ART. VI.—THE CARBONIFEROUS OF CAPE BRETON, WITH INTRODUCTORY REMARKS.—PART III.—BY E. GILPIN, JR., F. G. S., F. R. S. C., *Inspector of Mines.*

Read March 12, 1888.

As my paper to-night presents to the Institute little beyond columns of figures which are uninteresting to the general public, although eloquent to the chemist or mining engineer, I gladly avail myself of Mr. McKay's suggestion that it should be prefaced by a few remarks on Cape Breton Coal, of a character somewhat more popular.

I may remark that I have already in previous contributions outlined the various carboniferous districts of Cape Breton, and summarised their more valuable deposits of coal. In the accompanying paper, tabulated analyses of the seams worked at the different collieries, and of the typical seams of the western districts, serve as a ground of comparison with the coal products of other countries.

The popular idea is that a coal mine is a hole in the ground, and a coal field a section of country uninteresting from heaps of coal refuse, and the unpolished manners of its inhabitants. A closer survey, however, shows that the "holes in the ground" exercise the highest engineering and technical skill of those who conduct the operations connected with sinking them, and extracting the coal with the minimum of cost. The manners of the miners, if marked with a certain reserve toward strangers, are those of men whose occupations differ from the callings of ordinary humanity; and among themselves they are friendly and charitable, and ever ready to dare the dangers of the mine if a comrade calls for help. When the figures of the statistician show that the power and wealth of a nation is directly measured by the number of tons of coal it produces and consumes, the subject acquires a general and vivid interest. Coal fields seem to be a special gift of Providence to nations, and curiously enough the English-speaking races have the lion's share of coal fields, and have well availed themselves of their privileges.

The extraction and exportation only of coal however is not a permanent source of wealth. The treasures of the mine resemble more those of the forest, than the treasures of the field and of the sea. Every ton of coal when it leaves the country represents, in most cases it is presumed, a certain amount of profit, but its removal increases the cost of the extraction of the next ton, and like a tree of the forest it cannot be replaced. It must be used locally to smelt the ore, forge the metal, ply the loom, or to build the multifarious machinery demanded to-day, before its true value is seen. One man can dig a ton of coal, but two must toil before it has yielded up its many items of power, or heat, or light. Take the mother country, did she export all her coal, and close the myriad factories supported by it, her position would be vastly different.

The few introductory remarks I am permitted to make should however be directed rather to the geological than the economic side of my paper.

Could the student carry himself backward, beyond the time of Confederation, to the period of the formation of the Cape Breton coal beds, and take his stand on the granitic hills of Cape Dauphin, at the entrance of the Bras d'Or lake, his eyes would wander over a view widely different from that of the present day. Instead of the rolling hills covered with spruce undergrowth, and occasional ridges of hardwood which now stretch eastwardly from Sydney to the shores of the ever-encroaching Atlantic, he would see, mile upon mile, a dead monotonous level, with here and there dull sluggish reaches and swamps of dark peaty waters, while overhead the rays of a sun warmer than that now allotted to us, could scarce dissipate the clouds of vapor it kept drawing from the heated water and steaming soil.

On a nearer approach, this uninteresting country, which we would compare to some of the tidal marshes of the Bay of Fundy, is found to be covered with the densest of vegetation. No modern forest, tropical or temperate, reproduces the curious scene. A closer study, however, would detect some trees bearing a fanciful resemblance to plants now growing in the earth. There was one tree specially beautiful, its towering stem sometimes nearly one hundred feet in height, was fluted like a temple column, and crowned by magnificent fern-like fronds, a mysteriously-developed tree fern. Its roots descending into the marshy ground radiated, divided and sub-divided until they could suck nourishment rapidly for the great tree above with its quick growth and frequent branch-making.

There is also another tree with peculiarities now characteristic of the "club mosses," but its branches were flung wide in the air, and it appeared to the casual observer like a mighty pine.

Yet another curious plant recalls our "mare's tail," but its fluted bamboo-like stems were often forty feet high.

In those pre-historic forests of twenty millions of years ago, there was scarce a temptation for the little children to wander as Babes in the Woods, for nature, rioting in luxuriant growth, did not deign to captivate by the exhibition of the fleeting colors and fragrances which poets have sung and nations admired. In vain would search have been made for any plant now called national: the rose, the thistle, and even the humble emblem of our Province, all were wanting, and perchance only the mosses and fungi relieved the sombre colors of that "Dismal Swamp."

In vain would the hunter, so far as the records of the rocks inform us, have searched for his prey, in the air, or by land, or by sea. Locusts, beetles, scorpions, nondescript frogs or newts, all labored in their task of subduing, consuming and consolidating the great masses of vegetation. However, it must be said that these remarks are based on negative evidence only, the plants and insects from which our imagination has reconstructed so curious a page in the history of mother earth, are few in number, and owe their preservation as fossils to peculiar circumstances. There may have been many other organized helpers in the great scheme on the hills and highlands surrounding the marshes, and imagination may depicture the graces and beauties and the melodious sounds of an untrodden land.

Such were some of the curious forms that were crowded in the battle of life which left victors and vanquished preserved for our sole benefit. The plants grew and fell, and were buried, the water of the swamps allowing but a tardy decomposition, until a deep peaty mass accumulated. The sub-soil, a clay or loam, was filled with rootlets until perhaps no further mineral nourishment of silica or of potash, etc., was available. Long years this swamp, devoid of living vegetation, lay gradually undergoing changes consisting chiefly of elimination of water from the vegetable matter, until some oscillation of level, perchance a change in the current of some bygone river unnamed and unsung deposited on its partly hardened surface a layer of silt or mud. This went on until hundreds of feet of sandstone, shale, coal, fireclay, etc., are now presented. The accumulating mass in the slow course of time became firm. Pressure, the internal heat of the earth, chemical laws of change all combined to make the peaty mass a layer of carbon with a small percentage of ash, and of bituminous forming matter; the sand layers were cemented by silica into hard sandstone, the mud into bituminous or carbonaceous shale; and the ancient soil well robbed of its alkali; and silica became fireclay.

Almost without exception every bed of coal the miner explores has immediately below it a bed of fireclay often filled with carbonized roots. The coal bears in its structure the evidence of its vegetable origin, for under the microscope can be seen in it, fruits, flowers, and particles of wood fibre, etc. Above the coal comes the roof usually of shale or sandstone, often bearing in it at the junction with the coal bed, layers of ferns, pressed and preserved as in a herbarium; or a full length tree of that ancient forest showing in its flattened stem clearly and distinctly its species, etc., and recalling with its darkened color the logs found in our peat swamps.

We have now briefly traced the coal seam to its full growth, but had nature gone on adding the coral, the chalk, and all the varied and immense layers of subsequent formations this precious heritage would have been like an estate in chancery, pleasant to think about, but a thing unattainable, for we could not have sunk shafts some four or five thousand feet to provide our fuel.

The process of nature which has laid these stores of fossil fuel close to the surface in Cape Breton is one as yet little understood by geologists, but it is a subject fascinating from its grandeur, and to its operations do we owe all our mines. There have been elevations and depressions in the earth's surface ever since its creation, caused by internal forces, contraction of its crust, accumulation of sediments, or what not, we see the effect, and bless the hand that guided the cause. In the Sydney district it appears that the old, old rocks, the granites and gniesses of Coxheath, Boisdale and St. Ann's were forced slowly and gradually upwards. This motion enforced a tilting of the strata holding the coal so that they inclined to the eastward. This was continued until the "Atlantic" of that date came in upon the land, and had boundaries approximating those of the present day.

Had the uplifted edges of the older rocks been straight, like a ruler, the coal-bearing strata would have dipped uniformly away from them, and remained parallel throughout the district. But nature abhors a straight line, devoid of beauty save to the mathematician. Owing to underlying spurs of the older strata projecting beneath the coal measures the uplifting of the former produced transverse subordinate tilting in addition to the general or continental inclination to the east. The effect of this has been to throw the seams into a series of curves, having the ocean as a secant. Taking the coal seams of the Sydney district as they are met at Cape Dauphin they are seen ridged up against the Syenite of the Cape, then lessening in the steepness of their dip they range across the Big and Little Bras d'Or to Sydney Harbor, where their inclination is about four degrees. As they cross the harbor they turn more to the north-east, and dip steeply until they turn again with the regular dip and run into the sea at Lingan. Emerging again they stretch in a regular curve for miles across Glace Bay Brook and Basin, and turning again toward the north-east with increasing dips enter the sea at the north head of Cow Bay. Hitherto the transverse subordinate foldings have not been marked enough to interrupt the continuity of the strata enclosing the coal beds, but here the upward movement has brought lower rocks to the surface, and there is an interval of rocks which do not hold coal seams.

In Cow Bay the same forces have formed another basin, called a synclinal, the seams dipping down on the Long Beach side and up again on the Gowrie side. But the axis or general inclination of the trough is still to the eastward.

Finally, the seams of the Cow Bay district, after crossing the narrow strip of land forming the north side of Mira Bay, pass under the Atlantic and are lost beyond the three mile limit.

Speculation as to the original extent of this coal field is profitless, if interesting. But we do know that, reasoning from a fair basis of facts, we have now but a remnant of the great coal field of the Gulf of St. Lawrence. When we consider the fringes of coal fields, and of carboniferous strata which occur around Cape Breton, on the west side of Newfoundland, in the Magdalen Islands, and along the northern shores of Nova Scotia and New Brunswick, we can scarcely realize that over that great Gulf the forests of the Carboniferous once spread, amid the voiceless and sullen lagoons of the mysterious country.

Owing to sudden pressure or other causes, the movements of the coal-bearing strata are sometimes accompanied by breaks or faults. Often great blocks of strata, miles in extent, thousands of feet in depth, and weighing myriads of tons, have been raised out of the continuity of the coal field, so that the miner suddenly finds in front of him a wall of stone. His coal bed has vanished, cut off by the irresistible force of the great lever which is continually raising and depressing continents. Much trouble is often experienced in finding the lost bed of coal, which is sometimes moved many feet away. In the Cape Breton coal field the faults are few and of little moment,—a fact which not only reduces the risk and expense of mining, but encourages the capitalist and engineer in starting new pits. There are few coal fields of which it can be said, as in Cape Breton, that any seam can be located at any point inside the boundaries of the coal district with a margin of error not exceeding a few feet.

The question has often been asked me, " are the seams of the Cow Bay, Sydney, and Glace Bay districts distinct, or are they the same seams interrupted by the sea as the flexures of the strata approach and leave the shore. The answer is that they are the same seams although somewhat changed in character and size as they range over some twenty-five miles of country. The seams are identified by the thickness of the masses of intervening strata, some peculiarity of roof or floor, etc., etc. The Geological Survey have tabulated the seams of the different districts, and as their conclusions do not appear to coincide with the opinions of any of the critics, it may be assumed that they are pretty near the mark. The question, however, is one of geological rather than of economic interest, as the coal seams all vary slightly in their quality at intervals of a few miles.

Coal.

Having outlined the distribution of the Carboniferous of Cape Breton as laid down on the excellent maps of Mr. Fletcher's reports to the Geological Survey, the next task is the consideration of the minerals characterizing it. The principal minerals are coal, gypsum, limestone, and iron ore. As the first named is the most important, I venture to dedicate this paper to its consideration, and propose to describe the remaining minerals, together with those found in the other geological horizons, at a future time. This will prove more convenient for reference, as several of them, notably the iron ores, are common to several ages. In this island coal beds are found most abundantly in the productive measures, but there are important deposits in the millstone grit. There are also beds of coal in measures referable possibly to the upper coal measures, and in the Richmond district coal occurs apparently in conjunction with the marine limestone measures. Examples are not wanting in other countries of valuable deposits of coal in these divisions of the Carboniferous, but so far as our information goes we are not warranted in looking to them as important sources of this mineral in Cape Breton.

I have already alluded to the fact that it is difficult to draw with distinctness the line separating the productive from the millstone grit measures, and will therefore consider the coals without regard to their geological position, a factor little affecting their composition.

Speaking in general terms, the Cape Breton coals are bituminous and coking. Many of the seams yield large volumes of gas of good quality, provided that a reasonable care be exercised in screening and picking. For domestic purposes they have proved acceptable wherever offered, as they kindle readily and leave little ash. For house use public opinion has selected the Sydney mines' main seam as the typical coal of the Eastern district.

These coals have been largely used for marine and railway steam raising, and compare favorably with any foreign competitors. They may be ranked between the best Welsh and the best Newcastle steam coals, judging from analyses and the reports of practical tests on English and French men-of-war. The tests recorded appear to prove the contention that the evaporative power of a coal is in proportion to the total amount of carbon contained in it, and that the greater the gas value the less the amount of water it is capable of evaporating. It is to be regretted that a series of rigid tests of the coals now worked could not be made by an impartial authority, as they would undoubtedly show that with proper handling their evaporative powers are surpassed by few coals now used for marine boilers.

For coke-making these coals are well adapted, as they yield, from practical tests, a fuel excellently suited for iron and copper smelting. The adoption of any cheap form of washing would free the coal from the admixed stone and pyrites, and present a coke superior to that of Durham and Connelsville.

In presenting the following set of analyses of Coals of the eastern district I have followed the tabulation of the Geological Survey, altho' it differs from that of several writers, and have not attempted the correllation of the Gardner, Carrol, and other seams found underlying those at present being worked.

Pursuant to this arrangement the Hub and Crandal seams are grouped together. Next in descending order comes the seam known locally as the Block House, Harbor, Victoria and the Sydney Mines worked by the Block House, Glace Bay, Victoria, and Sydney Collieries. Below this comes the most extensively worked seam of the district known as the McAuley, Phelan, and Lingan and worked by the Gowrie, Ontario, Caledonia, Reserve, Bridgeport and Lingan mines. The next seam to be noticed is that known as the South Head, Ross and Collins. Below this comes the Gardner, Tracey, Carrol and other seams to be again referred to.

The Hub seam is not now worked. Altho' its land area is limited, it has an extensive sub-marine development. It was well adapted for gas making, and yielded 9,500 cubic feet of 15 candle gas per ton. The following analysis will serve to show its character.*

Volatile matter	33.21
Fixed Carbon	63.94
Ash	2.85
	100.00

The following table shows the composition of the second seam:

C.	Block House.	Harbor.	†International.	Victoria.	Sydney.
Moisture	.60	.80	.87	.75	1.26
Vol. Comb. matter, slow coking	29.48	27.85	35.41	26.85	33.84
" " " fast "	31.58	29.40		32.13	35.51
Fixed Carbon, slow coking	65.56	67.05	58.56	68.13	60.78
" " fast "	63.46	65.50		62.85	59.11
Ash	4.35	4.30	5.16	4.27	4.11
Sulphur	2.63	2.32	trace.	....	1,70
Specific gravity	1.29	1.29	....	....	1.31

The coals referred to above are generally laminated with a pitchy lustre, and carry a good deal of mineral charcoal on the deposition planes. The primary planes cut those of deposition at high angles, but the secondary planes are not so regular. The primary planes usually hold films of carbonate of lime and iron, which is less frequently present in the secondary planes.

The gas values vary from 8,200 feet of 8-candle power at the Sydney Mines to 10,000 feet of 16.5-candle power at the Block House workings. The gas values of the seam apparently increasing toward the south, while the northern openings produce, as at the Victoria and Sydney mines, an article better adapted for steam and domestic purposes.

* Analyst unknown.
Unless otherwise specified, the analyses in this paper are by the writer.
†Analyst Professor Chapman.

As few ultimate analyses have been made of Cape Breton coals, the following of the Block House seam made for the Admiralty (analyst unknown) is of interest:

Carbon	82.60
Hydrogen	4.79
Nitrogen	1.20
Oxygen	4.10
Sulphur	2.51
Ash	4.80
	100.00

The following is the result of a trial of the Sydney coal made by the American Government in 1844, and, so far as the writer is aware, it is the only practical test ever made of the evaporative power of any Cape Breton coal:

Moisture	3.13
Volatile combustible matter	23.81
Fixed carbon	67.57
Ash	5.49
Lbs. of steam to one of coal from 212°	7.90
Ash and clinker—per cent.	6.00
*Theoretical evaporative power	9.25

The following table shows the composition of the ashes of the above coals:

	Block House.	Harbor.	Victoria.	Sydney. †
Iron peroxide	45.621	63.355	56.543	51.33
Alumina	3.250	8.280	6.456	4.84
Insoluble silicious residue	35.110	21.872	27.500	29.57
Manganese	....	.....	1.930	....
Magnesia	1.100	.....	.035	.23
Lime	5,425	4.640	2 598	3.05
Sulphate of lime	....	.....	.....	10.98
Sulphuric acid	6.750	2.126	3.790	....
Phosphoric acid	1.900	.514	.691	trace.
‡Alkalies	trace.	trace.	.150	trace.
Chlorine	....	trace.	.....	trace.
	99.156	100.787	99.693	100.00

*From Regnault's formula.
†Analyst, H. How.
‡In this and following analyses alkalies are estimated only when in quantity.

The coal of the third seam to be noticed as worked at the Gowrie Colliery is black with a grayish tinge. On fresh surfaces the lustre is bright and pitchy, with very fine laminœ of jet-like coal, and a good deal of mineral charcoal on the deposition planes. This coal sometimes exhibits four cleavage planes, sometimes holding films of calc spar. Coal tolerably compact, with nearly black powder and little visible pyrites. This description answers for it throughout the district, except that at the Reserve and Bridgeport mines it is more pitchy and lustrous.

The following analyses will serve to show the composition of this coal at the Collieries operated on it from Cow Bay to Sydney Harbor:

	Gowrie.	Caledonia.	Reserve.	Lingan.
Moisture	.50	.92	.52	.75
Vol. Comb. Matter, slow Coking.	28.13	28.62	34.21	34.61
" " " fast "	31.41	30.31	37.60	37.26
Fixed Carbon, slow Coking	66.01	64.02	59.73	61.39
" " fast "	62.73	62.33	56.34	58.74
Ash	5.36	6.43	5.54	3.25
Sulphur	2.71	1.10	1.25	1.35
Specific Gravity	1.31	1.33	1.28	1.29

The ashes of this coal vary in color from light to deep red.

The gas values of this seam vary from 8,900 to 9,500 cubic feet of gas, of from 13 to 15 candle power, and a good Coke is left.

The following ultimate analysis of the coal from the Reserve mine, made at the Royal School of mines, will prove of interest:

Carbon	77.41
Hydrogen	5.47
Nitrogen. } Oxygen. }	9.30
Sulphur	2.47
Water	1.00
Ash	4.35

The following analysis of the coke from this mine is from a report of Mr. E. D. Peters, on practical tests made by him in experimental smeltings of Coxheath copper ore, and it may be remarked that a better article would be produced if the manufacture were conducted on a large and systematic scale :

Moisture	1.03
Carbon	90.04
Sulphur	.70
Phosphoric Acid	trace
Ash	8.01

The ash of this seam presents the following composition :—

	Caledonia Mine.	Reserve Mine.	Lingan* Mine. Top.	Middle.	Bottom.	Lingan Average.
Iron Peroxide	11.853	21.810	35.66	1.57	27.75	21.66
Alumina	4.200	8.110	9.07	6.08	4.91	6.69
Silica	65.734	68.330	43.07	79.06	48.62	57.05
Lime	7.151	.915	6.13	8.84	11.83	8.93
Manganese	.950	......	......	......	......	......
Sulphuric Acid	4.283	.480	5.73	3.08	6.52	5.11
Alkalies	2.150	......	......	......	......	......
Magnesia	1.260	......	.34	.97	.37	.56
Phosphoric Acid	2.725	trace	......	......	......	......
Chlorine	trace	......	......	......	......	......
	100.306	99.645	100.00	100.00	100.00	100.00

The following is the composition of the lowest of the seams worked to any extent. The coal is usually compact and lustrous, with fine laminœ. Some specimens show mineral charcoal, while others are free from it.

S.	South Head.	Emery.	†Collins.
Moisture	1.767	65	
Vol. Comb. matter, slow coking	28.000	32.21	36.75
" " " fast "	28.833	34.80	
Fixed Carbon, slow coking	62.263	63.49	57.10
" " fast "	61.430	60.90	
Ash	7.970	3.65	6.06
Sulphur	2.641	2.41	....
Specific gravity	1.382	1.28	1.27

The ash of this seam, as worked at the Emery Colliery, has the following composition :—

* Analyst : H. How.
† Analyst Professor Chapman.

Iron peroxide	38.764
Alumina	1.336
Silicious residue	50.673
Lime	4.200
Manganese	trace.
Magnesia	1.015
Sulphuric acid	4.030
Phosphoric acid	.012
Chlorine	decided trace.
Alkalies	do.
	100.030

During the examination of the ash of this coal numerous small rounded quartz pebbles the size of a pea were noticed.

The following analysis shows the ultimate composition of the seam as worked at the Schooner Pond Colliery (analyst unknown.)

Carbon	78.10
Hydrogen	5.48
Oxygen and nitrogen	7.81
Sulphur	2.49
Water	2.67
Ash	3.45
	100.00

The coals from this seam are claimed to be good for steam raising, and to give off less smoke than the overlying coals.

The following analysis will serve to show the character of the best known seams opened below those referred to above:

Tracey seam, of Mira Bay, (analy. Geo. Survey.)

Moisture	22.35
Volatile combustible matter	30.09
Fixed carbon	66.61
Ash	.98
	99.915

Mullins' seam, south side Sydney Harbor:

	ft.	in.
Coal	2	0
Shale	0	4
Coal	4	0
	6	4

Volatile matter	31.4
Fixed carbon	62.4
Ash	6.2

This analysis was made some years ago by Dr. Dawson, and he remarks: "This coal has some of the properties of cannel. It has great heating power and yields much dense carbonaceous gas."

In the Glace Bay section, a few feet below the Hub seam, is a bed of cannel coal one foot two inches thick lying on nine inches of ordinary bituminous coal. The following analysis was made by Dr. How:

Moisture	.83
Volatile combustible matter	30.07
Fixed carbon	44.42
Ash	24.68
	100.00

BROAD COVE DISTRICT.

In the Geological Survey Report for the year 1874, there is a description of the Broad Cove coal field, and a set of analyses made by Mr. Hoffman of the survey, which are given here with his remarks, in a condensed form:

	7 ft. Seam.	5 ft. Seam.	4 ft. Seam.
Moisture	4.02	7.78	8.45
Vol. Comb. Matter, slow Coking	20.17	27.67	28.36
" " " fast "	25.39	34.51	36.52
Fixed Carbon, slow Coking	70.41	52.87	56.94
" " fast "	65.18	46.03	48.78
Ash	5.40	11.68	6.25

These coals do not soil the fingers. They are black, with pitchy lustre, banded, with uneven fracture. The powder of the five and of the four feet seams when boiled in caustic soda imparts a brown color to the liquid, this with the percentage of water would make them approach in character to brown coal, although they occur in strata of Carboniferous age. The coal from the largest seam does not color a solution of caustic soda and is more closely allied with the typical carboniferous coals. Zinc blende was observed as a film in this coal. These coals are said to produce little smoke when burned in marine boilers.

PORT HOOD DISTRICT.

As yet but little mining has been done here, and the qualities of the coals have not been settled by practical experience. The Geological Survey Report, 1876-77, page 469, gives a report on the coal of the lower or 7 feet seam. It appears to resemble in its general characteristics the Broad Cove coal, and yielded on analysis :—

	Fast Coking.	Slow Coking.
Moisture	4.02	4.02
Volatile combustible matter	38.81	34.86
Fixed carbon	49.65	53.60
Ash (purplish red)	7.52	7.52

The coal is said to contain rather above the percentage of sulphur usually found in Cape Breton coals.

I have no analysis of the Chimney Corner coals. They are not as bright as many of the eastern coals, but are good steam coals.

Reference has been already made to the area of millstone grit extending from Sydney up the valleys of the Mira and Salmon Rivers. These measures show several outcrops of coal beds apparently underlying large tracts of country. The beds are known only by natural outcrops, and no attempt has been made to ascertain if other beds are present. They do not exceed two feet in thickness, and, as the route of the Cape Breton railway will not follow these rivers as was expected at one time, they will probably not receive any attention for many years to come. The following analysis is from the Canadian Geological Survey :

Moisture	1.53
Volatile combustible matter	20.16
Fixed carbon	47.49
Ash	30.82
	100.00

At other points the coal is reported by Mr. Fletcher as yielding an inconsiderable amount of ash. Another outcrop of coal in this district is interesting, as it presents in the Lower Carboniferous conglomerate the evidences of an origin identical with that of the more important seams of the productive measures. It yielded:

Volatile combustible matter	17.80
Fixed carbon	29.04
Ash	53.16

About eight miles from Baddeck, at Hunter's Mountain, is an outcrop of coal similar in composition and mode of occurrence to that just mentioned. The coal is irregular, varying in thickness from a few inches to two feet. It is divided by numerous cleavage planes, sometimes coated with galena.

At East Bay, in the marine limestones and marls, pockets occur holding calc and fluor spar and patches of bright cubical coal yielding on analysis:

Volatile matter	36.72
Fixed carbon	46.64
Ash	16.64
	100.00

For comparison with the seams of coal of economic value the following analysis of coal from a fossil carbonized tree in millstone grit measures in the same district may prove interesting:

Volatile matter	34.9
Fixed carbon	59.9
Ash	5.2
	100.0

Coke firm and vesicular.

Some years ago a good deal of interest was aroused by a statement that active work was being performed on a seam of anthracite coal at McAdam's Lake, near the head of East Bay. The bed occurred in red and gray shales and conglomerates of the lowest division of the Carboniferous. It, however, proved to be little more than a coaly shale, lustrous and resembling the poorer anthracite coals of the United States. On analysis it yielded—

Volatile Matter	17.80
Fixed Carbon	29.04
Ash	53.16
	100.00

Notwithstanding the large amount of ash the coal yielded a firm and porous coke.

Irregular pockets and beds, or rather seams, of hard compact coal are frequently found in the carboniferous of this Province. The mineral frequently breaks irregularly, does not soil the fingers, and resembles anthracite. On a closer examination however these coals are found to be either highly carbonaceous shales, or compact semi-anthracite coal, its more volatile ingredients being lowered in amount by the hardening, etc., the containing strata have undergone. Considerable sums of money have been spent in testing and prospecting these deposits, but so far the results have not been at all satisfactory.

RIVER INHABITANTS COAL DISTRICT.

I am not aware of any recent analysis of the coals of this district. Little systematic mining has been carried on for a number of years, and the writer is obliged, like Mr. Fletcher, to refer to the report made a number of years ago by Dr. Dawson to the Government of Nova Scotia. He gives the following analysis of the Little River four feet seam:—

Volatile matter	30.25
Fixed carbon	56.40
Ash	13.35
	100.00

and remarks that it is more bituminous than the Sydney or

Pictou coals, and should prove practically a good domestic and gas coal.

He also gives the following analysis of the eleven-feet seam found at Sea Coal Bay:-

Volatile matter	25.2
Fixed carbon	44.7
Ash	30.1
	100.0

The amount of ash given in this analysis would make the coal of little use for ordinary purposes. I am informed, however, by parties interested, that it by no means yields this large percentage of ash, and that the other seams are apparently of excellent quality. These beds are very well situated, as the harbor remains open all winter, and they will no doubt be re-opened whenever the conditions of the coal trade hold out more promising inducements to the miner. I have no analysis of the coal found at the head waters of the Inhabitants river.

From the analysis I have given it will be seen that the island of Cape Breton furnishes Coals adapted for every purpose. They are largely used for steam raising in locomotive and marine boilers, and as their qualities become better known they will be a favorite railway fuel. For gas making and domestic purposes they have established a good reputation. In connection with the various schemes mooted for iron and copper smelting in Cape Breton it is encouraging to note that practical tests have shown that an excellent coke can be made from them. At present the low price obtainable for coal, and the presence of large mines in the eastern district, will operate against developments in other parts of the Island. But it is to be hoped that the discovery of metallic deposits in the districts surrounding the western and southern coal beds may lead to the erection of works drawing their fuel from local sources, and the projected railway from the line of the Sydney and Hawkesbury Railway to Broad Cove will give this part of the island an outlet to good shipping ports.