

GEOLOGICAL SURVEY OF CANADA  
ROBERT BELL, M.D., D.Sc., LL.D., F.R.S., DIRECTOR

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REPORT

OF THE

SECTION OF CHEMISTRY AND MINERALOGY

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OTTAWA

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To .

ROBERT BELL, M.D., D.Sc., LL.D., F.R.S.,  
*Director of the Geological Survey of Canada.*

SIR,—In submitting to you the accompanying report for the past year, it should be mentioned that the same does not embrace all the work accomplished in this Laboratory during the period in question, indeed scarcely two-thirds, very many mineral determinations, qualitative examinations, and partial quantitative analyses, the results of which were of little or no interest save to those immediately concerned, having been altogether omitted.

I have the honour to be,  
Sir,  
Your obedient servant,

G. CHRISTIAN HOFFMANN.

OTTAWA, July 31, 1901.



## TABLE OF CONTENTS.

	PAGE
<b>I.—MISCELLANEOUS MINERALS—</b>	
Cassiterite, var. wood-tin, from Hunker creek, a tributary of the Klondike, Yukon district, N.W.T. ....	16
Danalite, from Walrus island, Paint Hills group, east coast of James bay, Ungava district, N.E.T. ....	15
Datolite, from lot 9, range 1, of the township of Derry, Ottawa county, Q.	17
Faujasite, from lot 9, range 1, of the township of Derry, Ottawa county, Q.	18
Grossularite, from the White Horse copper-belt, west side of Lewes river, Yukon district, N.W.T. ....	14
Hydronephelite, from Ice river, a tributary of the Beaver-foot, Rocky mountains, B.C. ....	13
Lepidolite, from lot 25, range 7, of the township of Wakefield, Ottawa county, Q. ....	11
Newberyite, from the tusk of a mammoth found in swamp-muck on Quartz creek, Yukon district, N.W.T. ....	13
Schorlomite, from Ice river, a tributary of the Beaver-foot, Rocky mountains, B.C. ....	12
Spodumene, from Walrus island, Paint Hills group, east coast of James bay, Ungava district, N.E.T. ....	15
Struvite, from the tusk of a mammoth found in swamp-muck on Quartz creek, Yukon district, N.W.T. ....	13
Uranophane, from lot 31, range 1, of the township of Villeneuve, Ottawa county, Q. ....	16
<b>II.—MINERALOGICAL NOTES—</b>	
Allophane, from the Rabbit-foot claim, White Horse copper-belt, Lewes river, Yukon district, N.W.T. ....	18
Altaite, from the Pay Roll claim, Little Nigger creek, East Kootenay district, B.C. ....	19
Amazonstone, from one of the islands of the Paint Hills group, east coast of James bay, Ungava district, N.E.T. ....	19
Barite, from lot 27, concession 7, of the township of Huntley, Carleton county, O. ....	19
Celestite, from Grand Manitoulin island, north shore of Lake Huron, O.	19
Chrysocolla, from the Pueblo claim, White Horse copper-belt, Lewes river, Yukon district, N.W.T. ....	19
Danaite, from lot 12, range 9, of the township of Calumet, Pontiac county, Q.	19
Epidote, from Walrus island, Paint Hills group, east coast of James bay, Ungava district, N.E.T. ....	20
Erythrite, from the Chickamon-stone claim, west side of Bull river, East Kootenay district, B.C. ....	20
———, from the Rabbit-foot claim, White Horse copper-belt, Lewes river, Yukon district, N.W.T. ....	20
Galena, from lot 18, concession 9, of the township of Bedford, Frontenac county, O. ....	20

II.—MINERALOGICAL NOTES—*Con.*—

PAGE.

Gmelinite, from the War Eagle mine, near the town of Rossland, West Kootenay district, B.C.....	21
Graphite, from lot 1, concession 5, and lot 2, concession 6, of the township of Bedford, Frontenac county, O.....	21
———, from lot 22, concession 2, of the township of South Canonto, Frontenac county, O.....	21
Hematite, from Rocher Rouge, MacTavish bay, Great Bear lake, Mackenzie district, N.W.T.....	21
Hydromagnesite, from cliffs on the south shore of Dease bay, Great Bear lake, Mackenzie district, N.W.T.....	22
Jamesonite, from the David Whitley or Red Paddy claim, Kettle river, Yale district, B.C.....	22
Magnesite, from Discovery claim on Pine creek, and the Anaconda group of claims on the Indian Reserve, Atlin city, east side of Atlin lake, Cassiar district, B.C.....	22
———, from about a mile north of Pike river, on the eastern side of the southern end of Atlin lake, Cassiar district, B.C.....	22
Magnetite, from the Arctic Chief and Valerie claims, White Horse, copper-belt, Lewes river, Yukon district, N.W.T.....	23
Marl, from the west half of lot 10, concession 1, of the township of Stafford, Renfrew county, O.....	23
Micaceous hematite, from one of the more southerly of the Les Isles du Large group, Great Bear lake, Mackenzie district, N.W.T.....	21
Molybdenite, from island No. 12 of the Paint Hills group, east coast of James bay, Ungava district, N.E.T.....	23
———, from lot 16, concession 1, of the township of Brougham, Renfrew county, O.....	23
———, from the Giant claim, Trail Creek mining area, West Kootenay district, B.C.....	23
Monazite, from lot 31, range 1, of the township of Villeneuve, Ottawa county, Q.....	24
Mountain leather, from near the village of Lower Five islands, township of Economy, Colchester county, N.S.....	24
Sericite, from Bonanza creek, a tributary of the Klondike, Yukon district, N.W.T.....	24
Siderite, from the south shore of Dease bay, Great Bear lake, Mackenzie district, N.W.T.....	24
Silver, Native, from the Westend mine, Silver mountain, township of Lybster, district of Thunder Bay, O.....	24
Specular iron, from Echo bay, east side of Great Bear lake, district of Mackenzie, N.W.T.....	21
———, from the Pueblo claim, White Horse copper-belt, Lewes river, Yukon district, N.W.T.....	21
Spessartite, from the township of Proudfoot, Parry Sound district, O.....	25
Sphalerite, from lots 41 and 42, ranges 1 and 2, of the township of Bouchette, Ottawa county, Q.....	25
Stibnite, from the Copper King and Anaconda claims, White Horse copper-belt, Lewes river, Yukon district, N.W.T.....	25
Wilsonite, from the Rabbit-foot claim, White Horse copper-belt, Lewes river, Yukon district, N.W.T.....	25

## III.—COALS AND LIGNITES—

PAGE.

Anthracite, from a seam about ten miles west of Dugdale station on the line of the W. P. and Y. R., Yukon district, N.W.T.....	30
Coal, from the so-called sixteen-foot seam on Collins gulch, Tulameen river, Yale district, B.C.....	29
——, from the so-called twenty-foot seam on Collins gulch, Tulameen river, Yale district, B.C.....	29
——, from a seam on the Stony Indian reserve, two miles south of Morley station on the line of the C.P.R. district of Alberta, N.W.T..	30
Lignitic coal, from a seam on Lewes river, about six miles above Rink rapid, Yukon district, N.W.T.....	28
Lignite, from the upper seam on Coal creek, an easterly branch of Rock creek—which is a tributary of the Klondike, Yukon district, N.W.T.	25
——, from the lower seam on Coal creek, an easterly branch of Rock creek—which is a tributary of the Klondike, Yukon district, N.W.T..	26
——, from the upper working on Cliff creek, a tributary of the Yukon, Yukon district, N.W.T.....	27
——, from the lower working on Cliff creek, a tributary of the Yukon, Yukon district, N.W.T.....	27

## IV.—LIMESTONES AND DOLOMITES—

Limestone, from the Rokes and Morse quarry on Drury cove, Kennebecasis river, parish of Portland, St. John county, N.B.....	31
——, from the first bed of Robillard and Son's quarry on lot 22, first concession of Ottawa Front, township of Gloucester, Carleton county, O.....	32
——, from the third bed of Robillard and Son's quarry, on lot 22, first concession of Ottawa Front, etc.....	32
——, from the fifth bed of Robillard and Son's quarry on lot 22, first concession of Ottawa Front, etc.....	33
——, from the fourth bed of a quarry on lot 8, concession 1, of the township of Colborne, Huron county, O.....	33
——, from the thirteenth bed of the quarry on lot 8, concession 1, of the township of Colborne, Huron county, O.....	34
——, from the twenty-fourth bed of the quarry on lot 8, concession 1, of the township of Colborne, Huron county, O.....	34
Dolomite, from lot 16, concession 6, of the township of Ross, Renfrew county, O.....	35

## V.—IRON ORES.—

Hematite, from the east branch of Doctors brook, and its tributaries Iron and McInnes brooks, Antigonish county, N.S.....	35
——, from Rocher Rouge, MacTavish bay, Great Bear lake, Mackenzie district, N.W.T.....	36
——, from one of the Les Iles du Large group, Great Slave lake, Mackenzie district, N.W.T.....	36
Limonite, from the Grand River barrens, one mile south-west of Grand River falls, Richmond county, N.S.....	36
Magnetite, from a deposit on the Old French road, two mile seasterly of the Mira R. C. chapel, Cape Breton county, N.S.....	36

## VI.—NICKEL AND COBALT—

PAGE.

Pyrrhotite, from a small island off the west point of Kogaluk river, east coast of Hudson bay, Ungava district, N.E.T. ....	37
———, from the township of Matawatchesan, Renfrew county, O. ....	37
———, from the north-east quarter section of block 1, west side of Texada island, B.C. ....	37
———, from near Kyuquot, west coast of Vancouver island, B.C. ....	38
Pyrite, from lot 14, range 5, of the township of Masham, Ottawa county, Que. ....	37

## VII.—GOLD AND SILVER ASSAYS—

Of specimens from the—

Province of New Brunswick. ....	38
— Quebec. ....	39
— Ontario. ....	42
— British Columbia. ....	46
Ungava district, North-east Territory. ....	39
North-west Territory. ....	42

## VIII.—NATURAL WATERS—

Water from a spring two or three hundred yards back from the Tobique river, east side and about a quarter of a mile above the mouth of the Wapskehegan, Victoria county, N.B. ....	48
———, from a spring on the east bank of the Tobique river, about a mile and three-quarters above the mouth of the Wapskehegan, Victoria county, N.B. ....	49
———, of Salt brook, a stream flowing into the Tobique about two miles and a quarter above the mouth of the Wapskehegan, Victoria county, N.B. ....	50
———, from a spring on the property of Mr. Hendricks, near Plumweseep station, on the line of the I.C.R., Kings county, N.B. ....	56
———, from a spring at Bay of Seven islands, Saguenay county, Q. ....	52
———, from a boring about two miles from the village of St. Grégoire, on concession Pointu, seigniory of Bécancour, Nicolet county, Q. ....	53
———, from a well on the farm of Narcisse Tetreau, St. Paul l'Ermite, L'Assomption county, Q. ....	57
———, from a spring at Ste. Rose, Laval county, Q. ....	57
———, from a well on the east-half of lot 17, concession 10, of the township of Ramsay, Lanark county, O. ....	58
———, from a well on lot 4, concession 12, of the township of Dereham, Oxford county, O. ....	58
———, from a hot spring on Sharp point, between Sydney inlet and Refuge cove, west coast of Vancouver island, B.C. ....	55
———, from a warm spring on the east shore of Atlin lake, ten miles south of Atlin city, Cassiar district, B.C. ....	59
———, so-called 'soda-water' from a spring near Discovery claim, three miles up McKee creek, east side of Atlin lake, Cassiar district, B.C. ....	60

## IX.—MISCELLANEOUS EXAMINATIONS—

Clay, from near Louisbourg, Cape Breton county, N.S. ....	60
———, found overlying a seam of lignite on Rock creek, Klondike river, Yukon district, N.W.T. ....	60



IX.—MISCELLANEOUS EXAMINATIONS—*Con.*—

PAGE.

Clay, found underlying a seam of lignite on Rock creek, Klondike river, Yukon district, N.W.T. ....	60
———, from Michel creek, East Kootenay district, B.C. ....	61
———, found underlying a seam of coal on Granite creek, Tulameen river, Yale district, B.C. ....	61
Claystone, from four miles north of Clinton, Lillooet district, B.C. ....	61
Coal, from Dunsinane, Kings county, N.B. ....	61
Graphite, disseminated, from Glendale, River Inhabitants, Inverness county, N.S. ....	62
———, disseminated, from lot 25, concession 5, of the township of Blythfield, Renfrew county, O. ....	62
———, from lot 22, concession 2, of the township of South Canonto, Frontenac county, O. ....	62
———, from lot 2, concession 6, of the township of Bedford, Frontenac county, O. ....	62
Hematite, from Cape Rouge, Inverness county, N.S. ....	62
Magnetite, from lot 14, range 8, of the township of Litchfield, Pontiac county, Q. ....	63
———, from lot 12, range 6, of the township of Sheen, Pontiac county, Q. ....	63
———, from a creek entering the Tulameen at Otter Flat, Yale district, B.C. ....	63
Marl, from the west-half of lot 10, concession 1, of the township of Stafford, Renfrew county, O. ....	63
Shale, Argillaceous, from lower part of Pierre shales, Lethbridge, district of Alberta, N.W.T. ....	64
———, Carbonaceous, from St. Liboire, township of Ramsay, Bagot county, Q. ....	64
———, Ferruginous, from Monument settlement, York county, N.B. ....	64
———, from Hay cove, Red islands, Richmond county, N.S. ....	63
Specular iron, Cupriforous, from the Pueblo claim, White Horse copper-belt, west side of Lewes river, Yukon district, N.W.T. ....	64



R E P O R T  
OF THE  
SECTION OF CHEMISTRY AND MINERALOGY.

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MISCELLANEOUS MINERALS.

1. LEPIDOLITE.

This species, which had previously been met with at but one locality in Canada, namely, that referred to by the writer in a note in the Annual Report of the Geological Survey of Canada for 1892-93, p. 29R has since been found to be a constituent of a coarse granite vein, of very considerable width, on the twenty-fifth lot of the seventh range of the township of Wakefield, Ottawa county, in the province of Quebec. The minerals composing this vein consist of white and light smoky-brown to brownish-black quartz, pinkish and light to dark verdigris-green microcline, a grayish albite having a fine bluish opalescence, and the mica in question, together with some aggregations of light purplish crystals of fluorite, and fine crystals of black and green tourmaline. The mica occurs in broad foliations having a rough, distorted hexagonal contour, and which in some instances have been found to measure fourteen by twenty-eight inches or more across. It has a pearly lustre. In thin laminæ it is transparent and colourless; in combinations of several laminæ it exhibits, on a white surface, a fine, light purplish colour; and in layers of about half an inch in thickness it has, by reflected light, a rich purplish-brown colour. Before the blowpipe it fuses easily and with much intumescence to a light yellowish-brown glass, simultaneously colouring the flame intense carmine-red. Its specific gravity, employing the air-pump, at 15·5°C.,

was found by Mr. R. A. A Johnston to be 2·858, and its analysis afforded him the following results :—

Silica.....	47·89
Alumina.....	21·16
Ferric oxide.....	2·52
Manganous oxide.....	4·19
Potassa.....	10·73
Lithia.....	5·44
Soda.....	1·34
Magnesia.....	0·36
Water (direct estimation).....	1·90
Fluorine.....	7·41
	<hr/>
	102·94
Less oxygen, equivalent to fluorine.....	3·12
	<hr/>
	99·82

## 2. SCHORLOMITE.

A mineral which, as the result of an examination by Mr. F. G. Wait, proves to be this species, has been met with, in masses of considerable size, as an accessory constituent of the nephelene-syenite rocks of Ice river, a tributary of the Beaver-foot, which flows into the Kicking Horse river, in the Rocky mountains, province of British Columbia.

It is massive, without cleavage; the colour is velvet black, here and there tarnished blue, and occasionally with pavonine tints; that of the streak, hair brown; the lustre is vitreous; it is brittle; the fracture is irregular, occasionally subconchoidal; it is opaque; fuses quietly at 3 to a black enamel; has a hardness of 6·5, and a specific gravity, at 15·5°C., of 3·802. Its analysis afforded him :—

Silica.....	25·77
Titanic oxide.....	19·95
Alumina.....	3·21
Ferric oxide.....	9·69
Ferrous oxide.....	8·01
Manganous oxide.....	0·76
Lime.....	31·76
Magnesia.....	1·22
	<hr/>
	100·37

These figures do not afford a rational formula. If, however, it be assumed that the iron represented as being present in the ferrous condition, does not exist in the mineral as such (as would appear to be justified by the fact that a very carefully conducted qualitative exam-

ination failed to afford more than the faintest reaction for ferrous iron), but that it resulted from an interaction between titanium and iron sesquioxides during the process of solution of the mineral, (the titanous oxide being converted into titanic oxide at the expense of a portion of the oxygen of the ferric oxide, with simultaneous formation of ferrous oxide), and the above analysis be recalculated in accordance with this view, we obtain for the composition of the mineral:—

Silica.....	25.77
Titanic oxide.....	10.83
Alumina.....	3.21
Ferric oxide.....	18.59
Titanous oxide.....	8.23
Manganous oxide.....	0.76
Lime.....	31.76
Magnesia.....	1.22
	<hr/>
	100.37

which figures afford a formula closely analogous to that required for garnet, and according with that now generally accepted for schorlomite.

### 3. HYDRONEPHELITE.

In the course of a lithological examination of a series of specimens of the nephelene-syenite of Ice river—above referred to under schorlomite, Dr. A. E. Barlow separated, by Thoulet's solution, from the rock, in which they are quite abundant, some minute, white to pinkish spherules, having a radiated structure, and a specific gravity, as determined by him, of 2.243-2.275. An analysis of these spherules, by Mr. Johnston, showed them to have the following composition:—

Silica.....	42.80
Alumina.....	28.50
Ferric oxide.....	0.34
Lime.....	1.90
Soda.....	14.33
Potassa.....	0.30
Water.....	10.81
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	98.98

### 4. NEWBERYITE AND STRUVITE.

A material corresponding in composition to a mixture of these two minerals, has recently been obtained from partings resulting from the

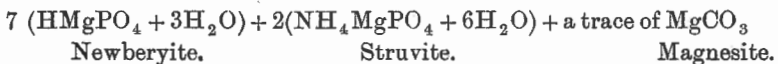
drying up of the soft material of the concentric rings of interglobular spaces in the ivory of the tusk of a mammoth which was found at a depth of some fifteen feet in a surface bed of dark frozen swamp-muck, overlying stream-gravels, on Quartz creek, a tributary of Indian river, which flows into the Yukon some twenty miles south of Dawson city, Yukon district, in the North-west Territory.

The material occurred in the spaces in question in the form of readily removable plates of from one to two millimetres in thickness, which were at first colourless and transparent, but on exposure to the air, became white and lost their transparency. In the closed tube it gives off water and ammonia and becomes opaque. When heated before the blowpipe, it imparts a green colour to the inner flame and fuses at about 3 to a white enamel, which, when moistened with a solution of cobalt nitrate and reheated, assumes a beautiful pink colour. It is slightly soluble in water, and readily and completely so in cold, dilute hydrochloric, nitric or sulphuric acid.

Its analysis afforded Mr. Johnston the following results :

Phosphorus pentoxide.....	38·53
Magnesia.. . . . .	21·93
Ammonia.....	1·94
Water, by difference.....	37·18
Carbon dioxide.....	0·42
	100·00

These figures afford a ratio closely agreeing with the following formula :



## 5. GROSSULARITE.

A faint yellowish light-gray, wood-brown, occasionally brownish-gray, compact massive, and, more rarely, yellowish-brown and reddish-brown, imperfectly crystalline, grossularite, is met with in considerable abundance in the White Horse copper-belt, on the west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, in the North-west Territory, where it is a very common, indeed the chief, constituent of the gangue of the copper-ore—bornite. Mr. Johnston

found it to have a specific gravity, at 15·5° C., of 3·603, and, conformably with the results of his analyses, the undermentioned composition :

Silica .....	38·94
Alumina.....	15·11
Ferric oxide.....	6·30
Manganous oxide.....	0·78
Lime ....	36·93
Magnesia.....	1·62
Loss on ignition .....	0·35
	<hr/>
	100·03

#### 6. DANALITE.

A few crystals of what has been identified by Mr. Johnston as the somewhat rare mineral danalite, have been observed by him scattered through the felspar of a vein-stone composed of orthoclase, spodumene and quartz, which was found by Mr. A. P. Low, cutting syenite on Walrus island, Paint Hills group, east coast of James bay, Ungava district, North-east Territory.

The crystals are mostly minute, seldom exceeding a millimetre in diameter; one, however, was found, and that the only one of any appreciable dimensions in some twenty pounds of the rock, which measures fifteen millimetres across. It is a contact twin of two tetrahedrons, and on some of the faces is triangularly marked by successions of crystal growth. On some of the more minute crystals the rhombic dodecahedral plane—which is striated in the direction of the longer diagonal, is largely developed, sometimes obscuring the tetrahedral plane.

It has a faint yellowish orange-gray (faint yellowish-brown) colour; is translucent; has a resinous lustre; affords a yellowish-white streak; is brittle, and breaks with a subconchoidal fracture. The hardness is 6, and the specific gravity, at 15·5° C., 3·25. Before the blowpipe, it fuses at about 5 to a black enamel. With soda on charcoal, it gives a slight coating of zinc oxide. It is perfectly decomposed by hydrochloric acid, with evolution of hydrogen sulphide and separation of gelatinous silica.

#### 7. SPODUMENE.

This species has been identified by Mr. Johnston as being a prominent constituent of a micaless orthoclasic granitic vein-stone, found by Mr. A. P. Low cutting syenite on Walrus island, Paint Hills group, east coast of James bay, Ungava district, North-east Territory.

The mineral occurs in more or less well-individualized grayish-green subtranslucent prisms, some of which measure more than ten centimetres in length and from eight to ten millimetres in diameter. It has one well-developed prismatic cleavage, the lustre of which is pearly, while that of the cross fracture, which is uneven, is vitreous. The hardness is nearly 7. Before the blowpipe, it swells up and fuses at about 4 to a white glass, imparting at the same time a bright purplish-red colour to the flame. The finely powdered mineral is not acted upon by hydrochloric acid.

#### 8. URANOPHANE.

A mineral which, on examination by Mr. Johnston, proved to be as anticipated by the writer, uranophane, has been found associated with gummite, uraninite, black tourmaline, white, light gray, pale olive-green and bluish-green apatite, spessartite, monazite, and green and purple fluorite, in a coarse pegmatite vein—composed of white and light to dark smoky-brown quartz, microcline, albite and muscovite, which traverses a gray garnetiferous gneiss on the thirty-first (and adjoining lots) of the first range of the township of Villeneuve, Ottawa county, in the province of Quebec.

The mineral which, in this instance, is evidently an alteration-product of gummite, occurs in small, bright, lemon-yellow fibrous masses, sometimes in immediate contact with the gummite found coating the uraninite or, per se, embedded in the albite immediately surrounding the tourmaline and often invading the latter. In the closed tube it blackens and gives off water. Before the blowpipe, it affords, with salt of phosphorus, in the oxidizing flame, a yellowish-green bead, which, on reheating in the reducing flame, assumes a fine green colour. Warm hydrochloric acid decomposes it, with separation of flocculent silica.

#### 9. CASSITERITE, VAR. WOOD-TIN.

The variety of tin-stone called wood-tin, has been met with in the form of small irregularly shaped nodules, scattered through the auriferous gravel of nearly all the tributaries—but, so far, most frequently in that of Bonanza and Hunker creeks—of the Klondike river, Yukon district, in the North-west Territory.

A specimen of the mineral from a claim on Hunker creek, which was sent to the writer for identification, consisted of a small water-



worn nodule of about a centimetre in its greatest diameter, exteriorly brownish-black, almost black, with a greasy lustre, but interiorly of a light to dark reddish-brown colour, dull in lustre, and, although very compact, exhibiting a divergingly fibrous structure in one direction and a concentrically lamellar one in the other. According to the finder of this specimen—Mr. W. T. Foster, some very much larger nodules of the mineral than the one just described, have since been found in the gravel of Bonanza creek.

#### 10. DATOLITE.

A specimen of a mineral was recently submitted to the writer for identification, which had been met with by Mr. Bush Winning in some abundance, in the workings of the Daisy mica mine, on the ninth lot of the first range of the township of Derry, Ottawa county, in the province of Quebec, which on being examined by Mr. R. A. A. Johnston, proved to be datolite. Mr. R. L. Broadbent has since visited the mine in question and collected a fine series of specimens which not only fully illustrate its mode of occurrence, but likewise its various mineral associations. On transferring these specimens to me, Mr. Broadbent drew my attention to some small white, occasionally colourless, octahedral crystals which he had observed on some of them. These crystals were also examined by Mr. Johnston, and identified by him as the somewhat rare mineral faujasite, a species not previously recognized as occurring in Canada.

The datolite occurs in the form of hard, compact, irregularly shaped, at times more or less nodular, masses some of which are of quite small dimensions while others are of considerable size—one having been found which measures six inches across, and weighs thirteen pounds. It has also occasionally been met with in the form of moist plastic masses, which on exposure to the air become crumbly and ultimately fall to pieces, forming a loose earth. The masses in question occur imbedded in a matrix composed of an association of a light to somewhat dark greenish-gray, more or less weathered, pyroxene, brown phlogopite, light grayish to white cleavable calcite, grayish-white translucent to colourless transparent quartz, and bluish-green, more rarely faint purplish, yellowish and colourless fluorite, with some intermingled pyrite and pyrrhotite, and small quantities of barite, chabazite and faujasite.

The mineral is greenish-white to all but white in colour; is almost opaque; has a dull lustre; is brittle; breaks with an uneven to sub-conchoidal fracture—the fractured surface resembling that of fine stone-

ware (Wedgwood-ware). It has a hardness of 5 and a specific gravity, at 15.5° C., of 2.985. Before the blowpipe, it fuses with slight intumescence, at about 2 to a clear glass, simultaneously colouring the flame yellowish-green. In fine powder it is easily and completely decomposed by hydrochloric acid, with separation of gelatinous silica.

The mean of two very closely concordant analyses, conducted by Mr. Johnston, showed it to have the following composition :

Silica .....	36.94
Boron trioxide.....	22.37
Lime.....	34.90
Alumina .....	0.12
Ferric oxide.....	0.02
Magnesia.....	0.05
Water (direct estimation) .....	5.68
	100.08

#### 11. FAUJASITE.

This species, which has been briefly alluded to in the preceding note, as being one of the mineral associations of the datolite found at the Daisy mica mine, on the ninth lot of the first range of the township of Derry, Ottawa county, in the province of Quebec, is there met with in the form of simple octahedral crystals implanted upon the walls of small cavities in the quartz or intimately associated with the fluorite, both of which enter largely into the composition of the matrix of the datolite. The crystals vary in size from such as are of almost microscopic minuteness to others having a diameter of about two millimetres. They are mostly milk-white—with, in some instances, a faint greenish tinge, in colour, and opaque, occasionally, however, colourless and translucent, and have a vitreous lustre. In the closed tube the mineral yields much water. Before the blowpipe, it intumescs and fuses to a white blebby enamel. It is decomposed by hydrochloric acid without gelatinization.

#### MINERALOGICAL NOTES.

- 1.—Allophane. A pale bluish-white allophane, having a waxy lustre, has been recognized by Mr. R. A. A. Johnston, as filling small fissures in specimens of light yellowish-gray andradite occurring at the Rabbit-foot claim on the White Horse copper-belt, on the west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory. Before the blowpipe it falls to pieces, and is infusible; when moistened with a solution

of cobalt nitrate, and again ignited, it assumes a blue colour. In the closed tube it gives off a large amount of water. It is decomposed by hydrochloric acid with separation of gelatinous silica.

- 2.—Altaite. Small quantities of a massive altaite have been recognized as occurring, with chalcopyrite and particles of native gold, scattered through some specimens of quartz, collected by Mr. J. McEvoy, from a narrow quartz vein at the Pay Roll claim, on Little Nigger creek, twelve miles south-west of Cranbrook, East Kootenay district, province of British Columbia.
- 3.—Amazonstone. Fine cleavable masses of a verdigris-green, passing into white, microcline, have been obtained by Mr. A. P. Low, from pegmatite veins cutting schistose traps on some of the islands of the Paint Hills group, east coast of James bay, Ungava district, North-east Territory.
- 4.—Barite. A white fine granular, and ash-gray coarse crystalline, massive barite, has been met with, in Lower Trenton limestone, on the twenty-seventh lot of the seventh concession of the township of Huntley, Carleton county, in the province of Ontario.
- 5.—Celestite. Among other specimens collected by Dr. R. Bell in the course of his geological examination of the Manitoulin islands in 1865, were some very good specimens, recently handed to me, of celestite found by him in the Hudson River formation on the east side of Manitouaning bay and at Cape Robert, Grand Manitoulin island, and west south-west of Cape Robert on Bayard island, a small island lying about a mile off shore. In these specimens, the mineral occurs in the form of white, at times, in part, bluish, translucent, radiating fine columnar masses with yellow to white, translucent, rhombohedral crystals of dolomite, inclosed in a very fine granular, light bluish-gray, compact magnesian limestone.
- 6.—Chrysocolla. Small quantities of a greenish-blue chrysocolla, together with some limonite and a little green carbonate of copper, have been observed incrusting specimens of a light yellowish-gray granite, collected by Mr. R. G. McConnell, from the west wall of the Pueblo claim on the White Horse copper-belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.
- 7.—Danaite. Fairly well-developed, at times perfect, crystals of danaite—one of the latter of which measured nearly two millimetres in the direction of the longer axis, have been observed by Mr. R. A.

A. Johnston, distributed through a crystalline granular, massive, cobaltiferous arsenopyrite which occurs, associated with a nickeliferous pyrrhotite, niccolite, and chalcopyrite, in a gangue composed of a dark gray calcareous mica-diorite gneiss, on the twelfth lot of the ninth range of the township of Calumet, Pontiac county, in the province of Quebec.

- 8.—Epidote. This mineral has been met with by Mr. A. P. Low, in considerable abundance, as a rock constituent, on the north-east part of Walrus island—one of the Paint Hills group, off the east coast of James bay, Ungava district, North-east Territory—which, as I am informed by Mr. Low, is occupied by a porphyritic augite-syenite, composed largely of felspar in a ground mass of dark green augite, cut by a large dyke of diabase which at, and for upwards of a hundred feet from its contact with the syenite, has effected an alteration of the augite of the latter to epidote, thereby converting the augite-syenite into an epidote-syenite. Some of the finest specimens of the mineral collected by Mr. Low were obtained in close proximity to the dyke. These consist of interlaced radiating crystalline aggregates of a light to dark yellowish-green epidote filling cavities in large cleavable masses of tile-red orthoclase.
- 9.—Erythrite. Earthy cobalt bloom, of a peach blossom colour, has been observed coating the surfaces of fine fissures in specimens of a gray felspathic rock, collected by Mr. J. McEvoy, carrying small quantities of magnetite, at the Chickamon-stone claim, on the west side of Bull river—a tributary of the Kootenay, about a mile above the old pack bridge, in the East Kootenay district of the province of British Columbia. Fleckings of a cochineal-red erythrite have also been observed on some specimens of a light gray massive grossularite, collected by Mr. McConnell, which enters largely into the composition of the gangue of the Cornite at the Rabbit-foot claim on the White Horse copper belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.
- 10.—Galena. Fine groups of cubic crystals of galena—the latter, in some instances, measuring four centimetres across, as likewise groupings of smaller cubo-octahedral crystals, more or less coated, however, with lead carbonate intermixed with a little lead sulphate, have occasionally been met with in a galena-bearing vein, having a gangue of calc-spar mingled with some heavy-spar, traversing the crystalline limestone of the Laurentian series on the

eighteenth lot of the eighth concession of the township of Bedford, Frontenac county, province of Ontario.

- 11.—Gmelinite. This species has been met with in reddish-white, well-formed, translucent crystals of rhombohedral habit, in the workings of the War Eagle mine, which is located on a spur of Red mountain, about half a mile north-north-west of the town of Rosland, in the West Kootenay district of the province of British Columbia.
- 12.—Graphite. A large deposit of graphite intermingled with calcite, dolomite, quartz, and actinolite—a specimen of which was found to contain 64.3 per cent of graphite, occurs forming a vein, as it has been described, of from four to eight feet in width, cutting a crystalline limestone, on the north shore of Birch lake, that is to say on the first lot of the fifth concession and extending thence, in a north-easterly direction, into the second lot of the sixth concession, of the township of Bedford, Frontenac county, in the province of Ontario. Another deposit of graphite, a sample of the material of which was found to contain 77.6 per cent of graphite, has been met with on the twenty-second lot of the second concession of the township of South Canonto, also in Frontenac county.
- 13.—Hematite. Has been met with by Mr. J. M. Bell, in reniform masses, having a finely fibrous structure—pseudomorph after limonite, intimately associated with a compact, also, at times, a lamellar and micaceous, hematite, forming a vein of from two to three feet or more in width, which traverses a dark red, highly felspathic, vesicular trap composing Rocher Rouge, MacTavish bay, east side of Great Bear lake, Mackenzie district, North-west Territory.
- 14.—Hematite, Micaceous. A dark, steel-gray, schistose aggregate of micaceous hematite and grayish-white, translucent quartz—micaceous iron-schist, has been found by Mr. J. M. Bell, forming lenticular veins, one of which had a maximum width of twenty feet, and stringers, in a greenish siliceous sandstone, on some of the more southerly of the group of islands known as Les Iles du Large, Great Slave lake, district of Mackenzie, North-west Territory.
- 15.—Hematite, var. specular iron. This has been met with by Mr. J. M. Bell, in some abundance, at Echo bay, on the east side of Great Bear lake, district of Mackenzie, in the North-west Ter-

ritory. A very large deposit of a crystalline massive specular iron, holding small quantities of intermixed green carbonate of copper, has likewise been met with, according to Mr. R. G. McConnell—who collected the specimens examined, at the Pueblo claim, on the White Horse copper-belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.

- 16.—Hydromagnesite. This species has been found by Mr. J. M. Bell—to whom the writer is indebted for the specimens examined, in the form of white, sometimes superficially pinkish, amorphous incrusting masses, having a more or less botryoidal structure, on the upper surfaces of cavities in an exposure of dark, porous, highly weathered dolomite, constituting, in part, high cliffs on the south shore of Dease bay, some thirty miles south-west of Fort Confidence, Great Bear lake, Mackenzie district, North-west Territory.
- 17.—Jamesonite. Fine specimens of a fibrous massive jamesonite have been obtained by Mr. R. W. Brock, at the David Whitley or Red Paddy claim, at the head of Kettle river, Yale district, in the province of British Columbia, where it occurs, with native gold, in a gangue of white subtranslucent quartz.
- 18.—Magnesite. Large exposures of magnesite rock, associated with serpentines, have been met with by Mr. J. C. Gwillim, in the vicinity of Atlin, on the east side of Atlin Lake, Cassiar district, in the province of British Columbia. Specimens of this rock, collected by Mr. Gwillim, from Discovery claim, on Pine creek, and from the Anaconda group of claims on the Indian reserve, Atlin city, have been examined and found to consist—that from the first mentioned locality, of an association of a white crystalline ferriferous magnesite with a little white translucent quartz, through which is distributed a few fine scaly aggregations of a bright green chromiferous muscovite, and that from the last mentioned locality, of an intimate admixture of a light yellowish-grayish crystalline ferriferous magnesite and white quartz, sometimes galena-bearing, through which are scattered small grains of pyrite and magnetite and, occasionally, some fine scaly aggregations of the above mentioned chromiferous mica.

Some fine specimens of a snowy-white, compact massive magnesite, have also been handed to the writer by Mr. Gwillim, which he found forming a vein of some seven inches or more in width,

cutting weathered slates, about a mile north of Pike river, on the eastern side of the southern end of Atlin lake, referred to above. This magnesite contains but a small proportion (amounting, in the specimen examined, to not more than ten per cent) of foreign admixture consisting of white quartz, which, on removal of the magnesium carbonate by treatment with acid, remains behind in a highly cellular, easily crumbled, skeleton form.

- 19.—Magnetite. Large bodies of a fine granular, massive magnetite, through which is disseminated a little chalcopyrite, have been met with, according to Mr. R. G. McConnell, at the Arctic Chief and Valerie claims on the White Horse copper-belt, on the west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.
- 20.—Marl. A deposit of comparatively pure shell-marl, having an area of some twenty acres and a depth of from three to six feet, has been found on the west half of the tenth lot of the first concession of the township of Stafford, Renfrew county, in the province of Ontario; and in the immediate vicinity of this deposit there is another of probably not less than five hundred acres in extent and having a thickness of from three to eight feet, which is for the greater part overlaid—in some places to a depth of five feet—by swamp-muck.
- 21.—Micaceous hematite. See hematite, micaceous, No. 14.
- 22.—Molybdenite. Good specimens of this mineral have been obtained by Mr. A. P. Low from a vein of pegmatite cutting the trap on island No. 12 of the Paint Hills group, off the east coast of James bay, Ungava district. In these the mineral occurs in foliated masses and in crystalline plates having a more or less perfect hexagonal outline, the largest of which measures twenty-five millimetres across, imbedded in a reddish felspar and grayish-white subtranslucent quartz. It has also been met with in large foliated masses, associated with pyrite, on the sixteenth lot of the first concession of the township of Brougham, Renfrew county, in the province of Ontario; and specimens of an exceptionally bright bluish-gray, fine-granular, massive molybdenite, have been obtained by Mr. R. W. Brock, at the Giant claim, Trail Creek mining area, in the West Kootenay district of the province of British Columbia, where it occurs with galena, pyrrhotite, chalcopyrite and arsenopyrite, in masses up to and exceeding a foot in diameter.

- 23.—Monazite. Several well-formed crystals of this mineral have recently been found by Mr. R. L. Broadbent in the coarse pegmatite vein occurring on lot thirty-one, and adjoining lots, of the first range of the township of Villeneuve, Ottawa county, in the province of Quebec. Some of these crystals occur imbedded in albite, others in tourmaline, and yet others partly in the albite and partly in the tourmaline. The largest is a short stout clove-brown crystal, measuring sixteen by thirteen by six millimetres in its diameters, twinned about the basal plane and exhibiting a distinct basal cleavage and a small subconchoidal fracture.
- 24.—Mountain leather. This has been found in some little quantity in narrow, more or less vertical, fissures of from less than an inch to four or five inches in width, in Triassic sandstones on the shore on the west side of the harbour, near the village of Lower Five islands, township of Economy, Colchester county, in the province of Nova Scotia.
- 25.—Sericite. A sample of the material constituting what is known as the 'quartz-drift,' from a deposit of the same on Bonanza creek, a tributary of the Klondike, Yukon district, North-west Territory, handed to me by Mr. R. G. McConnell on his return from a geological examination of the Klondike area, was found to consist of a firmly compacted mass composed of minute light yellowish-gray pearly scales of sericite, very fine to moderately coarse, angular grains of colourless transparent to white translucent quartz, some of which latter exhibited a faint bluish opalescence, and rounded fragments of sericite-schist, together with a few particles of native gold. The fine scaly sericite constituting the specimen examined, 29·4 per cent of the whole.
- 26.—Siderite. A coarse crystalline, massive, clove-brown, magnesian siderite has been found by Mr. J. M. Bell, in some little quantity, associated with quartz and calc-spar, forming stringers in a bed of dolomite, on the south shore of Dease bay, Great Bear lake, about twenty-eight miles south-west of the site of Fort Confidence, or nearly opposite the Narakay islands (Les Iles Hautes), as likewise and under the same conditions at a point some two miles further south-west of this locality, in the district of Mackenzie, North-west Territory.
- 27.—Silver, native. Some very handsome specimens of native silver have been found by Mr. McInnes, associated with argentite and sphalerite, in the silver-bearing vein at the West-end mine, Silver



mountain, township of Lybster, district of Thunder bay, province of Ontario. They consist of sheets of an arborescent form of the mineral of some seven by eight centimetres across and about half a millimetre in thickness, as likewise of plates of the same, of similar dimensions.

- 28.—Specular iron. See hematite, var. specular iron, No. 15.
- 29.—Spessartite. Fine specimens of this mineral have been handed to me by Mr. C. W. Willimott, which were given to him by a prospector who found them, associated with magnetite, et cetera, in a coarse pegmatite vein occurring in the township of Proudfoot, Parry Sound district, province of Ontario. They consist of dark brownish-red, compound rhombic dodecahedral crystals measuring from two or three up to as much as forty-five millimetres in diameter.
- 30.—Sphalerite. This mineral has been met with somewhat plentifully distributed through mica-schist, on the forty-first and forty-second lots of the first and second ranges of the township of Bouchette, Ottawa county, in the province of Quebec.
- 31.—Stibnite. Small quantities of stibnite have been observed distributed through specimens of the massive garnet (grossularite), collected by Mr. R. G. McConnell, which accompanies the bornite at the Copper King and Anaconda claims on the White Horse copper-belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.
- 32.—Wilsonite. Small masses of a pale peach-blossom red wilsonite have occasionally been found (as exemplified by specimens collected by Mr. McConnell), associated with grossularite, dolomite, tremolite, quartz and a little serpentine, accompanying the bornite at the Rabbit-foot claim on the White Horse copper-belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory.

#### COALS AND LIGNITES.

(Continued from page 11R of the Annual Report of this Survey for 1896.)

- 91.—Lignite. From the upper seam on Coal creek, aneasterly branch of Rock creek which is a tributary of the Klondike river, Yukon

district, North-west Territory. Thickness of seam, three feet. Geological position—Tertiary. Received from Mr. W. Ogilvie.

Structure, fine lamellar, compact; colour, black; lustre, dull; fracture, uneven; contains, in parts, particles of brownish-yellow sub-transparent resin; by exposure to the air becomes somewhat fissured and in consequence has a tendency to fall to pieces; does not soil the fingers; powder, brownish-black; it communicates a dark brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking, gave:

Hygroscopic water.....	18.31
Volatile combustible matter.....	34.96
Fixed carbon...	40.88
Ash.....	5.85
	100.00
Coke, per cent.....	46.78
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.17

It yields by fast coking, a non-coherent coke. The gases evolved during coking burn with a yellowish, slightly luminous, almost smokeless flame. The ash has a dark-brown colour—exposed to a bright red heat it becomes slightly agglutinated, at a most intense red heat it forms a vitrified mass.

92.—Lignite. From the lower seam on Coal creek, above referred to. Thickness of seam, two to three feet. The two seams are separated by a clay parting about a foot thick and are roofed and floored with clay. Received from Mr. W. Ogilvie.

Structure, fine lamellar, compact; colour, velvet black; lustre, dull to sub-resinous; fracture, uneven, occasionally subconchoidal; does not soil the fingers; by exposure to the air it becomes more or less fissured and has a tendency to fall to pieces; powder, brownish-black; it communicates a deep brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking, gave:

Hygroscopic water.....	19.37
Volatile combustible matter.....	33.85
Fixed carbon.....	37.45
Ash.....	9.33
	100.00
Coke, per cent.....	46.78
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.11

It yields by fast coking, a non-coherent coke. The gases evolved during coking burn with a yellowish, somewhat luminous, smokeless flame. The ash has a yellowish-red colour—exposed to a bright red heat it becomes very slightly agglutinated, at a most intense red heat it fuses to a slaggy mass.

- 93.—Lignite. From upper working on Cliff creek, about two and three-quarter miles up from its mouth, a tributary of the Yukon, Yukon district, North-west Territory. Geological position—Tertiary. Collected by Mr. R. G. McConnell.

Structure, on the whole, compact; made up of a very finely laminated—yet not always very distinctly so, grayish-black, dull coal, with interposed, more or less disconnected, lenticular layers of dense, jet black, highly lustrous coal; fracture, uneven, that of the bright layers, subconchoidal to conchoidal; is hard and firm; does not soil the fingers; contains, in parts, a large quantity of brownish-yellow resin diffused through its substance, and, here and there, a few films of pyrite; colour of powder, black with a faint brownish tinge; it communicates a dark brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking, gave:

Hygroscopic water. . . . .	8.57
Volatile combustible matter. . . . .	42.04
Fixed carbon . . . . .	45.77
Ash . . . . .	3.62
	100.00
Coke, per cent. . . . .	49.39
Ratio of volatile combustible matter to fixed carbon. . . . .	1 : 1.09

It yields, by fast coking, a feebly coherent, tender coke. The gases evolved during coking burn with a yellow luminous, smoky flame. The ash has a reddish-brown colour; this, when exposed to a bright red heat becomes slightly agglutinated, and at a most intense red heat forms a more or less vitrified mass.

- 94.—Lignite. From lower working on Cliff creek, about two and one-third miles up from its mouth, a tributary of the Yukon, Yukon district, North-west Territory. Collected by Mr. R. G. McConnell.

Structure, very fine lamellar—the lines of bedding are, however] often almost obliterated,—compact; colour, black; lustre, sub-resinous to resinous; fracture, uneven, at times subconchoidal;

hard and firm ; does not soil the fingers ; is here and there intersected by delicate films of pyrite ; colour of powder, black with a faint brownish tinge ; it communicates a dark brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking gave :

Hygroscopic water.....	10.58
Volatile combustible matter.....	40.10
Fixed carbon.....	46.74
Ash.....	2.58
	100.00
Coke, per cent.....	49.32
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.16

It yields, by fast coking, a non-coherent coke. The gases evolved during coking burn with a yellow, luminous, smoky flame. The ash has a light brownish-yellow colour ; this, when exposed to a bright red heat becomes slightly agglutinated, and at a most intense red heat forms a vitrified mass.

- 95.—Lignitic coal. From a seam on Lewes river, about six miles above Rink rapid ('Five Fingers' of miners), Yukon district, Northwest Territory. Taken some forty feet in from the outcrop, at which point the seam was found to have a thickness of about two feet and a half. Geological position—Laramie. Received from Mr. W. Ogilvie.

Structure, fine lamellar—compact ; colour, grayish-black ; lustre, resinous ; hard and firm ; fracture, uneven ; it is, here and there, intersected by a few films of calcite ; does not soil the fingers ; powder, brownish-black ; it communicates a brownish-yellow colour to a boiling solution of caustic potash.

An analysis by fast coking gave :

Hygroscopic water.....	6.42
Volatile combustible matter.....	36.98
Fixed carbon.....	46.03
Ash.....	10.57
	100.00
Coke, per cent.....	56.60
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.24

It yields, by fast coking, a very slightly fritted coke. The gases evolved during coking burn with a yellow, luminous, somewhat smoky flame. The ash has a dull reddish-brown colour—

exposed to a bright red heat it does not agglutinate, at a most intense red heat it readily fuses to a vitrified mass.

- 96.—Coal. From a seam, described by the sender as being 'sixteen feet in thickness, with twelve feet of solid coal,' on Collins gulch, Tulameen river, about eighteen or twenty miles west of Princeton, Yale district, province of British Columbia. Received from Mr. Geo. de Wolf.

Structure somewhat fine to coarse lamellar, more or less highly contorted; colour, grayish-black; lustre, dull to subresinous; fracture, irregular, that of some of the denser layers, at times, subconchoidal; is firm; does not soil the fingers; contains, here and there, a few films of pyrite; colour of powder, black with a faint brownish tinge; it communicates a brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking gave :

Hygroscopic water.....	4.62
Volatile combustible matter.....	41.16
Fixed carbon.....	49.04
Ash.....	5.18
	100.00
Coke, per cent.....	54.22
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.19

It yields, by fast coking, a firm coherent coke. The gases evolved during coking burn with a yellow, luminous, very smoky flame. The ash, which has a light gray colour, does not agglutinate at a bright red heat, and at a most intense red heat becomes only slightly fritted.

- 97.—Coal. From a seam, described by the sender as having 'a thickness of twenty feet, with seams of from two feet six inches to four feet eight inches of clean coal,' on Collins gulch, Tulameen river—same locality as that referred to under No. 96. Received from Mr. Geo. de Wolf.

Structure, lamellar, the lines of bedding are, however, often indistinct; colour, grayish-black; lustre, subresinous to resinous; is firm; does not soil the fingers; fracture, uneven; colour of powder, black with a faint brownish tinge; it communicates a brownish-red colour to a boiling solution of caustic potash.

An analysis by fast coking, gave :

Hygroscopic water.....	4.87
Volatile combustible matter.....	36.86
Fixed carbon.....	50.99
Ash.....	7.28
	100.00
Coke, per cent.....	58.27
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.38

It yields, by fast coking, a coherent but tender coke. The gases evolved during coking burn with a yellow, luminous, smoky flame. The ash, which is of a light gray colour, does not agglutinate at a bright red heat, and at a most intense red heat becomes only slightly fritted.

- 98.—Coal. From a seam on the Stony Indian reserve, about two miles south of Morley station on the line of the Canadian Pacific railway, district of Alberta, North-west Territory. Seam said to be six feet thick. Received from Mr. W. Pearce.

It has a crumpled laminated structure ; shows slickensides ; is moderately firm ; colour, grayish-black to black ; lustre, resinous to vitreous ; fracture, irregular ; powder, black with a faint brownish tinge ; it communicates a faint brownish-yellow colour to a boiling solution of caustic potash.

An analysis by fast coking, gave :

Hygroscopic water.....	1.26
Volatile combustible matter.....	41.30
Fixed carbon.....	48.60
Ash.....	8.84
	100.00
Coke, per cent.....	57.44
Ratio of volatile combustible matter to fixed carbon.....	1 : 1.18

It yields, by fast coking, a compact, firm, coherent coke. The gases evolved during coking burn with a yellow, luminous, very smoky flame. The ash, which is of a light reddish-brown colour, when exposed to a bright red heat becomes slightly agglutinated, and at a most intense red heat forms a more or less vitrified mass.

- 99.—Anthracite. From a seam about ten miles west of Dugdale station, on the line of the White Pass and Yukon railway, Yukon district, North-west Territory. Collected by Mr. R. G. McConnell

Structure, foliated, highly crumpled; contains occasional interposed patches of mineral charcoal; colour, grayish-black to black; lustre, dull to brilliant; is brittle; fracture, uneven; the brighter portions do not soil the fingers; powder, grayish-black; it communicates a faint brownish-yellow colour to a boiling solution of caustic potash.

An analysis by fast coking, gave:

Hygroscopic water.....	2.31
Volatile combustible matter.....	5.59
Fixed carbon.....	67.20
Ash .....	24.90
	100.00
Coke, per cent.....	92.10
Ratio of volatile combustible matter to fixed carbon.....	1 : 12.05

It yields, by fast coking, a non-coherent coke. The gases evolved during coking burn with a very faintly yellowish, smokeless flame of feeble luminosity. Colour of the ash, very light reddish-brown; this, when exposed to a bright red heat becomes very slightly agglutinated, and at a most intense red heat becomes fritted.

## LIMESTONES AND DOLOMITES.

(Continued from page 21R of the last Annual Report of this Survey—vol. XI., 1898.)

- 1.—Limestone. From the Messrs. Rokes and Morse's quarry on Drury cove, Kennebecasis river, about four miles from its mouth and about half a mile to the westward of Lawlors lake, parish of Portland, St. John county, province of New Brunswick.

A light bluish-gray, crypto-crystalline, massive limestone, traversed by numerous very thin layers of a yellowish-gray earthy mineral which, owing to insufficiency of material, was not identified. An analysis, by Mr. F. G. Wait, showed it to have the following composition:

(After drying at 100° C.—Hygroscopic water = 0.03 per cent.)

Carbonate of lime.....		96.55
"    magnesia.....		0.76
"    iron.....		0.11
"    manganese.....		trace.
Alumina.....	0.01	}..... 2.72
Silica, soluble.....	0.03	
Insoluble mineral matter.....	2.68	
		100.14

This stone affords an excellent lime.

2.—Limestone. This, and the two following stones represent the material of three of the more important beds (here referred to in descending order) at Messrs. H. Robillard and Son's quarry on the twenty-second lot of the first concession of Ottawa Front, township of Gloucester, Carleton county, province of Ontario. Geological position—Trenton formation, Cambro-silurian.

Stone from the first bed. Thickness of the same, eighteen to twenty-four inches. Structure, moderately fine-crystalline; colour, dark gray. Its composition was found by Mr. Wait, to be as follows:

(After drying at 100° C.—Hygroscopic water = 0.03 per cent.)

Carbonate of lime.....		97.87
"    magnesia.....		1.13
Phosphate of lime (tribasic).....	0.39*	}..... 1.28
Alumina.....	0.04	
Silica, soluble.....	0.05	
Bisulphide of iron.....	0.13†	
Insoluble mineral matter.....	0.59	
Organic matter.....	0.08	
		100.28

This stone is extensively quarried for structural purposes.

3.—Stone from the third bed of Messrs. H. Robillard and Son's quarry. This bed has a thickness of from fifteen to twenty inches. Structure, fine-crystalline; colour, light gray. An analysis by Mr. Wait, afforded the following results:

\* Corresponding to 0.079 phosphorus. † Corresponding to 0.07 sulphur.



(After drying at 100° C.—Hygroscopic water = 0·04 per cent.)

Carbonate of lime.....		98·25
"    magnesia.....		0·78
Phosphate of lime (tribasic).....	0·37*	} ... 1·13
Alumina.....	0·04	
Silica, soluble ..	0·02	
Bisulphide of iron.....	0·06†	
Insoluble mineral matter .....	0·60	
Organic matter.....	0·04	
		00 16

This stone is largely used for building purposes.

4.—Stone from the fifth bed of Messrs. H. Robillard and Son's quarry.

Thickness of the bed, twelve to twenty inches. Structure, somewhat coarse-crystalline; colour, faintly brownish light gray.

An analysis by Mr. Wait, gave as follows:

(After drying at 100° C.—Hygroscopic water = 0·06 per cent.)

Carbonate of lime.....		98·68
"    magnesia.....		0·90
Phosphate of lime (tribasic) .....	0·17‡	} ..... 0·73
Alumina.....	0·17	
Silica, soluble .....	0·02	
Bisulphide of iron.....	0·04§	
Insoluble mineral matter.....	0·32	
Organic matter.....	0·01	
		100·31

This stone is employed for building purposes.

5.—Limestone. This, and the two following stones represent the material of three of the beds worked at a quarry on the eighth lot of the first concession of the township of Colborne, Huron county, province of Ontario. They were examined for Mr. Alex. McD. Allan.

Stone from the fourth bed or layer occurring at the quarry in question. Thickness of the band, about six inches—more or less.

An ashy-brown, very fine-crystalline, almost compact limestone.

\* Corresponding to 0·074 phosphorus. † Corresponding to 0·03 sulphur.

‡ Corresponding to 0·035 phosphorus. § Corresponding to 0·02 sulphur.

Its analysis afforded Mr. Wait the following results :

(After drying at 100° C.—Hygroscopic water=0.06 per cent.)

Carbonate of lime.....	95.57	
"    magnesia.....	2.77	
"    iron.....	0.31	
"    manganese.....	trace.	
Alumina.....	0.01	}..... 1.62
Silica, soluble.....	0.04	
Insoluble mineral matter.....	1.30	
Organic matter.....	0.27	
		100.27

6.—Stone from the thirteenth bed or layer of the quarry from which the preceding specimen was taken. Thickness of the band, about three inches—more or less.

A yellowish-brown, fine-crystalline, dolomitic limestone. An analysis, by Mr. Wait, showed it to have the following composition :

(After drying at 100° C.—Hygroscopic water=0.04 per cent.)

Carbonate of lime.....	81.75	
"    magnesia.....	15.06	
"    iron.....	0.72	
"    manganese.....	trace	
Alumina.....	0.11	}..... 2.78
Silica, soluble.....	0.02	
Insoluble mineral matter.....	2.57	
Organic matter.....	0.08	
		100.31

7.—Stone from the twenty-fourth bed or layer of the quarry from which the two preceding specimens were taken. The thickness of the band, about six inches—more or less.

A light yellowish-brown, fine to moderately coarse-crystalline, somewhat magnesian limestone. Its composition was found, by Mr. Wait, to be as follows :

(After drying at 100° C.—Hygroscopic water = 0.03 per cent.)

Carbonate of lime.....	91.46	
"    magnesia.....	6.22	
"    iron.....	0.48	
"    manganese.....	trace	
Alumina.....	0.06	}..... 1.87
Silica, soluble.....	0.02	
Insoluble mineral matter.....	1.74	
Organic matter.....	0.05	
		100.03

8.—Dolomite. From the sixteenth lot of the sixth concession of the township of Ross, Renfrew county, province of Ontario. Geological position—Laurentian. Examined for Mr. W. P. Hinton.

A beautiful, white, translucent, coarsely crystalline dolomite.

Its analysis afforded Mr. Wait the following results:

(After drying at 100° C.—Hygroscopic water = 0.03 per cent.)

Carbonate of lime .....	55.32	
"    magnesia .....	44.54	
"    iron .....	0.11	
"    manganese .....	trace	
Phosphate of lime (tribasic).....	0.02*	} 0.47
Alumina .....	0.09	
Silica, soluble .....	0.17	
Insoluble mineral matter .....	0.19	
		100.44

### IRON ORES.

1.—Hematite. From the Arisaig district, Antigonish county, province of Nova Scotia, in which locality there occurs an extensive deposit of a dark-reddish-brown to blackish-brown oölitic hematite, upon which numerous trial pits have been sunk on the East Branch of Doctors brook and on its tributaries Iron and McInnes brooks.

(a.) A fair average sample of the material from four trial pits on or near Campbell's brook, a tributary of the East Branch of Doctors brook, was found by Mr. Wait to contain:

Metallic iron.....	44.75	per cent.
Phosphorus.....	0.84	"
Sulphur.....	0.008	"
Insoluble matter.....	25.76	"

(b.) A fair average sample of the material from eight trial pits on or in close proximity to Iron brook, was found by Mr. Wait to contain:

Metallic iron.....	45.30	per cent.
Phosphorus .....	0.60	"
Sulphur.....	0.003	"
Insoluble matter.....	26.33	"

\* Corresponding to 0.004 phosphorus.

(c.) A fair average sample of the material from five trial pits on or near McInnes brook, was found by Mr. Wait to contain :

Metallic iron.....	48.77	per cent.
Phosphorus.....	0.42	"
Sulphur.....	none	"
Insoluble matter.....	22.56	"

2.—Hematite. From a vein at Rocher Rouge, MacTavish bay, East side of Great Bear lake, Mackenzie district, North-west Territory. Collected by Mr. J. M. Bell.

A fibrous, botryoidal, and micaceous hematite, associated with some quartzite. Determinations by Mr. Wait gave :

Metallic iron.....	44.17	per cent.
Insoluble matter.....	28.92	"

3.—Hematite. A granular schistose aggregate of quartz and micaceous iron—micaceous iron-schist, has been met with, forming lenticular veins and stringers in a greenish siliceous sandstone, on some of the more southerly of the group of islands known as Les Iles du Large, Great Slave lake, district of Mackenzie, North-west Territory. A specimen of this ore, collected by Mr. J. M. Bell, has been examined by Mr. Wait and found to contain :

Metallic iron.....	64.35	per cent.
Insoluble matter.....	6.66	"

4.—Limonite. From the Grand River barrens, one mile south-west of Grand River falls, Richmond county, province of Nova Scotia. Examined for Mr. James MacIntosh.

A massive, compact and lustreless, hair-brown limonite. A partial analysis afforded Mr. Wait as follows :

Metallic iron.....	59.89	per cent.
Phosphorus.....	0.375	"
Sulphur.....	none.	"
Insoluble matter.....	0.98	"

5.—Magnetite. From a deposit on the Old French road, two miles easterly of the Mira Roman Catholic chapel, Cape Breton county, province of Nova Scotia. Examined for Mr. Patrick MacMillan.

A very fine-granular, compact, massive, dark gray, somewhat siliceous, magnetite, which on examination by Mr. Johnston was found to contain :

Metallic iron.....	61.45	per cent.
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## NICKEL AND COBALT.

Estimation of, in certain ores from the undermentioned localities in the provinces of Quebec, Ontario, and British Columbia and the district of Ungava. Continued from page 41R of the Annual Report of this Survey (vol. XI.), for 1898.

- 1.—From a small island off the west point of Kogaluk river, east coast of Hudson bay, Ungava district.

A massive pyrrhotite, through which was distributed a large amount of white cryptocrystalline quartz. Weight of sample, two pounds eleven ounces. A fair average of this was found, by Mr. R. A. A. Johnston, to contain :

Nickel, with some cobalt..... 0·08 per cent.

The gangue constituted 48·00 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·15 per cent of nickel, with some cobalt.

- 2.—From the fourteenth lot of the fifth range of the township of Masham, Ottawa county, province of Quebec.

A massive pyrite, through which was distributed a few particles of copper-pyrites, in association with a somewhat large proportion of gangue—consisting of a fine-grained granite. The pyrite, freed from all gangue, was found by Mr. F. G. Wait to contain :

Cobalt, with a little nickel. . . . . 0·28 per cent.

- 3.—From the township of Matawatchan, Renfrew county, province of Ontario.

A compact, massive pyrrhotite, with which was associated a small quantity of gangue—composed of white translucent quartz and hornblende-gneiss. The pyrrhotite, freed from all gangue, was found by Mr. Wait to contain :

Nickel..... 0·29 per cent.  
Cobalt..... trace.

- 4.—From the north-east quarter section of block 1, on the west side of Texada island, province of British Columbia. Examined for Mr. Alfred Raper.

A very fine-granular, massive pyrrhotite. It was found by Mr. Johnston to contain :

Nickel..... faint traces.

- 5.—From near Kyuquot, west coast of Vancouver island, province of British Columbia. Examined for Mr. G. H. Franklin.

A granular, massive pyrrhotite, with which was associated a very little copper-pyrites and a small quantity of quartzose gangue. Mr. Wait found it to contain :

Nickel ..... trace.

### GOLD AND SILVER ASSAYS.

*These were all conducted by Mr. R. A. A. Johnston.*

As explanatory of the numerous instances in which no trace of either gold or silver was found, it may be mentioned that in nearly all these cases the assay was carried out by special request.

### PROVINCE OF NEW BRUNSWICK.

- 1.—From one of several large quartz veins found on Biggar ridge, in the parish of Aberdeen, Carleton county.

An association of a dark greenish-gray felspathic rock with a white to reddish coloured quartz, carrying small quantities of copper-pyrites and a little galena and pyrrhotite. The sample consisting of five fragments, weighed nine pounds seven ounces. It was found to contain :

Gold.....none.  
Silver.....0·583 of an ounce to the ton of 2,000 lbs.

- 2.—From Beaufort, Carleton county. Examined for Mr. George Bailey.

An association of white crystalline quartz with some greenish-gray chloritic mineral matter, in parts coated with green carbonate of copper, carrying small quantities of iron pyrites, copper-pyrites and galena. The sample, consisting of eight fragments, weighed twelve ounces. Assays gave :

Gold.....trace.  
Silver... ..0·583 of an ounce to the ton of 2,000 lbs.

## PROVINCE OF QUEBEC.

- 3.—From a small island south of the mouth of East Main river, east coast of James Bay. Collected by Mr. A. P. Low.

A brownish-black hornblende-schist, carrying small quantities of pyrrhotite. The sample, a single fragment, weighed twelve ounces.

It contained neither gold nor silver.

## UNGAVA DISTRICT.

- 4.—From one of the Solomon Temple islands, east coast of James bay. This, and the fourteen following specimens were collected by Mr. A. P. Low.

A massive iron-pyrites, coated with hydrated peroxide of iron. The sample, a single fragment, weighed two pounds six ounces. It contained :

Gold .....none.  
Silver.....0·175 of an ounce to the ton of 2,000 lbs.

- 5.—From the south point of the mouth of Great Whale river, east coast of Hudson bay.

A gray quartzo-felspathic rock, carrying large quantities of iron-pyrites. The sample, consisting of six fragments, weighed six ounces. It was found to contain :

Gold.....none.  
Silver... .....0·175 of an ounce to the ton of 2,000 lbs.

- 6.—From Cape Hope island, east coast of James bay.

An association of white translucent quartz with a little greenish-gray chloritic schist, carrying small quantities of iron-pyrites. The sample, a single fragment, weighed nine ounces.

It contained neither gold nor silver.

- 7.—From the south side, near outlet, of Richmond gulf, east coast of Hudson bay.

A massive iron-pyrites, more or less thickly coated with hydrated peroxide of iron. The sample, a single fragment, weighed seven ounces. It contained :

Gold..... none.  
Silver.....0.350 of an ounce to the ton of 2,000 lbs.

- 8.—From the west point of mouth of Kogaluk river, east coast of Hudson bay.

A white to grayish-black quartz-syenite. The sample, a single fragment, weighed fourteen ounces.

It contained neither gold nor silver.

- 9.—From a small island off the west point of Kogaluk river, east coast of Hudson bay.

Pyrrhotite, through which was distributed a somewhat large amount of white crypto-crystalline quartz. The sample, a single fragment, weighed two pounds eleven ounces.

It contained neither gold nor silver.

- 10.—From Cape Wolstenholme, east coast of Hudson bay.

A weathered gneissoid rock, carrying small quantities of pyrrhotite. The sample, a single fragment, weighed four ounces.

It contained neither gold nor silver.

- 11.—From a small island lying off Cape Anderson, east coast of Hudson bay.

A bluish to grayish-white translucent quartz. The sample, a single fragment, weighed four ounces.

It contained neither gold nor silver.

- 12.—From a small island ten miles north of Portland promontory, east coast of Hudson bay.

A dark gray granitic gneiss, coated with hydrated peroxide of iron. The sample, a single fragment, weighed one pound six ounces.

It contained neither gold nor silver.



13.—From the same locality as the preceding specimen.

An association of bluish-white translucent quartz with a little black hornblende, through which was distributed a few particles of iron-pyrites. The sample, a single fragment, weighed ten ounces.

It contained neither gold nor silver.

14.—From No. 3 island, Point Hills islands, east coast of James bay.

A white translucent quartz, carrying very small quantities of iron-pyrites. The sample, a single fragment, weighed three ounces.

It contained neither gold nor silver.

15.—From No. 10 island, Paint Hills islands, east coast of James bay.

A white translucent quartz, stained with hydrated peroxide of iron. The sample, a single fragment, weighed eight ounces.

It contained neither gold nor silver.

16.—From No. 12 island, Paint Hills islands, east coast of James bay.

A white translucent quartz, carrying very small quantities of slightly weathered iron-pyrites. The sample, consisting of three fragments, weighed five ounces.

It contained neither gold nor silver.

17.—From the Pelton claim on No. 20 island, Paint Hills islands, east coast of James bay.

A massive iron-pyrites with which was associated small quantities of black hornblende. The sample, a single fragment, weighed three pounds. It was found to contain :

Gold.....	none.
Silver.....	0.058 of an ounce to the ton of 2,000 lbs.

18.—From No. 21 island, Paint Hills islands, east coast of James bay.

A massive iron-pyrites through which was distributed a small quantity of grayish-white, translucent quartz. The sample, consisting of several fragments, weighed two ounces.

It contained neither gold nor silver.

## PROVINCE OF ONTARIO.

- 19.—From mining location W. D. 129, fourteen miles west of Lake Wahnapiatae, district of Nipissing.

A light bluish-white translucent quartz, in parts coated with hydrated-peroxide of iron. The sample, consisting of five fragments, weighed one pound eight ounces.

It contained neither gold nor silver.

- 20.—This, and the following specimen are from a point north of Rossport, district of Thunder bay.

A white granular, quartzite, carrying somewhat large quantities of iron-pyrites. The sample, a single fragment, weighed one pound six ounces.

It contained neither gold nor silver.

- 21.—A dark-gray quartzite, more or less coated with hydrated peroxide of iron, through which was distributed a few particles of iron-pyrites.

It contained neither gold nor silver.

## NORTH-WEST TERRITORY.

- 22.—From a vein on Brown's mountain, Yellow Knife bay, Great Slave lake, Mackenzie district. This, and the following specimen were collected by Dr. R. Bell.

An association of white subtranslucent quartz with a little reddish-gray crystalline dolomite, carrying small quantities of stibnite. The sample, a single fragment, weighed four ounces.

It contained neither gold nor silver.

- 23.—From a large vein on the west side of East bay, Great Slave lake, Mackenzie district.

A white, cryptocrystalline quartz, stained and, in parts, coated with hydrated peroxide of iron. The sample, consisting of two fragments, weighed five ounces.

It contained neither gold nor silver.

24.—From Echo bay, Great Bear lake, Mackenzie district. Collected by Mr. J. M. Bell.

An association of white translucent quartz and white calcite, more or less coated with hydrated peroxide of iron and green carbonate of copper, holding small quantities of hematite and copper-pyrites. The sample, consisting of four fragments, weighed six ounces. Assays showed it to contain :

Gold..... none.  
Silver..... 0·058 of an ounce to the ton of 2,000 lbs.

25.—From a quartz vein opposite claim 35, above Discovery claim, Bonanza creek, Yukon district. This, and the following seventeen specimens were collected by Mr. R. G. McConnell.

An association of a grayish-white talcose schist with some white translucent quartz and a very little felspar, carrying small quantities of zinc-blende, galena, and copper-pyrites. The sample, a single fragment, weighed four ounces. It was found to contain :

Gold..... distinct trace.  
Silver..... 26·542 ounces to the ton of 2,000 lbs.

26.—From Indian river, a tributary of the Yukon, Yukon district.

A white subtranslucent quartz, slightly coated with hydrated peroxide of iron. The sample, a single fragment, weighed nine ounces.

It contained neither gold nor silver.

27.—From the Dome, Dominion Creek trail, Yukon district.

A white translucent quartz, stained and more or less, coated with hydrated peroxide of iron. The sample, a single fragment, weighed four ounces.

It contained neither gold nor silver.

28.—From near Fifteen-mile creek, Yukon river, Yukon district.

A mottled green (the colour being due to the presence of very fine scales of chromiferous mica) and yellowish-white dolomite. The sample, a single fragment, weighed one pound two ounces.

It contained neither gold nor silver.

## 29.—From Big Salmon river, Yukon district.

A white translucent quartz, stained and coated with hydrated peroxide of iron. The sample, a single fragment, weighed five ounces.

It contained neither gold nor silver

## 30.—From Stewart river, a tributary of the Yukon, Yukon district.

A grayish-white subtranslucent quartz, more or less stained and coated with hydrated peroxide of iron. The sample, a single fragment, weighed fifteen ounces. Assays gave :

Gold.....none.  
Silver.....0·058 of an ounce to the ton of 2,000 lbs.

## 31.—From the Eldorado reef, Gay gulch, Yukon district.

A white translucent quartz, in parts stained and coated with hydrated peroxide of iron. The sample, a single fragment, weighed one pound seven ounces.

It contained neither gold nor silver.

## 32.—From Cone hill, Yukon river, Yukon district.

A grayish-white, in parts green (owing to the presence of minute scales of chromiferous mica), crystalline dolomite, here and there coated with hydrated peroxide of iron. The sample, a single fragment, weighed one pound two ounces. It was found to contain :

Gold.....none.  
Silver.....0·117 of an ounce to the ton of 2,000 lbs.

## 33.—From opposite Cone hill, Yukon river, Yukon district.

A grayish-white, laminated quartzite, coated, in parts, with hydrated peroxide of iron. The sample, a single fragment, weighed ten ounces. It contained :

Gold.....none.  
Silver.....0·058 of an ounce to the ton of 2,000 lbs.

## 34.—From the head of Adams creek, a tributary of Bonanza creek, Yukon district.

A white subtranslucent quartz, in parts coated with hydrated peroxide of iron and green carbonate of copper, carrying a very

little copper-pyrites. The sample, a single fragment, weighed seven ounces. Assays showed it to contain :

Gold.....none.  
Silver.....12.717 ounces to the ton of 2,000 lbs.

35.—From Dion creek, Yukon river, near Dawson, Yukon district.

A moderately coarse quartz conglomerate, more or less coated with hydrated peroxide of iron. The sample, a single fragment, weighed nine ounces. It contained :

Gold.....none.  
Silver.....0.117 of an ounce to the ton of 2,000 lbs.

36.—From east of Mooseskin mountain, on the north side of the Klondike river, not far from Dawson, Yukon district.

A white subtranslucent quartz, in part incrustated with white calcite and a little green carbonate of copper, carrying small quantities of copper-pyrites. The sample, a single fragment, weighed twelve ounces. It was found to contain :

Gold... ..none.  
Silver.....0.292 of an ounce to the ton of 2,000 lbs.

37.—From Indian river, a tributary of the Yukon, Yukon district.

A white to dark-gray quartz conglomerate, stained and coated with hydrated peroxide of iron. The sample, a single fragment, weighed one pound one ounce.

It contained neither gold nor silver.

38.—Also from Indian river.

A white quartz conglomerate. The sample, a single fragment, weighed one pound two ounces.

It contained neither gold nor silver.

39.—From Stewart river, a tributary of the Yukon, Yukon district.

A grayish-white, schistose quartzite, in parts stained and coated with hydrated peroxide of iron, through which was disseminated a few particles of pyrrhotite. The sample, a single fragment, weighed one pound four ounces.

It contained neither gold nor silver.

## 40.—Also from the Stewart river.

An intimate association of quartz and dolomite, coated with hydrated peroxide of iron. The sample, a single fragment, weighed thirteen ounces.

It contained neither gold nor silver.

## 41.—From Mount Dominion, Yukon district.

A white subtranslucent quartz, in parts coated with hydrated peroxide of iron, carrying small quantities of iron-pyrites. The sample, a single fragment, weighed three ounces.

It contained neither gold nor silver.

## 42.—From the Yukon river, Yukon district.

A white cryptocrystalline quartz, stained with hydrated peroxide of iron. The sample, a single fragment, weighed ten ounces.

It contained neither gold nor silver.

## 43.—From the property of Mr. Thomas Brooks, of Stony beach, district of Assiniboia.

A finely crystalline galena in association with a little iron-pyrites and small quantities of a gangue composed of white translucent quartz and white calcite. The sample, a single fragment, weighed three ounces. It was found to contain :

Gold .....	none.
Silver .....	38·646 ounces to the ton of 2,000 lbs.

## PROVINCE OF BRITISH COLUMBIA.

## 44.—From the Delhi claim, on the west side of Fry creek, Purcell range, west Kootenay district. Examined for Messrs. Turner &amp; Keown.

An association of white cryptocrystalline quartz with a grayish-black chloritic-schist and a little brownish-black mica-schist, carrying small quantities of iron-pyrites, copper-pyrites and pyrrhotite. The sample, consisting of five fragments, weighed thirteen ounces. Assays showed it to contain :

Gold.....	none.
Silver.....	...0·058 of an ounce to the ton of 2,000 lbs.

- 45.—From about eight miles south-west of Kaslo, West Kootenay district. Examined for Mr. Geo. T. Kane.

A highly ferruginous decomposed rock matter. Weight of sample, seventeen pounds.

It contained neither gold nor silver.

- 46.—From a mountain in the neighbourhood of Cluscus lakes, Cariboo district.

A grayish-white quartzo-felspathic rock, in parts stained with hydrated peroxide of iron, carrying small quantities of iron-pyrites. The sample, a single fragment, weighed five ounces.

It contained neither gold nor silver.

- 47.—From a vein near Manson creek, a stream flowing into Manson lake, Cassiar district.

A white subtranslucent quartz, carrying large quantities of a coarsely crystalline galena and a little iron-pyrites. The sample] consisting of three fragments, weighed five ounces. Assays gave :

Gold.....	...trace.
Silver.....	32·812 ounces to the ton of 2,000 lbs.

- 48.—From granitic mass east of basic diorite on Nine-mile creek, Stikine river, Cassiar district.

A grayish-white to pale salmon coloured, moderately coarse crystalline, felspar. The sample, a single fragment, weighed seven ounces.

It contained neither gold nor silver.

- 49.—From the west slope of Dawson peaks, about five miles west of Teslin lake, Cassiar district.

A white, crystalline, triclinic felspar pitted with small patches of hydrated peroxide of iron, and holding a few disseminated particles of iron-pyrites. The sample, a single fragment, weighed six ounces.

It contained neither gold nor silver.

## NATURAL WATERS.

1.—Water from a spring some two or three hundred yards back from the Tobique river, east side, and about a quarter of a mile above the mouth of the Wapskehegan, Victoria county, province of New Brunswick.

It contained a trifling quantity of white flocculent organic matter in suspension—this was removed by filtration. The filtered water was colourless, odourless and devoid of any marked taste. Reaction, neutral, both before and after concentration. Its specific gravity, at 15.5° C., was found to be 1001.82. Boiling produced a slight precipitate, consisting of carbonate of lime.

One thousand parts, by weight, of the filtered water, at 15.5° C., were found by Mr. F. G. Wait to contain :

Potassa.....	0.002
Soda.....	0.008
Lime.....	0.797
Magnesia.....	0.039
Sulphuric acid.....	1.069
Carbonic acid.....	0.175
Chlorine.....	0.002
Silica.....	0.006
Organic matter.....	trace.
	2.098

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonate being calculated as monocarbonate, and all the salts estimated as anhydrous.)

Chloride of sodium.....	0.003
Sulphate of soda.....	0.016
"    potassa.....	0.004
"    lime.....	1.666
"    magnesia.....	0.117
Carbonate of lime.....	0.198
Silica.....	0.006
Organic matter.....	trace.
	2.010
Carbonic acid, half-combined.....	0.087
"    free.....	0.001
	2.098
Total dissolved solid matter, by direct experiment, dried at 180° C., = 2.086.	



An imperial gallon of the water, at 15·5° C., would contain :

(The carbonate being calculated as anhydrous bicarbonate, and the salts without their water of crystallization.)

	Grains.
Chloride of sodium.....	0·210
Sulphate of soda.....	1·122
"    potassa.....	0·280
"    lime.....	116·832
"    magnesia.....	8·205
Bicarbonate of lime.....	19·986
Silica.....	0·421
Organic matter.....	trace.
	<hr/>
Carbonic acid, free.....	147·056
	0·070
	<hr/>
	147·126

Lithia, baryta, and strontia were sought for, but not detected.

2.—Water from a spring on the east bank of the Tobique river, about a mile and three-quarters, following the course of the river, above the mouth of the Wapskehegan, Victoria county, province of New Brunswick.

The sample received for examination, contained a small quantity of suspended matter of a light brown colour which, on removal by filtration, was found to consist of organic matter with a little hydrated peroxide of iron. The filtered water was of a faint brownish-yellow colour; was odourless; and devoid of any marked taste. It reacted neutral, both before and after concentration. The specific gravity, at 15·5° C., was found to be 1000·16. Boiling produced a very slight precipitate, consisting of carbonate of lime with a little carbonate of magnesia.

One thousand parts, by weight, of the filtered water, at 15·5° C., were found by Mr. F. G. Wait to contain :

Potassa .....	trace.
Soda.....	0·006
Lime.....	0·093
Magnesia.....	0·025
Ferrous oxide.....	trace.
Sulphuric acid.....	0·049
Carbonic acid.....	0·157
Chlorine.....	trace.
Silica.....	0·007
Organic matter.....	trace.
	<hr/>
	0·337

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous.)

Chloride of sodium.....	trace.
Sulphate of soda.....	0·014
"    potassa.....	trace.
"    lime.....	0·070
Carbonate of lime.....	0·114
"    magnesia.....	0·053
"    iron.....	trace.
Silica.....	0·007
Organic matter.....	trace.
	<hr/>
	0·258
Carbonic acid, half-combined.....	0·078
"    free.....	0·001
	<hr/>
	0·337
Total dissolved solid matter, by direct experiment, dried at 180° C., = 0·250.	

An imperial gallon of the water, at 15·5° C., would contain :

(The carbonates being calculated as anhydrous bicarbonates, and the salts without their water of crystallization.)

	Grains.
Chloride of sodium.....	trace.
Sulphate of soda.....	0·980
"    potassa.....	trace.
"    lime.....	4·901
Bicarbonate of lime.....	11·482
"    magnesia.....	5·671
"    iron.....	trace.
Silica.....	0·490
Organic matter.....	trace.
	<hr/>
	23·524
Carbonic acid, free.....	0·070
	<hr/>
	23·594

Lithia, baryta and strontia were sought for, but not detected.

3.—Water of Salt brook, taken at its source, a stream flowing into the Tobique about two miles and a quarter, following the course of the river, above the mouth of the Wapskehegan, Victoria county, province of New Brunswick.

This water contained a trifling amount of light brown flocculent matter in suspension, which was removed by filtration. It con-

sisted of organic matter with a little hydrated peroxide of iron. The filtered water was clear and bright; had a pale brownish-yellow colour; was odourless, and devoid of any marked taste. Reaction, neutral; after evaporation to a small volume, however, decidedly alkaline. Its specific gravity, at 15.5° C., was found to be 1000.11. Boiling produced a slight precipitate, consisting of carbonate of lime with a little carbonate of magnesia.

One thousand parts, by weight, of the filtered water, at 15.5° C., were found by Mr. F. G. Wait to contain :

Potassa .....	0.002
Soda.....	0.005
Lime.....	0.064
Magnesia.....	0.013
Ferrous oxide.....	trace.
Sulphuric acid.....	0.002
Carbonic acid.....	0.134
Chlorine .....	0.003
Silica .....	0.005
Organic matter.....	trace.
	<hr/>
	0.228
Less oxygen, equivalent to chlorine.....	0.001
	<hr/>
	0.227

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous.)

Chloride of sodium.....	0.005
Sulphate of potassa.....	0.004
Carbonate of soda.....	0.003
"    lime.....	0.114
"    magnesia.....	0.027
"    iron.....	trace.
Silica .....	0.005
Organic matter.....	trace.
	<hr/>
	0.158
Carbonic acid, half-combined.....	0.065
"    free.....	0.004
	<hr/>
	0.227
Total dissolved solid matter, by direct experiment, dried at 180° C., = 0.152.	

An imperial gallon of the water, at 15.5° C., would contain :

(The carbonates being calculated as anhydrous bicarbonates, and the salts without their water of crystallization.)

	Grains.
Chloride of sodium.....	0.350
Sulphate of potassa.....	0.280
Bicarbonate of soda.....	0.280
"    lime.....	11.481
"    magnesia.....	2.870
"    iron.....	trace.
Silica.....	0.350
Organic matter.....	trace.
	<hr/>
	15.611
Carbonic acid, free.....	0.280
	<hr/>
	15.891

Lithia, baryta and strontia were sought for, but not detected.

4.—Water from a spring at Bay of Seven Islands, Saguenay county, province of Quebec. Examined for Mr. H. C. Thomson.

The sample sent for examination contained a trifling amount of suspended matter which, on removal by filtration, was found to consist of organic matter with a very little hydrated peroxide of iron. The filtered water had a faint brownish-yellow colour; was odourless and tasteless. Reaction, neutral, both before and after concentration. Its specific gravity, at 15.5° C., was found to be 1000.10. Boiling produced a very slight precipitate, consisting of carbonates of lime and magnesia.

One thousand parts, by weight, of the filtered water, at 15.5° C., were found by Mr. F. G. Wait to contain :

Potassa.....	0.007
Soda.....	0.014
Lime.....	0.008
Magnesia.....	0.008
Ferrous oxide.....	trace.
Sulphuric acid.....	0.010
Carbonic acid.....	0.030
Chlorine.....	0.012
Silica.....	0.021
Organic matter.....	trace.
	<hr/>
	0.110
Less oxygen, equivalent to chlorine.....	0.003
	<hr/>
	0.107

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous).

Chloride of sodium.....	0·020
Sulphate of potassa.....	0·015
"    soda.....	0·005
Carbonate of lime.....	0·014
"    magnesia.....	0·017
"    iron.....	trace.
Silica.....	0·021
Organic matter.....	trace.
	<hr/>
	0·092
Carbonic acid, half-combined.....	0·015
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	0·107
Total dissolved solid matter, by direct experiment, dried at 180° C.=0·080.	

An imperial gallon of the water at 15·5° C. would contain :

(The carbonates being calculated as anhydrous bicarbonates, and the salts with their water of crystallisation.)

	Grains.
Chloride of sodium.....	1·40
Sulphate of potassa.....	1·05
"    soda.....	0·35
Bicarbonate of lime.....	1·40
"    magnesia.....	1·62
"    iron.....	trace.
Silica.....	1·47
Organic matter.....	trace.
	<hr/>
	7·29

5.—Water from a boring (E. Bergeron's) about two miles from the village of St. Grégoire, on concession Pointu, seigniory of Bécancour, Nicolet county, province of Quebec. The water, which was taken at a depth of six hundred feet, is from the Medina formation—Middle Silurian.

The sample received for examination, contained a small quantity of suspended matter which, on removal by filtration, was found to consist of argillaceous matter with some hydrated peroxide of iron and a little organic matter. The filtered water had a pale brownish-yellow colour; was odourless; and possessed a strongly saline, slightly bitter taste. Reaction, neutral—both before and after concentration. The specific gravity, at 15·5° C., was found to be 1,045·63.

Mr. F. G. Wait found one thousand parts, by weight, of the filtered water, at 15·5° C., to contain :

Potassa .....	0·144
Soda .....	25·676
Lithia.....	trace.
Lime .....	4·232
Magnesia.....	1·113
Alumina .....	0·035
Ferrous oxide.....	trace.
Manganous oxide.....	trace.
Sulphuric acid.....	0·181
Carbonic acid.....	0·070
Chlorine.....	36·537
Bromine .....	trace.
Iodine, very small quantity.....	undet.
Silica .....	0·022
Organic matter.....	trace.
	<hr/>
	68·010
Chlorine required, in addition to that found, to satisfy bases.....	0·041
	<hr/>
	68·051
Less oxygen, equivalent to chlorine.....	8·243
	<hr/>
	59·808

The foregoing acids and bases may reasonably be assumed to be present in the water in the following state of combination :

(The carbonate being calculated as monocarbonate, and all the salts estimated as anhydrous.)

Chloride of potassium.....	0·227
" sodium.....	48·453
" lithium .....	trace.
" calcium .....	7·960
" magnesium .....	2·644
Bromide of sodium.....	trace.
Iodide of sodium, very small quantity.....	undet.
Sulphate of lime.....	0·308
Carbonate of lime.....	0·159
" iron.....	trace.
" manganese.....	trace.
Alumina .....	0·035
Silica.....	0·022
Organic matter.....	trace.
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	59·808

Total dissolved solid matter, by direct experiment, dried at 180° C.=59·912.

An imperial gallon of the water, at 15·5° C., would contain :

(The carbonate being calculated as monocarbonate, and all the salts estimated as anhydrous.)

	Grains.
Chloride of potassium.....	16·615
"    sodium.....	3546·474
"    lithium.....	trace.
"    calcium.....	582·625
"    magnesium.....	193·525
Bromide of sodium.....	trace.
Iodide of sodium, very small quantity.....	undet.
Sulphate of lime.....	22·544
Carbonate of lime.....	11·638
"    iron.....	trace.
"    manganese.....	trace.
Alumina.....	2·562
Silica.....	1·610
Organic matter.....	trace.
	4377·593

Baryta, strontia, and boric acid were sought for, and with negative results.

6.—Water from a hot spring on Sharp point, between Sydney inlet and Refuge cove, west coast of Vancouver island, province of British Columbia.

Temperature of the water at its source, where sample was collected, 124° F. Rate of flow, according to Mr. W. M. Brewer, M.E.—by whom it was collected, one hundred thousand gallons per day.

The sample received for examination, contained a very trifling amount of white, flocculent matter in suspension, which was removed by filtration. The filtered water was colourless, clear and bright. It was odourless and devoid of any marked taste. Reaction, neutral. Its specific gravity, at 15·5° C., was found to be 1000·5.

Agreeably with the results of an analysis by Mr. F. G. Wait, one thousand parts, by weight, of the filtered water, at 15·5° C., contained :

Potassa.....	0·002
Soda.....	0·185
Lime.....	0·028
Magnesia.....	0·002
Sulphuric acid.....	0·039
Chlorine.....	0·217
Silica.....	0·059
Organic matter.....	trace.
	0·532
Less oxygen, equivalent to chlorine.....	0·049
	0·483

## Hypothetical combination :

Chloride of potassium.....	0·003
"    sodium.....	0·348
"    calcium.....	0·002
"    magnesium.....	0·005
Sulphate of lime.....	0·066
Silica.....	0·059
Organic matter.....	trace.
	<hr/>
	0·483

Total dissolved solid matter, by direct experiment dried at 180° C. = 0·480.

## An imperial gallon of the water, at 15·5° C., would contain :

Chloride of potassium.....	grains. 0·210
"    sodium.....	24·372
"    calcium.....	0·140
"    magnesium.....	0·350
Sulphate of lime.....	4·623
Silica.....	4·132
Organic matter.....	trace.
	<hr/>
	33·827

Lithia, baryta, strontia, bromine, iodine, and carbonic acid, were sought for, and found to be absent.

- 7.—Water, from a spring on the property of Mr. Hendricks, near Plumwesep station on the line of the Intercolonial railway, and three miles above Sussex, King's county, province of New Brunswick. Examined for Mr. John White.

The sample sent for examination, not more than six fluid ounces, contained a trifling quantity of brown flocculent matter in suspension. This was removed by filtration. The filtered water was colourless and bright; devoid of odour; and had a strong saline taste. Reaction, neutral—both before and after concentration. It contained 3356·5 grains of dissolved saline matter, dried at 180° C., per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain :

Soda.....	large quantity.
Lime.....	small quantity.
Magnesia.....	very small quantity.
Sulphuric acid.....	small quantity.
Carbonic acid.....	trace.
Chlorine.....	large quantity.
Silica.....	trace.

Boiling did not produce a perceptible precipitate.



8.—Water from a well on the farm of Narcisse Tetreau, St. Paul l'Ermitte, L'Assomption county, province of Quebec.

The sample sent for examination contained a small quantity of brown, flocculent matter in suspension which, on removal by filtration, was found to consist of hydrated peroxide of iron with a very little organic matter. The filtered water was bright, colourless, and odourless. It had a faintly saline taste. Reaction, neutral—both before and after concentration. Its specific gravity, at 15.5° C., was found to be 1012.50. The total dissolved saline matter, dried at 180° C., amounted to 16.956 parts per 1000—equivalent to 1201.76 grains per imperial gallon.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained :

Potassa.....	trace.
Soda.....	large quantity.
Lithia.....	trace.
Ammonia.....	marked reaction.
Lime.....	rather small quantity.
Magnesia.....	rather small quantity.
Carbonic acid.....	somewhat large quantity.
Chlorine.....	large quantity.
Phosphoric acid.....	trace.
Nitrogen as nitrates.....	trace.
"    nitrites.....	trace.
Silica.....	trace.
Organic matter.....	trace.

Baryta and strontia were sought for, but not detected.

Boiling produced a slight precipitate, consisting of carbonate of lime with a little carbonate of magnesia.

9.—Water from a spring at Ste. Rose, Laval county, province of Quebec.

This water at the time of its receipt, was faintly turbid ; after filtration, however, perfectly bright and colourless. It was odourless and devoid of any marked taste. Reaction, neutral, both before and after concentration. Its specific gravity, at 15.5° C., was found to be 1000.2. The total dissolved saline matter, dried at 180° C., amounted to 0.220 parts per 1000, equivalent to 15.4 grains per imperial gallon.

A qualitative analysis by Mr. Wait, indicated the presence of :

Soda.....	trace.
Lime.....	small quantity.
Magnesia .....	small quantity.
Ferrous oxide ....	trace.
Sulphuric acid.....	small quantity.
Carbonic acid.....	rather small quantity.
Chlorine .....	trace.
Silica.....	trace.
Organic matter.....	trace.

Boiling produced but a very slight precipitate, consisting of carbonate of lime with a little carbonate of magnesia.

- 10.—Water from a shallow well, sunk through sand to bed rock, on the east-half of the seventeenth lot of the tenth concession of the township of Ramsay, Lanark county, province of Ontario. Examined for Mr. J. K. Cole.

The sample examined contained a trifling quantity of reddish-brown sediment, which, on removal by filtration, was found to consist of organic matter with a little hydrated peroxide of iron. The filtered water, which was bright and clear, had a very faint brownish-yellow colour. It was odourless and devoid of any marked taste. Reaction, neutral—both before and after concentration. The specific gravity, at 15·5° C., was found to be 1000·5. It contained 0·256 parts of dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water—equivalent to 17·92 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain :

Soda.. .....	very small quantity.
Lime.....	small quantity.
Magnesia .....	very small quantity.
Sulphuric acid .....	very small quantity.
Carbonic acid.....	small quantity.
Chlorine.....	very small quantity.
Silica ... ..	trace.
Organic matter.....	trace.

Boiling produced a small precipitate, consisting of carbonate of lime with a little carbonate of magnesia.

- 11.—Water from a well on the fourth lot of the twelfth concession of the township of Dereham (i.e., on lot C., north of Oxford street and east of Harvey street, in the town of Tilsonburg), Oxford county, province of Ontario. Examined for Dr. S. Joy.

The sample sent for examination contained a very trifling quantity of brownish, flocculent, organic matter in suspension.

This was removed by filtration. The filtered water was bright, and, when viewed in a column two feet in length, of a pale greenish-yellow colour. It had a marked odour of sulphuretted hydrogen combined with a very faint one of petroleum. The taste corresponded more or less with the odour. Reaction, neutral. Its specific gravity, at 15.5° C., was found to be 1002.5. The total dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the filtered water, amounted to 1.98—equivalent to 139.16 grains per imperial gallon.

Mr. Wait made a qualitative analysis of this water and found it to contain :

Potassa.....	trace.
Soda.....	very small quantity.
Lime.....	rather small quantity.
Magnesia.....	rather small quantity.
Sulphuric acid.....	somewhat large quantity.
Carbonic acid.....	rather small quantity.
Chlorine.....	very small quantity.
Boric acid.....	trace.
Silica.....	trace.
Organic matter.....	trace.

Boiling produced a slight precipitate, consisting of carbonate of lime with some carbonate of magnesia....

12.—Water from a warm spring on the east shore of Atlin lake, ten miles south of Atlin city, Cassiar district, province of British Columbia. Collected by Mr. J. C. Gwillim.

It contained a very trifling quantity of white, flocculent, organic matter in suspension, which was removed by filtration. The filtered water was perfectly bright, and had a faint brownish-yellow colour. It was devoid of odour or any marked taste. Reaction, neutral—both before and after concentration. Its specific gravity, at 15.5° C., was found to be 1000.5. The total dissolved saline matter, dried at 180° C., amounted to 0.236 parts per 1000—equivalent to 16.53 grains per imperial gallon.

A qualitative analysis, by Mr. Wait, showed it to contain :—

Soda.....	very small quantity.
Lime.....	small quantity.
Magnesia.....	very small quantity.
Sulphuric acid.....	very small quantity.
Carbonic acid.....	small quantity.
Chlorine.....	very small quantity.
Silica.....	trace.
Organic matter.....	trace.

Boiling produced a slight precipitate, consisting of carbonate of lime with some carbonate of magnesia.

- 13.—So called 'soda water' from a spring near Discovery claim, three miles up McKee creek, east side of Atlin lake, Cassiar district, province of British Columbia. Collected by Mr. J. C. Gwillim. The sample of water received for examination contained a very trifling quantity of reddish-brown sedimentary matter which, on removal by filtration, was found to consist of hydrated peroxide of iron. The filtered water was clear, bright, colourless, and devoid of odour or any marked taste. Reaction, neutral, but when evaporated to a small volume, decidedly alkaline. Its specific gravity at 15.5°C., was found to be 1001.0. The total dissolved saline matter, dried at 180°C., amounted to 1.47 parts per 1000—equivalent to 103.00 grains per imperial gallon.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained:—

Soda.....	very small quantity.
Lime.....	rather small quantity.
Magnesia.....	rather small quantity.
Sulphuric acid.....	trace.
Carbonic acid.....	somewhat large quantity.
Chlorine.....	trace.
Silica.....	trace.
Organic matter..	faint trace.

Boiling produced a rather small precipitate, consisting of carbonates of lime and magnesia.

#### MISCELLANEOUS EXAMINATIONS.

- 1.—Clay. From a deposit about six miles from Louisbourg and not far from the sea shore, Cape Breton county, province of Nova Scotia. Examined for Mr. W. Todd.

A light bluish-gray, non-calcareous, plastic, somewhat difficultly fusible clay, which when burnt assumes a light reddish-brown colour. It might advantageously be employed for the manufacture of ordinary building brick, drain tiles, and all kinds of common earthenware.

- 2.—Clay. Found respectively, overlying and underlying a seam of lignite on Rock creek, a tributary of the Klondike river, Yukon district, North-west Territory.

(a.) Overlying clay. Colour, light gray; is non-calcareous; contains but a very small proportion of gritty matter; is plastic;

when burnt, assumes a light brownish-yellow colour ; is readily fusible at a somewhat elevated temperature. The burnt mass is more or less tender, hence this material would be but ill adapted for the manufacture of bricks.

(b.) Underlying clay. Colour dark gray ; is non-calcareous ; contains but very little gritty matter ; is plastic ; when burnt assumes a light reddish-brown colour ; is somewhat readily fusible at an elevated temperature. The burnt mass is hard and firm. This clay might be employed for the manufacture of ordinary building brick.

- 3.—Clay. From Michel creek, East Kootenay district, province of British Columbia. Examined for Mr. W. Blakemore.

A dark brownish-gray, indurated clay ; is non-calcareous ; but feebly plastic ; when burnt it assumes a light reddish-brown colour ; is difficultly fusible. It does not afford a very strong brick.

- 4.—Clay. Under-clay from a seam of coal on Granite creek, a tributary of the Tulameen river, Yale district, province of British Columbia. Examined for Mr. Geo. de Wolf.

A faintly brownish light gray to yellowish-white, non-calcareous, highly plastic clay, which burns perfectly white, and is almost infusible. It could be used for the manufacture of pottery—including the finer varieties of stoneware, is well suited for the manufacture of stove-linings, and would make a fairly refractory fire brick.

- 5.—Claystone. From about four miles north of Clinton, Lillooet district, province of British Columbia.

A light to dark brown, slightly calcareous, highly ferruginous, claystone. When reduced to a fine state of division, it forms with water a plastic mass, which when burnt assumes a dark reddish-brown colour. It is readily fusible, at a somewhat elevated temperature, to a black shining magnetic slag. This material might be employed for the manufacture of ordinary building brick.

- 6.—Coal. From Dunsinane, King's county, province of New Brunswick. Examined for Mr. John White.

(a.) Taken from a depth of one hundred and seventy feet. Thickness of seam, two feet. On incineration it left 19.56 per cent of a dark reddish-brown coloured ash.

(b.) Taken from a depth of one hundred and eighty-three feet. Thickness of seam, two feet two inches. On incineration it left 38.59 per cent of a light brownish-red coloured ash.

- 7.—Graphite, Disseminated. From Glendale, River Inhabitants, Inverness county, province of Nova Scotia. Examined for Mr. James MacIntosh.

The sample examined, contained 31.8 per cent of graphite. A specimen from the same locality, collected by Mr. Hugh Fletcher in 1879, was found by the writer to contain not more than 13.96 per cent of graphite, as recorded in Rep. Geol. Surv. Can., 1878-79, p. 2 H.

- 8.—Graphite, Disseminated. From the twenty-fifth lot of the fifth concession of the township of Blythfield, Renfrew county, province of Ontario. Examined for Mr. P. T. Barry.

(a.) Quartz holding some disseminated graphite. It contained 39.65 per cent of the latter.

(b.) Quartz with which was associated a little felspar, holding small quantities of graphite. The latter amounting to 5.37 per cent of the whole.

(c.) An association of felspar and quartz, through which was distributed a small quantity of graphite—not more than 4.32 per cent.

- 9.—Graphite. From the twenty-second lot of the second concession of the township of South Canonto, Frontenac county, province of Ontario. Examined for Mr. M. P. Kingston.

The sample sent for examination was found to contain 77.6 per cent of graphite.

- 10.—Graphite. From lot two of the sixth concession of the township of Bedford, Frontenac county, province of Ontario. Examined for Mr. J. Bawden.

The material sent for examination, consisted of graphite through which was distributed a gangue composed of a ferriferous calcite, a ferriferous dolomite, some quartz, and small quantities of felspar and actinolite. Mr. F. G. Wait found it to contain—graphite, 64.3; calcite and dolomite, 24.5; quartz and actinolite 11.2 = 100.0.

- 11.—Hematite. From Cape Rouge, Inverness county, province of Nova Scotia.

An association of specular iron with small quantities of limonite, which was in parts flecked with a little green carbonate of copper, and contained a few particles of copper-pyrites as likewise a small quantity of gangue—composed mainly of quartz with a little calcite. This sample contained 57·00 per cent of metallic iron.

- 12.—Magnetite. From the fourteenth lot of the eighth range of the township of Litchfield, Pontiac county, province of Quebec. Received from the Rev. W. Ferreri, of Vinton.

The material consisted of a slightly titaniferous magnetite, through which was distributed a little iron-pyrites and a somewhat large proportion of gangue—composed of chloritic schist, mica-schist and some quartz. This particular sample, contained 38·87 per cent of metallic iron.

- 13.—Magnetite. From the twelfth lot of the sixth range of the township of Sheen, Pontiac county, province of Quebec.

A compact, massive, slightly titaniferous, magnetite with which was associated a small quantity of gangue, composed, mainly of brown mica-schist with a little quartz. Determinations by Mr. F. G. Wait gave—metallic iron, 64·43; and insoluble matter, 2·68 per cent.

- 14.—Magnetite. From a creek entering the Tulameen at Otter Flat, Yale district, province of British Columbia. Examined for Mr. Geo. de Wolf.

A non-titaniferous magnetite, with some intermixed chlorite, quartz and mica. Mr. Wait found it to contain—metallic iron, 54·38; and insoluble matter, 15·39 per cent.

- 15.—Marl. From the west-half of the tenth lot of the first concession of the township of Stafford, Renfrew county, province of Ontario.

A light gray, earthy, marl, through which was distributed a few shells and some root-fibres. The insoluble mineral matter, which consisted principally of argillaceous matter with some minute grains of quartz, amounted to 6·25 per cent.

- 16.—Shale. From Hay Cove, Red Islands, Richmond county, province of Nova Scotia. Examined for Mr. M. L. MacNeil.

The material sent for examination consisted of a pale yellowish-greenish, non-calcareous shale, which when reduced to fine powder and moistened with water afforded a slightly plastic mass. This when burnt assumed a light reddish-brown colour. The burnt

mass was difficultly fusible at a high temperature. This material would be suitable for the manufacture of a fire-brick in which a very high degree of refractoriness was not called for.

17.—Shale, Ferruginous. A reddish-brown, ferruginous, argillaceous rock, having an uneven, slaty structure, from Monument Settlement, York county, province of New Brunswick, has been examined and found to contain—8·15 per cent of ferric oxide, equivalent to 5·71 per cent of metallic iron.

18.—Shale, Argillaceous. A bluish-ash coloured argillaceous shale from the lower part of the Pierre shales, Lethbridge, district of Alberta, North-west Territory. Collected by Dr. G. M. Dawson.

It is non-calcareous; plastic; when burnt assumes a reddish-brown colour; is fusible at a somewhat elevated temperature. This shale might advantageously be employed for the manufacture of ordinary building brick.

19.—Shale, Carbonaceous. From St. Liboire, township of Ramsay, Bagot county, province of Quebec.

A grayish-black, highly pyritous, calcareous, carbonaceous shale, containing 8·75 per cent of fixed carbon.

20.—Specular iron, Cupriferous. A very large deposit of crystalline massive specular iron, holding small quantities of intermixed green carbonate of copper, has been met with at the Pueblo claim on the White Horse copper-belt, west side of Lewes river, opposite White Horse and Miles canyon, Yukon district, North-west Territory. A specimen of this ore, collected by Mr. R. G. McConnell, has been examined by Mr. Johnston and found to contain:

Copper, metallic.....	2·98 per cent.
Insoluble matter, gangue.....	2·50 "