ART. XI. NOTES ON THE ECONOMIC MINERALOGY OF NOVA SCOTIA; BY PROF. HOW, D. C. L., UNIVERSITY OF KING'S COLLEGE, WINDSOR, N. S.; PART V., COALS AND ALLIED MINERALS.

(*Read June* 14*th*, 1869.)

IT is proposed in the present continuation of these "Notes" to put together in a condensed form such results of the examination of the Provincial coals and other combustible mineral substances, as have been obtained with regard to their character, chemical composition, and economic value, and to institute comparisons between these and similar minerals of Great Britain and the United States, so far, at least, as the investigations made will admit of this course, for, owing to the various modes adopted in the analysis and practical examination of coals, any comparison of the kind in question must at present be very imperfect, and it will not be possible to show exactly the position occupied by the N. S. coals until such a systematic trial shall have been made of their qualities, as will bring out results comparable with those obtained in the enquiries instituted by the United States and Great Britain into the nature of coals suited for their respective steam navies. The first step in an investigation highly important, was taken by the former country, in the enquiry conducted at the Washington Navy Yard in the years 1842-3. It was obvious to a man of the discernment of Mr. Joseph Hume that such an example ought to be followed in England: he accordingly brought the matter before the Lords of the Admiralty in a letter from which I make the following extracts which can hardly fail to be interesting in this coal-enriched Province. "I am informed that no inquiry into the several kinds of fuel that might be used for steam engines, with the view of ascertaining what fuels have the greatest evaporating power in the smallest space and weight, has been instituted by any department of the Government, and therefor beg to recommend the subject as one deserving the immediate and serious attention of your Lordships. The efficiency of the steamers must depend on the quality of the coals and fuel used for the Naval Service, and, without an accurate knowledge of the power of the coals to be used, the country may be paying the highest prices for an inferior article;

and, depending on the power of the fuel, the public service may suffer disappointment at a moment when the greatest interests of the country may be at stake.

The late Mr. Upham of the U. S. was strongly impressed with the importance of determining the nature and qualities of the several coals in the U. S., with a view to their use in the steam navy of that country, and, in 1842-3, directed a course of experiments to be made on the different coals of the U. S., for the purpose of ascertaining their evaporative powers.

I have only this day received from the U. S. the report of that inquiry, and I have the satisfaction of sending a copy of that report that your Lordships may see the results. They have decided by direct and practical tests the comparative usefulness of American and English * coals, as well as the relative value of the former in their numerous varieties; and I submit to your Lordships that a similar enquiry should be instituted into the comparative usefulness of the several kinds of British coals with a view of ascertaining the best for the naval steamers of this country.

I may be allowed to point out to your Lordships that there is a public establishment perfectly qualified to apply the requisite tests, and one chemist of eminence may be added to assist in what is an object of great national importance."

The British Government ordered such an enquiry as was recommended: it was commenced in 1846, was carried on about 6 years, and the results obtained were embodied in three successive reports presented to Parliament by Sir Henry de la Beche and Dr. Lyon Playfair, who were entrusted with the superintendence of the investigations. Having been for about two years engaged as chemist I am familiar with the methods of examination adopted and naturally take considerable interest in all the chemical results brought out from time to time respecting the coals of this province. Although these are not, for the reason before given, altogether comparable with those obtained in the official enquiries, they are so to a certain extent, and more particularly with those of the U. S. investigation. It was the object in both countries to decide not only what coals were best for the purpose in question, but how far the practical results

* Three English coals only were tried against a large number from various parts of North America.

were in accordance with the amount of work theoretically possible in view of the chemical composition of the coals. The American fuels were subjected to proximate analysis which furnishes the relative amounts of moisture, volatile combustible matters, fixed carbon, and ash, while the British were made to exhibit not only these results, but, in a few cases, the amount of gas, tar, and other products, and in all, the relative quantities of their ultimate elements, viz., carbon, hydrogen, nitrogen, sulphur, oxygen (and ash). Now, as regards the coals of the province, several of them have been submitted to proximate analysis and the results of their examination are to be found in Dawson's "Acadian Geology," or in my late "Report to the Prov. Govt. on the Mineralogy of Nova Scotia." Some of the data obtained lead to certain conclusions with precision, and others are of approximate value as indicating the theoretical value of the coals, and thus enabling us to compare them to some extent with the fuels of the countries which have had the advantage of scientifically conducted practical inquiries. In addition, we have the results of such trials in the case of two N. S. coals made in the American enquiry, and one ultimate analysis of a provincial coal made for the Acadia Iron Company. Finally, a few of the coals have been tried in steamships, and so compared with others in a really practical way; affording results which are stated generally, and, of course, without the scientific accuracy attaching to those obtained in the enquiries under consideration.—(*Loc. cit.*)

Classification of Coals and Allied Minerals.—These substances are differently arranged by good authorities, especially as regards the varieties made of bituminous coals. There is not much diversity of opinion respecting the primary groups, viz., graphite; anthracite, stone coal, or culm; bituminous, soft, black, common, or pit coal; brown coal or lignite; peat; bitumen; and finally, shale or batt. When, however, the attempt is made to classify the bituminous coals, or to say what place such substances as are now generally called oil-coal for the sake of distinction, shall occupy, a very considerable range of opinion is observed. With reference to the first of these points—classifying common coal—Jukes says:—"*Ordinary* or *pit coal* has many varieties; indeed these are often as numerous as the different seams of a coal field, and even the different beds of a compound seam are readily distinguished from each other by the colliers who give particular names to them; and even small blocks of these varieties can be recognised by them, and identified with the seam, or part of a seam, from which they are derived. Neither are these distinctions, which are only to be perceived after long practice, unimportant, since these varieties have distinct qualities, some of them being better adapted to smelting, and said to be 'good furnace coal'; and some of them to blacksmith's work, or 'good shop coal'; others to various uses; while only a few, comparatively, are best fitted for domestic purposes, and are brought to market by the coal merchant." (Manual of Geology, p. 132.)

The variation in character throughout seams here alluded to is well shewn to be accompanied by diversity in chemical composition by analyses made of the coals of this province, all of which are "bituminous."

Thus, the two benches of the Haliburton seam at the Montreal and Pictou Mine give, by my analyses:—

	No. 1.	No. 2.
Volatile matter	29.35	25.40
Fixed carbon	61.07	68.55
Ash	9.58	6.05
	100.00	100.00

and the two benches of the M'Gregor seam at the Acadia Mine gave an analyst not named:—

	No. 1.	No. 2.
Volatile matter	22.50	23.30
Fixed carbon	65.70	70.00
Ash	11.80	6.70
	100.00	100.00

(Mineralogy of N. S. pp. 22–27.)

The series of 31 assays made by Dr. Dawson of the coal from the main seam at the Albion Mines, Pictou Co., taken throughout at distances of one foot thickness, shows a variation per cent within these limits:—

	Volatile Matter by rapid coking. A	Volatile Matter by slow coking B	Fixed Carbon C	Ash D
From	22.2 to 32.6	19.9 to 26.1	50.4 to 68.5	8.7 to 28.1

The series of 15 assays of coal taken at distances of one foot throughout the deep seam at the same mine, by Dr. Dawson, shewed variations per cent. under the same heads as above :—

	A	B	C	D
From	23 to 29	19.9 to 25.2	48 to 71.5	53 to 21.6

The set of analyses by Mr. Poole of coal from distances of one foot throughout the Wayland Seam, Caledonia Coal Mine, Glace Bay, C. B., eight in number, gave variations per cent :—

	Volatile Matter.	Fixed Carbon.	Ash.
From	27 to 37.5	51.7 to 61.1	5 to 17.8

The details of the instructive analyses of which the foregoing is the summary, are given in *Acadian Geology*, Second Edition, pp. 334, 336, and 419.

Jukes goes on to say : "Some idea of the immense varieties of coal may be gained from an inspection of the report of the Admiralty Coal Investigation, as well as from the varying qualities of those which we are in the habit of using in our houses. As many as seventy denominations of coal are said, by Ronald and Richardson in '*Chemical Technology*,' to be imported into London alone."

"All these minute varieties are commonly included under four principal heads :—1. *Caking Coal*; 2. *Splint* or *Hard Coal*; 3. *Cherry* or *Soft Coal*; and 4. *Cannel* or *Parrot Coal*."—(*Loc. cit.* p. 133.)

Dana adopts the arrangement of the principal kinds of bituminous coal into: "1, *Caking Coal*; 2, *Non-Caking Coal* including *cherry* or *soft coal* which ignites well and burns rapidly, and *splint* or *hard coal* which ignites less readily and burns less rapidly, owing to the smaller amount of volatile matters (coals which do not cake on burning are called 'free burning' coals, while the caking are called 'binding' coals) ; and 3, *Cannel Coal* (*Parrot Coal*) a variety of bituminous coal, and often caking, but differing from the preceding in texture, and to some extent in composition, as shewn by its products on distillation."—(Mineralogy, Fifth Edition, p. 755.)

Miller makes a class of *steam coal* between bituminous coals and anthracites : "it burns freely and with flame, giving out a steady heat, but it does not yield sufficient volatile matter to be advantageously employed in the preparation of coal gas. It is well fitted for use in the steam navy, since it does not crumble readily, and it emits but little smoke. Its coke scarcely cakes, and has little coherence or lustre. Much Welsh coal is of this description."—(Elements of Chemistry III. 99, First Edition.).

Consideration of the conditions under which coal beds could have been formed, and late researches into the minute structure of the dissimilar layers of the beds, have afforded insight into the causes of the differences just mentioned and indicated by the terms employed to distinguish the varieties of coal. The second edition of "Acadian Geology," may be consulted with advantage on these points, on which a brief remark or two here may not be uninteresting. Dr. Dawson observes that coal is proved beyond question to have accumulated by growth *in situ*; while the character of the sediments between the beds proves equally the abundant transport of mud and sand by water; that the true coal consists principally of the flattened bark of sigillarioid and other trees, mixed with leaves, and fragments of decayed wood, all these materials having manifestly alike grown and accumulated where we find them; that the microscopical structure and chemical composition of the beds of cannel-coal and earth, bitumen, and of the more brightly bituminous and carbonaceous shales, show them to have been of the nature of the fine vegetable mud which accumulates in the ponds and shallow lakes of modern swamps; when such fine vegetable sediment is mixed with marl it becomes similar to the bituminous limestone and calcareo—bituminous shales of the coal measures, (p. 138). Further on we find:—In ordinary bituminous coal we recognize by the unassisted eye laminæ of a compact and more or less lustrous appearance, separated by uneven films and layers of fibrous anthracite or mineral charcoal, and these two kinds of coal demand a separate consideration. They are shown to result from certain chemical changes, and the conclusion arrived at is that the mineral charcoal is formed by subaërial decay, and the compact coal by subaqueous putrefaction, more or less modified by heat and exposure to air. It is added that in coals, like cannel-coals, which have been formed wholly under subaqueous conditions, the mineral charcoal is deficient. The compact coal, constituting a far larger proportion of the mass than the "mineral charcoal," consists either of lustrous conchoidal *cherry* or *pitch coal*, of less lustrous *slate coal*, with flat fracture, or of coarse coal, containing much earthy matter. All of these are arranged in thin interrupted laminæ. They consist of vegetable matter which has not been altered by subaërial decay, but which has undergone the bituminous putrefaction, and has thereby been resolved into a nearly homogeneous mass, which still, however, retains traces of structure and of the forms of the individual plants composing it. The mineral charcoal affords the greater part of the material shewing distinct vegetable structures, the kinds of tissue in which are minutely described. (pp. 462, 466).

With reference to cannel coal, it was allowed by the microscopists on both sides of the question to be alluded to presently as to what substances are entitled to the name of "coal," that it affords clear evidence of its origin by exhibiting distinct vegetable tissues, though not so readily as common coal. Dr. Redfern, for example, one of those who would have made the term coal include what the other side considered a different mineral, said he found vegetable structure in six cannel coals. On the other side, Dr. Adams said he believed he had examined 40 or 50 different specimens of cannel coals, (of so many varieties?), and that, though the organic structure could be traced, it required more skill to find it than in ordinary coal, on account, as he believed, of the structure being much more compact in the cannel coal, and an exceedingly thin section being required, which it was found difficult to procure from the nature of the material. * Dr. Rowney, in his paper shewing the chemical composition of mineral charcoal to resemble that of anthracite, (Ed. Phil. Jnl. July 1855), indeed, says that this fibrous substance, described above as full of tissue remains, is found in cannel coal, but not in very great amount.

With regard to the second point above mentioned—the position of oil coals—it will be in the recollection of many members of the Institute that an important case was tried in Halifax some few years ago in which the matter in dispute was whether the black substance found at Hillsborough, in New Brunswick, was a coal. It may also be remembered that not long afterwards a similar issue

* Report of Trial, Gillespie *vs.* Russel.—Edinburgh, 1853.

was raised respecting the black-brown substance found at Torbane Hill, Linlithgowshire, Scotland, and that several trials were held, one after the other, to decide the question. I was one of numerous witnesses engaged to give evidence in the first of these trials held in Edinburgh, just referred to in a note, in which there were 78 witnesses examined, 33 for the plaintiff and 45 for the defendant, while a number were engaged, but not called on for want of time,—a curious *legal* deficiency. The witnesses consisted of geologists, mineralogists, chemists, microscopists and practical men connected with mining. Though the view I took, in common with a large proportion of the scientific witnesses, that the substance was not a coal, was not in accordance with the verdict, which indeed resulted from "the court virtually setting aside the discordant scientific evidence, and deciding on the legal merits of the commercial bargain," it was pleasant to learn in a short time that the mineral was admitted into Germany, where there is certainly some scientific knowledge, under a tariff different from that applied to coal, and also, years after, that the agreement finally come to by the litigants was to call the substance "the mineral in dispute:" it is now very frequently called Torbanite. It will be useful, as bearing on somewhat similar minerals found here, to mention the facts brought out as to the minute structure of Torbanite. While microscopists on both sides found tissue present, it was urged by the "non-coal" witnesses that these were due to accidental fragments of coals. Professor Quekett, for example, in his paper "On the Minute Structure of a Peculiar Combustible Mineral from Torbane Hill," (Qu. Jnl. Microscopical Science, 1854), states "that the Torbane-hill mineral is not, microscopically speaking, a Coal; that it is not like any of the combustible substances used in this country as a Coal, and that, although possessing some of the properties of Coal, it is, notwithstanding, a mineral *sui generis*, having a basis of clay which is strongly impregnated with a peculiar combustible principle, and that when plants are found in it, they are accidental, and have no more been concerned in the formation of the mineral than has a fossil bone in that of the rock in which it may be imbedded." The mode in which such deposits may have originated is given above from "Acadian Geology," p. 138, and is further dwelt upon by Dr. Dawson in connection with the Albertite of New Brunswick, which he now considers to be an altered asphalt, deposited in a vein or fissure, "and it only remains to consider whence the supplies of liquid bitumen could have been obtained. I have no hesitation in assigning them to the highly bituminous lower carboniferous shales. These beds are manifestly of the same character with the so-called 'oil-coals,' of Nova Scotia, and the earthy bitumens of Scotland. They must have been beds of mud charged with a great quantity of finely comminuted vegetable matter, of the nature of peaty muck, which has become perfectly bituminized, and which probably in an earlier stage of its formation was more prone to edge into fissures as a liquid petroleum than at present." (*Loc. cit.* p. 240). The best known "oil-coal" of the province is the "stellar-coal" of New Glasgow, which I have, for the sake of distinction, called Stellarite on giving a full comparison of its ultimate and proximate composition with those of Albertite and Torbanite in my "Report on the Mineralogy of N. S.," (p. 25). Bitumen, in some respects analogous to Albertite, as shewn in a paper of mine ("Contributions to Mineralogy of N. S.," II., L. E. D. Phil. Mag. 1867), was found by Mr. Barnes in limestone at Grand Anse, C. B., in globular and rounded masses in the rock, and in and among crystals of calc-spar on the rock. Liquid bitumen or petroleum is now circumstantially reported to have been found flowing from a rock at Lake Ainslie, C. B., and to have been discovered at Salmon River, Guysborough Co., N. S., and recently at Hantsport, Hants County.

Results of the official Enquiries made in U. S. and England on coals, etc.—The following tables are constructed to show at a glance some of the most important results brought out in these two valuable enquiries, A summary only of the very numerous details can be given in each case, and this is done so as to allow of comparison as far as possible. Though the averages are not from the same number of trials on the same number of fuels, they are interesting not only as regards the use of fuel for steam purposes, but in various other respects. The evaporative power is shewn by the number of pounds of water actually converted into steam at 212."

Summary of Results of Experiments on Fuels, by Prof. W. R. Johnson, at the U. S. Navy Yard, Washington, 1842–1843:

NAME AND LOCALITY OF FUEL.	Averages obtained from			Practical Evaporative Power.	Weight in lbs. of one c. ft. of fuel as used.	Storage space in c. ft. of one ton.	Proximate Analysis: Percentages.				
							Moisture.	Volatile combustible matter.	Fixed Carbon.	Ash.	Sulphur.
	Expts.		Fuels.	A.	B.	C.	D.	E.	F.	G.	H.
Coal, Anthract., Pennsyl.	9	on	6	9.59	53.35	42.14	1.19	3.98	88.54	6.51	0.052
" Bituminous, "	9	"	7	9.32	52.55	42.67	1.17	16.02	72.47	10.13	0.722
" " Maryland.	5	"	5	9.98	53.11	42.17	1.25	14.20	75.05	9.49	....
" " Virginia..	10	"	8	8.48	48.76	45.72	1.62	29.50	58.30	10.58	1.090
" " Foreign ..	6	"	5	8.06	50.00	44.87	2.06	35.11	57.66	8.45	0.433
" Do. W. of Alleg. Mt	2	"	2	7.77	47.23	47.43	2.00	35.30	56.68	6.02	0.160
" mixed, 4 An. to 1 Bit.	2	"	2	9.02	52.90	41.18	....	.....	.....	.....	.....
Coke, art. of Vir. & Md. Cl.	2	"	2	8.82	32.14	69.72	....	.....	.....	14.94	.....
" Natural, Virginia..	1	"	1	8.47	46.64	48.03	1.11	11.97	75.08	11.82	0.466
Wood, Dry Pine........	1	"	1	4.69	21.01	106.62	3 67	.....	.....	0.31	.....

Among the foreign coals in the foregoing table are two Nova Scotian coals, from which the following are the results under the heads specified above:

	Expts.		Fuels.	A.	B.	C.	D.	E.	F.	G.	H.
Coal, Bit., Pictou, N. S..	1	on	1	8.41	53.55	41.83	2.56	27.06	56.98	13.38	0.769
" " (Cunard's)...	"	"	"	8.49	49.25	45.48	0.78	25.79	60.73	12.51	.....
" " Sydney, C. B.	"	"	"	7.99	47.44	47.21	3.12	23.81	67.57	5.49	.....

Summary of Results obtained in the British Coal Enquiry, at Putney, 1856–52, under heads specified above:

		A.	B.	C.
Coals, Bitumin. *Wales..	37 samples.	9.05	53.10	42.71
" " Newcastle..	17 " .	8.37	69.18	45.30
" " Lancashire.	28 " .	7.94	49.70	45.15
" " Scotland...	8 " .	7.70	50.00	44.80
" " Derbyshire.	8 " .	7.58	47.20	47.45

As all the details necessary for arriving at the average chemical composition of the coals examined in the British Enquiry are not at hand, I give that of some representative coals as found by my own analyses, together with practical and theoretical evaporative power in each case, in the following

* And a very few Anthracites.

Table shewing the Value as Steam-Fuel and the Proximate Composition of some Representative British Bituminous Coals :—

LOCALITY OF COAL.	QUALITY.	Evaporative Power.		Proximate Analysis: Percentages.					Analyst.
		Practical.	Theoretical.	Moisture.	Vol. Com. Matter.	Fixed Carbon.	Ash.	Sulphur	
Ebbw Vale, Wales.	Caking ...	10.21	10.44	1.34	21.16	76.00	1.50	1.02	H. How
Duffryn, "	Not-Caking	10 15	11.13	1.13	14.17	81 04	3.26	1.77	"
Mynydd Newydd. "	Caking ...	9.52	9.83	0.61	24.59	71.56	3.24	1.21	"
Sydney, England...	Not-Caking	8.52	6.56	2.78	39.42	47.80	10.00	2.27	"
Broomhill, " ..	Not-Caking	7.30	7.71	9.31	31.49	56.13	3.07	2.85	"
Grangemouth, Scotd	Splint	7.40	7.29	6.42	36.98	53.08	3.52	1.42	"
Fordel, "	Splint	7 56	6.58	8.40	39.57	48.03	4.00	1.46	"

It will be observed on comparing this table with the foregoing that though some of these British coals are practically of the same evaporative value as some of the American as shewn by the average of Professor Johnson's results, while those at the head of the list are superior to any American fuel examined, the chemical composition is decidedly different; this is especially seen on comparing the Pennsylvania anthracite with the Welsh bituminous coal; the evaporative value being nearly the same, the latter contains very much more volatile combustible matter. The theoretical evaporative power is given above in order to show that, while it is not identical with the practical, which, as is obvious from a comparison of the results brought forward, depends upon various conditions, it affords a useful index to the steam-value of a coal in the absence of a practical scientific trial; and it appears that when the amount of volatile combustible matter is moderately large the approximation of these two numbers is sometimes rather close. At the same time it is evident that there are differences not accounted for by chemical analyses, and it follows that the only way of arriving at the absolute truth with regard to the heating power of a coal is by a trial under well considered circumstances, as in the enquiries so frequently mentioned.

Average Quality of Nova Scotian Coal, etc.—Average results having been given with regard to groups of British and American coals, I propose, in proceeding to compare those of this province to take them in groups from the different coal-fields and show average results; it is to be regretted that there are not sufficient details to make those of the groups of equal value, or to allow of complete comparison with the foreign coals. Here follows a

Table shewing the Theoretical Value as Steam Fuel and the Average Proximate Composition of some Groups of Nova Scotian Coals:

LOCALITY OF COALS.	AVERAGES OBTAINED FROM	Theoretical Evaporative Power.	Percentages.		
			Volatile Matters.	Fixed Carbon.	Ash.
Pictou Co., N. S.	12 Expts. on 5 Coals.	8.78	27.37	63.97	8.66
Cumberland Co., N. S.	4 " " 3 "	7.97	32.99	58.04	8.97
Cape Breton Co., C. B.	13 " " 4 "	8.58	32.14	62.50	5.36
Inverness Co., "	2 " " 2 "	8.16	31.51	59.41	9.08
Richmond Co., "	1 " " 1 "	7.93	30.25	56.40	13.35

It appears on comparing this and the foregoing official tables, considering what has been said with reference to the theoretical evaporative value being generally rather close to the practical when the volatile matters are moderately high, that the coals of this province should stand in a good position as steam producers, and this is quite consistent with their character in the market, for it is well known that several of these are highly esteemed on this account. (See "Acadian Geology," and "Mineralogy of Nova Scotia.")

As Gas-Producers, several of the provincial coals are in considerable repute, as is shown by the fact that they have been for some time mentioned in the price lists of the U. S. as gas coals.

The average yield of coals from Pictou county, as indicated by nine trials on fair and good coals, is 8093 cubic feet gas to the ton of 2240 lbs., some samples giving 9500 and 10000 feet. The illuminating power of the gas is sometimes up to 16 candles. The average yield of English Newcastle coal is given as 8500 cubic feet, and the Parliamentary illuminating standard, in London, where a good deal of this coal is used, is 12 candle, but the gas is actually 14 candle at times. In Boston, U. S., 15 candle gas is burnt from Pictou coal.

The majority of the coals quoted in the American lists are from Cape Breton; the yield of gas is reported as large in some of these, numerical results have been obtained for two cases only, in each of which the amount per ton, of 2240 lbs., was 8500 cubic feet.

Oil-coals.—The best known of the mineral substances so called, found here, occurs, as already mentioned, near New Glasgow, Pictou Co. The name I have proposed for it, "Stellarite," like the local term "Stellar Coal," alludes to the fact that flaming particles scintillate from the lighted mineral. The substance, or one very similar, is found on both sides of the East River, at four localities, at least, which mark an extensive area of distribution. The following and other particulars respecting it will be found in "Mineralogy of N. S." (p. 26). Stellarite compares favourably with other oil-minerals :—

	Crude oil per ton.
Union Oil Coal of West Virginia affords	32 gallons
Elk River " " " "	54 "
Kanawha " " " "	88 "
Lesmahagow Cannel Coal, Scotland	40 "
Albertite, New Brunswick	92 to 100 "
Torbanite, Scotland	116 " 125 "
Stellarite, Nova Scotia, No. 2	50 " 74 "
" " " No. 1	123 " 126 "
" " from picked samples in Boston	119 "

Some of these results are the amounts yielded by careful experiments on the small scale : when oil was made at the Fraser mine in 1852, the practical yield was about 60 gallons crude, and from 30 to 35 gallons fine clarified, oil to the ton.

Oil coal has been described by Mr. Campbell as occurring near Antigonish, but no trial, I believe, has been made of its quality.

Oil Shales.—Little is known of the adaptability of the numerous shales of the coal measures to the distillation of oil. The greatest yield obtained in the few experiments made by myself has been 35 gallons crude oil to the ton, an amount found remunerative, I believe, in Scotland.

Cannel Coal.—Several seams of cannel coal are mentioned by Prof. Lesley as occurring between Burnt Head and Little Glace Bay, Cape Breton. (Acadian Geology, Second Ed., p. 414). These are generally very thin, the thickest is 18 inches. An examination of a specimen of cannel coal given me by Dr. Paddock "from an eighteen inch seam at Little Glace Bay, C. B." afforded me these results :—

Moisture	0.83
Volatile Combustible matter	33.07
Fixed carbon	44.42
Ash	24.68
	100.00

The amount of ash, though considerable, is smaller than that in the well known Scotch cannel from Capeldrae, which gives 25.40 per cent. The volatile combustible matter is evidently high enough in proportion to the fixed carbon to mark the character of the mineral.