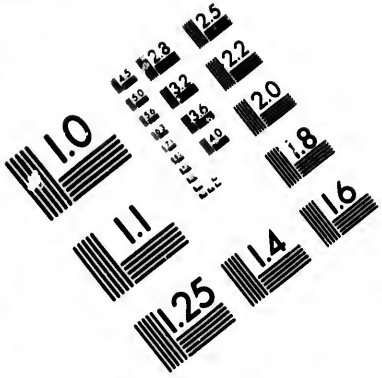

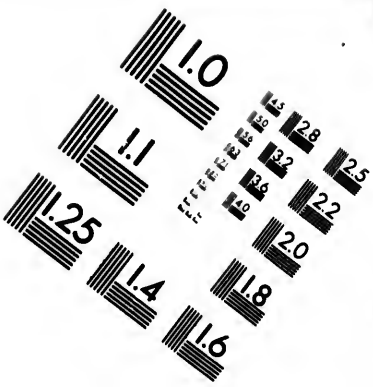

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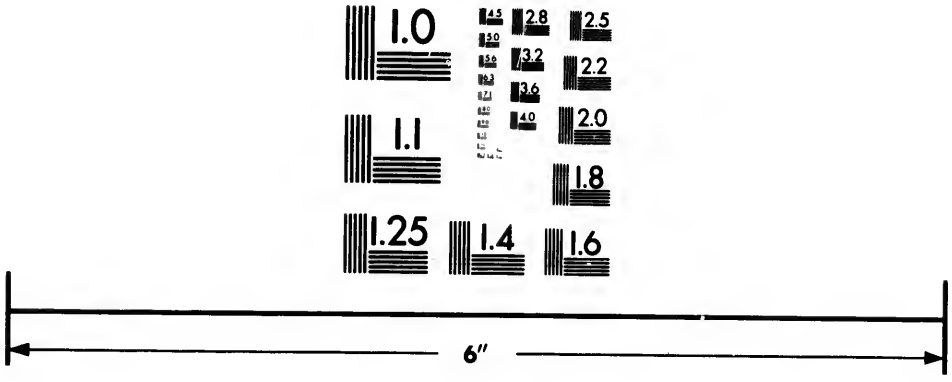

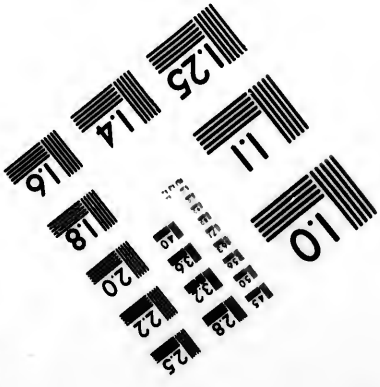

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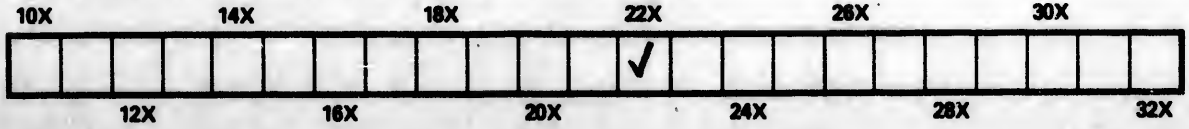

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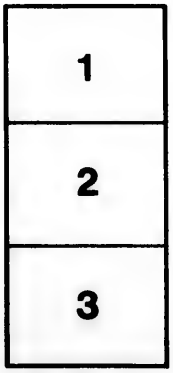

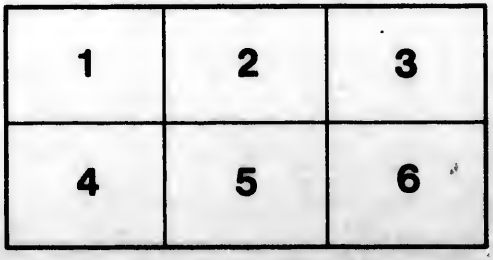

THE MINERAL DEVELOPMENT OF NOVA SCOTIA.

A PAPER READ BEFORE THE FEDERATED INSTITUTION OF MINING ENGINEERS.

BY

E. GILPIN, JUN., A.M., F.G.S., F.R.S.C.,

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GENERAL MEETING AT LONDON,

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THE MINERAL DEVELOPMENT OF NOVA SCOTIA.

By E. GILPIN, Jun., A.M., F.G.S., F.R.S.C.,
Inspector of Mines, Lecturer on Mining at Dalhousie University, etc.

The minerals which have hitherto received any attention in Nova Scotia are coal, iron, and gold. The list of those hitherto left neglected is much longer. The reason for the comparatively slight interest taken by Nova Scotians in the development of their mineral resources may be found in the fact that the lumber, farming, fishing, and similar industries have proved most attractive to people possessing comparatively small capital.

A very brief account of the chief geological features of Nova Scotia may advantageously preface these notes on the mineral deposits.

The Atlantic coast of Nova Scotia proper is occupied by pre-Cambrian measures, surrounding large masses and dykes of granite, considered as formed at the close of the Devonian period. In Cumberland, Pictou, and Antigonish counties there is a band of rocks, not yet worked out in detail, but believed to contain measures referred to the various horizons up to the Devonian. Between this range and the coast-rocks are areas of Devonian age, while great part of the counties of Antigonish and Guysboro is also Devonian. North of this range is a large tract of Carboniferous, which also occurs in connexion with the Devonian. In Cape Breton, the northern part of the island is Laurentian, comprising felsites, gneisses, granitoid rocks, and limestones. Similar rocks are found in the southern and western parts of the island. In Richmond county, there are large areas of Devonian rocks. Limited areas of Lower Silurian are found on the southern shore. The rest of the island is underlaid by the several divisions of the Carboniferous: these generally rest, without any intervening measures, directly on the Laurentian rocks, which form the hill-ranges. Without referring to the fact that some of the upper beds of the Carboniferous in Pictou,

Colchester, and Cumberland counties are provisionally classified as Permo-Carboniferous, the only "recent" rocks in Nova Scotia are represented by a few narrow bands of Triassic sandstones around the shores of the Bay of Fundy.

The Carboniferous are divided into five groups, the Upper, the Middle or productive, the Millstone Grit, the Marine Limestone, and the Lower Carboniferous.

In the upper division there are a few seams known, not of economic value. In the productive group, having an average thickness of about 5,000 feet, the chief coal industry is carried on. There are three districts, Sydney, in Cape Breton county, Pictou, in the county of the same name, and Springhill, in the county of Cumberland. These districts will be referred to in greater detail. The Millstone Grit series, as a rule, immediately surrounds the basins of productive measures. It holds seams of coal which have been worked in the Sydney district, and is known to contain seams at many other points. So far, these seams have received little attention in the presence of the larger seams of the true coal horizon, but there is every reason to believe that they will prove an important source of coal in the future, and widely extend the limits at present considered productive.

The Marine Limestone formation is distinguished in Nova Scotia by enormous deposits of limestone, gypsum, and marl, and holds many springs of saliferous water, and beds of iron ore, etc. The Lower Carboniferous measures are often composed of conglomerates, or contain thick beds of bituminous shale. So far as the author knows, they have not yielded beds of workable coal.

Coal-fields.

The Sydney coal-field is situated on the Atlantic, on the eastern shore of Cape Breton, and extends about 32 miles along the shore and about 6 miles inland. This area forms the western rim of a great basin extending out under the Atlantic. Fortunately, nearly all the seams can be followed in their subaqueous extension. It has been estimated that, within 3 miles of the shore, to a depth of 4,000 feet, adopting the calculations of the Royal Commission on the duration of Great Britain's coal supply, there are available 2,000,000,000 tons of submarine coal.

The coal-field presents itself as the outcrop of three subordinate basins, the upper seams in which, enter the land, swing round, and again enter the sea to re-appear on the land.

The following section taken in the centre of the district will show the relative positions of the seams, and the thickness of the intervening strata :—

Seams.	Strata and Coal. Ft.	Ins.
Seam A	3	0
Strata	306	0
Carr seam	6	5
Strata	190	0
Barasois seam	12	1
Strata	379	0
Victoria seam	8	0
Strata	235	0
Seam D	3	0
Strata	78	0
North head seam	4	0
Strata	75	0
Lingan main seam	8	0
Strata	95	0
Seam G	4	6
Strata	340	0
Seam H	4	9

These seams, except at two limited points, lie at low angles from 5 to 8 degs., and are almost entirely free from faults.

These seams are those included by the Geological Survey as in the productive measures ; there are, however, numerous workable seams lying below them. The lowest near the town of Sydney has nearly 4 feet of coal, and is distant about 8 miles from the outcrop of the lowest seam given in the above section. The fact that the fossils of the horizon yielding the seam near Sydney are referred by Sir William Dawson to the productive group, and not to the Millstone Grit, affords reasonable grounds for belief that future explorations will give the Sydney coal-field an area several times larger than that now assigned to it.

The coals of this district are bituminous and coking. They yield from 9,000 to 11,000 cubic feet of from 14·75 to 16 candle-power gas. Tests made of them in beehive ovens show that they make in their crude state a good coke, and that with preparation they would give a coke at least equal to any made on this side of the Atlantic. They are extensively used for domestic purposes, and for locomotive and marine steam-raising. The following average of analyses will serve to show their character :—

Moisture	0·75
Volatile combustible matter	37·26
Fixed carbon	58·74
Ash	3·25
	100·00

There are at present two companies operating in this field—the General Mining Association of London and the Dominion Coal Co. of Boston, the former owning 23 square miles, and the latter 76. There

are other large tracts of coal-land yet undeveloped. The operations of the former are entirely submarine. Two shafts were sunk to the Sydney six feet seam, close to the mouth of Sydney harbour, and protected from the salt water by iron tubing. The workings are quite dry, and about one-third of the coal is taken out by the pillar-and-stoop method, and brought to the shaft by a system of tail-rope haulage. The output last year was 208,131 tons.

The Dominion Company are working seven mines, the deepest being about 600 feet, reached by a slope in a seam dipping at an angle of 35 degs. The methods of working are capable of improvement, as much coal is left. At present mechanical cutters, Ingersoll, Harrison, and Jeffrey's (electrical), are being introduced. Mechanical ventilation is being substituted for furnaces, and little difficulty is experienced in ventilation, as gas is not given off in dangerous amounts. The output of the mines of this company was 762,583 tons in 1893, and will be largely increased this season.

There are large tracts of coal-bearing land at River Inhabitants, Port Hood, Mabou, Broad Cove, and Margaree in the island of Cape Breton, but hitherto they have received little attention.

In Nova Scotia proper, coal-seams are known at Pomquet, Hallowell, Stewiacke, Debert, and other points, but developments have been effected only in the Springhill and Pictou districts. In the latter place there are two companies operating, the Intercolonial and the Acadia. The output last year of the former was 208,098 tons, and of the latter 244,769 tons. The seams in the Pictou district occur as a long narrow synclinal about 12 miles in length and 4 miles in greatest width, having dips up to 40 degs.

The following section shows the relative position of the principal seams :—

Seams.	Strata and Coal. Ft.	Ins.
Main seam	34	7
Strata	148	0
Deep seam...	22	11
Strata	106	0
Third seam	5	7
Strata	113	0
Purvis seam	3	6
Strata	130	0
Fleming seam	3	3
Strata	4	3
McGregor seam	12	0
Strata	211	0
Stellar seam	5	0
Strata	15	0
Seam A	11	0
Strata	187	6
Seam C	10	0

The following average of analyses from the paper already referred to will show the general composition of the seams of this district:—

Moisture	1·19
Volatile combustible matter	29·10
Fixed carbon	60·63
Ash	9·34
	100·26

The coals are used largely for steam purposes, for iron working, and an excellent coke is furnished by several of them.

The seams are entered by slopes following their inclinations; levels are driven at intervals of 400 to 600 feet, and bord-and-pillar work carried on to the rise. Where the pitch of the seam permits, a gate-road is driven up on the full pitch of the seam, and bords turned right and left. By means of a platform and a loaded box running on wheels and connected by a rope passing round a drum provided with a brake, the platform and loaded coal-tub overpowers the balance-box and carries the loaded tub down to the level. The empty tub and platform are raised in turn by the weighted box. This permits of rapid handling of boxes at angles too great to allow of horse roads. At heavier angles the coal is run to the levels in shoots. Longwall work is adopted in the thinner seams, the shoots being opened out as the face advances inward, and lengthened as it advances upwards.

In the Pictou district careful attention is necessarily directed to the ventilation, as the seams give off much gas, and the "back balance" system of working requires ample air-supplies. Marsaut and Mueseler safety-lamps are found most satisfactory, and the use of gunpowder is greatly restricted. Roburite and a dynamite magnesian (local) explosive are found satisfactory substitutes.

In Cumberland county the coal-field is believed to cover an area of about 430 square miles. The coal-measures outcrop on the shores of Cumberland basin, run eastward into the land for about 18 miles, and outcrop again before they enter upon the return outcrop, running westward to the sea-shore. The northern outcrop has been systematically worked on the shore at the Joggins mines with a present annual output of about 80,000 tons, on a seam yielding about 6 feet of coal. The remainder of this side of the basin has not yet received much attention, but will, as the demand for coal increases, become more fully worked. The principal operations in this district are at the apex of the basin; as at Springhill where the Cumberland Railway and Coal Company are engaged in mining three valuable seams of coal.

At this point the following approximate section is presented, with the proviso that the coal-bearing horizon has not yet been systematically prospected :—

	Strata and Coal. Ft.	Ins.
A seam	13	0
Strata	105	0
B seam	6	0
Strata	130	0
Main seam	11	0
Strata	80	0
South seam	11	0
Strata	100	0
Seam	2	6
Strata	190	0
Seam	4	0
Strata	176	0
Seam	2	9

These seams, dipping at angles of from 10 to 35 degs., are entered by slopes to a depth of 4,000 feet, and worked by shoots and "balances," and, in the case of thinner parts of the seams, by longwall. The extraction of pillars has been carried on systematically and with unusual success. As a certain amount of gas is evolved in these mines, no explosive is used in getting the coal. The ventilation is provided for by blow-down fans with numerous outlets.

The general composition of the coals of this district is about as follows:—

Moisture	1·46
Volatile combustible matter	33·69
Fixed carbon	59·35
Ash	5·50
	100·00

They are very extensively used as a locomotive fuel, and for coke and domestic purposes.

The following figures will serve to show the markets supplied by Nova Scotian coal. They are for the year 1892, as the returns for 1893 are issued only to the end of September, a change having been made in the fiscal year of the province. If it be borne in mind that the production of 1893 was 2,229,715 tons distributed in the same proportion, they will answer for the calendar year 1893.

COAL.—SALES.

Names.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Year 1892.	Year 1891.
Nova Scotia—						
Landsales ...	88,051	78,566	77,875	109,636	349,128	360,742
Seaborne	12,006	63,146	94,606	100,092	274,850	278,995
Totals	100,057	141,712	172,481	209,728	623,978	639,737
New Brunswick ...	40,162	57,626	61,297	55,465	214,550	229,315
Newfoundland ...	2,431	21,805	26,485	44,278	94,999	108,617
Prince Edward Island	116	15,065	22,049	19,408	56,638	67,473
Quebec	43,012	264,048	323,692	115,285	746,037	775,286
West Indies... ...	418	534	1,166	731	2,849	4,086
United States ..	609	2,035	4,918	6,321	13,883	25,431
Other countries ...	—	—	—	—	—	—
Totals	186,805	502,825	612,088	451,216	1,752,934	1,849,945
1891	220,658	484,319	709,470	435,498	1,849,945	—

COAL.—GENERAL STATEMENT.

1892.	Produce.	Sold.	Colliery Consumption.
1st Quarter	317,505	186,805	35,480
2nd „	543,980	502,825	49,765
3rd „	585,622	612,088	48,981
4th „	485,673	451,216	40,866
Totals	1,932,780	1,752,934	175,092
1891	2,044,784	1,849,945	174,983

The development of the coal resources of Nova Scotia began over a century ago, but it is only during the past ten years that it has shown signs of a steady and satisfactory growth. The home market and that of the adjoining colonies have drawn their supplies from Nova Scotia at reasonable prices, coal selling, for instance, at Montreal for 2·68 dollars per ton of run-of-mine coal. It is anticipated that the increased facilities now available for mining and transporting coal will enable the owners of provincial coal to gain a foothold in the New England markets, which now consume annually about 6,000,000 tons of soft coal. The increasing manufacture of steel and iron in the province is also an assistance. With these steadily growing outlets, the future of coal-mining in Nova Scotia is at present most encouraging.

Gold-mines.

As already noted, the gold-fields occupy the Atlantic coast of the province. The age of the strata, in a paper read by the author before the American Institute of Mining Engineers, was referred to as equivalent to the Lower Cambrian or Longmynd series of Europe. The numerous bosses and dykes of granite which intersect the gold-fields can be determined as of an age not earlier than the Lower Carboniferous. They need not be further mentioned here, as they seem to exert no influence on the auriferous values of the rocks they intersect.

The auriferous horizon comprises two divisions, the upper containing dark pyritous slates, with beds of quartzite, and carrying veins of quartz usually small and irregular, but often showing gold. The lower division presents alternations of compact quartzites, frequently felspathic, but rarely calcareous, with argillaceous slates, sometimes magnesian or chloritic, and includes numerous quartz-veins. The thickness of the lower group has been estimated at about 10,000 feet, that of the upper at over 4,000 feet.

Estimates have placed the area of these rocks, after deducting the granitic masses, at about 3,000 square miles. This great mass of sediments has been folded in undulations having an east-and-west course. These foldings have in some cases been carried far enough to cause overturn dips. This force, acting at right angles to the coast-line, has been followed by transverse foldings. At points where the overlying pyritous slates have been denuded, the crests of these anticlinals present the lower or quartzite series, usually with vertical or heavy dips.

The auriferous quartz-bodies follow the course of the beds of the lower series as they run in their divergent dips, and as they sometimes sweep round the ends of the anticlinals. The quartz-bodies, at first sight, present the appearance of beds contemporaneous with the strata surrounding them. A closer study, however, would classify them as veins; thus they are found to pinch out, and the fracture to continue, to pass from one stratum to another, to show banded structure, to throw out feeders, to hold inclusions of slate, horses, etc.

Their formation may perhaps be most readily explained by supposing that the strata, consolidated and metamorphosed, opened along lines of least resistance during the process of folding, and that these openings, more or less affected by water, were filled with quartz, etc. There are abundant traces of subsequent faulting, etc., with and without vein-filling. In some cases these true veins are auriferous, but the bulk of the gold has come from the strata-veins.

The thickness of the veins at present worked varies from 2 inches to 12 feet. The usual width is from 5 to 10 inches. The horizontal extension varies from a few hundred feet to over 2 miles, and workings have been carried to a vertical depth of nearly 600 feet. The minerals usually associated with the gold are sulphides and arsenides of iron, galena, blende, copper pyrites, oxide of iron, copper glance, molybdenite, etc., none of these, however, occurring in quantities of economic importance.

The gold occurs in the veins in pay streaks. Their forms and inclination are irregular, their horizontal dimensions varying from 50 to 300 feet, and their depth varying up to 500 feet. In addition there are beds of slates carrying numerous irregular veinlets of quartz, which are crushed for a yield of from 3 to 6 dwts. per ton. It will probably be found in the future that these low-grade deposits will prove more certainly profitable than the thinner (if richer) quartz-veins. Hitherto alluvial mining has received little attention in Nova Scotia, although there are many places that should repay search. In many of the mining districts it has proved profitable to run the surface-ground through a mill.

The veins are almost invariably opened by shafts sunk on the dip of the vein. Shafts are sunk from 80 to 200 feet apart, and at a depth of say 50 feet stopes are commenced directly from the shaft, which is protected by blocks of the vein or closely-packed scaffolds. The work is done by underhand stoping, usually with two men to a drill, dynamite or powder being the explosive used according to the hardness of the rock. The ore is thrown to the level and barrowed to the nearest shaft. The hoisting is usually by means of friction-gear from an engine placed at a central point. It is customary to make the "cutting in" in the hanging wall, and to leave the vein standing until it is bared to give stone enough for a crushing. This prevents waste of the vein matter, and it is less exposed to the miners.

Mining in these rocks usually presents few difficulties. The strata are hard and firm, and readily handled by timber, etc. These properties naturally ensure little leakage of water, and the pumping power is usually small, except where the location of the mine permits the ingress of surface water. The quartz is broken to suitable size by hand or by a rock-breaker, and fed, often automatically, to the stamps. The mills here are usually small: two or three batteries of five stamps each. The stamps weigh from 600 to 800 lbs., and run at from 30 to 50 drops a minute, but a quicker speed has been successfully tried at some of the mills. The gold is amalgamated in the batteries without plates. The tailings are passed over plates, and in some cases vanners are employed to take out the sulphides.

The output of the mines, according to the returns received from the mills, has varied between 15,000 and 26,000 ounces a year, employing about 400 miners. The following general statement for the year 1892 includes the various districts, their yields, etc.:—

GOLD.—GENERAL STATEMENT FOR THE YEAR 1892.

District.	No. of Mines.	Days' Labour.	Mills.	Tons Crushed.	Yield of Gold per Ton.			Total Yield of Gold.		
					Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.
Tangier, Mooseland ...	2	3,172	2	311	0	6	15	103	8	0
Oldham	2	17,032	2	2,259	1	7	9	3,093	13	2
Caribou, Moose River ...	4	14,309	4	7,189	0	6	11	2,335	16	10
Stormont	2	18,094	1	3,625	0	13	18	2,482	11	2
Salmon River	1	11,702	1	4,220	0	4	22	1,042	10	0
Sherbrooke	3	4,470	2	893	0	4	0	179	8	20
Montague...	1	6,640	1	1,716	1	5	15	2,201	10	0
Malaga	2	,7,772	2	2,720	0	19	12	2,656	5	14
Waverley	2	9,057	1	3,154	0	5	17	906	11	0
Uniacke	3	12,006	2	786	2	18	12	2,300	0	14
Lake Catcha	2	5,284	2	2,467	0	8	11	1,046	18	16
Fifteen Mile Stream ...	2	7,825	1	2,412	0	12	13	1,236	17	0
Unproclaimed and other districts	4	3,398	3	800	0	10	7	412	13	0
Totals	30	120,761	24	32,552		—		19,998	3	18

IRON ORES.

The early attempts at iron smelting in Nova Scotia proved unsuccessful, but about the year 1870 two blast-furnaces were built at Londonderry, in Colchester county, and have been running since on forge and foundry pig. About a year ago the New Glasgow Iron and Coal Company built a furnace at Ferrona, in Pictou county, and are turning out an excellent Bessemer pig used at the local steel-works. A charcoal furnace plant has also been erected in Pictou county, and will shortly be in operation.

The output of iron ore for the year 1893 was 102,000 tons.

The ores of the province are magnetites and red hæmatites in Laurentian gneisses, limestones, etc.; bedded magnetites and red hæmatites, and veins of brown hæmatite and specular iron-ore in Devonian and Silurian strata; spathic, blackband, red and brown hæmatite in Carboniferous measures. Contact-deposits of red and brown hæmatite are frequently met at the junction of the Carboniferous with all the older measures.

In Cape Breton there are numerous known outcrops of iron ore, but as yet no work has been done on them beyond a few trenches. At Whyhogomah, on the Bras d'Or lake, explorations have exposed nine beds of red hæmatite and magnetite connected with Laurentian limestones. These

deposits vary in thickness from 3 to 9 feet. A bed of red hæmatite associated with similar strata, and from 4 to 14 feet thick, has been traced for several miles near East Bay. Specular ores have been found near St. Peter's. Among other localities for iron-ores are Loch Lomond, Ainslie, Cheticamp, Big Pond, and Loran, but little is known about them. Many of the Cape Breton deposits are good enough for Bessemer purposes, and they are all within easy distance of shipping. No doubt before long attempts will be made to smelt these ores with the coals of the Sydney coal-field, which yield an admirable coke.

In Guysboro' county several large deposits of specular ore, reported to be fit for steel making, have been partially tested. The test cargoes were satisfactory, but the expense of building 12 miles of railway to the harbour of Guysboro' caused the abandonment of the undertaking.

At Arisaig, in Antigonish county, about twelve deposits of red hæmatite are found in pre-Silurian measures. The ores are in some cases bedded, and in other instances appear to be connected with dioritic dykes. The deposits are from 2 to 24 feet in thickness. The quality is good, and a few trial-cargoes taken to the Ferrona furnace in Pictou county proved to be available, with local brown hæmatites, for steel for the local works.

The next noticeable district is on the East river of Pictou county, close to the Pictou coal-field. Here Devonian strata hold veins of brown hæmatite and specular ore with ankerite, etc., while Silurian measures hold bedded ores of red hæmatite comparable with the Clinton ores of the United States. At the junction of these horizons with the Carboniferous and in the latter are red and brown hæmatites, in places manganiferous, and spathose and carbonate ores. The extent of these ores is very great, and has not yet been clearly defined. The New Glasgow Iron, Coal, and Railway Company have built a railway for 13 miles up the East river from the Intercolonial Railway at Hopewell, and it passes close to several large deposits of brown hæmatite and limestone which they are mining and smelting at their furnace near the Intercolonial Railway. The brown hæmatite is also smelted at a charcoal-furnace at Bridgeville on the branch railway. The furnace of the New Glasgow Company yields about 85 tons a day of a good grade of Bessemer pig, which is used by the local steel works.

As yet mining in Pictou county has been confined to the contact deposits. The brown hæmatite, accompanied by clay, and at some points by ores of manganese, occurs in irregular beds and veins between the Carboniferous and older strata. The ores seem never to be wanting, and are sometimes present in several bodies, the thickness of which varies

from 3 to 25 feet. The deposits appear persistent in depth, and have so far been proved to a depth of 600 feet. On Sutherland river there are several beds of spathic ore up to 12 feet in thickness. Hæmatites, specular iron, bog ores, etc., are found at various other points in the county.

In Colchester county there is an extensive development of brown hæmatite in a vein in Devonian strata associated with specular ore, ochre, ankerite, and other carbonates of lime, iron, and magnesia. Operations have been carried on here for a number of years by the Londonderry Iron Company. There are two furnaces of about 90 tons capacity each. The furnace charges are a mixture of ankerite and spathic ores with local brown hæmatite and a compact red hæmatite from Annapolis county. The product is a foundry iron of good quality, largely used in Montreal.

Passing to Nictaux, in Annapolis county, there is a large iron ore field. Its limits have not yet been ascertained with precision, but it appears to be about 5 by 8 miles. The strata are considered to be of Devonian age, and have been in places largely acted upon by granitic masses; hence the ores, which are bedded, are more or less magnetic. The Torbrook Iron Ore Company are mining about 35,000 tons a year from a 6 feet bed situate near the eastern end of the district. Some explorations have been made in the remainder of the district, showing beds of from 3 to 12 feet in thickness. The amount of ore here must be very large. Some of the ores of this district are phosphoric and siliceous, but a large number are of good quality. A similar but smaller area is found about 40 miles to the westward at Clementsport.

In addition to these deposits, there are a great many other points where ores of good quality and of workable dimensions are known, viz., Pugwash, Grand Lake, Brookfield, Goschen, Selma, Clifton, etc.

TABLE SHOWING COMPOSITION OF IRON ORES.

Contents.	Whyhogomah.	East Bay.	East River.	East River.	East River.	Londonderry.	Nictaux.
	*	*	*	*	†	†	*
Metallic iron	56·00	59·52	54·36	64·41	59·50	57·85	59·11
Silica... ...	10·04	5·13	19·43	3·68	2·14	4·79	14·97
Sulphur ...	0·14	—	0·29	0·16	0·02	0·07	0·09
Phosphorus ...	trace	—	0·10	0·04	trace	0·06	0·17
Lime... ...	—	—	2·44	1·27	0·49	0·15	2·70
Magnesia ...	2·49	—	0·98	0·43	0·19	0·10	0·41
Alumina ...	5·85	0·07	0·45	0·21	0·69	0·56	5·53
Water ...	1·29	—	—	—	10·77	10·71	—
Titanic acid...	—	—	—	trace	—	—	—
Manganese ...	—	—	—	—	0·38	0·25	—

* Red hæmatites. † Brown hæmatites.

PIG IRON STATISTICS, 1893.

	Pig Iron Made. Tons.	Ore Charged. Tons.	Flux Charged. Tons.	Fuel Charged. Tons.*
Londonderry ...	23,474	56,390	13,500	34,840
Ferrona	22,500	44,856	12,890	30,846
Bridgeville ...	498†	953	124	68,220

OTHER MINERALS.

Gypsum.—In the Carboniferous marine limestone series of Nova Scotia gypsum forms one of the most prominent natural features. It outcrops at many places in the northern and eastern parts of Nova Scotia, and in the island of Cape Breton. The mineral occurs as hard and soft gypsum in every variety of form and purity. Owing to facilities for shipment, the greatest development of gypsum mining has been effected in the vicinity of Windsor, Hants county. The annual export from this district is about 150,000 tons, valued at about one dollar a ton. The mineral is taken from open quarries, trammed a few yards to the wharves, and shipped to the United States, where it is ground and largely used for agricultural purposes, and a small amount applied to builders' use. Numerous deposits are worked on a small scale in other parts of the province, for export to Montreal, for a basis for fertilizers, and for building purposes. The total annual production varies from 145,000 to 170,000 tons. The gypsum is accompanied by crystals of salt and saline springs, salts of magnesia, free sulphur, borates, etc., but these minerals have not yet received any attention.

Antimony.—Some years ago an antimony ore mine was opened and worked at Rawdon, in Hants county. After several years the low price obtainable for the product and legal troubles led to the closing of the mine. The ore was of good quality and in places decidedly auriferous. From researches made by the writer there would appear to be good grounds for expecting workable deposits of this ore over a considerable tract.

Barytes.—Barytes is found at a number of places, and has been worked for an annual yield of a few hundred tons, principally for local paint works. Among the best known localities may be mentioned Five Islands, River John, Gay's River, Stewiacke, and Loch Lomond. Carbonate of strontium is reported from several points.

Limestone.—Limestone is very abundant. In the Carboniferous strata it is usually compact, often fossiliferous, and laminated. It is quarried for lime, building purposes, and for fluxes for the iron furnaces. Considerable amounts are exported to be burned in Prince Edward's Island, which is destitute of this mineral. The limestone of the Laurentian series is usually metamorphosed into marble. As yet the stone has not been used to any extent for structural purposes, although often very beautiful. In

* Charcoal bus. † Charcoal pig.

the event of the removal of the duties on marble entering the United States a good market would be opened there. These limestones are sometimes magnesian, and have been used for furnace lining, the purer beds have been extensively used for lime.

Manganese.—The ores of this metal most frequently met with are pyrolusite, manganite, and wad. They are very frequently observed, and have been worked at several localities. At Tenny Cape, Hants county, pyrolusite occurs as pockets and veins in limestone said to be of Lower Carboniferous age. A small annual shipment has been maintained for a number of years. The ore is very pure and is, the author believes, used by glass makers in the United States. Similar ores have been worked on a limited scale at Loch Lomond, Cape Breton county, where one deposit apparently forms a bed, and the other occurs in sheets and nodules in a soft sandstone. Near Truro, it occurs under similar conditions. Manganite has not, the author believes, yet been found in workable quantity, nor has any attention been paid to the wad ores. As the indications of manganese are very widespread in the province, it is confidently anticipated that large deposits will be found.

Lead.—Galena occurs at many places in connexion with the Carboniferous limestones, disseminated or segregated in small veins. In the Stewiacke valley, at Pembroke and Smithfield, however, the lead bodies are large and important. The low price of lead has discouraged all attempts to open these mines, but it is anticipated that the construction of a railway (projected across the district they occur in) will allow of the starting of works to supply the home market, which is a very large one, and principally dependent on English sources. As a rule the silver percentages of the Nova Scotia ores are not high, the highest the author has seen being about 100 ounces to the ton from Smithfield.

Copper.—The copper ores of Nova Scotia have hitherto received little attention, beyond attempts by local parties to open the more promising deposits.

The Upper Carboniferous measures, extending through Pictou, Colchester, and Cumberland counties, show at numerous points sandstones containing copper ore, frequently of high grade, but hitherto the deposits have proved too irregular for systematic mining. In the county of Antigonish, in Devonian strata associated with dioritic dykes, some copper-pyrites deposits have been developed enough to show good promise. The distance of the ores from shipping and the price of copper has, however, discouraged further work.

In the island of Cape Breton the traces of copper are widespread, and promise that some day Cape Breton will prove, like its neighbour New-

foundland, the seat of an important copper-mining industry. The felsites, etc., of Laurentian age, seem to be the principal copper-containing rocks. At Coxheath, near Sydney, the Eastern Development Co., of Boston, are gradually developing a property which promises to become an important copper producer. This locality being close to iron ore, limestone, and coal, and on tide water, is unusually well situated to form the site of an important centre for smelting the copper ore, not only of Cape Breton, but of the Gulf of St. Lawrence, Newfoundland, etc.

The commencement of copper smelting at this point will undoubtedly direct the attention of prospectors to the numerous signs of copper ore in Cape Breton, and the supply of ore in large amounts can be safely calculated on.

The brief reference which the author has given above covers all the minerals of Nova Scotia, that have hitherto received any attention. There are in addition ores of molybdenum, zinc, nickel and cobalt, pyrites, graphite, asbestos, etc., but they are known almost entirely from samples, and no attempt has been made to test any of the deposits.

Building-stone, ochres, infusorial earth, clays, etc., abound, and are used to a small extent for local requirements. The building-stones embrace grey and red granites, syenites, freestone, marbles, etc., of excellent quality, and usually in the vicinity of shipment.

The Government of the province retains gold, silver, iron, coal, lead, copper, tin, and precious stones, and allows the other minerals to pass in fee in the Crown land grants. Leases are given for periods of forty to eighty years, on the usual conditions, subject to a royalty of 2 per cent. in the case of gold and silver, of from 10 to 12½ cents per long ton on coal sold, and of 5 cents per long ton of iron ore sold or smelted. A special department of the Government is charged with the care of the leases, etc., and a special registration is established free of cost.

From these brief remarks it will be seen that a promising development has been made in coal, iron, and gold, enough to show the extent and value of these three resources. All other minerals appear to have been hitherto practically ignored. This may be due to the absence of men accustomed to seek and utilize them, as well as to the lack of interest manifested by the inhabitants of the province, who devote their attention more especially to lumbering, farming, and fishing. The widespread indications of mineral wealth warrant the hope that their appropriate development will take place at an early date.