series, the organic remains are more distinct, and shew the formation to be equivalent to the Calciferous.—*Quebec group, Lower Silurian.*

3. Caughnawaga..... *Geological Survey.*

a. A foot cube of limestone, dressed.

4. St. Dominique ..... *Geological Survey.*

a. A foot cube of limestone, dressed.

5. East Hawkesbury..... *Geological Survey.*

a. A foot cube of limestone, dressed.

The specimens of building stone from Caughnawaga, St. Dominique, and East Hawkesbury, 3-5, are all from one geological formation, the Chazy; which in the area indicated by the distribution of the places named, is composed of massive beds, yielding blocks of stone fitted for the purposes of canal locks and railroad bridges. The quarries of Caughnawaga have supplied a large amount of material for the upper locks of the Lachine Canal, and those of the Beauharnois Canal. That of Hawkesbury, as well as a quarry on the same formation on Isle Bizard, has furnished blocks for the Carillon Canal. The same formation, near Montreal, and on Isle Jesus, near Terrebonne, has been resorted to for similar blocks for the lower locks of the Lachine Canal. In all the places named, the beds abound

in the remains of encrinites and cystidians, and the peculiar crystallization of these, give to the rock a crystalline texture, which constitutes one of its valuable characters. There is occasionally some admixture of magnesia in the stone, and after long exposure to the atmosphere it assumes a yellowish tinge. The St. Dominique stone is more compact than that of Caughnawaga, and has been used for the purposes of the St. Lawrence and Atlantic Railway.—*Chazy formation, Lower Silurian.*

6. Pointe Claire..... *Geological Survey.*

a. A foot cube of limestone, dressed.

7. Cornwall..... *Geological Survey.*

a. A foot cube of limestone, dressed.

The stone of Pointe Claire and Cornwall, 6—7, belongs to the formation next above the Chazy. It is black, compact, and thick bedded. At Mille Roches, near Cornwall, it has supplied stone for the construction of the locks of the Cornwall Canal, and at Pointe Claire, has furnished the stone used in building the piers of the western half of Victoria Bridge, while that used for the other half was brought from what is said to be the same formation, at Isle la Motte in Lake Champlain. On the north side of the Pointe Claire quarry, there is a vertical exposure of thirty feet of massive strata, varying in thickness from one to three feet, the blocks obtained from which, for the bridge, ranged from four to seven tons.—*Birdseye and Black River formation, Lower Silurian.*

8. Montreal..... *Geological Survey.*

a. A foot cube of limestone, dressed.

9. Chevrotière..... *Geological Survey.*

a. A foot cube of limestone, dressed.

The Trenton formation, which is the next in succession above the Birdseye and Black River, yields excellent building stone at Montreal, at Chevrotière, nearly forty miles above Quebec, and at many intermediate places. The best stone at Montreal is derived from a ten feet band of grey bituminous granular limestone, in beds of from three to eighteen inches thick at the bottom, passing at the top, into a black nodular bituminous limestone; which is interstratified with black bituminous shale, in irregular layers of from one to three inches. This grey limestone, which is near the base of the formation, is a mass of comminuted organic remains, which consist largely of the ruins of crinoids and cystideans. The crystallization of these fossils gives a crystalline character to the rock. A considerable number of quarries are worked upon this band of grey limestone, there being four principal ones near Montreal, and the best houses of the city are built of the stone. The quantity of stone annually quarried in the immediate vicinity of Montreal is computed to be:—

313,200 cubic feet of cut stone,.....	28,600 tons.
5,252 toises of rubble,.....	63,024 "
	91,624 "

The prices of good stone in Montreal are:—

Ashler stone, undressed,.....	$0.13¾ per square foot.
Ashler stone, dressed,.....	0.30 " "
Mouldings, from $0.16⅔ to $3.00, or for a fair moulding,	$1.50 per linear foot.
Fluted columns 18 inches diameter,.....for the stone,	$1.00 per rising foot.
" " " .....for cutting,	$2.50 " "
Heavy rough stone, from 6 to 30 cubic feet, from.....	$0.30 to 0.50 per cubic foot.
Very heavy rough stone, say 60 cubic feet,.....	$1.00 " "

The strata in the neighborhood of the city are much traversed by trap dykes, which probably have a connection with an intrusive mass extending over 700 acres, and constituting Mount Royal, from which the city and island take their name. Some of the quarries display a number of these trap dykes, which run in several directions and intersect one another. In some instances, the limestone, having been removed from among them, the dykes are left standing up several feet above the bottom of the quarries, representing in a marked manner the various details of the cracks they once filled.

In the seigniory of La Chevrotière, a very excellent limestone for building is obtained between three and four miles back from the St. Lawrence. It usually goes, however, under the name of the Deschambault stone, in consequence of its being put on board of boats at this place. The stone is of a yellower or warmer grey than the Montreal stone; it is more even in its tint, and becomes somewhat less discolored by weathering. It is more granular and more easily cut, being softer and tougher, but it does not take so fine nor so sharp an edge, nor does it *pick* so well. Three beds of pretty uniform character are worked; the top and bottom ones are eighteen inches thick each, and the middle one three feet. There is said to be a fourth bed beneath, with a thickness of four feet, which has not been quarried. The strata are so nearly horizontal, that it is difficult to determine their dip; it is therefore probable that the stone will spread to a considerable extent in the vicinity. Along the concession line, it is known for twenty-six acres to the S. W., and five acres to the N.E., and on the road across the concession, it is visible for a breadth of ten acres; beyond which, in sinking wells to a depth of twenty feet in blue clay, no rock is met with. The produce of the quarries of La Chevrotière has a deserved celebrity in Quebec, where it has been used in the construction of churches and other buildings.—*Trenton formation, Lower Silurian.*

Dolomites or Magnesian limestone.

1. Owen Sound..... *Geological Survey.*

a. A foot cube of dolomite, dressed.

This beautiful and enduring stone can be obtained in unlimited quantities, the formation from which it is derived being here 150 feet in thickness, and divided into beds varying from a few inches to six feet. This stone possesses the very great advantage of being free from any substance producing stains. Its color rather improves with the weather, and the beauty of no building erected of it appears, as yet, to be marred by the growth of lichens. It is especially adapted for heavy masonry, and blocks of any required size can be obtained. The quarries are about half a mile from the harbor.—*Niagara formation, Middle Silurian.*

2. Noisy River Falls, Nottawasaga, lot 3, range 11 ..... *Geological Survey.*

a. A foot cube of dolomite, dressed.

This stone is from the lower part of the Niagara formation, and is rather more compact than the Owen Sound specimen. The cliff is here about fifty feet high, and might be quarried with the greatest facility. Few of the beds are less than two feet in thickness, and some of them are about five feet, but the locality is not near to any navigable water or railway.—*Niagara formation, Middle Silurian.*

3. Rockwood, Eramosa, lot 5, range 4..... *Geological Survey*

a. A foot cube of dolomite, dressed.

This specimen is also from the Niagara formation, which is here more than 100 feet thick. The greater part of it consists of thick-bedded light grey porous crystalline dolomite. The beds vary from a few inches to ten feet in thickness; about thirty feet of it is almost white. Buildings of cut stone obtained from this band, are observed to improve in color after exposure, and at a short distance, have a silvery white appearance. The piers of the long railway viaduct over the valley of the Eramosa, at Rockwood, are built of stone from this formation, and have a very substantial appearance. The axis of an east and west anticlinal, runs under Rockwood, carrying a spur of the Niagara formation several miles to the eastward of the general trend of the outcrop. A north and south anticlinal passes under the same place; being one of a series which produces southward indentations in the outcrops of the palæozoic strata all the way from Kingston to the main body of Lake Huron. —*Niagara formation, Middle Silurian.*

4. Guelph, lot 20, range D..... *Geological Survey.*

a. A foot cube of dolomite, dressed.

This stone is from the immediate vicinity of the thriving town of Guelph. The quarries expose fifteen feet of strata similar to the specimen. The thickest bed is four feet, and the thinnest about three inches. The stone is a light grey crystalline dolomite, like the last, somewhat cellular, but strongly coherent. It is easily worked, is suitable for the best architectural purposes, and appears to be of a durable character. The Guelph formation extends over a large area, and much of it is of the same character as the specimen.—*Guelph formation, Middle Silurian.*

5. Oxbow, Saugeen River, Brant, lot 2, range 8..... *Geological Survey.*

a. A foot cube of dolomite, dressed.

b. Journal bearer, from a lower bed of the same rock.

The beds from which the block *a* is obtained, are near the summit of the Onondaga formation, and yield probably the best dolomite for fine architectural purposes, which has yet been discovered in the country. It resembles the Caen stone in the facility with which it can be worked, but it is closer grained, and by no means so absorbent, and is thus better adapted for withstanding the Canadian climate. Two bands, of about ten feet each, occur here, in the upper part of the Onondaga formation. The higher one is exposed at the surface, in a position offering every facility for quarrying it. The bed from which the specimen was procured, is two feet thick, free from stains, and splits with great precision with the plug and feather. The whole upper band is composed of thick beds of the same character; the thickest one in the lower band measures over three feet. The locality is near a projected line of railway, and is twenty-two miles from Southampton Harbor by the present road. It overlooks the Saugeen River, down which large scows can be floated to Southampton.

The specimen *b* is from a very light grey oolitic bed, seventeen inches thick, immediately beneath the previous bed. It has been used for supporting water wheels, in mills in the neighborhood, and found to answer well, becoming highly polished under the action of a revolving shaft.—*Onondaga formation, Upper Silurian.*

Sandstones.

1. Lyn, Elizabethtown, lot 26, range 2 ..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

2. Nepean, lots 27, 28, 29, ranges 5, 6..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

3. Augmentation of Grenville ..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

4. Quin's Point, Seigniory of La Petite Nation ..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

These specimens, 1-4, are derived from the Potsdam sandstone, which constitutes the summit of the lowest group of fossiliferous rocks of Canada. A quarry has been opened on the outcrop of the rock, at Lyn, by Mr. B. C. Brown, and the stone from this, and from a quarry on the property of Mr. Keefer, at Nepean, in the same formation, has been used in the construction of the new Parliament buildings at Ottawa. At Lyn, the beds of sandstone are massive, and are seen resting on the Laurentian gneiss.—*Potsdam group, Lower Silurian.*

5. Pembroke..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

This fine freestone is much exposed in the vicinity of the Allumette rapids, near Pembroke. A quarry has been opened on it, on the land of Mr. Peter White, where it occurs in beds varying in thickness from six to eighteen inches. It is easily wrought and carved, and although soft, is tough, and retains sharp angles and corners.—*Chazy formation, Lower Silurian.*

6. Hamilton, Barton..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

This fine grained compact greenish-gray sandstone is from a deposit of about ten feet in thickness. Some of the beds are thick, but others are thin enough for flagstones; the stone is free from iron stains, but subject to a growth of lichens in shaded and moist situations.—*Grey band, Medina formation, Middle Silurian.*

7. Georgetown, Esquesing, lot 22, range 7 ..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

This is from a bed of light grey freestone, which belongs to a band of about twenty feet in thickness. The beds are mostly thick, fine grained and compact; some split into good flagstones; but all are rather hard for grindstones. It has been used in constructing culverts on the Grand Trunk Railway, and numerous buildings in Toronto, among which are the University and other important structures, and it appears to answer well.—*Grey band, Medina formation, Middle Silurian.*

8. Nottawasaga, lot 2, range 6..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

b. A foot square of do., pierced for a stove pipe.

These specimens are from a band of fine grained soft light grey freestone, supposed to be twenty feet thick. The beds are from two inches to three feet in thickness; some of them *reedy*, or marked by lines of stratification. The stone yields good grindstones, but has not yet been much used for building purposes, although from the specimen *a*, it would appear to be well suited for such. From the facility with which parallel-faced blocks of the required thickness can be obtained, this stone is well adapted for stove-pipe holes, for which it is much used.—*Grey band, Medina formation, Middle Silurian.*

9. North Cayuga, lot 48, range 1..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

A band of white sandstone runs through Haldimand County in Western Canada, and is largely developed on the Oneida and North Cayuga town-line, north of the Talbot road. Its beds are massive, ranging in thickness from one to three feet, and when fine grained, it is well adapted for building purposes. A quarry has been opened in it, on the land of Mr. William De Cew, from whom this specimen of building stone was obtained.—*Oriskany formation, Devonian.*

Labradorite.

1. Abercrombie..... *Geological Survey.*

a. A foot cube of labradorite rock, dressed.

The opalescent variety of labradorite occurs in cleavable masses in a fine grained base of the same mineral character, which forms mountain masses. Where these are thickly disseminated in the paste, the stone becomes a beautiful decorative material, applicable to architectural embellishment, and to articles of furniture. Its hardness is about that of ordinary feldspar, and it would, in consequence, be more expensive to cut and polish than serpentine or marble, but it is not so readily scratched or broken, and would therefore be much more lasting. Professor Emmons states that a block of the stone submitted to the action of a common saw, such as is used in sawing marble, moved by the waste power of a common water-mill, was cut to the depth of two inch in a day. This is understood to be one-fifth the amount that would be cut in a block of good marble, in the same time, by the same means. It would thus appear that though the operation is slower in the case of labradorite, there is no greater amount of mechanical contrivance required than for marble, and that slabs could be prepared for chimney pieces, for pier tables, and other articles of furniture, at a cost beyond that of marble, not greater than is proportionate to the superior beauty and durability of the material.—*Laurentian.*

Gneiss.

1. St. Charles Reservoir, Jeune Lorette ..... *H. O'Donnell, C.E., Quebec.*

a. A foot cube of gneiss, dressed.

This stone has been used for building the dam and reservoir of the Quebec water-works, on the St. Charles river. The gneiss, which is obtained a short distance above the reservoir, is hornblendic, being composed of translucent, colorless quartz, white orthoclase, (the

feldspar predominating over the quartz) and black hornblende, all running in irregular parallel planes, showing the gneissoid structure very distinctly, and having at a little distance, a general grey color. The rock may be split in almost any direction by means of wedges, but most easily in that of the gneissoid layers, particularly when these are even. The layers are occasionally affected by undulations and contortions, but these do not materially affect its dividing by means of wedges. The rock splits and dresses with most difficulty at right angles to the gneissoid layers, but is capable of receiving fine smooth faces, with sharp edges and corners. Masses of almost any size can be blasted out from the rock, and large blocks have been dressed and applied to the masonry work of the reservoir, which will no doubt prove a structure of the most lasting character.—*Laurentian.*

2. Grenville ..... *Geological Survey.*

a. A foot cube of gneiss, dressed.

The porphyroid orthoclase gneiss, which this specimen represents, forms great mountain ranges among the Laurentian rocks, rising into the highest peaks of the orthoclase region, and generally constituting the main body of rock, which separates the great limestone bands from one another. These masses of gneiss appear sometimes to attain several thousand feet in thickness, but are divided at unequal intervals, by thinner and less feldspathic bands, in which the stratification is more distinct.—*Laurentian.*

Syenite.

1. Grenville ..... *Geological Survey.*

a. A foot cube of syenite, dressed.

2. Grenville ..... *Geological Survey.*

a. A foot cube of syenite, dressed.

3. Barrow Island, River St. Lawrence, opposite Gananoque..... *Geological Survey.*

a. A foot cube of syenite, dressed.

The intrusive masses of the Laurentian series consist chiefly of syenite and dolerite. These rocks occur in many parts of the country, but their relative ages have been ascertained principally by the investigation in the counties of Ottawa and Argenteuil. What appear to be the oldest intrusive rocks are dykes of a rather fine grained dark greenish-grey greenstone or dolerite, varying in thickness from a few feet to a hundred yards. Their general bearing appears to be E. and W. These greenstone dykes are interrupted by an intrusive syenite, a mass of which occupies an area of about thirty-six square miles in the townships of Grenville, Chatham, and Wentworth. The specimens 1, 2, are derived from it, and 3 is from an area of a similar character, occurring between Kingston and Gananoque. In Grenville, the syenite is penetrated by dykes of what has been called felsite-porphyry, hornstone-porphyry, or orthophyre, having for its base an intimate mixture of orthoclase and quartz, colored by oxyd of iron, and varying in color from green to various shades of black. Throughout the paste, which is homogeneous and conchoidal in its fracture, are disseminated well defined crystals of a rose-red or flesh-red feldspar, apparently

orthoclase, and, although less frequently, small grains of nearly colorless quartz. All of these intrusive masses are cut by another set of dolerite dykes, which probably belong to the Silurian, or perhaps to the Devonian period.—*Laurentian.*

Granite.

1. St. Joseph, Beauce..... *Geological Survey.*

a. A foot cube of granite, dressed.

This band of granite, which has a considerable proportion of quartz, has been used in the seigniory of St. Joseph for millstones, and would yield a strong and durable building stone, is about fifty or sixty feet thick. It runs with the stratification, near to a band of serpentine, and is supposed to be an altered sandstone, and not an intrusive rock.—*Quebec group, Lower Silurian.*

2. Barnston..... *Geological Survey.*

a. A foot cube of granite, dressed.

An intrusive granite of Devonian age occurs in considerable abundance in the Eastern Townships, and forms many isolated hills, the whole of them of small size, with the exception of Great Megantic Mountain, which occupies an area of about twelve square miles. The rock splits well with plug and feather, and can be obtained in blocks of almost any required size. It forms a handsome building stone, and has been used for bridges on the St. Lawrence and Atlantic Railway. It is composed of white quartz and white orthoclase feldspar, with black mica. An area of this rock occurs in Stanstead, covering six square miles, and there is another in Barnston, from which the specimen now exhibited was obtained. Granite of the same character, and probably of the same age, is widely distributed in the State of Maine, and is traceable to New Brunswick, where it is overlaid by the Carboniferous rocks.—*Devonian.*

MARBLES.

Limestones.

1. Arnprior..... *Geological Survey.*

a. Striped light and dark grey marble, large pattern.
b. " " " " small pattern.
c. " " " " cut across the beds.

At the mouth of the Madawaska, in McNab, a great extent of crystalline limestone is marked by grey bands, sometimes narrower, and sometimes wider, running in the direction of the original bedding, and producing, where there are no corrugations in the layers, a regularly barred or striped pattern. When the beds are wrinkled, there results a pattern something like that of a curly grained wood. The colors are various shades of dark and light grey, intermingled with white. These arise from a greater or less amount of graphite, which is intimately mixed with the limestone. The granular texture of the stone is somewhat coarse, but it takes a good polish, and gives a pleasing marble. Mr. W. Knowles has opened a quarry in limestone of this description at Arnprior, and erected a mill for the purpose of sawing and polishing it for chimney pieces, monuments, and other objects. A monument of it has been erected in the Mount Royal cemetery.—*Laurentian.*

2. Elzivir..... *Geological Survey.*

a. White marble.

3. Grenville..... *Geological Survey.*

a. Yellowish-white marble.

4. Augmentation of Grenville..... *Geological Survey.*

a. Spotted green and white marble.

In the township of Grenville and its Augmentation, a band of crystalline limestone, which has an extensive run through the country, presents, in many places, a peculiar variety of marble, having a white ground marked with a number of small green spots, arising from the presence of serpentine; which occasionally forms angular masses several inches in diameter. This disseminated serpentine, more or less aggregated, usually runs in bands parallel with the beds, and clearly marks the stratified character of the rock. These bands, as in the case of the Arnprior marble, are sometimes even, and at other times corrugated, giving diversities of pattern in cutting. Sometimes the serpentine, instead of green, is sulphur-yellow, as in the specimen from Grenville. In many parts of the country, the Laurentian limestones are free from foreign minerals, and give white marbles. These, however, are usually too coarse grained for statuary purposes, and sometimes they are barred with slight differences of color. The specimen from Elzivir, obtained from Mr. Billa Flint, of Belleville, is an instance of this. Many years ago, a mill for cutting and polishing a marble like the specimen from the Augmentation of Grenville, was erected on the Calumet, lot 19, range 3, of Grenville, where a similar rock occurs; but the demand for the marble was not sufficient to make the enterprise profitable. —*Laurentian.*

5. St. Armand..... *C. R. Cheeseman, Phillipsburg.*

a. White marble.
b. White "
c. White " clouded with pale green.
d. Dove-grey marble, marked with white.

The marbles, of which Mr. Cheeseman exhibits specimens, occur in great abundance in the immediate vicinity of Phillipsburg, on Lake Champlain. They are all easily cut, and take a good polish. Should a railway, which is projected between St. Johns and St. Albans, be carried into operation, it is probable there would be some demand for the stone. No quarries have been opened on any of the beds, and these specimens are taken from surfaces that have long been exposed to the influence of the weather.—*Quebec group, Lower Silurian.*

6. St. Armand..... *Geological Survey.*

a. Black marble.

About a mile and a half south-eastward from Phillipsburg, there occurs a black marble, similar to this specimen. The beds dip to the eastward at an angle of about twelve degrees; a quarry was many years ago opened on one of them, which has a considerable thickness. The stone was exported to the United States, and much esteemed in New York, but the opening of quarries of black marble at Glen's Falls, where there is a great water-power, interfered with the demand, and caused the enterprise to be abandoned.—*Quebec group, Lower Silurian.*

7. St. Joseph, Beauce ..... *Geological Survey.*

a. Red marble, veined with white.

This red marble occurs near the river Guillaume, associated with red shales and sandstones, resembling those of Sillery, near Quebec. The red limestone is succeeded by a band of a peculiar argillaceous rock resembling the *gabro rossi* of the Italians.—*Quebec group, Lower Silurian.*

8. Caughnawaga..... *Geological Survey.*

a. Grey marble.

b. Grey " with red spots.

Similar grey marbles, with red spots, occur in the same formation as the rock of Caughnawaga, behind the city of Montreal, and on Isle Bizard; while beds in the same formation, at St. Lin, in the county of L'Assomption, are wholly red. In all of these localities the rock is filled with fossils, which are plainly seen on the polished surfaces.—*Chazy formation, Lower Silurian.*

9. St. Dominique ..... *Geological Survey.*

a. Dove-grey marble.

The marble of St. Dominique is easily cut, and takes a good polish. It is surprising that situated so near to Montreal, with a railway running near, it has not been applied to various purposes in the city, for which a stone not so good, is at present used.—*Chazy formation, Lower Silurian.*

10. L'Orignal..... *Geological Survey.*

a. Grey marble, with thickly disseminated white spots.

b. Dark grey marble, with more thinly disseminated white spots.

The bed from which the specimen (*a*) is taken, varies in thickness from three to six inches; it is near the surface, and easily quarried, but it has hitherto been but little used. The locality is a quarter of a mile from the S. bank of the Ottawa, four miles west of L'Orignal village, and sixty-four above Montreal. The white spots are caused by small bivalve shells (*Atrypa plena,*) filled with calcspar. Of the darker variety (*b*) there are two beds, of six inches and one foot respectively, near the surface, and overlying the previous bed (*a*). Blocks large enough for chimney-pieces and tables are readily obtained.

11. Esquimaux Island, Mingan group ..... *Geological Survey.*

a. Drab marble.

This drab colored marble occurs in great quantity on Esquimaux Island, of the Mingan group, where the stone might be easily loaded on board of small vessels. It cuts with great facility, and takes a uniform polish.—*Chazy formation, Lower Silurian.*

12. Pointe Claire ..... *Geological Survey.*

a. Brownish black marble.

b. Greenish black "

13. Cornwall ..... *Geological Survey.*

a. Black marble.

These black marbles, from Pointe Claire and Cornwall, are derived from two beds, each about two feet thick, at the base of the Birdseye and Black River formation. These are apparently the only beds of the formation that will take a sufficiently even polish to be fit for the purpose. In the higher beds there are patches, which, from being more argillaceous than other parts, receive but an inferior polish, and produce a bad effect.—*Birdseye and Black River formation, Lower Silurian.*

14. Pakenham ..... *Geological Survey.*

a. Brown marble.

The Birdseye and Black River formation at Pakenham, on the Mississippi, a tributary of the Ottawa, yields a very peculiar dark smoke-brown or snuff-brown marble. The stone takes a good polish; but small pieces of chert are sometimes met with, which renders it necessary to be careful in selecting slabs to be wrought. Mr. Dickson, of Pakenham, on whose property the bed occurs, and from whom the specimen exhibited was obtained, had at one time fitted up an apparatus, driven by the waste power of his saw-mill, to polish slabs for chimney-pieces and other uses. But there was, at that time, no consumption for the material in the neighborhood, and no railway for carriage to a distance, and the marble works were abandoned.—*Birdseye and Black River formation, Lower Silurian.*

15. Gloucester ..... *Geological Survey.*

a. Brownish-grey marble.

16. Montreal ..... *Geological Survey.*

a. Grey marble from the Trenton formation.

b. Grey " from the Chazy formation.

The Montreal marble is derived from a bed in the Trenton, and another in the Chazy formation. Slabs for chimney-pieces and table-tops are sawn and polished by Mr. Hammond, and used for common purposes.— *Trenton and Chazy formations, Lower Silurian.*

17. Dudswell, lot 22, range 7 ..... *Geological Survey.*

a. Cream-white marble, striped with yellow.

b. Dark grey and yellowish marble.

c. Fawn-yellow and white "

Were the limestones of Dudswell worked, it is probable good marble might be obtained from them. The specimens exhibited, of cream-white and yellow, and dark grey and yellow, are from beds that overlie one another. The yellow streaks in both of these marbles are composed of dolomite, while the light ground of the one, and the dark ground of the other, are of carbonate of lime. When the dark grey approaches black, which it sometimes does, and the yellow streaks are narrow, the marble bears a strong resemblance to the Portor marble from Northern Italy, sometimes known as *black and gold.* On analysis, the resemblance between the two is farther sustained by the fact, tha in both cases the ground is a pure limestone, and the yellow veins are dolomite. It is no unlikely, that if the rock were extensively quarried, some beds might be found in which the resemblance to the Portor would be closer than in the specimens exhibited.—*Upper Helderberg formation? Devonian.*

Serpentines.

1. Orford, lot 6, range 13 ..... *Geological Survey.*

   a. Brecciated, dark green serpentine.
   b. " light green "

2. Orford, lot 12, range 8..... *Geological Survey.*

   a. Dark green serpentine, striped with light green.

3. Melbourne, lot 22, range 6 ..... *Benj. Walton, Montreal.*

   a. Green and white serpentine.
   b. Dark and light green "

4. Melbourne, lot 20, range 5..... *Geological Survey.*

   a. Brecciated green serpentine.

5. St. Joseph, Beauce ..... *Geological Survey.*

   a. Brecciated green serpentine, veined with white.

   The band of serpentine, from different places on which, these specimens have been obtained, has been traced on the south side of the St. Lawrence, from Potton to Cranbourne, a distance of 140 miles; in forty miles of which, it is repeated twice by undulations, giving an additional eighty miles to its outcrop. It is again recognized 250 miles farther to the N.E., in Mount Albert, in the Shickshock Mountains; and about seventy miles beyond this, in Mount Serpentine, approaching Gaspé Bay. All the specimens of these rocks, which have been analysed, contain small quantities of chromium and nickel, and the band is associated in its distribution with soapstone, potstone, dolomite and magnesite. The whole of these occur in large quantities, and in them, as well as in the serpentine, chromic iron occurs, sometimes in workable quantities. These rocks, or others immediately near them, contain the metals iron, lead, zinc, copper, nickel, silver and gold; with the drift gold, derived from these strata, are found platinum, iridosmine, and traces of mercury. In 1847, these serpentines, from their distribution, were described in the reports of the Geological Survey as an altered sedimentary rock. All subsequent observations have confirmed this, and beautifully stratified masses of it have at length been discovered in Mount Albert.—*Quebec group, Lower Silurian.*

   None of the serpentines, and, with the few trifling exceptions that have been mentioned, none of the marbles of Canada, have yet been quarried for economic purposes. All of the specimens of them exhibited by the Geological Survey, are consequently from parts of the strata that have long been exposed to the influence of weather, and are of course inferior to the unweathered portions beneath. There appears little doubt that, in time, both the limestones and serpentines will afford a great amount of beautiful material for architectural purposes, and support a great amount of industry.

SLATES, FLAGSTONES, LIME, BRICKS, AND DRAIN TILES.

Roofing Slates.

1. Walton Quarry, Melbourne, lot 22, range 6.....*Benjamin Walton, Montreal.*

a. Specimens of roofing slate.

This band of slate is in immediate contact with the summit of the serpentine. It has a breadth of one-third of a mile, and dips about S.E. $< 80°$. Mr. Walton commenced opening a quarry upon it in 1860, and found it necessary, in order to gain access to the slate, to make a tunnel through a part of the serpentine. To complete this, and to expose a sufficient face in the slate to pursue profitable working, has required two years of time, and $30,000 of expenditure. The face now exposed has a height of seventy-five feet; but the band of slate crosses the St. Francis and the fall from the position where the quarry is now worked, to the level of the stream, is upwards of 400 feet, the distance being one and a half miles, so that by commencing an open cutting on the slate, at the level of the stream, a much greater exposure can be ultimately attained. Up to a comparatively recent period, the usual coverings of houses in Canada have been wooden shingles, galvanized iron or tin-plate, but so many destructive fires have occurred from the use of the first of these, that they are now interdicted in all large towns. Slate, as a covering, costs about one-third more than shingles, but one-half less than tin, and one-third less than galvanized iron. In the following table are shown, 1st, the sizes of the slates, in inches; 2nd, the number of such slates in a square (of 100 square feet); and, 3rd, the price per square at which Mr. Walton supplies his slates, placed on the railroad cars at Richmond, which is within one and a half miles of the quarry.

Sizes.	Number	Price.	Sizes.	Number	Price.	Sizes.	Number	Price.
24 x 16	86	$4 00	20 x 10	169	$4 00	14 x 10	262	$3 00
24 x 14	98	4 00	18 x 11	175	4 00	14 x 9	291	3 00
24 x 12	114	4 00	18 x 10	192	4 00	14 x 8	327	3 00
22 x 12	126	4 00	18 x 9	213	4 00	14 x 7	374	2 75
22 x 11	138	4 00	16 x 10	222	3 75	12 x 8	400	2 75
20 x 12	141	4 00	16 x 9	246	3 75	12 x 7	457	2 50
20 x 11	154	4 00	16 x 8	277	3 60	12 x 6	533	2 25

The quarry has now been in operation since the spring of 1861; 2000 squares have been sold, and some of the slates have been sent to a distance of 550 miles from the quarry; a quantity of them having been purchased for Sarnia on the River St. Clair. To show that slate, as a covering, is well adapted to resist the influences of a Canadian climate, it may be here stated that slates from Angers in France, have been exposed on the roof of the Seminary building on the corner of Notre Dame and St. François Xavier Streets, in Montreal, for upwards of 100 years, without any perceptible deterioration. The strong resemblance between these and the slates of Melbourne, as well as those from Bangor in Wales, may be seen in the following comparative analyses by Mr. T. Sterry Hunt:

	Welsh.	French.	Melbourne.
Silica	60.50	57.00	64.20
Alumina	19.70	20.10	16.80
Protoxyd of Iron	7.83	10.98	4.23
Lime	1.12	1.23	0.73
Magnesia	2.20	3.39	3.94
Potash	3.18	1.73	3.26
Soda	2.20	1.30	3.07
Water	3.30	4.40	3.40
	100.03	100.13	99.63

The proximity of the serpentine leaves no doubt as to the geological horizon of these slates.—*Quebec group, Lower Silurian.*

2. Orford, lot 2, range 5..... *Geological Survey.*

a. Specimens of roofing slate.

3. Tring ..... *Geological Survey.*

a. Specimens of roofing slate.

4. Kingsey, lot 4, range 1..... *Geological Survey.*

a. Specimens of roofing slate.

5. Cleveland (formerly Shipton,) lot 6, range 15..... *Geological Survey.*

a. Specimens of roofing slate.

The Cleveland slates are a continuation of the Melbourne band. The Shipton Slate Company opened a quarry on them in 1854, and found them to be of superior quality. This quarry is now for sale. The slates of Orford may be on the same band, about ten or twelve miles to the S. E.; but the geological horizon of the Tring slates is uncertain, though they probably belong to the Quebec group. The Kingsey slates appear to be lower in the series than the magnesian group of strata.—*Quebec group, Lower Silurian.*

Flagstones.

1. Georgetown, Esquesing..... *Geological Survey.*

a. Specimen of flagstone.

This is a hard, fine-grained sandstone; and the surfaces are even and parallel. Many of the beds of the band, which is twenty feet thick, can be split into flagstones; which are used in the city of Toronto. Similar flagstones, used at Hamilton, are obtained from the same band there, and an equally good quality can be obtained wherever the band occurs.—*Grey band, Medina formation, Lower Silurian.*

Hydraulic lime.

1. St. Catherines..... *J. Brown, Thorold.*

a. Raw cement stone.

b. Prepared cement.

The bed which yields the Thorold cement is a dark brown dolomite of the Clinton formation. During the construction of various railway, and other public works, the quantity of cement manufactured by Mr. Brown averaged 80,000 bushels annually, but at present the quantity made does not exceed one-tenth of the amount. The present price of the cement is from twenty to twenty-five cents per bushel of sixty lbs.—*Clinton formation, Middle Silurian.*

2..... Walkerton ..... *Geological Survey.*

a. Raw cement stone.

b. Prepared cement.

The beds of this deposit are from two to eleven inches thick, occasionally separated by layers of shale, making in all fifteen feet. Cement has not yet been manufactured from this stone; and none is made within 100 miles of the locality, although there would, no doubt, be considerable demand for it in the neighborhood, were it prepared at the place. The locality is in the bank at a mill-dam on the Saugeen River, where an unlimited water-power for grinding the cement may be had.—*Onondaga formation, Upper Silurian.*

3. Limehouse ..... *Geological Survey.*

a. Raw cement stone.

b. Prepared cement.

This stone occurs in a band of nine feet thick, in beds varying from three to seven inches. The cement is manufactured in considerable quantities by Messrs. Bescoby and Newton. It sets slowly, and hardens during several weeks, after which it is said to possess great strength.—*Clinton group, Middle Silurian.*

4. Nepean ..... *Geological Survey.*

a. Raw cement stone.

Though the rock occurs in Nepean, its produce is usually designated as the Hull cement, from having been manufactured for several years, by Mr. Wright of Hull, opposite to Ottawa. The rock is a limestone holding about twelve per cent. of carbonate of magnesia, and it yields a strong and lasting cement. The bed to which it belongs, has been traced for nearly 100 miles through the country, preserving a very uniform character.—*Chazy formation, Lower Silurian.*

5. Rockwood ..... *Geological Survey.*

a. Raw cement stone.

This specimen comes from a band three and a half feet thick, associated with a layer of chert, and separating into beds averaging six inches. It is not worked, but could be easily quarried, and a good water-power for grinding is ready at the spot.—*Niagara group, Middle Silurian.*

6. Magdalen River..... *Geological Survey.*

a. Raw cement stone.

These specimens of black dolomite are derived from the Mountain Portage, about five miles up the Magdalen River from its mouth. The stone occurs in beds of from two to four inches, interstratified in black graptolitic shales, and yields a very strong hydraulic cement, setting in a few minutes under water, to a very hard and tenacious mass of a yellowish color. Similar bands occur at the Grande Coupe, six miles below Great Pond River. The range of the formation containing these bands, being from Gaspé to Quebec, makes it probable that a considerable quantity of the stone may be obtained from various places along the south shore of the St. Lawrence. The stone differs from that at Quebec, from which Capt., now Major-General Baddeley, R.E., first prepared a cement, now manufactured by Mr. P. Gauvreau. This contains no magnesia, while the Gaspé stone is a dolomite.—*Hudson River formation, Lower Silurian.*

Common lime.

1. Guelph ..... *Geological Survey.*

a. Raw limestone.

b. Prepared lime.

This lime is prepared from the Guelph dolomite or magnesian limestone. The stone takes rather longer to calcine than pure limestone; it slacks without the evolution of much heat, to a very white powder, much prized for whitewash and for mortar, which sets quickly. The stone occurs in unlimited quantities.—*Guelph formation, Middle Silurian.*

2. Walkerton..... *Geological Survey.*

a. Raw limestone.

b. Prepared lime.

This remarkably white lime is burnt from a band of drab-colored magnesian limestone, seven feet thick. It makes a superior whitewash and a strong cement.—*Onondaga formation, Upper Silurian.*

3. Montreal..... *Geological Survey.*

a. Raw limestone.

b. Prepared lime.

This limestone, which yields the best stone for the purposes of construction at Montreal, also burns to excellent lime, and the refuse which accumulates in the process of quarrying the building stone, is used for that purpose. The quantity of lime manufactured at Montreal is estimated to be 270,000 bushels per annum, and the price is about $0·16⅔ per bushel.

Common bricks.

1. Owen Sound..... *Geological Survey.*

a. Red bricks.

These bricks are made from a drab-colored clay, which has been dug to a depth of four feet. White bricks are made from the same clay by using a different sand. The deposit is not extensive.—*Drift.*

2. Walkerton, Brant, lot 31, range 2, south ..... *Geological Survey.*

a. Red bricks.

These bricks are made from a bed of nine feet of purplish-brown finely laminated clay, reposing on twenty feet of highly calcareous sand.—*Drift.*

3. St. Jean, County of Lotbinière..... *Geological Survey.*

a. Red bricks.

These specimens are manufactured from a thinly laminated blue clay, which the brick-makers of the place state to be upwards of 100 feet thick, and which requires a mixture of one-third of sand for the manufacture. In 1852 about 2,000,000 bricks were manufactured there by seven brick makers.—*Drift.*

4. Montreal..... *Peel & Compte, Montreal.*

a. Common red bricks; price $5.50 per 1000.

Messrs. Peel & Compte manufacture 6,000,000 common bricks annually, which are sold at from $5 to $6 per 1000.

The red bricks of Montreal are manufactured from a blue clay of marine origin, which is interstratified with reddish layers, and runs under a deposit of sand. The clay has been excavated to a depth of twenty feet, and may be deeper, as the same formation is known

to have a greater thickness in other localities. Its marine origin is proved by the occurrence of sea shells, of about six species in the pure clay, and about thirty in the sandy clay immediately overlying it; all probably the same as species now inhabiting the ocean. Our knowledge of the fossils of these deposits has been greatly extended by the researches of Dr. Dawson, of McGill College, who has more than doubled the number of shells known a few years since, and added to the list many species of *Bryozoa*, *Foraminifera*, and other small forms. The remains of the capeling (*Mallotus villosus*) and the lump-sucker (*Cyclostomus lumpus*) are obtained from the same clays near Ottawa, and a clay-pit of Messrs. Peel & Compte, on Côteau Baron, has yielded nineteen of the caudal vertebræ of a cetacean, similar to a species discovered in Vermont by the late Mr. Zadock Thompson, and named by Mr. C. H. Hitchcock, *Beluga Vermontana*. On Côteau Baron these remains were accompanied by one of the pelvic bones of a seal, by sea-shells, and by fragments of white cedar, *Thuya occidentalis*. The locality is about 140 feet above the level of the sea. In another of Messrs. Peel & Compte's pits there has recently been found a nearly entire skeleton of the Greenland seal (*Phoca Grœnlandica*,) a species still living in the Gulf of St. Lawrence; from the size of the head, the animal appears to have been six feet long, and full grown. Within a few days, a clay-pit of Messrs. Bulmer and Sheppard has given many of the bones of some other animal, supposed to be a seal, of much smaller dimensions. The brick yards are situated to the north-east of Mount Royal, on a plateau of considerable extent; above which, well-marked sea margins occur on the sides of the mountain, at elevations of 220, 386, 440 and 470 feet above the sea level, with marine shells up to the last mentioned height.—*Alluvion.*

5. Montreal ..... *Bulmer & Sheppard, Montreal.*

a. Common building bricks, price $ 5 per 1000.
b. Pressed front bricks, " $10 "
c. Radiating front bricks " $ 7 "
d. Circular bricks for shafts " $12 "

The quantity of bricks manufactured by Messrs. Bulmer & Sheppard is equal to 6,000,000 per annum. In this manufacture they use Boaden's brick-making machine.—*Alluvion.*

6. Hanover, Brant..... *Geologica. Survey*

a. White bricks.

The specimens are manufactured from a brownish laminated clay, which burns white, and is underlaid by a considerable deposit of sand. Either red or white bricks are made of this clay, according to the sand used.—*Drift.*

7. Toronto..... *Geological Survey.*

a. White bricks.

The deposit of clay, from which these white bricks are manufactured at Toronto, has a thickness exceeding sixty feet, and extends eastward, at least as far as Cobourg. It appears to be unconformably overlaid by a bed, which is three feet thick, giving red bricks. The white brick-clay lies in very even horizontal strata, while the other undulates with the general surface, not however descending to the bottom of deep ravines. The average annual manufacture of white bricks in Toronto is from three to five millions, and the ordinary price at the kiln is from $5.50 to $6.00 per 1000. The price of common red bricks is from $3 to $4 per 1000, and the average annual manufacture, including all kinds, is from eight to ten millions.—*Drift.*

Drain tiles.

1. North Plantagenet..... *C. P. Treadwell, L'Orignal.*

   a. One-and-a-half-inch red agricultural drain tiles.

   These tiles are manufactured by Thomas Gibb, at Treadwell, North Plantagenet, from a blue clay which forms a considerable deposit on the banks of the Ottawa. The price of these tiles is $10 per 1000.

2. Quebec ..... *H. O'Donnell, C.E., Quebec.*

   a. Clay used in making sewerage pipe tiles.

   b. A six inch sewerage pipe tile.

   These tiles are manufactured by Messrs. W. & D. Bell, from a deposit of clay, varying in thickness from three feet to thirty feet, on the river St. Charles, between one and two miles from Quebec. They are used for main sewers and house drains, in the city of Quebec, where 151,000 feet of them have been laid. They are united by means of rings of the same material, which cover the joints, and permit alterations and repairs without breaking the pipes. When in place, the pipes are capable of resisting a pressure of fifty lbs. to the square inch, and, when properly glazed with a composition, (the base of which is oxyd of lead,) which is applied either within and without, or within only, they remain free from the incrustations that are found to gather on the inside of iron pipes. The prices of these drain-tiles are:

4 in.	6 in.	9 in.	12 in.	15 in.	18 in.	internal diameter.
$0.15	$0.21½	$0.33¾	$0.60	$0.84	$1.13¾	per linear foot.

5.

GRINDING AND POLISHING MINERALS.

Whetstones.

1. Stanstead, lot 15, range 1..... *Geological Survey.*

   a. Cut whetstones.

2. Hatley, Massawippi Lake ..... *Geological Survey.*

   a. Cut whetstones.

3. Bolton, lot 23, range 6..... *Geological Survey.*

   a. Cut whetstones.

4. Kingsey, lot 7, range 2..... *Geological Survey.*

   a. Cut whetstones.

   In the Eastern Townships, stones of a good grit for the purpose of whetstones are found in several places. A band of this kind runs from Whetstone Island in Memphramagog Lake, lot 15, range 1, of Stanstead, by Lee's Pond to the head of Massawippi Lake, in Hatley; a distance of nearly twelve miles, and it may be available much further. The rock appears to be a mica slate, passing into an argillite, and its stratigraphical place would seem to be above the magnesian series. There is also a range of whetstone rock on each side of the anticlinal running from Melbourne to Danville, beneath the magnesian rocks. This rock again appears on the north-west side of the Shipton and St. Armand synclinal, in Kingsey, and good samples of the stone occur on lot 7, range 2 of the township, where whetstones were some years ago manufactured by Messrs. Gilmour & Jackman. They are much softer than the Memphramagog stones, the rock being probably more argillaceous. The Bolton stone very much resembles that of Memphramagog, but its stratigraphical place is probably the same as that of Kingsey.—*Quebec group, Lower Silurian.*

5. Collingwood, lot 25, range 6 ..... *Geological Survey.*

a. Cut whetstones.

These whetstones are obtained from about twenty feet of thin, even bedded, and very fine grained sandstones and arenaceous shales, at the top of the Hudson River formation. The inhabitants of the neighborhood make whetstones for their own use, from this rock, but it has never been extensively worked. The same rock is found in the same geological position at Meaford, Cape Rich, and on the Grand Manitoulin Island.—*Hudson River formation, Lower Silurian.*

6. Nottawasaga, lot 24, range 11..... *Geological Survey.*

a. Cut whetstones.

The specimens are taken from about twenty feet of freestone, representing the Grey-band. The rock is in every way suited to make superior scythe stones, although they have never yet been manufactured from it.—*Medina formation, Middle Silurian.*

7. Noisy River Falls, Nottawasaga ..... *Geological Survey.*

a. Cut whetstones.

These specimens are from a few feet of very fine grained compact sandstone at the foot of the falls, and immediately underlying the dolomite of the Clinton formation. It appears to be the upper part of the Grey-band. The rock is not worked in this locality.—*Medina formation, Middle Silurian.*

8. Madoc, lots 4 and 5, range 5..... *Geological Survey.*

a. Cut whetstones.

The mica slates associated with the crystalline limestones of the Laurentian series are frequently of the character required for scythe stones, and a band of this description occurs in Madoc, on the property of Mr. O'Hara, who at one time cut and wrought the rock into whetstones for sale. The whetstone rock occurs not far from crystalline limestone, and in immediate contact with a thick band of conglomerate, of which the matrix weathers white, and appears to be a dolomite. The pebbles, which are frequently large, some of them being six inches in diameter, are chiefly of quartz, but there are others of feldspar, and some which are calcareous. The quartz pebbles are for the most part distinctly rounded, and their colors various, some being bluish, and others white or pinkish on fracture. Those of feldspar are red and white.—*Laurentian.*

Hones.

1. Ottertail Lake, Thessalon River..... *Geological Survey.*

a. Cut hones.

Some of the silicious slates of the Huronian series yield very fine hones. They are usually of a green color, and belong to the lower part of the series.—*Huronian.*

Grindstones.

1. Nottawasaga, lot 24, range 11..... *Geological Survey.*

a. A grindstone, twenty-eight inches in diameter.

This grindstone is from the Grey-band, which is about twenty feet thick at this locality, and the whole of it appears equally well qualified for making grindstones. It splits well into the various thicknesses required for these stones, and they have been made from it, by hand, in considerable numbers, both at this place, and in the township of Mulmur. The same rock is found in many places near the escarpment of the Niagara formation, in Nottawasaga and Mulmur. The grindstones made from it, are declared by practical men, to be superior to those imported; but they have never yet been manufactured by machinery. A lathe for turning them could be erected on one of the numerous streams which cross the formation, for about $1000 (£200 stg.). Grindstones roughly hewn by hand, sell for 1½ cents per pound on the spot, which is the price of the imported Ohio stones, as sold on the coast of Lake Huron.—*Grey band, Medina formation, Middle Silurian.*

Millstones.

1. Grenville, lot 3, range 5 ..... *Geological Survey.*

a. A buhrstone, dressed.

This buhrstone occurs on the property of Mr. James Lowe. On his land and that of some of his neighbors, it constitutes a series of veins, cutting an intrusive mass of syenite, which occupies an area of thirty-six square miles, among the Laurentian rocks of Grenville, Chatham, and Wentworth. The veins consist of yellowish-brown or flesh-red cellular chert; the colors, in some cases, running in bands parallel to one another, and sometimes being rather confusedly mingled, giving the aspect of a breccia. The cells are unequally distributed, some parts being nearly destitute of them, while in others they are very abundant, and of various sizes, from that of a pin's head to an inch in diameter. On the walls of some of the cells, small transparent crystals of quartz are implanted; and in some of them are impressions of cubical forms, resulting, probably, from crystals of fluor spar, which have disappeared The stone has the chemical composition of flint or chalcedony. On Mr. Lowe's ground, one of the veins runs nearly east and west, and stands in a vertical attitude; while its breadth varies from about four to about seven feet. When the vein is banded, the colors run parallel with the sides. The attitude and associations of the chert clearly show that it cannot be of sedimentary origin, and its composition, taken in conjunction with the igneous character of the district, suggests the probability that it is an aqueous deposit, which has filled up fissures in the syenite, and is similar in its origin to the agates and chalcedony which in smaller masses are common in various rocks. For a distance of perhaps 200 yards on each side of these veins of chert, while the quartz of the syenite remains unchanged, the feldspar has been more or less decomposed, and is converted into a sort of kaolin. As this process involves a separation of silica from the feldspar, it is not improbable that it has been the origin of the veins of silex.—*Laurentian.*

2. Cayuga, north of Talbot Road..... *Geological Survey.*

a. A barley millstone.

Millstones for grinding oats and barley are manufactured by Mr. W. De Cew, of De Cewville, in the County of Haldimand, from whom this millstone was obtained. The stones, which are highly esteemed for the purposes to which they are applied, are derived from a bed of sandstone, varying in thickness from six to ten feet, which in some parts of its distribution, abounds in fossils. It constitutes the base of the Devonian series of Canada.—*Oriskany formation, Devonian.*

6.

MINERAL MANURES.

Gypsum.

1. Oneida ..... *Thomas Martindale.*
   - *a.* Crude gypsum.
   - *b.* Prepared "

2. Oneida ..... *Jno. Donaldson.*
   - *a.* Crude gypsum.
   - *b.* Prepared "

3. York, Grand River ..... *Alexander Taylor.*
   - *a.* Crude gypsum.
   - *b.* Prepared "
   - *c.* Plan of the mine, by Mr. J. De Cew.

All the gypsum mines at present worked in Canada, occur on the Grand River, in a distance of thirty-five miles, extending from Cayuga to Paris. The formation, to which they belong, however, runs from the Niagara River, to the Saugeen, on Lake Huron, a distance fo about 150 miles; and it seems probable that as the country to the north-west of Paris becomes more settled, further discoveries of workable masses will be made in that direction All the mines appear to be confined to one stratigraphical position in the formation, which is probably about the middle. The mineral occurs in lenticular masses, varying in horizontal diameter, from a few yards to a quarter of a mile, with a thickness of from three to seven feet. The layer of gypsum appears to be in general both underlaid and overlaid by beds of dolomite, much of which is fit for the purposes of hydraulic cement, and the gypsum itself is sometimes interstratified with thin beds of dolomite. In some parts, there appear to be two workable ranges of gypsum, one a few feet above the other. But this, perhaps, is only to be considered a thickening of the gypsiferous band, with an interstratification of a thicker mass of dolomite.—*Onondaga formation, Upper Silurian.*

The following is the amount of gypsum raised annually from the quarries on the Grand River:—

T. Martindale, Oneida..,	8500	tons.
J. Donaldson, "	1500	"
A. Taylor, York,	3000	"
Thompson & Wright, Paris,	4000	"
J. Brown, Cayuga,	2000	"
	14000	"

The greater part of this gypsum is employed for agricultural purposes, and the prices at which it is sold are as follows:—

Plaster, unground,	$2.00	per ton.
" ground for the land,	3.50—4.00	"
" " " stucco, raw,	5.50—7.00	"
" " " " calcined,	16.00	"

Fresh-water Shell Marl.

1. New Edinburgh ..... *Geological Survey.*
   - *a.* Specimen of marl.

This deposit is on the property of Messrs. John & Thomas MacKay, of Rideau Hall, New Edinburgh, and is five feet thick. Among the shells which it contains, are the following species: *Physa heterostropha, Limnæa pallida, Planorbis bicarinatus, P. campanulatus, P. parvus, Amnicola porata,* and *Valvata tricarinata.* With a thin covering of vegetable

mould, the marl supports a growth of large forest trees, under which it extends some distance along the east side of a small lake or pond, which occurs in the course of a small stream, discharging by a narrow ravine into the Ottawa close by. The surface of the pond is twenty-six feet above the river in summer, but only six feet in the freshets of spring; the river in summer is 118 feet above the sea. The marl bed is on a level surface, twenty-five feet above the pond, and, after spreading over a breadth of 200 yards, it appears to run under a terrace five feet higher, which maintains a level surface for considerable distance. This, instead of overlying the marl, may be the margin of the lake in which it was deposited. The pond is 200 yards wide, and on the west side there are evidences of three periods of recession, in distinct terraces; which are at heights of thirty, sixty, and seventy-five feet, respectively, over the level of the pond, or 174, 204 and 219 feet above the sea, each with a sudden step rising to the next. The upper step, or perhaps the upper two steps, may exhibit former limits of the sea. The clays of the banks of the Ottawa, at this part, are of marine origin, and nine miles farther down the river, at Green's Creek, hold the remains of two species of sea fish, which have been already mentioned (page 45), the *Mallotus villosus*, or common capeling, and the *Cyclostomus lumpus*, or lump-sucker; with *Saxicava rugosa*, *Leda Portlandica*, and other sea shells. The two flappers of a seal were obtained from the same clay, as well as sea-weeds, and leaves of large exogenous trees.—*Alluvion.*

2. Sheffield, lots 15 and 16, range 2 ..... *Geological Survey.*

a. Specimen of marl.

This deposit, which is on the property of Mr. McDonell, extends over an area of 200 acres and perhaps more, with a thickness, over the greater portion, of at least ten feet. On the surface there is a thin soil, bearing a luxuriant growth of prairie grass. The species of shells observed here are *Planorbis bicarinatus*, *P. parvus*, *Physa heterostropha*, *Amnicola porata*, with undetermined species of *Limnæa*, *Valvata*, *Cyclas*, and *Pisidium*. Another locality in Sheffield, where marl occurs, is on lot 12, ranges 3 and 4, extending over at least 300 acres and perhaps more than 400. The place where it occurs is chiefly a swamp or marsh, and it is covered over by an accumulation of excellent peat, averaging four feet in thickness. Still another locality in the same township, is in White Lake, and the brook leading from this to Beaver Lake.—*Alluvion.*

3. Montreal ..... *Geological Survey.*

a. Specimen of marl.

This deposit, which is very pure and white, occurs at Thornberry on the west side of Mount Royal. It is overlaid by peat, but does not seem to be of very great extent. The species of shells met with in it are *Planorbis campanulatus*, *P. bicarinatus*, *P. trivolvis*, *P. parvus*, *Limnæa umbrosa*, *L. stagnalis*, *Physa marginata*, *P. heterostropha*, *Valvata bicarinata*, *Amnicola porata*, *Melania acuta*, *Cyclas similis*, *Pisidium dubium*, and an undetermined *Unio.*—*Alluvion.*

4. Nepean ..... *Geological Survey.*

a. Specimen of marl.

This deposit is on the property of Mr. Sparks, of Ottawa. It is a foot thick, and is covered with a thin layer of peat. The species of shells found in it are *Physa heterostropha*, *P. marginata*, *Planorbis bicarinatus*, *P. parvus*, *P. campanulatus*, *Limnæa modicella*, *Amnicola porata*, *Valvata tricarinata*, and *Pisidium.*—*Alluvion.*

5. West Hawkesbury, lot 18, range 4..... *Geological Survey.*

a. Specimen of marl.

The marl is found on the property of Mr. George Cross, in the bottom of a prairie-like flat, traversed by a small brook; it is known to cover between three and four acres on this lot, but it is believed to be more extensive, and to continue into the next lot eastward. The specimen was obtained near the edge of the deposit. The bed is here three and a half feet deep, and is overlaid by four feet of peat. The surface is overgrown with grass, reeds, and moss, and the locality appears to have been the former site of a small lake. The marl taken from the upper half of the bed, becomes white when dry, and is filled with well preserved shells; that from the lower half is of a bluish color and more tenacious character. Branches and trunks of trees, in a good state of preservation, are found in the marl, but not in the peat. The marl has proved a very efficacious manure to the adjoining lands, which are of a sandy character. In digging it, the effluvium evolved is so offensive, that few men can bear it. The peat is also used as a manure by the proprietor. The following species of fresh-water shells have been obtained from this marl: *Limnæa stagnalis, L. umbrosa, Planorbis trivolvis, P. campanulatus, P. bicarinatus, P. parvus, Physa heterostropha, Amnicola porata, Valvata tricarinata, Cyclas similis,* and an *Anodonta.—Alluvion.*

6. Brant, lot 6, range 1, N. of Durham road ..... *Geological Survey.*

a. Specimen of marl.

The marl here occurs in a flat meadow, skirting a small stream, and extends over an area of seven acres. The bed is two feet deep, and is covered by a foot of peat, which supports a growth of prairie grass. The marl from the lower part of the bed is of a blue color when wet, while that from the middle is whitish, and has been used by the people of the neighborhood as a whitewash, but not yet as a manure, the lands being naturally very calcareous. Most of the shells are finely comminuted, and only an occasional whole specimen preserved. These appear to belong altogether to small species, and among them occur *Planorbis parvus, Valvata humeralis, V. tricarinata, Amnicola porata,* and several small species of *Pisidium.—Alluvion.*

7. Carrick, lot 25, range 15..... *Geological Survey.*

a. Specimen of marl.

This deposit is about six acres in extent, with an ascertained depth of twenty-seven inches. It is very white, and overlaid by a thin stratum of black mould. The surface has the aspect of prairie land, and is intersected by a brook. Similar prairies, in which marl is said to be found, occur at intervals along the brook, for four miles, and the whole area underlaid by marl, is estimated at forty acres. It has hitherto been used only for whitewashing. Among the shells which it contains, the genera *Limnæa, Planorbis, Physa, Valvata, Amnicola, Cyclas* and *Pisidium* are represented. A great many deposits of marl, similar to this and to the last, are met with in the counties of Bruce and Grey.—*Alluvion.*

8. Bentinck, lot 26, range 1..... *Geological Survey.*

a. Specimen of marl.

This bed occurs in low ground, close to the town of Durham. Its extent is uncertain, but it is known to cover eight or ten acres. At the spot where the specimen was taken, its depth was four feet. It is very solid and pure, and is covered by heavy timber. *Physa heterostropha, Planorbis parvus, Valvata tricarinata,* and *Amnicola porata,* with small species of *Pisidium,* are among the shells which it contains.—*Alluvion.*

9. Anticosti ..... *Geological Survey.*

a. Specimen of marl.

Marl Lake, at the west end of Anticosti, has a superficies of about ninety acres, and appears to have a bottom covered with shell marl. The thickness of the marl seems to be considerable, but its exact measure has not been ascertained. The creek which empties the lake into Indian Cove, carries down a large quantity of the marl to the sea, where it becomes spread out for a considerable distance over the rocks of the vicinity. This is the most northern deposit of marl which has been met with. Among the species of shells which it contains are *Limnæa acuta, Planorbis parvus, P. trivolvis?* with another small undetermined species, *Physa heterostropha, Valvata sincera, Pisidium dubium,* and one or two species of the last genus, supposed to be new. The most abundant species observed is *Limnæa acuta,* (Lea,) the next most abundant is *Valvata sincera* (Say,). Two small species of land snails were met with in the marl, *Helix arborea* and *H. striatella.*—*Alluvion.*

10. Belleville ..... *Geological Survey.*

a. Specimen of marl.

This deposit is on the land of Mr. Yeoman of Belleville, but does not appear to be extensive. The species of shells observed are *Valvata humeralis, Pisidium dubium,* with an undetermined *Limnæa* and a *Pisidium.*—*Alluvion.*

11. St. Armand ..... *Geological Survey.*

a. Specimen of marl.

This shell marl occurs on a pond, a mile south-east of Phillipsburgh, on lots 156 and 157 of St. Armand, on the lands of Mr. Strite and Mr. Taylor. The marl is visible all around the pond, and consists of the comminuted remains of fresh-water shells to a depth of several feet, resting on a deposit holding marine shells, probably of the age of the drift. The fresh-water species are *Planorbis parvus, P. campanulatus, Limnæa umbrosa, Physa heterostropha, Valvata tricarinata,* and *Amnicola porata.* The whole depth is in some parts seven feet, and the area of the deposit may be between thirty and forty acres. The specimen exhibited was obtained from Mr. Strite.—*Alluvion.*

Calcareous Tufa.

1. Noisy River Falls ..... *Geological Survey.*

a. Specimen of tufa.

This tufa covers the extensive slopes on both sides of the river, from the base of the Niagara escarpment to the edge of the water. It is constantly soft and moist, and is cut into by numerous springs, which flow down the long slopes. It probably covers an area of 300 acres in the vicinity of the falls, with an average thickness of five feet. Tufa of this character is found in many places along the base of the Niagara formation, in the counties of Grey and Simcoe; the most important is that on the great slopes of the Beaver River, in Euphrasia and Artemesia, which is supposed to extend over more than 1000 acres, in the form of a strip on each side of the river.—*Alluvion.*

7.

MINERAL PAINTS.

Iron ochres.

1. Ste. Anne de Montmorenci ..... *E. Caron, Ste. Anne.*

a. Brownish ochre.
b. Brownish-black ochre.
c. Yellow ochre.

This deposit of ochre is situated on the property of Mr. E. Caron, about a mile and a quarter above the mouth of the Ste. Anne River. It appears to extend over about four square acres. The locality is on the top of a bank, overlooking the main road, from which it is removed about a quarter of a mile. The surface of the bed has a slope to the south-east, of about fifty feet in one hundred and fifty yards, but its bottom keeps nearly level with the lower side for some distance back, and then rises quickly to the higher side. The thickness of the deposit is thus seventeen feet in the deepest part, and varies from that to four feet. Its form gives great facilities for excavating the ochre, as by beginning on the lower side, a considerable face of it would be exposed, and the water would run from it without the necessity of cutting drains. The three colors exhibited occur at the surface, but the lower and by far the larger part, is of a pale green color. In this green portion the iron is in a lower state of oxidation than in the yellow, but like it, becomes red upon ignition in the air.—*Alluvion.*

2. Cap de la Madelaine ..... *Geological Survey.*

a. Greenish-black ochre.
b. Yellow ochre.

In the St. Malo range of the seigniory of Cap de la Madelaine, about two miles below the church, and two miles back from the St. Lawrence, there is a deposit of ochre, extending over about 600 square acres. It is interstratified by peat, and underlaid by shell marl, which in successive borings along a transverse section from S. E. to N. W., were found to be arranged as follows, in descending order,—ochre, peat, and marl being indicated by the letters O, P, M:—

Paces, 50	100	145	181	281	441
Ft. in.	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*	*Ft. in.*
O, 0 6	O, 2 0	O, 1 6	O, 2 0	P, 9 0	O, 2 0
P, 0 6	P, 4 0	P, 8 0	P, 4 0	M, 0 6	P, O, P, M, 7 0
O, 0 6					
P, 2 0					
3 6	6 0	9 6	6 0	9 6	9 0

In the remaining 320 paces, the ochre is wanting, and we have twelve feet of peat, gradually thinning out. A very great quantity of red and yellow ochres might be obtained from this locality, and where the ochre is mixed with the peat, masses of the mixture might be cut out and dried, and afterwards burned. Experiments on a small scale shew that the quantity of peat in the mixture is often sufficient to calcine the ochre.—*Alluvion.*

3. Pointe du Lac..... *Geological Survey.*

a. Purplish ochre.

b. Yellow ochre.

An ochre bed of about 400 acres in extent, is situated on the St. Nicholas range of Pointe du Lac Seigniory, on the property of Mr. Pierre Chaillon and his brother. Its thickness varies from 6 inches to four feet, and it may have an average of about eighteen inches. Its prevailing colors are red and yellow, but there occurs also in some parts a beautiful purple ochre, and in others a blackish-brown. In 1851, Messrs. H. A. Monroe & Co., of New York, made arrangements to prepare the ochres for sale. Two furnaces were erected in the vicinity of the ochre bed, and an agent established to carry out the details of the manufacture, and to attend to the forwarding of the prepared ochre to New York; where the sale of it was effected. From the natural tints that have been mentioned, eight colors are said to have been prepared. The deposit being but little mixed with sand, the chief impurities to be got rid of, consisted of the roots of those plants which had been growing on the surface; some of these were found to penetrate to a considerable depth. Two modes were resorted to for this purpose; one by dry sifting, which was used when the natural colors of the ochres were to be preserved, as in the case of the yellow, the purple, and the blackish-brown varieties. The other mode was by burning. The yellow is a hydrated peroxyd of iron, the purple also is probably in some peculiar state of hydratation, but the red is the anhydrous peroxyd. By exposure to a sufficient heat, the water of combination is driven off from the yellow and purple, and both becoming anhydrous peroxyd, assume the tint of the natural red ochre, from which, as from the other two, the vegetable matter in this operation is burnt out. The blackish-brown variety is scarcer than the others, and affords colors of a more valuable description. Purified from roots, without fire, it is sold under the name of raw sienna; and is admirably adapted for graining. When subjected to fire, it assumes a brown of less intensity, and is sold as burnt sienna. As it does not turn red by burning, it is probable that there may be in this ochre, an admixture of manganese. The enterprise at Pointe du Lac appears, for the present, to be abandoned.—*Alluvion.*

4. Nottawasaga, lot 2, range 11..... *Geological Survey.*

a. Yellow ochre.

This deposit covers about half an acre, on the south bank of the river, and is produced by chalybeate springs issuing from the Clinton formation. When dry, it has a good yellow color. An excavation of two and a half feet, near the centre of the deposit, did not reach the bottom. Small deposits of yellow ochre are met with in similar situations near the Clinton formation in other places.—*Alluvion.*

5. Owen Sound, town plot..... *Geological Survey.*

a. Yellow ochre.

This ochre contains a small amount of calcareous tufa, and is of a bright yellow color. The bed occurs at the foot of a bank, in which the Clinton formation crops out, on the S. W. side of the town; its extent has not been accurately ascertained, but it does not seem to be great. It appears to have been deposited by springs which have long since changed their course, and is four feet deep in the middle, thinning out towards the edges.—*Alluvion.*

Sulphate of Barytes.

1. Burgess, lot 4, range 6..... *Geological Survey.*

   a. Specimen of sulphate of barytes from a vein.

2. Lansdowne, lot 2, range 7 ..... *Geological Survey.*

   a. Specimen of sulphate of barytes from a vein.

The barytes of Burgess and Lansdowne is derived from veins intersecting Laurentian rocks. In the latter township, as well as in Bedford, the mineral, associated with calcspar, constitutes the veinstone of some of the lead lodes met with there. The vein yielding the Lansdowne specimen cuts Laurentian limestone. In an unsuccessful attempt to mine the vein for lead, it was ascertained that twenty-eight feet of the lode, with a breadth of twenty-seven inches, consisted of highly crystalline almost colorless barytes, of which the vein in this part would yield about ten tons to a square fathom in the plane of the lode. The most abundant source of barytes in Canada, so far as known, appears to be the veinstones of lodes carrying copper ore, on the north shore of Lake Superior, between Pigeon River and Fort William, and in Thunder Bay. These, however, belong to the Quebec group. In Canada the mineral is as yet applied to no use, but in some parts of the United States it is refined and ground in large quantities, for use as a paint, and also for adulterating white lead. The value of the crude barytes suited for such a purpose, is about $10 per ton, while the wholesale price of the paint is $30 per ton.—*Laurentian.*

8.

MINERALS APPLICABLE TO THE FINE ARTS.

Lithographic stone.

1. Marmora, lot 7, range 4 ..... *Geological Survey.*

   a. Prepared lithographic stone, with *fac simile* autographs of Canadian Governors.

At Marmora, the Laurentian rocks are overlaid by about twenty feet of brownish-grey and light brownish-buff unfossiliferous compact limestone, with a conchoidal fracture, several beds of which would be well suited for the purposes of lithography, were it not for small imbedded lenticular crystals of calcareous spar, which, when abundant, unfit the stone for such an application. One of the beds, however, which is two feet thick, and of impalpable grain, is a lithographic stone of excellent quality. The lower half is much better than the upper, which is somewhat affected by the lenticular crystals of calcspar. The upper inch, which is just above the thus marked part, fits upon it in tooth-like projections, having columnar sides at right angles to the bed, of an inch long in some places; and usually covered with a thin film of bituminous shale. The same tooth-like forms occur in the lower part, but they are there more obscure. The band to which the bed belongs, presents occasional exposures of a similar character, all the way from Hungerford to Rama, a distance of 100 miles; but though the stone has been highly commended by all the lithographers who have tried it, no one has attempted to quarry it for use. The stone exhibited, presents the *fac simile* autographs of all the governors of Canada, both French and English, from the time of Champlain in 1612 to that of Lord Monck in 1862; with the exception of two of the French governors in the first half of the seventeenth century.—*Birdseye and Black River formation, Lower Silurian.*

2. Brant, lot 31, ranges 1, 2..... *Geological Survey.*

a. Prepared lithographic stone, with Bank cheque and transfer, No. 1.
b. " " " " " No. 2.
c. " " shewing natural fracture, with vignette of an Indian chief.

These are specimens of magnesian limestone of a yellowish drab color and fine texture, with a conchoidal fracture. The locality is the bed of a small stream, on lot 31, between ranges 1 and 2, south of the Durham road, Brant, and about half a mile south of the village of Walkerton. About fifteen beds of stone, apparently of the same character as the specimens, occur in a vertical section of nine feet, the thickest being eleven inches. Layers of dark colored shale separate some of the beds. The band is underlaid by about sixty-five feet of soft clayey strata, constituting the bank of the Saugeen River, at the top of which it occurs. The existence of this stone being a very recent discovery, only a preliminary trial of it has been made. The beds from which the specimens were taken, are intersected by a number of parallel joints, which render the specimens procured somewhat narrow; but the geological place of the band having been ascertained, it is probable that wider slabs may be found on the strike, in some other locality.—*Onondaga formation, Upper Silurian.*

3. Oxbow, Saugeen River, Brant, lot 3, range 7..... *Geological Survey.*

a. Prepared lithographic stone, with drawing of a steam-ship.
b. Transfer in two colors from *a.*

This stone is of the same character and from the same formation as the last. The locality is at the edge of the river, on the east side of the lot indicated in Brant. Two beds, of four and five inches respectively, occur here, but they were covered with water at the time the place was visited.—*Onondaga formation, Upper Silurian.*

9.

MINERALS APPLICABLE TO JEWELLERY.

Agates.

1. Michipicoten and St. Ignace Islands, Lake Superior ..... *Geological Survey.*

a. Specimens of agates cut and polished.

These agates occur on the south and north shores of Lake Superior, particularly on the island of St. Ignace, and on Simpson's Island to the east of it; but the largest and best are derived from the trap of Michipicoten Island, where they strew the shore in great abundance. On this island, agate occurs not only in the form of nodules in the trap, but in veins, filling cracks and dislocations, which traverse the trap, and run in several directions. —*Quebec group, Lower Silurian.*

Labradorite.

1. Grenville ..... *Geological Survey.*

a. Cut and polished specimens of labradorite from boulders.

2. Abercrombie ..... *Geological Survey.*

a. Cut and polished specimens of labradorite from a bed.

This beautiful opalescent mineral occurs in disseminated cleavable masses, imbedded in a finer grained paste of the same mineral character, but destitute of opalescence. The rocks composed of the series of triclinic feldspars, to which this mineral belongs, have been termed anorthosites, in describing the Laurentian system; in which they occupy a very conspicuous place. Great mountain masses of the rock occur in Abercrombie, in the county of Terrebonne, and boulders derived from these lie scattered over the plains to the south. They are abundant in the neighborhood of Grenville, on the Ottawa.—*Laurentian.*

Albite (peristerite).

1. Bathurst, lot 19, range 9..... *Geological Survey.*

a. Specimens of albite cut and polished.

This mineral, the peristerite of Thompson, so called from its beautiful bluish opalescence, is a variety of albite. It occurs in large cleavable masses, with disseminated grains of quartz, in veins cutting Laurentian strata. The specimens exhibited were obtained from Dr. James Wilson, of Perth, the discoverer of the mineral, who collected them in the locality indicated. A vein of the same character occurs on the north side of Stoney Lake, near the mouth of Eel Creek, in Burleigh. Its course is about N. 55° E., and it intersects a white crystalline limestone, interstratified with blackish-grey gneiss. The vein consists of a fine grained mixture of reddish white albite and quartz, in which are enclosed large cleavable masses of the opalescent albite, with occasional portions of fine granular black tourmaline.—*Laurentian.*

Orthoclase (Perthite).

1. Burgess, lot 3, range 6 ..... *Geological Survey.*

a. Specimen of orthoclase cut and polished.

This mineral, which is the perthite of Thompson, occurs in large cleavable masses, constituting, in association with quartz, a pegmatite, which occurs in considerable veins, cutting the strata of the Laurentian series. It is a variety of orthoclase feldspar, presenting different shades of mahogany-brown, the colors being arranged in bands. The surfaces of one of the cleavages present golden reflections, emanating from a multitude of small points, and the mineral very much resembles aventurine, or sunstone. These specimens were obtained from Dr. James Wilson, the discoverer of the variety.—*Laurentian.*

Jasper conglomerate.

1. Bruce mines, Lake Huron,..... *Geological Survey.*

a. Specimens of jasper conglomerate intended for a vase.

This beautiful rock consists of white quartzite, in which are imbedded a multitude of blood-red jasper pebbles, and occurs in mountain masses in the Huronian series. While the enclosed jasper pebbles constitute a material fit to receive the work of the jeweller, the whole rock is capable of being applied to the manufacture of vases and such like objects of vertû. Many boulders of the rock lie scattered along the north coast of Lake Huron, and they are abundant at the Bruce Mines.—*Huronian formation.*

Epidosite.

1. Shickshock Mountain..... *Geological Survey.*

a. Specimens of epidosite cut and polished.

This green rock, which is an intimate mixture of epidote and quartz, occurs in massive beds, and extends over considerable areas in the Shickshock Mountains, on the south side of the St. Lawrence, in Gaspé.—*Quebec group, Lower Silurian.*

10.

MISCELLANEOUS MINERALS.

Feldspar.

1. Bathurst, range 9.....*A. Cowan, Kingston.*

a. Feldspar, from Bathurst.
b. " " Brewer's Mills, Rideau Canal.

This feldspar occurs in considerable quantity on the land of Mr. Neil McEwan, and appears to form a vein of probably twenty feet in width.—*Laurentian.*

Sandstone for glass making.

1. Williamstown, Beauharnois..... *Geological Survey.*

a. Specimen of sandstone.

The Potsdam sandstone in the neighborhood of Beauharnois is in many places so free from iron as to afford an excellent material for glass making. One of the exposures giving the best examples of the stone, is at Williamstown, on the land of Mr. Donald McKillen, from which the specimen exhibited was obtained. Stone from the same formation was some years ago used for making glass at St. Johns and Vaudreuil; but it was found difficult to compete with foreign importations.—*Potsdam formation, Lower Silurian.*

Moulding sand.

1. Dundas..... *Geological Survey.*

a. Specimen of sand.

This sand occurs on the surface, in patches from a few rods to several acres in extent, on the tops and sides of hills of coarser sand. The best is found next the surface, and the layer seldom exceeds a foot in depth. It is the only moulding sand used in Gartshore's extensive iron foundry in Dundas, where superior castings are made. Since to obtain a fine casting, as much depends on the quality of the sand as the skill of the moulder, the occurrence of a good quality of this material in any locality is of sufficient importance to deserve notice.—*Drift.*

2. Owen Sound ..... *Geological Survey.*

a. Specimen of sand.

Moulding sand occurs in two places at Owen Sound, which together may have an area of six acres, with an average depth of eight or nine inches. It is used at the iron foundries in the town, and is said to answer well.—*Drift.*

3. Durham ..... *Geological Survey.*

a. Specimen of sand.

This is from a thin surface layer, covering between one and two acres. It is used in Cochrane's foundry in Durham, and is said to be of very good quality.—*Drift.*

Peat.

1. Chambly..... *Geological Survey.*

a. Specimen of peat.

This peat occurs near Chambly, on the south side of the St. Lawrence, and was some years ago cut, pressed, and sold as fuel by the late Mr. Scobell. The consumption, however, was scarcely sufficient to encourage the industry. As Canada is deficient in coal, when wood becomes scarce in the progress of settlement, peat will gradually assume some importance, as a fuel in many parts of the country. Peat occurs in great abundance in many places in the province; about 100 square miles of it extend along the south front of the Island of Anticosti. Successive areas of it are met with on the south side of the St. Lawrence, from Rivière du Loup to Ste. Marie de Monoir, opposite Montreal; on the north side it occurs at La Valtrie and other places. Large peat bogs occur between the Ottawa and St. Lawrence, and there are many of the same character to the westward. The peat, which is sufficiently matted to hold together when dried, usually supports a growth of prairie grass, or ericaceous plants, or of tamarac trees. That which occurs in cedar swamps is deficient in the fibrous plants which give it cohesion, and it falls to powder when dried.—*Alluvion.*

DESCRIPTIVE CATALOGUE

OF A COLLECTION OF THE

CRYSTALLINE ROCKS OF CANADA.

BY T. STERRY HUNT, F.R.S.

This collection, sent by the Geological Survey of Canada, is intended to illustrate some points in the natural history of its rocks, and is divided into four parts, which are as follows :—

I. Laurentian Rocks, ...	50	specimens,	green ticket.
II. Huronian Rocks, ...	20	"	blue "
III. Lower Silurian Rocks, ...	60	"	yellow "
IV. Eruptive Rocks, ...	20	"	white "

Of these, the first three are from stratified systems, and are generally distinguished as primitive or metamorphic rocks. As, however, we conceive eruptive rocks to be nothing more than displaced and altered sediments, we prefer to describe the whole collection as metamorphic or crystalline rocks, distinguishing the stratified masses which have not been displaced, as *indigenous*, and the eruptive ones as *exotic* crystalline rocks.

In the present collection, we have endeavored to do no more than present a few characteristic varieties of the principal types of rock met with in the three indigenous series. In the first and third of these, nearly all the great classes of crystalline rocks occur, and, with characteristic differences, will be found represented in each. The second series offers but a limited variety of rocks, many classes being imperfectly, or not at all represented. In the fourth division, we have selected only some of the more interesting varieties of the exotic rocks which occur in the vicinity of Montreal.

In the study of rocks, it is not possible to apply with exactness the rules of a natural-history classification, but we may conveniently arrange them in the following mineralogical groups:—

1. *Silicious rocks;* as quartzite, chert, and jasper.

2. *Aluminous silicated rocks: a,* containing alumina chiefly in the form of a mineral of the feldspar family; *b,* as a mica or chlorite; *c,* as a silicate of high specific gravity, such as epidote, garnet, or chloritoid.

In this group, the feldspathic rocks are in great part reducible to two classes, 1st, *Orthosites:* in which the chief mineral is orthoclase, including trachyte, orthophyre, syenite, granite, gneiss, and argillite. 2nd. *Anorthosites:* having as their basis anorthic or triclinic feldspars. These rocks, through the introduction of hornblende, pass into diorite, and with pyroxene give rise to diabase and dolerite.

3. *Non-aluminous silicated rocks:* including serpentine, talc, pyrallolite, chrysolite, hornblende and pyroxene; the latter two minerals sometimes including a portion of alumina.

4. *Carbonated rocks:* limestone, dolomite and magnesite. These divisions suffice for our present purpose, though they exclude many substances forming rock masses, such as sea-salt, sulphate of lime, oxyds, hydrates and carbonates of aluminum and iron, carbonaceous minerals, etc.

I. ROCKS OF THE LAURENTIAN SYSTEM.

The rocks of this system are the oldest known on the globe, and are widely spread in North America; where they are traced from the coast of Labrador to Lake Huron, and thence northward to the Arctic regions. Along the north side of the St. Lawrence, they form the Laurentide mountains, and in New York, to the west of Lake Champlain, the Adirondacks. The Laurentian system has been identified by Sir Roderick Murchison in the Western Islands of Scotland and the adjacent coast, where it forms what was, until recently, termed the fundamental gneiss. The primitive gneiss of Scandinavia also probably belongs to the same ancient system.

The Laurentian rocks of Canada consist in great part of orthoclase gneiss, with quartzites, sometimes conglomerate, and crystalline limestones and dolomites. The total thickness of these strata is estimated at not less than 20,000 feet. Besides these, there is a great formation of anorthosite rocks, amounting to several thousand feet in thickness. These latter overlie the orthoclase and limestone series; and there are reasons for supposing a want of conformity between the two. A very distinctive and characteristic feature of the Laurentian system is the absence, so far as yet examined, of anything like argillite or clay slate. The metalliferous contents of this system are chiefly beds of magnetic and oligist iron, in the gneiss and limestone series. Iron and copper pyrites are also met with in interstratified layers, the former sometimes cobaltiferous; and both of these sulphurets, together with blende and galena, are met with in veins, which cut these strata, but are as late as the Silurian period, the overlying strata of which they sometimes intersect. In the anorthosites, the only ores met with are beds of titaniferous iron or ilmenite.

1. Gneiss, flesh-red, Grenville.

2. " white, with garnets, River Rouge.

3. " pink, " River Ouitchawan.

4. " micaceous, " Joachim Rapids.

5. " pink, granular, with garnets, Grenville.

6. " epidotic, " " Carleton Place.

The most characteristic gneiss of the Laurentian series is represented by 1, which forms great mountain masses, and is so coarse grained, that, except in large masses, it might be taken for an intrusive granite. The mica which it contains, is often black, and sometimes associated with hornblende; giving rise to syenitic gneiss. Small portions of a white triclinic feldspar (albite, or oligoclase), are occasionally found with the red or pink orthoclase; and some coarse grained pegmatites, which are perhaps intrusive, consist of albite and a little quartz, with only small portions of orthoclase. The white gneiss, 2, is porphyroid, holding large cleavable masses of a pure orthoclase, in a granular mixture of the same mineral, with a little quartz and white mica, and garnets. The red gneiss, with green compact epidote, is met with in several localities in Canada. Some varieties of the Laurentian gneiss become fine grained and micaceous, passing into mica schists; but these are of comparatively small amount.

7. Garnet rock, quartzose, Bay St. Paul.

8. " pure, Rawdon.

Beds of red garnet rock are not unfrequent among the quartzose gneiss and quartzites. In the former, the mineral sometimes forms thin layers, marking the stratification. In the latter, small crystals of garnet often abound, particularly near to the limestones, and sometimes give rise to masses like 7, or to beds of a rock like 8.

9. Quartzite, conglomerate, Bastard.

9A. " Rawdon.

The above conglomerate is interstratified with white crystalline limestones, holding graphite and chondrodite. It is worthy of note, that, while some of the pebbles are of vitreous quartz, others are of sandstone, in which the layers of sedimentation are very apparent.

10. Anorthosite, granitoid, Abercrombie.
11. " " Château Richer.
12. " " with ilmenite, Château Richer.
13. " granular, Château Richer.
14. " " Abercrombie.
15. " " white, Rawdon.
16. " granitoid, violet, River Kenogami.
17. " " greenish, ——— ?
18. " granular, Rawdon.
19. " compact, whitish, Grenville.
20. " " greyish, Rawdon.
21. " " bluish-green, ——— ?
22. " gneissoid, with ilmenite, Château Richer.
23. " " " much pyroxene, ——— ?
24. " " " hypersthene, Rawdon.
25. " granitoid, with ilmenite, Château Richer.
26. " with rutile and ilmenite, Bay St. Paul.

The above seventeen specimens show the principal varieties of these remarkable rocks, which are seen, at intervals, from Lake Huron to Labrador. They often form belts of many miles in breadth, which, as before said, overlie, apparently unconformably, the orthoclase rocks and limestones. A notable feature in this formation is the almost total absence of other rocks; in some portions of their distribution these anorthosites are seen to be interstratified with thin bands of orthoclase gneiss, and more rarely with quartzite; but great masses, of thousands of feet in breadth, are found to be made up of alternating varieties of these anorthosites, which, as will be seen, exhibit great varieties of texture. Coarsely granitoid rocks abound, consisting of large cleavable masses of feldspar aggregated, or imbedded in a granular base. We find granular rocks of every grade, passing into compact and impalpable varieties with a conchoidal fracture. The composition of these feldspars varies from that of andesine, with sixty per cent. of silica (12), to varieties near anorthite, with only forty-seven per cent. of silica (the bytownite of Thompson). A beautiful pale blue cleavable variety (11) contains fifty-seven per cent. of silica, being intermediate between andesine and labradorite, while many others yield from fifty-two to fifty-five per cent. The white granular rock (15), and many others, have the composition of pure labradorite. The bases, besides alumina, are lime and soda, with a little potash, and traces of iron and magnesia. Ten analyses of chosen specimens of these feldspars, holding from forty-seven to sixty per cent. of silica gave for

their mean composition; silica 56.00, alumina 27.30, lime 9.42, soda 4.84, potash 0.84, magnesia, oxyde of iron, water and loss 1.60 = 100.00. The oxygen ratios of the silica, the alumina, and the lime and alkalies, in the above mean, are as 7.0: 3.0: 0.96. From their variations in composition, we have been led to regard these triclinic feldspars, whose density ranges from 2.67 to 2.73, as indefinite crystalline mixtures of the two homœomorphous species, anorthite and albite. (See L. E. & D. Philos. Magazine for May, 1855; where also will be found analyses and descriptions of these feldspars.)

The crystalline varieties of this rock often exhibit, in great perfection, the striæ resulting from their polysynthetic macles, and are sometimes beautifully opalescent: the original Labrador feldspar is from this formation. The foreign minerals of these rocks are few in number: quartz has been seen in small portions, but is a rare accident; granular red garnet is sometimes found marking the lines of stratification, generally with pyroxene, and epidote is said to occur with the anorthosites of the Adirondacks. A brownish-black mica, probably biotite, is met with in small quantities in the granitoid varieties, but pyroxene more abundant. It is sometimes dark green and granular, occasionally predominating in small beds, so as to form a pyroxenic rock, in which small kernels, or lenticular masses of cleavable feldspar are imbedded. In other cases, where its quantity is smaller, it may be seen passing into a brownish lamellar variety, like hypersthene; the typical form of which however occurs without any association of granular pyroxene. Hypersthene is seldom an abundant mineral; it passes from brownish-black, with bronze reflections, to a clear greenish variety, like diallage. Small amounts of carbonate of lime are occasionally met with, disseminated in the granular varieties of these anorthosites. Ilmenite is a characteristic mineral, sometimes in thin layers, marking, with pyroxene, the sedimentary layers; at other times in larger masses, or even in beds of great size; as at Château Richer, where it is mixed with rutile.

The predominant colors of these anorthosites are various shades of blue, passing into greenish and yellowish, rarely reddish, and sometimes nearly pure white. The lustre of the cleavable feldspars is vitreous, of the granular varieties waxy or dull. The weathered surfaces are always of an opaque white; but for which, some of the white granular anorthosites might be mistaken, at first sight, for quartzites.

The nomenclature of these rocks presents some difficulties. The name of labradorite-rock sometimes given, is applicable only to certain varieties, and the same may be said of hypersthenite and hyperite, when great masses of the rock are destitute of hypersthene. I have preferred to designate the granitoid, porphyroid, gneissoid, granular, and compact varieties of almost pure anorthic feldspar, which make up the great mass of the formation as normal anorthosites. The interstratified beds, in which granular pyroxene predominates, would come under the denomination of dolerite or diabase, and the varieties with bronzite or diallage would, by most lithologists, be called euphotide or gabbro. Both of these names, however, would be wrongly applied; the name of gabbro, as Brongniart has shown, belongs to a diallagic ophiolite, or serpentine rock. The euphotide of Haüy consists of smaragdite (a mixture of hornblende and pyroxene) with saussurite, which as we have shown, is a compact epidote or zoisite, with a specific gravity of 3·33—3·38. Hence, neither gabbro nor euphotide are feldspathic rocks, although the euphotide of Mount Rose occasionally includes portions of a cleavable triclinic feldspar, and thus presents a transition to the diallagic variety of diabase, with which modern lithologists have confounded this epidotic rock. (See Contributions to Euphotide and Saussurite, Am. Jour. of Science, March, 1859.)

The name of diorite is, by good authorities, restricted to rocks whose dominant elements are triclinic feldspars with hornblende. In smaragdite, however, we have a mixture of hornblende with pyroxene, and in many of the so-called euphotides, according to G. Rose, the hornblende entirely replaces the pyroxene; thus forming a transition between diorite and diabase; under which latter name we propose to include the compounds of triclinic feldspars with every variety of pyroxene, except the black augite of the basalt group.

To the rocks composed of augite and triclinic feldspars, are to be reserved the name of dolerite. The pyroxenic anorthosites of the Laurentian series are then varieties of diabase, which includes hypersthenite or hyperite, the gabbro of Rose, and the euphotide of most modern authors, which latter rocks are forms of diallagic diabase, passing into diorite.

It may here be remarked that although these anorthosites, as well as the gneissic rocks of the Laurentian series, are traversed by joints in various directions, nothing corresponding to slaty cleavage has ever been remarked, and that the lamination of these masses is apparently, in every case, coincident with, and dependent upon, the original stratification of the sedimentary layers. It is only in the Huronian and Silurian series that we meet with a foliation distinct from the bedding; this is confined to the argillites, and is wanting in the more crystalline sediments.

27. Agalmatolite, Diana, New York.

This rock has not yet been met with in Canada, but forms considerable masses at several localities among the Laurentian series, in St. Lawrence county, New York; where it is associated with beds of oligist iron ore, and had been regarded as a serpentine, until Prof. C. U. Shepard shewed its aluminous character, and gave it the name of dysyntribite. The subsequent analyses of Smith and Brush shewed it to be a hydrous silicate of alumina and potash, containing, accidentally, portions of lime and magnesia, and having the composition of the agalmatolite of China. Prof. Brush has since found this mineral crystallized in hexagonal prisms, with pyroxene, at Diana. It has the composition of the mineral gieseckite, with which it seems identical, and also agrees with pinite, and with what had been previously named wilsonite. This latter occurs in crystalline masses, with pyroxene and mica, in the Laurentian limestones in Canada. An analysis of the massive agalmatolite from Diana, gave to Smith and Brush, silica 46·70, alumina 31·01, peroxyd of iron 3·69, potash, with traces of soda, 11·68, water 5·30 = 99·88. Farther illustrations of this rock will be given in the descriptions of the Silurian rocks.

28. Steatite, Elzivir.

The mechanical and chemical analysis of this unctuous foliated rock, shows it to consist of talc, with small portions of quartz and of magnetic iron.

29. Pyrallolite, Grenville.

This rock forms considerable beds among the Laurentian limestones, both in Canada and New York; where it was first recognized by Prof. Emmons, and described by the name of rensselaerite. It appears, however, to be identical in chemical and physical characters with the pyrallolite of Nordenskiold, whose name must take priority. This substance occurs massive, granular, and crystallized in the form of pyroxene. It has a specific gravity of 2·7 to 2·8, and a hardness of 2·5–3·0, is unctuous, greenish in color, and except in its crystalline texture, cannot be distinguished from a compact talc; with which it is identical in composition. One of several concordant analyses gave silica 61·60, magnesia 31·06, protoxyd of iron 1·53, water 5·60 = 99·79. It is in fact a monoclinic talc, and has, without any good reason, been regarded as a product of the alteration of pyroxene.

30. Pyroxene rock, with hornblende crystals, Madawaska.

31. Hornblende rock, Indian River.

This is a stratified rock, consisting of hornblende with a mixture of feldspar. It perhaps belongs to the anorthosite formation, and may be considered a diorite.

32. Pyroxene rock, with sphene, Chatham.

Small beds and interstratified masses of pyroxene rock, occur among the Laurentian limestones, and present many varieties. In 30, we have a greenish-white massive and crystallized pyroxene, with a density of 3.27; associated with crystals of a dark green aluminous hornblende (pargasite), of density 3.05, and sometimes with black tourmaline. In 32, we have a rock made up of green pyroxene, with calcareous spar and quartz; holding crystals of sphene. Sometimes a feldspar enters into the aggregate, and the rock consists of quartz and pyroxene, with an orthoclase, which is found to contain potash, with but little soda. The loxoclase of Breithaupt, which belongs to a compound rock of this kind, is, however, according to Smith and Brush, an orthoclase, in which soda predominates; and in a similar rock, with sphene, is occasionally found a triclinic species, like oligoclase. Scapolite (a dimetric feldspar) sometimes takes its place, giving rise to a pyroxene and scapolite rock.

33. Ophiolite, opaque and earthy, Calumet Island.

34. " pale green, Burgess.

35. " retinalite, Talon Portage.

36. " calcareous, yellow, Grenville.

37. " " greenish, "

We distinguish by the name of ophiolite, all rocks with a base of serpentine. In the Laurentian series, ophiolites occur, interstratified with the limestones, but offer few varieties. Their colors are usually much paler than those of the Silurian series, from which they differ in containing smaller proportions of the oxyd of iron, and in the absence of those of chrome and nickel; which are constantly present in the latter. The Laurentian ophiolites are sometimes, however, of a dark red color, from the presence of disseminated peroxyd of iron. The retinalite of Thompson is but a light-colored and very pure serpentine, which is noticeable for its low specific gravity, 2.36—2.52, and its large proportion of water, which equals 15.0 per cent. These ophiolites sometimes include mica; and the calcareous mixture which they hold, is often dolomitic.

38. Limestone with apatite and phlogopite, Burgess.

39. " " chrondodite and graphite, Newborough.

40. " " apatite, fluor, and spinel, Ross.

41. " " brown tourmaline, Ross.

42. " " quartz, Bastard.

43. " " with pyroxene, ——— ?

44. " " grey, with hornblende, Marmora.

45. " " graphite and sphene, Grenville.

46. " " pyroxene, Horton.

Four bands of crystalline limestone have been identified in the great Laurentian system, which are equal in volume to the ordinary limestone formations of the fossiliferous rocks. Reposing upon a vast thickness of orthoclase gneiss, we have the lowest limestone band, of about 1500 feet; to this succeed about 4000 feet of similar gneiss, followed by a second limestone formation of 2500 feet; including two bands of quartzite and hornblendic orthoclase gneiss, equal to one half the volume. Following this, are 3500 feet of orthoclase gneiss, with quartzites at the base, and a third limestone band above; whose thickness varies in different parts of its outcrop, from 60 to 1500 feet. This is overlaid by 1500 feet more of gneiss, and a fourth thin band of limestone; followed by 3400 feet of quartzite and gneiss, exhibiting towards the summit, interstratified portions of anorthosites, which mark the passage to the succeeding formation. The thicknesses assigned to these masses are, however, only approximative.

The Laurentian limestones contain most of the mineral species which are met with in the crystalline limestones of other regions. Among them are apatite, fluor, wollastonite, hornblende, pyroxene, chrondodite, phlogopite, orthoclase, oligoclase, scapolite, garnet, idocrase, tourmaline, serpentine, loganite, agalmatolite, clintonite, volcknerite, quartz, spinel, corundum, zircon, sphene, iron and copper pyrites, and graphite. Many of these minerals, such as serpentine, chondrodite, graphite, and mica, are disseminated so as to mark the stratification of the limestones. The mica, in the pure limestones, generally occurs in small scales, but sometimes in large crystals. These last are, however, most frequent in pyroxenic beds, and often with a soft steatitic mineral, having the form of pyroxene, and the composition of pyrosclerite; to which it sustains the same relation as pyrallolite does to talc, and constitutes a new mineral species, called loganite. The magnesian mica, or phlogopite, often yields plates more than a foot square; which may be seen in the accompanying collection of economic minerals.

The contortions in the stratification of the limestone, show that it was once in a plastic condition, and the traces of its movement at that time, are curiously preserved, in several places, by thin interstratified layers of quartzite; which have been not only folded and broken, but twisted and rolled upon themselves, as leaves of paper would be in an agitated liquid. Occasionally we see the limestone extended among the overlying and broken layers of quartzite or of gneiss, and taking, for short distances, the form of an exotic rock.

Phosphate of lime sometimes occurs in disseminated crystals or rounded masses, in these limestones. It is a fluor-apatite, with but about one two-hundredth of chlorine, and is occasionally accompanied by fluor-spar, as in 40. These beds have been traced for several miles in the limestone, and are sometimes associated with layers of nearly pure crystalline

apatite. To one who is accustomed to look upon the graphite, and the great beds of iron ore in this system, as evidences of the intervention of organic life during the Laurentian period, these layers of phosphate of lime seem to be accumulations of coprolitic matters, from the animals (perhaps marine) of that period; in fact, the ancient representatives of modern guano beds. In the unaltered strata at the base of the Silurian system, layers of both limestone and sandstone, abound in phosphatic coprolites, apparently derived from the Lingulas, Orbiculas, Conularias, and Serpulites, of those early times; the shells of all of which have been shown by us to have essentially the composition of the skeletons of vertebrate animals.—*Am. Jour. of Science* (2), xvii. 235.

47. Dolomite, with green mica, Indian River.

48. " " white mica, Madawaska.

49. " " tremolite, "

Great beds of crystalline dolomite, and of limestones more or less magnesian, occur, interstratified with the purer limestones of this series. They are often very fine grained, and sometimes resemble statuary marble; others contain a portion of peroxyd of iron, and weather to a reddish-brown. Foreign minerals are less abundant in the dolomites than in the limestones; but besides mica, tremolite, and quartz, serpentine sometimes abounds, forming a dolomitic ophiolite. We shall consider the chemical and geological relations of dolomites, and the theory of their formation, in describing the Silurian rocks.

II. ROCKS OF THE HURONIAN SERIES.

The rocks which have been designated as the Huronian series, rest upon those of the Laurentian system, and are in part made up of the ruins of the latter. The unaltered and horizontal Lower Silurian strata, in their turn, repose upon the inclined and metamorphosed Huronian rocks, which are therefore regarded as constituting a distinct and intermediate formation. This seems, from its geological horizon, not less than from its lithological characters, to correspond to the quartzose division of the Primitive Slate Formation of Scandinavia. The Huronian series is met with at Lake Temiscaming, on the Ottawa, and on Lakes Huron and Superior. It is not known farther eastward, but it is not unlikely that it constitutes some portions of the Azoic rocks of the Upper Mississippi, and of Arkansas and Missouri.

The thickness of the Huronian series on the north shore of Lake Huron, is approximatively estimated at 18,000 feet. Of this, more than 10,000 feet are quartzites, which are sometimes schistose and micaceous. The remainder consists of chloritic and argillaceous slates, which occasionally hold epidote, and, like the quartzites, often become conglomerates. Three small bands of impure limestone occur in this formation, two of which are associated with layers of chert or hornstone. Throughout the whole formation, are interstratified great beds of crystalline greenstone or diorite, sometimes several hundred feet in thickness.

We remark in this series of rocks, but a small amount of carbonate of lime, and an absence of well characterized gneiss or orthoclase feldspar rocks. An impure ferruginous serpentine has been observed in the series, near Marquette, but no steatites nor talc slates. Its metalliferous minerals consist of beds of specular iron, to which species the great mines of Marquette, in Northern Michigan belong, and of large quantities of sulphurets of copper. The copper ores sometimes occur disseminated in the diorites or chloritic slates, but more generally in well-defined veins of quartz, which traverse the dioritic rocks.

1. Quartzite, white granular, Island near Grant's Island.
2. " " vitreous, Grande Batture Point.
3. " brown " Thessalon River.
4. " " schistose, Lacloche.
5. Limestone, slaty, Clear Lake.
6. Quartzite, conglomerate, with jasper pebbles, Bruce Mines.
7. " " " "

Quartzite may be said to be the predominant rock in the Huronian series. Its colors are white, gray, brownish, and sometimes greenish or reddish, and its texture is various; it being sometimes vitreous, and at other times, a granular sandstone. It is not unfrequently schistose, and sometimes slightly micaceous or feldspathic, but true gneiss and mica slate have not been met with in this series. These quartzites often become conglomerate, from the presence of various colored pebbles of quartz and jasper. The latter are frequently blood-red in color, and being imbedded in a white or a greenish base, constitute a very beautiful rock.

8. Argillite, bluish, talcoid, Spanish River.
9. Hornstone, in limestone, Chert Point, Lake Superior.
10. Limestone.
11. " Lake Huron.

The limestones of this series are but small in amount. One band of 300 feet in thickness has however been traced for considerable distances. Its colors are chiefly greyish, greenish, or buff, rarely white, and its fracture is conchoidal, and sometimes granular. It is often ferruginous and yellow-weathering, and is somewhat magnesian. Thin silicious layers give to its weathered surface a very uneven aspect. It is strikingly contrasted with the Laurentian limestones, by the absence of any pure crystalline varieties, or imbedded crystalline minerals. Two other bands, of 200 and 400 feet respectively, consist of similar impure limestones, with regular layers of yellowish chert, the latter predominating. Beds of this chert or hornstone are sometimes interstratified with the adjacent quartzites.

12. Argillite, greenish, Grant's Island, Lake Huron.
13. " " with pyritous copper, Root River, Lake Huron.

Beds of clay slate are sometimes met with in this series; they are occasionally bluish and talcose in their aspect, and at other times greenish, and apparently somewhat chloritic. We have noted the absence of clay slates from the Laurentian system; and their presence in the Huronian series, shows a condition of things approaching to that of the Silurian period, when we find these rocks in much greater abundance.

14. Silicious slates, Mississaugui.

15. " " Clear Lake.

16. " " conglomerate, Echo Lake.

17. " " " "

Great masses of a greenish slaty rock are met with in this series, which varies in hardness and texture, from a silicious slate, passing into hornstone, on the one hand, to an argillaceous or a chloritic slate, which is sometimes epidotic, on the other. These slates frequently include pebbles of crystalline rocks, which are chiefly feldspathic, and derived from the Laurentian strata. With these are, however, sometimes mingled others of quartz and of various colored jaspers. The pebbles vary much in their amount, and the rocks pass from ordinary slates, to what have been designated in the descriptions of this series, as slate conglomerates. The matrix of these is sometimes an argillaceous or chloritic slate, and occasionally becomes very quartzose, passing into a quartzite; so that it is not easy to draw the distinction between the conglomerate slates, and the jasper conglomerates of the quartzites.

18. Diorite, compact.

19. " fine grained, Dirty Lake.

20. " coarse grained, "

The diorites or greenstones of the Huronian series are intercalated in beds, alike with the quartzose and the argillaceous and chloritic members. They are sometimes coarse grained and crystalline, being made of dark green hornblende and a greenish feldspar. In other parts, the rock becomes finer and even compact in its texture, and it is frequently porphyritic from the presence of crystals of feldspar. Great masses of the rock become schistose, and are often intermingled with a considerable amount of chlorite, passing into dioritic and chloritic slates; which are often associated with a considerable amount of epidote, generally granular or imperfectly crystallized. In one locality, amygdaloidal strata, holding in their cells quartz and calcite, are found interstratified with the chloritic and the porphyritic beds. In some few instances, the feldspar in the coarse-grained diorite becomes reddish, and the rock includes a little quartz, passing into a variety of syenite. The Huronian series is traversed, like the Laurentian, by dykes of greenstone trap; but the great beds of diorite, just noticed, are considered to be altered sedimentary rocks.

III. ROCKS OF THE SILURIAN SERIES.

The Notre-Dame and Shickshock Mountains are the north-eastern prolongation of the great Appalachian chain, which extends from the Gulf of St. Lawrence, nearly to the Gulf of Mexico. These mountains, at least in Canada and New England, are altered sediments of Palæozoic age, and are referred to the Quebec group; which corresponds to the inferior part of the Lower Silurian series. They attain, in some places, a height of more than 4000 feet above the sea, and appear to be generally synclinal in their structure. The rocks are highly metamorphosed in the mountainous region, which constitutes a narrow belt, but on the north and west of this are found in a comparatively unaltered state. These hills, and the region around them, offer almost every variety of metamorphic sediments, but they are very deficient in intrusive rocks, of which scarcely a single dyke can be met with. The country on both sides of the altered mountainous belt, abounds in intrusive masses of various kinds, some of which will be described in the succeeding portion of this catalogue.

1. Gneiss, Sutton Mountain.

1A. Gneiss, granitic, St. Joseph.

Great masses of orthoclase gneiss are met with in this series. They are generally fine-grained, and are more quartzose than those of the Laurentian system; with which the practiced observer will never confound them. The coarse-grained and porphyritic reddish and white varieties are never met with, and the gneiss is generally of pale greyish or greenish hues. In some cases, great portions of it are so destitute of marks of stratification, that but for their relations to the adjacent beds, they might be taken for intrusive masses. The mica is generally white or greyish, and in small quantity.

2. Anorthosite, Melbourne.

2A. " Orford.

3. " with serpentine.

Rocks composed of triclinic feldspars, and representing the anorthosites of the Laurentian system, are common in this series; they are however never coarsely crystalline, and are often compact. In some cases the feldspar approaches to albite or to oligoclase in composition. Through an intermixture of hornblende, these rocks pass into diorite.

4. Diorite, St. Francis.

5. " Tring.

6. " Acton.

7. " "

8. " St. Joseph.

In the diorites of this series, the feldspar is sometimes the predominant element. One from Orford was found, by analysis, to consist of sixty-four parts of albite, and thirty-six of hornblende; another contained seventy-four parts of a feldspar, which was near albite in composition, but contained as much potash as soda. Others of these diorites exhibit a predominant of hornblende, often mingled with a chloritic mineral, and constitute veritable greenstones; which, however, appear to be in all cases sedimentary rocks. They are frequently so finely granular as to appear at first sight homogeneous, while at others they are rather coarsely crystalline, or sometimes porphyritic, from the presence of large feldspar crystals. The specimen from St. Joseph is associated with compact white garnet and crystallized hornblende.

9. Epidosite (epidote and quartz), Melbourne.

10. " schistose, with oligist iron, "

11. " chloritic, with epidote nodules, St. Armand.

12. Epidotic rock, with calcite and argillite, St. Joseph.

Epidote is a characteristic mineral of great portions of this series. Sometimes it forms with quartz, a fine-grained compact rock, which is found in thick beds in the Shickshock Mountains. At others, the epidote is disseminated in nodules, in a fine grained silicious rock, which often becomes chloritic or argillaceous.

13. Garnet-rock, St. Joseph.

A massive white lime-alumina garnet occurs in beds in this series, sometimes in contact with ophiolite, or mingled with feldspar and hornblende (as in 8), or with an admixture of serpentine. This garnet-rock is extremely tough, in some cases imperfectly crystalline, and has a specific gravity, when pure, of 3·53. Other specimens, probably mingled with feldspar or hornblende, and greyish or greenish in color, have a density of 3·3—3·4.

14. Epidotic rock, argillaceous, St. Joseph.

15. " " " "

These specimens, which should be placed with 12, from the same locality, are from a great mass of argillaceous rock, which passes into red shale in some parts, and in others, is concretionary in its structure. It would appear as if the clay had originally contained septaria, the fissures in which, as well as the interstices, have become filled with epidote, which is often crystallized, calcite, quartz, and sometimes talc. These altered argillites are in the immediate vicinity of the opholites, and, in some specimens, much resemble the *gabbro rossi* of the Italian geologists.

16. Mica-rock, Shipton.

This soft grey schistose rock, a bed of which has been wrought as a variety of potstone has nearly the composition of a hydrous mica, with only three per cent. of alkalies, and fifty-one per cent. of silica.

17. Mica-schist, Sutton.

18. " " St. Joseph.

19. " " Ireland.

20. " " Ste. Marie.

These mica-schists are very variable in their nature, and often highly quartzose; not unfrequently they have the aspect of what are called talcose slates, without however containing any magnesia, and owe their peculiar characters to a mica like that of 16, or perhaps to pholerite or pyrophylite. Pholerite is sometimes found in a pure state, in fissures in the sandstones of this series; and pyrophyllite forms beds, resembling steatite, in the same formation in the southern United States; where it also occurs crystallized with quartz.

21. Argillite, talcoid, Ireland.

22. " plumbaginous, Melbourne.

23. Mica-schist.

24. Sandstone, Granby.

25. Argillite, reddish, Ste. Marie.

26. " bluish, "

27. " with orthoclase and quartz, Cleveland.

28. " chloritic, Durham.

29. " with red orthoclase, Cleveland.

The argillaceous rocks of this series present many varieties, from roofing-slates, and talcoid and plumbaginous shales, to others which are more or less chloritic or micaceous. The specimen 27 is remarkable from containing small oval masses of regular outline, consisting of orthoclase and quartz. Their exterior portion is generally of feldspar, the centre being filled with quartz; but sometimes the one or the other is wanting, and the kernels consist of quartz or of feldspar only. These oval masses, which are from one-eighth to one-half an inch in length, have their greater diameters parallel. The rock might be called an amygdaloid. Some portions of these argillites are penetrated by small veins and irregular masses of bright red orthoclase. This feldspar is occasionally found in veins with quartz, chlorite, and bitter-spar, intersecting these slates.

30. Chloritoid-schist, Leeds.

Chloritoid is abundant in quartzose mica schists, in this series. It is generally in small plates, but sometimes in tables one-fourth of an inch in diameter, often arranged in spherical aggregations. It has a specific gravity of 3·5, and the usual composition of the species. Chloritoid is identical with the barytophyllite and the sismondine of different authors. It is also supposed to be the phyllite of Thompson, and the ottrelite of Haüy, both of which closely resemble it in appearance.

31. Iron-schist or itabirite, Sutton.

32. " " "

33. " " Plymouth, Vt.

Great beds of a rock made of scales of specular iron, with quartz and chlorite, are met with in the altered Silurian strata. They are sometimes rich iron ores, and at other times contain but small portions of the metallic oxyd. These specular schists often include a portion of titanic acid, which is occasionally seen in the form of rutile or of sphene, crystallized in veins, sometimes with feldspar. These rocks are apparently identical with the itabirite of Brazil.

34. Magnetic iron in dolomite, Sutton.

Magnetic iron ore is often found in these rocks, in irregular beds or masses in serpentine. In Vaudreuil, there is found a bed of granular ore, of which two-thirds are pure magnetite, and the remainder ilmenite; the two being intimately mixed. Grains and octahedral crystals of magnetite also occur in the chloritic schists, and in the present specimen, the crystals are so abundantly disseminated in some parts of a bed of chloritic dolomite as to constitute a valuable iron ore. This dolomite is remarkable for containing eight per cent. of carbonate of manganese.

35. Copper pyrites in chloritic limestone, Ascot.

36. Variegated copper in micaceous schist, Sutton.

37. " " " " "

Copper is abundantly distributed in this formation, generally disseminated in the beds, and forming an integral portion of the rock, in the shape of grains or lenticular patches. The yellow and variegated sulphurets, copper glance, and sometimes native copper, are met with alike in quartzose, argillaceous, micaceous, and chloritic slates, in limestones, and in dolomites. At Acton, the latter two ores form the cementing material of a conglomerate rock, made up of limestone and silicious matters. The copper in these strata seems to have been a contemporaneous deposit from aqueous solutions.

38. Hornblende rock, with garnets, Shickshock Mts.

Beds of black crystalline hornblende rock, including small crystals of red garnet, occur with the serpentines of Mount Albert. In many other parts, hornblende in the form of actinolite, or a tough, fibrous variety allied to it, forms beds of great thickness.

39. Diallage rock, Orford.

Diallage is abundant, not only as a component of some ophiolites, but sometimes forming a rock, either by itself, or with a little mixture of an amorphous mineral, which approaches to pyrosclerite in its composition.

40. Ophiolite, (serpentine,) Orford.

41. " St. Joseph.

42. " Melbourne.

43. " conglomerate, Orford.

44. " schistose, Melbourne.

Under the name of ophiolite we include those rocks which have serpentine for their base. The normal ophiolites are nearly pure serpentine, while some are mixtures of serpentine and carbonate of lime (calcareous ophiolites), and others dolomitic and magnesitic ophiolites; containing respectively dolomite and carbonate of magnesia, often in large proportions. All of these varieties are met with in Canada, or in the adjacent state of Vermont. These compound ophiolites are sometimes porphyritic from the presence of diallage (the Italian gabbro). At other times, they have the aspect of conglomerates, exhibiting rounded or angular masses of pure serpentine of various sizes, imbedded in a dolomitic paste, itself more or less colored by intermingled serpentine. A magnesitic ophiolite from Vermont has a gneissoid structure, due to the arrangement of the crystalline magnesite spar, with lamellæ of talc, apparently marking planes of stratification. The ophiolite of Mount Albert is marked with red and green bands, (see specimen 59,) which have the aspect of sedimentary layers; and the relations of the ophiolite throughout this series, where its outcrop has been followed for hundreds of miles, are always those of an interstratified deposit, and never of an eruptive rock. It occurs with dolomite, magnesite, steatite, diorite and argillite, with each one of which it has been found in contact, and it seems sometimes to replace the other magnesian rocks. Its beds vary from a few yards to several hundred feet in thickness. The colors of these ophiolites are of various shades of green; generally much darker than those of the Laurentian series. A red color sometimes occurs in patches and bands, or pervades the whole mass; this, in some cases, at least, is due to an intermixture of red hematite. Foliated and fibrous varieties (baltimorite and chrysotile) are frequently found in veins in these ophiolites. Chromic iron is also a characteristic mineral, in grains, or in interstratified beds or lenticular masses, often of large size. Magnetic iron occurs in these ophiolites, both in grains and beds, sometimes with ilmenite.

The analyses of the serpentines of these ophiolites show them to contain from seven to ten per cent. of protoxyd of iron, to which they owe their color, besides small portions of oxyds of chrome and nickel. These two metals often occur in the magnesian rocks of this series, in the form of chromic iron and sulphuret of nickel; but are in many cases present as integral portions of the silicate. This is true, not only of the serpentines, but of the diallage and actinolite rocks, and many of the dolomites and magnesites. It would seem that chrome and nickel were constant accompaniments of the magnesian deposits of the present series. We have also detected these metals in the ophiolites of California, of Portsoy in Scotland, Cornwall, the Vosges Mountains, Mount Rosa and Corsica; while they are wanting in the Laurentian ophiolites of Canada, and in specimens of serpentine from Norway, supposed to be of the same formation.

45. Steatite, Bolton.

46. " with bitter-spar, Ireland.

Besides the so-called talcose slates of this series, which are for the greater part aluminous, true talc slates, or schistose varieties of steatite are not unfrequent. These are sometimes nearly pure talc, and at others mingled with hornblende, in the form of actinolite, or with bitter-spar. They yield to analysis a few thousandths of oxyd of nickel.

47. Chlorite (potstone,) Bolton.

The chloritic slates of this series are often mingled with quartz and with epidote, and sometimes with specular iron. In other cases, however, beds of pure, compact, and somewhat schistose chlorite, occur.

48. Magnesite, Sutton.

49. " Bolton.

Magnesite rocks have been met with in three localities in this series. That of Sutton occurs with dolomite and steatite, and consists of carbonate of magnesia with some carbonate of iron, intermixed with grains of a feldspathic mineral, and a green, chromiferous mica. The magnesite of Bolton forms an immense bed, between steatite and diorite, and contains a mixture of grains of quartz, besides small portions of both chrome and nickel. In a third locality, the magnesite, which is compact, earthy, and yellow-weathering, is interstratified with argillite, and resembles in appearance many of the magnesian limestones of the region.

50. Dolomite, Leeds.

51. " conglomerate, Leeds.

52. " " Shefford.

53. Limestone, Ste. Marie, Beauce.

54. " plumbaginous, Melbourne.

Dolomites, or magnesian limestones, are abundant in this series, and frequently accompany the ophiolites, into the composition of which, as we have seen, they often enter. These dolomites are generally ferruginous, often containing eight or ten per cent. of carbonate of iron, and sometimes as much carbonate of manganese. They are often mingled with a portion of clay, or of silicious sand, sometimes considerable in amount, and very frequently become conglomerates, enclosing pebbles or rounded masses of pure limestone, and more rarely of sandstone, shale, or dolomite, in a paste of ferruginous red-weathering magnesian limestone. In some cases, these rocks have the composition of a true dolomite, in which the oxyds of iron and manganese replace a portion of magnesia. In others, the quantity of lime is not equivalent to the other protoxyd bases, and we have a passage to the magnesites already described; which are rocks consisting of carbonates of magnesia and iron, with little or no carbonate of lime. The carbonate of iron occasionally predominates in these, and in one instance, a bed of spathic carbonate of iron occurs. The foreign minerals of these rocks are few in number; chlorite, talc, hornblende, pyroxene, and brown garnet are sometimes met with, and a green chromiferous mica, probably allied to fuchsite, occurs in small scales, both in the magnesites and in the dolomites. An emerald-green garnet with six per cent. of chrome, is also, in one place, associated with these magnesian rocks. With the ferruginous dolomites, are often interstratified beds of pure limestone, which frequently enclose concretionary fibrous masses, made up of concentric layers, like the recent deposits of travertine from calcareous waters.

The conditions under which these dolomites and pure limestones are associated, are such as to leave no doubt that they have been contemporaneous deposits, and to forbid the notion of the formation of dolomite by any subsequent alteration of the limestones. In a series of investigations published in the Reports of the Geological Survey for 1857 and 1858, we have endeavored to explain the origin of these carbonates of lime and magnesia, and their associations in nature. It has there been shown that when waters holding bicarbonate of soda in solution, act upon sea-water, containing chlorids of calcium and magnesium, the whole of the lime is first precipitated in the form of carbonate, with but a very small proportion of magnesia. A farther addition of the alkaline carbonate, if fresh supplies of lime salts are excluded, gives rise to a very soluble bicarbonate of magnesia, which, by evaporation, is separated as a hydrous carbonate. This, when heated alone to 300° F., under pressure, to prevent the loss of carbonic acid is changed into magnesite, but if mingled with carbonate of lime, a double salt results, which is dolomite. The sources of the alkaline carbonate are to be found in decomposing feldspars; the surface waters from regions of feldspathic rocks, and the springs which traverse the debris of such rocks, are still, at the present day, impregnated with carbonates of soda and lime; in the latter case, they are often accompanied with oxyd of iron and with rarer metals. In this way the metalliferous character of many dolomitic formations is explained. The carbonated rocks have thus been formed by a series of decompositions, the results of which are represented by the clays and argillites (which are feldspars that have lost a portion of their alkali), by the limestones and dolomites, and by the chloride of sodium in the sea, and in the rocky strata. All limestones, as well as dolomites, are the result of this chemical process, which furnishes the elements for the limestones of organic origin. Great masses

of carbonate of lime, in various formations, as for example the statuary marbles of Lower Silurian age, in Vermont, are purely chemical in their origin, and do not result from the metamorphism of fossiliferous limestones.

These views were first enunciated in the reports of the Canada Geological Survey, already cited, and in the Am. Jour. Science, May 1858, xxv, 102, and Quar. Jour. Geol. Soc. London, for 1859, p. 492. In a sealed packet deposited by Cordier, with the French Academy, some years ago, and opened since his death, the same views are suggested. —*Comptes Rendus de l'Acad., Feb.* 17, 1862.

The magnesian limestones, commonly associated with beds or masses of gypsum, appear to have been formed by a reaction pointed out in the above Reports; in virtue of which, solutions of bicarbonate of lime, when mingled with evaporating waters holding sulphate of magnesia, give rise to sulphate of lime, which is first separated, and to a more soluble bicarbonate of magnesia, which is deposited by farther evaporation, mingled with a farther portion of carbonate of lime. The sulphate of magnesia, which, in Canada, as elsewhere, often exudes from these dolomites, appears not to be due, to a subsequent reaction between the dolomite and the gypsum, but to have been an original element of these rocks.

55. Chert, Cape Rouge.

56. Sandstone, St. Nicholas.

57. " "

58. Agalmatolite, "

The agalmatolite of St. Nicholas, which had at first been taken for serpentine was described, with analyses, in the Report of the Survey for 1850, under the name of parophite. The subsequent analysis of the dysyntribite of Shepard, from the Laurentian series, shewed the identity of the two rocks which have, as already remarked on page 67, the composition of agalmatolite or of the onkosin of Kobell. The specimens from St. Nicholas form thin layers, often concretionary, in an earthy shale, which has apparently the same composition. In other localities in this series, however, the agalmatolite appears as a soft, unctuous, translucent, yellowish-green rock, which is either granular, or has an indistinctly ligneous structure, with a satiny lustre.

Deposits of silica, which are evidently of chemical origin, and which assume the forms of hornstone or jasper, as they include more or less argillaceous or ferruginous matter, are not unfrequent among the mechanical sediments of this series. The two specimens of sandstone from the unaltered strata of the Quebec group at St. Nicholas, are supposed to represent the granitic gneiss of the altered portions of the same formation. The cement-in some of these sandstones, is a feldspathic matter, rich in potash; and the analysis of the rock, as a whole, gives a composition identical with the mixture of quartz, orthoclase, and mica, which constitutes this gneiss. The metamorphism of these aluminous rocks consists, then, simply in the crystallization of the silicates of alumina and alkali in the sediments, a reaction which has taken place at no very elevated temperature; the alkaline silicates and carbonates, by which the waters of these sediments are impregnated, aiding the process. At the same time, the reactions between the silicious and argillaceous matters, and the earthy carbonates, in the presence of these alkaline solutions, give rise to chlorite, garnet, and epidote. These views, together with various experiments on the artificial formation of silicates, were published in the Am. Jour. Science for May 1857, p. 438, and the Proc. Royal Society for May 7, 1857. They are also given in the Report of the Geological Survey of Canada for 1856, p. 479; all of which appeared anterior to the first publication of Daubrée; who, in November 1857, brought forward some striking experiments in support of the theory of the metamorphism of sediments, at comparatively low temperatures, by the intervention of alkaline salts.

In the Report for 1858, p. 188, will be found some account of the results of local metamorphism of limestone near a trap dyke at Montreal. The limestone here contains a portion of an argillaceous matter, with 70 per cent. of silica, consisting of finely divided orthoclase and quartz. Where the beds have been rendered crystalline, near the intrusive rock, these substances have become saturated with lime, magnesia, and oxyd of iron; and there results a silicate of these bases, with alumina, containing only 40 per cent. of silica. By similar reactions, the various silicates of lime and magnesia, both hydrated and anhydrous, may be formed; including both serpentine and talc. Steatite is however doubtless but the result of the molecular metamorphism of sepiolite, a silicate of magnesia which occurs in beds in many Tertiary deposits; and ophiolites have probably originated in beds of a similar magnesian silicate. The source of these silicates may be traced to the spontaneous evaporation of natural waters, many of which deposit silicates of lime, magnesia, and oxyd of iron. The proportion of silica in solution in the waters of the Ottawa River, is one third of all the solid matters (which amount to 6 parts in 100,000), and a part of this remains dissolved, together with lime and carbonate of soda, in the concentrated water; which, like that of the St. Lawrence, deposits an earthy silicate by farther evaporation. (Report of Geol. Survey for 1853-56, p. 360.)

The problem of rock metamorphism is the conversion of mechanical or chemical sediments into definite mineral species, by molecular changes, or by chemical reactions between their elements. Pseudomorphism, which is the change of one mineral species into another, by the introduction, or the elimination of some element, presupposes metamorphism; since only the definite mineral species of metamorphic rocks can be the subjects of this process. To confound metamorphism with pseudomorphism, as some have done, is therefore an error. It may be further remarked, that, although certain pseudomorphic changes may take place in some mineral species, in veins, and near to the surface, the alteration of great masses of silicated rocks by such a process, is an unproved hypothesis.

IV. INTRUSIVE ROCKS.

The results of recent geological investigations in various parts of the world, lead to the conclusion that many rocks, formerly regarded as intrusive or exotic, are really sediments, altered *in situ*, or indigenous rocks. Such is the case with many granites, syenites, greenstones, amygdaloids, porphyries and serpentines; all of which are represented among the altered strata of Canada. These sediments at the time of their metamorphism, were however in such a plastic state, that they were sometimes displaced and forced among the overlying and disrupted strata. It is not improbable that the intrusive granites, which are so abundant among the Devonian rocks to the south and west of the Notre-Dame Mountains, are the equivalents of the feldspathic sandstone and granitoid gneiss of the lower Silurian series. It is worthy of note, that intrusive masses are extremely rare in the Laurentian system, so far as known, except in one small area in the counties of Grenville and Argenteuil, where a succession of eruptions of dolerite, syenite, and quartziferous porphyry, occurred before the commencement of the Silurian period. In the same way, the great masses of the Lower Silurian mountains are free from intrusive rocks. To the south-east of them, however, occur the Devonian granites just mentioned, and to the north-west, along the vallies of the St. Lawrence and Lake Champlain, are a series of intrusive dolerites, diorites, and trachytes. The most remarkable of these, in Canada form a line of isolated hills, eight in number, extending about ninety miles along the line of an undulation, which runs nearly east and west, or almost transverse to the Notre-Dame Mountains, and has disturbed the Lower Silurian strata. These hills, beginning from the west, are Rigaud, Mount Royal, Montarville, Belœil, Rougemont, Yamaska, Brome and Shefford Mountains, to which may be added Mount Johnson, or Monnoir, a little to the south of this line. Brome and Shefford are on the confines of the metamorphic region. These masses, which were intruded among the members of the Lower Silurian series, have

been left by denudation, as hills, covering areas of several miles, and sometimes more than 1000 feet in height, and present great varieties in composition. Brome and Shefford are granitoid trachytes, Yamaska, partly trachyte and partly diorite; to which latter rock also belongs Belœil, so far as examined, and Monnoir. Rougemont, Montarville, and Mount Royal are dolerites, and Rigaud is, in great part, a granitoid trachyte. Dykes of numerous varieties of trachyte and of phonolite, cut the dolerites of Mount Royal, and the shales of the Hudson River formation. The conglomerate of St. Helen, which overlies and encloses masses of Upper Silurian limestone, as well as fragments of granitoid dolerite, is in its turn traversed by dykes of a newer rock, which is also a dolerite. The strata in the vicinity of these intrusive masses are not altered, except near the line of contact. (See page 80.) The present collection includes only a few of the more characteristic varieties of these intrusive rocks.

1. Quartziferous Porphyry, Grenville.

In the county of Grenville, the Laurentian limestones and gneiss are successively cut by intrusive masses of dolerite, syenite, and quartziferous porphyry, all of which rocks are older than the Silurian period. The last of these, which is an orthophyre or felsite porphyry, has a compact, apparently homogeneous base, inclosing crystals of orthoclase, and more rarely, grains of quartz. The color of the crystals is of different shades of red, while the base varies from black to purplish and greenish hues, and is found by analysis to consist of an intimate mixture of orthoclase and quartz, colored apparently by oxyd of iron. This porphyry receives a fine polish, and some varieties of it are very beautiful.

2. Trachyte, granitoid, with hornblende, Shefford Mountain.
3. " " " mica, Brome Mountain.
4. " " " " Yamaska "
5. " compact, with pyrites, Montreal.
6. " " "
7. " " "
8. " " red-weathering, "
9. " " Lachine.
10. " porphyritic, Montreal.

The mountains of Shefford and Brome are masses of intrusive rock, which break through the shales of the Quebec group; the latter, which is the larger, occupying an area of about twenty square miles. These mountains are composed of a granular rock, which might be mistaken for granite, but for the absence of quartz. It is an aggregate of crystalline grains

of orthoclase feldspar, with a small admixture of hornblende or black mica, which appear in different parts to replace one another. The rock is sometimes fine-grained, but in other parts consists of cleavable forms of orthoclase, which are occasionally half an inch in length. Small grains of magnetite, and of yellow sphene are also sparingly disseminated. This rock, from the absence of any mineral as a cementing medium between the grains of feldspar, is very friable, and rapidly disintegrates at the surface. Its structure and composition are such that it may be designated a granitoid trachyte. The feldspar has a specific gravity of 2·56. One of several concordant analyses, from different localities, gave for its composition: silica 65·15, alumina 20·55, lime 0·73, potash 6·39, soda 6·67, volatile 0·50 = 99·99.

A variety of this trachyte, from a dyke near Chambly, consists of large well-defined orthoclase crystals, in a fine-grained, lamellar base, both having nearly the same composition as that just given. The vicinity of Montreal abounds in trachytic dykes, which are generally fine-grained; they are sometimes crystalline, and at others earthy in texture, and are occasionally porphyritic from the presence of feldspar crystals. They are generally white or grey, and more rarely lavender-colored or purplish in hue. These trachytes often contain disseminated earthy carbonates, in some cases amounting to from seven to fifteen per cent., and consisting of carbonate of lime, with considerable proportions of carbonates of magnesia and protoxyd of iron. These varieties of trachytes are often grey, granular, and sub-vitreous, but effervesce freely with acids. The more earthy of them are sometimes weathered to a little depth, and reddish from the peroxydation of the iron. The insoluble residue of all these rocks approaches in composition to the orthoclase above described. In some cases, these trachytes contain an admixture of a hydrated silicate, which gelatinizes with acids, and has the composition of a zeolite: through this admixture they pass into phonolite.

11. Phonolite, Lachine.

This rock forms a large dyke, traversing the shales of the Utica formation. It is a fawn-colored compact mass, with a somewhat schistose fracture, and has a specific gravity of only 2·41. It effervesces slightly, and gelatinizes with acids, and is found by analysis to consist of from forty-five to fifty-five per cent. of an insoluble potash feldspar, near to orthoclase in composition, with from thirty-six to forty-six per cent. of a soluble hydrous silicate of alumina and soda, closely approaching to natrolite; besides about seven per cent. of carbonates of lime and protoxyd of iron, in nearly equal proportions.

12. Dolerite (Oligoclasic), Mount Johnson.

The isolated Mount Johnson, or Monnoir, as it is sometimes called, consists of a granular diorite, made up of black crystalline hornblende and white cleavable feldspar, with small crystals of amber-yellow sphene. The rock is sometimes finely granular, but more generally coarsely granitoid or porphyritic; the crystals of feldspar, which is the predominant mineral, being frequently an inch or more in length. They have a specific gravity of 2·63–2·65, and the composition of oligoclase. Its analysis gave silica 62·05, alumina 22·60, peroxyd of iron 0·75, lime 3·96, potash 1·80, soda 7·35, volatile 0·80 = 98·91.

13. Diorite (Anorthic), Yamaska Mountain.

The diorite of Yamaska much resembles the last, being made up of black hornblende, with a white feldspar, and small grains of sphene and magnetic iron. It is sometimes granular, but the feldspar often presents striated cleavage planes, half an inch in breadth, which have a specific gravity of 2·75–2·76, and a composition near that of anorthite. Its analysis gave silica 46·90, alumina 31·10, peroxyd of iron 1·35, lime 16·07, magnesia 0·65, potash 0·58, soda 1·77, volatile 1·00 = 99·42.

This beautiful diorite makes up a large part of the mass of Yamaska mountain, but the remainder is a granitoid trachyte (4). This is more micaceous than that of Brome, and consists in great part of a feldspar, which approaches oligoclase or andesine in composition.

14. Dolerite, Montarville.

15. " "

16. " Mount Royal.

17. " " "

18. " (Peridotite), Rougemont.

19. " " Montarville.

20. " " Vermont.

The dolerites which form the mountain masses of Rougemont, Montarville, and Mount Royal, present great varieties in their composition. Some parts of the latter mountain consist of a granitoid aggregate of a greenish-white feldspar, having the composition of labradorite, with black augite. This latter sometimes prevails, to the almost complete exclusion of the feldspar, forming a crystalline augite rock. In other parts, the black and more augitic portions are arranged in short irregular bands, with a lighter and more feldspathic dolerite, as if two plastic masses, holding different proportions of augite, had been partially mingled in flowing. Grains of olivine sometimes occur in the more feldspathic portion of Mount Royal, and are still more abundant in a similar rock from Rougemont and from Montarville. In both of these masses, more or less augitic varieties occur, as at Mount Royal. The chrysolite or olivine, which is rare in the greater part of Montarville, predominates in one portion, which is a granitoid aggregate of feldspar and augite; the latter often in well defined crystals, with a little brown mica, and grains or imperfect crystals of yellowish olivine. This, in some specimens, equals forty-five per cent. of the rock, and consists of silica 37·17, magnesia 39·68, protoxyd of iron 22·54 = 99·39.

This peculiar rock, which, from the predominance of olivine or peridot, might well be separated, from dolerite, may be distinguished by Cordier's name of peridotite. It is the more worthy of attention, from the fact that olivine has hitherto been regarded as characteristic only of fine grained dolerites or basalts. As an example of an extremely coarse grained or granitoid peridotite, the specimen 20 is subjoined. This rock, which consists of great crystals of cleavable feldspar, with masses of granular chrysolite, and small portions of green pyroxene, was found in a boulder, in the Connecticut valley.

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PHILADELPHIA INTERNATIONAL EXHIBITION,

1876.

DESCRIPTIVE CATALOGUE

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ECONOMIC MINERALS OF CANADA,

AND NOTES

ON A

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DESCRIPTIVE CATALOGUE

OF

THE CANADIAN GEOLOGICAL EXHIBITS,

COMPILED BY

THE GEOLOGICAL CORPS OF CANADA.

The classification given below is essentially that adopted by Sir W. E. Logan in the catalogue prepared for the London International Exhibition of 1862, although some alterations and additions have been rendered necessary. In some cases, where no more recent information has been obtained, Sir William's descriptions have been repeated here. The names of contributors will be found opposite the localities from which the specimens have been obtained; while the geological formations are in general indicated at the end of the descriptive matter. The arrangement of the specimens under each heading is not geological but geographical, the British Columbia exhibits, when there are any, being given first, then those from the North West Territory and Manitoba, and so on from west to east. The headings under which the various substances are classed are as follows:

I.—Metals and their Ores.
II.—Materials used in the production of Heat and Light.
III.—Minerals applicable to certain Chemical Manufactures, and their Products. (See also under IV.)
IV.—Mineral Manures. (See also under III.)
V.—Mineral Pigments and Detergents.
VI.—Salt, Brines, and Mineral Waters.
VII.—Materials applicable to Common and Decorative Construction.
VIII.—Refractory materials, Pottery Clays, and Pottery.
IX.—Materials for Grinding and Polishing.
X.—Minerals applicable to the Fine Arts and to Jewelry.
XI.—Miscellaneous Minerals.

I.

METALS AND THEIR ORES.

IRON.

Native Iron.

1. Madoc, O ..... *Geological Survey.*

a. Native or meteoric iron.

This aerolite was found in 1854, and before cutting weighed 370 pounds. It contains 6.35 per cent. of nickel, and in making a section of it, rounded masses of magnetic sulphide of iron (probably troilite) were observed. When etched with an acid it exhibits beautifully the so-called Widmannstättian figures. Several large masses of meteoric iron have been discovered in the North West Territory, but have not as yet been carefully examined.

Magnetic Iron Ore.

1. Texada Island, B.C..... *Geological Survey.*

a. Specimens of magnetic iron ore.

This important deposit occurs in crystalline rocks supposed to be of Carboniferous age. The largest exposure is on the south side of the island, about three miles north-west of Gillies' Bay. Here the ore-bed is seen to be from twenty to twenty-five feet thick, and to rest on grey crystalline limestone, with which, for about two feet down, are interstratified bands of ore, of from half an inch to one inch in thickness. From this point to the north-west, for nearly a mile, the bed is occasionally seen, and at one place there is a continuous exposure about 250 feet long and from one to ten feet thick. To the north-east it is also said to have been traced for more than three miles. As regards mining and shipment the ore is most favourably situated, while in the event of smelting operations being carried on, there is an abundance of wood suitable for making charcoal on the island, and Comox Harbor, from which the coal of the Comox area will be shipped, is less than twenty miles distant.

The ore is of an iron-grey colour, and frequently contains little cavities, which hold red or yellow ochre. Sometimes the cavities are lined with octahedral crystals of magnetite. A partial analysis of a specimen collected by Mr. James Richardson, of the Geological Survey, gave 68.40 per cent. of iron and only .003 per cent. of phosphorus. The deposit is in part owned by Messrs. Nelson & Moody, of Burrard Inlet.—*Carboniferous?*

2. An Island in Queen Charlotte Sound, B. C..... *Captain Lewis, Victoria.*

a. Specimen of magnetic iron ore.

The island is not named on any of the charts, but it occurs near the Walker group, in Schooner Passage. The ore is a finely-granular magnetite, exceptionally rich in iron, the specimens examined yielding as high as 71.57 per cent.

3. Mining lot 10 Z., Township of McGregor, Thunder Bay, Lake Superior..... } *T. D. Ledyard, Toronto.*

a. Specimen of magnetic iron ore.

The ore is a rich fine-grained magnetite, occurring as an irregular deposit among the slates of the Nipigon or Copper-bearing series at the above locality.—*Nipigon Series.*

4. Mining location Y XII., near Killarney, Lake Huron..... } *J. A. Lindsay, Toronto.*

a. Three specimens of magnetic iron ore.

This locality is near the west line of the township of Rutherford, and about three miles north-west of the village of Killarney. The main vein is reported to be about twenty feet in thickness, of solid ore, and is situated conveniently for shipping on the west side of a bay of Lake Huron. It runs N.W. and S.E., and is flanked by greenstone or diorite on the N.E. and quartzite on S.W. side. Professor Chapman has made a complete analysis of this ore, and finds it to contain 60.85 per cent. of iron, no titanium, and only traces of sulphur and phosphorus. Two other veins, each about four feet wide, occur on the property, which belongs to the Algoma Iron Mining Co. of Toronto.—*Huronian.*

NOTE.—In the Lakes Superior and Huron region magnetic iron ores occur in quantities which may be of economic value in the following localities: to the south of Nequaquon and Gun-flint Lakes (massive crystalline ore); in the N. W. corner of the township of Neebing, interstratified with sandstone (contains 37.73 per cent. of iron); one to two miles west of the mouth of Little Pic River (deposit 90 feet thick—the iron is chiefly a silicate—metallic iron from 36 to 46 per cent., according to Hayes, Hunt and Girdwood); Portage at the west end of Little Long Lake, near Long Lake House (ore siliceous and slaty); Gros Cap, mouth of Michipicoten River (a good quality of ore); Mammoth and Vulcan Iron Mountains, about eight miles north of Batchawana Bay (large quantities of fine-grained magnetite, averaging about 50 per cent. of iron); Agawa River (a large deposit of ore said to have been recently discovered a few miles from Lake Superior.)

5. Township of Galway, O..... *T. D. Ledyard, Toronto.*

a. Specimens of magnetic iron ore.

From a series of outcrops on lots twenty-seven in the thirteenth and fourteenth ranges, lot twenty-three in the fourteenth, and twenty-two and twenty-four in the twelfth. There has been no regular mining on any of these lots, but Mr. Ledyard states that small excavations have been made, and that there is reason to believe that the deposits will prove to be of importance. Some of the ores have been examined by Professor Chapman and found to be rich in iron and free from titanium.—*Laurentian.*

6. Snowdon Iron Location, Peterborough, O..... *Ontario Advisory Board.*

a. Specimens of magnetic iron ore.

This location comprises lot twenty, range one, of the township of Snowdon, county of Peterborough, and is situated fifteen miles N. E. of Coboconk, the present terminus of the Toronto and Nipissing Railway. The ore has a somewhat granular structure, and according to Professor Chapman of Toronto occurs in beds which have a possible aggregate thickness of fifty or sixty feet. Trial pits sunk on one bed showed a thickness of six or seven feet at least. The following is an analysis of an average sample of the ore by Professor Chapman :

Sesquioxide of iron		58.35	Metallic iron 60.18
Protoxide of iron		24.87	
Alumina		0.42	
Titanic acid		0.73	
Oxide of manganese		0.13	
Magnesia	2.56		
Lime	1.43	Rock-matter 15.16	
Silica	11.17		
Phosphoric acid		0.17	
Sulphur		0.04	
		99.87	

A few tons of the ore have been mined and sent to the United States during the past winter, but as yet the property has not been regularly worked. Messrs. Shortiss, Savigny and Major, of Toronto, are the owners.—*Laurentian.*

7. Blairton, Belmont, O..... { *The Cobourg, Peterborough, and Marmora Railway and Mining Company.*

a. Two large masses of magnetic iron ore, from a depth of 150 feet.

The *Blairton ore bed* or *Big ore bed*, as it was formerly called, is one of the most important deposits of magnetite in Canada, and has been extensively worked for many years. The ore is finely granular and often contains a considerable admixture of hematite. It occurs in a series of beds interstratified with crystalline limestone, talcose slate, serpentine and other metamorphic rocks, the whole highly inclined. Some of the beds are very pure, but others contain a good deal of rock matter and iron pyrites. An analysis of a specimen from what is known as the "sand-pit bed" gave Dr Hunt as follows :

Magnetic oxide of iron	72.80	=Metallic iron 52.72
Magnesia	6.46	
Lime	0.35	
Carbonate of lime	2.40	
Carbonate of magnesia	0.84	
Phosphorus	0.035	
Sulphur	0.027	
Water	3.50	
Insoluble	14.73	
	101.142	

Ore is now being raised from a depth of about 160 feet, the mining and loading

on the cars which take it to Rice Lake costing about $1.25. The annual production from 1869 to 1875, inclusive, was approximately as follows:

1869	20,000 tons
1870	10,000 "
1871	20,000 "
1872	20,000 "
1873	27,000 "
1874	25,000 "
1875	20,000 "
	142,000

The largest part of this has been shipped to the United States. Many years ago a blast furnace was erected in the adjoining township of Marmora, to smelt the ore with charcoal, but the attempts which were made were not attended with profit, owing, probably, to distance from a port of shipment, and inattention to the proper sorting of the ore and the nature of the required flux. The number of men employed in connection with the mines is generally about 150.—*Laurentian.*

8. Madoc, O., lot 11, range 5 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

A bed from twenty-five to thirty feet thick, known as the "Seymour Ore Bed." The ore is finely granular, unusually free from pyrites, and one of the finest in the country. It is underlaid by a thin band of soft black mica-schist, and overlaid by reddish-grey highly feldspathic rocks, which are porphyritic in places and graduate into syenite or syenitic gneiss, with epidote. On the run of the bed to the eastward, dark grey hornblendic rocks occupy the surface in places, as well as the feldspathic rocks just alluded to. Actinolite forms the chief associate of the magnetite, occurring in scattered radiating bunches, and also uniformly disseminated through the ore. In 1837 a furnace was erected in Madoc village for smelting this ore, but was in blast only a short time when it was abandoned, one of the proprietors having been killed in the mine and the other not having sufficient means to carry on the operations. The iron produced is said to have been of very superior quality. For a short time wood was employed as fuel. The distance of the deposit from railroad or navigable waters has until recently been the great obstacle to its further development, but the Grand Junction Railroad now passes a few miles to the south of it, and it is said that a branch will soon be built to the adjoining ore deposits in Madoc. The following is an analysis by Dr. T. Sterry Hunt:

Peroxide of iron Protoxide of iron	89.220	Metallic iron 64.61
Phosphorus	0.012	
Sulphur	0.073	
Insoluble matter	10.420	
	99.725	

Exploratory work carried on during 1875 is said to indicate that the bed is thicker than heretofore supposed.—*Laurentian.*

9. Madoc, O., west half of lot 19, range 2 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

From a deposit known as the "Neilson Mine," and evidently a continuation of the two preceding. The ore is rich in iron, but contains a good deal of iron pyrites. The thickness of the bed appears to be about twenty-five feet, but may prove to be greater.—*Laurentian.*

10. Madoc, O., west half of lot 16, range 5 ..... *Geological Survey.*

a. Specimen of magnetic iron ore.

From an opening known as the "Cooke Mine." The ore is a finely granular magnetite resembling that of the "Seymour Bed," of which it is probably the representative, on the opposite side of an anticlinal. The extent of the deposit is not known, but ore has been found in considerable quantity on the adjoining lots, 15 and 17 in the same range. The branch from the Belleville and North Hastings Railroad is expected to pass close by this locality.—*Laurentian.*

11. Madoc, O., east half of lot 17, range 5..... *Geological Survey.*

a. Specimen of magnetic iron ore.

From a property adjoining the preceding, and known as the "Moore Mine." The ore is very free from impurities and occurs in syenitic gneiss. It is said to contain about 61 per cent. of iron.—*Laurentian.*

12. Bathurst, O., lots 9 and 10, range 8..,.*John Hart and W. J. Morris, Perth.*

a. Specimens of magnetic iron ore.

An irregular deposit, known as the *Foley Iron Mine*, perhaps averaging two feet in thickness, in coarsely crystalline diorite. The ore sometimes occurs in large octahedral crystals, the axes of which are often more than an inch in length. Crystals of apatite are scattered here and there among the crystals of magnetite, and masses of granular apatite occur in the adjacent rock. The magnetite yields to analysis about fifty-eight per cent. of iron, and the horizon in which it occurs has been traced from Eagle Lake in Hinchinbrooke to Fitzroy on the Ottawa River, a distance of about fifty-six miles.—*Laurentian.*

13. Bedford, O., lot 4, range 1..... *Ontario Advisory Board.*

a. Specimens of magnetic iron ore.

The Glendower or Howse mine is situated in the south-west corner of Bedford, two and a half miles from the Kingston and Pembroke Railway on the west, seventeen from the Rideau Canal on the east, and about twenty north of Kingston on Lake Ontario. The ore is taken from a bed of crystalline magnetite running north-eastward, which appears to be at least eighty or ninety feet thick. During the summer of 1875, about 6,000 tons (of 2240 lbs.) of ore were raised, and 4,070 exported to Elmira, N.Y., where the company has headquarters. Only about 1,500 tons a month are being raised at present, although the mine is opened to a monthly capacity of 3,000 to 5,000 tons. The analysis of the ore shows 64.03 per cent. of metallic iron, 1.32 of titanic acid, and only traces of phosphorus and sulphur. Mr. A. Creveling of Kingston is the superintendent.—*Laurentian.*

14. Machar Mine, township of Bedford, O.....*Ontario Advisory Board.*

a. Specimens of magnetic iron ore.

This mine is situated on a thick bed of crystalline magnetite in the vicinity of the

Glendower mine. It was first opened in the summer of 1875, and six hundred tons of ore were mined and sold. Mr. John Machar, of Kingston, is the agent for the property.—*Laurentian.*

15. South Sherbrooke, lots 14 and 15, range 4.....*George Oliver, Perth.*

a. Specimen of magnetic iron ore.

From shallow openings known as the *Silver Lake Mines.* The ore is a compact magnetite of black colour and high lustre. It occurs in a succession of beds or lenticular masses, interstratified with dark hornblendic gneisses, crystalline diorites and some small bands of crystalline limestone. The beds are at present being opened up by Mr. Oliver of Perth, the exhibitor, but their extent is not yet known. The horizon in which they occur, however, has been traced through the contiguous townships of Bedford and Bathurst, in both of which townships there are frequent indications of iron ore. It is rather free from pyrites and contains:—

Magnetic oxide of iron	88.59	=Metallic iron 64.15
Titanic acid	1.75	
Insoluble residue	5.75	

About one hundred tons have been extracted from the openings in South Sherbrooke.—*Laurentian.*

16. Newborough, South Crosby, O., lots 26 and 27, range 6..... } *Geological Survey.*

a. Specimen of magnetic iron ore.

The bed occurs on an island in Mud Lake, a part of the Rideau canal, and is said to be about two hundred feet thick. The ore is a titaniferous magnetite containing, according to Dr. Hunt,

Magnetic oxide of iron	69.77	=Metallic iron 50.52
Titanic acid	9.80	
Magnesia	4.50	
Alumina	5.65	
Silica	7.10	
Water	2.45	
Phosphorus	1.520	
Sulphur	.085	
	100.875	

The deposit is known as the Chaffey Mine, having been worked for many years by the present owners, the Messrs. Chaffey. An extension of the bed occurs on the mainland, where it is also worked and known as the Matthews or Yankee Mine. The annual production of the two mines together is between 7,000 and 8,000 tons. The ore is mined for about $1.50 per ton, and carried to Cleveland for about $2.50.—*Laurentian.*

17. Fitzroy, O., lots 2 and 3, range 12....*Andrew Bishop, Bell's Corners, O.*

a. Specimen of magnetic iron ore.

Little is known about the extent of this deposit, as it has only been recently

discovered. It is owned by the contributor. The ore sometimes occurs in large octahedral crystals nearly six inches in diameter.—*Laurentian.*

18. Bristol, Q., lot 22, range 2.....*Geological Survey, and J. Bell, Arnprior.*

a. Specimen of magnetic iron ore.

This ore occurs in a series of beds which are interstratified with reddish hornblendic gneiss and glistening micaceous and hornblendic schists of Laurentian age. The thickness of what appears to be the uppermost and most important bed has not been ascertained; but the lowest one exposed is about nine or ten feet thick. The property is owned by Messrs. Taylor & Burns, of Pittsburg, and openings were first made during the winter of 1873-74. Several thousand tons of ore have been raised but not shipped.

The following is an analysis from the Report of the Geological Survey for 1873-74, page 208:

Peroxide of iron	65.44	} Metallic iron 58.37
Protoxide of iron	14.50	
Bisulphide of iron	2.74	= Sulphur 1.46
Protoxide of manganese	0.11	
Alumina	0.60	
Lime	3.90	
Magnesia	0.45	
Silica	11.45	
Carbonic acid	1.64	
Phosphoric acid	traces	
Titanic acid	none	
Water	0.14	
	100.97	

The ore though generally known as magnetite contains a considerable proportion of hematite. Pyrites is also present in larger quantity than desirable.—*Laurentian.*

19. Hull, Q., lot 11, range 7.....*A. H. Baldwin, Ottawa.*

a. Specimen of magnetic iron ore.

b. Photograph of blast furnace and charcoal kilns.

The "Hull Mines" are situated on lot eleven in the seventh range, and lots twelve and thirteen in the sixth range of Hull, about six miles from Ottawa. They include the Forsyth and Baldwin mines, which are about half a mile apart, though probably on the same bed. The ore occurs in crystalline limestone, and has a thickness in some places of over sixty feet. It was first mined in 1854 by Messrs. Forsyth & Company, of Pittsburg, and more recently by A. H. Baldwin, of Ottawa, about 30,000 tons having been taken from the Forsyth and 4,000 from the Baldwin mine. No mining has been carried on since 1873, in which year about 15,000 tons of ore were shipped to the United States. The blast furnace is situated near the Gatineau River, about three miles from the Forsyth mine. It has not been in blast since 1868, and was several years ago much injured by fire. Some of the ore contains an admixture of hematite, and is known as "red ore," while that which is

essentially magnetite is known as "black ore." The following analyses of these two varieties are by Dr. T. Sterry Hunt:

	Red ore.	Black ore.
Peroxide of iron	66.20	73.90
Protoxide of iron	17.78	
Oxide of manganese	traces.	none.
Alumina	.....	0.61
Lime	1.85	none.
Magnesia	0.18	1.88
Phosphorus	0.015	0.27
Sulphur	0.28	0.85
Carbonic acid	1.17	.....
Silica	11.11	20.27
Graphite	0.71	.....
Water	.....	3.27
	99.295	100.042
Metallic iron	60.17	53.51

The ore frequently contains scales of graphite. In the blast furnace it yields from 60 to 62 per cent. of iron.—*Laurentian.*

20. Grandison, Q..... *Geological Survey.*

a. Specimen of magnetic iron ore.

21. North Mountain, King's County, N.S.....*David Chipman, Berwick.*

a. Specimen of magnetic iron ore.

In the great ridge of Triassic trap which borders the south-eastern side of the Bay of Fundy thin veins of magnetite are occasionally found. A few attempts have been made to work them, but they can scarcely be regarded as of economic importance. The ore is often beautifully crystallized in dodecahedra, or in combinations of the octahedron and dodecahedron.—*Triassic.*

Iron Sand.

1. Moisie, Q..... *William Rhind, Montreal.*

a. Iron sand.

b. Billet of wrought iron (2¼ in.), bent cold.

c. Small axle (2½ in.), bent cold.

d. Large " (4 in.), " "

e. ¾ inch wrought iron, " "

f. ⅜ " " " twisted cold.

Many of the rocks in the great Laurentian series, which is extensively developed to the north of the gulf of St. Lawrence, contain small disseminated grains and crystals of magnetite and ilmenite, which, on the disintegration of the rocks, are gathered together by natural processes of concentration, and form important deposits of "iron sand," stretching in some cases along the coast for many miles. Some of them are of recent origin, but others belong to the post-pliocene age, and are found as high as one hundred, and even two hundred, feet above the tide-level of to-day. With the ores of iron there are variable proportions of

siliceous sand, and small quantities of garnet, so that artificial concentration is necessary to fit the material for metallurgical treatment. In practice this is effected by shaking-tables, but in a very incomplete manner. Dr. Hunt found the Moisie sand, before washing, to contain 46.3 per cent of magnetic grains, and after washing only 52.00 per cent. The washed sand contained 55.23 per cent. of iron, 16.00 of titanic acid, .07 of sulphur, .007 of phosphorus, and 5.92 of insoluble matter. (Report of the Geol. Survey of Canada, 1866-69, p. 267).

The only locality at which the sands have been extensively worked is at Moisie (or Moisic), near the mouth of the Moisie River, and about 330 miles below Quebec. Here several bloomary furnaces were built by Mr. W. M. Molson, of Montreal, in 1867, and since then a considerable quantity of excellent iron has been made, and in part shipped to England and the United States. At present the *Moisic Iron Company* is in insolvency, and the works closed. The property comprises, 3,300 acres of land, eight bloomary furnaces, capable of producing thirty tons of blooms a week, a reverberatory furnace in which to re-heat the blooms for a second hammering, a tilt hammer, set of rolls for making bar iron, forty miners' cottages, hotel, &c. Belonging to the same estate there is also a valuable rolling mill and nail factory in Montreal. While the works were in operation about one hundred hands were employed at Moisie.

Hematite, (including crystalline and earthy varieties.)

1. Silver Lake Mining Location, Thunder Bay, Lake Superior..... } *Geological Survey.*

   a. About 150 lbs. of broken ore from beds of fine-grained compact hematite opened on the western part of the location.

   b. About 150 lbs. of broken ore from the lowermost of the beds of botryoidal hematite or "kidney ore," opened about a quarter of a mile east of the above.

   c. Piece of ore weighing about 100 lbs., similar to the last, but taken from a higher bed in the same part of the location.

The above location is situated five and a half miles N. E. of the head of Thunder Bay. The ore occurs in a group of beds, not less than forty or fifty feet in thickness, associated with compact sandstone, and ferruginous limestone suitable for a flux, near the base of the Nipigon series. Most of the beds consist of very pure hematite, containing, on an average, 68 to 69 per cent. of iron, according to the analyses of Prof. H. Alleyne Nicholson, of Newcastle, and Dr. Ellis, of Toronto. The outcrop of the ore beds has an elevation of 470 feet above Lake Superior, and is very favourably situated for mining and for smelting with charcoal.—*Nipigon Series.*

2. Mining lots 67 B and 68 B, Loon Lake, near Thunder Bay, Lake Superior..... } *T. D. Ledyard, Toronto.*

   a. Small specimen of hematite from a bed.

The deposit from which this specimen is taken is said to be of considerable extent, and to run north-westward from Loon Lake, which is situated about five miles north of the head of Thunder Bay.—*Huronian.*

3. The Dickson Location, Desert Lake, near Bruce Mines..... } *Geological Survey.*

   a. Three specimens of hematite, weighing about 150 lbs.

This location comprises Blocks A 1 and A 2, situated on the north side of Desert Lake, and about five miles from Portlock Harbor on Lake Huron. The vein, of solid ore like the specimens, cuts the greyish-white Huronian quartzite, is three feet thick, and runs a little north of west and south of east. It has been traced for nearly a mile on the location, and in one place shows to great advantage for mining, at an elevation of 200 feet over Desert Lake, which connects by a navigable river (The Thessalon) with Lake Huron. Dr. Ellis of Toronto finds the ore to contain 56 per cent. of iron and no appreciable quantity of sulphur or phosphorus. E. B. Borron, M.P., Hamilton, Ont., is agent for the property.—*Huronian.*

4. Location Y VIII., Desert Lake, near Bruce Mines..... } *James Stobie, Bruce Mines.*

a. Specimen of hematite, weighing 155 lbs.

This location adjoins the Dickson, and the vein is a westward continuation of the one on the latter. At the part from which the specimen is taken it is said to be nine or ten feet thick. It cuts similar quartzite and underlies to the northward at an angle of 10° from the perpendicular. The surrounding country is well wooded.—*Huronian.*

NOTE.—Besides the above localities for hematite in the Lakes Superior and Huron region, the following are worth mentioning, the quantity in each case apparently indicating an economic value: East side of Lake Nipigon near the mouths of Oniminisagi or Red Paint River, and of the Sturgeon River, slaty hematite ores. (A specimen from the latter place was found to contain 36.06 per cent. of iron, and to be of such a nature as to render it easy of reduction); hills east of Lake Nonwatanose, Black Sturgeon River (a red earthy hematite); west point of the largest of the Slate Islands, (impure slaty ore); near Wallace mine Lake Huron (in combination with magnetite); about 10 miles up the east branch of the Montreal River, Ottawa valley (veins of specular iron in quartzite); foot of Big Rapids, below the Long Portage, south branch of Moose River (a large deposit of siliceous carbonate of iron passing into hematite).

5. Madoc, O., east half of lot 12, range 5.....*T. C. Wallbridge, Belleville.*

a. Specimen of red hematite.

b. Specimen of pig iron smelted in the blast furnace at Three Rivers.

From a deposit locally called *Wallbridge's Hematite Mine*; but concerning the extent of which little is known. The ore is a finely granular hematite, of a steel-grey colour on fresh fracture, but weathering red. About eight tons were extracted, and sent to the furnace at Three Rivers as a sample lot for smelting. The iron produced was found to be of superior quality.—*Laurentian.*

6. Dalhousie, O., east half of lot 1, range 4.....*Alexander Cowan, Brockville.*

a. Specimen of red hematite.

b. Plan of mine by Mr. Gerald C. Brown.

The mine is about twelve miles from the town of Perth, and is commonly known as the *Dalhousie* or *Cowan Mine*. It has been worked for several years by Alexander Cowan, Esq., of Brockville, under the management of Mr. Gerald C. Brown, and was at one time leased to and worked by Messrs. Spearman & Hanna of Cleve-

land, Ohio. The ore is a beautiful red hematite, and occurs in a tremolitic dolomite. The bed averages seven feet in thickness, striking N. 60° E. (mag.) and dipping to the south-east at an angle of 60°.

When the mine was opened up in 1866 there appeared to be two beds cropping out in places at the surface, with four or five feet of dolomite between them. The uppermost and smaller of these was found to run out at a few feet in depth, and to extend but a short distance in the direction of the strike. The larger deposit was in places as much as nine feet thick at the surface, and at a depth of eighty feet had an average thickness of four or five feet. From 3,000 to 4,000 tons of ore were for several years annually raised and shipped to Cleveland, the cost of carriage, as a rule, not exceeding $4.60 per ton. Owing, it is said, to the dullness of the market, no mining has been carried on since 1873. The ore is very free from deleterious constituents, and contains an average of over 60 per cent. of iron. The geological position of this deposit appears to be above that of the magnetites of Ontario.—*Laurentian.*

7. McNab, O., lot 6, concession C & D..... *Geological Survey.*

a. Specimen of red hematite.

This deposit occurs near the Fall of the Dochart, and about a mile from the shore of the Lac des Chats. The thickness at the surface was about thirty feet, but at a depth of eighty feet, the ore is said to have thinned out. It is possible however, that if further mining operations were carried on, the bed on some portions of its course would be found to extend to greater depths. The ore is of excellent quality as will be seen from the following analysis:

Peroxide of iron.....	84.42	Metallic iron 59.09
Carbonate of lime.....	5.40	
Carbonate of magnesia.....	1.05	
Phosphorus.....	0.03	
Sulphur.....	0.065	
Insoluble matter.....	7.16	
	98.125	*Laurentian.*

8. The Haycock Iron Location, Templeton and Hull, Q..... } *The Ottawa Iron and Steel Manufacturing Co.*

a. Specimens of specular iron ore.

b. Specimens of Magnetite.

c. Billet of wrought iron.

d Eight billets of steel.

e. Box of ore prepared for the furnace.

The ore of the Haycock location occurs in highly feldspathic gneisses belonging to the Laurentian system, and forms a series of parallel beds striking north-east and south-west and dipping to the north-west at an angle of about 50°. The beds range from a few inches up to several feet in thickness at the surface, and one of them, which was less than two feet at the surface, at a depth of fourteen feet is said to have widened to over twelve feet. The ore is essentially a hematite, but contains a small proportion of magnetic oxide, some specimens being readily attracted by the magnet. It is very free from impurities, and contains on an average about sixty-four per cent. of iron. The following complete analyses are

extracted from a report on the location by Professor Chapman, of Toronto University:

	I.	II.
Sesquioxide of iron	88.08	85.45
Protoxide of iron	6.86	5.24
Titanic acid	3.17	2.12
Protoxide of manganese	0.24	0.15
Magnesia	0.13	0.17
Lime	0.55	0.41
Phosphoric acid	0.16	0.13
Sulphur	0.03	0.35
Graphite	0.35	0.28
Insoluble rock matter	0.26	5.77
	99.83	100.07

The mines were first opened during the winter of 1872-73. They are about ten miles from the city of Ottawa, and six and a quarter miles from a shipping point on the Gatineau River, with which they are connected by a well built tramway. Four Catalan forges, with all necessary accessories, have recently been erected and are now in working order.—*Laurentian.*

9. Jacksontown, near Woodstock, Carleton County, N.B...*Geological Survey.*

a. Specimen of brownish-red hematite.

The iron ores of Woodstock were first discovered by the Geological Survey of the State of Maine, under Dr. Chas. T. Jackson, as early as the year 1836, having been traced by him from the Aroostook region in that state north-eastward to the St. John River, and more recently, by other explorers to the eastward of the river forming several bands extending over a considerable portion of the northern and north-eastern portions of the county of Carleton. The principal locality in which the ore has been mined is at Jacksontown, about three and a half miles from Woodstock and about two miles from the west bank of the St. John River. As seen at this point, the ore beds (portions of which are true hematite, while others consist of hydrous peroxide of iron or limonite) are somewhat irregularly interstratified with a series of clay slates, usually bright red or brownish-red in immediate proximity to the ore, but elsewhere of a pale grey colour, and highly inclined. The ore beds are from six inches to eight feet thick, the average being about three and a half feet, and their number variable. About 40,000 tons are said to have been smelted at the Woodstock works while in operation.—*Upper Silurian.*

10. Londonderry, N.S. .....*The Steel Company of Canada, (limited.)*

a. Specimens of specular iron ore.

From near the west bank of Cook's Brook, where a level was many years ago driven for a distance of 150 yards. The vein is said to have been reached at a distance of fifty yards from the mouth of the level, and to have an average thickness of from three to four feet. An analysis of a specimen of the ore gave the following results (Rept. Geol. Survey, 1873-74, p. 224)

Peroxide of iron	96.93	Metallic iron 67.85
Protoxide of manganese	traces	
Alumina	0.33	
Lime	0.04	
Magnesia	0.11	
Phosphoric acid	00.07	
Sulphur	none	
Water { hygroscopic	0.03	
Water { combined	0.79	
Insoluble residue	1.26	
	99.497	

Although this ore is but a short distance from the Londonderry furnace, but little has been smelted, probably on account of its being more difficult to reduce than the limonite.—*Upper Silurian.*

11. Pictou County, N.S., Lease No. 29 (area 100)..... } *J. D. Crawford & Co., Montreal.*

a. Specimens of specular iron ore.

These specimens are from an important deposit of ore occurring on the west side of the East River, in slates and quartzites of Upper Silurian age. The lode, so far as examined by Mr. Edward Gilpin, F.G.S., the engineer in charge, ranges in thickness from ten to twenty feet, with occasional side veins. From a single pit which was sunk to a depth of thirty feet on the lode, about fifty tons of ore were obtained. A specimen examined by Dr. T. E. Thorpe of the Andersonian University, Glasgow, contained,

Peroxide of iron.....	96.63	Metallic iron 68.33
Protoxide of iron.....	0.89	
Sulphide of iron.....	0.06	
Phosphorus.....	none	
Silica and insoluble matter.....	3.20	
	100.78	

The proximity of the Pictou coal field adds greatly to the value of this and other deposits of ore in the vicinity of the East River.—*Upper Silurian.*

12. Pictou County, N.S., Right-to-work No. 8, (Webster's.) } *J. D. Crawford & Co., Montreal.*

a. Specimens of red hematite.

From what is known as the "Great Red Hematite Bed of McLellan's Mountain," an interstratified bed of ore occurring in slates and quartzites. The following analysis of a specimen of the ore is by Dr. Stevenson MacAdam of Edinburgh:

Oxide of iron	75.67	Metallic iron 54.36
Oxide of manganese.....	0.52	
Alumina	0.45	
Carbonate of lime	2.44	
Carbonate of magnesia	0.98	
Phosphoric acid.....	0.22	
Sulphur.....	0.29	
Titanic acid.....	trace	
Silica	19.43	
	100.00	

The ore has been traced completely across *Right-to-work* No. 8, and found to vary in width from fifteen to thirty feet, the angle of dip ranging from 25° to 75°. The specimens are from about the centre of the area, where a section showed fifteen feet four inches of ore of uniform quality.—*Lower Helderberg formation, Upper Silurian.*

13. Pictou County, N.S., Lease No. 28.....*J. D. Crawford & Co., Montreal.*

a. Specimens of red hematite.

From a set of beds of hematite between McLellan's Mountain and the upper part of the East River. Specimens of the ore have yielded about 43 per cent. of iron.—*Lower Helderberg formation, Upper Silurian.*

14. Big Pond, East Bay, C.B .....*Matheson & Gillis, Sydney, C.B.*

a. Specimen of red hematite.

From a bed of ore about eight feet thick, occurring in hard felsitic rocks and soft nacreous and steatitic slates. The ore has been traced by a series of openings along the strike for a distance of seven hundred yards. The property is situated about twenty-four miles from Sydney, and is on the eastern shore of Bras D'Or Lake, an arm of the sea affording excellent harbours. In the event of smelting operations being carried on, coal could be easily obtained from Sydney, and the forests in the vicinity of the ore-bed would afford an abundant supply of wood for the manufacture of charcoal. According to Professor How of Windsor, N.S., the ore contains 61.39 per cent. of iron, and only traces of phosphorus and sulphur. On the opposite side of East Bay, and at Whykokomagh, somewhat similar ores occur in abundance, associated with beds of crystalline limestone.—*Huronian?*

15. Whykokomagh, C. B.....*Hon. John McKinnon.*

a. Specimens of red hematite.

Ilmenite or Titaniferous Iron Ore.

1. St. Urbain, Bay St. Paul, Q ..... *Geological Survey.*

a. Specimen of ilmenite.

b. Iron made from Bay St. Paul ilmenite.

A bed ninety feet thick occurring in anorthosite rock. The ore contains over forty per cent. of titanic acid and about thirty-seven per cent. of metallic iron. In some parts of the bed orange-red grains of rutile are disseminated through the ilmenite In 1873 two blast furnaces were erected near Bay St. Paul by the *Canadian Titanic Iron Company*, and attempts made to smelt the ilmenite with charcoal; but although good pig iron was produced, the enterprise was soon abandoned, owing to the enormous consumption of fuel. Under the most favourable circumstances from 190 to 237 bushels of charcoal were required to make a ton of iron, while in some cases over 400 bushels were consumed. The blast furnaces are forty feet high, fourteen feet in diameter at the boshes, eight feet at the throat, and four feet at the hearth. Both they and their accessories are built in the most substantial manner.—*Laurentian.*

Limonite. (including Bog Iron Ore).

1. North Elmsley, O..... *George Oliver, Perth.*

a. Specimen of bog iron ore.

2. St. Maurice Forges..... *J. MacDougall & Sons, Three Rivers.*

a. Specimens of bog iron ore.

b. Slag from the blast furnace.

c. Sandstone used for furnace hearths.

d. Grey pig iron made with charcoal and cold blast.

e. White pig iron made with charcoal and cold blast.

f. Axe iron made from charcoal pig iron.

g. Specimen of wrought iron, forged cold.

h. Seven specimens of wrought iron, bent or twisted cold.

i. Five specimens of axes, different sizes.

Bog iron ores are of common occurrence in the Provinces of Quebec and Ontario, more especially in the sandy tracts which often flank the Laurentian hills. The variety employed for smelting occurs in concretionary masses which are either dull or earthy, or at times highly lustrous when fractured. The colour is usually yellowish-brown, and dark brown or black when much manganese is present. The concretions are scattered through the soil, or else form patches or continuous layers which are sometimes several feet thick, though generally only a few inches. The specimens analyzed contain an average of fifty per cent. of iron, but the yield in the furnace is generally only thirty to forty per cent., owing no doubt to the difficulty of freeing the ore from sand. The blast furnace at the "St. Maurice Forges" was built as early as 1737, and is the oldest one in Canada. The fuel employed is entirely charcoal, and the flux limestone from the Trenton formation. The usual charge is bog ore 600 lbs., limestone 45 lbs., charcoal 16 bushels (the *minot*=2250 cub. in.) weighing 11 to 12 lbs. to the bushel. The pig iron is shipped to Montreal and there manufactured into car wheels, for which long experience has shown it to be well adapted. Small quantities of wrought iron are also made in a *hearth-finery*. The manufacture of axes has recently been discontinued. At L'Islet, about four miles from the St. Maurice, there is another blast furnace, also owned by the Messrs. MacDougall.—*Alluvion.*

3. Rivière aux Vaches, Q..... *J. McDougall & Co., Montreal.*

a. Specimens of bog iron ore.

b. Six samples of cold blast charcoal pig iron.

c. " " chilled iron.

d. Pair of car wheels, made at McDougall's works in Montreal.

Bog ores similar to those occurring near the St. Maurice Forges are found in the vicinity of the St. Francis River south of the St. Lawrence. In 1869 a blast-furnace was erected for smelting them, at Rivière aux Vaches, by the St. Francis River Mining Company, and in the ensuing four years between five and six thousand tons of pig iron were made, about half of which was white and mottled. The ore yielded on an average about thirty-six per cent. of iron. In 1873 the furnace was sold to John McDougall & Co., of Montreal, who make use of the iron produced in the manufacture of car wheels.—*Alluvion.*

4. Vaudreuil, County of Vaudreuil, Q..... *Geological Survey.*

a. Specimen of bog iron ore.

In the seigniory of Vaudreuil, at the confluence of the rivers Ottawa and St. Lawrence, bog iron ore is found in many localities, but appears to be most abundant in Côte St. Charles, where in one place a bed is said to attain a thickness of eight feet. In Ste. Angelique, on what is known as the McGillis property, and also in Ste. Elizabeth, the ore occurs in the form of brownish-black concretions averaging about three-quarters of an inch in diameter and containing a large proportion of oxide of manganese. An analysis of this variety gave as follows:

Peroxide of iron	40.96	Metallic iron 28.67
Oxide of manganese	26.34	
Lime	1.48	
Magnesia	traces	
Phosphoric acid	0.60	
Sulphuric	traces	
Insoluble matter and soluble silica	12.08	
Water and organic matter	17.97	
	99.43	

The specimen exhibited is from Côte St. Charles, where the ore generally contains over fifty per cent. of iron, and but little manganese.—*Alluvion.*

5. St. Valier, County of Bellechasse, Q..... *Geological Survey.*

a. Specimen of bog iron ore.

An interrupted bed extending over an area of ten or fifteen square miles, near the junction of the two branches of the Rivière du Sud, county of Bellechasse. The patches are from one to ten acres in superficies, and from twelve to twenty inches thick. The ore contains about fifty per cent. of iron, and has never been worked—*Alluvion.*

6. Parish of Maryland, York County, N.B..... *Geological Survey.*

a. Specimen of bog iron ore.

Deposits of bog iron ore, of greater or less extent, are not of unfrequent occurrence in New Brunswick, the largest as well as the purest beds being found in alluvion overlying the rocks of the coal measures in Queens, Sunbury and York counties. They are in some cases known to cover considerable areas, and to attain a thickness of several feet, but no attempt has hitherto been made to utilize them. A sample from the parish of Burton, in Sunbury county, was found to contain 47 per cent. of iron. Bog ores also occur in Nova Scotia, and small quantities have been smelted at Clementsport in Annapolis county.—*Alluvion.*

7. Brookfield, N.S..... *The Commissioner of Mines, N.S.*

a. Specimen of limonite.

8. Londonderry, N.S..... *The Steel Company of Canada (limited).*

a. Specimens of compact and ochrey limonite.

b. Ankerite, used as a flux in the blast furnace.

c. Charcoal pig iron made from Londonderry ores.

d. Chilled rolls.

e. Chilled car wheel.

f. Section of car wheel showing grain of metal and chill.

g. Cast iron chain, swivel and chain.

h. Cast iron chain $\frac{13}{16}$ of an inch in diameter, broken with a weight of 9,012 pounds.

i. Specimens of light castings.

j. Rings (17″ diameter) cut from cast iron cylinders, one of them twisted to show the iron under tortion, and one straightened to show the flexibility of the iron.

k. Section of cast iron bar (1″ square) broken by a weight of 1,115 pounds when suspended from centres three feet apart.

l. Tilted tool and spring steel, made by Siemens Martin process.

m. Section of steel axle showing grain of metal.

A most important vein of iron ore occurs in the Middle or Upper Silurian slates and quartzites of Londonderry, on the southern slope of the Cobequid Hills. It has an approximately east and west course, and has been traced for a distance of more than twelve miles. The largest proportion of the ore, so far as known, consists of limonite, which is generally earthy, but sometimes occurs in lustrous stalactitic and mammillary forms. It has evidently been derived from the alteration of spathic ore and ankerite, both of which are in many places found in an unaltered condition. Ochreous red hematite, specular iron ore, and small quantities of magnetite also constitute portions of the vein. The following analyses (Report of the Geological Survey, 1873–74, pp. 231, 233) will serve to illustrate the composition of the limonite:

	Ochrey. Limonite.	*Compact. Limonite.*
Peroxide of iron	79.68	84.73
Protoxide of iron	.....	traces
Protoxide of manganese	2.51	0.23
Alumina	0.63	0.23
Lime	0.57	0.14
Magnesia	0.34	0.14
Silica	3.05	.....
Phosphoric acid	0.44	0.19
Sulphuric acid	0.01	0.01
Water { hygroscopic	0.78	0.33
Water { combined	11.65	11.07
Insoluble residue	.....	2.67
	99.66	99.74
Metallic iron	55.78	59.31

Mining has been carried on since 1849, and a charcoal blast furnace was erected in 1853, which has, at short intervals, been in blast ever since, with a production of between 30,000 and 40,000 tons of pig iron from about 70,000 tons of ore (chiefly limonite). In 1873 the mines, blast furnace, forge, casting house, steel works, &c., together with large tracts of land covered with fine hardwood forest were sold by the *Acadia Charcoal Iron Company* to the *Steel Company of Canada*, and since then two Siemen's rotatory furnaces for the production of steel direct from the ore have been erected. Two new blast furnaces in which the ores will be smelted with coke are also in process of construction. When completed they are to be 63 feet high, 19 feet in diameter at the boshes, and 5 feet at the hearth. In 1875, about 300 men were employed in the mines. A branch railroad, three and a half miles in length, connects the works with the Intercolonial Railroad, effecting a direct communication with the coal-fields of Pictou and Springhill. Mr. Benjamin McKay is the present manager at Londonderry.—*Middle or Upper Silurian.*

9. Pictou County, N.S., Lease No. 26, (Fraser-Saddler area)..... } *J. D. Crawford & Co., Montreal.*

a. Specimen of fibrous limonite.

The deposit from which this specimen was obtained has been traced along the north bank of the East Branch of the East River, from Springville to a point seven miles higher up. Several openings have been made, and the lode proved to vary in thickness from six to about twenty-two feet. Mr. Edwin Gilpin, the engineer in charge, states that the specimen exhibited is from a pit thirty-five feet deep which proved the deposit to be eight feet thick at a point near the centre of the property. The following analysis (Rept. of the Geol. Survey, 1873-74, p. 233) shows the ore to be of excellent quality:

Peroxide of iron	85.01	Metallic iron 59.50
Protoxide of manganese	0.38	
Alumina	0.69	
Lime	0.49	
Magnesia	0.19	
Phosphoric acid	traces	
Sulphuric acid	00.55	
Water { hygroscopic	0.36	
Water { combined	10.77	
Insoluble residue	2.14	
Organic matter	traces	
	100.085	

Limestone suitable for a flux occurs in the immediate vicinity of the ore, and there are several coal mines in active operation only a few miles off.—*Junction of the Upper Silurian and Carboniferous.*

10. Pictou County, N.S., Cullen Area, (No. 105 of the Government Plan.) } *J. D. Crawford & Co., Montreal.*

a. Specimen of compact limonite.

On the banks of a small stream near the West Branch of the East River a band of quartzite intersected by numerous reticulating veins of limonite is exposed. The

veins are for the most part very thin, but according to Mr. Gilpin, there is one with a thickness of three feet. Judging from the numerous masses of ore scattered over the surface for a considerable dissance from the stream, there is some reason to suppose that the deposit will prove of economic value. "The ore is most favorably situated, having near it abundance of wood, water, and limestone, while the Intercolonial Railway passes within a few yards of the area."

The following is an analysis of a compact specimen of a dark brown colour and specific gravity 3.955. (See Report of the Geological Survey for 1873-74, p. 234.)

Peroxide of iron	76.930	Metallic iron 57.718
Protoxide of iron	4.972	
Protoxide of manganese	0.068	
Alumina	1.019	
Lime	0.313	
Magnesia	0.052	
Silica	5.836	
Phosphoric acid	0.989	
Sulphuric acid	0.114	
Water { hygroscopic	0.175	
Water { combined	9.287	
Organic matter	0.180	
	99.935	

According to an analysis by Dr. T. E. Thorpe, of Glasgow, the ore is free from phosphorus.—*Upper Silurian.*

Spathic Iron Ore.

1. Sutherland's River, Pictou County, N. S.... *J. D. Crawford & Co. Montreal*

a. A specimen of spathic or sparry iron ore.

From an irregular bed occurring in sandstones of the Millstone-grit formation. The ore is crystalline, and, where unacted upon by the weather, of a light grey colour. A specimen, evidently somewhat weathered, contained as follows (Report of the Geological Survey, 1866-69, p. 442)

Sesquioxide of iron	16.98	Metallic iron 43.56
Carbonate of iron	65.61	
" " manganese	7.98	
" " lime	2.67	
" " magnesia	3.23	
Silica	3.76	
Sulphur	0.00	
Phosphorus	0.013	
Hygroscopic water	0.76	
Organic matter	traces	
	101.003	

The bed has been traced for several hundred yards, and where exposed in the bank of a brook has a thickness of about ten feet. According to Dr. Dawson its mode of occurrence is not unlike that of the non-fossiliferous sub-crystalline limestones found in some parts of the Lower Carboniferous series associated with gypsum.—*Millstone-grit formation, Lower Carboniferous.*

Clay Iron-stone.

1. North Saskatchewan River, N. W. T.....*Geological Survey.*

a. Specimens of clay iron-stone.

From about two miles below Edmonton, and occurring in connection with a bed of lignite. Similar ores are found at many places along the Saskatchewan from Rocky Mountain House to Victoria, and at the latter locality both lignite and iron-stones occur in beds of considerable thickness. Further to the south-east also, iron-stones are widely distributed, generally in connection with the Tertiary lignites, in beds which are mostly thin, and in nodules sometimes weighing several hundred pounds. The average percentage of iron in several specimens from near Fort Edmonton, is 34.93. A specimen from the Dirt Hills contained 41.49 per cent. of iron, 1.18 of protoxide of manganese, .087 of phosphorus and .068 of sulphur.—*Cretaceous ?*

COPPER.

Native Copper.

1. Fraser River, about 30 miles above Fort George, B.C.....} *H. Glassy, Kamloops, B.C.*

a. Small nugget, found loose.

2. British Columbia.....*Moody & Nelson, Victoria.*

a. Large nugget found loose.

Native copper has not yet been found in rocks *in situ* in British Columbia, but the loose nuggets which are occasionally found indicate its existence, probably among some of the ancient volcanic rocks of the Province.

3. Michipicoten Island, Lake Superior..... *Geological Survey.*

a. Specimens of native copper.

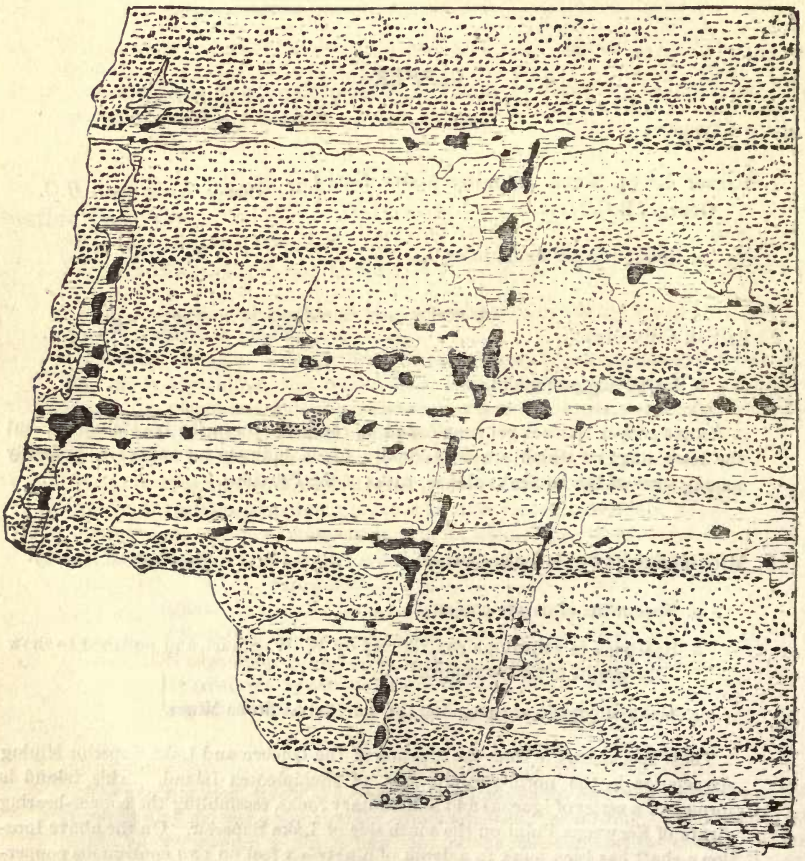
b. Specimen of sandstone contributed by W. W. Stuart, and polished to show the grains of native copper.

c. Cake of copper, weiging 100 lbs, smelted at Bruce Mines.

These specimens are from the location of the Quebec and Lake Superior Mining Association in the north-western part of Michipicoten Island. This island is formed of a series of igneous and sedimentary rocks, resembling the copper-bearing strata of Keeweena Point on the south side of Lake Superior. On the above location a shaft has been sunk to a depth of ninety-six feet on two contiguous copper-bearing beds, which together have a thickness of about three feet, and contain an

average of about two and one-half per cent. of native copper. The uppermost of the beds is a reddish-grey sandstone, with fine particles and filaments of copper, and has a thickness of from one to two feet, while the lowermost is a bluish-grey amygdaloid from eight to eighteen inches thick, with coarser grains of copper, but amounting to about the same percentage as in the sandstone. The appearance of a section of the upper bed is shown in the woodcut below. These layers are underlaid by a soft argillaceous ash-bed, six feet or more in thickness and containing from one half to one per cent. of copper, below which is a massive greenstone. The copper-bearing beds are overlaid by massive compact greenstone, succeeded by amygdaloid and conglomerate. These strata dip south-eastward at an angle of 30°, or at the rate of three feet in a fathom. The location was leased and worked by Mr. Hugh R. Fletcher of Toronto, to whom we are indebted for the above facts. In 1860 he took forty-five tons of the ore to the Bruce Mines and there smelted one half of it without dressing, obtaining about three per cent. of fine copper. The balance was hand-dressed, and yielded on smelting 7½ per cent. Work has been resumed at this locality during the past winter.—*Copper-bearing Series.*

Drawing showing the mode of occurrence of Native Copper at Michipicoten Island, Lake Superior.



4. Michipicoten Copper Mining Company's Location, Lake Superior..... } *W. W. Stuart, Montreal.*

a. Three specimens of native copper.

These specimens are from the northern part of a location which runs across the centre of Michipicoten Island. The metal occurs as nuggets in numerous calc-spar veins intersecting an "ash-bed" of considerable thickness.—*Copper-bearing Series.*

Sulphides of Copper.

1. Entrance of Howe Sound, B.C..... *Geological Survey.*

a. Specimens of copper pyrites.

The deposit is associated with greenish slates and is said to be extensive. The locality is not far from the sea-coast, and is at an elevation of about 3,000 feet. It was discovered in 1865, and some preliminary explorations have shown it to be of a promising character, but to require capital for its proper development.

2. McKellar's Copper Mine, near Little Pic, Lake Superior ..... } *McKellar Bros., Fort William, L.S.*

a. Sample of ore weighing 57 lbs.

b. About 60 lbs of prills.

These specimens are from a vein or bed six to eighteen inches in thickness, and running N. 30° E. in dark grey talcoid slate. It is situated near the shore of Lake Superior, about a mile and a half N. W. of the mouth of Little Pic River, and at an elevation of 400 feet above the lake. Assays by Mr. Charles Kreissman show fifteen per cent. of copper, together with 7·708 ozs of silver and 1·1634 ozs of gold per ton of ore. A brook with a good fall for driving machinery crosses the property. Only two openings have yet been made upon the vein.—*Huronian.*

3. Location V. L, Black Bay, Lake Superior... *C. J. Johnson, Wallaceburgh, O.*

a. Two specimens of copper pyrites.

The vein from which these specimens are taken is a south-westward continuation of the large vein on the adjoining, Location VI.L, which there carries galena, and is described under the section on lead ores. The copper-bearing belt of the vein, of which these specimens are said to represent a fair average, is stated to be sixteen to eighteen inches thick.—*Nipigon Series.*

4. West Canada Mines, Lake Huron..... *Capt. B. Plummer and G. G. Francis.*

a. Sixteen specimens yellow sulphide prills.

b. Four specimens variegated sulphide prills.

c. Ingot of fine copper smelted at the mines.

d. Plans and sections of the mines.

These mines are situated on the Bruce, Wellington, and Huron Copper Bay, Locations, which adjoin one another, the Bruce being the most easterly. Work was begun on the last named in 1846, and has since been gradually extended westward, across the Wellington and on to the Huron Copper Bay, the whole length of the workings comprising nearly four miles. The veins are of white quartz, cutting, with a westerly bearing, a thick bed of dark green, finely crystalline diorite, associated with what is locally called the Lower Slate Conglomerate of the Huronian series. On the Bruce location several nearly parallel veins of a similar character were opened, the main one having a thickness of about four feet, but on the other two locations operations have been confined almost entirely to two master veins, known as the Fire Lode and the New Lode. These are about of equal size and vary from four to twenty feet in width, averaging in the parts wrought ten to fifteen feet. Near the surface, especially on the Bruce Location, a good deal of purple or horseflesh ore was found; but, in working down, this was soon replaced by the yellow sulphide in all the veins. On the Bruce Location a great number of shafts were sunk, but all the workings were between the surface and 30 fathoms, while on the other two locations they extend a little below 60 fathoms. On the course of the New Lode on these locations, an almost barren floor has been met with nearly all along between the 40 and 60 fathom levels, but the vein maintains its strength, and it is believed that below this floor it will prove as rich as it is above it. The vein-matter brought to the surface appears to contain on an average about five per cent. of copper; but this is all crushed and very much concentrated for shipment to England. The present company purchased the Wellington Location from the Montreal Mining Company (who had previously worked the Bruce Mines from the time of their discovery in 1846) in 1853, and the Bruce Location in 1864, and they hold a renewable lease, obtained in 1858, of the Huron Copper Bay Location. Reverberatory smelting furnaces were erected by the Montreal Company in 1853, but afterwards abandoned. In 1869, '70 and '71 the present owners erected extensive and costly works for reducing the ore by Longmaid's or Henderson's wet process for which cheap salt could be obtained from Goderich, Kincardine &c.; but, owing to the want of skilled overseers and workmen, the operation could not be carried on satisfactorily, and the company are again exporting all their ores. For a time, some of the produce of the mine was sent to Baltimore, but the great bulk of it has gone to England, which is the present market. In the spring of 1875, owing to the neglect of proper precautions, a large part of the mine which was then producing the most ore caved in, thus greatly reducing the returns for the year. The capital of the Company is £60,000 sterling. The headquarters are in London, England, and the principal owners are Messrs. Richardson & Co. of Swansea, and John Taylor & Sons of London.

The table on the next page, compiled from authentic sources, shows the results of the working of these mines up to 1875—a period of thirty years. The total amount of the sales of the copper ore and copper to this date has been about $3,300,000, and this has afforded a good average profit. Mr. G. G. Francis of Montreal and Capt. B. Plummer at the Mines are the Canadian agents.—*Huronian.*

Table showing the amount of Copper Ores and Copper sent (principally to Great Britain) from the Bruce, Wellington, and Huron Copper Bay Locations from 1847 to 1875, both inclusive.

Year.	Location.	Kind.	Per cent. of Copper.	Tons of 21 cwt.
1847 to 1857 inclusive	Bruce	Yellow, variegated and vitreous sulphides	18.00	2,755
1858	Bruce and Wellington	Do. Do.	21.94	1,077
1859	Do. Do.	Do. Do.	21.35	1,534
1860	Do. & Huron Copper Bay	Do. Do.	20.50	2,051
1861	Bruce.....(tons) 472 Wellington ..... 1,175 H. C. Bay..... 413	Yellow, with a little of the others	19.60 (average)	2,060
1862	Bruce.....(tons) 380 Wellington..... 1,277 H. C. Bay..... 1,069	Mostly copper pyrites	19.65 (average)	2,726
1863	All three combined	Nearly all do	20.00	3,163
1864	Do.	Do.	19.48	2,940
1865	Very little from Bruce	Do.	21.24	2,834
1866	Do.	Do.	20.00	3,540
1867	Do.	Do.	20.00	2,742
1868	Wellington & H. C. Bay	Copper pyrites	20.00	2,804
1869	Do.	Do.	19.50	2,180
1870	Do.	Do.	18.75	2,162
1871	Do.	Do.	19.00 (about)	1,731
1872	Do.	Pyrites.....1,168	" 18.00	1,306
		Precipitate..... 13	" 80 00	
		Ingots..... 125	"100.00	
1873	Do.	Pyrites.....1,212	" 18.00	1,319
		Slags..... 32	" 10.00	
		Precipitate..... 49	" 80.00	
		Copper 26	"100.00	
1874	Do.	Pyrites.....	" 18.00	993
1875	Do.	Do.	" 18.00	598
		Total	Quant'y.	40,515
			Value....	$3,300,000

5. Pointe aux Mines, East shore of Lake Superior..... *Geological Survey.*

a. Specimens of copper pyrites.

The rocks of Pointe aux Mines consist of Laurentian gneiss, overlaid, on the north side, by beds of volcanic tufa interstratified by a band of greenstone, and dipping northward at an angle of 50°. The sulphurets of copper occur in veins cutting these latter rocks, and also in bunches between the greenstone and the tufa beneath it. The tufa holds disseminated grains of native copper.—*Copper-bearing Series.*

6. Palmerston, O., west half of lot 2, range 9..... *W. J. Morris, and George Oliver, Perth.*

a. Specimens of copper pyrites.

The vein occurs in dark green hornblende rocks and mica slates. The gangue consists of quartz and calcite, and holds both copper and iron pyrites. Very little has been done in the way of determining the extent of the deposit, but it is not supposed to be of much economic importance.—*Laurentian.*

7. Township of Brome, Q., lot 2, range 4..... *W. W. Stuart, Montreal.*

a. Specimen of copper pyrites in grey talcoid slate from a bed.

The cupriferous bed from which this specimen is taken is said to be from fifteen to twenty feet thick. The course of the bed conforms with the prevailing N.E. and S.W. strike of the rocks of the region.—*Quebec Group, Lower Silurian.*

8. Hartford Mine, Ascot, Q., lot 3, range 9,..... *Geological Survey.*

a. Specimen of copper pyrites.

This mine is owned by the Canadian Copper and Sulphur Company of Glasgow, and is the only one worked by them at present, out of some fifteen copper mining properties which they hold in Canada. It was opened in the Spring of 1865 under the name of the Lower Canada Mine, and produced between 400 and 500 tons of marketable ore during the first year. It was next worked under its present name by General Adams, of the United States, who obtained from it in the course of five years not less than 25,000 tons of ore. Since the mine came into the possession of the present company in 1872 it has been steadily worked, and has produced, up to the present time, an equal or greater quantity of ore, so that the total yield of the mine since its discovery has been over 50,000 tons, worth upwards of one million of dollars.

The country-rock consists of glossy, light grey, fine-grained mica schist, running N.E. and S.W. The vein, which coincides nearly with the cleavage or stratification, consists of granular iron pyrites mingled with more or less copper pyrites usually running in streaks parallel to the walls. It has an average thickness in the workings of ten feet, the extreme variation being from four to about thirty feet. The dip, which is about S.S.E., varies from 18° to 40°, and averages about 30° from the horizon. The proportion of copper is greatest towards the footwall, but the richest streaks seldom exceed ten per cent. The actual yield of all the ores during the past two years has averaged 4½ per cent. The monthly output of ore during that period has averaged 1000 tons. During the present year it has been about 1,300 tons. The ore is treated on the spot by Henderson's wet process, the reduction works comprising about 80 burners and 60 furnaces. Between 65 and 70 tons of precipitate, containing 70 to 75 per cent. of copper, are produced monthly. About 100 men are employed in connection with the mine, and nearly as many more about the reduction works.—*Quebec Group.*

9. The Huntington Mine, Bolton Q., lot 8, range 8..... *Geological Survey.*

a. Two specimens of copper pyrites.

The ore at the Huntingdon mine consists chiefly of a chloritic slate and diorite more or less impregnated with copper pyrites, pyrrhotine and iron pyrites. No mining is being done at present, but considerable quantities of ore yielding between four and five per cent. of copper were raised in 1874. It was treated by the Henderson process, and up to the beginning of 1875, 1500 tons of ore had been reduced and about $25,000 worth of copper produced. During the first six months of 1875, 4012 tons of ore were treated, and 299½ tons of precipitate, containing 75 per cent. of copper obtained and sold for $66,300. In July last the reduction works (owned by the Huntington Copper and Sulphur Company), were partially destroyed by fire, and since then only small quantities of ore have been reduced.—*Quebec Group.*

10. Harvey Hill Mine, Leeds, Q., lot 18, range 15.....*Geological Survey.*

a. Bornite or purple copper ore, in a gangue of quartz and dolomite, from the Fanny Eliza lode.

b. Purple copper and copper pyrites, in nacreous schist.

c. Ingot of copper, obtained in the treatment of the ore by the Hunt & Douglas process.

At the Harvey Hill mine the country rocks are chiefly finely micaceous or nacreous schists belonging to the Quebec group. Purple copper ore, copper glance, and copper pyrites are all found, both in veins cutting the strata and in beds conformable with the stratification. The veins, which are irregular and lenticular in shape, have a gangue of quartz and dolomite, with more or less calc-spar and chlorite. In places they contain titanic iron ore, molybdenite, and small quantities of native gold. In the beds the copper ore is distributed through the nacreous schist in small patches, generally of a lenticular form, and in irregular crystals and grains. Mining operations have been carried on for many years, and a few years ago works were erected at the mine for the treatment of the ore by the Hunt & Douglass process, but were destroyed by fire. At present the mine is worked on a small scale by the Harveyhill Copper Company (limited), of which Mr. F. Oliver is the secretary.—*Quebec Group.*

11. Garthby, lot 22, range (north) 1 ....*Geological Survey.*

a. Iron and copper pyrites.

This appears to be a large mass of iron and copper pyrites, subordinate to the strata, which here consist of calcareous serpentine, and run N.E. and S.W., with a dip about S.E.$<$ 50°. The entire thickness of the mass is uncertain, but the breadth in which the sulphurets are more or less mingled with the rock, is probably not less than twenty feet. In some parts sulphuret of iron prevails, almost to the exclusion of that of copper, while in others there is as much as eight per cent. of copper.—*Quebec Group.*

12. Salmon River, Albert County, N.B.....*William Davidson.*

a. Copper glance or vitreous copper ore.

This specimen is a portion of a boulder originally weighing about 350 lbs., found buried beneath several feet of alluvium, not far from Salmon River, in the Parish of Alma, Albert county, and which first caused attention to be turned towards the existence of copper in that vicinity. Though its exact source is unknown, it may be taken as a fair representative of a series of copper ores, not only occurring in its immediate neighbourhood, but also met with, in greater or less abundance at many other points along the southern seaboard of New Brunswick. The rocks in which they occur consist chiefly of slates, of a micaceous or talcoid aspect, together with chloritic slates and grits, and some diorite, the ore being usually in veins, which are either calcareous or siliceous, but sometimes disseminated in lumps or grains in layers of the slate, forming *fahlbands.* The attempts to work these ores, which have been made at several points, have so far proved unsuccessful; for although the ore appears to be widely distributed and to occur occasionally in masses of remarkable richness, it yet does not seem at any point to be sufficiently concentrated to repay the cost of its extraction. The specimen referred to above is said to have yielded, by analysis, 62 per cent. of copper.

13. Grand Manan, Charlotte County, N.B..... *Geological Survey.*

a. Vitreous copper ore, with green carbonate.

Native copper, and copper ores of several varieties, have been found upon Grand Manan at different times, being evidently connected with the igneous outbursts by which a large portion of the island has been formed. The specimen is from a locality recently opened near the southern head of the island, and close to the line of contact of a series of red sandstones and an overlying mass of trap, both of the Triassic Period.—*Triassic.*

14. Polson's Lake, Antigonish County, N.S..... *H. S. Poole, Halifax, N.S.*

a. Specimens of copper pyrites.

For many years loose boulders of copper ore have frequently been found in the soil near Polson's Lake, but their origin was unknown. Recently, however, a vein, said to be six feet wide, has been discovered by sinking sixteen feet through the surface soil to the bed rock. The vein is stated to consist, where exposed, chiefly of spathose ores, spotted with copper pyrites, (see Report of the Nova Scotia Department of Mines, 1875, p. 64).—*Upper Silurian.*

15. Lochaber Lake, Antigonish County, N.S..... { *James Hudson, Albion Mines, N.S.*

From a vein recently discovered and stated to vary from nine to twelve inches in thickness of ore like the specimen exhibited.

ZINC.

Zinc Blende or Sulphide of Zinc.

1. Blende Lake, near Thunder Bay, Lake Superior..... *Geological Survey.*

a. Eleven specimens of vein-matters, mostly blende.

From a vein about eight feet wide on the shore of Blende Lake, a small sheet of water about one mile and a half N.N.W. of the head of Thunder Bay. The vein runs east and west. The north wall consists of beds of ferruginous siliceous clay slates belonging to the Nipigon Series, and the south wall of dioritic schist of Huronian age. The blende (which is of a dark colour) occurs in curving ribs two to four inches thick, transverse to the plane of the vein, in a gangue of white calc-spar, with some galena, and iron and copper pyrites. Silver is also said to have been detected in it. A shaft has been sunk upon it to a depth of twenty-five feet.—*Nipigon and Huronian Series.*

2. Lot 10, Con. VI. Township of Dorion, Lake Superior..... } *C. J. Johnson, Wallaceburgh, O.*

a. Three specimens of blende.

The vein is reported by Mr. Johnson to be about three or four feet wide, and to run N. W. and S. E. The locality is about four miles west of Black Bay. It is not yet worked.—*Nipigon Series.*

3. Paresseux Rapids, Kaministiquia River, L. Superior.... *Geological Survey.*

a. Specimen of crystalline blende.

From a large vein varying from ten to twenty-five feet in width, which cross the Kaministiquia in a W. S. W. course about the line between lots 20 and 21 range I. N., in the township of Paipoonge. At this locality the blende may be in sufficient quantity to prove of economic value. Besides the blende the vein is composed of barytes, quartz, calc-spar and fluor-spar, with a little copper pyrites, iron pyrites and galena. It is supposed to be identical with the Shuniah vein, the large vein on Location M., at the N. W. corner of Neebing.—*Nipigon Series.*

4. Silver Lake, Location, Thunder Bay..... *Geological Survey.*

a. Specimens of hand-dressed ore.

These specimens are from the vein on the above location, described under galena, and which also contains blende in promising quantities. (See Lead, No 2).—*Nipigon Series.*

5. Point aux Mines, Lake Superior,..... *Geological Survey.*

a. Specimens of blende with galena.

NOTE.—In addition to the above localities for zinc blende on Lake Superior, it may be mentioned that the mineral occurs in greater or less abundance in almost every metalliferous vein which was been opened in the rocks of the Nipigon Series, from Pigeon River to Nipigon Bay. Further east it occurs in promising quantities in a vein in older rocks between Otter head and Michipicoten, and again in veins in the copper-bearing series at Pointe aux Mines and Mamainse. (See Reports of the Geological Survey, 1863 to 1873.)

LEAD.

Galena or Sulphide of Lead.

1. Snow-shoe Mountain, Cariboo, B.C..... *P. Dunlevy, Soda Creek, B.C.*

   a. Specimens of galena with pyrites.

2. Silver Lake Location, Thunder Bay..... *Geological Survey.*

   a. About 50 prills of galena.

   Silver Lake lies at a distance of about six miles northward from the head of Thunder Bay, and at an elevation of about 500 feet above Lake Superior. A short distance to the west of it there is an enormous brecciated vein, some 250 feet in width, composed of masses of the country rocks cemented together with quartz and some barytes and calc-spar, and holding small quantities of galena, copper and iron pyrites, and blende. This has been traced for about three miles. In approaching Silver Lake it contracts rather abruptly, but sends out several branches to the eastward, of which four or five have been followed for considerable distances and are found to be much richer in galena and blende than the great vein. The latter is on the line of a dislocation which increases in going west and appears to die out to the eastward. The downthrow is on the north side, and brings the indurated calcareous marls of the Nipigon series on that side down to the level of the iron-ore beds (at the base of the series) on the south side, amounting to 400 feet, or upwards, on this location. The specimens are taken from a shaft sunk on a vein on the line of the eastward continuation of the dislocation, at a point from one to two hundred yards south of Silver Lake, and about eighty feet above its level. Here the vein runs N. 80° E. and may be about six feet wide, but its north wall is not well defined. The gangue consists of calc-spar with some quartz and barytes, and holds a good proportion of galena and blende. Mr. John McIntyre of Fort William is agent for the property.—*Nipigon Series.*

3. Location, "Island No. 2 in Silver Lake"..... *C. H. W. Wearne, Toronto.*

   a. Specimens of galena, weighing about 75 lbs.

   The island known by the above description is traversed by one of the branch-veins referred to under the last heading. The vein runs nearly E. and W., and is described as being about six feet wide, with good walls. The gangue is chiefly calc-spar, with some quartz, barytes, &c., carrying a fair proportion of galena accompanied by blende. Two samples of dressed ore assayed by Prof. Chapman gave an average of 57·53 per cent. of lead and 2 ozs. 6 dwts. of silver per ton of 2,000 lbs.—*Nipigon Series.*

4. Enterprise Mine, Lake Superior..... } *H. L. Hime, Toronto, Col. Sibley, Silver Islet, and John McIntyre, Fort William.*

   a. Mass of solid galena with copper pyrites, gold and silver, weighing 116 lbs., taken at the surface.

   b. Mass of galena, with some vein matter, weighing 77 lbs., taken at a depth of sixty feet.

   c. Two specimens of galena and copper pyrites, polished to show the structure of the ore.

This mine is situated on mining lot C. in the township of McTavish, about three miles west of Black Bay. The vein, which runs N. 60° E. and S. 60° W., cuts indurated red marl forty feet thick, underlaid by grey quartzose sandstone, flanked by red granite at about 300 yards to the northward. At the surface there was a thickness of four feet of solid ore like specimen *a*. According to Professor Chapman of Toronto this ore contains 47½ per cent. of lead and 10 per cent. of copper, together with an average of 17 dwts. 12 grs. of gold and 2 ozs. 2 dwts. of silver to the ton of 2,000 lbs. On entering the sandstone the vein became smaller and poorer, but at 100 feet from the surface it had opened out to seven feet in width, and contained bunches of ore like specimen *b*. Several hundred barrels of ore were shipped from this mine in 1875, and work is still being carried on.—*Nipigon or Copper-bearing Series.*

5. Location VI.L, Black Bay, L. Superior.... *C. J. Johnson, Wallaceburgh, O.*

a. Specimens of fine-grained galena from the foot-wall of a vein.

The above location touches the N. W. corner of the township of Dorion. The vein is described by the owner (Mr. Johnson) as being about twelve feet wide, running north-eastward and underlying to the south-eastward. A parallel vein, underlying towards the first, is said to occur at about twenty rods to the southward, and both are stated to have been traced for a considerable distance on the surface. The gangue is calc-spar with quartz and barytes, and, besides the galena, it contains more or less copper pyrites.—*Nipigon Series.*

6. St Clair Location, Black Bay, L. Superior. *C. J. Johnson, Wallaceburgh, O.*

a. Specimen of galena, weighing 65 lbs.

This location comprises parts of lots 10 and 11 in the 6th, and of 9 and 10 in the 7th ranges of the township of Dorion. As stated in a report by Captain John C. Harking, the vein is twelve to twenty feet wide, composed of calc-spar, quartz and gossan, and carries promising quantities of galena. It runs a little N. of E., has been traced for thirty chains on the surface, and is situated on high ground favourable for mining, at about four miles from Black Bay. The country-rock is said to be red indurated marl, associated with reddish granite, with a high bluff of coarse grey trap a short distance to the northward.—*Nipigon Series.*

7. Pointe aux Mines, Lake Superior..... *Geological Survey.*

a. Specimen of galena with zinc blende.

8. Limerick, O., lot 1, range 3.... { *Thos. Devine, F.G.S, Deputy Surveyor General, Toronto.*

a. Specimen of galena, weighing about 150 lbs, from a vein.

The vein from which this specimen is taken is being worked on the above lot, situated fifty-six miles north of Belleville on Lake Ontario. At the point at which a shaft is being sunk it is sixteen inches wide at the surface, but has increased to four feet

at the depth of ninety-four feet. The vein runs westward through the 1st, 2nd, 3rd and 4th lots of the first concession of Limerick, and has been traced for about three miles. The gangue is crystalline calc-spar with some quartz. Another shaft which is being sunk on a parallel vein is down 100 feet, and the two veins are expected to meet at a depth of about 400 feet. The ore taken out is yet upon the ground, and machinery, buildings, &c., are being prepared for its reduction.—Messrs. John B. Maas & Co. are the owners.—*Hastings Series.*

9 Loughborough, O., south half of lot 16, range 9.... *George Morton, Kingston*

a. Specimen of galena with gangue of calcite.

b. Picked ore.

c. Pig lead.

The country rock at the *Frontenac Lead Mine* consists of greyish and reddish gneiss interstratified with thick bands of crystalline limestone, all striking N. N. E. and S. S. W., and dipping to the westward at a high angle. The vein cuts these at right angles, and at the surface has a slight underlie to the north, although at a depth of sixty feet in the main shaft it becomes vertical. The veinstone consists of calc-spar, generally showing a banded structure, and, in addition to galena, containing small quantities of blende and iron and copper pyrites. The galena occurs in scattered bunches throughout the whole vein, but appears to be most abundant towards the north wall. Some years ago a crushing mill, washing machinery, and smelting furnace were erected, and between one and two thousand tons of ore mined; but, after crushing and washing, only five per cent. of galena were obtained, although trials on a small scale are said to have indicated from twelve to fifteen per cent. This, and indeed most of the lead-bearing veins of Ontario, are probably of the same age as those of Rossie in New York State. They are more recent than the Laurentian, as they cut the rocks of both the Potsdam and Calciferous formations. In the Laurentian their greatest dimensions and largest content of galena seem to be attained where they traverse crystalline limestones, and in the alternating gneisses and diorites, the galena is often replaced by blende, copper pyrites and other minerals.—*Calciferous formation.*

SILVER.

Native Silver and Silver Ores.

1. Omineca, British Columbia..... { *P. O'Reilley, and Col. C. C. Lane, Victoria, B. C.*

a. Nuggets of native silver.

Nuggets and grains of native silver have been found in washing for gold in almost all parts of British Columbia, the largest being obtained in the Omineca gold district on a branch of the Peace River. A nugget from this district analysed by Messrs. Riotte & Leckhardt of San Francisco contained, silver 83.30 per cent., mercury 11·00, lead 0·40, copper 0·20, besides traces of gold, platinum, and iron.—*Alluvion.*

2. Fort Hope, British Columbia...*Messrs. Moody and Nelson, Victoria, B.C.*

a. Two specimens of ore from the Eureka Mine.

b. Specimen of ore from the Victoria Mine.

c. Ingot of silver from the Eureka Mine, weighing 114.10 ozs., value (silver $79.36, gold $4.71) $84.07.

d. Ingot of silver from the Victoria Mine, weighing 62.10 ozs., value (silver $40.94, gold $6.42) $47.36.

The veins, from the ores of which the above ingots were cast, are described in the report of the B. C. Minister of Mines as follows: "True veins of silver ore were discovered about 1871 in the Cascade Mountain Range at Fort Hope, about eighty miles from the mouth of Fraser River and six miles south of the town. The first lead, called the Eureka Mine, crops out about 5,000 feet above the river level, is well defined, four to seven feet in thickness, and has been traced 3,000 feet. A tunnel has been driven into this lead 190 feet. The ore is described as argentiferous grey copper, and has yielded, under assay, from $20 to $1,050 worth of silver to the ton.

"During the time the above lead was being worked, another about 300 feet distant was discovered. This is of a far more valuable character, and is called the Van Bremer mine. The ore is described as chloride of silver, and has yielded, under assay, from $25 to $2,403 of silver per ton of rock. A quantity from the outcrop sold at San Francisco at $420 a ton. The lead is distinctly traceable for half a mile."

A specimen of the Hope silver ore—"a yellowish decomposed veinstone,"—assayed by Dr. Harrington, gave 271·48 oz. to the ton of 2000 lbs.; it also contained lead, copper, antimony, iron, arsenic and sulphur.

A specimen from the Eureka mine—"a veinstone of spathic iron with some quartz,"—assayed by Dr. Hunt, gave 347·08 oz. of silver to the ton of 2,000 lbs., also sulphur, antimony and copper.

3. Location AL (island in Pine Bay,) Lake Superior..*J. A. Lindsay, Toronto.*

a. Small specimen from a vein.

The vein from which this specimen is taken is described as being eight to ten feet wide, composed of calcspar and quartz, running north-westward across an island at the S. W. horn of Pine Bay, near Pigeon River. Mr. J. H. Woodside, of Prince Arthur's Landing, is the proprietor.—*Nipigon Series.*

4. Jarvis Island, Lake Superior ... { *Messrs McIntyre, Russell and Plummer, Fort William, L.S.*

a. Specimen of native silver and silver-glance in calc-spar.

Jarvis Island lies a mile or two off the north-west shore of Lake Superior, between Thunder Bay and Pigeon River. The vein from which the specimen comes crosses the island in a north-westerly course, with an underlie of about 50° to the north-eastward. It varies from about eight to ten feet in width, and is filled with barite, celestite and calcite, with a little silver-glance and native silver, but hitherto it has not been found sufficiently rich to pay for the working. A shaft has been sunk upon it to the depth of 150 or 160 feet, and two others of somewhat less depth, and adits have been driven between them. Captain Frue, of Silver Islet is agent for the property.—*Nipigon Series.*

5. McKellar's Island, Lake Superior.....*McKellar Brothers, Fort William.*

a. Specimen of wall-rock and veinstone containing silver glance.

McKellar's Island is situated about one mile south of the S. E. side of Pie Island, Thunder Bay. The specimen is taken from a vein forty-five feet in width, consisting of alternating bands of white barytes and coarse calc-spar, with blende, silver glance and native silver in some of them. The wall-rock is a massive, dark, crystalline diorite.—*Nipigon Series.*

6. Pie Island Mine, Lake Superior. *D. McKellar and R. M. Eames, Thunder Bay.*

a. Five polished specimens showing native silver in quartz.

b. Fourteen specimens of brecciated veinstone.

This mine is on the S. W. point of Pie Island. According to Prof. Eames, the vein runs N. 30° W. (Ast.), and is three feet two inches thick at the surface and four feet one inch at a depth of sixty feet. It is filled with angular fragments of the wall-rock (which consists of a dark hard clay slate) cemented together with crystalline quartz, blende and galena, with bunches of native silver in grains and strings. Work was begun in 1875. Mr. S. J. Dawson, M.P.P., is the principal owner.—*Nipigon Series.*

7. Singleton Mine, Prince Arthur's Landing, Lake Superior } .....*S. J. Dawson, M.P.P.*

a. Specimen of quartz with silver.

This name was given to a small opening on a vein of granular white quartz about one foot thick and containing some rich bunches of native silver.—*Nipigon Series.*

8. Duncan (formerly Shuniah) Mine, Thunder Bay.....*Judge Van Norman.*

a. Specimen of native silver in calc-spar.

This mine is situated on lot eight, township of McIntyre, about four miles north of the town of Prince Arthur. The vein is about thirty feet wide at the surface, and is believed to have been traced south-eastward, as far as the Parasseux Rapids on the Kaministiquia River, a distance of seventeen miles. At the Duncan mine the gangue consists of white, coarsely crystalline calc-spar, which in depth becomes finer and mixed with quartz. Both silver-glance and native silver are sparingly distributed throughout the whole width of the vein, but a richer streak has been discovered near the southern wall, and the prospects of the mine have latterly improved very much. Three shafts have been sunk, the deepest of which is down rather more than 240 feet, and several adits and cross cuts have been driven. The country-rock at the mine consists of a variety of granular siliceous, cherty and dark (sometimes black) argillaceous slates, lying almost horizontally. A thick bed of crystalline diorite overlies these rocks for an area of several square miles immediately to the southward of the vein. The mine is owned and worked by a joint stock company having its head-quarters in Boston.—*Nipigon Series.*

9. Thunder Bay Silver Mine, Lake Superior..... *George Stephen, Montreal.*

a. Seven specimens of native silver in quartz.

The lode at this mine consists of closely reticulated veins of white granular quartz, the largest being about one foot thick, and the aggregate averaging perhaps ten feet in width. It runs north-eastward with a slight underlie to the N. W., and cuts a series of flaggy dark drab and grey to black shales, interstratified with dolomitic beds which are overlaid a short distance to the north-westward by a massive bed or overflow of dark crystalline diorite. The vein has been traced for upwards of half a mile. The metal occurs as native silver in the form of grains and filaments mixed with the quartz, and also as silver glance. At a depth of about twenty feet the main lode appears to be thrown a few feet to the S. E. The mine has been opened to a depth of seventy feet, and work is still in progress. —*Nipigon Series.*

10. 3 A Mine, Thunder Bay..... *Judge Van Norman.*

a. Specimens of native silver.

This mine is situated on lot 3 A, township of McGregor, at a distance of about a mile northward from the shore of Thunder Bay, and 250 feet above its level. The vein is from one to two feet wide and runs about S. 75° W., with the cleavage of the country-rock, which consists of grey dolomitic schist associated with dark-green compact diorite, while fine-grained dark greyish-red felsitic syenite occurs a short distance to the south. The veinstone is principally white quartz. The silver is mostly native, and occurs as large grains and nuggety bunches alone and with sulphide of nickel. Several shafts have been sunk on the vein—one of them to a depth of about 160 feet—but operations are at present suspended.—*Huronian.*

11. Silver Islet, Lake Superior..... *Major A. H. Sibley, New York.*

a. Large rough specimen representing the ordinary character of the ore.

b. Large polished specimen of the same.

c. Specimen of nuggety and filiform native silver.

d. Do. combined with calcspar and quartz.

e. Filiform native silver associated with silver-glance.

f. Crystalline silver-glance associated with calc-spar and galena.

g. Surface ore, stained with nickel and cobalt.

h. Specimen of "Macfarlanite."

i. Bar of silver, 999 fine, valued at $87, smelted from the ore of Silver Islet.

The exhibitor gives the intrinsic value of the above specimens at $1,450.

Silver Islet, originally a mere rock, whose greatest diameter was seventy-five feet, and greatest height above Lake Superior about eight feet, lies at a distance of about half a mile from the north shore of the lake, and six miles east of Thunder Cape. It consists of part of a dyke of crystalline diorite, which has been traced west-south-westward through several islands to McKellar's Point, and thence inland for a number of miles. At Silver Islet it is nearly vertical, and is less than 300 feet wide, but in other parts of its course it attains a width of upwards of 500 feet and shows bands of different characters. The dyke cuts the nearly horizontal darkly

coloured slates of the Nipigon series, which on the mainland opposite the islet are overlaid by thinly bedded agillaceous sandstones. The vein crosses the dyke nearly at right angles, its course being N. 32° W. (Ast.) (32°), with a slight underlie to the north-eastward. Its average width in the mine is four or five feet, the extreme variations being six inches and twelve or fifteen feet. It has an appearance of great persistence, and has been pierced by a diamond drill to a depth of 1,000 feet. The veinstone consists of white calc-spar, bitter-spar and quartz, with occasional masses of the wall rocks (slate and diorite). The silver occurs both native and as silver-glance; the former running in small arborescent forms into the latter. The other associated minerals are plumbago, zinc-blende, iron-pyrites, copper-nickel and small quantities of cobalt and antimony ores. A continuation of the vein is found on the mainland, where it contains a little argentiferous galena. The vein was discovered in 1868 by Mr. John Morgan, an assistant to Mr. Thomas Macfarlane, who was then engaged in making a survey of the location (Wood's) of which this islet forms a part, for the Montreal Mining Company, who were then the owners of the property. This company worked the mine on a very small scale in 1869 and '70, and in the autumn of the latter year sold it, together with all their mineral lands around Lake Superior, amounting to 107,000 acres, to Major Sibley, of New York, and his associates, for the sum of $125,000. Since that time the mine has been steadily worked by the American owners, under the management of Captain W. B. Frue, and according to the most trustworthy information obtained, has produced up to the present time (spring, 1876), about $2,500,000 worth of silver at a cost of $1,500,000.

The islet is now very much enlarged by the lines of crib-work which have been successively built around it and filled up with stone from the mainland and refuse rock from the mine. The workings have extended to a depth of 550 feet below the surface of Lake Superior, and laterally about 300 feet to the south-eastward and 100 to the north-westward. In a general way the mine has become poorer in depth. The richer ore is merely spalled, barrelled and sent to Wyandotte (near Detroit) where it is smelted for $80 a ton, the freight and charges amounting to about $15 more per ton. In the month of September, 1875, a fifty stamp crushing mill, built on the mainland opposite the mine, commenced operations, and has been running regularly since that time. The metalliferous portion of the crushed ore is separated by Frue's patent vanning machines, of which there are twenty-four in the mill, and the value of the concentrated ore thus produced is said to average $36,000 a month. When the mill commenced running, about 25,000 tons of ore were on hand, which had been proved by experiment to contain about $40 worth of silver to the ton, and many thousands of tons of low grade ore remained unstoped in the mine. The mine and mill give employment to about 150 men.—*Nipigon Series.*

12. Little Pic Silver Lode, Lake Superior. } *Thos. Marks and McKellar Bros., Thunder Bay.*

a. Eighteen large and seven small pieces of "brown ore" weighing about 150 lbs.

The exact locality is three miles west of the mouth of Little Pic River, and one mile north of the shore of Lake Superior. The vein has an average thickness of three feet and is very persistent, having been traced a distance of five miles. At the above locality its course is N. 67½° W., Ast. The veinstone is principally white and reddish bitter spar and "brown ore" with galena and blende, while the country rock is a greenish-grey siliceous slate. The silver occurs chiefly in the "brown ore," three assays of which yielded Mr. C. Kreissman an average of $25.95 to the ton. This vein was discovered in 1874, and is now being worked.—*Huronian.*

13. Location C. 45, near Little Pic, Lake Superior...*Ambrose Cyrette, Fort William.*

a. Specimen weighing about 40 lbs., from the hanging-wall of the vein.

b. Specimen weighing 50 lbs., from the foot-wall of the vein.

These specimens are taken from an opening in the same vein as the last, but about one mile nearer the Little Pic River. The gangue is here principally yellow bitter spar and white calcite, with a considerable proportion of zinc blende and galena. Numerous openings have been made on this vein over a line of two miles.—*Huronian.*

GOLD.

Native Gold.

1. Province of British Columbia.....*Geological Survey.*

a. Specimens of gold from about twenty different localities.

b. Gilded pyramid surmounted by an octahedron, the pyramid representing the total production of gold in the last eighteen years, and the octahedron the average annual production.

Notwithstanding that fine gold has been found in almost all parts of British Columbia, where it has been sought for in the river and creek sands, from the 49th parallel northwards, there are at present only three recognized gold fields, viz., Cariboo, Omineca and Cassiar.

Cariboo is situated immediately east of the Fraser River, in an elevated region averaging 4,000 feet above sea level, between the 52nd and 53rd degrees of latitude. Omineca lies between the 55th and 56th degrees of latitude, on one of the main sources of Peace River, and Cassiar lies still further north, near the head waters of the Stickeen River. Of the wide tracts of country which separate these limited auriferous areas very little is at present known; but it seems probable that they are for the most part occupied by formations which are newer than the gold-bearing schists and slates. The age of the latter is, however, still quite uncertain, and as they have as yet been examined geologically only at Cariboo, and there very cursorily, it would be premature to hazard any opinion on this subject.

The area of the Cariboo district is only 400 or 500 square miles, and that of the Omineca district still less. The Cassiar district has been worked for only two years, but it is already the most productive gold region in the province. In the Cariboo district, where from twenty to twenty-four separate creeks are being worked, the bed-rock is chiefly blue and grey slate, and often satiny and micaceous schist with hard grey quartzite bands, and whitish quartz-rock traversed by seams and veins of opaque white and rusty looking quartz. The gold drift is apparently of local origin, and not generally much water worn. It often extends high up on the sides of the valleys, and in places has been worked by the hydraulic method to as much as seventy or eighty feet above the adjoining creek-bed. The small percentage of quartz in the drift and the small size of the fragments would seem to indicate that the quartz veins are not generally large or very numerous. Most of the veins run about N. 60° W. There is said to be a

quartz lode on Lowhee Creek, containing gold and galena in considerable quantity. Galena is also said to accompany all the "wash-dirt" in the Cariboo district. The sinking gradually becomes deeper as the creeks are followed downwards, and the quantity of water, which is very great, also increases. The Van Winkle claim may be taken as an example of one of the mines. Here the workings are only 72 feet deep. Three 11½-inch pumps, worked by an eighteen feet overshot wheel, raise the water into an adit forty feet below the surface, and are kept working day and night. The adit is 3,000 feet long, and was nearly three years under construction. The yield of this claim in May, 1875, averaged 160 ounces per week, @ $17.00= $2720.00. The timbering required is very heavy; props from one to two feet in diameter stand in pairs at from six to ten inches apart, with heavy cross-pieces and close over head longitudinal timbering in five feet lengths. The shaft is 300 feet from the creek, on the opposite side of which the bed rock is at the surface and forms steep cliffs. Very few of the claims have sufficiently powerful machinery to work them beyond a limited depth.

In the collection there are samples of gold from sixteen creeks in the Cariboo district, and the differences in the character of these samples are very remarkable. The creeks represented are:

Williams Creek.	Jack of Clubs Creek.
Mosquito Creek.	Harvey Creek.
Conklin Gulch.	Lowhee Creek.
Davis Creek.	Cunningham Creek.
Stouts Gulch.	Keithley Creek.
Grouse Creek.	California Creek.
Lightning Creek.	Bear River.
Antler Creek.	Valley Mountain.

There are also two samples from Omineca, and a small nugget, value $48.00, from Cassiar, sent by the British Columbia Advisory Board. The value of British Columbia gold varies from $16 to $18 per ounce.

From carefully compiled statistics by the Deputy Minister of Mines we find:—

The average number of miners employed yearly from 1858 to 1875 to have been	3,220
Average earnings per man per year	$ 658
Total estimated and actual yield of gold 1858-75 inclusive	$38,166,970

The following table, compiled by the same person, shows the yield of gold for the whole province, since its existence was first made known to the world in 1858, up to the present time. Two-thirds of the amounts here given were actually known to have been exported by the banks, &c., while one-third is added in each year as the amount estimated to have been carried away in private hands:

1858, 6 months	$ 520,353	1868	2,372,972
1859	1,615,072	1869	1,774,978
1860	2,228,543	1870	1,336,956
1861	2,666,118	1871	1,799,440
1862 } 1863 }	4,246,266	1872	1,610,972
		1873	1,305,749
1864	3,735,850	1874	1,844,618
1865	3,491,205	1875	2,474,904
1866	2,662,106		
1867	2,480,868	18 years	$ 38,166,970

2. Mosquito Creek, B.C..... *Oppenheimer Bros., Victoria, B.C.*

a. Nugget of gold.

3. Fort Edmonton, Saskatchewan River, N.W.T..... *Geological Survey.*

a. Specimen of alluvial gold.

Gold may be obtained by washing the sands or gravels of the Saskatchewan at many points from Rocky Mountain House eastward to the Forks. It appears to be most abundant in the neighbourhood of Edmonton, and miners here are said to make about $5.00 a day. Above Rocky Mountain House it has not been found, though frequently looked for by experienced miners. Its origin therefore cannot be the Rocky Mountains, but is in all probability the drift which is spread over the country for hundreds of miles and derived from the crystalline rocks to the north-eastward. The gold is always in a finely divided state, showing that it has been transported from a distance.—*Alluvion.*

4. Location H., near Jackfish Lake..... { *W. W. Russell, D. McKellar, and N. Kingsmill.*

a. Nine specimens of quartz with gold.

These specimens are taken from an auriferous quartz vein on which a shaft has been sunk by the Shebandowan Mining Company on the above location, lying fifteen miles west of Shebandowan Lake. At this shaft the vein has a width of five feet of solid quartz, which, however, divides into three branches to the north-eastward. The vein carries considerable quantities of copper and iron pyrites, galena and silver glance, and is rich in visible gold. Numerous assays of the one which have been made, show very rich proportions of both gold and silver, but it has not yet been tested on a large scale. In the neighborhood of the shaft, this vein is enclosed in soft talcoid slate, which is flanked on either side by chloritic slates. These again are associated with dioritic, argillaceous, siliceous and porphyritic slates, and also with massive diorite, porphyry, slate-conglomerate and granite. There are likewise bands of magnetite and quartzite. On location H. the vein has been proved for nearly half a mile, and its apparent continuation has been traced for about eight miles further, varying greatly, however, in richness. Its general course is about N. 60° E. (ast.), while the slates, which dip northward, at angles varying from 60° to 80°, run rather more easterly, so that the vein intersects them at a small angle and varies in character in crossing the different bands. The above information is condensed from descriptions kindly furnished by Messrs. P. McKellar and W. W. Russell, and from plans sent by the latter. Capt. W. B. Frue, of Silver Islet, is agent for the Company.—*Huronian.*

5. Partridge Lake Location..... { *W. W. Russell and D. McKellar, Fort William.*

a. One large and six smaller average samples of veinstone.

b. Seven specimens with visible gold from the same vein.

Partridge Lake is a small sheet of water a few miles west of the western arm of Lac des Mille Lacs. The vein, which consists of white quartz, averages five feet in width, and runs north-eastward with the strike of the talcoid schists which enclose it. Greenish mica schists with the same strike are met with on the south

side of the lake, while granite occurs on an island a short distance to the north of the vein. The vein holds iron and copper pyrites, besides the gold, which occurs in disseminated grains. Specimens assayed in the Geological Survey laboratory contained about $30.00 worth of gold to the ton of 2,000 lbs. No trials have as yet been made on a large scale.—*Huronian.*

6. Locations 64 Z and 94 Z, S. side upper L. Shebandowan.. { *J. A. Lindsay, Toronto.*

a. Specimen of gold-bearing quartz.

The vein from which this specimen is taken is described as being from three to four feet wide, and said to carry a considerable proportion of copper pyrites. (See paper by Prof. H. Alleyne Nicholson in Quart. Jour. Geol. Soc., 1873.) Specimens assayed by Mr. Wm. Low gave from $37 to $47 gold to the ton.—*Huronian.*

7. Victoria Cape, Lake Superior..... *McKellar Bros., Fort William, L.S.*

a. Four specimens of gold-bearing quartz from the surface.

Victoria Cape is on the west side of Jackfish Bay (opposite to the Slate Islands), Lake Superior. The vein from which the specimens are taken is from 1½ to 3½ feet thick, and runs N. 55° E. It is heavily charged with iron pyrites, and also holds galena and blende. The country rock is a light red granite with green dioritic slate in close proximity to it. The discovery of gold in this locality was only made last summer, but the vein has been uncovered for a distance of 500 feet and shows a vertical section of sixty feet in a neighboring cliff. An average of assays of the white and the dark parts of the veinstone gave Mr. Charlee Kreissman $27.00 gold and $7.78 silver per ton. A smaller vein a short distance S.E. of the above yielded the same assayer $140.33 gold and $17.62 silver to the ton, and shows free gold.—*Huronian.*

8. Marmora, O..... *Toronto Gold Mining Company, Toronto.*

a. Gold-bearing arsenical pyrites.

b. Seven samples in bottles, illustrating separating process.

1. Crushed ore.
2. Concentrated ore.
3. Tailings left after concentration (worthless.)
4. Ore roasted with nitrate of soda.
5. Paris-green made from the ore (150 lbs. to the ton.)
6. White arsenic from condensed fumes of the roasting ore, (500 lbs. to the ton.)
7. Brown pigment residuum, (600 lbs. to the ton). The ore yields besides the above products $30.00 gold per ton.—*Laurentian.*

9. Marmora, O..... *Gatling Gold Mining Company, Marmora.*

a. Gold and silver bearing arsenical pyrites.

b. A small bar of gold from the ore.

c. A small bar of silver from the ore.

d. Plan of the Company's location.

Twenty assays made in the Geological Survey laboratory of samples from the Marmora mines have given an average of 1.6367 oz. of gold, equal $33.81 to the ton of 2,000 lbs. Twelve of the samples were from the Gatling Mines, and gave an average of 1.9107 oz. of gold, equal to $39.47 to the ton.—*Laurentian.*

10. St Francis Beauce, Q..... *W. P. Lockwood.*

a. Model of Kilgour nugget. Weight of nugget 51½ ounces.

This nugget was found in 1869, on the Gilbert River, lot sixteen, twenty-four feet from the surface. Narcisse Rodrigue, a farmer residing in the vicinity, took out, on lot nineteen, in one day, gold of the value of $1,200, with a pan. On lots sixteen and twenty-one about ten acres have been worked, and the value of the gold taken out is stated to be over $500,000.—*Upper Silurian.*

11. Eastern Townships, Q..... *Geological Survey.*

a. Models of gold nuggets.

b. Four samples of alluvial gold.

The auriferous alluvions of the Province of Quebec cover an extended region. In 1852 the Geological Commission had already shown their extension over more than 10,000 square miles. The gravels through which the gold is irregularly distributed are generally covered by a layer of vegetable earth and often by a bed of clay. They repose in part on metamorphic Lower Silurian rocks consisting of talcose, micaceous, or chloritic schists, associated with diorites and serpentines. To the southward these Lower Silurian strata are unconformably overlaid by others of Upper Silurian and Devonian age, which are also covered by auriferous alluvion. Both formations, but especially the Upper Silurian, are traversed by numerous veins of quartz running with the stratification or between N.E. and E.

Samples from one of these veins, on lot twenty-one, St Charles, assayed by Dr. A. A. Hayes, of Boston, gave $77.56 in gold and $2.55 in silver to the ton. Other samples are said to have yielded by assay as much as $106 and $136 to the ton.—*Alluvion.*

12. Province of Nova Scotia.... *N. S. Advisory Board and Geological Survey.*

a. Specimens of gold in quartz from veins in various districts. (See labels.)

Gold was first discovered in Nova Scotia in 1859, and in 1862 upwards of seven thousand ounces were obtained. Since that time the average annual yield for the province has been over 17,000 ounces, the quantity for the fourteen years from 1862 to 1875, both inclusive, having been 242,072 oz. 14 dwts. 22 grs., according to the

figures of the N. S. Mines Department. This was obtained from 325,363 tons (of 2,000 lbs.) of quartz, which would give an average yield of 14 dwts. 21 grs., per ton. Owing to its great purity the gold sells at about $19.50 per ounce. But counting at the official estimate of $18 per ounce, and reckoning 300 working days to the year, the above amount would give an average of $525 a year for each man engaged in the industry. There has, however, been an almost steady increase from $249 per man, in 1862, to $660, in 1875. Twelve steam and eight water-power stamp mills were in operation more or less regularly during the year, but most of these mills are of small capacity, the quartz crushed having amounted to only 14,810 tons for the twelve months.

The gold-bearing rocks form a broad belt along nearly the whole Atlantic coast of Nova Scotia proper. They consist usually of compact white-weathering, greenish-grey felsitic quartzite, sometimes approaching in character to sandstone, interstratified with beds of slate, generally of a similar colour to the quartzite ; but frequently the slaty bands are dark grey or nearly black. Several areas of coarse reddish-grey granite of considerable extent occur within the gold-bearing belt of rocks. The gold is found in separate limited districts of which about twenty are known. It generally occurs in thin interlaminated veins of hyaline quartz, accompanying the slaty bands. The outcrops of the veins, in each district, appear to be arranged in concentric lines, approaching the form of elipses, due to domes along anticlinal axes. Occasionally a small productive vein is found cutting the quartzite (locally called "whin") at an angle to the bedding. Sometimes the interlaminated veins are quite large, but in those cases they seldom contain much gold. The richer veins are usually less than two feet thick—oftener only a few inches—but occasionally several of these lie near enough to each other to be worked together, and the slate between them also frequently carries gold. The same vein is generally found to vary much in richness in different parts, as if the gold ran in "streaks" or "shoots" and branches. As a general rule the greater part of the gold contained in the veins occurs as visible grains and nuggets, the latter having frequently been found as heavy as five ounces.

The deepest workings are in the district of Waverly, where one shaft is said to be down about 800 feet, and Sherbrooke, where another has been sunk about 600 feet on the slope of the veins. About 300 men are at present engaged in gold-mining in Nova Scotia. Owing to the small amount of sand, gravel or clay to be found in the gold region of Nova Scotia, very little alluvial mining has been done, although in several cases the earth at the crops of the veins has been found to be rich in the precious metal.—*Primordial Silurian and Cambrian.*

PLATINUM.

Native Platinum.

Similkameen River, British Columbia..*Mechanics' Institute, New Westminster.*

a. Specimen of platinum in fine grains.

More or less fine platinum has been found along with alluvial gold in several of the streams of British Columbia, and it has been particularly noticable in the river from which the above specimen comes.—*Alluvion.*

ANTIMONY.

Sulphide and Oxysulphide of Antimony.

1. South Ham, Q, lot 28, range 1..... *Geological Survey.*

a. Specimens of sulphide of antimony (stibnite) and red antimony.

In 1863 a deposit containing native antimony, antimony glance and small quantities of senarmontite, valentinite, and the red oxysulphide (kermesite) was discovered in the township of South Ham, in the magnesian rocks of the Quebec group. At the surface the vein was from six to sixteen inches in thickness, the gangue consisting of quartz and a little dolomite. Attempts were made to work it, but are said to have proved unsuccessful.—*Quebec Group, Lower Silurian.*

2. Parish of Prince William, York County, N.B..... } ..... *Lake George Mining Company.*

a. Specimens of antimony ore (stibnite).

b. " " " " (roasted)

c. Regulus of antimony.

d. Babbit metal, three grades.

The occurrence of stibnite or grey sulphide of antimony at Prince William seems to have been known for a number of years without attracting much attention until about the year 1862, when fresh discoveries having been made indicating a considerable body of ore, several companies were formed with a view to its development. Through their explorations the mineral was found to be more or less abundantly spread over an area of several square miles, occurring chiefly in veins of white quartz or of quartz and calc-spar, intersecting hard clay slates and sandstones of undetermined age. These veins vary in thickness from a few inches to six feet, the ore being irregularly distributed through the quartz in strings or veinlets, sometimes attaining a thickness of from twelve to fifteen inches. A large portion of that hitherto raised has been obtained within a short distance of the surface by means of trenches dug on the course of the lodes, but several shafts have also been sunk to a depth of over one hundred feet. In connection with these, the Lake George Mining Company have erected extensive works and machinery, embracing an 80 horse-power engine, a 30 horse-power air-compressor engine, a Burleigh steam-drill, Blake's crusher, rollers, jiggers, &c., as well as furnaces for desulphurization and smelting. These, when in full operation, yield fifteen tons of metal about every six weeks, the charges (of 500 cwt.) yielding from 45 to 55 per cent of regulus. The materials employed in smelting are charcoal, soda or salt-cake and rosin. The value of the metal on the ground is twelve to fourteen cents per pound. It is partly exported in cakes or ingots to the United States, and partly employed on the ground in the manufacture of Babbit metal (containing fifteen to twenty per cent. of antimony with lead and tin, or in the better qualities with lead, copper and tin) valued at from twenty to fifty cents per pound.—*Upper Silurian.*

BISMUTH.

Sulphide of Bismuth.

Tudor, O..... *Geological Survey.*

a. Specimens of sulphide of bismuth.

b. Metallic bismuth, obtained from the sulphide.

Fine specimens of sulphide of bismuth several ounces in weight were several years ago obtained in the township of Tudor. The ore, however, was for the most part only sparsely disseminated in a veinstone of quartz, which also held graphite and black tourmaline. At the surface small quantities of carbonate of bismuth were found; but lower down this was replaced by the sulphide, with traces of metallic bismuth. The vein in places was over two feet in thickness, and traversed hornblendic rocks belonging to division B of the Hastings series. It was worked, for a time, but finally abandoned in 1868, the ore not having been found in remunerative quantity.—*Hastings Series.*

II.

MATERIALS USED IN THE PRODUCTION OF HEAT AND LIGHT.

Anthracite.

1. Graham Island, (one of the Queen Charlotte Islands), B.C. ..... *Mechanics Institute, New Westminster, B.C.*

a. Specimen of anthracite.

The deposits of anthracite on the Queen Charlotte Islands are, so far as examined, of very irregular character. The locality best known is on Skidegate Channel, at the southern end of Graham Island. Here the coal has been worked in several places, and found in one instance to be as much as six feet thick. In the direction of its strike, however, it appeared to thin out altogether, or to be represented by coal of very inferior quality mixed with shale and clay iron-stone. The seams are vertical, and the rocks containing them are flanked to the northwest by escarpments of volcanic rock.

Analysis of two specimens of the anthracite by fast coking gave (see Report of the Geological Survey of Canada, 1872-73, p. 81):

Water.....	1.89	1.60
Volatile combustible matter.....	4.77	5.02
Fixed carbon.....	85.76	83.09
Sulphur.....	0.89	1.53
Ash.....	6.69	8.76

A large amount of money has been spent by the *Queen Charlotte Coal Mining Company* in the construction of a wharf, houses, tramway, etc., and in endeavours to work the seams; but unfortunately the efforts have not been attended with success.—*Jurassic or Cretaceous?*

Bituminous Coal.

1. Baynes Sound Mine, B.C.....*Baynes Sound Mining Co.*

a. Block of coal.

This mine is situated about forty miles north of Nanaimo, and about one and a half south-west from the shore of Baynes Sound, which forms a good harbour for shipping. In the section at this locality, there are two seams of coal. The lower varies in thickness from five feet two inches to seven feet; the lower two feet, however, containing thin seams of shale with impressions of plants. The upper seam is separated from the last by about sixty feet of brownish-grey sandstone, and shows five feet ten inches of good coal. An analysis of a specimen from the lower seam gave Dr. Hunt by slow coking:

Fixed carbon	64.70
Volatile combustible matter	29.55
Ash	5.75

A somewhat weathered specimen from the upper seam gave:

Fixed carbon	57.48
Volatile combustible matter	29.10
Ash	13.42

In both cases a good firm coke was obtained. No coal has as yet been shipped from this locality.—*Cretaceous.*

2. Wellington Mine, B.C.....*Dunsmuir, Diggle & Co., Departure Bay, B.C.*

a. Block of coal.

This mine is situated two and a half miles north-west of Nanaimo and three miles west of Departure Bay. At one point a trench cut through the clay covering showed the seam to have a thickness of nine feet of coal, resting on a bed of light drab sandstone. At a distance of a quarter of a mile from this there is another exposure, where the coal is from four to seven feet thick. An analysis of the coal by Dr. Hunt gave by slow coking:

Fixed carbon	55.50
Volatile matter	34.70
Ash	9.80

The coal does not coke well. Last year (1875) a new opening was made which promises to be valuable. The total sales in 1875 were 48,223 tons, with 2,318 tons on hand at the close of the year. The output for 1874 was 29,818 tons. Preparations are being made by which the output will shortly be increased from 150 to 250 tons per day. At the mine the coal sells for from five to six dollars per ton, and in San Francisco, which is the principal market, for ten dollars per ton.—*Cretaceous.*

3. Nanaimo Colliery, B.C.. *Vancouver Coal Mining Company, Nanaimo, B.C.*

a. Block of coal.

This locality is seventy miles north-west of Victoria. The principal workings are on a six-foot seam, a specimen from which gave Dr. Hunt by slow coking the following results :

Volatile matter	38.40	Coke firm.
Fixed carbon	51.45	
Ash	10.50	

Another seam, seven feet thick, occurs above the one just mentioned, from which it is separated by about 140 feet of sandstone. The colliery has been in operation for upwards of twenty years, and in 1871 the output was from 160 to 180 tons per day. The total production in 1874 was 51,728 tons, valued at $6.00 per ton. In 1875, 49,421 tons were shipped, and a balance of 13,037 remained on hand. The principal markets are Victoria and San Francisco, but small quantities are also shipped to Honolulu, Mazatlan, Alaska, &c.—*Cretaceous.*

4. Union Mine, Comox, B.C..... *Union Mining Company.*

a. A two-feet cube of coal.

This mine is situated on a small tributary of the Puntledge River, where a perpendicular cliff affords a section containing eleven coal seams, varying from one and a half to ten feet in thickness, or altogether about twenty-nine feet of coal. The lower two and a half feet of the ten feet seam is a dull earthy coal, the remaining seven and a half feet being clean and bright. Analysis of a specimen from the upper part gave by slow coking :

Water	1.70
Volatile combustible matter	27.17
Fixed carbon	68.27
Ash	2.86

By rapid heating yields a tolerably firm coke.—*Cretaceous.*

5. Grand Lake, Queen's County, N.B..... *Queens & Sunbury Coal Mining Company.*

a. Block of coal representing maximum thickness of the bed.

More than a third of the Province of New Brunswick is occupied by rocks of the Coal formation, which present the usual variety of sandstones, conglomerates and shales met with in other coal regions, together with numerous and characteristic fossil remains. Seams of coal have been found at various points ; none of them, however, exceed twenty-six inches in thickness. But as the stratification is nearly or quite horizontal, and the seams close to the surface, they can be readily mined over very large areas. The possible occurrence of thicker seams at greater depths can only be ascertained by boring. The results already obtained by this means are unfavourable, and tend to prove that the Coal formation itself is of inconsiderable thickness in this region. As, however, the coal rocks cover a very uneven surface of older rocks, it is possible that at some point the former may attain a much greater thickness, and include workable beds of coal.

The only localities in which coal is now raised are in the vicinity of the New-

castle River and about the shores of Grand Lake in Queen's county. The seam is about two feet thick and from ten to fifteen feet from the surface. It has been mined at a great number of points over an area of one hundred square miles, indicating a total productive capacity of about 150,000,000 tons. The coal is a caking bituminous coal, and is employed both for household and blacksmith's use. The annual production is at present about 3,000 chaldrons, which, delivered in the city of St. John, is sold, according to quality, at from $4.50 to $8.00 per chaldron.—*Carboniferous.*

6. Springhill Mines, Cumberland County, N.S..... *Wm. Hall, Springhill, N.S.*

a. Column of coal, from the 11 feet seam, three feet square at base.

The Springhill coal field is situated in the county of Cumberland, N.S., about twenty-two miles from Amherst, and twenty miles south-east of the Joggins Shore. It may be divided into two sections, North and South Springhill. The Black seam, from which the specimen exhibited is taken, is situated in the latter. Seven principal coal seams have been discovered in this section, having the following thicknesses in descending order:

	Feet.	Inches.	
A	13	0	
B	6	0	
C	2	4	
D	11	0	"Black" seam
E	2	6	
F	4	0	Shaly
G	2	0	"

The average of four analyses made by the late Mr. E. Hartley gave for the coal of the "Black" seam:

Hygroscopic moisture	1.02
Volatile combustible matter	34.38
Fixed carbon	60.82
Ash (white)	3.78

This is the only seam that has as yet been worked. The amount of coal raised in 1875 was 50,505 tons, against 33,000 tons in 1874, 164 men and 14 boys being employed.* The Intercolonial Railway, which passes through this section, affords an outlet to markets at St. John and Halifax. The coal is admirably fitted for the manufacture of gas; it yields a compact coke, containing but little ash, and well adapted for iron smelting.—*Carboniferous.*

7. Scotia Mine, Cumberland County, N.S..... *W. Bennett, Maccan, N. S.*

a. Block of coal, one and a half feet square and three feet high.

*The facts given with regard to the number of hands employed in the Nova Scotia coal mines and the production of coal are chiefly from the Report of the Department of Mines of that Province.

A section of the coal beds at the pit of this mine gives :

	Feet.	Inches.
Coal	0	4
Coaly slate	0	1½
Coal	0	1
Slaty fire clay	0	3
Coal (good)	1	3
Coaly shale	0	6
Coal (good)	1	8
Black or grey slate	0	1
Coal (good)	0	10½
	5	2

The beds dip S. 5° W. < 39° magnetic. The workings so far have been very limited, and the amount raised has been mostly used for local purposes. The output for 1875 was 1,460 tons, against 1,740 in 1874.—*Carboniferous.*

8. Intercolonial Mines, Pictou County, N.S.....*James Simpson.*

a. Column of coal, two feet square at the base and five feet high.

The Drummond Colliery, which is the only one at present in operation on this property, is situated on the Bear Creek area. It includes the extension from the Carmichael area of the Acadia seam, which in a section exposed in the air pit of the colliery gives eighteen feet seven inches of coal, with an included parting of three inches of fire-clay. Though operations were much hindered at this place by the terrible accident of May, 1873, work has been again commenced, and an output of 72,016 tons effected in 1875. An analysis of coal from the top bench, six feet from the top of the seam and directly under the clay parting, gave according to Mr. Broome,

Total volatile matter	33.526
Fixed carbon	55.390
Ash (grey)	10.500
Sulphur	0.584

A trial of the coal from this bench at the gas works, Pictou, gave 8,500 cubic feet of gas per ton, with thirty-six bushels of good coke. As a coal for steam and domestic purposes this one possesses excellent qualities.—*Carboniferous.*

9. Acadia Mines, Pictou County, N.S.....*Jesse Hoyt.*

a. Column of coal, two feet square at the base and five feet high.

The Acadia Coal Company own three mining rights known as the Carmichael area, the Fraser area, and No. 3 area. Work is at present confined to the first, on which the Acadia Colliery is situated. Here the supposed representatives of the Main and Deep seams of the Albion Mines are found. The Acadia seam, the equivalent of the Main seam, is eighteen feet two inches thick, and is overlaid by a band of carbonaceous and oil shale eleven feet seven inches thick. The second seam is about 160 feet below the first, and, where exposed in a trial pit, consists of three feet ten inches of shaly coal, and seven feet eight inches of good coal. It is not worked at present, operations being restricted to the Acadia seam. A specimen of coal from the latter gave Mr. Gordon Broome.

Moisture	2.10
Volatile combustible matter	32.27
Fixed carbon	57.57
Ash	7.56
Sulphur	0.50

The coal from this seam is more compact than that from the Albion Mines, and contains but little mineral charcoal. It does not coke readily, but is an excellent steam coal. In 1875 the production was 65,992 tons, and the number of hands employed 240.—*Carboniferous.*

10. Albion Mines, Pictou County, N.S.....*James Hudson, Stellarton, N.S.*

a. Column of coal, three feet square at the base and twelve feet high.

b. Coke.

This property is three square miles in extent, and is the central area of those within the limits of the productive coal measures. It includes the crops of the two principal seams, the "Main" and the "Deep." Till within a few years the workings on this area and those on the McGregor seam constituted the principal ones in the Pictou coal field. The term "Albion Mines" embraces the following collieries: 1st, Burnt Mines, 2nd, Crushed Mines, (abandoned), 3rd, Dalhousie pit works, 4th, Forster pit works, 5th, Foord pit works—all on the Main seam—and the Cage pit works on the Deep seam. A section of the Main seam at the Dalhousie pit works gave 36¾ feet of coal, including five interstratified bands of ironstone with a total thickness of twenty-three inches. The quality of the coal varies, so that in some places only a part can be worked, while in others, the whole thickness is mined. A section of the Deep seam, taken three-quarters of a mile from the Cage pit, where the whole thickness of the bed is worked, gives eighteen feet three inches of good coal, with a parting of pyritous coal one and a half feet thick. The amount of coal raised from these mines during 1875 was 130,069 tons, the number of persons employed being 607.

The following analyses are by Professor How of Windsor College, N.S.:—

Main Seam;

Moisture	1.48
Volatile combustible matter	24.28
Fixed carbon	66.50
Ash	7.74

Deep Seam:

Water	2.54
Volatile combustible matter	20.46
Fixed carbon	68.50
Ash	8.50

This coal cokes well, and is largely used both for house and steam purposes.—*Carboniferous.*

11. Vale Colliery, Pictou County, N.S.....*John Greener.*

a. Block of coal, two feet square and two and a half feet high.

The area of *the Vale Coal, Iron, and Manufacturing Company* is three square miles in extent, and contains two important seams, the "McBean six feet seam" and the "McBean eight feet seam." The latter, which is the only one worked by the company at present is about 800 feet below the former, the measures having an

inclination of about 35°. Operations were begun in 1873, and since then a slope has been driven for 840 feet, and levels extended on each side to a distance of 2,100 feet. In 1875 there were 247 hands employed, and 36,547 tons of coal raised, 7,448 tons more than in the preceding year. An analysis of a specimen from the eight feet seam gave :

Water	2.22
Volatile combustible matter	30.23
Fixed carbon	59.70
Ash (white)	7.85

The coal is chiefly used as a steam and house coal. Like the other collieries in the Pictou field, this one is worked by the post-and-stall system.—*Carboniferous.*

12. Sydney Mines, C.B.....*Richard H. Brown.*

a. Column of coal, two feet square and six feet high, from the Sydney main seam.

The Sydney mines are the most important in Cape Breton. From 1785 to 1827 they were worked in a very irregular manner, sometimes by the government and at others by various individuals and companies. According to Mr. Richard Brown, the production during this period was only 275,000 tons, or less than half what should have been produced from the area worked. In 1827 the mines passed into the hands of the General Mining Association of London, who hold under lease in the district more than 30,000 acres, underlaid for the most part by valuable seams of coal, which range from four to eight feet in thickness.

The Sydney main seam has been the most extensively worked in the past, and at present operations are almost entirely confined to it. It is from five and a half to six feet thick, and of good quality throughout. The following is an analysis of a specimen of the coal by Professor How, of Windsor, Nova Scotia:

Moisture	3.04
Volatile combustible matter	31.14
Fixed carbon	61.50
Ash (reddish-brown)	4.32
	100.00

According to G. Buist, Esq., manager of the Halifax Gas Works, the yield of gas (8 candles) is 8,200 cubic feet per ton (2240 lbs.) of coal. The coal is largely exported to the United States and the neighboring Provinces, and is used chiefly for domestic purposes. In 1875 there were 640 persons employed in connection with the mines, and the output was 124,199 tons of coal.—*Carboniferous.*

13. Victoria Mine, C. B.....*J. W. Fraser, Halifax.*

a. Block of coal, one foot square and two feet high.

This mine was established in 1867 to work a submarine area of four square miles on the east side of Sydney Harbor. In this area there are numerous seams of coal, six of which, with an aggregate thickness of thirty-six feet, are probably workable. The seam mined at present, called the Victoria seam, has a thickness of six feet ten inches, of which, however, only five feet six inches of good coal are taken out. The coal is of excellent quality, and is chiefly used for domestic and steam purposes. An analysis of a specimen by Dr. Dawson gave,

Volatile matter	38.70
Fixed carbon	58.40
Ash	2.96

The number of persons employed in this mine during 1875 was 104, and the total output amounted to 18,814 tons.—*Carboniferous.*

14. Lingan Mine, C.B.....*R. H. Brown, Sydney Mines, C. B.*

a. Column of coal, from the Lingan main seam, two feet square and five and a half feet high.

The Lingan Colliery is situated on the North shore of Indian Bay, about twelve miles from Sydney. It was first opened, in 1854, by the General Mining Association, on whose valuable area of fourteen square miles eight workable seams have been found and proved. The aggregate thickness of these is not less than forty feet of good coal. The seam worked at present is known as the Lingan main seam. It is eight feet eight inches thick, and dips N. 32° E < 12°—16°. At a height of five feet eight inches from the floor, a clay parting occurs, which at its outcrop in Indian Bay is one inch in thickness, but in the working slope, half a mile westward, increases to fifteen inches, and at a further similar distance west, forms a division of eight feet, splitting the seam into two. The land and sea areas of this tract taking the lower seam only, should contain about 73,060,000 tons of coal. The coal is shipped largely to Boston and New York, where it is used in the manufacture of gas, for which purpose it is well suited; the yield of gas per ton is stated to be 9,700 cubic feet. Analysis of a specimen gave,

Volatile matter	33.84
Fixed carbon	63.60
Sulphur	0.77
Ash	1.79

The output of coal for 1875, as in most of the other Cape Breton mines, shows a great falling off as compared with former years, amounting to only 22,805 tons. The number of persons employed was only 113.—*Carboniferous.*

15. Gardiner Mine, C.B.....*Wm. Routledge, Bridgeport, C.B.*

a. Block of coal, one foot square and two feet high.

This mine is situated eight and a half miles from the town of Sydney, on the south side of the Lingan Basin. The property is two square miles in extent, one-half being land and the other half sea area. The two principal seams, so far as known, are the Gardiner and the Carroll seams. The former is four feet nine inches thick, of uniformly good coal, and is estimated to contain within the area about 6,500,000 tons. The Carroll seam shows at the outcrop six feet of good coal, separated by a band of shale into two benches. An analysis of coal from the Gardiner seam gave by slow coking,

Volatile matter	31.37
Fixed carbon	64.63
Ash	2.82
Sulphur	1.18

According to Dr. Dawson the yield of gas is 10,700 cubic feet per ton. The coal is also an excellent steam coal. The total output during the last three years

amounted to 39,765 tons. The number of persons employed in 1875 was sixty-five, including boys.—*Carboniferous.*

16. International Mine, C. B.....*R. N. McDonald, Bridgeport, C. B.*

a. Column of coal, from the Harbor seam, two feet square and six feet high.

The International Coal and Railway Company of New York acquired in 1863 an area of four square miles, situated about half-way between Sydney Harbor and Cow Bay, the breadth of the property being not less than three miles, in the very centre of the productive coal measures. It is underlaid by at least four most important seams, with an aggregate thickness of twenty-two feet of workable coal. Mining operations have been hitherto confined to the Harbor seam, which is the highest in the area, and has a thickness of from five feet six inches to six feet of good coal. It has been proved to extend entirely across the area, having an outcrop of over two miles. The estimated amount of coal on the property in this seam is estimated at 4,500,000 tons, and about 500,000 tons have been extracted. For the year 1875 the output amounted to 40,489 tons, the number of persons employed being 126, including seventeen boys. The coal is of excellent quality, and is largely exported to New York for the manufacture of gas; it is said to yield 10,000 cubic feet of 16 candle gas and 1,470 lbs. of coke per ton. It is also an excellent steam coal. An analysis of a specimen gave,

Volatile matter	34.09
Fixed carbon	62.92
Ash	2.99

The seam dips S. 84° E > 5°, and the coal has a regular cleat running N. 75°–80° W. The mine is worked by means of a shaft ninety-six feet deep and a slope 550 feet long.—*Carboniferous.*

17. Little Glace Bay Mines, C.B....*Henry Mitchell, Little Glace Bay, C.B.*

a. Column of coal, two feet square and six and a half feet high.

These mines are owned by a company of Halifax capitalists, who leased an area of 1,640 acres in 1861 from Mr. E. N. Archbold of Sydney. They have been worked more or less profitably, and at one time are said to have paid a dividend of 40 per cent. to the shareholders. The area is about sixteen miles from Sydney, and is most favourably situated as regards shipment of coal. It embraces the entire land outcrop of the Hub seam, and a large proportion of that of the Harbor seam (from which the column was taken), and is also underlaid, at a depth not exceeding 700 feet below that last named, by three workable seams, and at a lower depth by two others, the thickness of which has not yet been determined. The total thickness of the Hub seam is nine feet ten inches, of which the upper portion, one foot eight inches thick, being of inferior quality, is not taken out except in the main level. The Harbor seam, which is the representative of the Sydney main seam, has a thickness of five feet six inches. The coal from both these seams is largely used for gas purposes in Halifax and the United States, and yields nearly 10,000 cubic feet of 15 candle gas per ton. An analysis of a specimen from the Harbor seam gives,

Volatile matter	30.21
Fixed carbon	67.78
Ash	2.01

The total output of coal in 1875 amounted to 22,734 tons, giving employment to 111 men and boys.—*Carboniferous.*

18. Caledonia Mines, C.B..... *David MacKeen, Little Glace Bay, C.B.*

a. Column of coal, two and a half feet square and eight feet high, from the Phelan seam.

This property is situated sixteen miles from Sydney, adjoining to the east that of the Little Glace Bay Company. It comprises 875 acres of land and 632 acres of sea area, and is underlaid, at an easily accessible depth, by about five workable seams of coal, the united thickness of which may be stated as twenty-four feet. Besides these there are other important seams at greater depths. Mining was begun here in 1866 by a company of Boston capitalists, and has been carried on uninterruptedly ever since. The "Phelan seam" is the only one worked. It averages eight feet three inches in thickness; but, owing to the badness of the roof, eighteen inches of the top coal is not taken out.

The coal answers for most purposes for which bituminous coals are ordinarily employed, though the proportion of ash is rather large for a good steam coal.

An analysis of a sample from the Phelan seam by Poole gave,

Volatile matter	33.00
Fixed carbon	57.37
Ash	9.63

According to the same authority the yield of gas is 9,700 cubic feet per ton.

The output from this mine may be taken as an example of the great decrease in the coal trade during the past two years, being only 16,566 tons in 1875 with a force of seventy-eight hands employed, against 75,202 tons with 196 persons employed in 1873.—*Carboniferous.*

19. Ontario Mine, C.B..... *John Sutherland, Port Caledonia, C.B.*

a. Column of coal, two and a half feet square at the base and seven feet high.

This property is 880 acres in extent, and is situated on the coast between Glace Bay and Schooner Pond. It is underlaid throughout its entire length, two and a half miles, at a moderate depth, by two very valuable seams, the Phelan and Ross, as well as by several others of importance. The only seam which has been mined is the Phelan, which has a thickness of about eight feet, of which, however, eighteen inches is left to support the shaly roof. The coal is chiefly used in the manufacture of gas.

An analysis of a specimen from the seam worked gave,

Volatile matter	32.82
Fixed carbon	64.33
Ash	2.85
Sulphur	2.17

The output in 1875 amounted to 5,653 tons, the number of persons employed being forty-six.—*Carboniferous.*

20. Gowrie Mines, C.B..... *T. D. Archibald, North Sydney, C.B.*

a. Block of coal, one foot square and two feet high, from the McAuley seam.

The property on which these mines are situated covers an area of two square miles, and is situated on the north side of Cow Bay, adjoining that of the Block-house mine. It is underlaid by several workable seams, only one of which, the

McAuley, is being worked. This seam has an average thickness of five feet of good coal, with from two to six inches which is inferior and is left to support the roof. The amount of coal yet remaining, besides that contained in the pillars, may be estimated at about 5,000,000 tons. The coal has an excellent reputation both for domestic and steam purposes, and though it has a considerable proportion of ash, it is not apt to form clinkers. An analysis by slow coking gave,

Volatile matter	30.64
Fixed carbon	63.00
Ash	3.50
Sulphur	2.86

It has been extensively used in the manufacture of gas, though the large proportion of sulphur is objectionable. The output from this mine during 1875 was only 23,924 tons, against 59,625 tons in 1873. The number of persons employed in 1875 was 145.—*Carboniferous.*

21. Block House Mine, C.B.....*William McQueen, Cow Bay, C.B.*

a. Column of coal, three feet square and eight and a half feet high.

This property is situated on the shore of Cow Bay, seventeen miles from Sydney. The mining right was sold to a New York Company by Mr. Marshall Bourinot in 1863, since which time work has been carried on systematically, and with but little intermission. The property controlled by the Company comprises three square miles, 1,280 acres of which are land, and the rest sea area. The Blockhouse seam, the uppermost and by far the thickest in the Cow Bay basin, is entirely contained in this area. It has an average thickness of eight feet ten inches, of which one foot is left in to support the roof, and underlies 240 acres of the land area. Besides the Blockhouse seam, the property is underlaid by several others of importance hitherto unworked. The coal is used in Boston and New York for the manufacture of gas, and is said to yield 10,500 cubic feet per ton. It is also a good steam coal. An analysis of a specimen by slow cooking gave:

Volatile matter	35.37
Fixed carbon	59.30
Ash (purplish-red)	5.33

The output in 1875 amounted to only 23,064 tons, against 52,571 tons in 1873. The number of persons employed in 1875 was 113.—*Carboniferous.*

22. New Campbellton Mine, ...*Hon. C. J. Campbell, Baddeck, C. B.*

a. Block of coal, one foot square and two feet high.

The property on which this mine is situated is three square miles in extent, a small proportion being sea area, but easily accessible. It is on the northern side of the great entrance to the Bras d'Or Lake, at the north-west extremity of the Sydney coal field, about thirteen miles, on the course of the beds, from the Sydney mines. The principal seams at present known are three, one of four feet, one of six feet and a third of two feet. Of these the four feet seam, from which by far the largest amount of coal has been taken, is found to be contaminated with earthy and other impurities, which, however, may diminish as the seam is worked farther to the deep.

The six feet seam, where it has been cut by the tunnel, yields a bright clean bituminous coal, but it does not maintain its regular thickness in the exposures yet made. The two feet seam is also a fine bituminous coal, and is very regular. Mining has been carried on to a limited extent, and with occasional intermissions, for the last twelve or fourteen years. The output for 1875 was only 456 tons, and the number of persons employed sixty-five.—*Carboniferous.*

Lignite.

1. Saskatchewan River, N.W.T..... *Geological Survey.*

a. Block of lignite, four feet high and one foot square.

This specimen is from the great lignite bed on the North Saskatchewan River, about seventy-five miles above Edmonton. The bed is seen in two places, eight or ten miles apart, and has a thickness of twenty feet above low water mark; but as the bottom is not seen, its total thickness is not known. The lower exposure is very near the contemplated crossing of the Saskatchewan by the Canada Pacific Railway. The lignite burns freely, with a resinous odour and pleasant flame, leaving a reddish-grey ash. It is dull and black, and often contains mineral charcoal; on exposure it is liable to crack and fall to pieces. An analysis of a specimen by slow coking gave:

Water	10.90
Volatile combustible matter	28.69
Fixed carbon	54.96
Ash	5.45

Large seams are exposed at many other places in this part of the country. On the Brazeau River there are said to be three, from fourteen to twenty-six feet thick. In the bank of the Pembina River, ninety miles west of Edmonton, a seam fourteen feet thick is exposed, and on the Saskatchewan itself, besides the one already described, a number of others, varying in thickness from a few inches, are found, as far down as Victoria. Further south, in the vicinity of the forty-ninth parallel, important beds have been discovered, one of them, at Porcupine Creek, having, according to Mr. G. M. Dawson, a thickness of eighteen feet.—*Lignite Tertiary, or Cretaceous.*

Albertite.

1. Albert Mines, Albert County, N.B. } *Albert Mining Company, Albert Mines, N.B.*

a. Specimens of albertite.

This remarkable mineral, occurring in connection with the calcareo-bituminous shales or pyroschists described further on, was first discovered by accident, about the year 1850, and has been by some regarded as a true coal, by others as a variety of jet, and by others again as more nearly related to asphaltum. It resembles the latter closely in appearance, being very black, brittle and lustrous, with a broad conchoidal fracture, and, like asphaltum, is destitute of structure, but differs in fusibility and in its relation to various solvents. It differs from true coal in being of one quality throughout, in containing no traces of vegetable

tissues, and in its mode of occurrence, as a *vein*, and not as a bed. The vein occupies an irregular and nearly vertical fissure, and varies from one inch to seventeen feet in thickness. It has been mined to a depth of 1,162 feet. The accompanying shales are in some portions abundantly filled with the remains of fossil fishes (*Palæoniscus*), and it is not improbable that it was from these, in part at least, that the mineral was derived, existing perhaps at first in a fluid or semi-fluid condition (in which state it has in some instances become the cementing material of conglomerates), and subsequently being altered into its present form. Vegetable remains are almost entirely wanting in the shales.

Since the first discovery of the Albert mines the amount of the mineral exported, chiefly to the United States, has been very large. The following are the shipments for the twelve years from 1863 to 1874, inclusive:

	Tons.
1863	18,600
1864	19,300
1865	20,500
1866	20,500
1867	17,000
1868	12,400
1869	17,000
1870	6,000
1871	5,500
1872	5,000
1873	6,000
1874	7,000
Total in twelve years	154,800 tons.

The royalty paid to the government up to the first of January, 1866, was $8,089.29.

The mineral has been used in the United States partly for the manufacture of oil, and partly for admixture with ordinary bituminous coals in the preparation of illuminating gas. For either of these purposes it is admirably adapted, yielding 100 gallons of crude oil or 14,500 cubic feet of gas of superior illuminating power per ton. When employed with coal it leaves as a residuum a valuable coke. The marked decrease in the amount exported since 1869 has been due partly to extensive fires in the mines, and partly to a great diminution in the size of the vein. It is, however, hoped that explorations now in progress may result in the discovery of other extensive deposits. The price has varied at different times from $15.00 to $20.00 (gold) per ton. The number of men at present employed in connection with the works is about one hundred and twenty. The freight to Boston is $2.00 or to St. John $1.00 per ton.—*Lower Carboniferous formation.*

2. Albert Mines, Albert County, N.B. } *Belliveau Albertite Mineral Oil Company Westmorland, N.B. & J. Byers.*

a. Specimens of albertite.

Bituminous Shale.

1. Collingwood, O., lot 23, range 3 ..... *Geological Survey.*

a. Bituminous Shale.

The shale of Collingwood, on lot 23, range 3, yields, when distilled, from three to four per cent. of tarry oil, which, by the usual process of rectification, affords oils fitted for illumination and lubrication. Works were erected by Messrs. Pollard & Macdonell, in October, 1859, containing twenty-four retorts, and capable of yielding about 250 gallons of oil daily, by the distillation of from twenty to thirty tons of shale. The available bed of shale is seven feet in thickness, and the material was delivered, broken for the retorts, at twenty cents per ton. The cost of the crude oil was said to be fourteen cents a gallon, and for a while the business was carried on successfully, a ready market being found for the oils; but the works were repeatedly destroyed by fire, and the oils from this source coming into competition with petroleum from the oil wells of Enniskillen, the enterprise was finally abandoned.—*Utica formation, Lower Silurian.*

2. Albert Mines, Albert County, N.B.....*Geological Survey.*

a. Bituminous shale.

3. Albert Mines, Albert County, N.B.....*E.K. Ketchum.*

a. Bituminous shale, (polished).

The bituminous shales or pyroschists, of which numbers 2 and 3 are specimens, occur near the base of the Lower Carboniferous formation in Albert County, New Brunswick, and appear to be somewhat local, not being represented in connection with the rocks of the same formation in other portions of the Province. They are most conspicuous in the vicinity of the celebrated Albert mine, near Hillsborough, and thence extend in two or more belts both to the eastward and westward, having a total length of over fifty miles, and a thickness which is as yet undetermined. The shales are of a remarkably tough, dense and fine-grained character, with a considerable admixture of calcareous matter. They are susceptible of a good polish, and, especially when rubbed, emit a strongly bituminous odor. Their inclination is at some points low, but in general they are highly inclined or even vertical, with numerous corrugations and faults. It is in connection with the latter that they appear to be most highly bituminous, and contain veins of albertite as well as small quantities of petroleum.

Attempts to employ these shales for the manufacture of oils have been made at various times, and somewhat extensive works for the purpose were erected at Baltimore, a few miles distant from the Albert mines, but after a few years operations they were abandoned in consequence of the heavy import duties imposed upon such products in the United States, and the competition of the natural oils then being extensively developed in that country. The yield of oil was somewhat variable, but that of the best bed used at Baltimore was sixty-three gallons per ton. The same shales were capable of yielding 7,500 feet per ton of gas. In the year 1865 about 2,000 tons were removed from similar beds in the County of Westmorland, and exported to the United States, selling in that market for $6.00 per ton.—*Lower Carboniferous formation.*

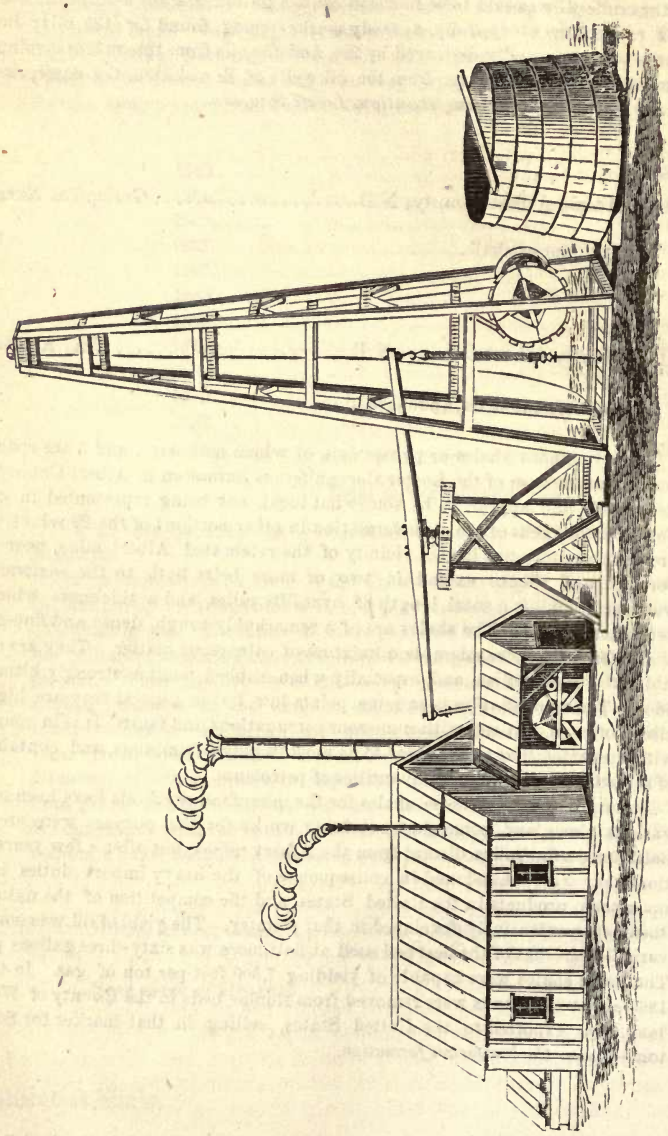
4. South Joggins, N.S.....*Geological Survey.*

a. Bituminous shale (and limestone).

Petroleum.

Ontario Petroleum Region.

VIEW OF FAIRBANKS' PETROLEUM WELL.



1. Atlantic Petroleum Works, London, O ..... *Waterman Bros.*

a. Crude petroleum, ($1.25 per 43 gals)*. 33° Baumé.

b. Benzine ..... 62° "

c. Head-light oil ..... 46° " 175° Vapour test.

e. Tar ..... 22° "

d. Illuminating oil ..... 45° " 150° "
" " ..... 44° " 130° "

f. Engine lubricating oil ..... 27° "
Coach oil ..... 28° "
Wooden-machinery oil ..... 26° "
Wollen-mill oil ..... 27° "
Spindle oil ..... 26° "

g. Pressed paraffin oil ..... 28° "
Pressed " ..... 26° "
Unpressed " ..... 29° "

h. Paint oil.

i. Tanner's oil.

j. Altar candles, ½ and 1 lb. each, in colours ..... 140° melting point.
Ordinary paraffin candles for domestic purposes.. 132° "
" " for railroad cars and carriages. 150° "
Small tapers of various colours ..... 125° "

k. Axle grease.

l. Flour paraffin.
Pure paraffin wax.
Crude paraffin wax.

m. Pyramid of pure wax, 7 feet high ..... 840 lbs.
Statuette, 3 feet high, female figure ..... 180 "
Two pyramids, (small) ..... 100 " each.
Cakes of paraffin wax.

n. Coke from oil, soft.
Coke from tar, hard.

Surface oil and "gum-beds" were known to exist in the southern part of the township of Enniskillen from the time of the first settlement of the western part of Ontario. In 1860, Mr. Williams, of Hamilton, Ont., first obtained petroleum by boring in the underlying rock at this locality, which was then named Oil Springs. It was soon discovered, however, that the best "oil territory" lay a few miles northward in the same township, in the vicinity of the present town of Petrolia. The whole of the surrounding country is very level, with a clay surface. The present oil-producing region around Petrolia has an area of about eleven square miles, with its longer diameter running about N.N.W. The bluish clay of the surface has a pretty uniform depth of about 100 feet, and beneath it the borings penetrate an average thickness of 380 feet of interstratified bluish-grey dolomites, shales and marls (the last being locally known as "soapstone,") to the most

* Wine gallons, one-fifth less than Imperial gallons.

productive stratum, or 480 feet in all. At first many of the wells, both at Oil Springs and Petrolia, flowed spontaneously, but now they all require to be pumped. The oil is accompanied by sulphurous saline water, and has an offensive odour. The difficulty in getting rid of this odour at first stood much in the way of the successful competition of the Canadian petroleum with mineral oils from other countries; but since the refineries have been able to thoroughly accomplish this, it has been acknowledged to be a very superior burning oil.

The rocks penetrated in boring the oil wells belong apparently to the Hamilton and the Chemung and Portage formations, but the petroleum itself is believed to originate in the limestones of the Corniferous formation, which is the next beneath. It has been supposed that the position occupied by the petroleum is the summit of a very flat anticlinal dome.

At present there are about 350 wells capable of producing petroleum, but, owing to the dulness of the market, only about 200 of these are in operation. At one time about 500 small steam engines for boring and pumping were on the ground, but this number is now reduced to between 200 and 300. The oil wells in Ontario have all been bored by the ordinary percussion drill. The accompanying woodcut, representing the old Fairbanks Well at Petrolia, shows the style of the derricks, buildings and tanks used in the Enniskillen oil region. A small proportion of the oil is distilled at Petrolia, but the greater part is refined in London, about fifty miles to the eastward. Here there are fifteen refineries of a total capacity of 12,000 to 15,000 barrels per week, the principal one being the Atlantic Petroleum Works, of which Messrs. Waterman Bros. are proprietors. The total value of the plant, &c., employed in the production of the oil is valued at about $750,000, and of that used in the refining processes at about $550,000, although at one time both were considerably greater. There has also been a falling off in the number of men employed in both processes, the number now being about 500 engaged in connection with the producing, and 300 with refining. Wages are $2.50 per day for drillers, $2.00 for mechanics, and $1.25 for laborers. The amount of oil sent from Enniskillen region previous to 31st January, 1862, was 11,775 barrels. For the year ending 31st January, 1863, the quantity was 82,814 barrels, after which time the yield gradually increased for ten years. The following are the quantities refined in Ontario for the last five years:—

Year ending 30th June,	1871	269,395	barrels of	40 gals.
" "	1872	308,100	"	"
" "	1873	365,052	"	"
" "	1874	168,807	"	"
" "	1875	(about) 210,000	"	"

Latterly, the greater part of the oil has been consumed within the Dominion, only a comparatively small proportion being exported.

In former years, and when petroleum commanded much higher prices than at present, it was sought for by boring in the rock, and obtained in greater or less quantities near Wequamikong, on the Grand Manitoulin Island, in Lake Huron, at Tilsonburg and Bothwell in the western peninsula of Ontario, and around Gaspé Bay in the Province of Quebec. Traces of it have been found in various other parts of Ontario and Quebec; also in Cape Breton, and at Port au Port on the west coast of Newfoundland. The petroleum of Manitoulin Island comes from limestones of the Trenton formation, that of Gaspé, Tilsonburg, Bothwell and Enniskillen, as well as the great natural outflow of the Athabaska River, about to be noticed, is derived, in each case, from rocks belonging to the *Devonian System*.

2. Athabaska River, N. W. Territory..... *Geological Survey.*

a. Specimens of crude petroleum.

b. " inspissated petroleum.

c. Sandstone impregnated with petroleum.

d. Sandstone from above the petroleum.

The occurrence of petroleum or "bitumen" on the Athabaska was recorded by Sir Alexander MacKenzie in 1789, and again by Sir John Richardson in 1851. The first-named author states, on page 87 of his narrative, alluding to the Forks of the Athabaska or Elk River that "At about twenty-four miles from the Forks are some bituminous fountains into which a pole twenty feet long can be inserted without the least resistance. The bitumen is in a fluid state; heated it emits a smell like that of sea coal." And Sir John Richardson says, "The whole country for many miles is so full of bitumen that it flows readily into a pit dug a few feet below the surface."—*Devonian.*

Peat.

1. St. Hubert, Q..... *Canada Peat Fuel Company, Montreal.*

a. Specimens of peat prepared by Hodge's process.

b. Two views of Hodge's peat-cutting machine.

Peat occurs in great abundance in many places in the Dominion, but has never been much worked, except in a few localities south of the River St. Lawrence and not far from Montreal. The bogs which have for some years been worked by the *Canada Peat Fuel Company* are situated at St. Hubert, in Chambly county, about ten miles from Montreal, and at Ste. Brigide, about ten miles from the town of St. Johns, on the Richelieu River. The peat is entirely extracted and prepared by Hodge's machines, of which, in 1875, there were two in use at St. Hubert and one at Ste. Brigide. The two at St. Hubert produced 8,000 tons of peat during the season, and that at Ste. Brigide 5,000 tons, or 13,000 tons in all. A small proportion of this was sold for domestic purposes, chiefly in Montreal, the balance being employed by the Grand Trunk Railway Company in their locomotives. The corresponding production in 1874 is stated to have been about 20,000 tons, most of which was also sold to the Grand Trunk. The season lasts from the first of May to the first of October, during which time from 300 to 400 men and boys are employed. On the ground the peat sells for $3.50 per ton, and in Montreal for from $4.00 to $4.25 per ton. At present the enterprising manager at St. Hubert, Mr. David Aikman, is making experiments, the object of which is to improve the manufacture of the fuel. For further information the reader is referred to the reports of the Geological Survey, and to Percy's Metallurgy, where full details concerning Hodge's process will be found.—*Alluvion.*

2. Huntingdon, Q..... *The Huntingdon Peat Company (limited).*

a. Nine specimens of peat prepared according to "Griffin's patent."

The *Huntingdon Peat Company* commenced operations in 1875, and made about 400 tons of excellent peat on the "Tea Field," four miles from Port Lewis on the

road to Huntingdon, but became insolvent, and were sold out before the autumn. According to Griffin's process the peat is first pulped, then drained in crates made of iron bars set half an inch apart, and finally moulded into bricks.—*Alluvion.*

III.

MINERALS APPLICABLE TO CERTAIN CHEMICAL MANUFACTURES, AND THEIR PRODUCTS.

Iron Pyrites.

1. Elizabethtown, O..... { *Alexander Cowan, Manager of the Brockville Chemical and Superphosphate Works.*

a. Specimens of cobaltiferous iron pyrites.

b. Burnt iron pyrites from the kilns of the acid works at Elizabethtown.

c. Nitrate of soda (South American), used in the production of sulphuric and nitric acids.

d. Nitre-cake, a by-product in the manufacture of sulphuric and nitric acids.

e. Salt from Goderich, Ontario, used in the production of hydrochloric acid.

f. Salt-cake, a by-product in the manufacture of hydrochloric acid.

g. Sulphuric acid (commercial).

h. Nitric acid (commercial).

i. Hydrochloric acid (commercial.)

An important deposit of iron pyrites occurs in connection with the Laurentian quartzites and gneisses of Elizabethtown, near Brockville. It is probably lenticular, but, although it has been worked for several years, its limits have not been reached in any direction. According to the determinations of Hunt and Macfarlane, the pyrites contains about half of one per cent. of oxide of cobalt. Small quantities of both nickel and cobalt have also been recently detected in the pyrrhotine, which is sometimes associated with the pyrites. In 1869 sulphuric acid works were erected in Brockville, about three miles from the pyrites mine. They were, however, destroyed by fire in 1871. The present sulphuric acid works at Elizabethtown were begun in 1872 and completed in 1874. Their capacity is about three tons of acid (66° Baumé) daily. The pyrites averages about forty per cent. of sulphur, and a ton of pyrites produces nearly a ton of acid.

In 1875 the manufacture of both hydrochloric and nitric acid was commenced. The prices of the acids per pound in June last were, sulphuric (66° Baumé) two and a half cents; nitric (36° Baumé) eight and a half cents, and of 48° Baumé twenty to twenty-two cents; hydrochloric two and three-quarter to five cents.—*Laurentian.*

2. Lennoxville, Q., ... *Quebec Advisory Board.*

a. Specimens of iron pyrites.

Pyrrhotine or Magnetic Iron Pyrites.

1. Dalhousie, O., lot 20, range 2..... *W. J. Morris, Perth, O.*

Apatite or Phosphate of Lime.

1. North Burgess, O..... { *Alexander Cowan, Manager of the Brockville Chemical and Superphosphate Works.*

a. Specimens of apatite or phosphate of lime.

b. Apatite ground for conversion into superphosphate.

c. Superphosphate of lime.

Apatite in both beds and veins is very common in the Laurentian rocks of Canada, and has been mined on a small scale for some years. It is generally found in pyroxenic or garnetiferous gneiss, or in crystalline limestone, and deposits several feet in thickness, and almost entirely free from foreign minerals, are of frequent occurrence. When in the form of scattered crystals in limestone it is of little economic value, on account of the difficulty of separating it from its matrix. The best known deposits are in Ontario, in the townships of North and South Burgess and North Elmsley; but important localities have also been discovered in Buckingham and Portland townships, Quebec. As yet underground mining has been attempted in only a few instances, the apatite being chiefly derived from shallow pits and trenches. The deepest mine is on the tenth lot of the sixth concession of North Burgess, where two shafts were sunk in 1873 to depths of one hundred and thirty-five and seventy feet respectively, on veins of sea-green apatite from six inches to six feet in thickness.

The specimens of apatite exhibited by Mr. Cowan are from the seventh concession of North Burgess, where a thousand acres of mining lands are owned by the Brockville Chemical and Superphosphate Company. The superphosphate works of this company are in Brockville, and were established in 1869.

The apatite as it comes from the mines is said to contain an average of about eighty per cent. of phosphate of lime. It is first broken by a small Blake's rock-breaker, then crushed between iron rollers, and, after passing through a series of sieves, to free it from mica, ground between ordinary millstones. The ground mineral is then mixed in an agitator with an equal weight of sulphuric acid of 50° Baumé (from the acid works of the company at Elizabethtown.) From the agitator it is dumped into a car, which in turn dumps it into a series of bins, where it soon solidifies into white honey-combed masses, containing, it is said, as high as twenty per cent. of soluble phosphoric acid. The superphosphate is then broken or ground up in a Carr's disintegrator and put up in barrels for shipment. The price at Brockville is $30.00 per ton of 2,000 lbs.—*Laurentian.*

2. Storrington, O..... *Geological Survey.*

a. Crystal of phosphate of lime.

3. North Burgess, O.....*A. Meighen & Bros., Perth, O.*

a. Specimen of phosphate of lime.

4. North Elmsley, O., lots 25 and 26, range 8.....*George Oliver, Perth, O.*

a. Specimens of phosphate of lime.

5. Buckingham, Q.....*Edmund W. Murray, Buckingham, Q.*

a. Specimen of phosphate of lime.

6. Buckingham, Q., lot 19, range 12.....*Buckingham Mining Company.*

a. Crystal of phosphate of lime.

NOTE.—The following apatite localities are also represented by specimens contributed by the Ontario Advisory Board: Bedford, lots 2 and 3, range 12; North Burgess, lot 2, range 8, lot 4, range 6, lot 9, range 5; Storrington, lot 2, range 8. At the last named place the apatite is associated with hematite and does not occur in sufficient quantity to be of economic importance.

The total quantity of apatite which has been raised in Ontario since it began to be mined about 1863 is probably between 12,000 and 15,000 tons.

Magnesite or Carbonate of Magnesia.

1. Bolton, Q., lot 17, range 9.....*Geological Survey.*

a. Specimens of magnesite.

b. Sulphate of magnesia (*Epsom Salts*) prepared from the Bolton magnesite.

c. Carbonate of magnesia (*Magnesia alba*) " " "

Magnesite forms rock masses associated with the dolomites, serpentines and steatites of the Eastern Townships. In Bolton it occurs on the east side of the Melbourne and Potton anticlinal, in an enormous bed resembling crystalline limestone in appearance. A specimen from this locality was found to contain, besides small quantities of chromium and nickel,

Carbonate of magnesia	59.13
Carbonate of iron	8.32
Insoluble (nearly pure quartz)	32.20
	99.65

In the township of Sutton magnesite occurs on the east side of the Shipton and St. Armand anticlinal. It is here often slaty, and contains an admixture of feldspar and green chromiferous mica. The purest specimens yield over eighty

per cent. of carbonate of magnesia. In the township of Melbourne *magnesitic ophiolites*, or rocks consisting of a mixture of serpentine and magnesite, occur. The use of magnesite for the manufacture of magnesia and magnesian salts is well known.—*Quebec Group, Lower Silurian.*

Calcite or Carbonate of Lime.

1. Five Islands, N.S ..... *Geological Survey.*

   a. Specimen of calcite (dog-tooth spar).

2. Galway, O ..... *Ontario Advisory Board.*

   a. Specimens of calcite.

Chromic Iron.

1. Bolton, Q., lot 23, range 6 ..... *Geological Survey.*

   a. Specimens of chromic iron.

   A bed occurring in serpentine and stated by Sir William Logan to have a thickness of from one to two feet. The ore occurs in detached masses of from fifty to 1,000 pounds in weight.—*Quebec Group, Lower Silurian.*

2. South Ham, Q., lot 4, range 2 ..... *Geological Survey.*

   a. Specimens of chromic iron.

   From a bed occurring in serpentine. About ten tons of the ore, yielding forty-five per cent. of chromic oxide, were many years ago shipped to England, but since then the deposit has not been worked.—*Quebec Group, Lower Silurian.*

Oxides of Manganese.

1. Markhamville, King's County, N. B ..... *Alfred Markham, Esq.*

   a. Specimens of pyrolusite and manganite.

   Deposits of oxides of manganese, consisting chiefly of pyrolusite, but containing more or less manganite, are not of uncommon occurrence in connection with the rocks of the Lower Carboniferous formation in New Brunswick, and have been mined to a greater or less extent at several points, such as Markhamville, Quaco, and Shepody Mountain. At each of these localities the mineral is met with in connection with limestones lying at or near the base of the series, being distributed through the latter partly in the form of veins, but chiefly in irregular masses or "pockets", some of which are of remarkable richness.

The most important deposits which are at present being worked are those of Markhamville, under the direction of the Victoria Manganese Company. These were first opened in 1863, since which time about 6,000 tons of ore have been removed, the annual production varying from 500 to 1,500 tons. Owing to the mines being eleven miles from railway transport, the ore is subject to a cartage of $3.00 per ton, but is, notwithstanding, profitably worked. The price, delivered at Sussex Station, on the Intercolonial Railroad, varies, according to quality, from $15.00 to $50.00 per ton.

Manganese is also met with to a limited extent near Bathurst in slates which are probably of Silurian age, and also in some of the Huronian rocks of King's County.—*Lower Carboniferous.*

2. Teny Cape, N.S.. ..... *G. Brown, N.S.*

a. Specimens of pyrolusite.

The Lower Carboniferous limestones of Hants and Colchester counties, Nova Scotia, often contain manganese ores in irregular veins and nodules, and at Teny Cape, in the former county, some years ago, considerable quantities of ore were extracted, and a number of shipments made to England. The mineral was there considered to be of excellent quality and found ready sale at from £8 to £9 per ton.—*Lower Carboniferous.*

IV.

MINERAL MANURES.

Gypsum.

1. Salt River, 100 miles N. W. of Fort Chippewyan..... *Geological Survey.*

a Gypsum.

2 Paris, O..... ....*Wm. Coleman.*

a. Gypsum.

b. " prepared for agricultural purposes.

c. Fibrous gypsum.

d. Prepared plaster for stucco work.

These specimens are from the plaster mills of Mr. Wm. Coleman, where the average quantity of plaster made for agricultural purposes is about 5,000 tons, or 40,000 barrels a year, which sells for ninety cents per barrel. The fine plaster, of which from fifty to five hundred barrels are made annually, is prepared from fibrous gypsum; it sells for ninety-five cents per barrel.—*Onondaga formation.*

3. Mount Healy, O.....*Ontario Plaster Co.*

a. Gypsum.

b. Rocks immediately overlying and underlying the gypsum.

c. Calcined plaster.

d. Land "

The Ontario Plaster Company is producing annually about the following quantities of plaster at the mines of

A. W. Thompson, N Cayuga	1,500 tons.
Alex. Taylor, North Cayuga	2,000 "
Thos. Martindale, Oneida	2,000 "
W. Donaldson & Co., Oneida	1,000 "
Other mines together	3,000 "
	9,500 "

About 1,000 tons of the above is calcined; the rest being used in the raw state for agricultural purposes.

The following are the prices obtained:

Raw plaster for land	$4 per ton.
Raw plaster for calcining	$5 " "
Calcined plaster	$2 per barrel.

The gypsum or "plaster" deposits of Ontario belong to the Onondaga formation, and are therefore much older than those of Nova Scotia and New Brunswick which are of Lower Carboniferous age. The Onondaga formation, which is extensively developed in northern New York, crosses the Niagara River into Canada, and extends north-westward to Lake Huron, a distance of 150 miles, again appearing at the Straits of Mackinac between Lake Huron and Lake Michigan. It not only affords gypsum, but is also the source of valuable brine springs, and includes magnesian limestones which are often suitable for the manufacture of hydraulic cement. The principal gypsum mines worked are along the Grand River, between Cayuga and Paris, a distance of thirty-five miles. The mineral here occurs in lenticular masses varying from a few yards to a quarter of a mile in horizontal diameter, and from three to seven feet thick. Dolomite is found immediately above and below the gypsum, and is sometimes interstratified in thin beds with it. That above is often arched, forming domes or mounds at the surface indicative of gypsum beneath.—*Onondaga formation.*

4. Tobique River, Victoria County, N.B.....*John Edgar.*

a. Crude gypsum.

The deposits of gypsum occurring in New Brunswick are wholly confined to the Lower Carboniferous formation, and are both numerous and extensive. The largest ones at present known are those of Hillsborough in Albert county, where extensive quarries have been opened, and whence enormous quantities have been and are still being removed for calcination and exportation. The mineral is usually met with in very irregular masses, associated with red marls, sandstones and limestones, at or near the summit of the series, and varies much in character. Thus at Hillsborough, in the quarries now being worked, there is exposed a total head of rock of from ninety to one hundred feet, of which about seventy, forming the upper portion, consist mostly of "soft plaster" or true gypsum, which rests

on beds of "hard plaster" or anhydrite, of unknown depth. At the same point considerable masses of a very beautiful snow-white gypsum or alabaster are also met with, associated with the varieties named above, but comparatively little selenite; while at Petitcodiac, where the deposit has a breadth of about forty rods, and a total length of about one mile, the whole is fibrous and highly crystalline, and traversed by a vein of nearly pure selenite, eight feet wide, through its entire extent. The rock on the Tobique River, which rises in bluffs along the stream some thirty miles above its mouth, is mostly soft, granular or fibrous, and of a more decidedly reddish colour than in the localities first described.

With the exception of the Hillsborough rock, the gypsum from the localities above noticed is employed simply for application to the soil, and mostly for local use; from Hillsborough, however, where extensive works have been in operation for a number of years, large quantities are annually exported, both in the raw and calcined condition. The present productive capacity of these works is about 600 barrels per diem, giving employment in the quarries and mills to about one hundred and twenty-five hands.

The price of the Hillsborough plaster, crude, ground, is at present seventy-five cents per bbl., duty free, while that of the calcined is $1.10 per bbl., subject in the United States to a duty of twenty per cent. The rock from Petitcodiac, delivered on the Intercolonial R.R. is seventy cents per bbl., or forty cents per bbl. in bulk.—*Lower Carboniferous.*

5. Petitcodiac, Westmorland County, N.B.....*Amasa Brown.*

a. Crude gypsum (fibrous).

b. Prepared gypsum, ground for land.

c. Selenite.

6. Hillsborough, N.B.....*Albert Manufacturing Co.*

a. Blocks of gypsum.

b. Calcined gypsum (from *a.*)

c. " " after setting.

d. Cube of laminated gypsum.

e. " " anhydrite.

f. Alabaster.

7. Wentworth, Hants County, N.S.....*S. H. Sweet.*

a. Gypsum for calcining.

b. Anhydrite.

c. Blue gypsum used for agricultural purposes.

d. Gypsum containing nodules of ulexite, howlite and cryptomorphite.

In connection with the Lower Carboniferous limestones of Nova Scotia there are enormous deposits of gypsum, alternating or in some cases mixed with anhydrite. The gypsum is known as *soft plaster* and is classified as *white* and *blue*, the

former being best adapted for calcining, while that which is of a blue or grey colour answers as well as the white for agricultural purposes. On account of its greater hardness the anhydrite is known as *hard plaster*, and is generally regarded as a waste product of the quarries, although occasionally employed for structural purposes. To give an idea of the thickness of the deposits it may be mentioned that there are cliffs of solid snowy white gypsum from 100 to 200 feet high. Considerable quantities have been quarried for many years, the largest proportion being shipped to the United States. In 1875 the shipments to the United States amounted to 95,159 tons, valued at $95,907. The specimens exhibited from Wentworth are from important quarries owned by Mr. Sweet, and only a mile distant from the point of shipment.—*Lower Carboniferous.*

8. Montague, Hants County, N.S..... *Joseph McLennan.*

a. Gypsum.

The Montague quarry has only been recently opened. The deposit of gypsum is supposed to be the lowest bed in the series in the Windsor trough. It rests on coarse grits which repose on the black slates overlying the gold-bearing rocks.—*Lower Carboniferous.*

9. Newport, N.S.....*Nova Scotia Advisory Board.*

a. Gypsum.

10. Shubenacadie, N.S.....*Nova Scotia Advisory Board.*

a. Gypsum.

9. Claremont Hill, N.S.....*James Cove.*

a. Gypsum.

This locality is about a mile and a half south of Salt Springs station on the Intercolonial Railway. Quantities have been dug for local use for the last thirty years.—*Lower Carboniferous.*

11. Oxford, River Philip, N.S.....*A. J. Hill, C.E., Sydney, Cape Breton.*

a. Selenite or foliated gypsum.

b. Massive gypsum.

The selenite occurs in a cliff fifteen to twenty feet high, associated with red clay, soft red and greenish sandstones, and considerable quantities of massive gypsum. River Philip flows at the base, and undermines the cliff, so that large quantities are constantly falling. Vast deposits of gypsum occur in this vicinity, and stretch eastward across the country to and beyond the Pugwash River, and westward

towards Springhill. Near it are found the grey and red sandstones of the Millstone grit formation, and coarse conglomerates which also occur six miles below Oxford. Brine lakes and springs also occur near the river, which never freezes.—*Lower Carboniferous.*

12. Plaster Cove, Wallace Harbor, N.S.....*C. A. Fulton.*

a. Specimens of massive white gypsum.

Mr. Fulton's quarry is situated between a quarter and a half a mile from the shipping ground. The gypsum is sold to vessels calling for $1.00 per ton, though contracts would be made to deliver large quantities (1000 tons or over) for eighty cents a ton. The cost of carriage to Quebec is generally about $2.80 per ton, and the mineral sells there for from $3.75 to $4.00 per ton.—*Lower Carboniferous.*

13. Black River, N.S.....*Henry A. Davison, Glenville, N.S.*

a. Gypsum.

This locality is a mile and a half east from Salt Springs station on the Intercolonial Railway. Five hundred barrels were calcined here in 1874, and one hundred barrels up to August in 1875. A few hundred barrels were previously sold on the ground at eighty cents per barrel.—*Lower Carboniferous.*

14. Antigonish, N.S.....*John A. Converse, Montreal.*

a. Gypsum.

b. Plaster of Paris.

c. Ground gypsum ready for calcining.

Mr. Converse calcines at his works in Montreal six charges of twenty barrels each in twenty-four hours. The plaster sells for $2.60 per barrel in small lots and $2.00 in quantities of fifty or more barrels.—*Lower Carboniferous.*

15. Bras D'Or Lake, C.B .....*R. N. McDonald, International Mine, C.B.*

a. Gypsum.

The gypsum above Big Harbor, four miles from Baddeck, does not, it is stated, usually occur in regular layers. Where the stratification is evident the deposit is thin and of no great importance. In some places it has a face of 200 feet; in others it is nipped out, being surrounded by clay. About 10,000 tons have been shipped this year. All the gypsum raised during the past two years has been sent to New York, where it is used in the finishing of houses, &c. Other quarries have been opened in the neighborhood, from which a large quantity has been exported.—*Lower Carboniferous.*

16. Cape Breton.....*Nova Scotia Advisory Board*

a. Gypsum.

Shell Marl.

Rockwood, O..... *Geological Survey.*

a. Shell marl.

This is from a stratum three feet thick underlying three feet of peat in the neighbourhood of the Eramosa branch of the Green River.—*Alluvion.*

Belleville, O..... *H. Yeomans, Belleville, O.*

a. Shell marl.

This deposit does not appear to be extensive. The shells observed are a *Valvata, Pisidium Virginicum,* and an undetermined *Limnæa.*—*Alluvion.*

Hungerford, lot 33, range 1..... *Ontario Advisory Board, Toronto.*

a. Shell marl.

The deposits of this substance are very common throughout eastern Ontario, forming the beds of many lakes.—*Alluvion*

V.

MINERAL PIGMENTS AND DETERGENTS.

Iron Ochres, &c.

1. Walsingham, O., lot 12, range 14..... *Buchanan Mineral Co., Hamilton, O.*

a. Raw ochre, yellow.
b. Prepared yellow, " metallic."
c. Raw sienna.
d. Prepared brown, " metallic."
e. " red, "
f. Burnt sienna.
g. Prepared stone drab.
h. " yellow "
i. " pink "

2. Brantford, O., lot 3, range 2..... *G. B. Hall, Quebec.*

a. Crude black ochre.

b. Prepared do.—*Alluvion.*

3. Limehouse, O.....*James Newton.*

a. Crude rock used for making raw sienna, six specimens.

b. Raw sienna.

c. Prepared sienna.

d. Slate drab.

e. Stone drab.

f. Dark chocolate.

g. Light chocolate.

h. Light brown.

i. Raw umber.

j. Brown umber, prepared.

The minerals from which these paints [with the exception of one which is obtained at Conestogo] are manufactured, are from the vicinity of Limehouse. Mr. Newton says he can produce about 450 tons per annum. The works have been in operation two years. The following is a list of colours and prices communicated by Mr. Newton:—

No. 1.	Dark chocolate	¾ cent per lb.
2.	Light brown	¾ "
3.	Chocolate	¾ "
4.	Stone drab	¾ "
5.	Slate drab	¾ "
6.	Pink drab	¾ "
7.	Raw sienna	1¼ "
8.	Burnt umber	3½ cents "
9.	Raw umber	2 "

A reduction of ten per cent. is made on wholesale orders.—*Clinton formation.*

4. Mallorytown, O .....*Leeds Paint Manufacturing Co.*

a. Raw ochre.

b. Prepared yellow ochre.

c. " burnt "

d. Raw light Spanish-brown.

e. Prepared " "

f. Raw Spanish-brown for fire proof paint.

g. Leeds brown.

h. Raw brown umber.

i. Prepared "

The mills of the Leeds Paint Company are situated in the township of Young, and have a capacity of five tons of pigments per day.—*Alluvion.*

5. Elzevir, O., lots 8 and 9, range 5.....*Merrill and Flint, Belleville, O.*

a. Iron ochre, purplish-brown.—*Alluvion.*

6. Pointe du Lac, Q.....*Geological Survey.*

a. Crude iron ochre.

b. Prepared " "

An ochre bed, of about 400 acres in extent, is situated on the St Nicholas range of Pointe du Lac Seigniory, on the property of Mr. Pierre Chaillon and his brother.

Its thickness varies from six inches to four feet, and it may have an average of about eighteen inches. Its prevailing colors are red and yellow, but there occurs also in some parts a beautiful purple ochre, and in others a blackish-brown. In 1851, Messrs. H. A. Monroe & Co., of New York, made arrangements to prepare the ochres for sale. Two furnaces were erected in the vicinity of the ochre bed, and an agent established to carry out the details of the manufacture, and to attend to the forwarding of the prepared ochre to New York, where the sale of it was effected. From the natural tints that have been mentioned, eight colors are said to have been prepared. The blackish-brown variety is scarcer than the others, and affords colors of a more valuable description. Purified from sods, without fire, it is sold under the name of raw sienna; and is admirably adapted for graining. When subjected to fire, it assumes a brown of less intensity, and is sold as burnt sienna. As it does not turn red by burning, it is probable that there may be in this ochre an admixture of manganese.—*Alluvion.*

7. Three Rivers, Q.....*John McDougall & Sons, Three Rivers, Q.*

a. Iron ochre, yellowish-brown.

This specimen is for convenience classed with the ochres, intended to be used as pigments, although it is exhibited by the Messrs. McDougall as a material for the purification of coal gas.—*Alluvion.*

8. Cap de la Madelaine.....*Geological Survey.*

a. Greenish-black ochre.

b. Yellow ochre.

c. Burnt "

In the St. Malo range of the seigniory of Cap de la Madelaine, about two miles below the church, and two miles back from the St. Lawrence, there is a deposit of ochre, extending over about 600 square acres. It is interstratified with peat, and underlaid by shell marl, which in successive borings along a transverse section from S. E. to N. W., were found to be arranged as follows, in descendingorder,—ochre, peat, and marl being indicated by the letters O, P, M:—

Paces, 50	100	145	181	281	441
Ft.in.	*Ft.in.*	*Ft.in.*	*Ft.in.*	*Ft.in.*	*Ft.in.*
O, 0 6	O, 2 0	O, 1 6	O, 2 0	P, 9 0	O, 2 9
P, 0 6	P, 4 0	P, 8 0	P, 4 0	M, 0 6	P, O, P, M, 7 0
O, 0 6					
P, 2 0					
3 6	6 0	9 6	6 0	9 6	9 0

In the remaining 320 paces the ochre is wanting, and we have twelve feet of peat, gradually thinning out. A very great quantity of red and yellow ochres might be obtained from this locality, and where the ochre is mixed with the peat, masses of the mixture might be cut out and dried, and afterwards burned. Experiments on a small scale show that the quantity of peat in the mixture is often sufficient to calcine the ochre.—*Alluvion.*

9. Montmorency Falls, Q.....*G. B. Hall, Quebec.*

a. Yellow ochre.—*Alluvion.*

10. Ste. Anne de Montmorenci, Q..... *Geological Survey.*

a. Brownish ochre.

b. Brownish-black ochre.

c. Yellow ochre.

This deposit of ochre is situated about a mile and a quarter above the mouth of the Ste. Anne River. It appears to extend over about four square acres. The locality is on the top of a bank, overlooking the main road, from which it is distant about a quarter of a mile. The surface of the bed has a slope to the south-east of about fifty feet in one hundred and fifty yards, but its bottom keeps nearly level with the lower side for some distance back and then rises quickly to the higher side. The thickness of the deposit is thus seventeen feet in the deepest part, and varies from that to four feet. Its form gives great facilities for excavating the ochre, as by beginning on the lower side a considerable face of it would be exposed, and the water would run from it without the necessity of cutting drains. The three colours exhibited occur at the surface, but the lower and by far the larger part is of a pale green colour. In this green portion the iron is in a lower state of oxidation than in the yellow, but is peroxydized by ignition in the air, and a red colour produced.—*Alluvion.*

11. Etchemin, Q.....*G. B. Hall, Quebec.*

a. Burnt ochre.—*Alluvion.*

12. Pudsey's Point, N.S.....*Capt. W. Edgett, Apple River, N.S.*

a. Iron ochre.—*Alluvion.*

Barytes or Heavy Spar.

1. Jarvis Island, Lake Superior.....*McKellar Bros., Fort William, L.S.*

a. Specimen of barytes, weighing about 100 lbs.

Jarvis Island is situated near the north-west shore of Lake Superior, between Thunder Bay and Pigeon River. The vein from which the specimen comes is about ten feet thick, and has been worked for silver to a depth of about 150 feet. Other barytes veins occur on the adjacent island, the principal one being on McKellar's Island, one mile south of Pie Island, where a vein forty-five feet in width

occurs,one-third of which consists of white barytes in bands from two to six feet thick, parallel to the walls of the vein, the remainder of which is crystalline calc-spar holding some silver glance and native silver.—*Nipigon or Copper-bearing Series.*

2. Galway, O..... *Ontario Advisory Board.*

a. Barytes.

3. Galway, O..... *Galway Lead Mining Co., Peterborough.*

a. Barytes.

4. North Burgess, O..... *Geological Survey.*

a. White barytes.

5. Hull, Q, lot 7, range 10..... *Geological Survey.*

a. Barytes, crushed.

A beautiful vein of this mineral occurs on the west half of the seventh lot in the tenth concession of the township of Hull four miles from the Gatineau River. It varies in width from two to three and a half feet, and was traced for upwards of 100 yards in a N. N. W. direction. The adjacent rock is a highly crystalline white limestone striking N. 22° 30′ E. and dipping to the south-eastward at a steep angle. The barytes is of an opaque white colour, and is associated with sea-green fluor-spar, which occurs chiefly towards the outer edges of the vein. This fluor-spar is hardly in sufficient quantity to detract from the value of the barytes, besides when ground it forms a powder almost as white as the latter.—*Laurentian.*

6. Five Islands, N.S..... *Dolphin Manufacturing Co., St. Catharines, O.,*

a. Crystallized barytes.

This is used in the manufacture of paint by the "Dolphin Manufacturing Co." of which Mr. G. M. Bligh is the manager. The barytes is obtained at Five Islands, but the Colour and Chemical Works of the company are at St. Catharines, Ont.—*Lower Carboniferous.*

7. Bass River, Five Islands, N.S.....*James H. Ackerly, Five Islands, N.S.*

a. Barytes with copper ore.

This mine is situated two miles up Bass River, and is owned by Messrs. Copland, Leaman, Holmes and Daniels of Boston. Eight hundred tons of crude barytes were shipped in 1874-5 at a market value of $10.00 per ton; when ground it is said to be worth $30.00 per ton.—*Lower Carboniferous.*

Soap-clay.

1. Fort Edmonton, N.W.T..... *Geological Survey.*

a. Specimen of so-called soap-clay.

Like Fuller's earth this clay has the power of removing grease from woollen goods, and is said to have been used at the fort for washing blankets. It forms a layer eight or ten inches thick, immediately above a coal seam on the left bank of the Saskatchewan, a short distance below Edmonton. Essentially it is a hydrous silicate of alumina.—*Cretaceous*

VI.

SALT, BRINES, AND MINERAL WATERS.

Salt and Brine.

1. Salt River, 100 miles N. W. of Fort Chippewyan..... *Geological Survey.*

a. Native salt.

The salt at this place exists in immense quantities, and is obtained by simply breaking the crust and shovelling it into bags.—*Devonian.*

2. Kincardine, O..... *Bruce Salt Co.*

a. Fine salt.

b. Coarse salt.

c. Brine.

The value of the plant and works of this Company in 1874 was $28,000. The number of hands employed was twenty-five, and the pay-roll $877.50 per month. The total quantity of salt manufactured in 1873 was 21,000 barrels, which sold for one dollar per barrel, the greatest part going to the United States. The average production in 1875 was 150 barrels per day, consuming in the evaporation about twelve cords of wood. The price per barrel in 1874 was ninety-two cents, and for 1875, eighty cents per barrel.—*Onondaga formation.*

3. Kincardine, O..... *Gray & Scott.*

a. Fine salt.

b. Sample from sand pumps.

This firm manufactures three kinds, fine, coarse, and dairy salt. The production is about 600 barrels per day, worth on an average seventy cents per barrel. The amount manufactured in 1873 was 26,000 barrels. The value of the plant and works in 1874 was $50,000, the number of hands employed twenty, and the monthly pay-roll, $782.00. The works are in operation only seven months out of the twelve —*Onondaga formation.*

4. Goderich, O.....*Samuel Platt.*

a. Fine table salt.

Analysis of *a.**

Sodium chloride	98.4238
Calcium sulphate	1.0426
Magnesium chloride	0.0915
Water	0.6483
Insoluble matter	0.4200
	100.6262

The capacity of this establishment is 15,000 barrels fine salt per annum.

5. Goderich, O.....*Tecumseh Salt Works.*

a. Fine salt.

b. Brine.

Mr. Neibergall, who is the proprietor of these works, produces about 150 barrels of salt per day, worth about eighty cents per barrel.

The total production in 1873 was 20,000 barrels with a value of one dollar per barrel, and 18,000 barrels were sent to the United States. The value of the the plant and works in 1874 was $28,000, and the number of hands employed seventeen. The works have a capacity of 300 barrels per day.—*Onondaga formation.*

6. Goderich, O.....*Harrison & Evans.*

a. Salt.

7. Goderich, O.....*International Works.*

a. Fine salt.

b. Extra fine salt.

c. Coarse salt.

d. Brine.

Analyses of *a. b.* and *c.*

	a.	*b.*	*c.*
Sodium chloride	98.0253	98.0947	97.3039
Calcium sulphate	1.7918	1.2574	1.4316
Magnesium chloride	0.0480	0.0010	0.0436
Water	0.4991	1.2610	0.6454
Insoluble matter	0.0100	.....	.....
	100.3742	100.6141	99.4245

These works are under the management of Mr. Peter McEwin, and are on a very large scale. The pumping capacity is 44,000 gallons of brine per hour, and the production of salt as high as 800 barrels per day. From the tables compiled by Mr. Lionel Smith, we find that the value of the plant and works was $75,000 in 1874. Forty hands are employed, and the pay-roll amounts to $1,435.20 per month. Work is carried on during only six months of the year. The average price of the salt is seventy-five cents per barrel.

*This and all the following analyses of salt were made by Dr. Ellis, of Toronto, for the Ontario Advisory Board.

8. Clinton, O.....*Stapleton Salt Works, Clinton, O.*

a. Dairy salt.

b. Fine salt.

c. Coarse salt.

Analyses of *b.* and *c.*

Sodium Chloride	98.5743	97.4756
Calcium Sulphate	1.1554	1.3899
Magnesium Chloride	0.1368	.....
Water	0.7944	0.9830
Insoluble matter	0.0600	0.2200
	100.7209	100.0685

These works are under the management of Mr. R. Ransford, and during the twelve months ending May, 1875, produced 50,000 barrels of salt, which sold for seventy cents per barrel. The yield has been steadily increasing, the production in 1873 having been 40,000 barrels, which was disposed of in Canada at an average price of ninety cents per barrel.

9. Seaforth, O.....*Coleman & Gouinlock.*

a. Ground table salt.

b. Common fine salt.

c. Coarse salt.

d. Dairy salt.

e. Brine.

f. Salt cake from salt pans.

Analyses of *b.*, *c.* and *d.*

	b.	*c.*	*d.*
Sodium chloride	97.8401	98.2778	98.7393
Calcium sulphate	1.1568	1.2515	1.3642
Magnesium chloride	0.0480	0.0078	0.0168
Water	0.9095	0.6832	0.3289
Insoluble matter	0.0150	0.0160	0.0170
	99.9694	100.2363	100.4662

The value of the plant and works owned by this Company in 1874 was $5000. there was a force of thirty-three hands, working eight months, and a pay-roll of $1,158.30 per month. The quantity of salt manufactured in 1873 was 57,076 barrels, which sold at an average price of ninety-six cents per barrel. The production is annually increasing, being for the past year from 90,000 to 100,000 barrels.—*Onondaga formation.*

10. Seaforth, O.....*Merchants Salt Company.*

a. Salt.

The production of salt by this Company in 1873 was 50,000 barrels, valued at $47,500. The value of the plant and works in 1874 was $45,000, the number of hands employed twenty-six, and their pay-roll $912.60 per month, working eight months in the year. The greater part of the salt was sold in Canada, only 3 500 barrels, going to the United States. The daily capacity of the works is 300 barrels per day.

11. Seaforth, O..... *Gray & Sparling.*

a. Fine salt.

b. Coarse salt.

Analyses of *a.* and *b.*

	a.	*b.*
Sodium chloride	98.46	95.8838
Calcium sulphate	1.29	1.3230
Magnesium chloride	0.00	0.2660
Water	0.58	2.3946
Insoluble matter	0.04	0.0010
	100.37	99.8684

NOTE.—From the carefully compiled tables of Mr. J. Lionel Smith, we learn that in 1874 the capital invested in the salt interest in Ontario was $624,000, the value of plant and works being $571,838. The total production of fine salt in 1873 was 438,076 barrels, and of coarse salt 13,500 barrels, valued at $436,218; of which 226,576 barrels were sold in the Dominion and 225,000 barrels in the United States. There were also manufactured about 3,040 tons of land salt, valued at $8,360. The consumption of wood for that year was 50,635 cords, valued at $143,096, and the amount paid for wages was $89,524.24. Since that time, owing to various causes, the price has declined, but at many of the wells the returns show a considerable increase in the production, though the absence of official returns for the past two years renders it difficult to make a complete report for that period. The surface-rock in the Ontario salt region belongs to the Corniferous formation, although the brine is believed in all cases to come from the underlying Onondaga formation.

12. Sussex, N.B..... *Geological Survey.*

a. Salt.

b. Brine.

c. Residue from crystallizing pans.

d. Salt scales.

Brine springs of greater or less strength occur at several places in King's County. They are supposed to be derived from a series of bright red sandstones and brownish-red shales, forming one of the upper members of the Lower Carboniferous formation. The brine obtained from them has been employed for the separation of the contained salt at the locality above-named since 1827, but only in a very rude and uneconomical way, there being no concentration previous to boiling, and great waste of heat from improper construction of the ovens. The quantity manufactured per year is very variable; under favourable circumstances, however, it reaches sixty to seventy bushels per week, but might readily be increased to 300 bushels per week. Its consumption is entirely local, chiefly in the manufacture of butter, for which it is preferred by the farmers to all imported salts. The price at Sussex is $1.20 per bushel, or $4.00 per barrel of four bushels.—*Lower Carboniferous.*

13. Apohaqui, N.B..... *Joseph F. Sharp.*

a. Salt.

14. Cardwell, N.B..... ....*Thomas Mercer.*

a. Salt.

15. Salt Springs, Cumberland County, N.S..... *J. Hickman, Amherst, N.S.*

a. Saline water.

This water is from a spring 2¼ miles east of Springhill Mines. Salt has been manufactured here in a small way for about twenty years. The yield of salt is one bushel from 100 to 120 gallons of brine.—*Carboniferous.*

Mineral Waters.

1. Goderich, O.....*Geological Survey.*

a. Mineral water from the Harbor well.

2. Paris, O.....*Geological Survey.*

a. Mineral water (sulphur).

This water was obtained from a spring on the property of Mrs. Capron, near Smith's Creek bridge. It has not been analyzed.

3. St Catherines, O.....*Geological Survey.*

a. Mineral water (saline.)

4. Gillan's Spring, Pakenham, Fitzroy Township, O.....*Geological Survey.*

a. Mineral water, (saline).—*Calciferous formation.*

5. Caledonia Springs, O.....*J. A. Gouin & Co., Caledonia Springs.*

a. Mineral water, (gas).

b. " " (saline).

c. " " (sulphur).

The following analyses of these different waters were made many years ago by Dr. T. S. Hunt.

	1	2	3
Chlorid of sodium	6.9675	6.4409	3.8430
" " potassium	.0309	.0296	.0230
Bromid of sodium	.0150	.0169	.0100
Iodid " "	.0005	.0014	traces
Sulphate of potash	.0053	.0048	.0183
Carbonate of soda	.0485	.1762	.4558
Carbonate of lime	.1480	.1175	.2100
" " magnesia	.5262	.5172	.2940
" " iron	traces	traces	traces
Alumina	.0044	undet.	.0026
Silica	.0310	.0425	.0840
In 1000 parts water	7.7773	7.3470	4.9407
Specific gravity	1006.2	1005.8	1003.7

(1) Caledonia Gas Spring. 2. Saline Spring. 3. Sulphur Spring.—*Trenton formation.*

6. St. Francis Springs, Q.....*J. A. Gee, Melbourne.*

b. Mineral water, (saline).—*Quebec Group.*

VII.

MATERIALS APPLICABLE TO COMMON AND DECORATIVE CONSTRUCTION.

BUILDING STONES, MONUMENTS, &c.

Limestones.

1. Texada Island, B.C .....*Geological Survey.*

a. Two six-inch cubes of limestone, dressed.

At the north-western end of Texada Island, crystalline limestones are well exposed along the coast, for a distance of about seven miles. They are white dove-grey, and bluish in colour, and resemble those of Mount Mark on Vancouver Island; some of the white, however, being of rather finer texture. The beds are traversed by numerous joints, so that in most places it would be difficult to obtain sound blocks of large dimensions.—*Carboniferous?*

2. Goderich, O.....*John Hyslop.*

. A six-inch cube of limestone, dressed.

There are about thirty feet of this stone exposed in a cliff at Mr. Hyslop's quarry, in beds from three to six feet thick, and large blocks can be easily obtained. The annual production varies according to the demand, being from 1,000 to 3,000 cords. At the quarry, rubble sells for $2.00 per cord, and stone fit for dressing for $6.00 per cord. The stone makes good lime, but is chiefly used for building purposes. The piers of the Maitland Bridge at Goderich and the Goderich jail are built of it.—*Corniferous formation, Devonian.*

3. St. Mary's, O..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

4. Downey's Rapids, Hog Lake, O..... *Wallbridge Bros., Belleville.*

a. Two six-inch cubes of limestone, dressed.

b. Window sill.

These limestones are from an escarpment about one hundred feet high which runs along the south shore of Hog Lake. The pale drab specimen is from near the base of the escarpment, and occurs in a bed twelve to fourteen inches thick. Its geological horizon is probably the same as that of the lithographic stone of Marmora. The brownish-grey limestone is from a bed between eighty and a hundred feet higher in the series, the intervening beds being of poor quality. The window sill is from the same escarpment. Small quantities of these stones have been quarried and used in the construction of Wallbridge's mills at Downey's Rapids. Window sills or stones for coping can be obtained more than ten feet in length.—*Birdseye and Black River formation, Lower Silurian.*

5. Lanark Village, O..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

This building stone is obtained from a band of Laurentian limestone supposed to be over 1,000 feet thick. At its base it is thinly-bedded, and affords large flagstones, which are employed at Lanark for hearths and doorsteps. The beds gradually thicken, however, to about three feet, and blocks of this thickness and any required length and breadth can be obtained. The limestone is underlaid by hornblende rocks and diorites, and succeeded by a dolomite containing large quantities of tremolite. Like the Arnprior limestone, which is probably an extension of the same band, it displays a banded or barred structure, the alternate layers being white and grey. The latter owe their colour to finely disseminated graphite. The following analyses show that the limestone is somewhat magnesian, and also that the grey layers are more highly magnesian than the white:

	White band.	*Grey band.*
Carbonate of lime.....	90.38	77.39
" " magnesia.....	8.32	20.57
" " iron.....	0.52	0.78
Graphite.....	none	0.16
Insoluble.....	0.90	1.26
	100.12	100.16

It has been employed for building purposes both in Lanark and Perth, and for culverts on the road between these places.—*Laurentian.*

6. Ramsay, O., lot 25, range 6..... *Geological Survey.*

a. A six-inch cube of serpentine limestone, dressed.

This handsome stone has never been quarried, but could be obtained in blocks of large size.—*Laurentian.*

7. Ramsay, O., lot 24, range 8..... *Geological Survey.*

a. A six-inch cube of crystalline limestone, dressed.

The quarry from which this stone is derived is situated close to the Indian River. Here the limestone occurs in great thickness. It is white, highly crystalline, and contains scales of graphite. It has been extensively quarried for lime burning, and small quantities have been employed in Pakenham and Almonte for foundations and facings of buildings.—*Laurentian.*

8. Ramsay, O., lot 7, range 4..... *N. Lavallée, Carleton Place.*

a. A six-inch cube of crystalline limestone, dressed.

9. Pakenham, O., lot 3, range 6..... *Geological Survey.*

a. A six-inch cube of serpentine limestone, dressed.

The band of limestone from which this block was taken is largely developed on the third lot of both the fifth and sixth concessions of Pakenham, and is associated with rust-coloured hornblendic gneiss. It has never been quarried for building purposes, but, notwithstanding its being serpentinous, is locally employed for making lime. Blocks of any required size for building purposes could be readily obtained When polished it makes a handsome marble.—*Laurentian.*

10. McNab, O., lot 11, range 3..... *Eric Harrington, Arnprior.*

a. A six-inch cube of limestone, dressed.

Among the limestones and dolomites of the Calciferous formation there are many beds which afford durable material for building purposes, though the beds as a rule are not very thick, and the stone is often rather hard to dress. The limestones are bluish-grey to brownish-grey in colour, compact and generally break with a conchoidal fracture. They contain more or less magnesia, and appear to pass by insensible gradations into dolomite, which forms the largest part of the formation. A specimen resembling that exhibited was found to contain 81.78 per cent. of carbonate of lime, and 13.68 per cent. of carbonate of magnesia. The bank of British North America, and other buildings in Arnprior, are built of stone from this locality. Price of ashlar at the quarry $1.50 per cord.—*Calciferous formation, Lower Silurian.*

11. Pembroke, O., lot 12, range 1..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

There is a fine quarry at this locality. The beds are from three to eighteen inches thick. An analysis of a specimen like that exhibited gave, carbonate of lime 83.96, carbonate of magnesia 9.29, carbonate of iron 0.69, insoluble 6.06.—*Chazy formation, Lower Silurian.*

12. Rockville (Gloucester,) O.....*J. & S. Young.*

a. A six-inch cube of limestone, dressed.

The "Rockville Limestone Quarries" are situated about three miles from the city of Ottawa. The thickness of limestone exposed by quarrying is about twenty feet, consisting of beds of from three inches up to two feet six inches in thickness. The stone dresses well, and is largely used in Ottawa, where the court house, city hall, French cathedral, and many other large buildings are constructed of it. About 25,000 cubic feet of cut stone are sold annually, besides large quantities of ashlar and rubble, and in the three months ending February, 1876, over 20,000 cubic feet of stone were quarried and dressed for the tower of the west block of the Parliament Buildings. The price of the cut stone at the quarries is from thirty to eighty-five cents per cubic foot, according to the size of the blocks; and $5.00 per toise for ashlar.—*Chazy formation.*

13. Grenville, Q.....*Geological Survey.*

a. Two six-inch cubes of crystalline limestone, dressed.

From the great band of Laurentian limestone called by Sir William Logan the "Grenville band," and estimated by him to have an average thickness of 750 feet. The quarry from which the specimens were obtained is situated about half a mile from the Calumet mills, and both varieties of stone were employed in the construction of the Northern Colonization Railroad bridge over the Calumet River.—*Laurentian.*

14. Lachute, Q., (McGregor's quarry).....*Geological Survey.*

a. A six-inch cube of crystalline limestone, dressed.

An extensive outcrop of the Grenville band occurs on the farm of Mr. McGregor, near Lachute, and has recently afforded large blocks of stone for the piers of the Northern Colonization Railway bridge over the North River. It contains brown tourmaline in irregular grains and crystals, mica, numerous scales of graphite, and more rarely quartz and magnetic pyrites.—*Laurentian.*

15. Pointe Claire, Q.....*R. Forsyth, Montreal.*

a Two six-inch cubes of limestone, dressed.

The beds of limestone quarried at Pointe Claire are from one to three feet thick, and belong to the lower portion of the Trenton group. The stone is compact and dark grey to black in colour. It was used in the construction of the piers of the western half of Victoria Bridge, the blocks obtained for this purpose weighing from four to seven tons each. At present the quarries are only worked on a very limited scale.—*Birdseye and Black River formation, Lower Silurian.*

16. Caughnawaga, Q..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

The Caughnawaga quarries are on lands belonging to the Indians, and at one time furnished large quantities of stone for the upper locks of the Lachine canal, and those of the Beauharnois canal. Subsequently they were only now and then worked, and that on a very limited scale; but at present considerable quantities of stone are being obtained from them to be used in the enlargement of the locks on the Lachine canal. The beds are from nine inches to three feet thick.— *Chazy formation.*

17. Terrebonne, Q..... *Worthington & Co., Montreal.*

a. A six-inch cube of limestone, dressed.

At the quarry of Messrs. Worthington & Co., the beds of limestone worked are from eight inches to four, or in places five, feet thick, and are cut by joints from ten to forty feet apart, which greatly facilitate the quarrying. The stone is of excellent quality, and blocks of any required size can be easily obtained. It is carried to Montreal, a distance of sixteen miles, in scows drawn by steam tugs. From 190 to 250 men are employed, and from twenty to thirty horses. The production in 1874 was 5,000 cubic yards, in 1875, 15,000 cubic yards, and it is expected that this year it will be between 20,000 and 30,000 cubic yards. Work in connection with the enlargement of the Lachine canal has recently been contracted for by the proprietors of the quarry which will require about 65,000 cubic yards. *Chazy formation.*

18. Montreal, Q..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

19. Pointe aux Trembles, Q..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

20. La Chevrotière, Q..... *Geological Survey.*

a. A six-inch cube of limestone, dressed.

The Trenton formation, which is the next in succession above the Birdseye and Black River, yields excellent building stone at Montreal, at Chevrotière, nearly forty miles above Quebec, and at many intermediate places. The best stone at Montreal is derived from a ten feet band of grey bituminous granular limestone, in beds of from three to eighteen inches thick at the bottom, passing at the top into a black nodular bituminous limestone; which is interstratified with black bituminous shale, in irregular layers of from one to three inches. This grey limestone, which is near the base of the formation, is a mass of comminuted organic remains, which consist largely of the ruins of crinoids and cystideans. In Montreal undressed ashlar stone sells for from eighteen to twenty cents. per square foot, dressing costing from fifteen to thirty cents extra per foot. Stones of larger dimensions, sold by cubic measure, are worth forty-five cents per foot, for blocks of fifteen cubic feet or under; blocks containing from fifteen to thirty feet sell for sixty cents per foot.—*Trenton formation.*

21. St. Armand, Q.....*Joseph Brunet, Montreal.*

a. A six-inch cube of limestone, dressed.—*Quebec Group.*

22. Parrsboro', N.S.....*Geological Survey.*

a. A six-inch cube of limestone, dressed.

This stone is from the Kirkpatrick quarry, two and a-half miles north-west of Parrsboro'. The bed is about six feet thick, running east and west for half a mile; the stone is in layers of from four inches to two feet, thick and dipping north $<69°$. It is used in Parrsboro', for foundations, bridges, &c.—*Lower Carboniferous?*

Dolomites.

1. Rapids of the Red River, above Stone Fort, Manitoba.....*Barclay & Morrison, Stony Mountain, Manitoba.*

a. A six-inch cube of dolomite, dressed.

2. Stony Mountain, Manitoba.....*Barclay & Morrison.*

a. A six-inch cube of dolomite, dressed.

3. Owen Sound.....*Geological Survey.*

a. A six-inch cube of dolomite, dressed.

This beautiful and enduring stone can be obtained in unlimited quantities, the formation from which it is derived being here 150 feet in thickness, and divided into beds varying from a few inches to six feet. The stone possesses the very great advantage of being free from any substance producing stains, and its colour seems rather to improve after weathering. It is especially adapted for heavy masonry, and blocks of any required size can be obtained. The quarries are about half a mile from the harbour.—*Niagara formation, Middle Silurian.*

4. Guelph, O.....*Geological Survey.*

a. A six-inch cube of dolomite, dressed.

The Guelph formation which immediately succeeds the Niagara formation in Western Ontario, is largely developed in the neighbourhood of Guelph and Galt. It is made up of pure dolomites, which though generally porous are nevertheless

coherent and well suited for building purposes. At Guelph, where the beds are from four inches to two feet in thickness, there are nine quarries in the immediate vicinity of the town, and large quantities of stone are quarried, blocks suitable for dressing selling for about forty cents per cubic foot.—*Guelph formation, Middle Silurian.*

5. Rockwood, Eramosa, O..... *Henry Strange.*

a. A six-inch cube of dolomite, dressed.

This specimen is also from the Niagara formation, which is here more than 100 feet thick. The greater part of it consists of thick-bedded, light grey, porous, crystalline dolomite. The beds vary from a few inches to ten feet in thickness; about thirty feet being almost white. Buildings of cut stone obtained from this band are observed to improve in colour after exposure, and at a short distance, have a silvery white appearance. The piers of the long railway viaduct over the valley of the Eramosa, at Rockwood, are built of stone from this formation, and have a very substantial appearance.—*Niagara formation, Middle Silurian.*

6. Dundas, O..... *E. & C. Farquhar, Toronto.*

a. A six-inch cube of dolomite, dressed.

The quarry of Messrs. Farquhar is only a short distance from the Dundas railway station. The beds here are from three inches to three feet thick, the total thickness being about sixty feet. A specimen like that exhibited was found to contain carbonate of lime 51.85, carbonate of magnesia 41.65, carbonate of iron 0.62 and insoluble matter 5,88. The stone is chiefly used for making lime, and for road metal which sells for ten dollars per toise.—*Niagara formation, Middle Silurian.*

7. Cayuga, O..... *Geological Survey.*

a. A six-inch cube of dolomite, dressed.

From Dr. B. Baxter's quarry, lots ten and eleven of "Jones' tract" on the west side of the Grand River. The stone is a greyish-drab dolomite containing remains of *Eurypterus remipes.*

Some of the beds are as much as two feet thick, but those worked are only from three to twelve inches. The stone is used almost entirely for rubble work, from two hundred to four hundred cords being sold annually at from $2.00 to 2.50 per cord.—*Lower Helderberg formation, Upper Silurian.*

8. Grimsby, O..... *Robert L. Gibson.*

a. Six-inch cube of dolomite, dressed.

The stone overlies the Clinton and Medina sandstones. At Mr. Gibson's quarry there are six beds exposed, ranging from one to three feet in thickness. It has been used for ordinary building purposes, and in the construction of abutments, &c, for railway bridges. At the quarry it sells for from $3.00 to $3.50 per

cubic yard, undressed, and for $6.00 dressed. A specimen like that exhibited was analyzed and found to contain, carbonate of lime 68.92, carbonate of magnesia 29.48, carbonate of iron 1.10, and insoluble matter 0.50.—*Niagara formation, Middle Silurian.*

9. Beckwith, O..... *Geological Survey.*

a. A six-inch cube of dolomite, dressed.

This greyish-brown dolomite is from the quarries of Mr. McEwan on the tenth and eleventh lots of the ninth range of Beckwith. It is used chiefly for window and door sills; but the *round-house* at Brockville, as well as bridges and culverts along the line of the Brockville and Ottawa railway, are built of it .Blocks 3 x 3 x 15 feet can be easily obtained. Ordinary window sills, dressed, sell for about $2.00 each, and rubble for $5.00 per cord, delivered at the railway station close by.—*Calciferous formation, Lower Silurian.*

10. Bell's Corners, Nepean, O..... *Geological Survey.*

a. A six-inch cube of dolomite, dressed.

The beds at this quarry are from three to twenty inches thick, and capable of affording large blocks of stone.—*Calciferous formation, Lower Silurian.*

11. McNab, O., lot 9, range 14..... *Eric Harrington Arnprior.*

a. A six-inch cube of dolomite, dressed.

The quarry from which this stone was obtained is situated close to the shore of the Lac des Chats, about two miles from the mouth of the Madawaska River; but has not been worked for many years. There are several beds about eight inches thick exposed, of a brownish-grey colour and containing numerous geodes of calc-spar. A specimen from one of them was analyzed and found to contain 52 per cent. of carbonate of lime, and 43.88 per cent. of carbonate of magnesia.

The Calciferous dolomites are extensively developed in the triangular area between the Ottawa and St. Lawrence Rivers, and have been quarried for building purposes in a great many localities. They are very durable, but are liable to assume a yellowish tinge on weathering.—*Calciferous formation, Lower Silurian.*

Sandstones.

1. Newcastle Island, B. C..... *Vancouver Coal Company.*

a. A six-inch cube of sandstone, dressed.

Among the coal-bearing rocks of Newcastle Island there are beds of brownish-grey sandstone which afford excellent material for building and flagging stones. The uppermost beds are of the best quality, and it was from one of these that stone was obtained by Mr. E. E. Emery of San Francisco for the construction of portions of the mint in that city. Blocks for pillars were taken out, which, after dressing,

were twenty-seven feet six inches in length, and three feet ten inches in diameter. Even-surfaced flagstones, as much as ten feet square, have also been obtained, and are easily quarried; and it is not unlikely that some of the measures will afford good grindstones. The building stone dresses freely, and will probably preserve its appearance, as natural causes seem to produce little effect upon it.—*Cretaceous.*

2. Nanaimo, B. C..... *Vancouver Coal Company.*

a. A six-inch cube of sandstone, dressed.

From an extension of the beds occurring on Newcastle Island. The quarry was opened in the spring of 1875, but little work has yet been done. Large blocks could be easily obtained.—*Cretaceous.*

3. Oneida, O., lot 48, range 1..... *William De Cew.*

a. A six-inch cube of sandstone, dressed.

This sandstone is from a band which runs through Haldimand county, and is largely developed on the Oneida and North Cayuga town-line, north of the Talbot Road. It occurs in beds from one to four feet thick, and Mr. William De Cew's quarry from which the specimen was obtained has a face of twelve feet. The stone is largely employed for building purposes, for which, when fine-grained, it is well adapted. Recently it has been proposed to use it for glass-making.—*Oriskany formation, Devonian.*

4. Grimsby, O..... *Robert L. Gibson.*

a. Two six-inch cubes of sandstone, dressed.

There are about sixteen feet of this mottled red and grey sandstone, in beds about four feet thick. A large quantity of the stone has been employed by the great Western Railway Company for the construction of bridges. It is sold at $3.00 per cubic yard in the rough, $6.00 dressed. Blocks ten feet long and four feet square can be easily obtained. The specimen is from Mr. Robert L. Gibson's quarry, the annual production of which is about 1,500 cubic yards.—*Niagara formation, Middle Silurian.*

5. Esquesing, O., lot 21, range 5..... *Farquhar and Booth.*

a. A six-inch cube of sandstone, dressed.

This is from a bed of light grey freestone, which belongs to a band of about twenty feet in thickness. The beds are mostly thick, fine-grained and compact; some split into good flagstones, but all are rather hard for grindstones. The stone has been used in constructing culverts on the Grand Trunk Railway, and numerous buildings in Toronto, among which are the University and other important structures, and it appears to answer well. Large quantities of a similar stone have been quarried at Limehouse.—*Grey band, Medina formation, Middle Silurian.*

6. McBride's Corners, Rideau Canal, O ..... *James Howley.*

a. A six-inch-cube of sandstone, dressed.

This red sandstone is from Mr. Howley's quarry at McBride's Corners, about twelve miles from Kingston. The beds are from two inches to two feet in thickness, and some of them afford flagstones. Small quantities of the stone have been used for building purposes in Montreal.—*Potsdam formation, Lower Silurian.*

7. Lyn, Elizabethtown, O., lot 26, range 2..... *Geological Survey.*

a. A foot cube of sandstone, dressed.

Massive beds of sandstone are seen to rest upon the Laurentian gneisses at Lyn, near Brockville. They have been quarried for many years, and a portion of the stone employed in the construction of the Parliament Buildings at Ottawa was derived from them.—*Potsdam formation, Lower Silurian.*

8. Nepean, O., lot 6, range 2..... *H. Bishop, Bell's Corners,*

a. A six-inch cube of sandstone, dressed.

The fine quarry from which this sandstone was obtained is on the property of Mr. H. Bishop, and from it the largest part of the stone used in the construction of the Parliament buildings at Ottawa was derived. In Ottawa the rough ashlar sells for $28.00 per toise, and sills in the rough for thirty-eight cents per cubic foot. Blocks are now being quarried, 10 x 4 x 4 feet, and much larger ones could be obtained.—*Potsdam formation, Lower Silurian.*

9. Bell's Corners, Nepean, O., lot 12, range 7..... *Geological Survey.*

a. A six-inch cube of sandstone, dressed.

The quarry from which this stone was derived is only worked on a very small scale at present.—*Chazy formation, Lower Silurian.*

10. Gloucester, County of Carleton, O..... *Geological Survey.*

a. A six-inch cube of sandstone, dressed.

From Skead's quarry, near Brockville, about four miles from Ottawa. The stone is very fine-grained and of a brownish-grey colour, and would make handsome buildings. It appears, however, to be difficult to quarry, the blocks obtained being of very irregular form owing to the somewhat conchoidal fracture. A dressed specimen, about seven feet long, may be seen in the coping of the wall round the grounds of the Parliament Buildings at Ottawa; but it can only be distinguished from the adjoining blocks of Ohio stone by its finer texture. The quarry has only been opened a short time.—*Chazy formation, Lower Silurian.*

11. Pembroke, O..... *Geological Survey.*

a. A six-inch cube of sandstone, dressed.

The quarry from which this fine stone is obtained is in the vicinity of the Allumette rapids, near Pembroke, and is owned by Mr. John Rankin. The stone occurs in beds from six to twenty inches thick. It is easily worked, and, although soft, is tough, and retains sharp angles. The Pembroke Court House is built of it, and it is sometimes employed for monumental purposes.—*Chazy formation, Lower Silurian.*

12. Augmentation of Grenville, lot 3, range 1..... *Geological Survey.*

a. A six-inch cube of sandstone, dressed.

This stone appears to be of good quality, but very little of it has as yet been quarried.—*Potsdam formation.*

13. Cap Rouge, Q..... *Geological Survey.*

a. A six-inch cube of sandstone, dressed.

The Sillery division of the Quebec group affords massive beds of greyish-green sandstone, which is extensively quarried in the vicinity of Quebec. The upper beds there are even, and split well, both with the layers and across them, but the lower portions are inferior in this respect. The stone has been used in the construction of the Quebec jail and many other large buildings; also in parts of the fortress walls, and for pavements.

Delivered on barges, the ordinary building stone sells for twenty cents per cubic foot, while rubble brings about $15.00 per toise. Blocks of large dimensions can be easily obtained, as some of the beds are as much as four feet thick.—*Sillery formation, Lower Silurian.*

14. South Quebec (Point Levis), Q..... *Messrs. Pitton & Co.*

a. Specimen of sandstone (ashlar).

From the *Point Levis quarry.* Blocks of any size required for building can be obtained. Price of ashlar, thirty to forty cents per foot face, dressed.—*Sillery formation, Lower Silurian.*

15. Cap à L'Aigle, Murray Bay, Q,..... *Messrs. Pitton & Co., South Quebec.*

a. Specimen of sandstone (ashlar).

The ashlar is used for building purposes in Quebec, where it sells for from thirty-five to fifty cents per foot face, dressed.—*Potsdam formation.*

16. Budreau Village, Parish of Dorchester, Westmorland, N.B..... } *Dorchester Union Freestone Company.*

a. A six-inch cube of sandstone, dressed.

17. Rockland, Dorchester, N.B.....*Caledonia Freestone Company.*

a. A six-inch cube of sandstone, dressed.

18. Mary's Point, Hopewell, Albert, N.B.....*Messrs. Roberts & Company.*

a. A six-inch cube of sandstone, dressed.

19. Shepody Mountain, Hopewell, Albert, N.B.....*Hopewell Quarry Company.*

a. Specimen of sandstone.

These specimens are from the Millstone Grit formation, or lower member of the Carboniferous system, as represented in New Brunswick and Nova Scotia. The Budreau quarries were first opened in 1856, and since then the annual shipments have been from 5,000 to 7,000 tons. The Caledonia quarries at Rockland were first opened in 1864, and now ship annually from 4,000 to 6,000 tons. Large quantities are also quarried at the other localities mentioned above.

The stones are prized on account of their colour, the facility with which they may be cut, dressed or ornamented, and their durability; in the United States they are known as "Nova Scotia stone." The prevailing colour of the Dorchester stone is a yellowish or olive-grey, shading on the one hand into a chocolate-brown, and on the other into a bluish-grey. At Mary's Point a portion of the rock is a pale purplish-grey, and stone of this colour is the most abundant and most durable. The workable beds vary from two to six feet in thickness, and blocks can readily be obtained of any size up to a length of thirty feet and a weight of twenty tons. As a rule they contain little or no pyrites, and after seasoning, by wetting and exposure, are unaffected by frost. Portions of the rock also yield good grindstones, moderately soft, and with a clear sharp grit.

The price of the ordinary building stone averages in Boston $15.00 (gold) per ton (17 feet), including the freight, which is from $2.50 to $4.00 per ton, and the duty of $1.50 per ton.—*Millstone Grit formation, Carboniferous.*

20 Cornwallis, N. S.....*G. J. McDonald & Company.*

a. Five specimens of sandstone, dressed.

21. Johnson's Brook, Glenville, N.S.....*G. O. Davidson.*

a. Six-inch cube of sandstone, dressed.

Small quantities of this stone were employed in building culverts on the Intercolonial Railroad, and in the construction of portions of the railway bridge over River Philip. There are several quarries, but they have only been worked on a very small scale, although the stone appears to be of good quality.—*Millstone Grit formation, Carboniferous.*

22 Wallace, Cumberland County, N.S.....*R. B. Heustis.*

a. A six-inch cube of sandstone, dressed.

The Carboniferous sandstones of Nova Scotia in many localities afford fine building stones. The specimen contributed by Mr. Heustis is from a quarry at Wallace situated about 150 feet above high water mark, and only 600 yards from a good harbour. The beds are horizontal, and for the first fifteen feet from the sur-

face vary in thickness from four inches to two feet; below this there is a massive bed which, according to Mr. Heustis, is from three to eight feet thick. It is divided into rectangular masses by joints from six to fourteen feet apart, which greatly facilitate the quarrying. The price of the stone delivered on board vessels in the harbour is from forty to sixty cents per cubic foot. Blocks containing 160 cubic feet have been shipped. The quarry is held by a joint stock company which was organized in March, 1873, with a capital stock of $60,000.00, divided into 600 shares.

According to the Report of the Department of Mines, of Nova Scotia, the exportation of building stone from that Province was considerably reduced in 1875. "Pictou only shipped 17 tons, valued at $140.00, to Newfoundland; Wallace sent 819 tons to Boston, 319 to Newfoundland, 268 tons to Prince Edward Island, 50 tons to Halifax, and 9 tons to Montreal; valued at $3.00 per ton, $4,611.00. Wallace also exported to Prince Edward Island 2,083 tons of rubble, valued at 50 cents a ton, $1,041.00."—*Carboniferous formation.*

23. Wallace, N. S..... *John Beatty.*

a. A one-foot cube of standstone, dressed.

b. A carved capital of the Wallace sandstone, with the angles and tool marks still sharp after thirty years exposure.

24. Pictou, N. S., McKenzie's quarry..... *Nova Scotia Advisory Board.*

a. A nine-inch cube of brown sandstone, dressed.

b. A nine-inch cube of chocolate sandstone, dressed.

NOTE.—In addition to the sandstones and limestones from the places named above, the Nova Scotia Advisory Board exhibits eleven dressed specimens of sandstone and two of limestone, from various localities in Nova Scotia.

Granite and Syenite.

1. Victoria, B.C..... *Geological Survey.*

a. Dressed cube of syenite, cut from a boulder.

This specimen was taken from a boulder in the vicinity of Victoria, for convenience, but it represents a rock which is abundant in the Cascade Range, and which might be easily quarried at many places along the coast of British Columbia. Granite is also abundant on the same coast.

2. Kingston, O..... *Hon. John Young, Montreal.*

a. Specimens of salmon-red syenite.

From the east side of the harbour of Kingston. The rock is exposed for a length of more than a quarter of a mile, with a breadth of upwards of 100 yards, and has a face of ninety feet, overlooking the harbour. It dresses easily and takes a fine polish.—*Laurentian.*

3. Forsyth's or Barrow Island..... *Robert Forsyth, Montreal.*

a. Monument of polished syenite.

Pedestal of the same, four feet high and ten inches square.

b. Two vases, three feet high and two feet in diameter.

c. Two six-inch cubes of syenite, dressed.

d. Paving blocks.

The handsome red syenite of Barrow (now called Forsyth's) Island has long been known to the Geological Survey, and described in different reports, though it was not quarried until a little over two years ago, when the property came into the possession of Mr. R. Forsyth of Montreal, who has since worked it on a moderate scale. The island is situated in the St. Lawrence, opposite and about a mile from, the village of Gananoque. It is about twenty acres in extent, and the rock in places about thirty feet above the level of low water. The largest columns taken out as yet are twelve feet in length, but much larger ones will probably be obtained when the quarry is fairly opened up. The stone is said to be harder than the red granite of Scotland, and takes a very fine polish. It consists of bright red orthoclase feldspar, bluish-grey quartz, often slightly opalescent, a small quantity of greenish-black or black hornblende, and generally a little mica.

Mr. Forsyth has quarried quite a number of monuments and columns for architectural purposes, and the waste material has afforded a large quantity of excellent paving blocks which have been laid in some of the streets of Montreal. The blocks are from eight to twelve inches long, four inches thick and six inches deep. They are shipped at the quarries for about $2.50 per superficial yard. The facilities for shipping are all that could be desired, as vessels can load direct from the quarry.—*Laurentian.*

4. North Burgess, O., lot 12, range 5..... *Ontario Advisory Board.*

a. Specimen of syenite.

5. Grenville, Q., lot 2, range 5..... *Geological Survey.*

a. A six-inch cube of fine grained syenite, dressed.

b. " " coarse-grained " "

These specimens are from a mass of syenite which occupies an area of about thirty-six miles in the townships of Grenville, Chatham, and Wentworth. No quarrying has been done, but large blocks could be obtained.—*Laurentian.*

6. Barnston, Q..... *Geological Survey.*

a. A six-inch cube of granite, dressed.

Granite occurs in considerable abundance in Barnston, Stanstead, and elsewhere in the Eastern Townships. In the last-named township there is an area covering six square miles. The granite is composed of white quartz, white feldspar, and black mica, and takes a fine polish. It is easily worked, and in many localities can be obtained in blocks of any required size. The new Eastern Townships Bank at Sherbrooke is built of it, and it was many years ago used for

bridges on the St. Lawrence and Atlantic Railway. There is also a considerable demand for it for monumental purposes. Mr. George Taylor, of Lineboro, states that his quarry at Marlow, in Stanstead, was first opened about thirty years ago, but has only been worked regularly for ten years, during which time the demand for the stone has increased rapidly. In the past year he has quarried about 5,000 cubic feet, the selling price being about fifty cents per cubic foot, delivered on the cars.—*Devonian.*

7. St. Joseph, Beauce, Q ..... *Geological Survey.*

a. A six-inch cube of granite, dressed.

For practical purposes this rock is classed here as a granite, although not a true granite, but probably a fragmental rock made up of quartz, feldspar and mica. The band is fifty or sixty feet thick and runs with the stratification, near to a band of serpentine. It has been used for millstones, and would probably afford an excellent material for the purposes of construction.—*Quebec Group, Lower Silurian.*

8. St. George, Charlotte County, B.C..... *Bay of Fundy Red Granite Co.*

a. A monument of red syenite polished, three feet two inches square at the base, and fifteen feet high. Value $1000.

b. Four head-stones polished.

c. Two urns.

9. St. George, N.B..... *William Ingram.*

a. Clock-case made of syenite.

10. Hampstead, Queens County, N.B..... ..... *Geological Survey.*

a. A foot cube of grey granite, dressed and polished.

Granites and syenites of several different shades of colour and varieties of texture occur in New Brunswick, and cover extensive areas. They are mostly, if not wholly, of intrusive origin, but appear to represent at least two very distinct periods of intrusion, the rocks of the one—characterized usually by grey and dark grey colours, and containing more or less hornblende, and not unfrequently magetic iron disseminated in grains,—having probably been produced at least as early as the Lower Silurian era; while the other, varying in colour from a pale pink or grey to a tawny-yellow or bright red, and usually more or less porphyritic, is probably of Devonian age. Rocks of both these types yield good building materials, but it is in the latter that the principal quarries have been opened. Until recently the grey rock alone was removed, and simply employed within the province for ordinary constructive purposes, but the introduction of processes for polishing such rocks, together with a growing demand for brightly coloured granites similar to those of Scotland, caused attention to be directed to the quarrying and polishing of the red variety. Of this, extensive beds, forming a portion of the Nerepis range of hills, occur in the county of Charlotte, and have been opened in the vicinity of the town of St George, on the Magaguadavic River. There is here every facility for the removal and working of the stone, blocks of any size up to thirty or forty feet in length and four or five feet in thickness being easily obtainable, while the stream affords at all seasons ample means of transport, as well as an almost illimitable water-power. Works erected at St. George about three or four years ago by the Bay of Fundy Red Granite

Company, now give employment to about 110 men, the water-power in use, with a single wheel, being equal to about 240 horse-power. A second company (the St. George Red Granite Company) have been until recently working in Carleton near St. John, but contemplate removing to St. George, whence their stone is also derived.—*Lower Silurian? and Devonian.*

11. Queen's Quarry, North West Arm, Halifax, N.S.. { *Nova Scotia Advisory Board.*

a. A foot cube of grey granite, dressed.

b. A rough block of the same.

12. Shelburne, N.S..... *Nova Scotia Advisory Board.*

a. A foot cube of grey granite, dressed.

Gneiss.

1. Grenville, Q., lot 3, range 8..... ..... *Geological Survey.*

a. A six-inch cube of coarse-grained gneiss, dressed.

2. Grenville, Q., lot 1, range 3..... *Geological Survey.*

a. A six-inch cube of porphyroid gneiss, dressed.

The Laurentian gneisses sometimes occur in bands several thousand feet thick, and occupy large portions of the country all the way from Labrador on the east to the Lake of the Woods on the west. They vary much in colour, in texture, and in the relative proportions of their constituents, and frequently contain hornblende instead of, or in addition to mica. In some cases they have a banded or schistose structure, but in others they are massive and scarcely distinguishable from granite or syenite. Though many of them are well adapted for structural purposes, and can be obtained in unlimited quantity, their employment is not common. The dam and reservoir of the Quebec water-works near Jeune Lorette on the St. Charles River, is built of grey gneiss, which was obtained close by.—*Laurentian.*

Labradorite Rock.

1. Abercrombie, Q..... *Geological Survey.*

a. A foot cube of labradorite rock, dressed.

Most of the localities in which this rock is found *in situ* are not very accessible, but numerous large boulders are scattered over the country in the vicinity of Grenville, St. Andrews (Q.) and other places, more especially along the Ottawa and St. Lawrence. In some parts of the country, as for example in the township

of Rawdon (Q.), the rock is fine-grained and homogeneous; but at Abercrombie, where it forms large mountains masses, it exhibits a compact base, chiefly of labradorite, with imbedded cleavable masses of the same feldspar sometimes several inches in diameter and often exhibiting beautiful reflections. The rock has been but little used for building purposes, although its durability certainly recommends it. It is not quite as hard as granite, and takes a fine polish, so that it might in some cases be employed with advantage for decorative construction.—*Laurentian.*

MARBLES.

Limestones.

1. Metlah Catlah Bay, B.C..... *Englehard & Co., Victoria, B. C.*

   a. Two specimens of white marble.

2. Mount Mark, near Horne Lake, Vancouver Island..... *Geological Survey.*

   a. Short column and pedestal of marble.

   The crystalline limestones of Mount Mark occur in very thick beds, interstratified with diorite. They are capable of affording a great variety of marbles suitable for ornamental purposes, though not fine enough for statuary. White, dove-grey, and bluish tints are the most common; but some varieties contain reddish and greenish bands. Large blocks, entirely free from flaws, could be easily obtained. Though the limestones are highly crystalline they are in many places crowded with fossils, among which Mr. Billings has detected corals of the genera *Zaphrentis* and *Diphiphyllum*, large crinoidal columns, specimens of *Fenestella* or *Polymorpha*, beside a large *Productus* and a large *Spirifer*.—*Carboniferous?*

3. Texada Island, Strait of Georgia, B.C..... *Geological Survey.*

   a. Grey marble with black spots and veins.

   b. Greyish-white marble with brownish veins.

   c. Small cube of serpentine limestone.

4. Elzevir, O..... *Geological Survey.*

   a. White marble.

5. Cornwall, O..... *Geological Survey.*

   a. Black marble.

This black marble, and the one from Pointe Claire (No. 15), are derived from two beds, each about two feet thick, at the base of the Birdseye and Black River formation. These are apparently the only beds of the formation that will take a sufficiently even polish to be fit for marble. In the higher beds there are patches, which, from being more argillaceous than other parts, receive but an inferior polish, and produce a bad effect.—*Birdseye and Black River formation, Lower Silurian.*

6. Burgess, O..... *W. J. Morris, Perth, O.*

a. Specimen of white serpentinous marble, ten inches square and three inches thick, one face polished.—*Laurentian.*

7. High Falls of the Madawaska, Blythfield, O., lot 13, range 3.... *James Bell, Arnprior.*

a. A nine-inch cube of white marble.—*Laurentian.*

8. McNab, O., lot 4, range 14 ..... *James Bell, Arnprior.*

a. A specimen of marble.

9. Arnprior, O..... *Geological Survey.*

a. Marble, striped light and dark grey.

b. " cut across the beds.

c. " column and pedestal.

At the mouth of the Madawaska, in McNab, a great extent of crystalline limestone is marked by grey bands, sometimes narrower, and sometimes wider, running in the direction of the original bedding, and producing, where there are no corrugations in the layers, a regularly barred or striped pattern. When the beds are wrinkled, there results a pattern something like that of a curly grained wood The colours are various shades of dark and light grey, intermingled with white. These arise from a greater or less amount of graphite, which is intimately mixed with the limestone. The granular texture of the stone is somewhat coarse, but it take a good polish, and gives a pleasing marble. Some difficulty has been experienced in obtaining large blocks free from flaws. At present the quarries are not regularly worked, although blocks are occasionally taken out for monuments mantel pieces, &c. Considerable quantities were also employed in the decorative work of the Houses of Parliament at Ottawa.—*Laurentian.*

10. Arnprior, O..... *P. T. Somerville, Arnprior.*

a. Monument of banded Arnprior marble.

b. A foot cube of the same, polished.

11. Gloucester, O..... *Geological Survey.*

a. Brownish-grey marble.—*Chazy formation.*

12. L'Orignal, O.....*Geological Survey.*

a. Grey marble, with thickly disseminated white spots.

b. Dark grey marble, with more thinly disseminated white spots.

The bed from which the specimen (*a*) is taken, varies in thickness from three to six inches; it is near the surface, and easily quarried, but has hitherto been but little used. The locality is a quarter of a mile from the south bank of the Ottawa, four miles west of L'Orignal village, and sixty-four above Montreal. The white spots are caused by small bivalve shells (*Atrypa plena*) filled with calc-spar. Of the darker variety (*b*) there are two beds, of six inches and one foot respectively near the surface, and overlying the previous bed (*a*). Blocks large enough for chimney-pieces and tables are readily obtained.

13. Grenville, Q.....*Geological Survey.*

a. Yellowish-white marble.

14. Augmentation of Grenville, Q.....*Geological Survey.*

a. Spotted green and white marble.

In the township of Grenville and its Augmentation, a band of crystalline limestone, containing *Eozoon Canadense*, has an extensive run through the country, and affords in many places a peculiar variety of marble, having a white ground marked with small green spots of serpentine, which occasionally forms angular masses several inches in diameter. The serpentine usually runs in bands marking the stratification of the rock. These bands, as in the case of the Arnprior marble, are sometimes even, and at other times corrugated, giving diversities of pattern. Sometimes the serpentine, instead of green, is sulphur-yellow as in the specimen from Grenville. In many parts of the country, the Laurentian limestones are tolerably free from foreign minerals, and give white marbles These, however, are usually too coarse-grained for statuary purposes, and sometimes they are barred with slightly different colours. Such is the case with the crystalline limestone occurring in the township of Elzevir. Many years ago, a mill for cutting and polishing a marble like the specimen from the Augmentation of Grenville was erected on the Calumet, lot 19, range 3, of Grenville, where a similar rock occurs; but the demand for the marble was not sufficient to make the enterprise profitable.—*Laurentian.*

15. Pointe Claire, Q.....*Geological Survey.*

b. Brownish-black marble
a. Greenish-black " } See No. 5.

16. Caughnawaga, Q.....*Geological Survey.*

a. Grey marble.

b. Grey " with red spots.

Similar grey marbles, with red spots (generally corals), occur in the same formation as the rock of Caughnawaga, behind the city of Montreal, and on Isle Bizard. In all of these localities the rock is filled with fossils, which are plainly seen on the polished surfaces.—*Chazy formation, Lower Silurian.*

17. St. Lin, Q..... *Geological Survey.*

a. Red marble, polished slab 26 x 58 inches.

b. " " " 18 x 12 inches.

At St. Lin, about thirty miles from Montreal, there are massive beds of limestone portions of which are of a red colour and afford a good marble. There will probably soon be railway communication between Montreal and St. Lin.—*Chazy formation, Lower Silurian.*

18. Terrebonne, Q..... *James Worthington & Co., Montreal.*

a. Specimen of grey marble.

19. Montreal, Q..... *Geological Survey.*

a. Grey marble from the Trenton formation.

b. Grey marble from the Chazy formation.

The Montreal marble is derived from a bed in the Trenton, and another in the Chazy formation. It is not now in great demand, though it has sometimes been used for mantel pieces and table tops.—*Trenton and Chazy formations, Lower Silurian.*

20. St. Dominique, Q..... *Geological Survey.*

a. Dove-grey marble.

b. Dove-grey marble with white spots.

The marble of St. Dominique is easily cut, and takes a good polish. It seems surprising that, situated so near to Montreal, with a railway running near, it has not been applied to various purposes in this city.—*Chazy formation, Lower Silurian.*

21. St. Armand, Q..... *Geological Survey.*

a. White marble.

b. White marble.

c. White marble clouded with pale green.

d. Dove-grey marble, marked with white.

The marbles, of which the above are specimens, occur in great abundance in the immediate vicinity of Philipsburg, on Lake Champlain. They are all easily cut and take a good polish. The specimens exhibited were obtained many years ago, and are from surfaces that had long been exposed to the influence of the weather. Since then, quarries have been opened by Mr. J. Brunet, of Montreal, chiefly with a view, however, of obtaining building-stone.—*Quebec Group, Lower Silurian.*

22. St. Armand, Q..... *Geological Survey.*

a. Black marble.

About a mile and a half south-eastward from Phillipsburg there occurs a black marble, similar to this specimen. The beds dip to the eastward at an angle of about twelve degrees; a quarry was many years ago opened on one of them, which has a considerable thickness. The stone was exported to the United States, and much esteemed in New York, but the opening of quarries of black marble at Glen's Falls, where there is good water-power, interfered with the demand, and caused the enterprise to be abandoned.—*Quebec Group, Lower Silurian.*

23. Durham, Q., lot 1, range 8..... *Geological Survey.*

a. Red marble.

24. Kingsey, Q., lot 3, range 1..... *Geological Survey.*

a. Red marble.

b. Red marble striped with white.

25. Shipton, Q., lot 22, range 7..... *Geological Survey.*

a. Red marble.

b. Variegated marble, red and green.

c. Variegated marble, yellow, green, and cream white.

d. Variegated marble, with less red and more white than the last.

Numbers 20, 21, and 22 are from a band of limestone from thirty to forty feet thick, at the base of the Sillery formation.—*Quebec Group, Lower Silurian.*

26. Dudswell, lot 22, range 7 ..... *Geological Survey.*

a. Cream-white marble, striped with yellow.

b. Dark grey and yellowish marble.

c. Fawn-yellow and white "

Were the limestones of Dudswell worked, it is possible good marble might be obtained from them. The specimens exhibited, of cream-white and yellow, and dark grey and yellow, are from beds that overlie one another. The yellow streaks in both of these marbles are composed of dolomite, while the light ground of the one, and the dark ground of the other, are of carbonate of lime. When the dark grey approaches black, which it sometimes does, and the yellow streaks are narrow, the marble bears a strong resemblance to the Portor marble from Northern Italy, sometimes known as *black and gold.* On analysis, the resemblance between the two is farther sustained by the fact, that in both cases the ground is a pure limestone, and the yellow veins are dolomite.—*Upper Helderberg formation? Devonian.*

27. St. Joseph Beauce, Q..... *Geological Survey.*

a. Slab of red marble veined with white.

b. Column of the same.

This handsome marble occurs near the River Guillaume, associated with red shales and sandstones, resembling those of Sillery, near Quebec. The bed is from ten to forty feet thick, and exposed in four places on its strike in a distance of half a mile. The marble takes a fair polish and could be obtained in large blocks. The Levis and Kennebec railway will pass close to the locality, which is forty-five miles south of Quebec.—*Quebec Group, Lower Silurian.*

28. Marble Mountain, C.B..... *John Silver, Halifax, N.S.*

a. Two dressed cubes of marble.

29. Esquimaux Island, Mingan group..... *Geological Survey.*

a. Drab marble.

This drab-colored marble occurs in great quantity on Esquimaux Island, of the Mingan group, where the stone might be easily loaded on board of small vessels. It cuts with great facility, and takes a uniform polish.—*Chazy formation, Lower Silurian.*

Serpentines.

1. Burgess, O., lot 2, range 8..... *W. J. Morris, Perth.*

a. Two specimens of pale green serpentine, veined with red.—*Laurentian.*

2. Orford, lot 6, range 13..... *Geological Survey.*

a. Brecciated serpentine, dark green with grey spots.

b. " " green and grey with white clouds.

c. " " green and grey with less white.

d. " " dark green mixed with light green.

3. Orford, Q., lot 6, range 13..... *Geological Survey.*

a. Brecciated serpentine, green and grey with white clouds.

b. " " green and grey with less white.

c. " " dark green mixed with light green.

d. Yellowish green serpentine with grey spots.

4. Orford, Q., lot 7, range A..... *Geological Survey.*

a. Plum-coloured serpentine with greenish-white streaks.

5. Orford, Q., lot 4, range F.....*Geological Survey.*

a. Yellowish-green serpentine.

6. Orford, Q., lot 5, range B.....*Geological Survey.*

a. Light green serpentine, clouded with grey and black.

b. " " with clouds of green and grey.

c. " " with greyish-white streaks and dark spots.

7. Orford, Q., lot 15, range 18.....*Geological Survey.*

a. Brecciated serpentine, dark green with grey markings.

8. Orford, Q., lot 12, range 8.....*Geological Survey.*

a. Brecciated serpentine, dark green with light green and white spots.

9. Orford, Q.....*Geological Survey.*

a. A square column of dark green serpentine veined with white calcite, 15 × 15 × 60 inches.

10. Melbourne, Q., lot 20, range 5.....*Geological Survey.*

a. Green serpentine with greyish-white spots.

b. Green and grey serpentine.

11. Melbourne, Q., lot 21, range 6.....*Geological Survey.*

a. Yellowish-green serpentine.

12. Melbourne, Q., lot 22, range 6.....*Geological Survey.*

a. Dark green serpentine with light green spots.

13. Melbourne, Q.....*Geological Survey.*

a. A square column of dark green serpentine with white veins, 15 × 15 × 48 inches.

14. Shipton, Q., lot 8, range 5.....*Geological Survey.*

a. Dark green serpentine with yellowish spots.

The band of serpentine from which specimens 2 to 14 have been obtained has been traced on the south side of the St. Lawrence, from Potton to Cranbourne

a distance of 140 miles; in forty miles of which it is repeated twice by undulations, giving an additional eighty miles to its outcrop. It is again recognized 250 miles farther to the N.E., in Mount Albert, in the Shickshock Mountains; and about seventy miles beyond this, in Mount Serpentine, approaching Gaspé Bay. All the specimens of these rocks, which have been analyzed, contain small quantities of chromium and nickel, and the band is associated in its distribution with soapstone, potstone, dolomite and magnesite. The whole of these occur in large quantities, and in them, as well as in the serpentine, chromic iron occurs, sometimes in workable quantities. These rocks, or others immediately near them, contain the metals, iron, lead, zinc, copper, nickel, silver and gold; with the drift gold, derived from these strata, are found platinum, iridosmine, and traces of mercury. In 1847, these serpentines, from their distribution, were described in the reports of the Geological Survey as altered sedimentary rocks. All subsequent observations confirmed this, and beautifully stratified masses of it were afterwards discovered in Mount Albert. In some of the brecciated serpentines from Melbourne numerous fragments of organic remains have been discovered, leaving no doubt as to their stratified origin and Palæozoic age. None of the serpentines, and, with the few trifling exceptions that have been mentioned, none of the marbles of Canada, have yet been quarried for economic purposes. All of the specimens of them exhibited by the Geological Survey are consequently from parts of the strata that have long been exposed to the influence of the weather, and are of course inferior to the unweathered portions beneath. There appears little doubt that, in time, both the limestones and serpentines will afford a great amount of beautiful material for architectural purposes.—*Quebec Group, Lower Silurian.*

Breccia.

1. One of the Ballinac Islands, B.C..... *Geological Survey.*

   a. Slab of volcanic breccia, polished.

2. Scatari Island, Cape Breton..... *J. Bowser, Halifax.*

   a. Specimen of dark green breccia, polished.

SLATES, FLAGSTONES, LIME, BRICKS, AND DRAIN TILES.

Slates.

1. New Rockland Slate Quarry, Q..... *C. Drummond, Montreal.*

   a. Specimens of roofing slate, eight sizes.

   b. Planed slabs (14 feet 6 inches by 3 feet. 3 inches), for billiard tables.

   c. Hearthstones (4 feet by 1 foot 6 inches).

   d. Pastry slabs, two sizes (2 feet and 1 foot 6 inches square).

   e. Library shelves (3 feet long and 7 inches wide).

This quarry is situated at a distance of about five miles south-westward from the Richmond station on the Grand Trunk Railway; but the line of a projected railroad passes within a few hundred yards of the quarry. It was first opened in 1868, and has been worked ever since. The quarry is at the top of a steep hill which is nearly 500 feet over the level of the St. Francis River at Richmond. Its depth is now upwards of 100 feet, and it presents natural facilities for working to a depth of 300. In 1874 the company commenced the manufacture of slab-slate, and erected a mill with superior machinery, for sawing, planing and rubbing such materials as flooring, hearths, billiard-beds, blackboards, &c. The company have about eighty men constantly employed, and produce between 7,000 and 8,000 squares of roofing slates a year. The following list shows the number of pieces to the square (100 square feet) of the various sizes of first class slate made by the company. All these are sold at a uniform price of $5 per square delivered on the cars at Richmond. Other sizes are made to order. Slate of second quality is sold at a lower price.—*Quebec Group.*

Size. in inches.	No. pieces to square.	Size in inches.	No. pieces to square.	Sizes. in inches.	No. pieces to square.
24 × 14	98	18 × 12	160	14 × 9	291
24 × 12	114	18 × 11	175	14 × 8	327
22 × 14	108	18 × 10	192	14 × 7	374
22 × 12	127	18 × 9	213	12 × 8	400
22 × 11	138	16 × 10	222	12 × 7	458
20 × 12	141	16 × 9	124	12 × 6	534
20 × 11	154	16 × 8	277	10 × 8	514
20 × 10	169	14 × 10	262		

2. Melbourne Slate Quarry, Q..... .....*Benjamin Walton.*

a. Specimen of roofing slate.

This quarry is situated on elevated ground on lot twenty-two, range six, township of Melbourne, at a distance of one mile and a half west of the St. Francis River. A tunnel has been driven through a bank of serpentine which lies between the face of the hill and the slate band. The quarry is opened on the summit of the hill, and is now more than 100 feet deep and several hundred feet long. The present bottom of the quarry is upwards of 300 feet over the St. Francis River, so that a great body of slate remains to be quarried above the natural drainage level. The quarry has been in operation almost continually since 1860, when it was first opened, but the production has varied greatly according to the demand. At present about forty men are employed, and about 3,000 squares are said to have been made in 1875. A variety of sizes are made to suit the market, and the slates are sold at an average price of $3.80 a square delivered on the cars at Richmond Station. Mr. Benjamin Walton, of Melbourne, Q. is the proprietor and manager.—*Quebec Group.*

The above quarries are about two miles apart, and are situated upon the same band of slate, which has a vertical attitude with a breadth of about a quarter of a mile, and runs S.W. and N. E. In the latter direction, it crosses the St. Francis River and runs through Cleveland and Shipton, in both of which townships quarries have also been opened upon it. The slates are of a bluish-black colour, smooth surfaced, thin, light and strong. Experience has proved them to be unsurpassed, if equalled, by slates from any other part of the world. Their chemical composition is almost identical with that of the slates of Anger in France, which have withstood the climate of Montreal for upwards of one hundred years.

3. Rankin Hill Slate Quarry, Q..... *Geological Survey.*

a. Specimens of red slates.

b. " " green "

This quarry is situated on lot twenty-five, range five, township of Acton, about four miles east of Actonvale station on the Grand Trunk Railway. The quarry which was opened in June, 1875, is now about 150 feet long and sixty feet wide, with a depth which increases from ten feet at the west end to thirty feet at the other. The greater part of the slate is red, the green occurring in large patches having no reference to the bedding or the cleavage, both of which dip N. 80° E. (mag.) at an angle of about 12° to the horizon. The quarry has the advantage of being near the Grand Trunk Railway, and the rock is easily quarried. A small quantity of slate has been already sold at about $5.50 a square. It is used for ornamental work in slate roofing. About eighty men have been employed for some months in opening the quarry. Mr. John Rankin, of Montreal, is the principal owner. He is also proprietor of a quarry of green slate situated about a mile west of Actonvale.—*Quebec Group.*

4. Danville,..... *Danville School Slate Company.*

a. Two blocks of split slate.

b. Set of school slates.

c. Ornamental slate pannel.

d. Slate with inlaid work.

e. Large slab of slate (26 by 47 ins.)

The works of this Company are situated at Gansonville, near Danville. The following is their price list:

Sizes.	Price per doz.	Doz. in case.	Price per case.
4 × 6	$ 0.54	25	$12.96
5 × 7	.60	18	10.80
6 × 8	.72	20	14.40
6 × 9	.80	20	16.00
6½ × 10	.90	20	18.00
6 × 12	.96	15	14.40
7 × 11	1.00	15	15.00
8 × 12	1.20	12	14.40
9 × 13	1.50	10	15 00

—*Quebec Group.*

5. Westbury, Q..... *Geological Survey.*

a. Polished slates.

Flagstones.

1. Esquesing, O..... *Farquhar and Booth.*

a. Specimen of flagstone.

There is at the quarry from which this specimen was obtained an exposed thickness of seven feet, made up of beds of light grey sandstone from one to six inches thick, and splitting with great ease into large slabs which can be delivered on the cars at Limehouse station for from twenty to forty cents per square foot, according to size and thickness. Similar flagstones are obtained from the same band at Hamilton and elsewhere.—*Grey band, Medina formation.*

2. McBride's Corners, O..... *James Howley, Montreal.*

a. Specimens of flagstone, red and white.

The quarry from which these stones were obtained is about twelve miles from Kingston, and near the Rideau Canal. The thickness of the beds ranges from two inches to two feet.—*Potsdam formation.*

3. Nepean, O., lot 6, range 2..... *Henry Bishop, Bell's Corners, O.*

a. Flagstone (sandstone.)

Good stones could be got at this place, but the expense of taking them out would be too great, unless the quarry were extensively wrought.—*Potsdam formation.*

4. Cap Rouge, Q..... *Geological Survey.*

a. Flagstone (sandstone).—*Quebec Group.*

5. Point Levis Quarry, Q..... *Pitton & Co., South Quebec.*

a. Chain or curbstone, $1.00 per linear foot.

b. Paving stone, hammer-dressed, $3.60 per yard.

This paving stone has been used in St. Peter and St. Paul streets South Quebec —*Quebec Group.*

6. Cap a L'Aigle, Murray Bay, Q..... *Pitton & Co., South Quebec.*

a. Flagstone for sidewalks.

b. Paving stone.

c. Curbstone.

These different kinds of stone can all be obtained of any desired size at this quarry. There is a good wharf at Murray Bay, so that barges and schooners can load direct for Quebec or Montreal.

Common Lime.

1. Kincardine, Q..... *Levi Lewis.*

a. Raw limestone.

b. Prepared lime.

This beautiful white lime is made from a six-inch bed of dark bluish-grey bituminous limestone associated with compact beds of a blue colour. Mr. Lewis burns ten kilns per year, which average 700 bushels per kiln, and the lime sells at twenty cents per bushel.—*Onondaga formation.*

2. Goderich, O..... *George Buxton.*

a. Raw limestone.

b. Prepared lime.

This quarry is situated about one mile east of the station. Mr. Buxton burns yearly about 18,000 bushels.—*Onondaga formation.*

3. St. Mary's, O..... *Whitson & Slater.*

a. Raw limestone.

b. Prepared lime.

There are two kilns owned by this firm, called the "Dominion Champion Draw Kilns." The lime is made from a dark yellowish compact limestone, overlying the blue limestone of the locality. The average quantity of lime manufactured yearly is 50,000 bushels of very excellent quality, which is sold for sixteen cents per bushel.—*Corniferous formation.*

4. Galt, O..... *Mrs. Ballantyne.*

a. Raw limestone.

b. Prepared lime.

These specimens are from the quarry and kilns owned by Mrs. Ballantyne, who from two kilns makes yearly 9,750 bushels of lime, which sell at eighteen cents per bushel.—*Guelph formation.*

5. Guelph, O..... *R. Emsley.*

a. Raw limestone (magnesian.)

b. Prepared lime.

This lime is prepared from the Guelph dolomite. The stone takes rather longer to calcine than pure limestone: it slacks without the evolution of much heat to a very white powder, much prized for whitewash and mortar, which sets quickly. The stone occurs in unlimited quantities, Mr. Emsley makes yearly 50,000 bushels of lime, which sells for twenty cents per bushel.—*Guelph formation.*

6. Rookwood, O., lot 5, range 5..... *George Dunbar.*

a. Raw limestone.

b. Prepared lime.

At the quarry of Mr. Dunbar there is an exposed face of twenty-five feet in layers of one to six inches thick. Eight kilns of 1,250 bushels each, are burned annually. The lime is sold at twenty cents per bushel.—*Niagara formation.*

7. Limehouse, O..... *Thomas Gowdie.*

a. Raw limestone (magnesian.)

b. Prepared lime.

This lime is made from a light grey, porous, crystalline dolomite, which occurs in beds of three inches to three feet thick, showing a face of over thirty feet, overlying twenty-two feet of hydraulic limestone. A large quantity of the lime is shipped every year; the kilns and quarry are within a few yards of the R.R. station.—*Niagara formation.*

8. Dundas, O..... *E. & C. Farquhar.*

a. Raw limestone.

b. Prepared lime.

This lime is made from a dark brown limestone which has a thickness of sixty feet, in beds of three inches to three feet. The quarry is situated on the side of the Mountain, a short distance from the railway station. Messrs. Farquhar have two kilns, in which they make annually 100,000 bushels of lime, which sells at fifteen cents per bushel.—*Niagara formation.*

9. Cayuga, O., lots 10 and 11..... *Dr. B. Baxter.*

a. Raw limestone.

b. Prepared lime.

This limestone is highly fossiliferous, and occurs in beds from one to three inches thick, overlying the water-lime deposits. The amount of lime produced annually is about 5,600 bushels which is sold for eighteen cents per bushel.—*Oriskany formation.*

10. Oneida, O., lots 48 and 49, range 1..... *Wm DeCew.*

a. Raw limestone.

b. Prepared lime.

This stone is magnesian and is in the immediate vicinity of large sandstone quarries. It appears to underlie the sandstone of the Oriskany formation.—*Corniferous formation.*

11. Ramsay, O. lot 7, range 4..... *N. Lavallée, Carleton Place, O.*

a. Raw limestone.

b. Prepared lime.

This lime is made from a beautiful white crystalline limestone found in the township of Ramsay. Mr Lavallée of Carleton Place made last year about 10,000 bushels.—*Laurentian.*

12. Arnprior, O..... *Wm. Baker.*

a. Raw limestone.

b. Prepared lime.—*Laurentain.*

13. Montreal, Q..... *C. A. Garvies.*

a. Raw limestone.

b. Prepared lime.

This limestone, which yields the best stone for building purposes at Montreal, also burns to an excellent white lime, and the refuse that accumlates in the process of quarrying is used for that purpose. There are a number of lime-kilns in the vicinity of the city ; that of Mr. Garvies produces about 54,000 bushels yearly and each of the others about the same quantity.— *Trenton formation.*

14. Arthabaska, Q..... *Sheriff Quesnel.*

a. Prepared lime.—*Quebec Group.*

15. Beauport, Q..... *Quebec Advisory Board.*

a. Raw limestone.

b. Prepared lime.

16. Green Head, near St. John, N.B..... *Geological Survey.*

a. Raw limestone.

b. Prepared lime

This lime is prepared from a belt of dark grey graphitic limestone traversing the Laurentian area of St John county, though possibly itself of more recent origin. Notwithstanding its dark colour it yields readily a white lime, which is said to be very strong, and is largely used in the city of St John. The quantity burnt during last year amounted to about 8,000 casks or 16,000 American barrels.

Other belts of lighter coloured limestone occur in the same Laurentian area varying from blue to pink and white. Several quarries have been opened in these The principal ones are at West Head near the Suspension Bridge over the St John

River, which yielded, during the past year, 2,000 casks, and at Brookville, on the Intercolonial Railway, four miles east of St John (Wm. Lawlor & Son's), which produced in the same period 5,000 casks. The price in St John varies from $1.50 to $2.00 per cask of 4 cwt. The beds are from fifty to sixty feet thick. Much of the lime is exported to Nova Scotia.—*Laurentian.*

17. Pugwash, N.B..... *David Douglas.*

a. Prepared lime.—*Lower Carboniferous.*

18. George's River..... *John McQuarrie.*

a. Limestone.

b. Prepared lime.

Hydraulic Lime.

1. Rockwood, O..... *Geological Survey.*

a. Raw cement-stone.

This specimen comes from a band three and a half feet thick, divided into beds averaging six inches. It is easily quarried, and there is good water-power for grinding on the place.—*Niagara formation.*

2. Limehouse, O..... *Thomas Gowdie.*

a. Raw cement-stone.

b. Prepared cement.

This stone occurs in a band nine feet thick, in beds varying from three to seven inches. The cement sets slowly and hardens during several weeks, after which it is said to possess great strength.—*Clinton formation.*

3. Cayuga, O., lots 10 to 12, "Jones Tract," W. side of Grand River.... } ..... *Dr. B. Baxter.*

a. Raw cement-stone.

The stone from which this is made occurs in beds from fifteen inches to two feet in thickness.—*Onondaga formation.*

4. Ramsay, O..... *Geological Survey.*

a. Raw cement-stone.

5. Nepean, O..... *Geological Survey.*

a. Raw cement-stone.

Though the rock occurs in Nepean, the cement is usually designated as the Hull cement, from having been manufactured for several years, by Mr. Wright of

Hull, opposite to Ottawa. The rock is a limestone holding about twelve per cent. of carbonate of magnesia, and it yields a strong and lasting cement. The bed to which it belongs, has been traced for nearly 100 miles through the country, preserving a very uniform character.—*Chazy formation.*

6. Arthabaska, Q.....*Sheriff Quesnel, Arthabaska, Q.*

a. Raw cement-stone.

b. Prepared cement.

This stone is from a quarry lately opened on the property of Sheriff Quesnel. It is said to make a very good hydraulic cement, but has not been examined chemically.—*Quebec Group.*

7. St. John Ward, Quebec,.....*Gauvreau & Co.*

a. Raw cement-stone.

b. Prepared cement.

This cement-stone is a dark bluish-black dolomite. 6,000 to 7,000 barrels of cement are annually manufactured from it by this firm. The price is $1.50 to $2,00 per barrel.—*Quebec Group.*

8. Magdalen River, Gaspé, Q.....*Geological Survey.*

a. Raw cement-stone.

These specimens of black dolomite are derived from the Mountain Portage, about five miles up the Magdalen River from its mouth. The stone occurs in beds of from two to four inches, interstratified in black graptolitic shales ; it yields a very strong hydraulic cement, setting in a few minutes under water, to a very hard and tenacious mass of a yellowish colour. Similar bands occur at the Grande Coupe, six miles below Great Pond River The range of the formation containing these bands, being from Gaspé to Quebec, makes it probable that a considerable quantity of the stone may be obtained from various places along the south shore of the St. Lawrence. The stone differs from that at Quebec, from which General Baddeley, R. E., first prepared a cement. This contains no magnesia, while the Gaspé stone is a dolomite.—*Hudson River formation.*

Bricks and Brick-clays.

1. Winnipeg, Manitoba.....*Geological Survey.*

a. White bricks.

There are several large brick-yards in the vicinity of the town. The clay used occurs at the surface. The quantity of bricks made annually is very considerable. Price from $10 to $12 per 1,000, according to quality.—*Drift.*

2. Stony Mountain, Manitoba..... *Barclay and Morrison.*

a. White bricks.

b. Brick-clay.

These bricks are manufactured from a grey clay of the prairie, found at the base of the mountain, and were used in the construction of the penitentiary at this place. The supply of clay is practically inexhaustible.—*Drift.*

3. Owen Sound, O..... *Geological Survey.*

a. Red bricks.

b. White bricks.

c. Unburned bricks.

d. Brick-clay.

The deposit here is a drab-coloured clay, which has been dug to a depth of four feet. White bricks are made from the same clay by using a different sand. The deposit is not extensive.—*Drift.*

4. Kincardine, O..... *George Riggins.*

a. Best white brick.

b. Clay for white brick

c. Yellowish white brick.

d. Clay for yellowish-white brick.

e. Corner brick.

f. Bath-brick.

g. Clay for Bath-brick.

These bricks are made of clay from a deposit which yields three kinds, white, yellow and Bath-bricks; the clay from which the Bath-bricks are made, overlying the other. Mr. Riggins makes annually from 200,000 to 300,000 stock bricks, and about 100,000 Bath-bricks. The price of the bath bricks is $1.50 per box of twenty-four. The stock bricks sell for $7.00 to $8.00 per 1000. Mr. McLean of this place makes about the same quantity.—*Drift.*

5. Goderich, O..... *Geological Survey.*

a. Red brick.

These bricks are of rather poor quality, and are only used in small quantity for local purposes,—*Drift*

6. Seaforth, O..... *Geological Survey.*

a. White brick.

7. London, O..... *Samuel Russell.*

a. White brick.

b. Brick-clay.

There are seven brick-yards in the vicinity of London, each of which produces about 900,000 white bricks yearly, the average price being $5 per 1,000. They are made from a very extensive deposit of drab-coloured clay, thirty feet thick.—*Drift.*

8. Brantford, O.....*Hugh Workman.*

a. White stock brick.

b. Compressed brick.

These are made from a deposit of light greyish-blue clay, apparently covering many acres, and having a thickness of about fifty feet. The present price is $11 per 1,000. The two yards at this place produce about 300,000 annually.—*Drift.*

9. Dundas, O.....*Munn & Cockhner.*

a. Red brick.

b. Brick-clay.

Messrs. Munn & Cockhner make about 640,000 red bricks annually, which sell for $5.75 per 1,000. They are made from extensive deposits of clay occuring in the vicinity of Dundas. White bricks have also been made at this place from the underlying clay.—*Drift.*

10. Glen William, O.....*Robert Leslie.*

a. Red brick.

b. Brick-clay.

Mr. Leslie produces about 200,000 bricks annually, which sell for $6.50 per 1,000. The deposit of clay from which these bricks are made is very extensive.—*Drift.*

11. Yorkville, O.....*Mrs. Mary Townsley, Toronto,*

a. White brick.

b. Red brick.

c. Brick-clay.

At the yard owned by Mrs. Townsley about 1,890,000 white stock bricks are manufactured yearly, besides a large quantity of red bricks. The white bricks are sold for $10 to $12 per 1,000, and the red for $9. The deposit of clay from which the white bricks are made has a thickness exceeding sixty feet, and extends east-ward, with some interruptions and a varying thickness, at least as far as Cobourg. At Yorkville, it is unconformably overlaid by a bed yielding red bricks. The white brick-clay lies in very even, horizontal strata, while the other undulates with the general surface, not, however, descending to the bottom of deep ravines.—*Drift.*

12. Yorkville, O.....*Bulmer & Douglas, Toronto, O.*

a. White brick.

Messrs. Bulmer & Douglas make annually about 1,500,000 white bricks and about 100,000 white drain tiles. Mr. John Sheppard of this place makes about the same number of bricks, and, it is said that, altogether, about 15,000,000 white bricks are made annually at Yorkville and used in the city of Toronto.—*Drift.*

13. Peterborough, O,.....*Robt. Romaine.*

a. White bricks.

b. Brick-clay, and loam.

14. Belleville, O.....*W. A. Foster.*

a. Stock bricks, hand made..... $8 per 1,000

b. " " machine " ..... 8 " "

c. " " " " ..... 11 " "

d. Brick-clay.

These bricks are made at the Bay of Quinté works, owned by Mr. Foster. The average production is 5,000 per day, during a working season of five months.—*Drift.*

15, Carleton Place, O.....*William Baker.*

a. Brick-clay.

16. Ramsay, O. lot. 26, range 9.....*Eneas Foshick.*

a. Red brick.

b. Brick-clay.—*Drift.*

17. Ramsay, O, lot 20, range 8.....*Gilbert Moore.*

a. Red brick.

b. Unburnt brick.

c. Brick-clay.—*Drift.*

18. Ramsay, O., lot 17, range 8.....*James Coulter.*

a. Red brick.

b. Brick-clay.—*Drift.*

19. Ramsay, O., lot 14, range 8.....*James Metcalfe.*

a. Brick.

b. Brick-clay.—*Drift.*

20. Arnprior, O.....*William Baker.*

a. Common brick.

b. Stock brick.

c. Brick-clay.

In the manufacture of these bricks, Mr. Baker uses a machine of his own invention, which, with eight men, produces from 8,000 to 10,000 per day of ten hours. The quantity made in 1874 was 650,000, which sold for $6.50 per 1,000.—*Drift.*

21. Pembroke, O.....*Daniel McGregor.*

a. Common brick, $8 per 1000

b. Well brick, $10 " "

c. Brick-clay.—*Drift.*

22. Pembroke, O.....*Thomas Cashmore.*

a. Pressed brick.....$13 per 1,000

b. Window-jamb brick.....$10 " "

23. Nepean, range 4.....*Thos. Anderson, Bell's Corners.*

a. Red brick.

b. Brick-clay.

These specimens are from Bell's Corners, where the clay shows a thickness in the pit of twenty feet. Mr. Anderson made in 1875, 400,000 stock bricks, using Bulmer & Sheppard's machine. The bricks sell for $10 per 1,000 at the kiln.—*Drift.*

24. Montreal, Q.....*Bulmer & Sheppard.*

a. Common building bricks.

b. Bevelled brick.

c. Radiating front brick.

d. Circular bricks for shafts.

The quantity of bricks made by this firm annually is about 10,000,000, having a value, delivered in the city, of $100,000.—*Drift.*

25. Montreal, Q..... *Thos W. Peel.*

a. Common pressed brick.

b. Brick-clay.

Mr. Peel manufactureres about 4,000,000 common bricks annually, which are sold for from $7.00 to $8.00 per 1,000.

The red bricks of Montreal are manufactured from blue clay of marine origin, which is interstratified with reddish layers, and runs under a deposit of sand. The marine origin of the clay is proved by the occurrence in it of sea-shells, *Bryozoa* and *Foraminifera*, besides the bones of seals and of marine fishes. The brick-yards are situated to the north-east of Mount Royal, on a plateau 140 feet above the level of the sea and of considerable extent; above which, well-marked sea margins occur on the sides of the mountain, at elevations of 220, 386, 440 and 470 feet above the sea level, all of them containing marine shells.—*Drift.*

26. St. Johns, Q..... *Albert Mochon.*

a. Red bricks.

These bricks are made from an extensive deposit of blue clay of marine origin, having a thickness of twenty-two feet. The quantity produced by Mr. Mochon is about 1,000,000 yearly.—*Drift.*

27. Arthabasca, Q..... *Geological Survey.*

a. Red brick.

There are only a few kilns burnt at this place, for local purposes.—*Drift.*

28. Three Rivers, Q..... *Geological Survey.*

a. Red brick.

b. Brick-clay.

These specimens are from the vicinity of the town of Three Rivers. There are seven brick yards in this place, each of which produces yearly about 400,000 bricks. The current price per 1,000 is $4.—*Drift.*

29. St. Jean Lotbiniere, Q..... *Geological Survey.*

a. Red brick.

b. Brick-clay.

These bricks are manufactured from a thinly laminated blue clay, said by the brick makers to have a thickness of 100 feet. It requires a mixture of about one-third sand for its proper working.—*Drift.*

30. Upper Woodstock, N.B.....*Charles Jackson.*

a. Brick.

b. Sand.

c. Brick-clay.

These bricks are manufactured from clay of which some three or four acres are exposed, near the west bank of the St. John River, a short distance above the town of Woodstock. The upper portion of the clay bed is of a yellowish-grey colour, and about ten feet thick. It rests upon blue clay, of which about sixteen feet have been exposed, but whose real thickness is unknown, and has been worked for twenty-six years. The number of bricks manufactured, varies from 300,000 to 400,000 per year.—*Drift.*

31. St. John, N.B.....*Lee Brothers.*

a. Common brick.

b. Machine-made brick.

c. Lees' X X X brick.

Drain Tiles.

Brantford, O.....*H. Spencer.*

a. 1½ inch drain tile.

Mr. Spencer makes yearly 150,000 tiles and 100,000 white bricks. The price of the bricks is $6 to $10 per 1000. The tiles sell as follows:

1½	inch	.....	$7.50 per thousand.
2	"	.....	9.00 " "
3	"	.....	12.50 " "
4	"	.....	20.00 " "
6	"	.....	60.00 " "

Yorkville, O.....*Thomas Nightingale, Toronto.*

a. Drain tile.

This specimen is made from the stratum of clay which is used for the manufacture of red bricks in this locality. The quantity of drain tiles manufactured annually by Mr. Nightingale is,

2000	4	inch.....	25	cents each
4000	6	"	35	" "
2000	9	"	75	" "
1000	12	"	$1.00	each
1000	15	"	$1.50	"

From 4,000,000 to 5,000,000 white bricks are also made annually in the same yards, and sell at $8.00 per 1,000.—*Drift.*

Yorkville, O.....*Bulmer and Douglas, Toronto.*

a. Drain tile.

This firm manufactures 100,000 white drain tiles annually.—*Drift.*

Montreal, Q.....*Bulmer and Sheppard.*

a. Two-inch drain tile

b. Three- " " "

c. Four- " " "

d. Five- " " "

e. One- " " " with collars and junctions.

About 250,000 drain tiles are made yearly, worth about $2,000.—*Drift.*

Quebec, Q.....*David Bell, Little River, Q.*

a. Two-inch drain tile, $2.00 per 100.

b. Clay used for making drain tiles.

The clay from which these tiles are made is found in many places in the vicinity of the city.—*Drift.*

St. John, N.B.....*Lee Brothers.*

a. Five-inch drain tile

b. Four- " " "

c. Three- " " "

d. Two- " " "

e. One and a half-inch drain tile

VIII.

REFRACTORY MATERIALS, POTTERY CLAYS, AND POTTERY.

Plumbago or Graphite.

1. Bedford, O.....*Ontario Advisory Board.*

a. Plumbago.

2. North Elmsley, O., lots 21 and 22, range 6.....*Ontario Advisory Board.*

a. Specimens of crude plumbago.

b. " " dressed "

Plumbago or graphite is a very common mineral in the Laurentian rocks of Quebec and Ontario, occurring in the form of disseminated scales in limestones, gneisses and other rocks, or in veins cutting these rocks. In the former case the beds are often so highly charged with it as to become workable, but the plumbago, as might be expected, is not so pure as that found in veins. The most important localities known are north of the Ottawa River, in the townships of Buckingham, Lochaber and Grenville, but the mineral has also been found in the Laurentian country south of the Ottawa, in Bedford, North Burgess, North Elmsley and elsewhere. At the locality in the last named township, from which the specimens exhibited were obtained, the plumbago occurs mostly in a disintegrated quartzose rock which passes into an impure limestone. No mining of any consequence was done here until 1871; but from that time until the summer of 1873 about 6,000 tons of "ore" are said to have been taken out by the company (the International Mining Company, of New York) and delivered at the works, half a mile from the mine, for eighty cents a ton. It was there stamped, and the plumbago separated from the rock-matter by revolving buddles. The works are situated at Oliver's Ferry on the Rideau canal, about seven miles from the town of Perth. Since 1873, they have at times been in operation, working up the material on hand, although no mining has been done.—*Laurentian.*

3. Buckingham, Q..... { *The Dominion of Canada Plumbago Company, (limited).*

a. Specimens of plumbago from fourteen different veins, said to contain ninety-six per cent. of carbon.

b. Specimens of "disseminated plumbago," said to contain from twenty-six to forty per cent. of carbon.

c. Prepared plumbago, for various purposes mentioned below.

d. Crucibles, both new and after testing.

e. Pencils of different qualities.

f. Stove polish in pressed squares.

The *Dominion of Canada Plumbago Company* was formed in June 1875, with a capital of £100,000 sterling, and has commenced operations on an extensive scale. The property of the company comprises 1,250 acres of land in the seventh, eighth and ninth ranges of Buckingham. The country here is well timbered and watered, and the facilities for mining unsurpassed. The mines are about eighteen miles from Ottawa. The plumbago is found in both beds and veins, the principal veins, so far as known, being on lot twenty-one in the seventh range, while the most important beds are on lot twenty in the eighth range. Some idea of the size of the masses of plumbago which can be obtained may be formed from the fact that one of the specimens exhibited weighs 4,870 pounds. The works of the company are on the nineteenth lot of the eighth range of Buckingham, and, include appliances for crushing, washing, dressing, &c. When in full working order they are expected to turn out about four tons of "prepared stock" per day, suitable for crucibles, pencils, and stove-polish, as well as for lubricating, electrotyping, casting and numerous other applications. Mr. W. H. Walker, of Ottawa, is the present manager.—*Laurentian.*

4. Buckingham, Q..... *Geological Survey.*

a. Specimen of plumbago.

5. Buckingham, Q., east half of lot 13, range 10...*T. D. Ledyard, Toronto.*

a. Two specimens of plumbago.

6. Grenville, Q., lot 10, range 5.....*John G. Miller, Toronto.*

a. Large blocks of unprepared plumbago.

b. Specimen of pure graphite.

On this lot five beds or veins of more or less pure graphite occur in a belt varying from five to eight feet in width. They range from five to twenty-two inches in thickness and are enclosed in a gangue from which the graphite may be readily separated. This gangue consists of pyroxene, wollastonite, feldspar, and quartz, with smaller quantities of sphene, phlogopite, zircon, garnet and idocrase. The country-rock consists of white crystalline limestone. The deposit has been opened to a depth of thirty feet along sixty feet of its course, and some of the graphite has been exported. It is said that it yielded 34 lbs. of shipping "ore" for every cubic foot excavated, and that one-seventh of this is equal to sample *b*. Some of the blocks broken up for shipping were estimated to weigh from 700 to 1,500 lbs.—*Laurentian.*

Soapstone (Steatite, Compact Talc).

1. Bolton, Q., lot 24, range 4.....*Geological Survey.*

a. Cut specimens of soapstone.

2. Potton, Q., lot 16 range 5.....*Geological Survey*

a. Cut specimens of soapstone.

Among the magnesian rocks at the base of the Quebec group, in that part of its distribution where it is in a metamorphic state, soapstone or steatite occurs in great abundance. Beds of it, varying in thickness from one to sixteen feet, can be traced for long distances, usually not far removed from serpentine, dolomite, or magnesite; or apparently replacing one or other of these rocks. In general the soapstone is remarkably pure, but occasionally there are disseminated in it crystals of bitter-spar or of actinolite. The specimens exhibited from Sutton and Bolton are from equivalent bands, twenty and thirty feet thick respectively, on the opposite sides of Sutton Mountain. In the latter locality the soapstone is interstratified with potstone and dolomite, and in some parts of the band, the three rocks are seen to interlock among one another in lenticular masses. These two bands of soapstone appear to be on the opposite sides of a general synclinal form. —*Quebec Group, Lower Silurian.*

Potstone (Compact Chlorite).

1. Bolton, lot 26, range 2.....*Geological Survey.*

a. Cut specimens of potstone.

A considerable portion of the rocks of the Quebec group, in their metamorphic condition, consists of chloritic slates; which appear to occupy a somewhat higher

stratigraphical place than the more magnesian strata just mentioned, and usually to fill up the middle, and more elevated parts of the synclinal forms of the Quebec series, through the country. There occur also bands of pure compact chlorite or potstone interstratified with the more magnesian strata. Some of these are of considerable thickness, and the one in Bolton, from which the specimens were derived, has a width of about twenty feet.—*Quebec Group, Lower Silurian.*

Mica Rock.

1. Shipton, Q., lot 18, range 5..... *Geological Survey.*

a. Specimens of mica rock, dressed.

In nearly the same stratigraphical place as the potstone, there occurs, in some localities, in the Eastern Townships, a compact, hydrous mica, which so much resembles potstone as to have been mistaken for it; and very probably it possesses the same refractory properties. Where the specimens were obtained, a breadth of five feet is exposed; the full thickness of the band, however, is supposed to be much greater.—*Quebec Group, Lower Silurian.*

Mica.

1. North Burgess, O., lot 17, range 9..... *Geological Survey.*

a. Specimen of mica, uncut.

b. Plates of mica, cut and dressed, two sizes.

Magnesian mica or phlogopite occurs abundantly, in small scales, in the crystalline limestones of the Laurentian system, but sometimes also in crystals sufficiently large to be economically available. These are generally met with near bands of quartzite, or of pyroxenic gneiss, limiting the limestones, or near to some interstratified mass of a similar character, and they are usually associated with other minerals. Among these, in addition to quartz, pyroxene and feldspar there occasionally occur,loganite, tabular-spar,apatite,sphene, iron pyrites, idocrase garnet, tourmaline, zircon, and sometimes corundum. In Grenville, where the mineral is imbedded in massive pyroxene rock, close alongside of a band of crystalline limestone, crystals of mica have been obtained, giving sheets measuring twenty-four by fourteen inches. In North Burgess, on lot 17, range 9, the mica is imbedded in a soft pyroxenic rock, and a few sheets have been obtained measuring as much as twenty by thirty inches, after dressing. No mica has been mined at this locality since 1871 or 1872, but previous to that time the deposits had been worked at intervals by different parties for as much as ten or twelve years. Mica mines were also worked for several years in Grenville, though only on a small scale.—*Laurentian.*

Asbestus.

1. Melbourne Slate Quarry, Q..... *Geological Survey.*

a. Specimens of asbestus.

The serpentines of the Eastern Townships are frequently cut by veins of chrysotile, the fibrous variety of the same mineral. It is commonly called asbestus, a

name which, strictly speaking, should be restricted to fibrous varieties of hornblende and pyroxene. The veins as a rule are small and have not as yet been worked with profit. Chrysotile veins also occur in the serpentine limestones of the Laurentian series, but so far as known are not of much economic importance. —*Quebec Group, Lower Silurian.*

Fire Clays.

1. Dundas, O.....*Geological Survey.*

a. Fire-clay.

This clay is derived from an argillaceous band, twenty feet in thickness, near the base of the Clinton formation. The rain washes the clay from the bank, and deposits it in the bottom of pools at its foot. When the water dries up in these, the clay is dug from them, and is used in the iron foundries at Dundas and at Hamilton. The same clay band is met with at many other places along the outcrop of the Clinton formation.—*Clinton formation.*

2. Grand Lake (Little River), N.B.....*G. N. McMann, St. John, N.B.*

a. Fire-clay.

This fire-clay is from beds occurring beneath the coal in the New castle (Grand Lake) coal field. They have a thickness of from a few inches to four feet, and though sometimes yellowish and ochreous, are at others nearly white and free from impurities. They are within a short distance of the surface and conveniently situated for transport. Fire bricks made from them are said to answer well. —*Carboniferous.*

3. Pictou County, N. S.....*Edwin Gilpin, Springville.*

a. Specimen of fire-clay.

b. Fire-brick.

4. Intercolonial Coal Mine, Pictou County, N.S.....*Geological Survey.*

a. Specimen of fire-clay.

Numerous beds of fire-clay occur in the Coal measures of Nova Scotia, and it is altogether likely that some of them will be found to be of good quality. The few which have been examined, however, contain too large a proportion of alkalies. Considering the large quantities of fire-bricks and fire-clays annually imported into the Dominion from Great Britain and the United States, the thorough testing of Canadian clays is a question of great importance. The value of the fire bricks imported in the fiscal year 1873-74 was $78,040 and of fire clay $10,873. (Trade and Navigation Returns.)—*Carboniferous.*

Sandstone.

1. Oneida, O., lots 48 & 49, range 1.....*William DeCew.*

a. Sandstone for furnace linings.

2. McBride's Corners, O.....*James Howley, Montreal.*

a. Sandstone for furnace linings.

3. St. Maurice Forges, Q.....*J. McDougall & Sons, Three Rivers, Q.*

a. Sandstone used for blast furnace hearths.

Pottery Clay and Pottery.

1. Seaforth, O.....*Geological Survey.*

a. Preserve jar.

2. London, O.....*Charles Pratt.*

a. Milk-pans.

b. Spittoon.

c. Preserve-jar.

d. Nest of flower-pots.

e. Clay employed in making the above articles.

The clay used is from the township of Westminster. Mr. Pratt uses about 300 tons per year, and manufactures goods to the value of $10,000.—*Drift.*

3. Paris, O.....*G. H. Ahren.*

a. Nest of flower-pots and saucers.

b. Spittoon.

c. Clay used in making the above.

This clay is obtained in the vicinity of Paris. Mr. Ahren uses annually 250 tons, manufacturing goods to the value of $8,000.—*Drift.*

4. Beamsville, O.....*Wm. Wells.*

a. Flower-pot and saucer.

b. Red clay.

This clay is from Mr. Tufford's brick yard. Extensive deposits of similar clay are found for many miles east and west in this section of the country.—*Drift.*

5. Peterborough, O.....*Robt. Romaine*

a. Nest of flower-pots.

6. St. Johns, Q.....*E. H. and L. E. Farrar.*

a. Fancy flower-pots.
b. " " "
c. " " "
d. Clay for " "

This ware is made from a very extensive deposit of blue clay of marine origin which occurs within the town limits, and has a thickness of twenty-two feet, resting on a sandy gravel, and covered with one foot of soil.—*Drift.*

7. St. Sauveur, (near Quebec).....*Walter Hobson.*

a. Rustic flower-pot.
b. Common flower-pot.
c. Preserve-jar.
d. Soap-dish.

These are made from clay from a marine deposit which is found in the vicinity of St. Sauveur. Drain tiles are also manufactured from the same material.—*Drift.*

8. Wentworth, Hants County, N.S.....*S. H. Sweet.*

a. Specimens of kaolin.—*Lower Carboniferous formation.*

IX.

MATERIALS FOR GRINDING AND POLISHING.

Whetstones.

1. Collingwood, O., lot 25, range 6.....*Geological Survey.*

a. Cut whetstones.

These whetstones are obtained from about twenty feet of thin, even-bedded, and very fine grained sandstones and arenaceous shales, at the top of the Hudson River formation. The inhabitants of the neighbourhood make whetstones for their own use from this rock, but it has never been extensively worked. The same rock is found in the same geological position at Meaford, Cape Rich, and on the Grand Manitoulin Island.—*Hudson River formation.*

2. Nottawasaga, O., lot 24, range 11.....*Geological Survey.*

a. Cut whetstones.

The specimens are taken from about twenty feet of freestone, representing the grey-band. The rock is in every way suited to make superior scythe-stones, although they have never yet been manufactured from it.—*Medina formation.*

3. Noisy River Falls, Nottawasaga, O.....*Geological Survey.*

a. Cut whetstones.

These specimens are from a few feet of very fine-grained compact sandstone at the foot of the falls, and immediately underlying the dolomite of the Clinton formation. It appears to be the upper part of the grey-band. The rock is not worked in this locality.—*Medina formation.*

4. Madoc, O., lots 4 and 5, range 5.....*Geological Survey.*

a. Cut whetstones.

The mica slates associated with the crystalline limestones of the Laurentian series are frequently of the character required for scythe-stones, and a band of this description occurs in Madoc. The whetstone-rock occurs not far from crystalline limestone, and in immediate contact with a thick band of conglomerate.—*Laurentian.*

5. Stanstead, Q., lot 15, range 1.....*Geological Survey.*

a. Cut whetstones.

6. Hatley, Massawippi Lake, Q.....*Geological Survey.*

a. Cut whetstones.

7. Bolton, Q., lot 23, range 6.....*Geological Survey.*

a. Cut whetstones.

8. Kingsey, Q., lot 7, range 2.....*Geological Survey.*

a. Cut whetstones.

In the Eastern Townships, stones of a good grit for the purpose of whetstones are found in several places. A band of this kind runs from Whetstone Island in Memphremagog Lake, lot 15, range 1, of Stanstead, by Lee's Pond to the head of Massawippi Lake, in Hatley, a distance of nearly twelve miles, and it may be available much further. The rock appears to be a mica slate, passing into an argillite, and its stratigraphical place would seem to be above the magnesian series. There is also a range of whetstone rock on each side of the anticlinal running from Melbourne to Danville, beneath the magnesian rocks. This rock again appears on the north-west side of the Shipton and St. Armand synclinal, in Kingsey, and good samples of the stone occur on lot 7, range 2, of this township. They are much softer than the Memphremagog stones, the rock being probably more argillaceous. The Bolton stone very much resembles that of Memphremagog, but its stratigraphical place is probably the same as that of Kingsey.—*Quebec Group.*

9. Joggins, Cumberland County, N.S .....*Seamans & Co.*

a. whetstones.

Hones.

1. Ham, Q..... *E. Richard, Arthabaskaville, Q.*

a. Specimens of hones or "sharpening stones," from a quarry recently opened.

Bath-brick

1. Kincardine, O ..... *George Riggins.*

a. Bath-brick.

b. Clay for making Bath-brick.

The material used by Mr. Riggins for making Bath-brick is found about a mile from Kincardine, and directly overlies the clay used for making white building-bricks. Mr. Riggins makes annually about 100,000 Bath-bricks. Price $1.50 per box of twenty-four.—*Drift.*

Tripoli.

Victoria, B.C..... *W. Fisher.*

a. Specimen of tripoli.

Grindstones.

1. Clifton, Gloucester County, N.B..... *Geological Survey.*

a. Cutler's grindstone.

2. North Esk, Miramichi, N.B..... *Joseph Goodfellow.*

a. Grindstone, bluish colour.

b. " olive, fine-grained

c. " " coarse grained

d. " (water grindstone.)

3. Dorchester, N. B..... *Read, Stevenson & Co.*

a. Grindstone.

b. Cutler's stone.

c. Polishing stone.—*Carboniferous.*

4. Joggins, Cumberland County, N.S.... { *Seamans & Co., Lower Cove Quarries Cumberland, N.S.*

a. Grindstones.

5. Pudsey's Point, Apple River, N.S..... *Geological Survey.*

a. Grindstones, three specimens.

These grindstones are taken from a sandstone reef lying off the Point, which is uncovered at low water, and has a thickness of 20 to 30 feet, with a dip of S. 60° to 82° E. < 12°. The stones are made from five feet to six feet nine inches in diameter and from seven to thirteen inches thick.—*Lower Carboniferous.*

6. Port Philip, N.S..... *David Douglas.*

a. Grindstone.

This stone is from a quarry owned by the Port Philip Freestone and Brick Manufacturing Company. The rock is of two colours, reddish and grey, and is all more or less micaceous. Grindstones of all sizes up to seven feet in diameter are quarried from both bands; the thickness of the grey stone is 22 feet, and it is underlaid by the red.—*Lower Carboniferous.*

7. Glenville, N. S..... *Geological Survey.*

a. Grindstone.

Millstones.

1. Grenville, lot 3, range 5..... *Geological Survey.*

a. A buhrstone, dressed.

This burhstone constitutes a series of veins, cutting an intrusive mass of syenite, which occupies an area of thirty-six square miles, among the Laurentian rocks of Grenville, Chatham, and Wentworth. The veins consist of yellowish-brown or flesh-red cellular chert; the colours, in some cases, running in bands parallel to one another and sometimes being rather confusedly mingled, giving the aspect of a breccia. The cells are unequally distributed, some parts being nearly destitute of them, while in others they are very abundant, and of various sizes, from that of a pin's head to an inch in diameter. The attitude and associations of the chert clearly show that it cannot be of sedimentary origin, and its composition, taken in conjunction with the igneous character of the district, suggests the probability that it is an aqueous deposit, which has filled up fissures in the syenite, and is similar in its origin to the agates and chalcedony which in smaller masses are common in various rocks.—*Laurentian.*

X.

MINERALS APPLICABLE TO THE FINE ARTS AND TO JEWELRY.

Lithographic Stone.

1. Marmora, lot 7, range 4.....*Geological Survey.*

a. Prepared lithographic stone, with *fac simile* autographs of Canadian Governors.

At Marmora, the Laurentian rocks are overlaid by about twenty feet of brownish-grey and light brownish-buff unfossilferous compact limestone, with a conchoidal fracture, several beds of which would be well suited for the purposes of lithography, were it not for small imbedded lenticular crystals of calcareous spar, which, when abundant, unfit the stone for such an application. One of the beds, however, which is two feet thick, and of impalpable grain, is a lithographic stone of excellent quality, and has been commended by many lithographers who have tried it. The lower half is much better than the upper, which is somewhat affected by the lenticular crystals of calc-spar. The band to which the bed belongs presents occasional exposures of a similar character, all the way from Hungerford to Rama, a distance of 100 miles. The stone exhibited, presents the *fac simile* autographs of all the governors of Canada, both French and English, from the time of Champlain, in 1612, to that of Lord Monck, in 1862; with the exception of two of the French governors in the first half of the seventeenth century.—*Birdseye and Black River formation.*

2. Marmora, O..... *Ontario Lithographic Stone Company.*

a. Prepared lithographic stone, with view of quarry and prospectus of the Company.

b. Impression taken from the stone.

A number of attempts have been made from time to time, during the past twenty-five years, to quarry the Marmora stone and introduce it in the market, but have not met with success. It is to be hoped, however, that the company contributing this specimen will be more fortunate than its predecessors. In 1874 a small steam mill was erected to saw the stone.—*Birdseye and Black River formation.*

3. Marmora, O ..... *Ontario Advisory Board, Toronto.*

a. Lithographic stone.

4. Brant, lot 31, ranges 1, 2..... *Geological Survey.*

a. Prepared lithographic stone, with Bank cheque and transfer, No. 1.

b. " " " " " No. 2.

c. " " showing natural fracture, with vignette of an Indian chief.

d. " " with impression of *Eozoon Canadense.*

These are specimens of magnesian limestone of a yellowish-drab colour and fine texture, with a conchoidal fracture. The locality is the bed of a small stream, on lot 31, between ranges 1 and 2, south of the Durham road, Brant, and about half a mile south of the village of Walkerton. About fifteen beds of stone, apparently of the same character as the specimens, occur in a vertical section of nine feet, the thickest being eleven inches. Layers of dark coloured shale separate some of the beds.—*Onondaga formation.*

Porphyries.

1. Grenville, Q., lot 4, range 6..... *Geological Survey.*

a. A specimen of green porphyry breccia, polished.

b. A polished specimen showing white crystals in a dark coloured base.

2. Chatham, Q., lot 7, range 7..... *Geological Survey.*

a. A specimen of porphyry polished, showing red crystals in a dark coloured base.

In the townships of Grenville and Chatham, the Laurentian limestones and gneisses are successively cut by intrusive masses of dolerite, syenite, and quartziferous porphyry, all of which rocks are older than the Silurian period. The porphyry has a compact, apparently homogeneous base, inclosing crystals of orthoclase, and, more rarely, grains of quartz. According to Hunt the base consists of an intimate mixture of orthoclase and quartz, coloured apparently by oxyd of iron. The porphyries receive a fine polish, and some varieties are very beautiful. That occurring in Chatham is the handsomest, but it is doubtful whether large masses of it could be obtained, as it appears to be a good deal jointed.

Labradorite.

1. Grenville, Q..... *Geological Survey.*

a. Cut and polished specimens of labradorite from boulders.

b. Vase of labradorite, made in Paris.

2. Alexcrombie, Q..... *Geological Survey.*

a. Cut and polished specimens of labradorite from a bed.

This beautiful opalescent mineral occurs in disseminated cleavable masses, imbedded in a finer grained paste of the same mineral character, but destitute of opalescence. The rocks composed of the series of triclinic feldspars, to which this mineral belongs, have been termed anorthosites, in describing the Laurentian system; in which they occupy a very conspicuous place. Great mountain masses of the rock occur in Abercrombie, in the county of Terrebonne, and boulders derived from these lie scattered over the plains to the south. They are abundant in the neighbourhood of Grenville, on the Ottawa.—*Upper Laurentian.*

Albite (peristerite).

1. Bathurst, lot 19, range 9..... *Geological Survey.*

a. Specimens of albite, cut and polished.

This mineral, the peristerite of Thompson, so called from its beautiful bluish opalescence, is a variety of albite. It occurs in large cleavable masses, with disseminated grains of quartz, in veins cutting Laurentian strata. The specimens exhibited were obtained from Dr. James Wilson, of Perth, the discoverer of the mineral, who collected them in the locality indicated. A vein of the same character occurs on the north side of Stoney Lake, near the mouth of Eel Creek, in Burleigh. Its course is about N. 55° E., and it intersects a white crystalline limestone, interstratified with blackish-grey gneiss. The vein consists of a fine grained mixture of reddish white albite and quartz, in which are enclosed large cleavable masses of the opalescent albite, with occasional portions of fine granular black tourmaline.—*Laurentian.*

Perthite.

1. Burgess, lot 3, range 6..... *Geological Survey.*

a. Specimen of perthite, cut and polished.

The perthite of Thompson occurs in large cleavable masses, constituting, in association with quartz, a pegmatite, which occurs in veins of considerable thickness, cutting the strata of the Laurentian series. It consists of interlaminated orthoclase and albite, the darker bands being orthoclase.—*Laurentian.*

Jasper Conglomerate.

1. Bruce Mines, Lake Huron..... *Geological Survey.*

a. Specimens of jasper conglomerate, polished and rough.

b. Vase of jasper conglomerate, made in Paris.

2. Northern extremity of Goulais Bay, L. Superior..... *Geological Survey*

a. Polished specimens.

This remarkable and beautiful rock occurs in the form of thick beds, constituting in fact mountain masses, along with the white quartzite formation of the Huronian series. The matrix consists of white quartzite and the pebbles of red and black jaspers and smoky chalcedony. Thick bands of it run for miles through the country north of the Bruce Mines and on the north side of Goulais Bay, Lake Superior. It comes to the shore of the St. Mary's River about four miles west of Campement d'Ours and to the east shore of Lake George in two places. Boulders of it are abundant along the lake and river shores in this region. A ridge showing several varieties of the rock runs within half a mile of the northern extremity of Goulais Bay. Some varieties of the rock contain numerous small drusy cavities, and might make good millstones.—*Huronian.*

Amethystine Quartz.

1. Amethyst Harbor, Lake Superior,..... *Geological Survey.*

   a. Two blocks of crystals of amethystine quartz.

   b. Ornamental pile composed of several hundred specimens of the same.

Nearly every vein cutting the cherty and argillaceous slates, the syenites and diorites around Thunder Bay contains more or less of this mineral. At Amethyst Harbor, openings have been made on several veins cutting dark cherty slates for the purpose of obtaining these crystals, which constitute almost the entire vein-matter.—*Nipigon Series.*

2. McKenzie's River, Lake Superior..... { *R. Blackwood and Geo. McVicker, Thunder Bay.*

   a. Block of large crystals of amethyst, coated with iron-pyrites.

   b. Amethyst associated with cubes of fluorite coated with iron-pyrites.

The vugs in the large irregular veins passing into the syenite at the mouth of McKenzie's River, Thunder Bay, are lined with crystal, of amethysts, which in the larger cavities attain a diameter of six inches. Immense masses of these crystals have been taken out of the more accessible vugs, but a large supply might yet be obtained by opening new veins or following down the old ones.—*Huronian.*

Agates.

1. Michipicoten and St. Ignace Islands, Lake Superior.... *Geological Survey.*

   a. Specimens of agates, cut and polished.

These agates occur on the south and north shores of Lake Superior, particularly on the island of St. Ignace, and on Simpson's Island to the east of it; but the largest and best are derived from the trap of Michipicoten Island, where they strew the shore in great abundance. On this island, agate occurs not only in the form of nodules in the trap, but in veins, filling cracks and dislocations, which traverse the trap, and run in several directions.—*Copper-bearing Series.*

NOTE.—In addition to the minerals described above, Mr. W. A. Morrison, of Toronto, exhibits a collection of Canadian precious stones.

XI.

MISCELLANEOUS.

Sandstone for Glass-making.

1. Oneida, O., lots 48 and 49, range 1 ..... *William De Cew, Caygua, O.*

a. Sandstone for glass-making.

2. McBride's Corners, O ..... *James Howley, Montreal.*

a. Sandstone for glass-making.

3. Nepean, O., lot 6, range 2 ..... *H. Bishop, Bell's Corners.*

a. Sandstone for glass-making.

b. " " pulverized.

Moulding Sand and Clay.

1. Owen Sound, O ..... *Geological Survey.*

a. Specimen of moulding sand.

Moulding sand occurs in two places at Owen Sound, which together may have an area of six acres, with an average depth of eight or nine inches. It is used at the iron foundries in the town, and is said to answer well.—*Drift.*

2. Lewisville, O ..... *Geological Survey.*

a. Specimen of moulding sand.

From a bed about one foot thick. Used in the iron foundries at Goderich.—*Drift.*

3. Dundas, O ..... *Geological Survey.*

a. Specimen of moulding sand.

This sand occurs on the surface, in patches from a few rods to several acres in extent, on the tops and sides of hills of coarser sand. The best is found next the surface, and the layer seldom exceeds a foot in depth. Considerable quantities have been shipped during the last few years.—*Drift.*

4. Limehouse, O ..... *Geological Survey.*

a. Specimen of clay.

This clay is used for moulding, and also for furnace linings.

5. Montreal, Q..... *Robert Bannerman.*

a. Specimen of clay.

This clay occurs in thin layers interstratified with the blue clay at the pits of Messrs. Bulmer & Sheppard. It is used in foundries chiefly for making cores.—*Drift.*

Carbonaceous Shale.

2. Queen Charlotte Islands, B.C..... *Geological Survey.*

a. Indian carvings made of indurated carbonaceous shale.

This shale is associated with the anthracite of the Queen Charlotte Islands. It is quarried by the Haidah Indians, and carved by them into tobacco pipes, grotesque images, &c.—*Cretaceous or Jurassic?*

Artificial Stone.

1. Strathroy, O..... *Milner & Heard.*

a. Window arch and vase of artificial stone.

2. Tilsonburg, O..... *Hon. J. C. Jocelyn.*

Two square paving tiles.

3. Quebec, Q..... *P. Gauvreau & Co.*

a. Four specimens of artificial stone.

b Two " " " with stove-pipe holes.

NOTE.—In preparing such an extensive catalogue as the foregoing, it is impossible that some omissions should not have been made. It can only be said, however, that they have not been intentional, and that if they prove to be sufficiently numerous to warrant it, they will be brought together in the form of a supplementary catalogue.

NOTES

ON

A STRATIGRAPHICAL COLLECTION

OF

CANADIAN ROCKS.

BY

A. R. C. SELWYN, F.R.S., F.G.S.,
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NOTES

ON

A STRATIGRAPHICAL COLLECTION OF CANADIAN ROCKS.

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Director of the Geological Survey of Canada.

This collection, containing 1074 specimens—rocks 902, fossils 172—is arranged according to the supposed age of the formations. Specimens from the same formation in different localities are grouped together.

In studying the rocks of the various groups in Canada, from the Primordial Silurian up to the base of the Carboniferous, the difference in mineral character which is everywhere apparent in the same formation on either side of the great break of the St. Lawrence valley—or the great St. Lawrence and Champlain fault—is most remarkable. To the south-east, between the St. Lawrence valley and the Atlantic, all the formations are in a more or less metamorphic condition: sharp folds, intense slaty cleavage, and often a high state of crystallization is constantly exhibited, while to the north-west nothing of the kind is to be seen; there is no abrupt contortion, no slaty cleavage, and an almost entire absence of crystalline rocks. This disturbed, altered and crystalline condition of the rocks in the south-eastern area, and their consequent resemblance in parts to others of undoubted Huronian and even Laurentian age elsewhere, has led some observers in Canada and in the neighbouring States to assign the bulk of these crystalline rocks to the pre-Silurian era, notwithstanding that to do so is clearly in opposition both to stratigraphical and to palæontological evidence. Such being the case these determinations should not be hastily accepted, especially when the very uncertain nature of mineral character as a test of geological antiquity is considered. And that it is so could scarcely be more conclusively shown than by a comparison of the specimens in the present collection, which includes serpentines, diorites, magnetites, crystalline limestones and other varieties of crystalline rocks from British Columbia, none of them probably older than Devonian, but which, whether examined in situ or in hand specimens, can not be distinguished, either as regards general physical condition, or in special mineral characters, from others, collected in Ontario and in eastern Canada, which are of undoubted Laurentian age.

The distinctive condition of the several formations in the eastern and in the western areas, above briefly alluded to, as well as the great St. Lawrence and Champlain fault, has already been pointed out by Dr. T. Sterry Hunt, Geology of Canada 1863, page 597. After describing the run of the "*immense dislocation or series of dislocations*," he says: "For the present purpose it will be convenient to consider this line of dislocation as one separating the palæozoic rocks of Canada into an eastern and a western district. In the latter, which also extends eastward as far as Anticosti on the north of the line, there are found the various members of the palæozoic series from the Potsdam to the Devonian system, inclusive, presenting the character by which they are generally known to American Geologists and unaltered and in nearly horizontal position.

"In the eastern district, on the contrary, is found a vast series of strata..... The whole of these rocks are, however, much contorted and, with the exception of a narrow belt along the north and west limits of the district, are in a *metamorphosed condition*, and are included in that great belt of altered rocks which stretches

from Gaspé to Alabama. The metamorphism has comprehended not only the Quebec group, but those of the Upper Silurian and Lower Devonian series to the east of them, and in Massachusetts it has included the rocks of the Carboniferous system. It is, moreover, probable, that the rocks of New Hampshire and the White Mountains are altered strata of Devonian age."

The present collection has been arranged with the view of illustrating the facts above stated, the unaltered rocks of each formation in the western area being followed by the altered rocks of the same formation in the eastern area.

The formations and localities which are represented by specimens in the collection are as follows:

I.

LAURENTIAN.

It is now supposed that the rocks of this system in Canada will have to be divided into a lower, middle and upper series. The line between the lower and middle or "Hastings" series is not yet well defined. The lower division, however, embraces the great dolomite, ophiolite and crystalline limestone series, with the associated micaceous granitoid and syenitic gneisses of Burgess, Grenville and Buckingham. The middle division comprises the Arnprior banded limestones with associated slates, mica schists and coarse diorites; while the upper division, resting unconformably on the lower and middle, consists largely of anorthosite rocks with some bands of coarsely crystalline limestone and quartzites.

The economic minerals of the Laurentian system are, in the lower division, graphite, apatite, mica, magnetite, hematite and pyrites; in the middle division, gold, galena, silver, bismuth, antimony, iron and copper pyrites, fine-grained magnetites and hematites. In the upper division the only ores met with are beds of ilmenit- or titaniferous magnetite. The crystalline limestones, dolomites and ophiolites often afford handsome ornamental marbles. Eozoon has been found both in the lower and middle divisions. There are no serpentines associated with either the middle or the upper series.

The foregoing brief description is applicable only to the comparatively small areas of Laurentian rocks which have been examined in portions of the provinces of Ontario and Quebec. In the much larger areas lying north and north-west of Lake Superior, and in the same latitude on the east, from the Saguenay to Labrador, no bands of limestone have been discovered among the Laurentian rocks; and the entire formation there, so far as known, appears to consist of repeated alternations of grey feldspathic and dark hornblendic, micaceous and garnetiferous gniesses and quartzites, with, occasionally, areas which are occupied by massive crystalline granitic and syenitic rocks, in which no traces of stratification can be discerned, and which may probably be of intrusive origin.

Specimens.

Dolerite, porphyry, and breccia: occurring in dykes and masses cutting Laurentian rocks.—Nos. 1 to 7. (Age uncertain).

1. *Lower Laurentian*, 8 to 84.

Localities represented.

Gananoque, Burgess, North Sherbrooke, Hull, Grenville, Chatham, Wentworth, River Rouge, Ramsay, Huntington.

2. *Middle Laurentian, or "Hastings series,"* 85 to 138.

Localities represented.

Bathurst, Olden, Kaladar, Sheffield, Pakenham, Dalhousie, Madoc, Tudor, Levant, Elzevir, Barrie.

3. *Laurentian of New Brunswick*, 139 to 198.

Localities represented.

St. John, Moosepath, Pisarinco, Dipper Harbour, Musquash, Big-duck Island, Nerepis River.

4. *Laurentian of Cape Breton, N.S.*, 199 to 227.

Localities represented.

Kelly Cove, Cape Dauphin, George's River.

The rocks which are supposed to be of Laurentian age, in New Brunswick and in Nova Scotia, occur over comparatively small areas. Those of New Brunswick have been fully described by Messrs. Bailey & Matthew in the Report of Progress of the Geological Survey, 1870-71; and the supposed course of the Laurentian axis to the north-eastward through Nova Scotia and the Island of Cape Breton is shown on the coloured geological map of the Lower Provinces which, is exhibited with the collection. This part of the axis has been as yet only very partially examined by the Geological corps. Strata belonging to formations from the Huronian to the Lower Carboniferous, have, however, been observed in unconformable contact with it, in different parts of its course.

5. *Upper Laurentian or "Labradorite series,"* 228 to 254.

Localities represented.

Burgess, Rawdon, Wentworth, St. Jerome, Chateau Richer, Chicoutimi, Seven Islands, Labrador.

This remarkable series of rocks has been observed at intervals from Lake Huron to Labrador. In the vicinity of Grenville, on the Ottawa, it has been shown by Sir W. E. Logan to be in unconformable contact, probably overlying the limestone and gneiss series (Lower Laurentian). In none of the localities where it has been observed have its precise limits or its stratigraphical relations been fully determined. Except in the prevalence and variety of anorthosite rocks it does not greatly differ from the older "Lower Laurentian" series. Dr. Sterry Hunt, writing of the Upper Laurentian anorthosites, says: "The crystalline varieties of this rock often exhibit in great perfection the striæ resulting from their polysynthetic macles, and are sometimes beautifully opalescent. The original Labrador feldspar is from this formation. The predominant colors of these anorthosites are various shades of blue, passing into greenish and yellowish, rarely reddish and sometimes nearly pure white. The lustre of the cleavable varieties is vitreous, of the granular varieties waxy or dull. The weathered surfaces are always of an opaque white, but for which some of the white granular varieties might be mistaken at first sight for quartzites."

II.

HURONIAN AND LOWER CAMBRIAN SERIES.

The geographical range of the rocks of this series in Canada, as shown by the recent explorations of the Geological Corps, is much wider than has hitherto been supposed. Its precise relations in the several districts where it has been examined,

to the Laurentian system on the one hand, and to the Lower Cambrian or Primordial Silurian and to the Upper copper-bearing rocks of Lake Superior on the other, remain uncertain. Some of the facts which have been ascertained point to the possibility of its connection with the group which is provisionally classed as Middle Laurentian, while others seem to indicate that it is more closely connected with the Lower Cambrian. As will be seen from an examination of the specimens, it varies considerably in its lithological character in the different regions. In that of Lakes Huron and Superior it is largely made up of siliceous slates, with massive beds of quartzite and slate conglomerate, associated with a great variety of dioritic and chloritic rocks. Granitic and hornblendic gneiss with micaceous and nacreous schists are also common. And there are occasionally beds of hard grey siliceous limestone, and of whitish granular dolomite. In several localities beds of dark green chromiferous serpentine have been observed which do not apparently differ from those occurring in the Quebec group. With these bedded rocks there occur many irregular patches and dyke-like protrusions of granite, red syenite and porphyry. Some of these seem to be of Laurentian age, as they have contributed fragments to the Huronian slate conglomerates.

In New Brunswick and in Cape Breton the series is characterized by a great variety of felsites and felsitic trap ashes (petro-siliceous-rocks,) often porphyritic with vitreous quartz, and with feldspar. Massive quartzite, conglomerates and siliceous slates, so prevalent in the Lake Superior region, are here almost wanting. With the Upper Copper-bearing rocks, however, there are porphyritic felsites quite like those of the New Brunswick Huronian. The grey quartzites (whin) and siliceous gold-bearing slates of Nova Scotia and the peculiar dioritic, chloritic and epidotic rocks of Jebogue Point in the vicinity of Yarmouth, N.S., are also provisionally considered to be Huronian. The former are probably somewhat newer. They apparently occupy the same geological horizon as the Harlech group of Britain, and they precisely resemble it in lithological and in mineral character, while those of New Brunswick and of Cape Breton more nearly resemble the Longmynd rocks. When in proximity to the granitic masses these rocks pass into micaceous, gneissose and granitic forms, as do likewise all the newer rocks, up to the base of the Carboniferous.

6. *Huronian Series*, 255 to 425.

Localities represented.

Lake Huron and Lake Superior regions, 255 to 305.

Country containing rocks of the Upper Copper-bearing series, 306 to 352.

New Brunswick, St. John, &c., 353 to 394.

Cape Breton, Louisburg, &c., 395 to 416.

Nova Scotia, Jebogue Pt., Yarmouth, &c., 417 to 425.

7. *Lower Cambrian.*

Nova Scotia, Atlantic coast, 426 to 450.

The Upper Copper-bearing rocks, or Nipigon series, numbers 306 to 352, are placed here for convenience of comparison with the Huronian rocks of Lake Superior upon which they rest. They are certainly newer than these, but according to the most recent investigations of them in Northern Michigan, they are now considered to be older than the Potsdam formation.

The remarkable general similarity of the Cape Breton rocks to those which, according to Messrs. Bailey & Matthew, underlie the Primordial Silurian of St.

John, combined with the recent discovery of fossils of Potsdam age, in beds which seem to overlie them, has suggested their provisional classification with the Huronian.

The rocks of Jebogue Point, Yarmouth and Cape St. Mary seem to be lower than the gold-bearing slates and quartzites (whin) in the same neighbourhood. The latter are supposed to represent either the base of the Primordial or the Lower Cambrian series.

III.

LOWER SILURIAN.

8. *Primordial Silurian and Potsdam*, 451 to 510.

With the Primordial are classed the black slates, sandstones, &c., of St. John New Brunswick, and also the upper black slates of the Nova Scotia Atlantic coast series, of Halifax, Dartmouth, Oven Bluffs, &c., the latter holding.—*Eophyton Linnæarum.*

Localities represented.

St. John, New Brunswick, 451—460.

Halifax, from granite junction, 461

Cape Breton, Bras d'Or, &c, 462—476.

Newfoundland, 477—479.

Metis, Bic and Lower St. Lawrence, south side, 480—497.

Lower St. Lawrence, north side, Ottawa valley, &c, 498—510.

Fossils 1—16.

9. *Calciferous formation*, 511 to 515.

Localities represented.

Beauharnois, Gloucester, Bell's Corners, Beckwith, Mingan Islands.

Fossils 16—20.

The distribution and the character of this formation in Canada have been fully described by Sir W. E. Logan. Geology of Canada, 1863.

10. *Levis formation, Quebec group*, 516 to 537.

Localities represented.

Point Levis, Acton Vale, Melbourne, Bolton, Nicolet River, Farnham, Philipsburg.

Fossils 21—53.

11. *Lauzon formation, Quebec group*, 538 to 567.

Localities represented.

Bolton, Roxton, Melbourne, Brome, Sutton, Patton, Stukeley, Kingsey, Levis, Portage church.

Fossils 34—35.

12. *Sillery formation, Quebec group*, 568 to 608.

Localities represented.

St. Joseph, Beauce; Bolton, Rockland, Magog, New Liverpool, Sherbrooke, Cleveland, Ascot, Kingsey.

The unconformable relations of the Quebec group to the Potsdam on the south shore of the St. Lawrence below Quebec, is shown by Mr. Richardson (Report of Progress, Geological Survey of Canada, 1869-70), and the most recent investigations of its relations in the Eastern Townships south-west of Quebec, while they confirm the previous determinations of Sir W. E. Logan regarding the general structure and position of the group, point to the conclusion that some of the black slates and limestones hitherto included in the distribution of the Levis formation are perhaps of Chazy or Trenton age.

13. *Kingston series, New Brunswick*, 609 to 624.

Localities represented.

Kingston Peninsula, St. John Narrows (east side,) Long Reach, St. John River, Lands End, Kings County.

A good deal of uncertainty still exists regarding the position of these rocks. No fossils have been found in them. Messrs. Bailey & Matthew consider them to be certainly older than the Upper Silurian, but probably newer than the St. John Primordial.

14. *Chazy formation*. 625 to 638.

Localities represented.

Pembroke, Bell's Corners, Hull, Gloucester, Clarence, Caughnawaga.

Fossils, 36–41.

This formation has not been certainly recognized in Canada on the east side of the great fault; unless it is represented by some portion of the Levis or Sillery formations. On the west side it rests directly on the Calciferous, but unconformably and the fauna of the two formations likewise indicate a complete break. At one time Sir W. E. Logan, (page 20, Geology of Canada, 1863,) considered the Chazy and Calciferous to equal the Sillery and Levis. But in 1865, Mr. Billings writing of the succession as seen in Newfoundland says: "It would appear that the rocks at Point Levis not only overlie, but also when the series is complete are at least 2,000 feet above the true Calciferous. Judging from the fossils alone I should say that the Levis formation immediately succeeds the Calciferous, but the physical evidence seems to show that such is not the case."

The succession given as found at Bonne Bay, Newfoundland, is :

Sillery	2,000 feet.
Levis	1,400 "
Limestones not represented in Canada and holding an altogether new fauna, having an aspect partly Calciferous, partly Levis, partly Chazy and partly Trenton	1,369 "
Calciferous	1,839 feet.
	6,600 "

These are underlaid by the Potsdam group, 2020 feet in thickness consisting of quartzites, dolomites and shales.

15. *Bird's Eye, Black River and Trenton formations*, 639 to 648.

Localities represented.

Paquette Rapids, Pointe Séche, Montreal, Pointe aux Trembles.

Fossils 48–52.

Sir W. E. Logan says, (Geology of Canada, 1863,) "The Bird's Eye, Black River and Trenton formations constitute one of the most persistent and conspicuously marked series of strata of the Lower Silurian period on the continent of North America. They first appear to the north-east in small outliers at Murray Bay and Lake St. John, resting on the Laurentian, and from Cape Tourmente below Quebec they have been traced with an almost unbroken outcrop for a distance of nearly 2000 miles westward, into the southern part of Minnesota, where they are overlaid and concealed by newer rocks." They re-appear in Canada to the north, in the Province of Manitoba, whence they have been observed at intervals, and probably form a continuous belt, to the shores of the Arctic Ocean.

They have not been certainly identified in Canada on the east side of the St. Lawrence and Champlain fault, unless some portion of the black slates and plumbaginous limestones included hitherto in the Levis division of the Quebec group are of this age, which the fossils recently found in them would seem to indicate; or else that we have in the Levis formation of the Eastern Townships a commingling of forms similar to that noticed above as occurring in Newfoundland.

16. *Utica Slate and Hudson River formations*, 649 to 675.

Localities represented.

Collingwood, Gloucester, Lake St. John, Cote St. Michel, St. Marks, Anticosti

With the Hudson River rocks are placed a few specimens of the intrusive rocks, dolerites, diorites and trachytes, which are intruded among the members of the Lower Silurian series, but which may themselves be of much more recent date.

"The most remarkable of these in Canada form a line of isolated hills, eight in number, extending about ninety miles along the line of an undulation, which has disturbed the Lower Silurian strata. These hills, beginning from the west, are Rigaud, Mount Royal, Montarville, Belœil, Rougemont, Yamaska, Brome and Shefford mountains; to which may be added Mount Johnson or Monnoir, a little to the south of this line. These masses have been left by denudation as hills covering areas of several miles and sometimes more than 1000 feet in height, and present great varieties in composition. Brome and Shefford are granitoid trachytes, Yamaska, partly trachyte and partly diorite; to which latter rock also belongs Belœil, so far as examined, and Monnoir. Rougemont, Montarville, and Mount Royal are dolerites, and Rigaud is, in great part, a granitoid trachyte. Dykes of numerous varieties of trachyte and of phonolite, cut the dolerites of Mount Royal, and the shales of the Hudson River formation. The conglomerate of St. Helen's Island, which overlies and encloses masses of Upper Silurian limestone, as well as fragments of granitoid dolerite, is in its turn traversed by dykes of a newer rock, which is also a dolerite. The strata in the vicinity of these intrusive masses are not altered except near the line of contact."

The lithological characters of the Utica and Hudson River formations are not specially interesting: the strata composing them are made up of black graptolitic shales, arenaceous shales, sandstones and limestones. Like the preceding group they have not been found in Canada to the south-east of the great fault.

IV.

MIDDLE AND UPPER SILURIAN.

17. *Medina and Clinton formations*, 676 to 678.

Localities represented.

Grimsby, Dundas, Hamilton, Limehouse.

Fossils 78–80.

18. *Niagara formation*, 683 to 693.

Localities represented.

Dundas, Grimsby, Rockwood, Thorold, Anticosti.

Fossils 81–89.

19. *Guelph formation*, 694 to 695.

Localities represented.

Guelph, Galt.

Fossils 90–98.

UPPER SILURIAN.

20. *Onondaga formation*, 696 to 698.

Localities represented.

Goderich, Oxbow, Cayuga.

This is the great salt and gypsum bearing formation of Western Canada.

21. *Lower Helderberg formation*, 699 to 706.

Localities represented.

Bertie, Cayuga, Gaspé (limestones).

Fossils 99–106.

MIDDLE AND UPPER SILURIAN OF EASTERN AREA.

Formations 17 *to* 21 *of Western area*, 707 to 735.

Localities represented.

22. *Quebec.*

Bolton, Shipton, Chaudière, Temiscouata Lake, Rivière du Loup, Gaspé.

23. *New Brunswick.*

Chamcook Lakes, Petersville, Moore's Mills, Oak Bay.

Queens Brook, Nerepis Valley, Woodstock.

24. *Nova Scotia* 736 to 753.

Arisaig, Frenchman's Barn, East River, Malignant Cove, Doctor's Brook McLellan's Brook.

Fossils.—107 Arisaig.

Some of the specimens included with the above (736 to 753) are probably older than the group with which they are placed. They may belong to the Laurentian series which is exposed at intervals from Cape St. George to Cape Chiegnecto; but the relations and distribution of which in this region have not yet been studied by the Canadian Geological Corps, but are indicated on the coloured geological map of the Lower Provinces. The valuable deposits of iron ore, hematite and limonite of Londonderry, Pictou, &c., in Nova Scotia, are associated with these Upper Silurian formations.

V.

DEVONIAN.

25. *Oriskany and Corniferous formations*, 754 *to* 756.

Localities represented.

Cayuga, Oneida.

Fossils 108–127.

26. *Hamilton formation*.

Locality represented.

Hamilton.

Fossils 128–133.

The distribution of these formations is shown on the large geologically coloured map of Canada, and they have been fully described by Sir W. E. Logan in the fourteenth chapter of the "Geology of Canada." As the source of all the petroleum produced in the Dominion, and as affording excellent lime and fine building stone they are of great economic importance.

27. *Devonian of Eastern Area. Formations* 25 *and* 26 *of the Western Area* 757 to 781,

Localities represented.

Belœil, Gaspé, Port Joli, Matapedia.

Mispec Creek, St. John, N.B., Nictaux, N.S., and Peace River, B.C.

Fossils 134–141.

28. *Devonian Granites*, 781 to 804.

Provinces represented.

Quebec.
New Brunswick.
Nova Scotia.

VI.

CARBONIFEROUS, PERMIAN AND TRIAS.

29. *Lower Carboniferous, Bonaventure formation*, 805 to 824.

Provinces represented.

Nova Scotia.
New Brunswick.

30. *Millstone Grit and Coal Measures*, 825 to 839.

Provinces represented.

Nova Scotia.
New Brunswick.

Fossils 143–153.

31. *Upper Coal Measures*, 840 to 843.

Provinces represented.

Nova Scotia and New Brunswick.

32. *Permian*, 844 to 848.

Province represented.

Prince Edward Island.

33. *Trias*, 849 to 854

Province represented.

Prince Edward Island.

VII.

ROCKS OF BRITISH COLUMBIA.

34. *Crystalline rocks of undetermined age*, 855 to 884.

35. *Silurian, Devonian and Carboniferous formations*, 885 to 892.

36. *Devonian and Carboniferous formations*, 893 to 899.

Localities represented.

Vancouver and Ballina Islands.c

37. *Cretaceous formation*, 900 to 902.

Localities represented.

Queen Charlotte Islands.

Vancouver Island.

NOTE.—In addition to the stratigraphical collection of rocks from the Geological Survey, Dr. Honeyman of the Provincial Museum, Halifax, exhibits a collection of Nova Scotia rocks, Professor How of Windsor, Nova Scotia, a collection of minerals, and Mr. H. S. Poole, of Halifax, a collection of ores and associated rocks.

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