R. D. CRAIG

GEOLOGICAL SURVEY OF CANADA

A. P. LOW, DIRECTOR.

REPORT

OF THE

SECTION OF CHEMISTRY AND MINERALOGY

BY

G. CHRISTIAN HOFFMANN, LL.D., F.I.C., F.R.S.C.,
Chemist and Mineralogist to the Survey.

ASSISTANTS

F. G. WAIT, M.A., F.C.S.
R. A. A. JOHNSTON.

OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1906

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To

A. P. Low, Esq.,

Director of the Geological Survey of Canada.

Sir,—In submitting to you the accompanying report for the interval comprised between the date of my last and December the 31st, 1905, it should be mentioned that the same does not by any means represent all the work accomplished in this Laboratory during the period which it embraces—indeed but little more than one-third—the balance, possessing little or no interest except to those immediately concerned, having been excluded.

I have the honour to be,

Sir,

Your obedient servant,

G. CHRISTIAN HOFFMANN.

Ottawa, August 31st, 1906.

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REPORT

OF THE

SECTION OF CHEMISTRY AND MINERALOGY

MISCELLANEOUS MINERALS.

1. Souesite.

A native iron-nickel alloy occurring in the auriferous gravels of the Fraser, B.C.

In washing the material obtained in dredging for gold in the Fraser river, two miles below Lillooet, it has been found that there remains, at the time of cleaning up, a fine, heavy, greyish sand, having a metallic aspect. A sample of this sand, which was sent to the writer for identification, has been examined and found to consist, essentially, of an aggregation of small, very irregular-shaped, rounded grains of an iron-nickel alloy and small to minute, flattened, rounded, steel-grey, glistening scales of native platinum; intermingled with which were some minute, bright, steel-grey coloured, irregular-shaped, flattened grains of iridosmine, a few flattened grains of native gold, some minute partially rounded crystals of magnetite, a few equally small grains of ilmenite, and a few particles of quartz and of garnet. Of the foregoing, the grains of the iron-nickel alloy constituted, approximately, forty-seven per cent, and those of the native platinum forty-three per cent, by weight, of the whole; the grains of iridosmine, native gold, magnetite, ilmenite, and of quartz and garnet, making up the balance of ten per cent.

This iron-nickel alloy occurs, as above described, in the form of small, very irregular-shaped, rounded grains, the largest not exceeding a millimetre and a half in diameter, whilst many, indeed the greater number, were of far smaller dimensions, and others were of microscopic minuteness. It has a faint yellowish steel-grey colour, and a subme-

tallic lustre; is strongly magnetic, and malleable. Its specific gravity, at 15·5° C., is 8·215. The mineral is very slightly acted upon by hydrochloric acid in the cold; upon the application of heat, however, it slowly passes into solution. It is readily attacked by dilute nitric acid, even in the cold, and is easily and completely dissolved by it on heating.

The mean of two closely concordant analyses, conducted by Mr. F. G. Wait, upon carefully selected material, showed it to have the following composition :—

Nickel	75·50
Cobalt	none.
Iron	22·02
Copper	1·20
Insoluble siliceous matter	1·16
	99·88

Deducting the insoluble siliceous matter, and recalculating the remaining constituents for one hundred parts, we obtain, as representing the composition of the mineral :—

Nickel	76·48
Iron	22·30
Copper	1·22
	100·00

There are only two instances on record of a mineral similar to that above described having been met with. One of these is the nickeliferous iron called "awaruite," referred to by W. Skey (Trans. N. Zeal. Inst., vol. 18, p. 401, 1885) as having been found, associated with gold, platinum, cassiterite, chromite, and magnetite, in the drift of the Gorge river, a stream flowing into Awarua bay, on the west coast of the South island of New Zealand; and the other, the iron-nickel alloy described by A. Sella (Compt. Rend., vol. 112, p. 171, 1891) as occurring in the auriferous sands of the Elvo, a mountain-stream near Biella, Piedmont, Italy.

As tending to facilitate a comparison of these three apparently closely related minerals with each other, their analyses are here given in a tabular form, — (1) being the analysis of the nickeliferous iron "awaruite"; (2) that of the iron-nickel alloy from the Elvo, Piedmont; and (3) the analysis, after deducting some insoluble siliceous matter and recalculating the remaining constituents for one hundred parts, of the iron-nickel alloy from the Fraser river.

	G	Fe	Ni	Co	Cu	S	SiO_2		
(1)	8·1	31·02	67·63	0·70	..	0·22	0·43	=	100·0
(2)	7·8	26·60	75·20*		..	..	..	=	101·8
(3)	8·215	22·30	76·48	..	1.22	..	..	=	100·0

*Nickel, with some cobalt.

The writer suggests that this mineral be named "souesite," after Mr. F. Soues—to whom he is indebted for the sample sent for identification—to distinguish this find from that of other naturally occurring iron-nickel alloys.

MINERALOGICAL NOTES.

1.—AGATE-JASPER. A large fragment, apparently part of a water-worn mass, of brownish-red jasper with bands and veinings of a light bluish-grey, in parts light lavender-blue, chalcedony, and which represents a fine example of agate-jasper, has been found in the detritus of the Fraser river, at Big Bar, Lillooet district, B. C.

2.—ARQUERITE. Several small irregular shaped pellets of this mineral—a native silver-amalgam, which is commonly referred to by the British Columbian miner as silver, owing to its presenting the outward appearance of native silver,—the largest not exceeding a gram and a half in weight—have been handed to me by Mr. R. G. McConnell. They were found, accompanying coarse native gold and nuggets of native copper, in the auriferous gravel of Burwash creek, a tributary of Kluane river, a stream flowing out of the northern end of Kluane lake, Ykn.

3.—BISMUTH, NATIVE. Very irregular-shaped pellets, of from two to seven decigrammes in weight, of what on examination proved to be native bismuth with, in some instances, a little partially embedded native gold, were found in a sample of material taken by Mr. J. Keele from the riffles of a sluice-box, on Highet creek—a tributary of Minto creek, which flows into Mayo river, and through the latter into the Stewart river, Ykn.

4.—CALCITE. Fine groupings of rhombohedral crystals of a light to dark, rich yellowish-brown calcite, have been found, together with isolated crystals and crystal aggregates of a sky-blue celestite, on the surface of fissures or cavities in a brownish-grey fossiliferous dolomite met with in cutting a channel in the

bed of the Detroit river at Amherstburg, Malden tp., Essex co., Ont.; and fine masses of a yellowish-white, greenish-yellow, and yellowish-green, sub-translucent to translucent, calcite having a fine-columnar, radiated, and concentric structure, have been met with by Prof. R. W. Brock at the Black Prince claim at the head of Gainer creek, a tributary of the South fork of Lardeau creek, which flows into Trout lake, West Kootenay dist., B. C.

5.—Celestite. Large, isolated, more or less perfect, sky-blue, translucent, tabular crystals of celestite—some of which measure three inches in length and two inches and a quarter across, and groupings of similar, but smaller, crystals have been found implanted on the surface of fissures or cavities in a brownish-grey fossiliferous dolomite met with in cutting a channel in the bed of the Detroit river at Amherstburg, Malden tp., Essex co., Ont.

—Chalcedony. A very interesting occurrence of this mineral has been observed by Mr. R. A. A. Johnston at the Maggie claim, in Aspen Grove camp, Similkameen div., B.C., where he found it lining the walls of an extensive vertical fissure in a reddish-grey andesite. Some of the specimens obtained by him at this locality are exceptionally fine, and represent an incrustation of some two inches and a quarter in thickness, made up of closely aggregated, frequently coalescing, drooping, stalactitic forms of a light ash-grey, occasionally bluish-grey, translucent chalcedony.

7.—Chert. Among other specimens received from the Rev. Thomas Nattress for identification, was a fragment of a nodule of greyish-white to white, opaque, dull, chert or hornstone, to which is attached a little celestite and bituminous calcite, found in a brownish-grey fossiliferous dolomite met with in cutting a channel in the bed of the Detroit river at Amherstburg, Malden tp., Essex co., Ont.

8.—Cobaltite,—*see under* Niccolite.

9.—Copper, Native. Irregular-shaped, flattened masses of native copper of six and seven or more pounds in weight have been found by Mr. R. A. A. Johnston filling fissures in a purple andesite at the Sovereign claim, in Aspen Grove camp, Similkameen div., B. C.; and variously sized rounded masses of

native copper are frequently met with in the auriferous gravel of Burwash creek, a tributary of Kluane river, Ykn. One such, collected by Mr. R. G. McConnell, consists of a more or less kidney-shaped nugget, weighing one pound five and three-quarter ounces, in parts coated with a little cuprite and malachite.

10.—EPSOMITE. Specimens of this mineral, in the form of greyish-white friable masses have recently been handed to the writer by Mr. J. Keele, with the information that the same had been collected by Mr. C. Camsell, who had met with this salt, in some little abundance, at Alum hill, on Peel river, Ykn., and had also found it as a thin incrustation on the clay banks of that river in many places farther up stream between Alum hill and the mouth of Snake river, a distance of some twenty miles.

11.—GOLD, NATIVE. Some very pretty wire-like forms of native gold, one of which measures twenty-two millimetres in length and a little over one millimetre in diameter, have been obtained by Mr. J. Keele, in the course of working for gold on Highet creek, a tributary of Minto creek, Mayo river, Ykn.

12.—LEAD, NATIVE. A sample of material—received by the writer from Mr. W. J. B. Pinder, for identification—which had been found among the native gold obtained in washing auriferous gravel at the Lippy claim on Eldorado creek, Klondike dist., Ykn., was found to be composed of rounded, flattened, grains of native gold united together by a network of lustrous, bluish-grey, native lead which in parts exhibits a globular surface.

13.—LIMONITE. There has recently been presented to the Museum a fragment of limonite—apparently part of a nodular mass of that mineral—having a concentrically arranged radiating fibrous structure, which was found by the donor on Grindstone island, one of the Magdalen group, in the Gulf of St. Lawrence. Hematite has, it may be observed, been met with, by Mr. James Richardson, in the form of rounded nodules—an analysis of one of which is given in the Report of Progress for 1879-80. p. 15 H—amongst the debris of the fallen cliff immediately under Demoiselle hill, on Amherst island, which lies about ten miles south of Grindstone island, above referred to. Neither occurrence has, it is anticipated, other than a scientific interest.

14.—LIMONITE, pseudomorph after pyrite. A fine, although imperfect, pentagonal dodecahedron of limonite, pseudomorph after pyrite, measuring some six centimetres across, the faces of which are deeply striated, has been presented to the Museum by M. C. H. Pollen, who informs me that it was found in a small deposit of iron-ore on Bull river, about six miles up from its entry into the Kootenay river, B. C.

15.—MOLYBDENITE. This mineral has been met with, by Mr. Anthony Dacy, on lot 6, range XII of Eardley tp., Wright co., Que., where it occurs—as shown by the specimens which were brought by him to the Survey for examination—in the form of thin to stout foliated masses, associated with pyrite, distributed through a gangue composed of quartz and feldspar with a little hornblende. Molybdenite has also, somewhat recently, been met with at what is known as the Tamarac group of claims, situated on Gnawed mountain, Highland valley, Yale dist., B. C. A sample of material from one of the veins constituting the group in question, which was received for examination, was found to consist of a white translucent quartz traversed by thin layers of a, for the most part, very fine-granular molybdenite, and also carrying small quantities of chalcopyrite.

16.—MORION. Fairly well-formed, singly terminated, hexagonal prisms, measuring, in some instances, an inch or more in diameter, of pitch-black to velvet-black, opaque, quartz,—constituting what is known as 'morion,' a variety of quartz, have been found by Mr. E. R. Faribault in a vein of coarse pegmatite cutting a ridge of granite just west of Joe Bill brook, a tributary of Gold river, and one mile west of Sefferensville post-office, Chester tp., Lunenburg co., N. S.

17.—NICCOLITE. Among some of the more recently received mineral specimens sent for identification, was one consisting of a compact, massive, niccolite, through which is distributed a little cobaltite, which was found by Mr. J. Boyer on lot No. 287, on McIntyre street, in North Bay, Widdifield tp., Nipissing dist., Ont.; and another, consisting of niccolite, with some cobaltite, and a little native silver, in a gangue composed of a ferruginous dolomite, which had been found on lot 22, con. A, Widdifield tp., or about two miles and a half north-northwest of the first mentioned occurrence.

18.—Platinum, Native. Small irregular-shaped grains and scales of native platinum, together with a few scales of native gold, and an occasional grain of pale brownish, translucent corundum, were found to enter into the composition of a sample of black sand—sent to the writer for examination, from the riffles of a sluice-box at Pine creek, about a mile and a half below Atlin, B.C. Native platinum has likewise been found by the writer to occur, in very appreciable quantity, in the form of small to minute, flattened, rounded, steel-grey, glistening scales, with small irregular-shaped, rounded grains of souesite—a native iron-nickel alloy, flattened grains of native gold, and some minute, flattened grains of iridosmine, in a sample of heavy greyish sand left as a residuum in washing the material obtained in dredging for gold in the Fraser river, two miles below Lillooet, B.C.

19.—Polycrase.—This mineral, which was first met with in Canada —as described in Annual Report for 1898, vol. xi, p. 14 R, in a coarse granite vein, on lot 19, con. 9, Galvin tp, Nipissing dist., Ont., has since been found to occur some twenty-five miles to the east of this in a coarse granite vein which cuts the biotite gneiss on lot 7, concession A of Cameron tp., Nipissing dist., Ont. The latter vein is composed, as may be inferred from a large quantity of material collected by Mr. C. W. Willimott to represent its components, of a light to somewhat dark greyish, translucent quartz, a light hyacinth-red to tile-red orthoclase, a verdigris-green to bright apple-green microcline—amazon-stone, muscovite, and a little biotite, together with masses of a light greyish-green fluorite, some inclusions of a brownish-red calcium iron-garnet—andradite, and an occasional small crystalline mass of polycrase. In addition to the polycrase thus occurring scattered through the vein, Mr. Willimott found in a drusy cavity of the same an implanted crystal of what he conjectured might be the same mineral, and this on examination it proves to be. It measures about seventeen millimetres in diameter, and shows well defined terminal faces.

20.—Pyrargyrite. This mineral was found by Mr. F. G. Wait to occur, associated with argentite, stephanite, argentiferous tetrahedrite, argentiferous galena, sphalerite, arsenopyrite, pyrite, and some scales of native silver, scattered through a white, sub-translucent to translucent quartz, in a series of

specimens, collected by Mr. R. G. McConnell, from quartz veins at, respectively, the Montana and the M. and M. claims, on the west side of Windy Arm, a southerly branch of Tagish lake, Ykn.

21.—PYROPHYLLITE. A light greenish-grey, sub-translucent, compact pyrophyllite, has been met with by Mr. Hugh Fletcher, but not in any great quantity, in the form of thin layers traversing the felsites and quartzites of the Pre-Cambrian at Eagle Head, Gabarus bay, Cape Breton co., N.S.; and a similar, but somewhat lighter coloured variety occurs, in some abundance, in the Pre-Cambrian felsites of Kennington cove, about three miles west of Rochefort (on some maps incorrectly spelt Rochford) point, at the entrance of Louisburg harbour, in the same county.

22.—SCHEELITE. This mineral (which was first met with, in Canada, in Nova Scotia and Quebec, as mentioned by the writer in some of his previous reports—Rept. Geol. Surv. Can., vol. v, p. 21 R, 1890-91, and vol. vii, p. 14 R, 1894), is occasionally found to occur in the auriferous gravels of some of the streams in the Yukon, as evidenced by two samples of material taken by Mr. J. Keele from the riffles of sluice-boxes at, respectively, Dublin gulch, on Haggart creek, a tributary of the McQuesten, which flows into the Stewart; and Highet creek, a tributary of Minto creek, which flows into Mayo river. Of these samples, that from Dublin gulch was found to consist of a fine to coarse sand composed of small rounded grains of white scheelite with a few intermingled particles of quartz and of hematite and a little native gold; whilst that from Highet creek contained numerous pellets, the largest of which measured one centimetre in diameter, of a white, translucent scheelite having a vitreous lustre. Scheelite has also been met with, and in some quantity, at the following localities in British Columbia, namely, at the Dawson and Mabel claims on Hardscrabble creek, a tributary of Willow river, Cariboo dist., where a cream-yellow, sub-translucent, massive scheelite is found, associated with galena, in small quartz veins of from one to four inches in width, some of which have been found to contain as much as eighty per cent of the mineral; and at the Meteor mine on Springer creek, a stream flowing into the southern extremity of Slocan lake, in the West Kootenay dist., where a yellowish-brown, in parts straw-yellow, opaque, massive

scheelite occurs, in the quartz, in the form of lenticular masses of from one to three feet in length, two to three inches in width.

23.—SELENITE. Fine clear, colourless, isolated crystals, and penetration-twins, of this mineral have been found by Mr. A. Saint Cyr, in the mud banks on the Simonette river—a tributary of Smoky river—about where it is crossed by the sixth meridian.

24.—SILVER, NATIVE. Handsome specimens of fine-filiform native silver—one of which has recently been presented by Dr. John Thorburn to the Museum—have frequently been found, with argentiferous galena and decomposition products of the same, some sphalerite, and a little chalcopyrite and pyrite, at the 'Number One' mine, situated about two miles due west of the town of Ainsworth, on Kootenay lake, B.C. Native silver has also, and that quite recently, been met with—as indicated by specimens received for examination—in the form of leafy, occasionally granular, masses, accompanied by very small quantities of sphalerite and pyrite, freely scattered through a two inch vein of light to dark grey, sub-translucent quartz, in a mineral claim at the headwaters of McGillivray creek, a stream flowing into Anderson lake, Lillooet dist., B.C.

25.—SPHALERITE. A coarse-granular to compact, massive, cleavable, dark brownish-red to almost black blende, with which is occasionally associated some galena, a little pyrite and, more rarely, some minute brownish-yellow crystals of idocrase, has been met with, in some abundance, forming veins, stringers, and pockets in a crystalline limestone of the Grenville series, on lot 3, con. 5 and lot 3 of con. 6, Olden tp., Frontenac co., Ont. A somewhat coarse, crystalline, massive, black blende, has likewise been met with, but only in comparatively small quantity on lot 10, range XII, Eardley tp., Wright co., Que.

26.—STEATITE. A light grey, feebly lustrous, sub-transparent, compact steatite has been met with, but, as yet, only in limited quantity, in connexion with the crystalline limestones of Skye mountain on the north bank of Brigend brook, about two miles up from its entry into Whycocomagh bay, Inverness co., N. S.

27.—STEPHANITE. This species—one not previously known to occur in Canada, has been recognized by Mr. F. G. Wait as occurring, with argentite, pyrargyrite, argentiferous tetrahedrite, argentiferous galena, pyrite, arsenopyrite, sphalerite, and some scales of native silver, scattered through a white, sub-translucent to translucent quartz, in a series of specimens, collected by Mr. R. G. McConnell, from quartz veins at, respectively, the Montana and the M. and M. claims, on the west side of Windy Arm —a southerly branch of Tagish lake, Ykn.

28.—STIBNITE. A bluish ash-grey, fine-granular, massive, argentiferous stibnite, has recently been met with, in some abundance, in an auriferous quartz vein some three feet in width, at the southeast end of Chilco lake, about thirty-two miles east by north of the head of Bute inlet, Strait of Georgia, B. C.

29.—TALC. Some fine specimens of a yellowish-green, translucent, in thin laminæ transparent, talc, with a pearly lustre, have been received by the writer from Mr. G. V. M. Temple, with the information that they were obtained by him from a deposit of this mineral on cadastral lot 683 of lot 2 of Craigs Road range, or range II, Ireland tp., Megantic co., Que.

30.—VESUVIANITE. A yellowish-green, compact, massive variety of vesuvianite has been met with forming, as observed by Mr. R. A. A. Johnston, a vein, of some six or seven inches in thickness, cutting the limestones and schists at Charley cove, on the northwest side of Frye or Cailiff island, on the southern coast of Charlotte co., N. B.

COALS AND LIGNITES.

[Continued from page 25 R of the Annual Report—
vol. xiii, 1900.]

104.—LIGNITE. From the vicinity of Roche Percée, Souris river, Sask. Geological position—Tertiary.

This fuel was received, owing to exposure to the atmosphere, in a very broken-down condition.

An analysis, by fast coking, gave :

Hygroscopic water	20·29
Volatile combustible matter	31·41
Fixed carbon	31·35
Ash	16·95
	100·00
Coke, per cent	48·30

Ratio of volatile combustible matter to fixed carbon 1 : 0·998.

It yields, by fast coking, a non-coherent coke. Colour of the ash, pale reddish-white.

105.—LIGNITE. From the Souris river, one mile west of La Roche Percée, at the junction of Short creek and Souris river, Sask. Geological position—Tertiary.

There are, agreeably with the observations of the late Dr. A. R. C. Selwyn, then Director of the Survey, three distinct seams of lignite exposed at the above mentioned locality. Of these, the uppermost, which is some fifteen or sixteen feet below the surface, has a thickness of two feet. Immediately beneath this there is a one-foot-six-inch layer of clay shales, followed by a five-foot seam of lignite. This, in turn, is succeeded by fifty feet of a soft whitish sand-rock, at the base of which there is another seam of lignite, which has a thickness of three feet.

The following are the results of an examination of a sample of the material from the above referred to five-foot seam.

A brownish-black, compact lignite ; ligneous texture very marked ; lustre, for the greater part, dull, in more altered parts, sub-resinous to resinous ; tough ; fracture, on the whole, uneven, occasionally, however, verging on the sub-conchoidal, does not soil the fingers ; powder, black with a brownish tinge ; it communicates a deep brownish-red colour to a boiling solution of caustic potash ; by exposure to the air becomes more or less fissured and falls to pieces.

An analysis, by fast coking, gave :

Hygroscopic water	21·84
Volatile combustible matter	35·12
Fixed carbon	38·64
Ash	4·40
	100·00
Coke, per cent	43·04

Ratio of volatile combustible matter to fixed carbon 1 : 1·10.

It yields, by fast coking, a non-coherent coke. The ash has a brownish-yellow colour, and when exposed to a bright red heat it becomes slightly agglutinated.

106.—LIGNITE. From a deposit in tp. 63, on or near Towtinow river, at a point some eighteen miles south-southwest of Athabaska Landing, Alta. Structure, fine-lamellar, compact; colour, black, inclining to brownish-black; lustre, dull to sub-resinous; fracture, on the whole, uneven, but occasionally verging on the sub-conchoidal; powder, blackish brown; it communicates a deep brownish-red colour to a boiling solution of caustic potash. On exposure to the air it splits along the plane of bedding and falls to pieces.

An analysis, by fast coking, gave :

Hygroscopic water	19·45
Volatile combustible matter	34·34
Fixed carbon	41·86
Ash	4·35
	100·00
Coke, per cent	46·21
Ratio of volatile combustible matter to fixed carbon.	1:1·22.

It yields, both by slow and fast coking, a non-coherent coke. The ash has a brownish-yellow colour.

107.—LIGNITE. From Kneehills creek, a tributary of Red Deer river, Alta. Geological position—Lower Laramie, Edmonton series. Structure, somewhat coarse lamellar, compact,—made up of alternating layers of a greyish-black, dull, and dense, bright, black lignite, the latter layers exhibiting, in many instances, a distinct ligneous structure; fracture, on the whole, uneven, that of the denser layers, sub-conchoidal; does not soil the fingers; powder, brownish-black; it communicates a deep brownish-red colour to a boiling solution of caustic potash; by exposure to the air it becomes fissured, preferably along the line of bedding, and falls to pieces.

An analysis, by fast coking, gave :

Hygroscopic water	13·28
Volatile combustible matter	36·69
Fixed carbon	43·84
Ash	6·19
	100·00
Coke, per cent	50·03
Ratio of volatile combustible matter to fixed carbon	1 : 1·19

It yields, both by slow and fast coking, a non-coherent coke. The gases evolved during coking burnt with a yellowish, somewhat luminous, almost smokeless flame. The ash, which has a reddish-brown colour, becomes agglutinated at a bright red heat, and at a most intense red heat it forms a vitrified mass.

108.—LIGNITE. From a seam eleven and three-quarter miles up Coal creek,—a stream flowing into the Yukon five miles below the mouth of Fortymile river, Ykn. Seam four to eleven feet thick. Geological position—Tertiary. Collected by Mr. R. G. McConnell.

Structure, somewhat coarse lamellar—made up of layers of a greyish-black, dull, and bright, black coal ; contains, in parts, a little lemon-yellow and brownish-yellow, sub-transparent resin ; fracture, uneven ; does not soil the fingers ; powder, blackish-brown ; it communicates a dark brownish-red colour to a boiling solution of caustic potash ; by exposure to the air becomes fissured, but is, on the whole, tolerably hard and firm.

An analysis, by fast coking, gave :

Hygroscopic water	6·03
Volatile combustible matter	38·44
Fixed carbon	50·53
Ash	5·00
	100·00
Coke, per cent	55·53
Ratio of volatile combustible matter to fixed carbon	1 : 1·31

It yields, both by slow and fast coking, a non-coherent coke. The gases evolved during coking burn with a yellowish, somewhat luminous, very slightly smoky flame. The ash, which has a light reddish-brown colour, agglutinates at a bright red heat, and at a most intense red heat it becomes slightly fritted.

109.—LIGNITIC COAL. From a seam not far from Roche Percée, Souris river, Sask. Geological position—Tertiary.

This fuel, owing to a lengthened exposure to the atmosphere, was received in a broken down condition.

An analysis, by fast coking, gave:

Hygroscopic water	5·95
Volatile combustible matter	13·65
Fixed carbon	67·58
Ash	12·82
	100·00
Coke, per cent	80·40
Ratio of volatile combustible matter to fixed carbon	1 : 4·95

It yields, by fast coking, a non-coherent coke. Colour of the ash, light reddish-brown. It communicates a brownish-yellow colour to a boiling solution of caustic potash.

110.—LIGNITIC COAL. From a seam on a branch of Ruby creek, a tributary of Indian river, Ykn., about seven miles up from the mouth of the creek. Geological position—Tertiary. Collected by Mr. R. G. McConnell.

Structure, moderately coarse lamellar—made up of alternating layers of a greyish-black, dull, and bright, black lignitic coal; contains, here and there, small particles of brownish-yellow sub-transparent resin; fracture, uneven; powder, black, with a slight brownish tinge; it communicates a dark brownish-red colour to a boiling solution of caustic potash; by exposure to the air becomes fissured, and has a tendency to fall to pieces.

An analysis, by fast coking, gave:

Hygroscopic water	4·68
Volatile combustible matter	29·88
Fixed carbon	60·06
Ash	5·38
	100·00
Coke, per cent	65·44
Ratio of volatile combustible matter to fixed carbon	1 : 2·01

It yields, both by slow and fast coking, a non-coherent coke. The gases evolved during coking burn with a yellowish, somewhat luminous, almost smokeless flame. Colour of the ash, reddish-white. The same, when submitted to a bright red heat becomes agglutinated, whilst at a most intense red heat it becomes fritted.

111.—LIGNITIC COAL. From tunnel on the Jackson seam on Quilchena creek, five miles from its entry into Nicola lake, Yale dist., B.C. Thickness of seam, six feet. Geological position—Tertiary. Collected by Dr. R. W. Ells.

Structure, fine lamellar,—compact; is made up of thin layers of a brownish-black, dull coal with an occasional interposed layer of a jet-black, highly lustrous variety of the same; fracture, uneven, that of the bright layers, sub-conchoidal; does not soil the fingers; colour of powder, blackish-brown; it communicates a brownish-red colour to a boiling solution of caustic potash; when freshly mined, is hard and firm, but by exposure to the atmosphere it becomes more or less fissured and has a tendency to fall to pieces.

An analysis, by fast coking gave:

Hygroscopic water	6·95
Volatile combustible matter	37·21
Fixed carbon	47·95
Ash	7·89
	100·00
Coke, per cent.	55·84
Ratio of volatile combustible matter to fixed carbon	1 : 1·29

It yields, by fast coking, a firm coherent coke. Colour of the ash, pale reddish-brown.

112.—COAL. From a seam on the north side of the north fork of Oldman river, about half a mile east of Ernst creek, section 35, tp. 10, range III, west of the fifth initial meridian, Alta. Seam said to be thirty feet thick. Geological position—Cretaceous, lower than Pierre shales, probably Kootanie series.

Structure, lamellar, compact, the lines of bedding are at times somewhat indistinct; is made up of a greyish-black, dull, and dense bright black coal; shows slickensides; slightly soils the fingers; is hard and firm; fracture, uneven; powder, brownish-black; it communicates a pale brownish-yellow colour to a boiling solution of caustic potash; resists exposure to the air.

An analysis, by fast coking, gave :

Hygroscopic water	1·03
Volatile combustible matter	32·20
Fixed carbon	61·28
Ash	5·49
	100·00
Coke, per cent	66·77
Ratio of volatile combustible matter to fixed carbon	1:1·90

It yields, by fast coking, a firm coherent coke. The gases evolved during coking burn with a yellow luminous smoky flame. Colour of the ash, white with a faint reddish tinge. The same becomes slightly agglutinated at a bright red heat, and at a most intense red heat it becomes fritted.

113.—Coal. From a seam at the head of Snow creek, between Panther and Red Deer rivers, Alta. Thickness of seam, five feet. Collected by Mr. D. B. Dowling.

An analysis, by fast coking, afforded Mr. F. G. Wait :

Hygroscopic water	0·72
Volatile combustible matter	21·28
Fixed carbon	75·80
Ash	2·20
	100·00
Coke, per cent	78·00
Ratio of volatile combustible matter to fixed carbon	1:3·56

It yields, by fast coking, a compact, firm, coherent coke. Colour of the ash, white. It imparts a pale brownish-yellow colour to a boiling solution of caustic potash.

114.—Coal. From Millers workings on the Lewes river, Ykn., about twenty miles above Five Finger rapids. Geological position—Cretaceous. Collected by Mr. R. G. McConnell.

Structure, lamellar—made up of a greyish-black, dull, and bright black coal ; shows slickensides ; slightly soils the fingers ; is hard and firm ; fracture, irregular ; is, here and there, intersected by a few films of calcite ; powder, blackish-brown ; it communicates a barely perceptible colour to a boiling solution of caustic potash ; resists exposure to the air.

An analysis, by fast coking, gave :

Hygroscopic water	0·45
Volatile combustible matter	28·74
Fixed carbon	56·74
Ash	14·07
	100·00
Coke, per cent	70·81
Ratio of volatile combustible matter to fixed carbon	1:1·97

It yields, by fast coking, a compact, firm, coherent coke. The gases evolved during coking burn with a yellow, luminous, smoky flame. Colour of the ash, white with a faint reddish-brown tinge. The same, at a bright red heat becomes slightly agglutinated, whilst at a most intense red heat it undergoes incipient fusion.

115.—Coal. From tunnel on lower seam at Coal gully, on the west side of the Coldwater, a mile and a half south of the confluence of the Coldwater and Nicola rivers, Yale dist., B.C. Thickness of seam, thirteen feet six inches. Geological position—Tertiary. This, and the following specimen were collected by Dr. R. W. Ells.

Structure, somewhat coarse lamellar—made up of irregularly alternating layers of a greyish-black, feebly lustrous, and dense, velvet-black, highly lustrous coal ; fracture, on the whole, uneven, that of the denser layers sub-conchoidal ; it is, here and there, intersected by thin plates of calcite ; contains numerous particles of a pale brownish-yellow to reddish-brown, sub-transparent resin diffused through its substance ; is hard and firm ; does not soil the fingers ; colour of powder, brownish-black ; it communicates a faint brownish-yellow colour to a boiling solution of caustic potash ; resists—does not become fissured or disintegrated—exposure to the air.

An analysis, by fast coking, gave :

Hygroscopic water	3·04
Volatile combustible matter	37·18
Fixed carbon	52·05
Ash	7·73
	100·00
Coke, per cent	59·78
Ratio of volatile combustible matter to fixed carbon	1:1·40

It yields, by fast coking, a compact, firm, coherent coke. Colour of the ash, reddish-white.

116.—Coal. From the southerly or upper outcrop of a seam on the bank of the Coldwater, about two miles south of its confluence with the Nicola, Yale dist., B.C. Thickness of seam, seven feet ten inches. Geological position—Tertiary.

Structure, on the whole, fine lamellar,—compact, made up of layers of a faint greyish-black, somewhat dull, and velvet-black, lustrous coal; fracture, uneven, that of the bright layers sub-conchoidal; is hard and firm; does not soil the fingers; colour of powder, brownish-black; it communicates a brownish-yellow colour to a boiling solution of caustic potash; it apparently resists—does not become fissured or disintegrated—exposure to the air.

An analysis, by fast coking, gave:

Hygroscopic water	3·17
Volatile combustible matter	35·73
Fixed carbon	55·25
Ash	5·85
	100·00
Coke, per cent.	61·10
Ratio of volatile combustible matter to fixed carbon	1:1·55

It yields, by fast coking, a firm coherent coke. Colour of the ash, light reddish-brown.

117.—Coal. From the northerly or lower outcrop of the seam referred to under the preceding specimen, but about a mile and three-quarters south of the confluence of the Coldwater with the Nicola. Thickness of seam, seven feet six inches. Geological position—Tertiary. Examined for Mr. C. H. Keefer.

Structure, very fine lamellar—compact; colour, velvet-black; lustre, for the most part sub-resinous to resinous, at times vitreous; fracture, uneven; does not soil the fingers, except in parts containing a thin film of mineral-charcoal; is hard and firm; colour of powder, brownish-black; it communicates only a just perceptible brownish-yellow tinge to a boiling solution of caustic potash; resists exposure to the air.

An analysis, by fast coking, gave:

Hygroscopic water	1·37
Volatile combustible matter	38·24
Fixed carbon	54·25
Ash	6·14
	100·00
Coke, per cent	60·39
Ratio of volatile combustible matter to fixed carbon	1:1·42

It yields, by fast coking, a compact, firm, coherent coke. Colour of the ash, light reddish-brown.

118.—Coal. From a seam on the east fork of Pine river (south)—a tributary of Peace river, B.C. Geological position—Cretaceous, Dunvegan series. This, and the two following specimens were collected by the late Mr. Arthur Webster, who informed me that the seams from which they were taken ranged from eight to twelve inches in thickness.

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

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	1·70
Volatile combustible matter	43·76
Fixed carbon	50·10
Ash	4·44
	100·00
Coke, per cent	54·54
Ratio of volatile combustible matter to fixed carbon	1:1·14

It yields, by fast coking, a compact, firm, coherent coke. Colour of the ash, light reddish-brown.

119.—Coal. From a seam on Cañon creek, Pine river (south,)—a tributary of Peace river, B.C. Geological position—Cretaceous, Dunvegan series.

Structure, somewhat fine lamellar—compact; colour, greyish black; lustre, sub-resinous to resinous; fracture, uneven; is hard and firm; powder, greyish-black; it communicates a

faint brownish-yellow colour to a boiling solution of caustic potash.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·67
Volatile combustible matter	17·23
Fixed carbon	77·34
Ash	4·76
	100·00
Coke, per cent	82·10
Ratio of volatile combustible matter to fixed carbon	1:4·49

It yields, by fast coking, a coherent but tender coke, which on incineration leaves a white ash.

120.—Coal. From a seam on Coal brook, Pine river (south),—a tributary of Peace river, B.C. Geological position—Cretaceous, Dunvegan series.

Structure, somewhat fine lamellar—compact, made up of layers of a greyish-black, dull, and bright black coal; lustre, sub-resinous to resinous; fracture, uneven; powder, brownish-black; it communicates a pale brownish-yellow colour to a boiling solution of caustic potash.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	1·39
Volatile combustible matter	23·11
Fixed carbon	31·38
Ash	44·12
	100·00
Coke, per cent	75·50
Ratio of volatile combustible matter to fixed carbon	1:1·36

It yields, by fast coking, a firm coherent coke; and, on incineration, leaves a very light reddish-brown ash.

The above sample of this coal contained some interposed layers of shale. These were not separated from the coal at the time of preparing the material for analysis, inasmuch as a wish had been expressed that this should be conducted upon a fair average sample of the whole, as sent. Hence, the large percentage of ash shown in the analysis.

It may be mentioned, in connexion with the last three above referred to samples of fuel, that the occurrence of coal on Pine river was noted by Dr. A. R. C. Selwyn in the course of his exploration of that stream in August 1875, —See Report of Progress, 1875-76, pp. 28-86. In this he mentions, on p. 53, having found on Pine river, five miles above the Lower forks, four thin seams of good bright coal in about ninety feet of alternating beds of sandstone and shale. These coal seams being, in descending order, six inches, eight inches, two feet, and six inches thick. A sample of the material of the two-foot seam was collected by Dr. Selwyn and submitted to the writer for examination, with the following results:

Structure, very fine lamellar, the lines of bedding, which are very numerous and close together, are frequently very indistinct or altogether obliterated,—compact; colour, black; lustre of fracture parallel to the bedding dull, that of the cross fracture resinous, occasionally brilliant; hard and firm; fracture, uneven; contains a brownish yellow sub-transparent resin, chiefly in small particles, diffused through its substance; powder, very dark brown, inclining to blackish-brown; it communicates only a just perceptible brownish-yellow tinge to a boiling solution of caustic potash; resists exposure to the air. In appearance it is not unlike some varieties of coal of the Carboniferous system.

An analysis, by fast coking, gave:

Hygroscopic water	2·45
Volatile combustible matter	33·76
Fixed carbon	48·69
Ash	15·10
	100·00
Coke, per cent.	63·79
Ratio of volatile combustible matter to fixed carbon.	1:1·44

It yields, by fast coking, a firm, compact, and lustrous coke, the coking being doubtless materially influenced by the presence of the resin. Colour of the ash, white. This, when exposed to a bright red heat does not become agglutinated, but at a most intense red heat it becomes slightly sintered.

Again, and in the same connexion, Dr. G. M. Dawson mentions on page 117 of his Report, Pt. B, for 1879-80, that on the lower part of Coal brook, coal was discovered by Mr. J. Hunter

in 1877, as is mentioned by him in the C.P.R'y. Report of 1878, p. 79. Dr. Dawson personally examined this locality, which is two miles and a half east of the lower forks, in 1879, and found that the coal occurs in several beds and appears to be of good quality, but so far as observed all are very thin, the thickest not exceeding six inches. He collected, and handed me, a sample of the material from the six-inch bed in question, and the following are the results of its examination :

Structure, very fine lamellar, the lines of bedding, which are very numerous and close together, are almost obliterated,—compact ; colour, black ; lustre, sub-resinous to resinous, occasionally, in parts, brilliant ; hard and firm ; shows well-defined planes of cleat ; does not soil the fingers ; weathered surfaces in places coated with ferric hydrate ; powder, brownish-black ; it communicates a deep brownish-red colour to a boiling solution of caustic potash ; resists exposure to the air ; in appearance it resembles some varieties of coal of the Carboniferous system.

An analysis, by fast coking, gave :

Hygroscopic water	7·83
Volatile combustible matter	34·21
Fixed carbon	52·09
Ash	5·87
	100·00
Coke, per cent	57·96
Ratio of volatile combustible matter to fixed carbon.	1:1·52

It yields, by fast coking, a non-coherent coke. The ash has a reddish-white colour ; exposed to a bright red heat it becomes very slightly agglutinated, and at a most intense red heat it becomes slightly fritted.

121.—Anthracitic coal.—From Sheep creek, close on line between sections 19 and 30, township 19, range V, west of the fifth initial meridian, Alta.

A compact, greyish-black, almost lustreless coal, traversed by occasional very thin seams of velvet-black, highly lustrous material ; fracture, on the whole, uneven, that of the bright layers, conchoidal ; does not soil the fingers ; is tough, and more or less sonorous ; readily takes fire in a lamp flame, burn-

ing with a yellow luminous flame, which, however, dies out immediately after withdrawal from the source of heat; colour of powder, brownish-black; it does not impart any colour to a boiling solution of caustic potash; resists exposure to the air.

An analysis, by fast coking, gave:

Hygroscopic water	0·53
Volatile combustible matter	14·99
Fixed carbon	64·55
Ash	19·93
	100·00
Coke, per cent	84·48
Ratio of volatile combustible matter to fixed carbon	1:4·31

It yields, by fast coking, a compact, firm, coherent coke. The gases evolved during coking burn with a yellow, luminous, somewhat smoky flame. Colour of the ash, white. This, at a bright red heat, becomes very slightly agglutinated, and at a most intense red-heat, slightly fritted.

122.—Anthracitic coal. From No. 4 seam at the Canmore mine, northwest quarter of section 29, tp. 24, range X, west of the fifth initial meridian, Alta. Seam, three feet one inch thick.

Structure, coarse lamellar, moderately compact; shows jointage planes, and evidence of slickensiding, in an eminent degree; contains an occasional thin layer of mineral charcoal; colour, velvet black; lustre, sub-metallic, almost metallic; in parts iridescent; fracture, on the whole, uneven, that of the individual layers, sub-conchoidal to conchoidal; powder, black; it imparts only a just perceptible yellowish tinge to a boiling solution of caustic potash.

An analysis, by fast coking, gave:

Hygroscopic water	0·72
Volatile combustible matter	15·73
Fixed carbon	80·90
Ash	2·65
	100·00
Coke, per cent	83·55
Ratio of volatile combustible matter to fixed carbon	1:5·14

It yields, by fast coking, a compact, firm, coherent coke. The gases evolved during coking burn with a yellow, luminous, somewhat smoky flame. Colour of the ash, white with a faint reddish tinge. At a bright red heat, the ash becomes agglutinated, and at a most intense red heat, slightly fritted.

123.—Anthracitic coal. From pinch-out northwest of slope, bottom of No. 1 seam at the Canmore mine, Alta. This, and the following specimen, was collected by Mr. D. B. Dowling.

Structure, compact, highly contorted, shows slickensides in an eminent degree; is mostly made up of layers of a dense, velvet-black, highly lustrous coal, with a few interposed layers of a greyish-black, comparatively dull coal; does not soil the fingers; is brittle; fracture, on the whole, uneven, that of the denser layers, imperfectly conchoidal; powder, black with a faint brownish tinge; does not impart the least colour to a boiling solution of caustic potash; is hard and firm; resists exposure to the air.

An analysis, by fast coking, gave:

Hygroscopic water	0·43
Volatile combustible matter	15·10
Fixed carbon	81·74
Ash	2·73
	100·00
Coke, per cent	84·47
Ratio of volatile combustible matter to fixed carbon	1:5·41

It yields, by fast coking, a compact, firm, coherent coke. The gases evolved during coking burn with a yellow, luminous flame. Colour of the ash, white with a very faint reddish tinge. At a bright red heat the ash becomes very slightly agglutinated, and at a most intense red heat it becomes slightly fritted.

124.—Anthracitic coal. The material examined was in the form of more or less rounded fragments, found loose in the dry bed of a gully, but which had evidently become detached from a vertical seam occurring high up the mountain on the east branch of Kananaskis river,—a tributary of the Bow, five miles below the head of Elbow river, section 33, tp. 19, range VIII, Alta

Structure, fine lamellar, the line of bedding is, however, frequently indistinct, — compact; colour, greyish-black to black; lustre, dull to resinous; hard and firm; fracture, uneven; powder, black with a slight brownish tinge; it communicates a faint brownish-yellow colour to a boiling solution of caustic potash; resists exposure to the air.

An analysis, by fast coking, gave:

Hygroscopic water	0·87
Volatile combustible matter	13·66
Fixed carbon	66·72
Ash	18·75
	100·00
Coke, per cent	85·47
Ratio of volatile combustible matter to fixed carbon	1:4·88

It yields, by fast coking, a slightly fritted coke. The gases evolved during coking burn with a yellow, luminous, very slightly smoky flame. Colour of the ash, white with a faint reddish tinge. At a bright red heat, the ash becomes very slightly agglutinated, and at a most intense red heat, fritted.

125.—Anthracitic coal. From the Costigan seam, three miles west of the forks of Panther river, Alta. Thickness of seam, five feet seven inches. Collected by Mr. D. B. Dowling.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·69
Volatile combustible matter	15·75
Fixed carbon	77·15
Ash	6·41
	100·00
Coke, per cent	83·56
Ratio of volatile combustible matter to fixed carbon	1:4.90

It yields, by fast coking, a firm, coherent coke. Colour of the ash, white. The powder imparts a very faint brownish-yellow colour to a boiling solution of caustic potash.

126.—Anthracitic coal. From seam one hundred and sixty-four feet below that of the preceding specimen. Thickness of seam, three feet six inches. Collected by Mr. D. B. Dowling.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·79
Volatile combustible matter	15·66
Fixed carbon	76·05
Ash	7·50
	100·00
Coke, per cent	83·55
Ratio of volatile combustible matter to fixed carbon.	1:4·86

It yields, by fast coking, a feebly coherent coke. Colour of the ash, white. Its powder imparts a faint brownish-yellow colour to a boiling solution of caustic potash.

127.—Anthracitic coal. From a seam two hundred and seventy feet below the Costigan seam,—see above—No. 125, Panther river. Thickness of seam, three feet six inches. Collected by Mr. D. B. Dowling.

An analysis by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·61
Volatile combustible matter	16·49
Fixed carbon	79·56
Ash	3·34
	100·00
Coke, per cent.	82·90
Ratio of volatile combustible matter to fixed carbon.	1: 4·52

It yields, by fast coking, a firm, coherent coke. Colour of the ash, white. Its powder imparts a scarcely perceptible coloration to a boiling solution of caustic potash.

128.—Semi-anthracite. From C. P. R. tunnels, Cascade mountain, section 19, tp. 26, range XI, Alta. Collected by Mr. D. B. Dowling.

Structure, compact, highly contorted, shows slickensides in an eminent degree; is made up of alternating layers of a greyish-black, somewhat bright, and dense, jet-black coal of brilliant lustre; hard and firm; fracture, uneven, that of the denser and more lustrous layers often more or less conchoidal; powder black; it communicates a pale brownish-yellow colour to a boiling solution of caustic potash; resists exposure to the air; does not decrepitate when suddenly heated.

An analysis, by fast coking, gave :

Hygroscopic water	0·43
Volatile combustible matter	10·65
Fixed carbon	85·02
Ash	3·90
	100·00
Coke, per cent	88·92
Ratio of volatile combustible matter to fixed carbon.	1: 7·98

It yields, by fast coking, a non-coherent coke. When heated in a covered crucible it yields a small amount of gas, which burns with a pale yellowish, feebly luminous flame. Colour of the ash white ; the same when exposed to a bright red heat becomes very slightly agglutinated, and at a most intense red heat it becomes fritted.

129.—SEMI-ANTHRACITE. From a seam on the south branch of Sheep creek, section 11, tp. 19, range VII, Alta. The seam has a thickness of nine feet, but of this, the upper three feet is very much shattered and readily falls to pieces ; the lower six feet, however, consists of a fairly firm coal. Collected by Mr. D. B. Dowling.

The material of the lower six feet of this seam answers to the following description :—Structure, coarse lamellar, compact, made up of irregularly alternating layers of a greyish-black, for the most part dull, and dense, jet-black, highly lustrous coal ; with an occasional thin, interposed layer of mineral charcoal ; shows slickensides ; is hard and firm ; brittle ; fracture, on the whole, irregular, that of the denser layers subconchoidal ; powder, black ; it does not impart a colour to a boiling solution of caustic potash ; resists exposure to the air.

An analysis, by fast coking, gave :—

Hygroscopic water	1·30
Volatile combustible matter	11·14
Fixed carbon	77·13
Ash	10·43
	100·00
Coke, per cent	87·56
Ratio of volatile combustible matter to fixed carbon.	1 : 6·92

It yields, by fast coking, a non-coherent coke. When heated in a covered crucible it yields a small amount of gas, which burns with a pale yellowish, smokeless flame of feeble luminosity. On incineration it leaves a white ash. This does not agglutinate at a bright red, or even a most intense red, heat.

130.—SEMI-ANTHRACITE. From the Costigan seam, at its outcrop just above the forks of Panther river, Alta. Thickness of seam, four feet four and a half inches. Collected by Mr. D. B. Dowling.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	1·14
Volatile combustible matter	13·63
Fixed carbon	80·64
Ash	4·59
	100·00
Coke, per cent	85·23
Ratio of volatile combustible matter to fixed carbon.	1 : 5·92

It yields, by fast coking, a non-coherent coke. Colour of the ash, white, with a faint reddish tinge. Its powder imparts a very pale brownish-yellow colour to a boiling solution of caustic potash.

131.—SEMI-ANTHRACITE. From an exposure nine miles and a half west of the outcrop of the seam last referred to. Thickness of seam, two feet. Collected by Mr. D. B. Dowling.

An analysis by Mr. Wait, by fast coking, gave:

Hygroscopic water	1·13
Volatile combustible matter	11·59
Fixed carbon	84·94
Ash	2·34
	100·00
Coke, per cent	87·28
Ratio of volatile combustible matter to fixed carbon.	1 : 7·33

It yields, by fast coking, a non-coherent coke. Colour of the ash, white. Its powder imparts a pale brownish-yellow colour to a boiling solution of caustic potash.

132.—SEMI-ANTHRACITE. From a five-foot seam occurring above that from which the preceding specimen was taken. Collected by Mr. D. B. Dowling.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·93
Volatile combustible matter	10·58
Fixed carbon	83·55
Ash	4·94
	100·00
Coke, per cent	88·49
Ratio of volatile combustible matter to fixed carbon.	1 : 7·90

It yields, by fast coking, a non-coherent coke. Colour of the ash, white. Its powder imparts a very pale brownish-yellow colour to a boiling solution of caustic potash.

133.—SEMI-ANTHRACITE. From lower seam on Goat creek—a tributary of Telkwa river, which flows into Bulkley river, Cassiar dist., B.C. Thickness of seam, about fourteen feet. Received from Mr. G. H. Cowan.

Structure, compact,—lines of bedding not always very distinct; it contains a few layers of interstratified bright black coal; colour light-greyish black; lustre, sub-resinous to resinous; fracture, uneven, that of the bright layers conchoidal; is hard and firm; does not soil the fingers; powder, almost black; imparts no colour to a boiling solution of caustic potash; resists exposure to the air.

An analysis, by Mr. Wait, by fast coking, gave:

Hygroscopic water	0·98
Volatile combustible matter	9·94
Fixed carbon	80·76
Ash	8·32
	100·00
Coke, per cent	89·08
Ratio of volatile combustible matter to fixed carbon.	1 : 8·12

It yields, by fast coking, a non-coherent coke. Colour of the ash, white.

LIMESTONES AND DOLOMITES.

[Continued from page 28 R of the Annual Report—vol. xiii, 1900.]

1.—LIMESTONE. From an extensive deposit of the same immediately east of the end of the bar at the mouth of South pond of Aspy bay, Victoria co., N.S. Geological position—Lower Carboniferous. Collected by Mr. Hugh Fletcher.

A light bluish to light brownish-grey, very fine-crystalline, in parts vesicular, fossiliferous limestone.

An analysis, by Mr. F. G. Wait, of a fair average sample of this stone—prepared from equal weights of thirty-three fragments of the same taken from as many different parts of the deposit, showed it to have the following composition:

(After drying at 100°C.—Hygroscopic water=0·08 per cent.)

Calcium carbonate		95·95
Magnesium carbonate		0·29
Ferrous carbonate		0·17
Manganous carbonate		0·34
Calcium sulphate	0·25	
Calcium phosphate	0·01	
Alumina	0·01	
Silica, soluble	0·02	
Organic matter	0·40	3·57
Insoluble matter, consisting of:		
Silica	2·43	
Alumina	0·27	
Ferric oxide	0·09	2·88
Lime	0·02	
Magnesia	0·01	
Alkalies, by difference	0·06	
		100·32

2.—LIMESTONE. From an extensive deposit at Dewar hill, west side of Pugwash harbour, Cumberland co., N.S. Geological position—Lower Carboniferous. Collected by Mr. Hugh Fletcher.

A light grey—at times, ash-grey, brownish-grey, and reddish-grey very fine-granular to almost compact, fossiliferous limestone.

An analysis, by Mr. Wait, of a fair average sample of this stone—prepared from equal weights of twenty-five fragments

of the same taken from equidistant points across the strike of a series of nearly vertical beds having, in the quarry worked, a total thickness of sixty feet, afforded the following results :

(After drying at 100°C.—Hygroscopic water=0.12 per cent.)

Calcium carbonate		76·98
Magnesium carbonate		12·05
Ferrous carbonate		0·50
Manganous carbonate		0·53
Calcium sulphate	0·14	
Calcium phosphate	0·04	
Alumina	0·21	
Silica, soluble	0·15	
Organic matter	0·41	10·06
Insoluble matter, consisting of :		
Silica	6·70	
Alumina	1·49	
Ferric oxide	0·27	9·11
Lime	0·03	
Magnesia	0·15	
Alkalies, by difference	0·47	
		100·12

3.—LIMESTONE. From a deposit three miles east of Brookfield station on the line of the Intercolonial railway, Colchester, co., N.S. Geological position—Windsor formation, Lower Carboniferous. Collected by Dr. H. M. Ami.

An ashy-brown fossiliferous limestone, the composition of which was found by Mr. Wait to be as follows :

(After drying at 100°C—Hygroscopic water=0.18 per cent.)

Calcium carbonate		97·97
Magnesium carbonate		1·22
Ferrous carbonate		0·13
Manganous carbonate		0·16
Calcium sulphate	0·17	
Calcium phosphate	0·06	
Alumina	0·02	
Silica, soluble	0·02	
Organic matter	0·17	0·61
Insoluble matter, consisting of :		
Silica	0·09	
Alumina with a little ferric oxide	0·06	0·17
Lime	0·01	
Magnesia	0·01	
		100·09

4.—LIMESTONE. From the quarry of Mr. B. Beaulieu, on Little Mascouche road, Ste. Anne des Plaines par., Terrebonne co., Que.

A dark greyish, fine to somewhat coarse-crystalline, fossiliferous, limestone. An analysis by Mr. Wait, showed it to have the following composition:

(After drying at 100° C.—Hygroscopic water = 0·08 per cent.)

Calcium carbonate			97·46
Magnesium carbonate			1·76
Ferrous carbonate			0·03
Manganous carbonate			trace.
Calcium sulphate		trace.	
Calcium phosphate		0·11	
Alumina		0·03	
Silica, soluble		0·03	
Organic matter		0·18	1·04
Insoluble matter, consisting of:			
Silica	0·45		
Alumina	0·12		
Ferric oxide	0·08	0·69	
Lime	0·01		
Magnesia	0·01		
Alkalies, by difference	0·02		
			100·29

5.— LIMESTONE. From Carswell's quarry, lot 13, range I, Litchfield tp., Pontiac co., Que. Geological position—Grenville series —Huronian. Collected by Mr. R. L. Broadbent.

A light to rather dark bluish-grey, moderately coarse-crystalline limestone, through which are distributed a few particles of quartz, hornblende, and pyrrhotite. Its composition was found, by Mr. Wait, to be as follows:

(After drying at 100° C.—Hygroscopic water = 0.05 per cent.)

Calcium carbonate			89·03
Magnesium carbonate			8·70
Ferrous carbonate			0·07
Manganous carbonate			trace.
Calcium phosphate		0·01	
Alumina		0·17	
Silica, soluble		0·49	
Iron sulphide, pyrrhotite		0·09	
Organic matter		0·10	2·21
Insoluble matter, consisting of:			
Silica	0·77		
Alumina with a trace of ferric oxide	0·15	1·35	
Lime	trace.		
Magnesia	0·43		
			100·01

6.—LIMESTONE. From the immediate vicinity of Philipsburg, on the east side of Missisquoi lake, Armand tp., Missisquoi co., Que. Geological position—Philipsburg formation, Quebec group, Lower Silurian.

An exceedingly fine-crystalline, almost compact, limestone of a dove-grey colour with white markings. Its analysis afforded Mr. Wait the following results:

(After drying at 100° C.—Hygroscopic water = 0·02 per cent.)

Calcium carbonate			98·03
Magnesium carbonate			0·97
Ferrous carbonate			0·07
Calcium phosphate		0·01	
Alumina		0·01	
Silica, soluble		0·03	
Organic matter		0·06	1·52
Insoluble matter, consisting of:			
Silica	1·14		
Alumina with a little ferric oxide	0·19	1 41	
Lime	0·06		
Magnesia	0·02		
			100·59

This stone takes a good polish and is well fitted for purposes of decoration. When burnt it affords a very white and pure lime.

7.—LIMESTONE. From Rudd's quarry, Barriefield, Pittsburg tp., Frontenac co., Ont.

A light bluish-grey, very fine crystalline, massive, magnesian limestone. Determinations, by Mr. Wait, of the more important constituents, gave, as follows:

Calcium carbonate	49·8
Magnesium carbonate	25·2
Alumina with a little ferric oxide	2·1
Insoluble matter	22·0

The insoluble portion of this stone consisted of— silica 13·24, alumina with a little ferric oxide 4·04, small quantities of lime and magnesia, and strong traces of alkalies.

8.—LIMESTONE. From Marble cove, on the northeast shore of Texada island, Strait of Georgia, B. C. Geological position—Carboniferous.

A somewhat fine-crystalline limestone of a light and dark bluish-ash colour, clouded, with greyish-black spots and veinings. An analysis by Mr. Wait showed it to have the following composition:

(After drying at 100° C.—Hygroscopic water = 0·01 per cent.)

Calcium carbonate			87·01
Magnesium carbonate			12·47
Ferrous carbonate			0·34
Manganous carbonate			trace.
Calcium phosphate		0·01	
Alumina		0·02	
Silica, soluble		0·11	
Organic matter		0·15	0·64
Insoluble matter, consisting of:			
Silica	0·20		
Alumina with a little ferric oxide	0·08	0·35	
Lime	0·01		
Magnesia	0·06		
			100·46

This stone occurs, at the above mentioned locality, in almost unlimited quantity. It is useful for ordinary purposes of contruction and, taking a good polish, is also well adapted for use as a marble. Further, it affords an excellent material for the manufacture of lime.

9.—Dolomite. From lot 2, con. 11, Faraday tp., near the old Faraday road, Hasting co., Ont. The bed from which this stone was taken, a very large one, extends into the adjoining lot, lot 3, of the same concession where, however, according to Mr. C. W. Willimott, the stone exhibits a much coarser texture.

A faint greenish-white to greyish-white, cryptocrystalline, sub-translucent, magnesian limestone. Its composition was found by Mr. Wait to be as follows:

(After drying at 100° C.—Hygroscopic water = 0·02 per cent.)

Calcium carbonate			55·22
Magnesium carbonate			44·03
Ferrous carbonate			0·26
Manganous carbonate			0·11
Calcium phosphate		trace	
Alumina		0·04	
Silica, soluble		0·03	
Insoluble matter, consisting of:			0·74
Silica	0·39		
Alumina with a trace of iron	0·15	0·67	
Magnesia	0·13		
			100·36

This stone takes a very high polish and affords an excellent marble.

IRON ORES.

1.—CLAY IRON-STONE. A compact, massive, dark brownish-grey, lustreless, clay iron-stone, very tough, and breaking with a large conchoidal fracture, from section 17, tp. 10, range XXI, west of the fourth initial meridian, Alta., has been analysed by Mr. F. G. Wait, and found to have the following composition:

Ferrous oxide	44·87
Manganous oxide	1·54
Alumina	4·25
Lime	4·80
Magnesia	1·67
Carbonic anhydride	33·57
Phosphoric anhydride	0·43
Sulphuric anhydride	0·02
Silica	7·56
Iron disulphide	0·09
Water	0·62
Organic matter	1·29
	100·71
Metallic iron	34·94
Phosphorus	0·19
Sulphur	0·06

Mr. Wait has also examined a specimen of a dark grey, very fine-granular, almost compact, clay iron-stone, upon one of the surfaces of which were implanted numerous small crystals of selenite, from section 6 of the above mentioned township, and found it to contain—ferrous oxide 42·56 per cent, equivalent to 33·10 per cent of metallic iron.

Among the many specimens of clay iron-stone collected by Dr. G. M. Dawson at the time of his exploration of the Bow and Belly River region, in 1881, were three from points not far distant from those where the foregoing were obtained. These were examined by the writer, and the results of their analysis were given in the Annual Report of this Survey for 1880-81-82, p. 11 H. They comprised, (a) a specimen of a very fine-granular massive brownish-grey, clay iron-stone, breaking with an imperfectly conchoidal fracture, from "Coal Banks," which was found to contain—ferrous oxide 41·458 and ferric oxide 0·328 per cent, equivalent to a total of 32·475 per cent of metallic iron; (b) a specimen of a fine-granular, massive, pale reddish-brown clay iron-stone, breaking with an irregular fracture, from about

seven miles below "Coal Banks," Alta., section 30, tp. 9, range XXI, west of the fourth initial meridian, which was found to contain—ferrous oxide 30·730 and ferric oxide 1·398 per cent, equivalent to a total of 24·880 per cent of metallic iron; and (c) a specimen of a compact, massive, pale brownish-yellow clay iron-stone, breaking with a large conchoidal fracture, from Belly river, about seventeen miles east of the mouth of the Little Bow river, section 19, tp. 10, range XVI, west of the fourth initial meridian, Alta., which was found to contain—ferrous oxide 30·302 and ferric oxide 1·487 per cent, equivalent to a total of 26·165 per cent of metallic iron.

2.—Clay iron-stone. A dark clove-brown, very fine granular, almost compact, massive, clay iron-stone from Collin gulch; Tulameen river, about eighteen or twenty miles west of Princeton, Yale dist, B.C., has been examined by Mr. F. G. Wait, and found to contain:

Ferrous oxide	27·05	per cent.
Ferric oxide	1·37	"
Insoluble siliceous matter	46·11	"
Carbonaceous matter	1·82	"
Water, hygroscopic	0·19	"
Metallic irons	22·00	"

This iron-stone occurs in bands, having an aggregate thickness of some three feet, in the so-called twenty-foot seam of coal at the locality above mentioned. An analysis of the coal of the seam in question is given in one of my previous reports,—see Annual Report, vol. 12, p. 29 R, 1899.

3.—Bog-iron ore. The following are the results of an analysis, by Mr. F. G. Wait, of a fair average sample prepared from equal weights of numerous fragments of bog-iron ore taken from a series of isolated deposits of that mineral occurring in a strip of country—overlying the black slates of the Nova Scotian gold-bearing series—of some forty miles in length by about two miles in width, which extends, in a southwesterly direction, from Upper Musquodoboit along the south side of the Musquodoboit river and along the south side of the old Guysborough road to Fall river, Halifax co., N.S.

It was found to contain :

Ferric oxide	64·04
Ferrous oxide	9·27
Manganous oxide	2·14
Alumina	0·68
Lime	1·55
Magnesia	0·68
Silica	5·65
Phosphoric anhydride	0·04
Sulphuric anhydride	0·30
Water, hygroscopic	3·37
Water, combined	10·53
Organic matter	3·22
	101·47
Metallic iron	52·04
Phosphorus	0·02
Sulphur	0·12

The following partial analyses of hematites and magnetites were all conducted by Mr. F. G. Wait.

4.—Hematite. From about half a mile south of Grand Pré (Lower Horton) Railway station, Kings co., N.S. Collected by Mr. A. T. McKinnon.

A reddish-brown to brownish-red, fine-granular, massive admixture of anhydrous and hydrous peroxide of iron. It contained—metallic iron 47·40 per cent, insoluble residue 24·16, water, hygroscopic, 0·90 and water, combined, 4·59. Titanium dioxide, none.

5.—Hematite. From lot 1, range III, Dunham tp., Missisquoi co., Que. Examined for Mr. Levi. Y. Blake.

A dark purplish-brownish-red, very fine granular, almost compact, schistose, massive hematite. It was found to contain—metallic iron, 62·71 per cent, insoluble residue 6·90, titanium dioxide, none.

6.—Hematite. From the Rocky mountains, south of Blairmore, Alta.

A fine granular, massive, in parts micaceous, hematite, through which was distributed a few particles of iron-pyrites. Determinations gave—metallic iron, 68·51 per cent, insoluble siliceous matter, 2·01, titanium dioxide, none.

7.—Magnetite. From the property of W. R. Neily, and close to the Leckie mine, Torbrook mines, Annapolis co., N.S.

A fine to somewhat coarse-granular, massive magnetite, through which was distributed a somewhat large quantity of quartzose gangue. It contained—metallic iron 51·92 per cent, insoluble siliceous matter 24·03, titanium dioxide, none.

8.—Magnetite. From Clarendon par., Charlotte co., N.B. Received from John Shearer.

A fine crystalline granular, massive magnetite, through which was distributed a small quantity of quartzose gangue. Analysis showed it to contain—metallic ore, 65·42 per cent insoluble siliceous matter, 9·36, titanium dioxide, none.

9.—Magnetite. From the northwest branch of the Gatineau river, Que.

A moderately fine-crystalline, massive magnetite holding a large quantity of intermixed gangue composed, for the most part, of hornblende. It was found to contain—metallic iron 45·81 per cent, insoluble matter 33·90, titanium dioxide, none.

10.—Magnetite. From a point on the Rivière des Quinze (Ottawa river), Lake Timiskaming, Que.

A fine-crystalline, massive, schistose magnetite, with which was associated a somewhat large quantity of siliceous gangue. Determinations gave—Metallic iron 52·40 per cent, insoluble siliceous matter 26·60, titanium dioxide, none.

11.—Magnetite. From lot 27, con. 4, North Crosby tp., Lanark co., Ont.

A somewhat coarse-crystalline, massive magnetite with which was intimately associated a large quantity of gangue composed, mainly, of hornblende and feldspar with a little quartz and a few particles of garnet. It contained—Metallic iron 38·97 per cent, insoluble matter 43·30, titanium dioxide, none.

12.—Magnetite. From the vicinity of Lake Temagami, Nipissing dist., Ont.

A very fine-granular, massive magnetite, holding numerous thin laminæ of quartz. It was found to contain—Metallic iron 52·86 per cent, insoluble siliceous matter 24·50, titanium dioxide, none.

13.—MAGNETITE. From a deposit on the east slope of the Rocky mountains, near Pincher creek, Alta.

A fine-granular, massive, partially weathered magnetite. Determinations gave—metallic iron 53·46 per cent, insoluble siliceous matter 14·99, titanium dioxide, none.

14.—MAGNETITE. From near Enderby, Yale dist., B.C.

A fine-crystalline, massive magnetite through which was distributed a small quantity of partially altered feldspathic gangue. Analysis showed it to contain—metallic iron, 59·55 per cent, insoluble matter 12·85, titanium dioxide, traces.

COPPER ORES.

1.—From a shaft sunk in the Triassic trap at Westport, Digby co., N.S.

A partially altered trap through which was scattered a small quantity of native copper. Agreeably with the results of a determination made by Mr. Wait, it contained :

Copper.... .. .. 00·19 per cent

2.—From La Tête, Charlotte co., N.B.

An association of copper-pyrites and iron-pyrites, with a little pyrrhotite, in a gangue composed for the most part of chloritic schist, with some quartz and calcite and a very little siderite. It was found by Mr. Wait to contain :

Copper..... 10.70 per cent.

3.—From Orford tp., Sherbrooke co., Que,

It consisted of chloritic schist carrying small quantities of chalcopyrite and bornite and a very little sphalerite. Mr. Wait found it to contain :

Copper.... ... . 3·12 per cent.

4.—From mining location No. 2961, R. 455, northeast of Schreiber, Thunder Bay dist., Ont.

An association of a dark-grey limestone and calcite with hematite, carrying a small quantity of copper-pyrites and a few flakes of native copper. It was found by Mr. Wait to contain :

Copper..... 5·07 per cent.

5.—From the Eureka claim No. 14, Britannia mountain, Howe sound, New Westminster dist., B.C.

A dark-grey quartz through which was distributed a small quantity of copper pyrites and a little pyrrhotite. Mr. Wait found it to contain :

Copper..... 3·83 per cent.

NICKEL AND COBALT.

Estimation of, in certain ores from the undermentioned localities, Ontario and British Columbia. Continued from page 36 R. of the Annual Report (vol. XIII) for 1900.

1.—From the west-half of lot 10, con. 4 Olden tp., Frontenac co., Ont.

An association of quartz and hornblende with a little feldspar, carrying a somewhat small quantity of pyrrhotite and a very little copper-pyrites. The pyrrhotite, freed from the copper-pyrites and all gangue, was found by Mr. Wait to contain.

Nickel..... 1·92 per cent.
Cobalt..... none.

2.—From the north-half of lot 3 of con. 4, Kerns tp., Nipissing dist., Ont.

An association of iron-pyrites and copper-pyrites with small quantities of limonite, hematite, and pyrrhotite, and trifling quantities of erythrite, through which was distributed a small quantity of quartzose gangue. An analysis by Mr. Wait showed it to contain.

Nickel..... 0·11 per cent.
Cobalt..... 1·68 "
Copper..... 6·07 "

3.—From near Ingall station on the line of the Canadian Pacific railway, some thirty miles west of Rat Portage, Rainy River dist., Ont. Collected by Dr. R. Bell.

A compact, massive pyrrhotite. It was found by Mr. Wait to contain :

Nickel	none.
Cobalt	none.

4.—From a vein about four miles from Hope and near the Fraser river, Yale dist., B.C.

An association of arsenical-pyrites with a small quantity of iron-pyrites and a very little copper-pyrites, through which was distributed a small quantity of quartzose gangue. The metalliferous portion of the ore, freed from all gangue, was found by Mr. Wait to contain :

Nickel	0·20
Cobalt	trace.

Traces of silver were also shown to be present, but no gold.

NATURAL WATERS.

1.—Water from a spring at Brook village about seven miles east-southeast of Mabou, Inverness co., N. S. It apparently rises from the gypsiferous beds of the Lower Carboniferous. The flow from the spring is constant and estimated to be about four gallons per minute.

The sample received for examination contained a trifling quantity of white flocculent matter in suspension, which was removed by filtration. The filtered water was clear and bright and apparently colourless; when viewed in a column two feet in length, however, it was found to have a just perceptible brownish-yellow hue. It was odourless; had a mildly saline taste; reacted neutral, both before and after concentration; and had a specific gravity, at 15.5° C., of 1008.87. Boiling produced a slight precipitate, consisting of calcium carbonate with a very little magnesium carbonate.

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

Potassa	0·012
Soda	5·168
Lime	0·575
Magnesia	0·112
Sulphuric anhydride	0·780
Carbonic anhydride	0·134
Chlorine	5·927
Silica	0·013
Organic matter	trace.
	12·721
Less oxygen, equivalent to chlorine	1·336
	11·385

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.)

Potassium chloride	0·019
Sodium chloride	9·752
Calcium sulphate	1·326
Calcium carbonate	0·052
Magnesium carbonate	0·235
Silica	0·013
Organic matter	trace.
	11·397
Less carbonic anhydride employed in excess of that actually found	0·012
	11·385
Total dissolved solid matter, by direct experiment, dried at 180° C., = 11·191	

An imperial gallon of the water, at 15·5° C., would contain : (The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous.)

	Grains.
Potassium chloride	1·342
Sodium chloride	688·695
Calcium sulphate	93·643
Calcium carbonate	3·672
Magnesium carbonate	16·596
Silica	0·918
Organic matter	trace
	804·866
Less carbonic anhydride employed in excess of that actually found	0·847
	804·019

Lithia, baryta, strontia, bromine, and iodine were sought for, and with negative results.

2.—Water from a boring on the east bank of the Richelieu river (about one hundred and fifty feet back from that stream and about one hundred feet back from Barbotte creek, which here flows into the Richelieu), on lot 86, con. 1, in St. Athanase par., Bleury seig., Iberville co., Que.

This water had, when first received, a very perceptible greenish-yellow colour, and a pronounced odour of hydrogen sulphide; after standing in a loosely stoppered glass container, however, it became perfectly odourless, colourless, clear and bright. Its specific gravity, at 15·5° C., was found to be 1003. 27. Boiling produced a very slight precipitate consisting of calcium carbonate with some magnesium carbonate.

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

Potassa	0·008
Soda	1·632
Lithia	trace.
Lime	0·074
Magnesia	0·139
Ferrous oxide	trace.
Sulphuric anhydride	0·256
Carbonic anhydride	0·290
Chlorine	1·671
Bromine	trace
Iodine (very small quantity)	undet.
Silica	0·012
Hydrogen sulphide	0·026
Organic matter	trace
	4·108
Less oxygen, equivalent to chlorine	0·376
	3·732

The hydrogen sulphide referred to in the above analysis had most probably resulted from the reducing action of organic matter (the water having been put up in an ordinary corked vessel) upon the sulphates present in the water, whereby a certain proportion of these latter were converted into sulphurets which being in turn decomposed by carbonic acid resulted in the separation of hydrogen sulphide.

It may be reasonably assumed that the foregoing acids and bases exist in the water in the following state of combination: (The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous.)

Potassium sulphate	0·015
Sodium sulphate	0·399
" chloride	2·753
" bromide	trace
" iodide	undet.
Lithium carbonate	trace
Calcium sulphate	0·041
Calcium carbonate	0·102
Magnesium carbonate	0·292
Ferrous carbonate	trace
Silica	0.012
Organic matter	trace
	3·614
Carbonic anhydride, in excess of that required to form monocarbonates	0·092
Hydrogen sulphide, free	0·026
	3·732

Total dissolved solid matter, by direct experiment, dried at 180° C.,–3·579.

The amount of carbonic anhydride found, in excess of that required to form normal carbonates, is somewhat less than half that required by these to form bicarbonates, from which it would appear that only a portion of the neutral carbonates is present in the water in the latter condition.

An imperial gallon of the water at 15·5°C., would contain: (The carbonates being calculated as monocarbonates, and all the salts estimated as anhydrous)

	Grains.
Potassium sulphate	1·053
Sodium sulphate	28·021
" chloride	193·340
" bromide	trace.
" iodide	undet.
Lithium carbonate	trace.
Calcium sulphate	2·879
Calcium carbonate	7·164
Magnesium carbonate	20·507
Ferrous carbonate	trace.
Silica	0·843
Organic matter	trace.
	253·807
Carbonic anhydride, in excess of that required to form monocarbonates	6·461
Hydrogen sulphide, free	1·826
	262·094

Baryta, strontia, and boric anhydride were sought for, and found to be absent.

3.—Water from an artesian-well on the east end of cadastral lot 52, con. 1, St. Johns par., (a mile and a half south of the town of St. Johns, and about thirty feet back from the west shore of the Richelieu river), Longueuil seig., St. Johns co., Que. It was struck at a depth of sixty feet from the surface.

The sample of water sent for examination was, at the time of its receipt, perfectly clear, bright and colourless, but after standing in a loosely stoppered glass container for a few days it deposited a brownish-yellow sediment which, on removal by filtration, was found to consist of ferric hydrate with a very little calcium carbonate. In its original condition this water was perfectly odourless; had a mildly saline taste; reacted neutral, both before and after concentration; and had a specific gravity, at 15·5° C., of 1006·03.

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

Potassa	0·020
Soda	2·788
Lime	0·265
Magnesia	0·309
Ferrous oxide	0·002
Sulphuric anhydride	1·596
Carbonate anhydride	0·235
Chlorine	2·555
Bromine	trace.
Iodine (very small quantity)	undet.
Silica	0·016
Organic matter	trace.
	7·786
Less oxygen, equivalent to chlorine	0·576
	7·210

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.)

Potassium sulphate	0·037
Sodium sulphate	1·276
" chloride	4·210
" bromide	trace.
" iodide	strong trace.
Calcium sulphate	0·411
" carbonate	0·171
Magnesium sulphate	0·927
Ferrous carbonate	0 003
Silica	0·016
Organic matter	trace.
	7·051
Carbonic anhydride, half combined	0·077
" " free	0·082
	7·210

Total dissolved solid matters, by direct experiment, dried at 180° C., =7·120

An imperial gallon of the water, at 15·5°C., would contain: (The carbonates being calculated as anhydrous bicarbonates, and the salts without their waters of crystallization.)

	Grains.
Potassium sulphate	2·606
Sodium sulphate	89·859
" chloride	296·477
" bromide	trace.
" iodide	strong trace.
Calcium sulphate	28·943
" bicarbonate	17·394
Magnesium sulphate	65·281
Ferrous bicarbonate	0·282
Silica	1·127
Organic matter	trace.
	501·969
Carbonic anhydride, free	5·774
	507·743

Lithia, baryta, strontia and boric anhydride were sought for, and found to be absent.

4.—Water from a boring in Front street, Courtright, Lambton co., Ont. Depth of boring, one hundred and thirty feet. Rate of flow, one hundred and sixty-five gallons per hour.

The sample of water sent for examination was perfectly bright and clear; colourless; odourless; and devoid of any marked taste. It reacted neutral: after evaporation to a small

volume, however, decidedly alkaline. Its specific gravity, at 15·5° C., was found to be 1001·29. Boiling produced a slight precipitate, consisting of calcium carbonate with a little magnesium carbonate.

An analysis, by Mr. Wait, showed one thousand parts, by weight, of this water, at 15·5°C., to contain :

Potassa	0·003
Soda	0·457
Lime	0·029
Magnesia	0·012
Sulphuric anhydride	trace.
Carbonic anhydride	0·204
Chlorine	0·420
Iodine	trace.
Silica	0·011
Organic matter	trace.
	1·136
Less oxygen, equivalent to chlorine	0·095
	1·041

It may be reasonably assumed that the foregoing acids and bases exist in the water in the following state of combination.

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

Potassium sulphate	trace.
Potassium chloride	0·005
Sodium chloride	0·689
" iodide	trace.
" carbonate	0·157
Calcium carbonate	0·052
Magnesium carbonate	0·025
Silica	0·011
Organic matter	trace.
	0·939
Carbonic anhydride, half-combined	0·101
" " free	0 002
	1·042

Total dissolved solid matter, by direct experiment, dried at 180° C., =0·888.

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.
Potassium sulphate	trace.
Potassium chloride	0·350
Sodium chloride	48·292
" iodide	trace.
" bicarbonate	15·560
Calcium bicarbonate	5·257
Magnesium bicarbonate	2·664
Silica	0·770
Organic matter	trace.
	72·893
Carbonic anhydride, free	0·140
	73·033

Bromine was sought for, and not detected.

5.—Water from a well at Ingram, on the main line of the Canadian Pacific railway, four miles and a half west of Grenfell station, Sask. The well in question is ten feet in diameter and ten feet deep.

The sample of water procured for examination was perfectly clear, bright and colourless. It was odourless and devoid of any marked taste. Reacted neutral, both before and after concentration. Boiling produced a small precipitate, consisting of calcium carbonate with some magnesium carbonate.

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

Potassa	0·006
Soda	0·175
Lime	0·261
Magnesia	0·234
Sulphuric anhydride	0·707
Carbonic anhydride	0·297
Chlorine	0·038
Silica	0·020
Organic matter	trace.
	1·738
Less oxygen, equivalent to chlorine	0·009
	1·729

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.)

Potassium sulphate	0·011
Sodium sulphate	0·323
Sodium chloride	0·063
Calcium sulphate	0·634
Magnesium sulphate	0·220
Magnesium carbonate	0·338
Silica	0·020
Organic matter	trace.
	1·609
Carbonic anhydride, in excess of that required to form monocarbonate	0·120
	1·729

Total dissolved solid matter, by direct experiment, dried at 180° C.,=1·548

The amount of carbonic anhydride found, in excess of that required to form normal carbonate, is, approximately, one-third less than that required for the conversion of this into bicarbonate. For this reason, the neutral carbonate is, in the following statement, represented as being present in that condition.

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.
Potassium sulphate	0·772
Sodium sulphate	22·655
Sodium chloride	4·419
Calcium sulphate	44·468
Magnesium sulphate	15·341
Magnesium carbonate	23·707
Silica	14·03
Organic	trace.
	112·855
Carbonic anhydride, in excess of that required to form monocarbonate	8·417
	121·272

6.—Water from a well at Whitewood, on the main line of the Canadian Pacific railway, thirty-one miles east of Grenfell station, Sask.

The sample of water procured for examination was perfectly clear, bright and colourless. It was odourless, and devoid of any marked taste. Reacted neutral, both before and after concentration. Boiling produced a small precipitate, consisting of calcium carbonate with some magnesium carbonate.

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

Potassa	0·013
Soda	0·280
Lime	0·464
Magnesia	0·273
Sulphuric anhydride	1·035
Carbonic anhydride	0·553
Chlorine	0·048
Silica	0·027
Organic matter	trace.
	2·693
Less oxygen, equivalent to chlorine	0·011
	2·682

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).

Potassium sulphate	0·020
Sodium sulphate	0·545
Sodium chloride	0·079
Calcium sulphate	1·127
Magnesium sulphate	0·087
Magnesium carbonate	0·512
Silica	0·027
Organic matter	trace.
	2·397
Carbonic anhydride, half-combined	0·268
" free	0·017
	2·682

Total dissolved solid matter, by direct experiment, dried at 180° C., = 2·316.

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.
Potassium sulphate	1·403
Sodium sulphate	38·245
Sodium chloride	5·544
Calcium sulphate	79·087
Magnesium sulphate	6·105
Magnesium bicarbonate	54·737
Silica	1·895
Organic matter	trace.
	187·016
Carbonic anhydride, free	1·193
	188·209

7.—Water from a boring (for coal) at Rear brook, East river, opposite Trenton, Pictou co., N.S. It was struck at a depth of 2,254 feet from the surface, and rises from the base of the New Glasgow conglomerate, Permian.

The sample of water sent for examination contained a small quantity of reddish-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 strongly saline, slightly acrid taste, succeeded by a bitter one. Reacted, faintly acid. The total dissolved saline matter, dried at 180° C., amounted to 127.972 parts per 1000—equivalent to 8958.04 grains per imperial gallon.

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

Soda	somewhat large quantity.
Lime	large quantity.
Magnesia	rather small quantity.
Ferrous oxide	very small quantity.
Sulphuric anhydride	rather small quantity.
Chlorine	large quantity.
Silica	trace.

Boiling produced a very slight precipitate, consisting of ferric hydrate.

8.—Water from a well near the Post Office at Granville Centre, Annapolis co., N.S. The well has a depth of six feet, the upper five feet passing through a stiff red clay and the lower one foot through gravel, from which the water rises.

The water contained a very small quantity of pale brown, flocculent matter in suspension. This, on removal by filtration, was found to consist of organic matter with a trifling quantity of hydrated peroxide of iron. The filtered water, when viewed in a column two feet in length, was found to have a pale brownish-yellow colour. It was odourless; devoid of any marked taste; and reacted neutral, both before and after concentration. The total dissolved saline matter, dried at 180° C., amounted to 0·142 parts per 1000, which would be equivalent to 9·94 grains per imperial gallon.

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

Potassa	trace.
Soda	small quantity.
Lime	very small quantity.
Magnesia	" " "
Sulphuric anhydride	" " "
Carbonic anhydride	" " "
Chlorine	" "
Silica	trace.
Organic matter	"

Boiling produced a slight precipitate, consisting of calcium carbonate.

9.—Water from what is known as the "How" spring, lot 15, con. 3, Fitzroy tp., Carleton co., Ont.

The sample sent was, at the time of its receipt, somewhat turbid, and after standing for a short time deposited a very small quantity of what proved to be a slightly ferruginous argillaceous matter. After filtration, this water was found to be bright and, apparently, colourless, but when viewed in a column two feet in length, it was seen to have a faint yellowish tinge. It was odourless; possessed a mildly saline taste; and reacted neutral, both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1008·0. The total dissolved saline matter, dried at 180° C., amounted to 9·524 parts in 1000 parts, by weight, of the filtered water, which would be equivalent to 666·68 grains per imperial gallon.

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

Potassa	trace.
Soda	somewhat large quantity
Lime	small quantity.
Magnesia	" "
Ferrous oxide	trace.
Sulphuric anhydride	small quantity.
Carbonic anhydride	rather small quantity.
Chlorine	somewhat large quantity.
Silica	trace.
Organic matter	trace.

Boiling produced a somewhat copious precipitate, consisting of calcium carbonate, with some magnesium carbonate, and a trifling quantity of ferric hydrate.

10.—Water from the coal mine at Frank, Alta.

The sample received for examination contained a small quantity of dark brownish-black sedimentary matter which, on removal by filtration, was found to consist of flocculent organic matter with some very finely divided coaly matter, a very small quantity of basic ferric sulphate, and a little siliceous matter. The filtered water was bright and had, when seen in a clear glass vessel of moderate capacity, a brownish-yellow, but when viewed through a column two feet in length, a deep red, colour. It reacted strongly acid; and possessed a styptic taste. ts specific gravity, at 15·5° C., was found to be 1017·5.

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

Lime	small quantity.
Magnesia	very small quantity.
Ferrous oxide	" " "
Ferric oxide	rather large quantity.
Sulphuric anhydride	" " "
Chlorine	trace.

In addition to the foregoing, this water also contained a considerable quantity of free sulphuric acid.

On heating, it became turbid, and at the boiling temperature deposited a dense brownish-yellow precipitate consisting, essentially, of basic ferric sulphate.

Its chief constituents consisted, evidently, of ferric sulphate with a little ferrous sulphate and some free sulphuric acid.

11.—Water from a spring near Baker or Cannington lake, on the east side of Moose mountain, tp. 9, range II, west of the second initial meridian, Sask.

The sample sent for examination contained a very small quantity of light brown flocculent matter in suspension. This, on removal by filtration, was found to consist, essentially, of organic matter with a very little ferric hydrate. The filtered water, which was perfectly clear and bright, had a brownish-yellow colour. It was odourless, devoid of any marked taste, and reacted neutral—both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1001·0, and the total dissolved saline matter, dried at 180° C., amounted to 0·566 parts per 1000—equivalent to 39·66 grains per imperial gallon.

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

Soda	very small quantity.
Lime	small quantity.
Magnesia	very small quantity.
Ferrous oxide	trace.
Sulphuric anhydride	very small quantity.
Carbonic anhydride	small quantity.
Chlorine	trace.
Silica	"
Organic matter	"

Boiling produced a small precipitate, consisting of calcium carbonate with a little magnesium carbonate and a trace of ferric hydrate.

12.—Water from a coal mine, worked by the Souris Coal Mining Company, on section 4, tp. 2, range VI, west of the second initial meridian, Sask.

Two samples of the water from this mine were sent for examination. Of these, the one—A., represented the water which percolates through the strata into the mine; and the other—B., represented the water discharged by the pumps from the mine.

A. This water was clear, bright, and of a pale brownish-yellow colour. It was inodorous; devoid of any marked taste;

and reacted neutral, but after evaporation to a small volume, decidedly alkaline. Its specific gravity, at 15·5° C., was found to be 1001·5. It contained 0·60 parts of dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water, which would be equivalent to 42·06 grains per imperial gallon.

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

Potassa	trace.
Soda	small quantity.
Lime	" "
Magnesia	very small quantity.
Sulphuric anhydride	small quantity.
Carbonic anhydride	rather small quantity.
Chlorine	none.
Silica	trace.
Organic matter	"

Boiling produced a small precipitate, consisting of calcium carbonate with a very little magnesium carbonate.

B. This was very turbid, owing to the presence of suspended argillaceous matter. When freed from the latter by filtration the water was seen to have a brownish-yellow colour. It had a faint argillaceous odour; no marked taste; and reacted neutral,—after concentration, however, strongly alkaline. Its specific gravity, at 15·5° C., was found to be 1002·5. The total dissolved saline matter, dried at 180° C., amounted to 1·6 parts in 1000 parts, by weight, of the filtered water,—equivalent to 112·28 grains per imperial gallon.

A qualitative analysis, conducted by Mr. Wait, gave as follows:

Potassa	trace.
Soda	somewhat large quantity.
Lime	small quantity.
Magnesia	very small quantity.
Sulphuric anhydride	small quantity.
Carbonic anhydride	somewhat large quantity.
Chlorine	very small quantity.
Silica	trace.
Organic matter	strong traces.

Boiling produced a small precipitate, consisting of calcium carbonate with traces of magnesium carbonate.

Determinations of the oxygen consuming power of these waters showed the absorption,—in the case of water A., to be but slight; in that of water B., quite considerable.

13.—Water from a hot spring near Vancouver, B.C.

The sample received for examination was clear, colourless, and bright; inodorous, and devoid of any marked taste. It reacted neutral, both before and after concentration. Its specific gravity, at 15·5° C., was found to be 1001·5. The total dissolved saline matter, dried at 180° C., amounted to 1·155 parts per 1000,—equivalent to 80·92 grains per imperial gallon.

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

Soda	small quantity.
Lime	" "
Magnesia	trace.
Sulphuric anhydride	small quantity.
Chlorine	" "
Silica	trace.
Organic matter	"

Boiling did not produce any perceptible precipitate.

BRICK AND POTTERY-CLAYS.

1.—Clay from what is said to be an extensive deposit occurring on section 28, tp. 12, range XXIV, west of the second initial meridian, Sask.

This clay has, in the air-dried condition, a bluish-greyish-white colour. It contains but a small quantity of siliceous grit; is highly plastic; burns white, or nearly so; and is very difficult to fuse at an elevated temperature.

Its analysis afforded Mr. Wait the following results:—

Silica	62·30
Alumina	22·24
Ferrous oxide	2·07
Lime	0·60
Magnesia	0·18
Alkalies, by difference	3·21
Water (ignition)	9·40
	100·00

This clay affords a very strong brick, and it is therefore particularly well adapted for the manufacture of building brick. It might also be advantageously employed in the manufacture of stove linings, and even fire-brick in which an exceptionally high degree of refractoriness was not called for, and could likewise be used in the manufacture of pottery, including the finer varieties of stoneware.

A precisely similar clay has been met with in the vicinity of Pasqua about seven miles east of Moosejaw, Sask. The deposit from which the latter was taken may possibly be an extension of that above referred to, which is situated about thirty miles southeast of Moosejaw.

2.—Clay from a deposit on the farm of Angus McLean, French Vale, Cape Breton co. N.S.

A slightly calcareous, slightly ferruginous, somewhat strongly plastic clay, through which is disseminated a rather large proportion of grit, composed, for the most part of quartz and feldspar, with some hornblende, chlorite, and mica, and a few particles of pyrite. It is somewhat readily fusible at an elevated temperature. When burnt it assumes a reddish-brown colour. It affords a strong brick.

3.—Clay from a deposit occurring on, or near, the bay shore and about a mile from the town of Baddeck, Victoria co., N.S.

A dull reddish-brown, non-calcareous, slightly ferruginous, somewhat strongly plastic clay, containing a small quantity of gritty matter. When burnt it assumes a bright reddish-brown colour. It is readily fusible at a somewhat elevated temperature. This clay might advantageously be employed for the manufacture of building bricks, drain-tiles, and all kinds of common earthenware.

4.—Clay from Garlic mountain, about seven miles from the town of Baddeck, Victoria co., N.S.

A greyish-white, non-calcareous, but very slightly ferruginous strongly plastic clay, containing a small quantity of gritty matter. It is somewhat readily fusible at an elevated temperature. When burnt it assumes a light reddish-white colour.

It affords a strong brick, and would, apart from its employment for the manufacture of ordinary building brick, be well suited for the manufacture of drain-tiles and coarse earthenware.

5.—Clay from Arichat, Richmond co., N.S.

A light reddish-grey, non-calcareous, slightly ferruginous rather feebly plastic clay, through which is distributed a large proportion of fine siliceous grit. It is somewhat difficult to fuse and affords a fairly strong brick of a light reddish-brown colour.

6.—Clay from a deposit on Dutch Valley road, Sussex, Kings co ,N.B.

A calcareous—the calcium carbonate amounting to, approximately, 10·7 per cent,—somewhat ferruginous, rather feebly plastic clay, through which is disseminated a little gritty matter. It is readily fusible at an elevated temperature. When burnt it assumes a light reddish-brown colour. It affords a very strong brick.

7.—Clay from a boring two miles east of The Brook village, Clarence tp., Russell co., Ont.

A light brownish-grey, slightly calcareous, slightly ferruginous, rather strongly plastic clay, through which is distributed a small quantity of gritty matter, and a few scales of yellow mica. It is readily fusible at an elevated temperature. When burnt it assumes a light reddish-brown colour. It affords a strong brick.

8.—Clay from a deposit extending over lots 10 and 11, con. 3, Sarawak tp., Grey co., Ont.

A bluish-grey, somewhat highly calcareous, slightly ferruginous, readily fusible, highly plastic clay, containing a very small quantity of fine siliceous grit. When burnt it assumes a light reddish-brown colour. It affords a strong brick, and is well suited for the manufacture not only of ordinary building brick, but also drain-tiles and all kinds of coarse earthenware.

9.—Clay from Red river, where it occurs on blocks 9, 13, 14 and 15, of river lot 13, Kildonan, about three miles northeast of Winnipeg.

A light brownish grey, somewhat highly calcareous, non-magnesian, rather strongly ferruginous, highly plastic clay, through which is distributed a very small quantity of fine siliceous grit. It fuses readily at an elevated temperature. When burnt it assumes a bright reddish-brown colour. It affords a strong brick, and might advantageously be employed for the manufacture of ordinary building brick, as well as drain-tiles and other kinds of common earthenware.

10.—Clay from a deposit on, or near, Prairie creek—a tributary of Clearwater river, near Rocky Mountain House, Alta.

A bluish-grey, calcareo-magnesian, somewhat ferruginous, rather strongly plastic clay through which is disseminated a small quantity of fine siliceous grit. It is easily fusible at a somewhat elevated temperature. Determinations of certain of the constituents of this clay showed it to contain, approximately, calcium carbonate 32·59, magnesium carbonate 12·6, ferrous oxide 1·93, and ferric oxide 2·00 per cent. The siliceous grit amounted to, approximately, 3 per cent. It affords a strong brick, of a pleasing light reddish-brown colour.

11.—Clay from a bed, five to seven feet in thickness, occurring, at a depth of five feet from the surface, on the north-half of section 11, tp. 29, range XXIII, west of the fourth initial meridian, Alta.

A dark grey, rather strongly calcareous, somewhat highly magnesian, rather strongly ferruginous, readily fusible, plastic clay, containing a very little fine siliceous grit diffused through its substance. It affords a strong brick, of a reddish-brown colour, and is well adapted for the manufacture both of common building brick, and coarse earthenware in general.

12.—Clay from a bed some ten feet in thickness, immediately underlying that from which the preceding specimen was taken.

A light grey, rather strongly calcareous, somewhat highly magnesian, slightly ferruginous, rather plastic clay, through which is distributed a small quantity of fine siliceous grit. When burnt it assumes a light reddish-brown colour. Is easily fusible at a somewhat elevated temperature. Like the preceding clay, it affords a strong brick. It might be used for the manufacture of ordinary building brick, drain-tiles, and similar ware.

13.—Clay from a deposit occurring on section 1 or 12 or both, of tp. 24, range I, west of the fifth initial meridian, Alta.

A brownish-grey, somewhat strongly calcareous, slightly magnesian, and slightly ferruginous, rather readily fusible, strongly plastic clay, holding numerous rounded pebbles of quartz, sandstone, and limestone, and also containing a very large quantity of fine siliceous grit. After separation of the pebbles in question, the clay itself was found to contain, approximately, calcium carbonate 13·46, magnesian carbonate 3·38, and intermixed fine siliceous sand 42·00 per cent. It afforded a strong brick of a reddish-brown colour.

14.—Clay occurring on the homestead of Mr. A. M. Kay, section 34, tp. 32, range I, west of the fifth initial meridian, Alta., about one mile and a half east of the town of Olds, Calgary div., Alta.

A greenish-grey, somewhat highly calcareous, slightly magnesian, slightly ferruginous, rather feebly plastic clay, which burns reddish-white, is somewhat difficultly fusible at an elevated temperature, and affords a strong brick. It might be employed for the manufacture of ordinary building brick, drain tiles, and similar ware.

15.—Clay from a deposit on the west-half of section 19, tp. 7, range III, west of the fifth initial meridian, Alta.

A light greenish-grey, slightly calcareous, very slightly magnesian, slightly ferruginous, feebly plastic, readily fusible clay, containing a small quantity—approximately 13 per cent, of fine grit composed, essentially, of quartz and feldspar. When burnt it assumes a dull reddish-brown colour. It affords but a weak brick.

16.—Clay from the same locality as the preceding specimen.

A bluish-grey, somewhat highly calcareous, slightly magnesian, and slightly ferruginous, feebly plastic, readily fusible clay, containing a somewhat large quantity—approximately 27 per cent, of fine grit composed, chiefly, of quartz and feldspar. It affords a fairly strong brick of a reddish-brown colour.

17.—Clay from the same locality as the two preceding specimens.

A light greenish-grey, slightly calcareous, non-magnesian, slightly ferruginous, readily fusible, rather strongly plastic

clay, containing only a small quantity—approximately 5 per cent, of fine grit composed, mainly, of quartz and feldspar. It yields a strong brick of a bright reddish-brown colour, and is quite suitable for the manufacture of common building brick and coarse earthenware.

18.—Clay from the same locality as the three preceding specimens. A light greenish-grey to light grey, slightly calcareous, very slightly magnesian, slightly ferruginous, feebly plastic, easily fusible clay, containing a somewhat large quantity—approximately 30 per cent, of fine siliceous grit composed, for the most part, of quartz and feldspar. It affords a strong brick of a reddish-brown colour.

19.—Claystone, from mountain three miles east of Enderby, Yale district, B.C.

It has a dark grey colour; is non-calcareous; slightly ferruginous; has a small quantity of fine siliceous grit and a few minute scales of mica, diffused through its substance; disintegrates when immersed in water; in the moist condition is feebly plastic; when burnt assumes a reddish-brown colour; and is easily fusible at a somewhat elevated temperature. It affords a strong brick.

A similar material—claystone, has been met with about four miles north of Clinton, Lillooet district, B.C., as mentioned in the Annual Report, vol. xii, p. 61 R., for 1899.

MISCELLANEOUS EXAMINATIONS.

1.—Arenaceous clay. From a deposit occurring some ten or twelve miles west of Desbarats, Algoma dist., Ont.

A slightly calcareous, very slightly magnesian, and slightly ferruginous, readily fusible, somewhat strongly plastic clay, through which is disseminated a very large quantity—approximately 63 per cent, of exceedingly fine-grained siliceous sand—When burnt it assumes a light reddish-brown colour. Notwithstanding the large proportion of siliceous sand, it affords quite a strong brick.

2.—Bog manganese. From a deposit on the farm of Mr. F. McAulay of Cardigan, St. George parish, P.E.I.

A partial analysis of this, by Mr. Wait, showed it to contain —manganese dioxide 35·44, ferric oxide 34·91, insoluble siliceous matter 3·60, water, hygroscopic and combined, 18·63, per cent.

3.—Carbonaceous shale. From the shore of Tagish lake, about forty miles southeast of Dugdale station on the line of the White Pass and Yukon railway, Ykn.

A greyish-black, lustrous, slickensided, carbonaceous shale. It contained 11·234 per cent of fixed carbon.

4.—Ferruginous shale. From Oak mountain, Carleton co., N.B.

A specimen of a reddish-brown, argillaceous shale, traversed by an occasional thin seam of quartz, from this locality, was found to contain—16·50 per cent of ferric oxide, equivalent to 11·55 per cent of metallic iron.

5.—Graphitic shale. From an occurrence of this material on the farms of Mr. Donald McInnis and Mr. McSween, on Big brook, near West Bay Road station, Inverness, co., N.S., about half a mile from the railway.

Three samples of the material from this locality, where it is met with in the Lower Carboniferous, have been examined by Mr. Wait and found to contain, respectively,—26·59, 31·57, and 35·53, per cent of graphitic carbon.

6.—Molybdenite. From one of the veins constituting what is known as the Tamarac group on Gnawed mountain, Yale dist., B.C.

The material received for examination consisted of a white subtranslucent quartz traversed by thin veinings of molybdenite and holding a very small quantity of chalcopyrite. A fair average sample of the particular specimen sent was found by Mr. Wait to contain, approximately, 7 per cent of molybdenite.

7.—Silt. A very fine-grained, compacted, yet readily friable, somewhat argillaceous, siliceous silt, has been found, forming a bed immediately overlying a bed of arenaceous clay, at a point some ten or twelve miles west of Desbarats, Algoma dist., Ont.

A partial analysis, by Mr. Wait, of a sample of this material, dried at 100° C., showed it to be composed of, approximately, —minute grains of siliceous sand 75·0 ; calcium carbonate 15·2 ; magnesium carbonate 4·0 ; ferric oxide, trace ; clay 5·8=100·0. When moistened with water it forms a somewhat plastic mass, which, when dried and burnt assumes a reddish-white colour, is tender, and readily fusible at an elevated temperature.

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(SINCE 1885)

OF SPECIAL ECONOMIC INTEREST

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THE GEOLOGICAL SURVEY OF CANADA

MINERAL RESOURCES BULLETINS

818. Platinum
851. Coal.
854. Asbestus.
857. Infusorial Earth.
858. Manganese.
859. Salt.
860. Zinc.
869. Mica.
872. Molybdenum and Tungsten.
877. Graphite.
880. Peat.
881. Phosphates.
882. Copper.
913. Mineral Pigments.

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745. Altitudes of Canada, by J. White. 1899. (40c.)

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236. The Rocky Mountains, Geological Structure, by R. G. McConnell. 1886. (20c.).
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294. West Kootenay district, by G. M. Dawson. 1888–89. (35c.).
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968. Report to accompany map of the Moose Mountain area, Alta., by D. D. Cairnes.
961. Reprint of No. 873.
962. " No. 672.

IN PREPARATION.

Rossland district, B.C. (full report), by R. W. Brock.
Report on Prince Edward county, Brockville and Kingston map sheet, by R. W. Ells.
Report on Cornwall sheet, by R. W. Ells.
Reports on Country between Lake Superior and Albany river, by W. J. Wilson and W. H. Collins.