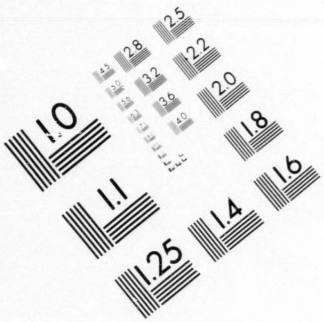

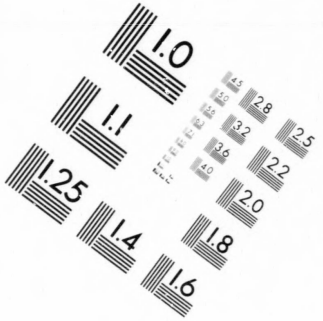

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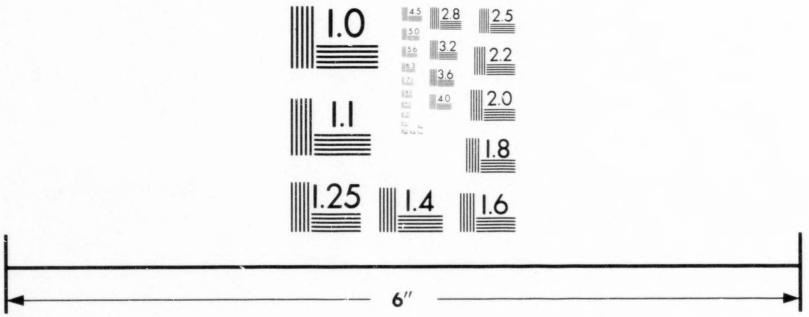

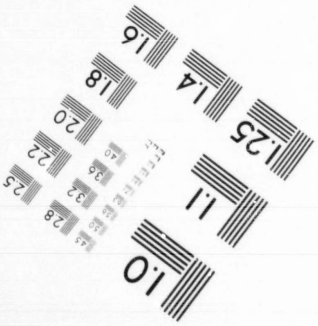

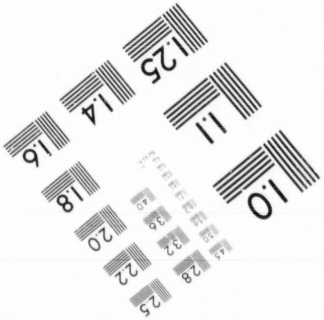

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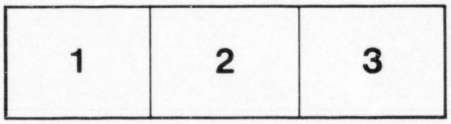
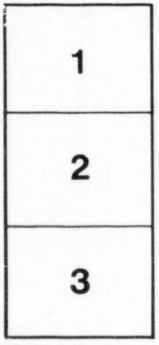
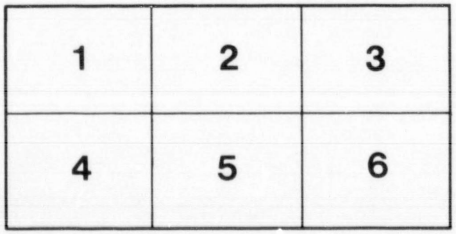
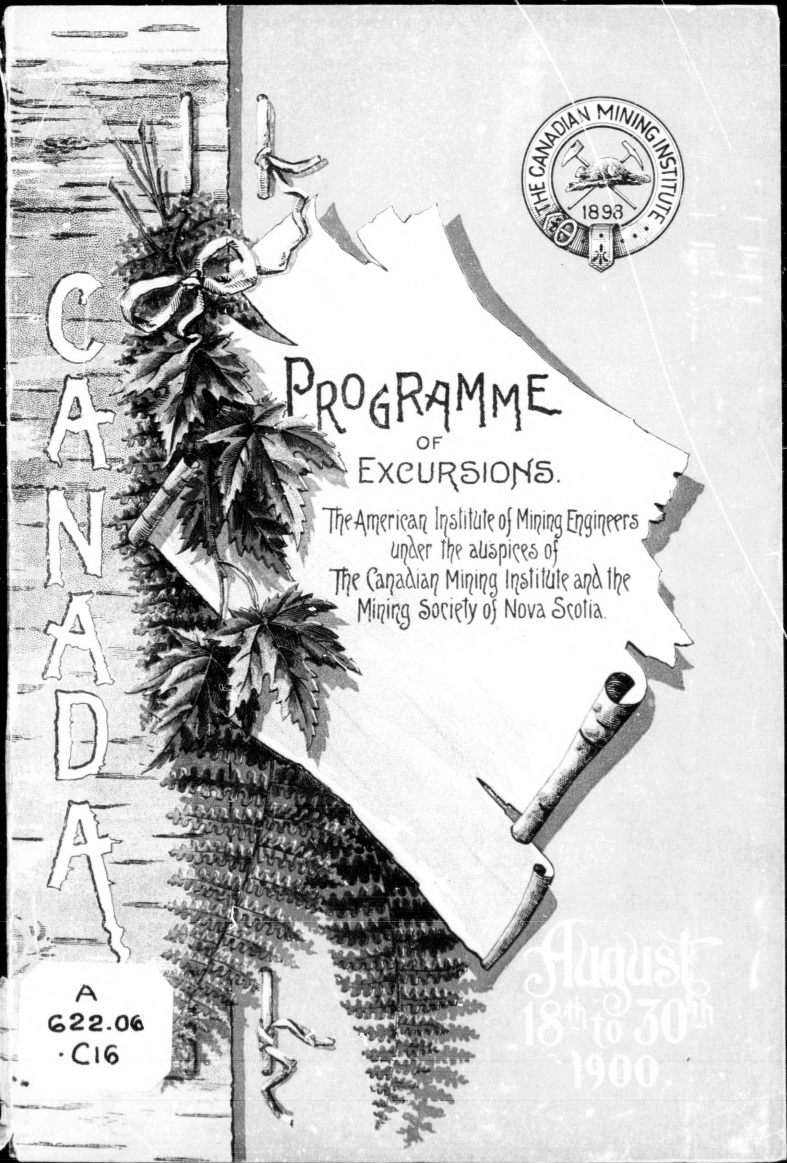
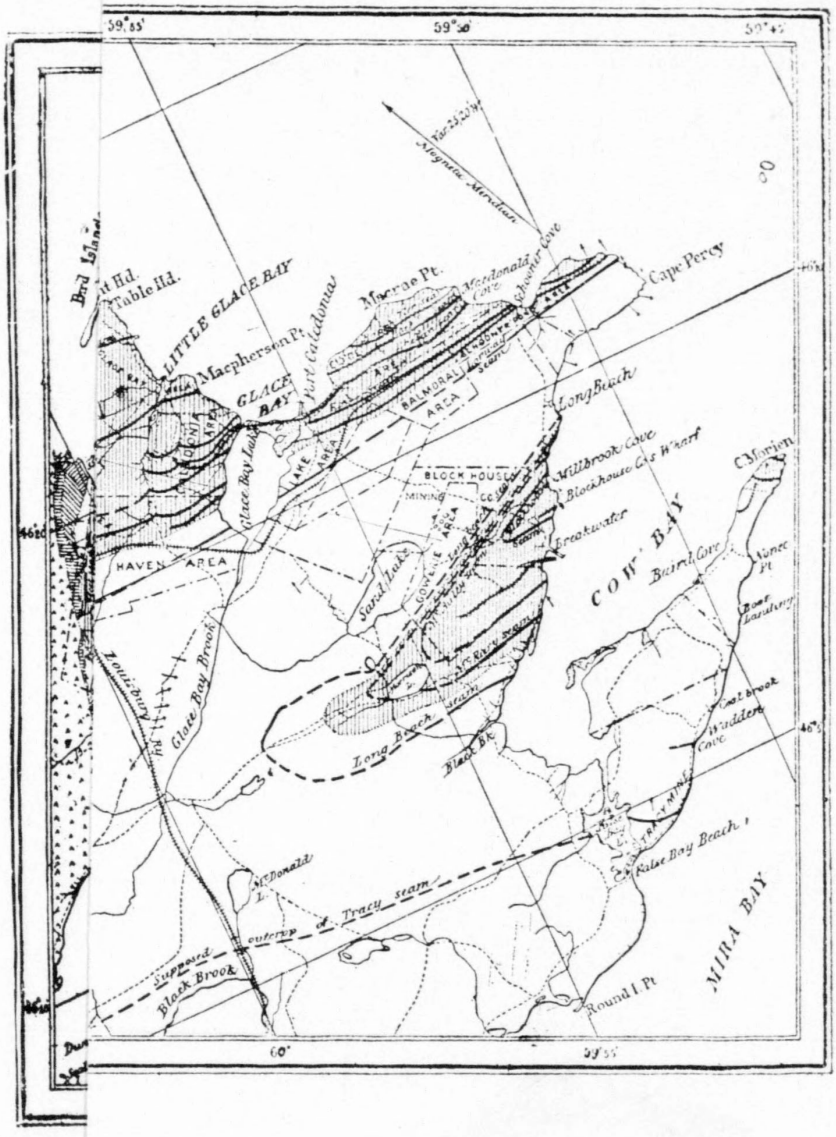




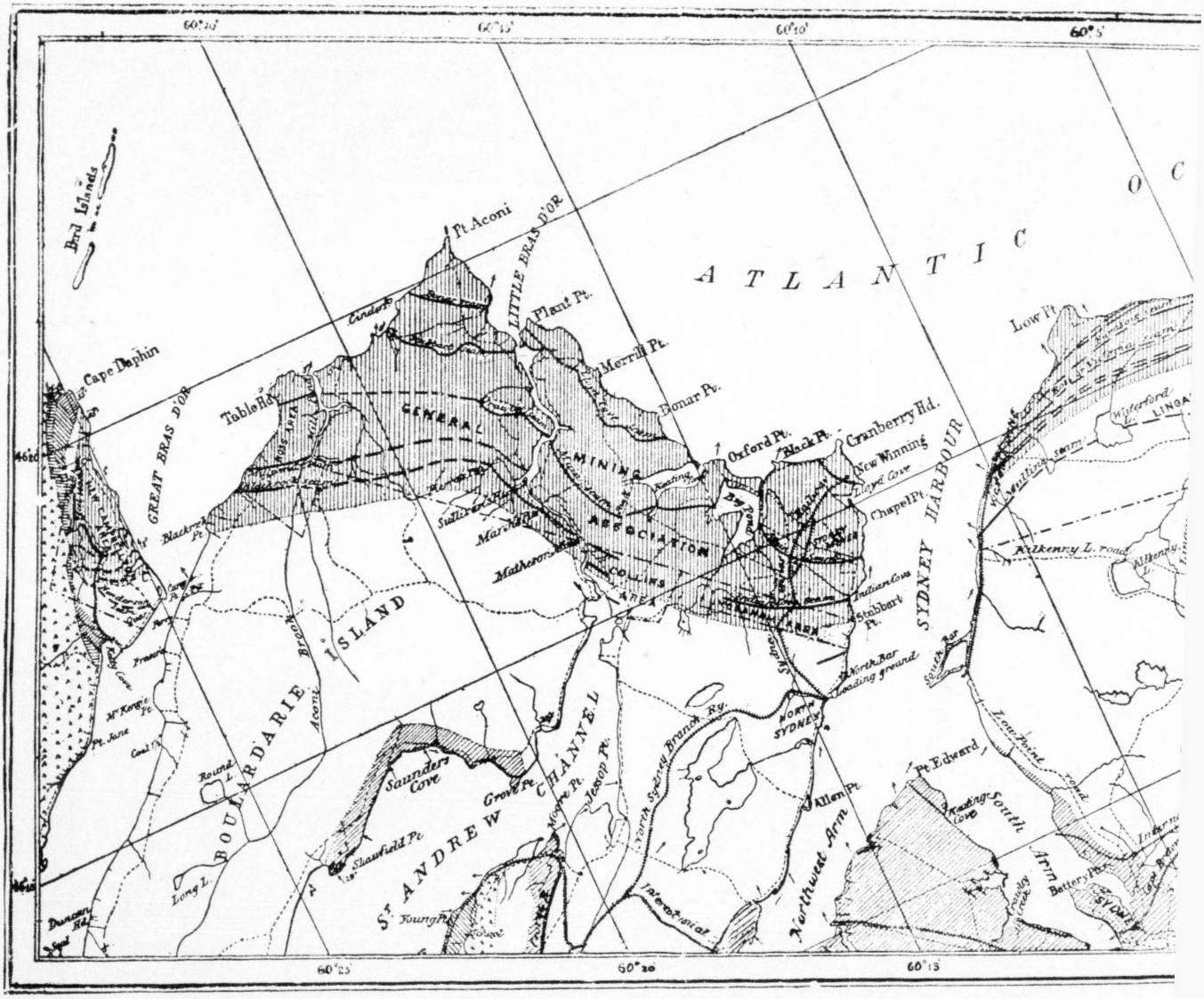



CANADA
THE CANADIAN MINING INSTITUTE
1893
PROGRAMME
OF
EXCURSIONS.
The American Institute of Mining Engineers
under the auspices of
The Canadian Mining Institute and the
Mining Society of Nova Scotia.
August
18th to 30th
1900.

ields.


59°35'
59°30'
59°25'
Magnetic Meridian
Bird Island
Table Hd.
LITTLE GLACE BAY
Macpherson Pt.
GLACE BAY
Port Caledonia
Morgan Pt.
Mendonald Cove
Schooner Cove
Cape Percy
Long Beach
BALMORAL Colliery
AREA
LAKE AREA
BLOCK HOUSE MINING CO. LTD.
Millbrook Cove
Blockhouse C.o's Wharf
Breakwater
C. Marion
HAVEN AREA
Sand Lake
COW BAY
Baird Cove
Nunec Pt.
Boat Landing
Louisburg Rd.
Glace Bay Brook
Long Beach
Black Bk.
Coal Brook
Dodden Cove
Kelso Bay Beach
McDonald
outcrop of Tracy seam
Shepard
Black Brook
Round I. Pt.
MIRA BAY
60'
59°35'

Map of the Cape Br

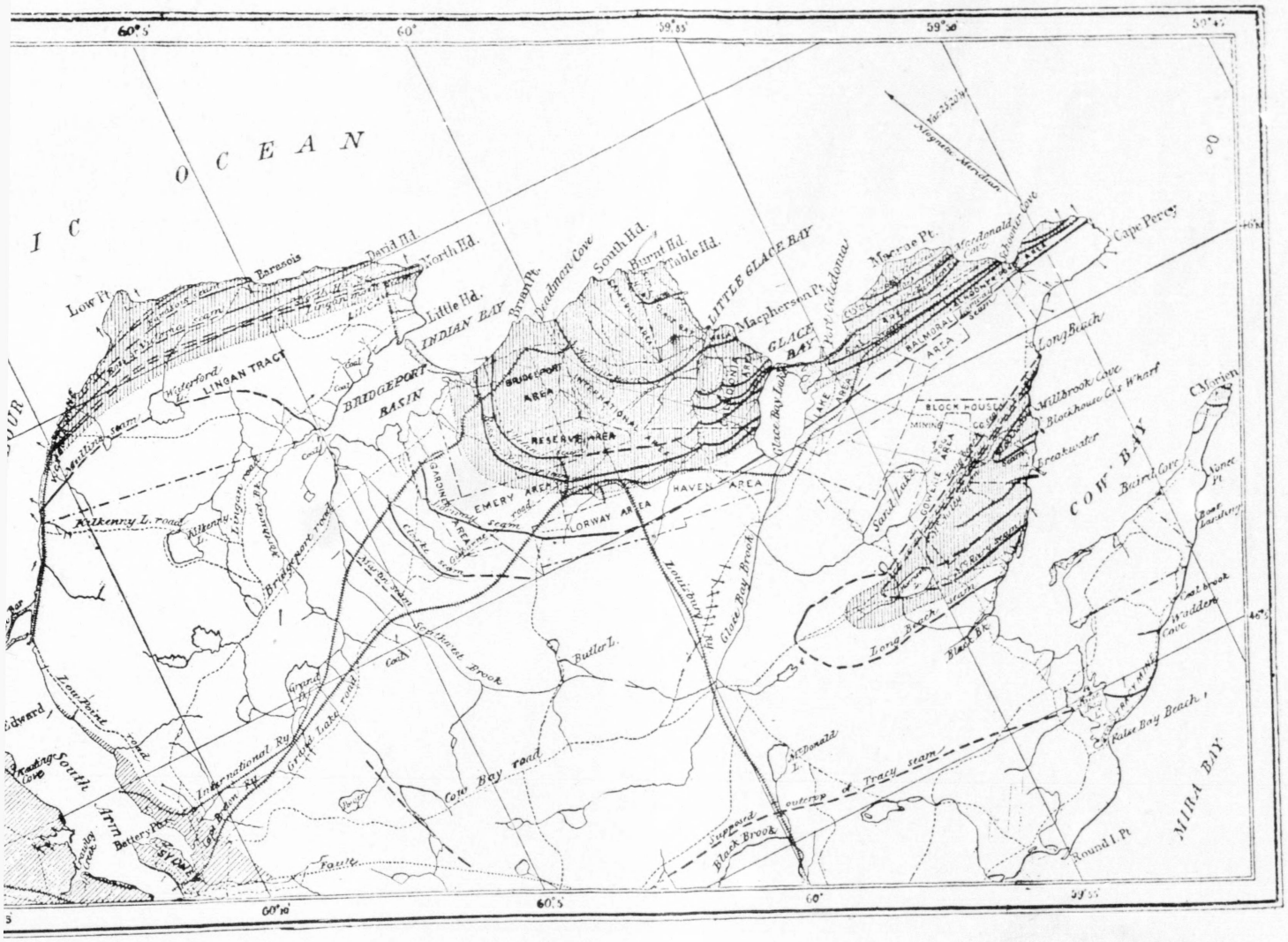


LEGEND

- Coal Measures.
- Millstone Grit.
- Carboniferous Limestone.
- Potsdam
- George River Limestone
- Laurentian.

Scale of

Cape Breton Coal Fields.



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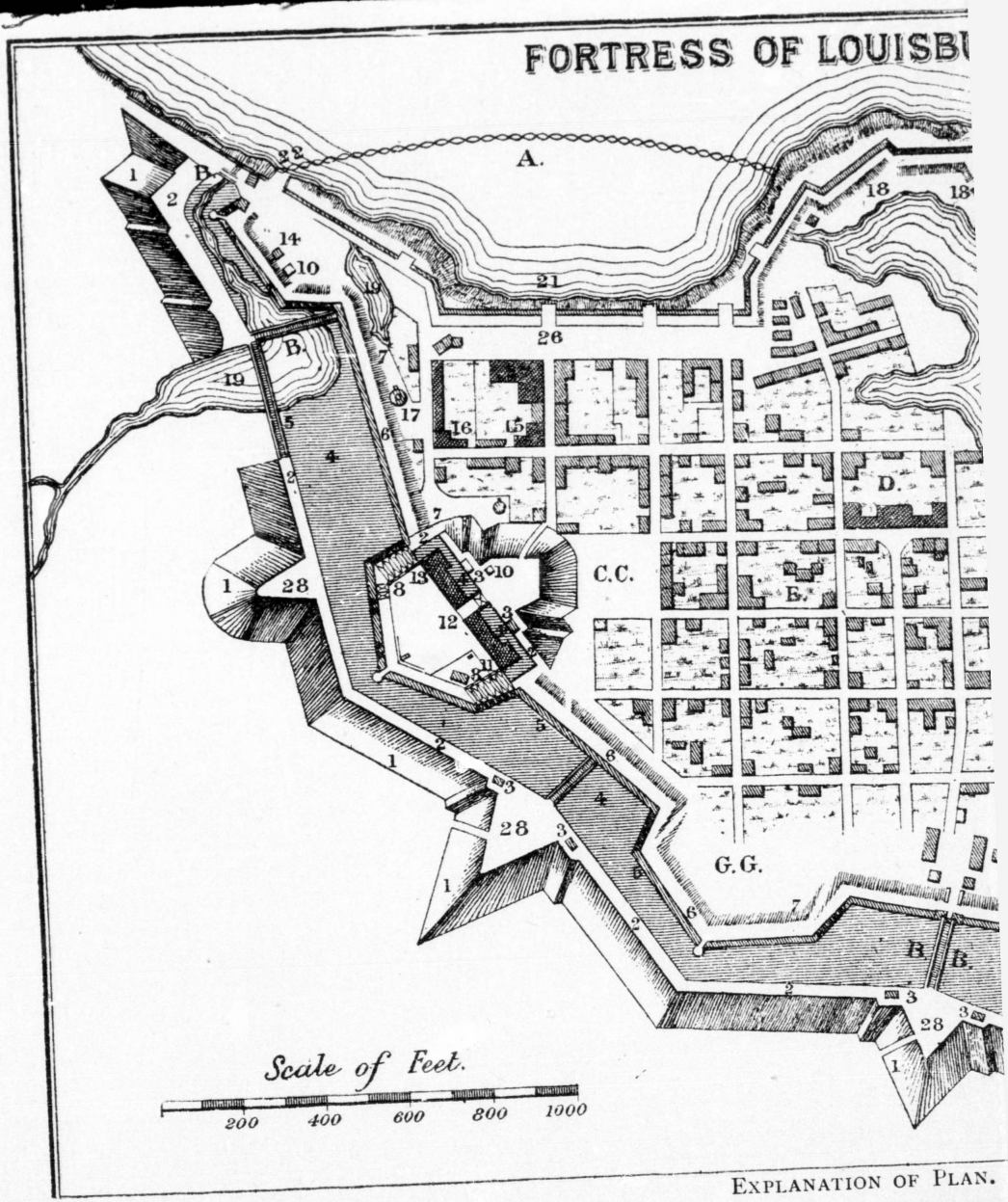
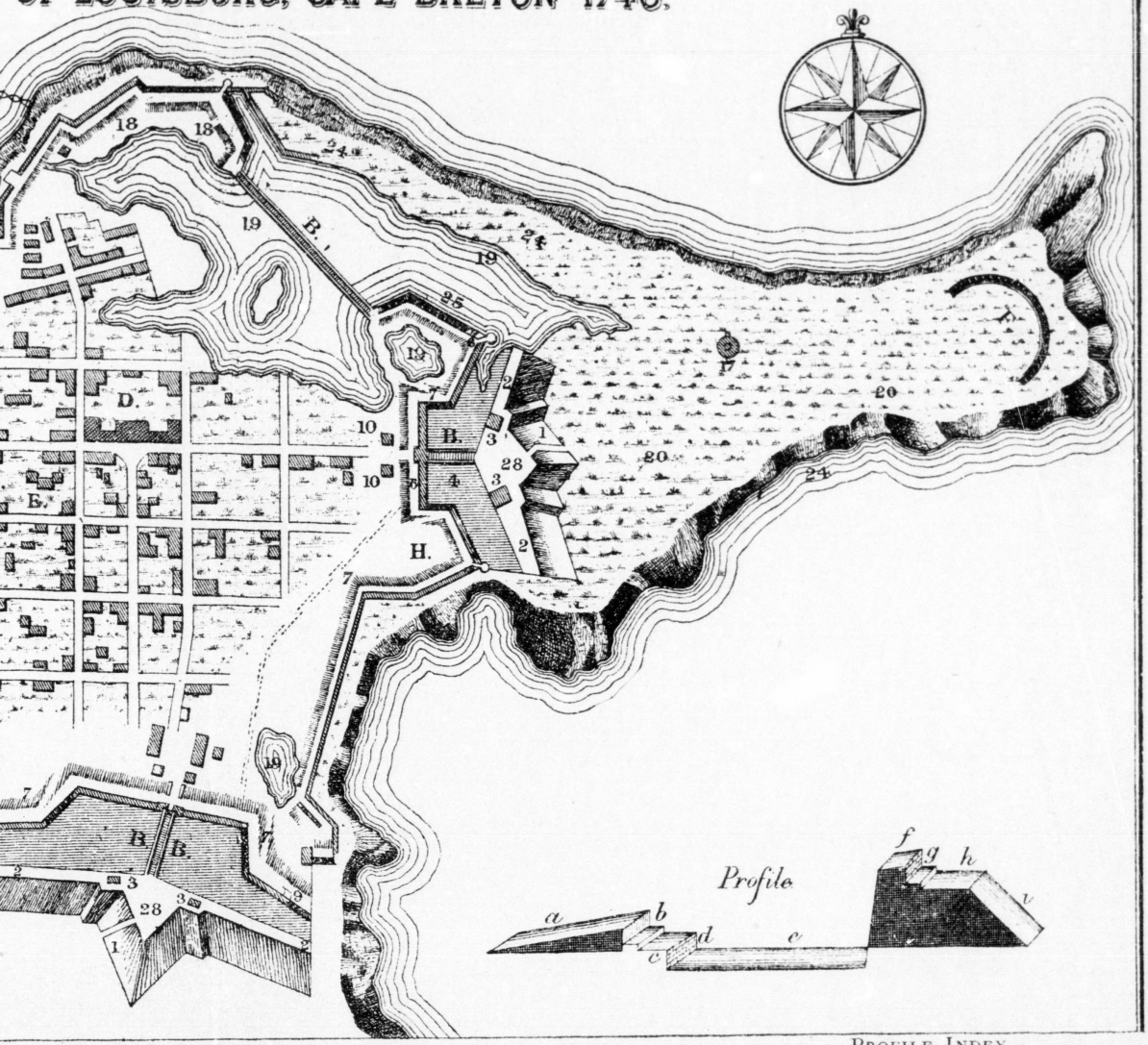


EXPLANATION OF PLAN.

1. The Glacis.
2. Covert Way.
3. Traverses.
4. Ditch.
5. Parapet.
6. Rampart.
7. Talus, Slope or Heel of Rampart.
8. Casemate.
9. Fortified or Gun-Proof Vault.
10. Guard-Houses.
11. Governor's Apartments.
12. Chapel.
13. Barracks.
14. Powder Magazine.
15. Engineer's Fortification House.
16. Arsenal, Bakehouse & Ordnance Store.
17. Lime Kiln.
18. Battery La Grave.
19. Ponds, Fresh Water.

OF LOUISBURG, CAPE BRETON 1748.



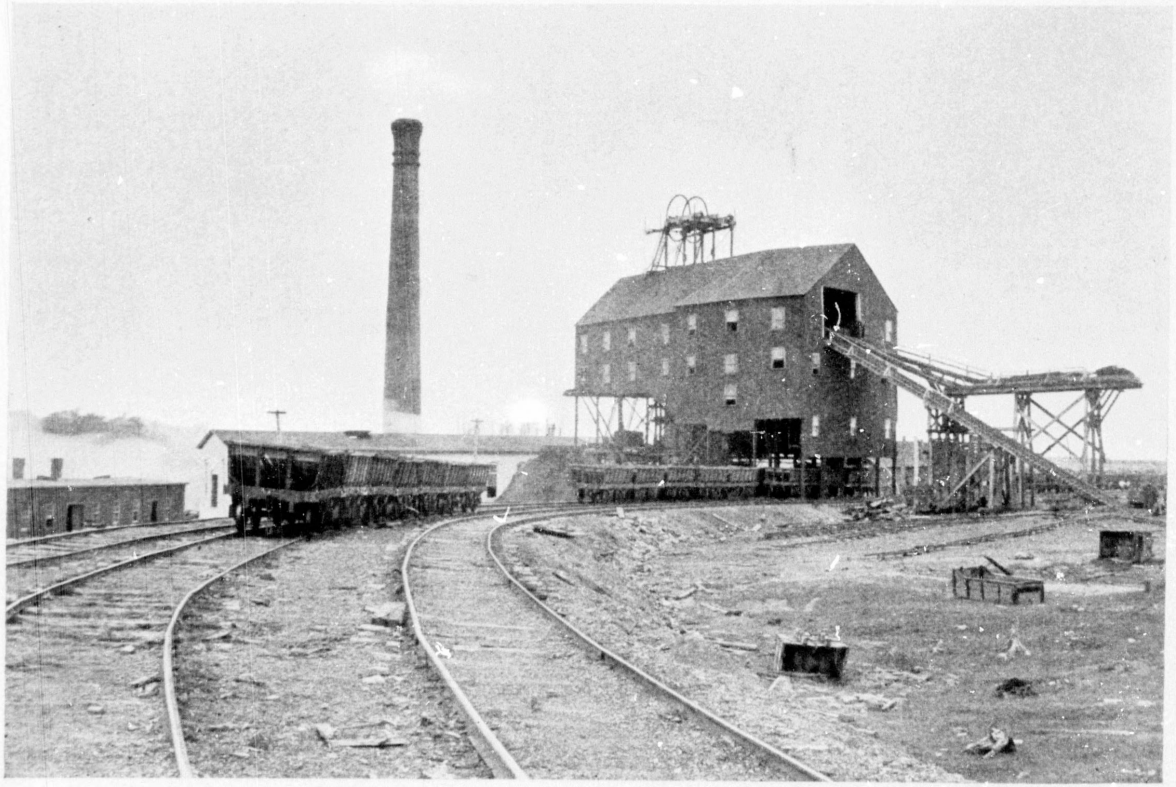
LANATION OF PLAN.

. Powder Magazine.
. Engineer's Fortification House.
. Arsenal, Bakehouse & Ordnance Store.
. Lime Kiln.
. Battery La Grave.
. Ponds, Fresh Water.
20. Cemetery Grounds.
21. The Key Curtain.
22. The Spur.
24. Beach and Shore.
25. Maurepas Bastion.
26. Frederic's Gate.
27. General Storehouse.
28. Place of Arms.

A. Boom to Preserve the French Ships.
B. Bridge-Way.
C.C. Parade Ground.
D. The Hospital.
E. The Nunnery.
F. New Battery.
G.G. Queen's Bastion.
H. Brouillan Bastion.

PROFILE INDEX.

a. Glacis.
b. Banquet.
c. Covert Way.
d. Counterscarp.
e. Ditch.
f. Parapet.
g. Banquet.
h. Rampart.
i. Talus, or Heel.



BANK-HEAD CALEDONIA COLLIERY OF THE DOMINION COAL CO., LIMITED.

Output in 1899: 403,629 tons.

Bank-head Caledonia Colliery of the Dominion Coal Co., Limited.
Output in 1899: 403,629 tons.

SOUVENIR PROGRAMME

OF THE

Meetings and Excursions

TO BE HELD

During the Visit of The American Institute of Mining Engineers
to Canada in August, 1900

Conducted under the Auspices of

THE CANADIAN MINING INSTITUTE

AND

THE MINING SOCIETY OF NOVA SCOTIA

TOGETHER WITH SOME

NOTES ON THE PROMINENT MINERAL RESOURCES AND MINING INDUSTRIES OF NOVA SCOTIA

Illustrated with Three Maps, Sundry Drawings and Numerous
Illustrations of the Working Mines

Edited and Published
By the Secretary of The Canadian Mining Institute
By Order of the Council.

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Mr. B. T. A. Bell, Ottawa, Ont., Sec. Canadian Mining Institute, Hon. Sec. Mining Society of Nova Scotia.

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Mr. Eugene Coste, M. E., Toronto, Ont.

Mr. A. Marshall Hay, Rat Portage, Ont.

Mr. C. H. Carriere, Quebec, Que.

Mr. Hiram Donkin, C. E., Sydney, Cape Breton.

Mr. W. L. Libbey, North Brookfield, N.S.

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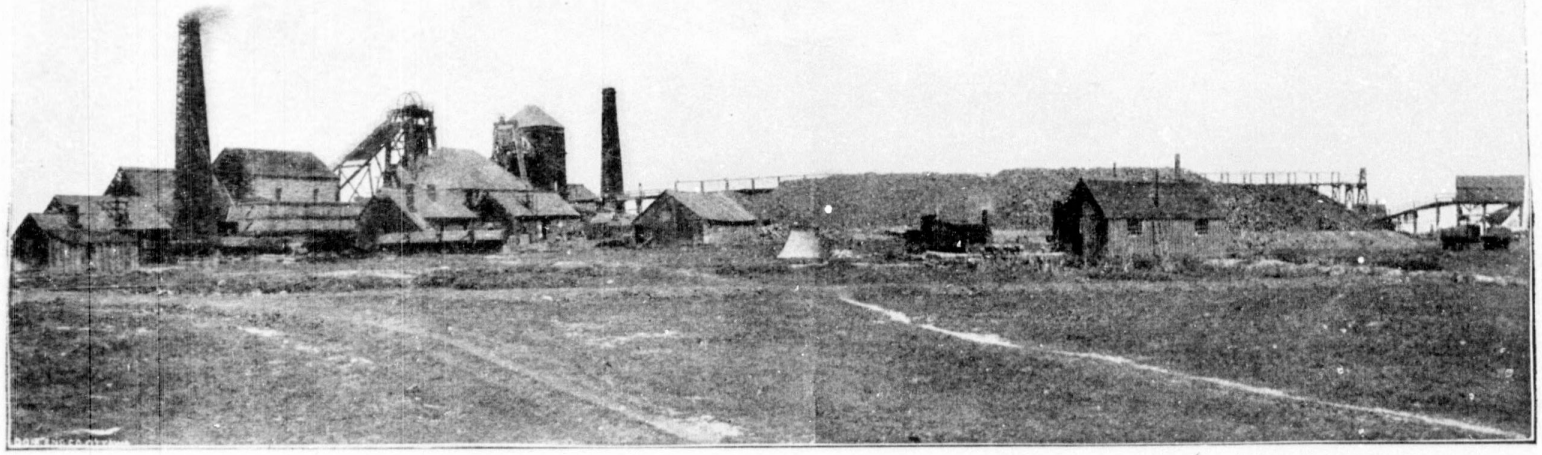
Mr. A. G. McNulty, Waverley, N.S.



GENERAL MINING ASSOCIATION, LIMITED. OLD SYDNEY MINES, CAPE BRETON.

This colliery was worked as far back as 1785. The present Company commenced operating in 1830, when the first shaft, 200 ft., was sunk. The average output during the past three years has been about 270,000 tons per annum. Seam 5 ft. 4 in. thick.

RECEPTION COMMITTEES.

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Mayor L. C. Belanger, Chairman.

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Mr. John Blue, C. & M. E.
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Mr. George R. Smith, M.L.A., Chairman.

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Mr. B. Bennett
Dr. James Reed
Mr. T. H. Crabtree
Mr. Hugh Leonard.
Mr. R. T. Hopper

QUEBEC COMMITTEE.

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Mr. Frank Carrell.

RECEPTION COMMITTEES—Continued.

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Mayor CROWE.

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Mr. A. J. MOXHAM
Mr. J. G. S. HUDSON
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Mr. R. H. BROWN
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Mr. A. C. ROSS
MR. J. T. BURCHELL

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Mr. T. CANTLEY
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HALIFAX.

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Mr. GEO. W. STUART
Mr. B. F. PEARSON
Mr. M. R. MORROW
Mr. D. C. HOOD
Mr. ALEX. MCNEIL
Mr. C. C. STARR
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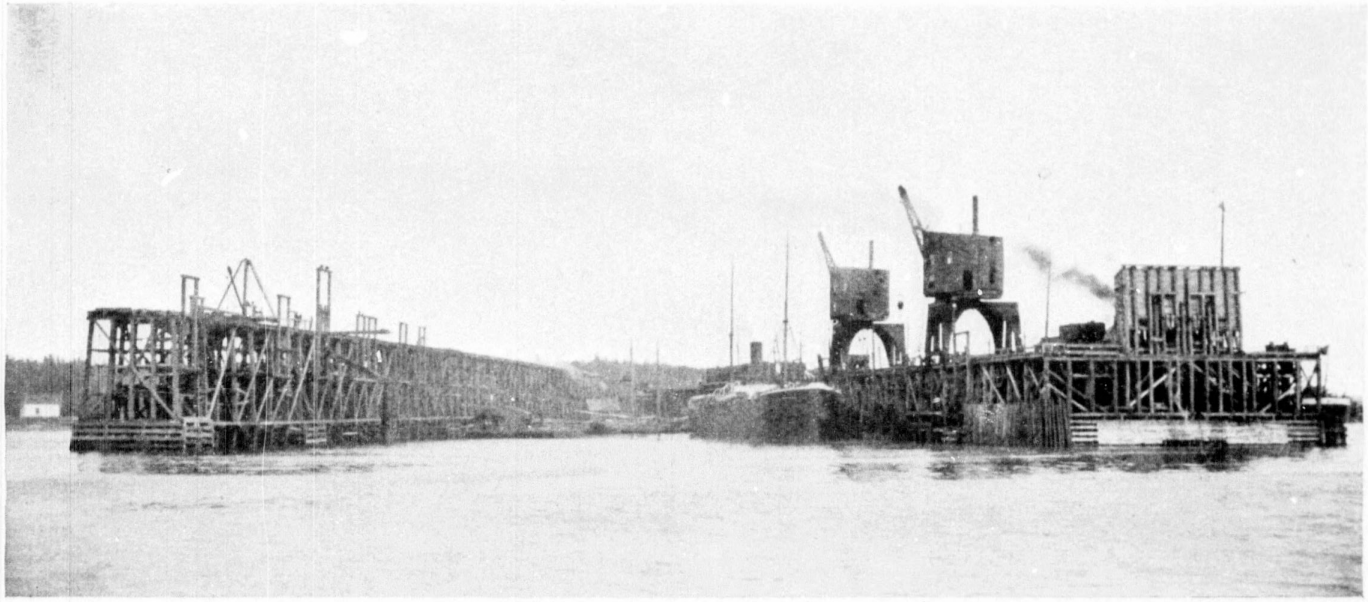
Mr. GEOFFREY MORROW
Mr. A. A. HAYWARD
Mr. B. C. WILSON
Mr. T. R. GUE
Mr. G. L BURRITT
Dr. GILPIN



INTERNATIONAL SHIPPING PIERS OF THE DOMINION COAL CO., LIMITED, AT SYDNEY, C. B.

No. 1—Length, 1,150 ft.; height above high water, 27 ft.; width, 90 ft. Equipped with two Ludlow loading towers. Two cargo and one bunker steamer can load at one time, with two sailing vessels of smaller tonnage.

No. 2—Length, 1,150 ft.; height above high water, 37 ft.; width 28 ft.; depth of water at low tide, 25 ft. Built of Southern hard pine; creosoted piles; can load two steamers at one time; high and low level tracks; two drop tables; lighted by electricity. August 18th, 1899, 8,445 tons shipped. Total shipment for August, 1899, 172,750 tons.

No. 2—Length, 1,150 ft.; height above high water, 37 ft.; width 28 ft.; depth of water at low tide, 25 ft. Built of Southern hard pine; creosoted piles; can load two steamers at one time; high and low level tracks; two drop tables; lighted by electricity. August 18th, 1899, 8,445 tons shipped. Total shipment for August, 1899, 172,750 tons.

PROGRAMME OF EXCURSIONS

(Subject to Revision by Local Committees.)

SATURDAY, 18th AUGUST, 1900.

Members of the American and Canadian Institutes assemble at Sherbrooke. Breakfast from 7 to 9 o'clock will be provided at the Magog House. Official Drive, given by citizens, visiting various points of interest in and around the city, concluding at the mining machinery establishment of the Canadian Rand Drill Company, where luncheon will be served at 1 o'clock. At 3 p.m., by courtesy of the General Manager and officers, the members will be conveyed to Quebec by special train over the Quebec Central Railway. A stop will be made (about 5 o'clock) at Thetford Mines, where an opportunity will be afforded of inspecting the asbestos mines and works of the Bell's Asbestos Co., Limited, King Bros., the Johnsons' Company, and other large producers of this valuable mineral. Quebec will be reached about 10 o'clock.

SUNDAY, 19th AUGUST.

Headquarters Chateau Frontenac; rates, $3.50 to $4.50, according to rooms. Leaving the Chateau at 10 a.m., members will be driven to the Citadel, Heights of Abraham, and other points of interest in and around Quebec, returning to the Chateau by the new Dufferin Terrace Extension, commanding one of the finest views in the world. At 2 p.m., by courtesy of the Honorable the Minister of Marine and Fisheries, who has placed the Government steamer *Druid* at their disposal, members will be entertained to a sail in the harbour visiting the site of the new bridge being built across the St. Lawrence, Montmorenci Falls, Louise Basin, etc., returning about five o'clock. **Special Train** (comprising five Pullman Sleepers and Baggage car) **will leave Levis via Intercolonial Railway for Sydney, Cape Breton, promptly at 8 o'clock Sunday evening.** Train timed to arrive in Sydney early Tuesday morning.

TUESDAY, 21st AUGUST.

By courtesy of the officers of the Dominion Iron and Steel Co., Limited, and the Dominion Coal Co., Limited, members will be conducted over the extensive new Iron and Steel Works, in course of construction at Sydney, and a visit will be paid to the shipping piers, coal handling plants, and other important works in the vicinity. In the evening a Reception will be tendered on behalf of the Mayor and Council of Sydney, and one or two papers describing the prominent mining industries of the Province may be read.

WEDNESDAY, 22nd AUGUST.

Leaving Sydney at 8.45 a.m. the Institute Special will be hauled over the Sydney and Louisburg Railway, making first stop at the Dominion No. I colliery of the Dominion Coal Co., Ltd. The following is the itinerary for this date :—

Leave	Sydney	8.45 a.m
Arrive	Dominion No. I Colliery	9.10
Leave	do do	10.00
Arrive	Reserve Colliery	10.15
Leave	do do	11.00
Arrive	International Colliery	11.15
Leave	do do	11.30
Arrive	Dominion No. 2 (new shaft)	11.40
Leave	do do do	12.00
Arrive	Caledonia Colliery	12.15 p.m.
Leave	do do	12.30

Visit Dominion Nos. 3 and 4 and the new village in connection therewith where Lunch will be served at 1 p.m.

Leave	Dominion No. 4 for Louisburg at	2.00 p.m.
Leave	Louisburg for Sydney at	5.30

THURSDAY, 23rd AUGUST.

There will be an excursion by steamer through the beautiful Bras d'Or Lakes, rejoining the special train at Port Mulgrave ; thence on to New Glasgow.

FRIDAY, 24th AUGUST.

In the morning the visitors will visit the steel works of the Nova Scotia Steel Co., Limited, and thereafter be driven over Fraser's Mountain, where luncheon will be served. The afternoon will be

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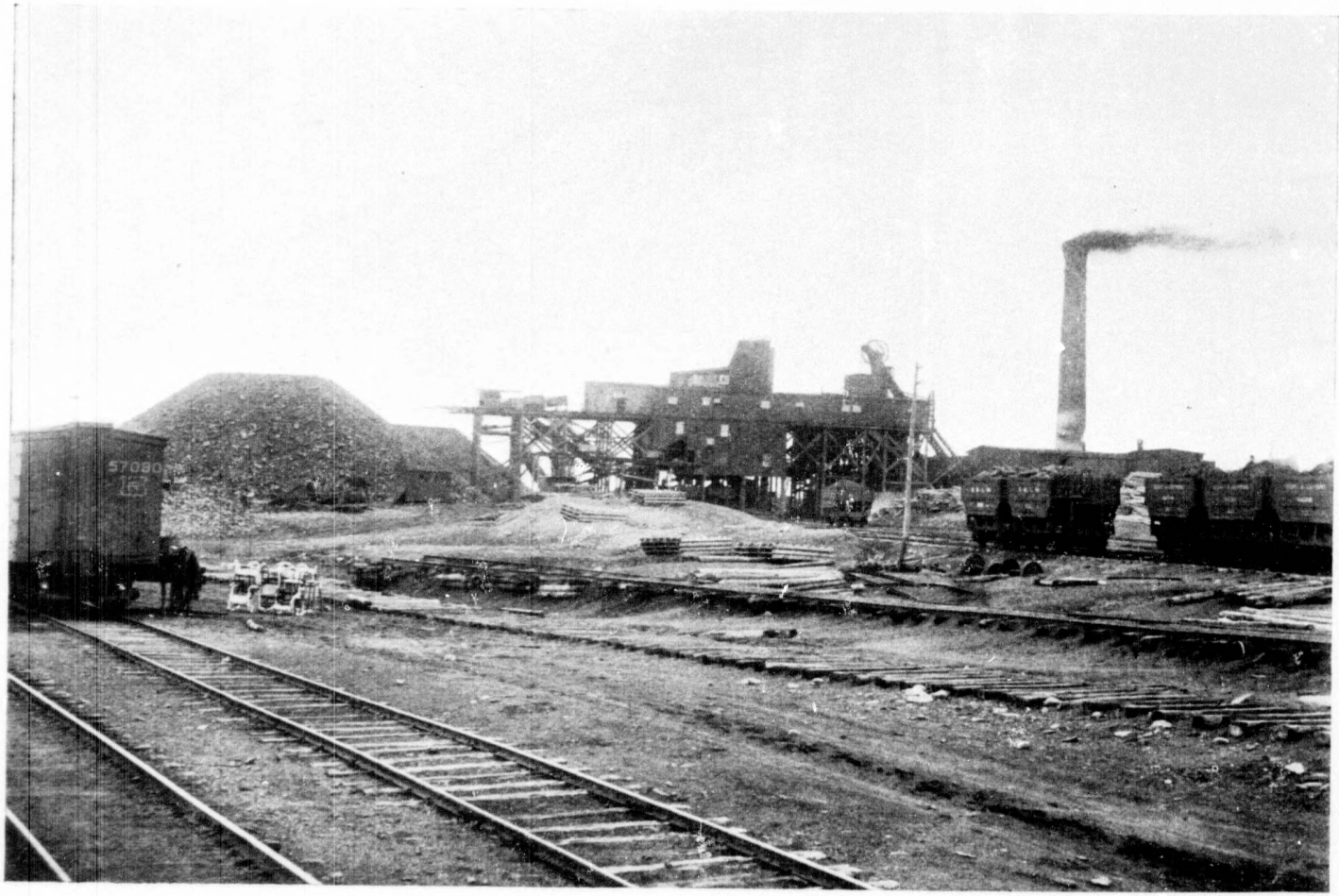

BANK-HEAD INTERNATIONAL COLLIERY OF THE DOMINION COAL CO., LIMITED.

Output in 1899: 211,068 tons.

spent in an inspection of the plants of the Intercolonial Coal Company, Limited, at Westville, and the Acadia Coal Company at Stellarton. Special train will go on to Halifax in evening.

SATURDAY, 25th AUGUST.

By courtesy of the officers and members of the Mining Society of Nova Scotia, the party will be entertained to a drive, visiting various points of interest in and around the city of Halifax, and, if possible, an opportunity will also be given of inspecting the warships in the harbour.

MONDAY, 27th AUGUST.

By courtesy of the Mining Society, the members will be entertained to an excursion in the harbour, visiting, by steamer, the Basin, North-West Arm, and other points, stopping, *en route*, at the works of the People's Light and Heat Company, Limited. In the evening a promenade concert in the Public Gardens will be given in honor of the visitors.

TUESDAY, 28th AUGUST.

Drive to the gold mines at Waverley, where the party will be entertained to luncheon.

WEDNESDAY, 29th AUGUST.

Special train will return to Levis.

BANK-HEAD INTERNATIONAL COLLIERY OF THE DOMINION COAL CO., LIMITED.

Output in 1899: 211,068 tons.

NEWFOUNDLAND EXCURSION.

Party for Newfoundland, which must not exceed twenty-five, will leave Halifax on Wednesday morning, 29th August, for Sydney, Cape Breton, either by the Institute's special train (as far as Truro) or by the Sydney Express At Sydney they will take the S.S. *Bruce* and on arrival at Port aux Basque will be provided with transportation over the Newfoundland Railway to St. Johns where arrangements are being made by Mr. H. M. Whitney and the officers of the Dominion Iron and Steel Company, Ltd., to take them to the famous Wabana iron mines. This party will sail via S.S. *Bonavista* from St. Johns early on Tuesday morning, September 4th, for North Sydney, C.B. Certificates entitling members to transportation and meals on the *Bonavista*, and return travel over the Intercolonial from North Sydney to Levis, will be issued, on application at Halifax, by Mr. B. T. A. Bell, Secretary of The Canadian Mining Institute.

MEETINGS.

If possible, arrangements will be made for holding joint sessions for the reading and discussion of papers at Sydney and Halifax.

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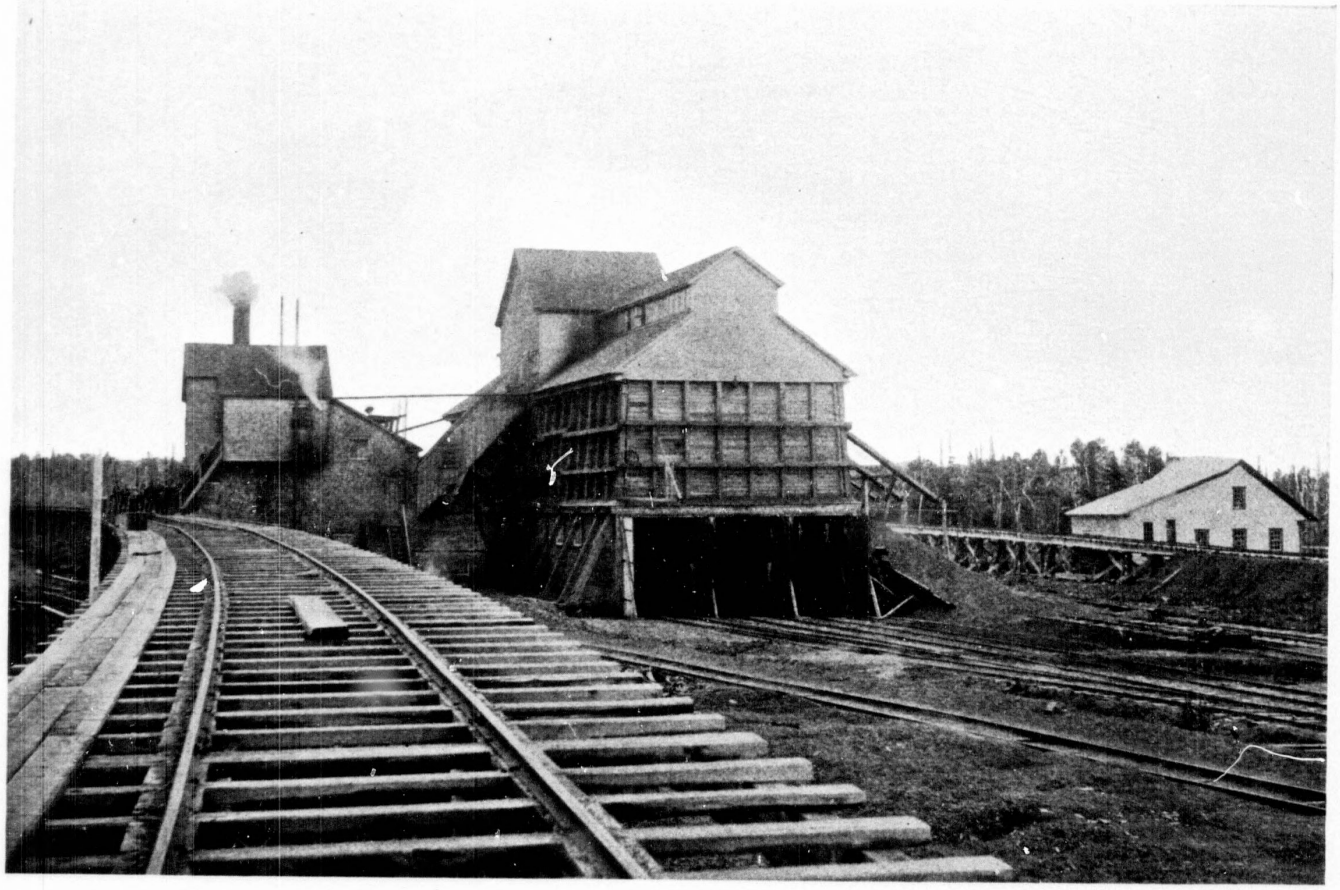

COAL WASHING PLANT ON THE MAIN LINE OF THE SYDNEY & LOUISBURG RY., SEVEN MILES FROM GLACE BAY, C. B.
Capacity, 1,000 tons slack per 24 hours. Used to decrease sulphur and ash in slack coal. Storage bin capacity, 2,000 tons.
ANALYSIS.—Unwashed Slack, 2.51 p. c. Sulphur; 8.90 p. c. Ash. Washed Slack, 1.88 per cent. Sulphur; 4.25 p.c. Ash.

Coal Washing Plant on the Main Line of the Sydney & Louisburg Ry., Seven Miles from Glace Bay, C. B. Capacity, 1,000 tons slack per 24 hours. Used to decrease sulphur and ash in slack coal. Storage bin capacity, 2,000 tons. Analysis.—Unwashed Slack, 2.51 p. c. Sulphur; 8.90 p. c. Ash. Washed Slack, 1.88 per cent. Sulphur; 4.25 p. c. Ash.

MINERAL RESOURCES OF NOVA SCOTIA.

Although the total area of Nova Scotia does not much exceed 20,000 square miles, it offers a remarkable diversity of geological conditions and mineral resources. The principal minerals now worked are coal, iron and gold, with gypsum and various materials of construction. Besides these are copper and lead deposits which have not yet become the basis of continuous industries, as well as manganese, antimony and other minerals which have been worked irregularly or of which the existence is known.

Nova Scotia was known from very early days to possess important mineral deposits, but these only began to attract attention in the first part of this century, and their exploitation on any considerable scale practically dates from 1830, when the first deep shaft of the General Mining Association was sunk on a coal seam. Since then the development and working of some of the mineral deposits have been pushed actively, while others, although apparently promising, yet remain undeveloped.

The following summary shows the mineral production of the province for the year ending September 30th, compared with that for the year ending September 30th, 1898 :—

Mineral.	Year ending Sept. 30, 1898.	Year ending Sept. 30, 1899.
Gold ..... Oz.	31,104	27,772
Iron Ore*† ..... Tons	31,050	16,169
Manganese Ore† ..... "	75	100
Coal raised† ..... "	2,281,454	2,642,333
Coke made† ..... "	42,000	55,484
Gypsum†‡	131,000	140,000
Grindstones, etc.§	38,000	50,000
Limestone† ..... Tons	24,000	32,000
Barytes	.....	335
Tripoli and Silica	.....	893
Copper Ore	.....	400

COAL FIELDS OF NOVA SCOTIA.

CAPE BRETON.

The coal fields of Cape Breton comprise four large areas, (1) on the coast east and west of Sydney harbor, (2) in Inverness County, between Margaree harbor and Port Hood, including important mines at Broad Cove, (3) a basin on River Inhabitants, near Glendale, and (4) a tract in Richmond County, near the mouth of River Inhabitants. But as all the mines at present worked, producing about two million tons of coal annually, lie within the Sydney coal field, this alone will be referred to.

The land area occupied by coal bearing rocks in the Sydney coal field has been estimated at two hundred square miles, while an immense submarine area contains large seams of coal in workable condition, easily accessible. The rocks are regular and rest everywhere upon the millstone grit, except where brought by a fault against a mountain of Laurentian rocks at New Campbellton at the western edge of the coal field.

The coal measures have been folded into subordinate basins so as to bring the coal seams to the surface under the most favorable conditions for their extraction and shipment. The whole coast is deeply indented by bays and channels approximately coinciding with the axes of these folds, affording in the sea cliffs numerous natural exposures of the coal seams and accompanying strata and constituting excellent harbors, one of which, Sydney harbor, situate towards the centre of the district is one of the finest in the world. During the few months of winter, when the more northerly harbors are closed or obstructed by ice, a railway carries coal from the collieries east of Sydney harbor to the fine winter port of Louisburg.

The cliffs are generally from thirty to one hundred feet high, and the country is of a gently rolling character, the highest altitudes seldom exceeding two hundred and fifty feet. Such natural advantages, combined with its highly favorable geographical position, point to this district as probably the most important in the Dominion for the supply of fuel to the numerous steamers navigating the Atlantic.

Taking the average of all the sections, the total number of seams in the productive measures is twenty-four, of which six are 3 feet

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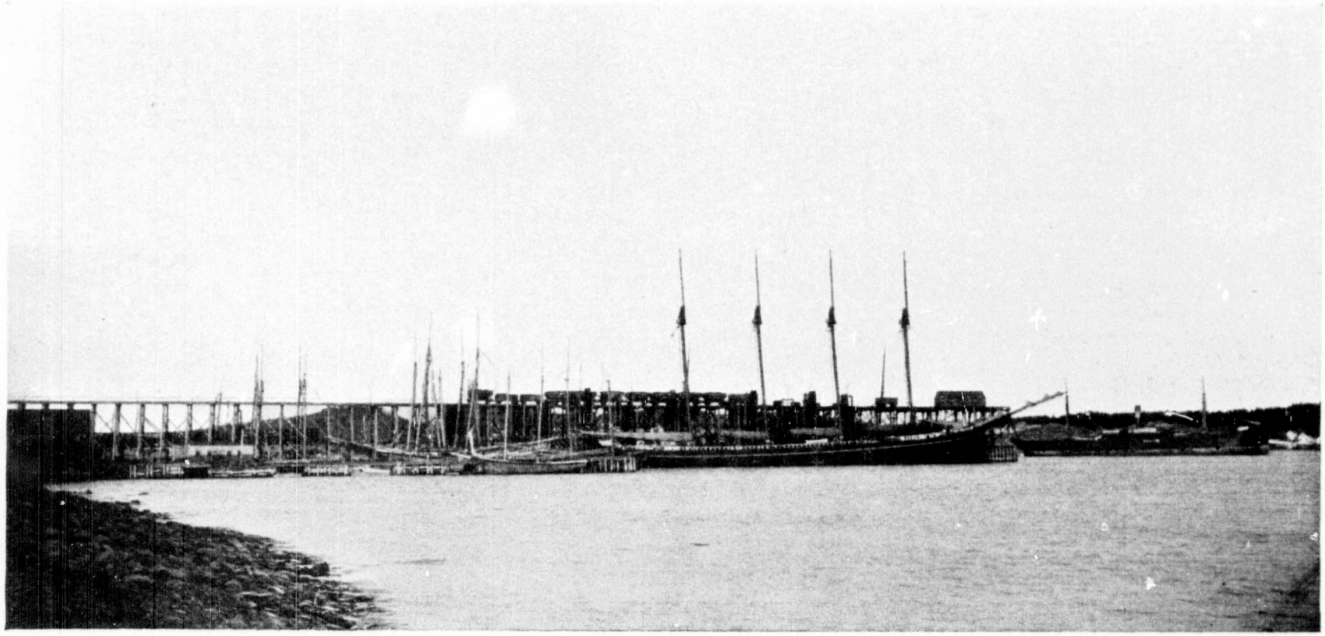


LOUISBURG PIER OF THE DOMINION COAL CO., LIMITED, LOUISBURG HARBOUR, C. B.

Winter Port. Length, 1,290 ft.; height, 40 ft.; width, 32 ft. Built of Southern hard pine. Thirty-five feet of water at end of pier. High and low level tracks. Operated by drop tables. Shipped in April, 1899, 42,478 tons. Largest shipment in one day, 3,873 tons.

or upwards in thickness, and the total average thickness of coal may be stated at 46 feet. The similarity and persistency of the seams over great areas is very remarkable, although local variations are frequent. There is, therefore, no great uncertainty in regard to the equivalency of the various seams at different points. They generally dip at a very low angle and are little affected by faults and disturbances.

The coal is of the soft, or bituminous variety, with comparatively little diversity in the quality of the different seams, all of which yield a coal exceedingly well adapted for steam and domestic purposes, while that of some of them is especially applicable to the manufacture of gas. Much of it will compare very favorably with the best English coal. As compared with the Pictou coal it is characterized by a greater proportion of combustible matter and a smaller proportion of ash; but on the other hand it usually contains a greater amount of sulphur; although experiments made on a small scale at Ferrona seem to prove that some of the coals will yield a coke as suitable for iron smelting as that made from a mixture of Acadia, Drummond and Springhill coals.

Underclays, charged with roots and innumerahle rootlets, occur beneath every coal seam and bed of carbonaceous shale, and their roof shales are for the most part rich in fossil plants. The productive measures contain also beds of argillaceous and aranaceous shale, usually grey; sandstone, limestone, red and green marl. They are underlaid in descending order by the millstone grit, carboniferous limestone and conglomerate.

ANALYSES OF CAPE BRETON COALS.*

Mine.	Volatile Matter.	Fixed Carbon.	Ash.	Total Sulphur.	Sulphur in Ash.	Calorific Power.
Caledonia (Phelan)	28.02	68.05	2.19	1.72	0.05	7623
Dominion (Phelan)	25.13	71.22	2.73	1.10	0.10	7403
Old Bridgeport (Phelan).	31.81	63.86	3.09	1.33	0.12	7238
Reserve (Phelan).....	32.00	63.93	2.95	1.33	.....	7513
Hub.....	29.10	65.50	4.50	3.29	0.12	7458
Sterling (Harbour).....	37.96	54.84	5.60	4.03	.....	7403
Victoria (Ross).....	34.65	58.42	4.93	3.48	.....	7513
Old Sydney (Main).....	34.65	57.67	6.63	4.10	0.14	7623
New Campbellton.....	32.07	56.86	7.46	5.90	.....	7073

* By Mr. F. H. Mason, F.C.S., Trans. Fed. Canadian Mining Institute, Vol. I, 1896.

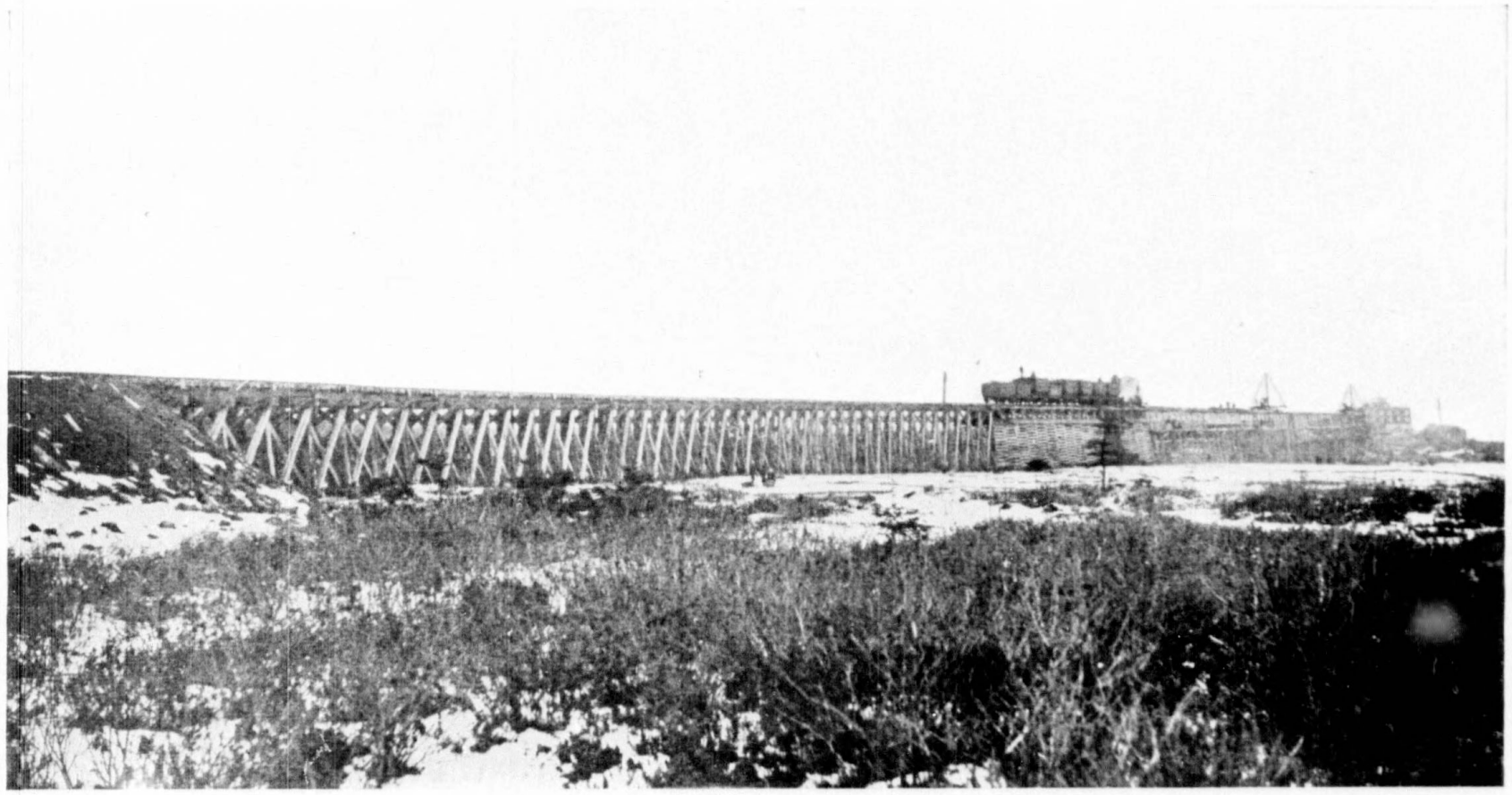
LOUISBURG PIER OF THE DOMINION COAL CO., LIMITED, LOUISBURG HARBOUR, C. B.

Winter Port. Length, 1,290 ft.; height, 40 ft.; width, 32 ft. Built of Southern hard pine. Thirty-five feet of water at end of pier. High and low level tracks. Operated by drop tables. Shipped in April, 1899, 42,478 tons. Largest shipment in one day, 3,873 tons.

STATEMENT SHOWING WORKABLE SEAMS AND YIELD OF COAL IN THE EASTERN COALFIELD, CAPE BRETON COUNTY.

SEAM.	Thickness. Ft. In.	Land Area Square Miles.	Sea Area Square Miles.	Total Square Miles.	Gross Tons in Land Area.	Gross Tons in Sea Area.	Total Gross Tons.	Workable Tons in Land Area.	Workable Tons in Sea Area.	Total Workable Tons.
OLD SYDNEY MINES.										
Main Seam	6.0	11	30	41	59,136,000	161,280,000	220,416,000	39,916,800	72,576,000	112,492,800
Indian Cove	4.8	6	12	18	17,920,000	35,840,000	53,760,000	12,096,000	16,128,000	28,224,000
Lloyd's Cove	5.0	2	20	22	8,960,000	89,600,000	98,560,000	6,048,000	40,320,000	43,368,000
Cranberry Head	3.8	$\frac{1}{25}$	$4\frac{1}{2}$	$4\frac{27}{50}$	131,413	14,783,998	14,915,411	118,272	6,652,800	6,771,072
	19.4	$19\frac{1}{25}$	$66\frac{1}{2}$	$75\frac{27}{50}$	86,147,413	301,503,998	387,651,411	58,179,072	135,676,800	193,855,872
LOW POINT AREA.										
Carr	4.0	$\frac{1}{4}$	$13\frac{1}{2}$	$13\frac{3}{4}$	896,000	48,384,000	49,280,000	604,800	21,772,800	22,377,600
Paint	8.0	$\frac{3}{8}$	14	$14\frac{3}{8}$	2,688,000	100,352,000	103,040,000	1,814,400	45,158,400	46,972,800
Crandall	4.4	1	$21\frac{1}{2}$	$22\frac{1}{2}$	3,882,666	83,477,319	87,359,985	2,620,800	37,564,794	40,185,594
Ross	6.3	2	27	29	11,200,000	151,200,000	162,400,000	7,560,000	68,040,000	75,600,000
Frazer	6.0	6	$27\frac{1}{2}$	$33\frac{1}{2}$	32,256,000	147,840,000	180,096,000	21,772,800	66,528,000	88,300,800
McGillvray or Lingan	5.0	$7\frac{1}{2}$	28	$35\frac{1}{2}$	34,200,000	125,440,000	159,640,000	23,160,000	56,448,000	79,608,000
Mullins	6.0	12	$29\frac{1}{2}$	$41\frac{1}{2}$	64,512,000	157,692,000	222,204,000	43,545,600	70,961,400	114,507,000
	39.7	$29\frac{1}{8}$	161	$190\frac{1}{8}$	149,534,666	814,385,319	964,019,985	101,078,400	366,473,394	467,551,794
GLACE BAY AREA.										
Hub	8.6	$\frac{1}{2}$	$10\frac{1}{2}$	11	3,808,000	79,968,000	83,776,000	3,570,400	35,985,600	39,556,000
Harbour	5.0	$2\frac{1}{2}$	15	$17\frac{1}{2}$	8,960,000	53,760,000	62,720,000	6,048,000	24,012,000	30,060,000
Back Pit	4.0	7	28	35	24,528,000	98,112,000	122,640,000	16,556,400	44,150,400	60,706,800
Phelan	8.0	11	29	40	78,848,000	207,872,000	286,720,000	53,222,400	93,542,400	146,764,800
Ross or Emery	5.0	13	30	43	58,240,000	134,400,000	192,640,000	39,312,000	60,480,000	99,792,000
Gardner	4.6	24	33	57	96,768,000	133,056,000	229,824,000	65,319,400	59,875,200	125,194,600
	35.0	58	$145\frac{1}{2}$	$203\frac{1}{2}$	271,152,000	707,168,000	978,320,000	184,028,600	318,045,600	502,074,200
COW BAY AREA.										
Blockhouse	8.10	$\frac{1}{2}$	$4\frac{1}{2}$	5	3,957,333	35,615,997	39,573,330	2,671,200	16,027,199	18,698,399
McAulay	5.0	$2\frac{1}{2}$	6	$8\frac{1}{2}$	11,200,000	26,880,000	38,080,000	5,040,000	12,096,000	17,136,000
McRury	4.4	$3\frac{3}{4}$	7	$10\frac{3}{4}$	14,559,997	23,215,996	37,775,993	9,827,999	10,442,198	20,270,197
	18.2	$6\frac{3}{4}$	$17\frac{1}{2}$	$24\frac{1}{4}$	29,717,330	85,711,993	115,429,323	17,539,199	38,565,397	56,104,596

Phelan	8.0	11	29	40						
Ross or Emery	5.0	13	30	43	58,240,000	134,400,000	192,640,000	39,312,000	60,480,000	99,792,000
Gardner	4.6	24	33	57	96,768,000	133,056,000	229,824,000	65,319,400	59,875,200	125,194,600
	35.0	58	145½	203½	271,152,000	707,168,000	978,320,000	184,028,600	318,045,600	502,074,200
COW BAY AREA.										
Blockhouse	8.10	½	4½	5	3,957,333	35,615,997	39,573,330	2,671,200	16,027,199	18,698,399
McAulay	5.0	2½	6	8½	11,200,000	26,880,000	38,080,000	5,040,000	12,096,000	17,136,000
McRury	4.4	3¾	7	10¾	14,559,997	23,215,996	37,775,993	9,827,999	10,442,198	20,270,197
	18.2	6¾	17½	24¼	29,717,330	85,711,993	115,429,323	17,539,199	38,565,397	56,104,596



COAL BANKING TRESTLES.

Banking out trestle. Length, 1,450 ft.; height at end, 40 ft.; width, 16 ft. 4,000 tons have been banked out in one day. Coal is run out with the locomotive and cars as it comes from the collieries. It is then dumped into pockets, and through sliding doors into self-dumping cars of 4 tons capacity, which are run out with horses. The coal is refilled by two steam shovels (one of 1,500 tons per day and one of 1,000 tons per day) into 6-ton cars. These cars run by gravitation roads to the foot of an incline, and are then hoisted on an incline 500 feet long and 43 feet high to the re-screening plant. Then the coal runs over screens with bars 15.0 feet long, 1½ to ¾ inch space for screened coal, and over knocking screens, mechanically driven, 10 feet long by 7 feet wide, with ½ inch mesh, which makes nut and slack coals.

COMPARATIVE ANALYSIS recently made by the People's Heat and Light Co., Halifax:—

	Volatile Matter.	Fixed Carbon.	Ash.
Ordinary Cape Breton coal	36%	59%	5%
Crushed coke from coal	1	90	9

ANALYSIS of washed coal slack, and coke made therefrom by the Nova Scotia Steel Co.:—

	Ash.	Sulphur.
HUB:		
Washed coal	4.37	2.38
Coke	11.20	1.34
PHALEN:		
Washed coal	7.05	2.87
Coke	11.30	2.13
HARBOUR:		
Washed coal	5.50	3.12
Coke	12.80	2.79

THE PICTOU COAL FIELD

In its relation to the other two most important fields of the Province—Cape Breton and Springhill—is much nearer to the latter, and in its general character bears a striking resemblance to it. It lies inland about 12 miles from Pictou harbor, in the county of the same name.

The true or productive area is about 11 miles long, extending almost from Sutherland's river in the east to some distance beyond the Middle river in the west, and in its broadest part, from the town of New Glasgow in the north to a point a mile south-east of the town of Stellarton, is three miles wide, covering an area of about 22 square miles.

In age of discovery the field ranks next to that of Cape Breton, but is contemporary with it in so far as active development of the mines is concerned, for they both became the property of the same great corporation, the General Mining Association of London, in the year 1827; and from that year dates the inception of mining operations on a larger scale than had hitherto obtained.

According to the Rev. Dr. Patterson, historian of the county, coal was first found on a brook near the present town of Stellarton, formerly known as the Albion mines, in 1798, but the main seam was not discovered until some years later. Subsequently a second seam was opened up, and from those two seams—the Main and the Deep—

Banking out trestle. Length, 1,450 ft.; height at end, 40 ft.; width, 16 ft. 4,000 tons have been banked out in one day. Coal is run out with the locomotive and cars as it comes from the collieries. It is then dumped into pockets, and through sliding doors into self-dumping cars of 4 tons capacity, which are run out with horses. The coal is refilled by two steam shovels (one of 1,500 tons per day and one of 1,000 tons per day) into 6-ton cars. These cars run by gravitation roads to the foot of an incline, and are then hoisted on an incline 500 feet long and 43 feet high to the re-screening plant. Then the coal runs over screens with bars 15.0 feet long, 1½ to ¾ inch space for screened coal, and over knocking screens, mechanically driven, 10 feet long by 7 feet wide, with ½ inch mesh, which makes nut and slack coals.

the output of the county was drawn down to the year 1858, when the G. M. A. surrendered, with certain reservations, the exclusive mineral rights of the Province, which had been held by them since 1827. The story of that monopoly has been so often re-told and recorded, that it needs no repetition here.

Little time elapsed, however, before the change in affairs brought about the discovery of valuable seams of coal to the west of the Albion mines, and a few years later a seam was found at the Vale, or eastern end of the field, to be followed shortly afterwards with the finding of others. At odd intervals in several other parts of the field crops of limited extent, owing to the faulted character of the ground, have been traced and some exploratory work done upon them.

Bands of oil shale, of which several are known to exist, were also exploited about the same time, but for many years nothing has been done upon them.

Geologically considered, the field is one of intricate structure, and presents to the student many features of interest and several knotty problems for solution. The remarkable thickness of many of the seams, ranging as high as 40 feet; the great deposits of black and brown shale, and the marked changes that both undergo in comparatively short distances; the heavy and ever-changing dip at which the measures lie, and the faults of greater or less magnitude that traverse the field in many directions, are some of the notable features that afford food for reflection.

Over the larger portion of the field the measures are underlaid conformably by the millstone grit, which is not known to contain any seams of workable thickness, while at other points they come up against the lower carboniferous and rocks of much greater age. Skirting the northern edge of the field is the great bed known as the New Glasgow Conglomerate, the true relation of which to the coal measures was for long a matter of dispute, but is now believed to be the base of a large expanse of Permian strata that stretched from Merigonish in the east to Amherst in the west, and extend many miles northwardly to the waters of the Gulf.

There are three coal producing districts, the Albion or Central—also the oldest in point of discovery—flanked on the west and east by

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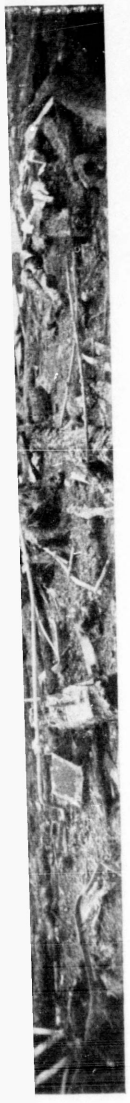
Bank-head Reserve Colliery of the Dominion Coal Co., Limited.

Output in 1899: 555,867 tons.



BANK-HEAD RESERVE COLLIERY OF THE DOMINION COAL CO., LIMITED.
Output in 1899: 555,867 tons.

the Westville and Vale districts, respectively. The Westville division is believed to be the equivalent of the Albion, separated from it by a down-throw fault to the west of some two or three thousand feet, while the Vale syncline appears to lie in an upper series of measures.

Four seams have been worked at the Albion, the Main 38 feet thick, Deep 22 to 40 feet, Third 10 to 13 feet, and the McGregor, 13 to 20 feet thick, all occurring in some 500 feet of strata, and with over 1,000 feet of black and brown shales overlying the main or uppermost seam. Several bands of inferior coal and bituminous shale appear in the seams and undergo changes previously referred to. Other seams are known to exist, but the workable thickness has not been proved, except in the case of the Stellar oil-coal, which was worked about 36 years ago for the sake of its oil and gas-producing properties. The dip of the measures varies from 10 degrees in the eastern end of the syncline to 31 degrees in the western portion approaching the McCulloch brook fault.

In the Westville division one seam only, the Acadia, 20 feet thick, and believed to be the equivalent of the Albion main seam, has been worked extensively, although at the Drummond colliery a second seam 12 feet thick has been exploited. The crops of the other two underlying seams, called the Third and Fourth, and having thicknesses given at six and eight feet respectively, have been proved. These seams all occur in about 380 feet of measures, which vary in dip and change in character in a similar manner to that prevailing in the Albion section.

At the Vale, or eastern end of the field, the order of affairs is transposed, and the thicker and more valuable seams are on the southern outcrop, the lower. Here the McBean, or eight feet, and the overlying six feet seams, with about 800 feet of shales and sandstones intervening, have been extensively worked In the latter seam the floor of the cyncline has been reached, and a peculiarity noticeable is the frequency with which masses of compact shale take the place of coal without any disturbance of roof or pavement.

The coals from the different seams vary somewhat in character and composition, but are of the bituminous coking variety; all are comparatively high in ash and low in sulphur, and an excellent coke

is made from some. They are chiefly in demand for steam raising and domestic purposes, and have been used in a raw state for iron smelting. Some have been used for gas making, yielding as much as 10,450 cubic feet of fifteen candle power per ton in tests made at the Gas Light and Coke Company's works, London, Eng. The slack coal from some of the seams is held in high repute for blacksmith's purposes.

The system of working adopted at the inception of the General Mining Association's operations, and with one or two exceptions practised at the present time, is that known as the bord and pillar. In the original work along the crops of the seams, the size of the pillars was so regulated as to be of only sufficient strength to sustain the weight of the overlying measures during the process of coal-getting in the bords, and in the course of time they collapsed and much coal was lost.

Later, the size was increased with a view to subsequent robbing, and was in a measure successful. In recent years, however, modern methods, despite the physical difficulties of increased depth, higher angle of dip and tenderness of roof metals, have reduced the loss to practically nothing. At two collieries long-wall working has been successfully pursued for some years.

With one exception all the seams are fiery, and require the closest attention in directing the ventilation. Underground furnaces have long since disappeared, and fans of large capacity and modern construction, driven by engines of the most approved type, have taken their place. Safety lamps of the Mueseler, Marsaut, and other patterns, have been in use for many years. And, where the coal is got by blasting, explosives of a flameless character are employed and fired by electricity under the direction of a person appointed for the purpose.

The use of compressed air for haulage and pumping underground is employed at the Westville collieries, and an endless-rope haulage has been installed at Stellarton.

The surface equipment of the collieries is up-to-date in all respects—powerful hoisting engines, water-tube boilers, &c., and the screening appliances of such a character as enable all grades and classes of coals to be properly prepared for market.

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BANK-HEAD DOMINION NO. 1 COLLIERY, DOMINION COAL CO., LIMITED.

BANK-HEAD DOMINION No. 1 COLLIERY, DOMINION COAL CO., LIMITED.

THE CUMBERLAND COAL FIELD,

which is the most westerly of the coal districts of the province, lies, for the most part, adjacent to Chignecto Bay, the more northerly and westerly of the two arms into which the upper part of the Bay of Fundy is divided.

The coal measures outcrop on the shores of Cumberland basin, run eastward into the land for about eighteen miles, and outcrop again before they enter upon the return outcrop, running westward to the seashore. 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 six 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 & Coal Co. is engaged in mining three valuable seams. The seams dipping at angles of from 10 to 35 degrees, 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 long-wall. 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.

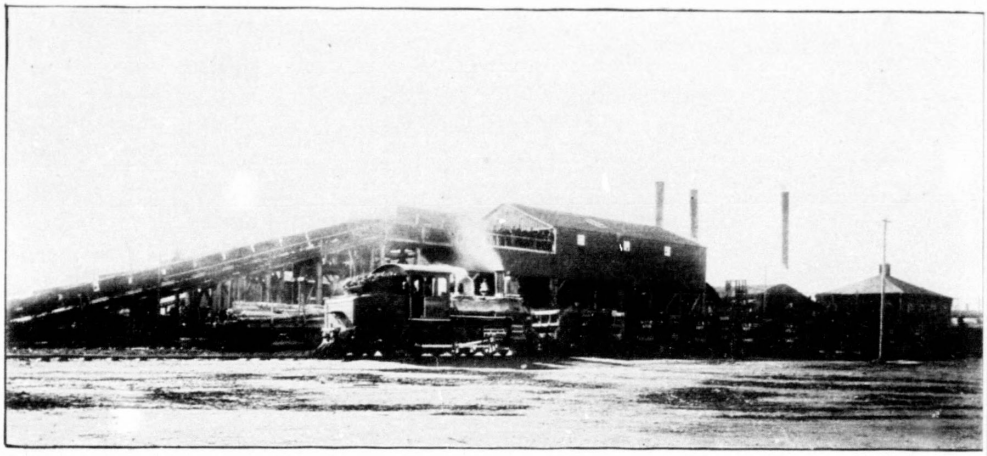
The general composition of the coals of this district is about as follows:—

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

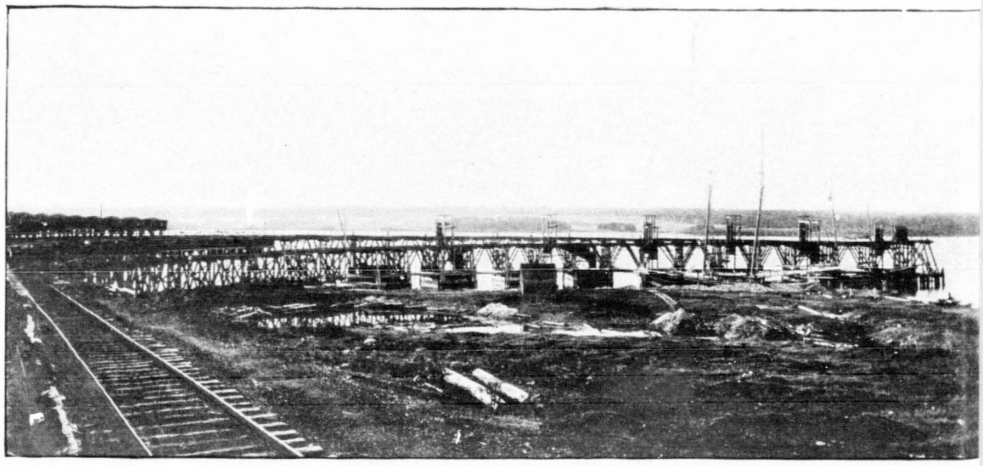
They are very extensensively used as a locomotive fuel and for coke and domestic purposes.

COAL TRADE OF NOVA SCOTIA (FOR THE YEAR ENDED 30TH SEPTEMBER, 1899).

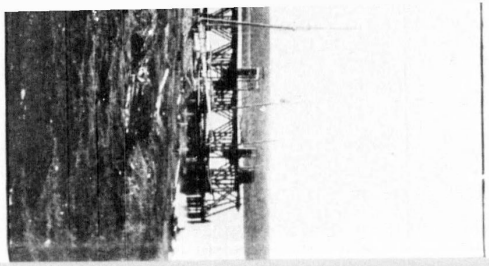
	CUMBERLAND.		PICTOU.		CAPE BRETON.		OTHER COUNTIES.		TOTAL.	
	Raised.	Sold.	Raised.	Sold.	Raised.	Sold.	Raised.	Sold.	Raised.	Sold.
First Quarter	121,146	114,174	117,311	105,285	316,010	301,059	4,418	4,381	558,885	524,899
Second "	114,173	103,642	103,711	85,432	359,464	107,012	975	332	578,323	296,418
Third "	112,635	103,263	117,124	102,774	515,788	482,839	3,192	1,982	748,739	690,858
Fourth "	89,167	85,199	122,090	116,357	540,136	700,673	4,993	4,733	756,386	906 962
Total.....	437,121	406,278	460,236	409,848	1,731,398	1,591,583	13,578	11,428	2,642,333	2,419,137



Intercolonial Coal Co., Limited, Westville, N. S.
Tipple and Mouth of Slopes, Drummond Colliery.



Intercolonial Coal Co., Limited, Westville, N. S.
Shipping Pier, Granton, from the Railway, Drummond Colliery.



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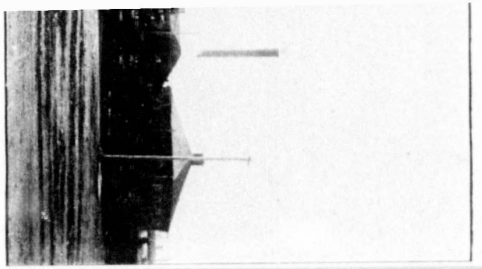

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Coal Trade by Districts for the Year ended September 30, 1899.

Sold to	Cumberland.	Pictou.	Cape Breton.	Other.	Total.
Nova Scotia :—By Land	116,328	198,793	16,942	4,744	336,807
" By Sea	.....	40,873	349,079	2,718	392,670
Total N. S.	116,328	239,666	366,021	7,462	729,477
New Brunswick	229,961	42,901	54,527	115	327,504
Newfoundland	.....	131	106,591	33	106,755
P. E. Island	.....	40,604	24,273	2,004	66,881
Quebec	44,577	80,502	902,395	1,814	1,029,288
West Indies	.....	6,044	.....	.....	6,044
United States	15,412	.....	137,776	.....	153,188
Other Countries	.....	.....	.....	.....	.....
Total	406,278	409,848	1,591,583	11,428	2,419,137

COAL COMPANIES.

The following are the principal companies producing coal in the Province:—

Dominion Coal Co , Ltd.,	Cape Breton.
General Mining Assn., Ltd.	"
Port Hood Coal Co., Ltd.	"
Gowrie & Blockhouse Colliery Co., Ltd.	"
Cape Breton Coal Co., Ltd.	"
Sydney Coal Co., Ltd.	"
Acadia Coal Co., Ltd.,	Pictou County.
Intercolonial Coal Co., Ltd.	"
Cumberland Ry. & Coal Co., Ltd.,	Cumberland County.
Canada Coals & Ry. Co., Ltd.	" "

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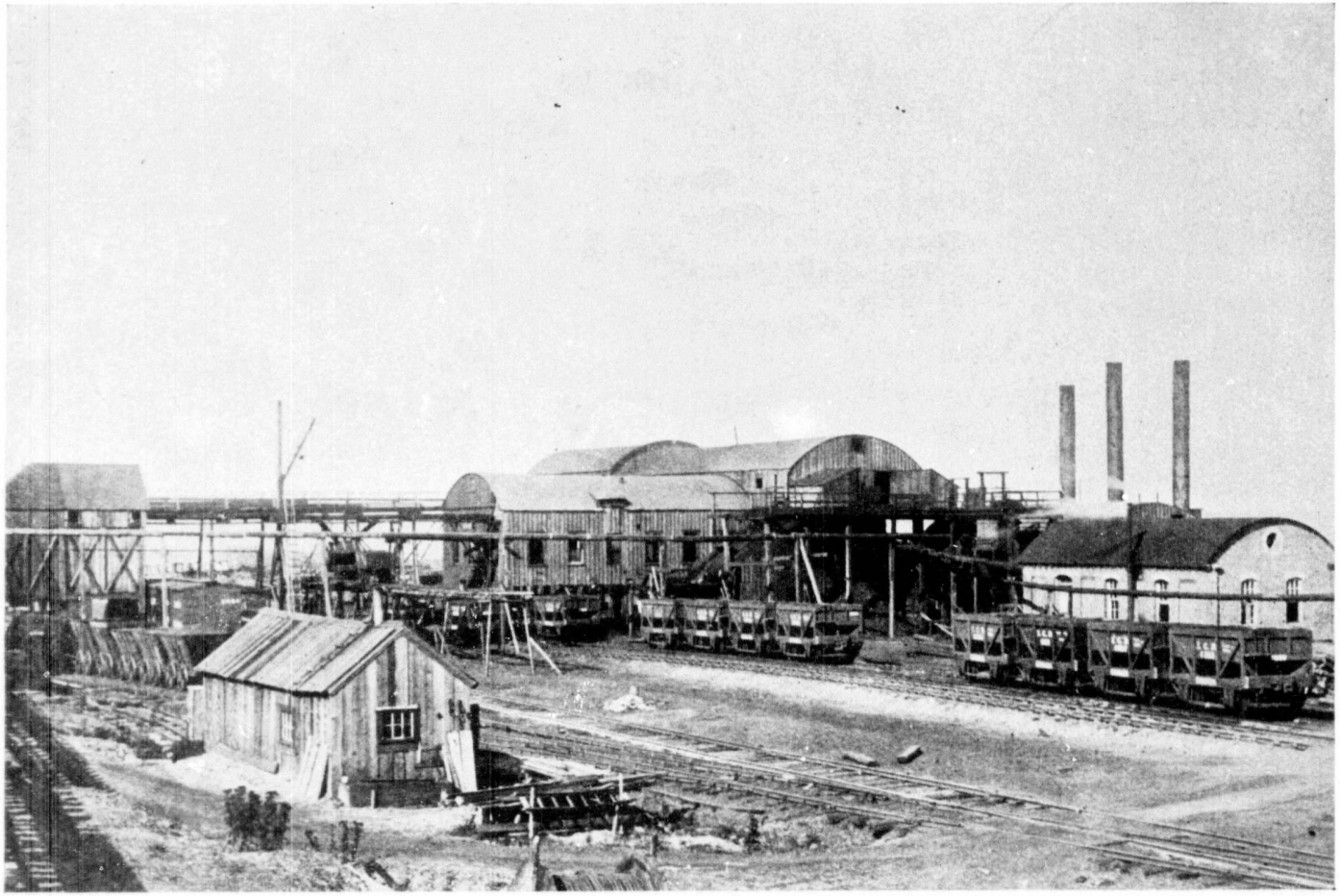

ACADIA COAL CO., LIMITED, STELLARTON, NOVA SCOTIA.

Seam of 10 ft. worked; dip averages 27 deg.; slope, 3,900 ft. Average output about 300,000 tons per annum.

ACADIA COAL CO., LIMITED, STELLARTON, NOVA SCOTIA.

Seam of 10 ft. worked; dip averages 27 deg.; slope, 3,900 ft. Average output about 300,000 tons per annum.

GOLD MINING IN NOVA SCOTIA.

The first discovery of gold in Nova Scotia was made at Tangier in 1860; but as an industry gold mining may be said to date from 1862, when most of the older districts were proclaimed by the government, a "Chief Gold Commissioner" was appointed, and laws were framed governing the acquisition and working of gold-bearing lands.

During that year several quartz-crushing mills (some 30 in number) were built, of types varying from the arrastra, and its offspring, the Chilian mill, to the stamp batteries of that date. No royalties, however, were collected by the government until the year following.

From the year 1862 dates also the wild excitement consequent upon the inception of mining work in many and distant sections of the province; an excitement which was in part due to the richness of the gold streaks which were found cropping to the surface; in part due to the schemes of both English and American speculators, and also in part due to the greatly exaggerated idea of the value of the fields thus discovered.

This excitement culminated in 1867 and 1868, when the inevitable leaner or poorer portions of the lodes began to predominate, and when shareholders began to realize that their extravagant expectations of dividends were doomed to disappointment.

The reaction was natural and inevitable when the mines were managed by men not trained to mining, and entirely unfamiliar with the business. Large losses occurred in milling, and the peculations of the workmen at that time were not inconsiderable. Thus, when these lower grade spots were encountered profits temporarily ceased, there being no development of the veins ahead, and consequently no body of reserves to fall back upon, and, but too often, no treasury fund to pay for development work. Of course, primarily, the cause of all this was the incapacity and inexperience of the then managing men, but another reason contributed largely to the same effect, and that was the idea (promulgated, it is said, by a Mr. Thomas Belt) that no lode would be found to be auriferous below depths varying from 100 to

200 feet. This notion seems to have been borrowed or transplanted from Australia, where the same idea was prevalent from 1865 to 1875. The notion is so absurd as to need no refutation.

There followed a period of general depression, and amongst capitalists, a great distrust of Nova Scotia gold properties. From 1871 to 1882, the production and the number of men employed fell off greatly, in some years to the extent of more than one-half. During this period of ten years the production was maintained chiefly by the discovery of new districts and the finding of one or two rich veins in some of the older districts. Unfortunately, however, experience had not taught wisdom, and these later discoveries were worked in the same systemless manner that the earlier mines had been, and of course with the same results. No mine being opened in a systematic manner, so soon as its rich quartz was all extracted from the surface workings it was declared "worked out" and was abandoned.

In 1883 and 1884, however, several attempts were made by men of experience and training in other countries to re-open and work some mines which had been idle and filled with water for ten or fifteen years. These attempts were successful and from the year 1885 dates a new era, or epoch, in the gold mining industry of Nova Scotia. In that year the annual production exceeded the average annual production by 7,000 ounces, and in 1889 the production was nearly 10,000 ounces in excess of the average annual production of that date. In 1890 the production was about 8,000 ounces in excess of the average, and the number of tons of stone crushed was the highest in the history of the industry.

The years since 1885 have been marked by the successful opening of old and previously abandoned mines in nearly all the older districts in the province; by the introduction of modern mining and milling machinery, and by greatly improved systematic and scientific methods of mining and exploitation. To develop your mine is now considered the "correct and necessary thing," but the writer well remembers being laughed at in 1884 by one of the "old timers" when he intimated his intention of opening up a mine by sinking, driving levels and opening up for backs and reserves. And last, though by no means least, this period has been marked by a partial disappear-

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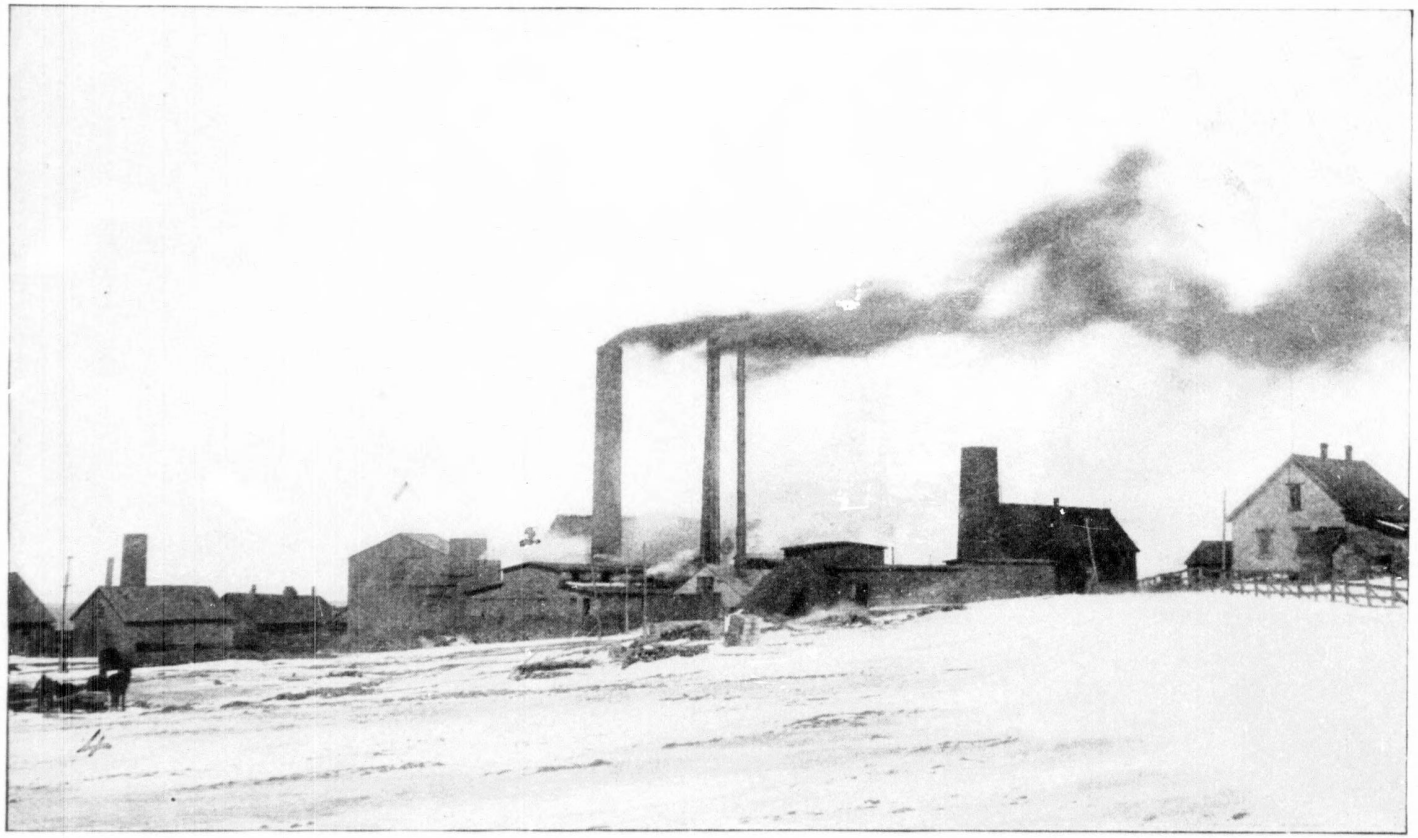

CUMBERLAND RAILWAY AND COAL CO.—No. I. SLOPE, SPRINGHILL, N.S.

ance of distrust amongst capitalists, and by the attraction of foreign capital to our gold fields as being ventures in which money can be profitably invested.

In most cases this investment has proved profitable, but in one or two cases, which derive prominence from their rarity, money has been paid for properties which were valueless from the start, or a management has been appointed whose incompetency doomed the enterprise to failure from the beginning, or the money for development has been squandered in huge surface plants and high salaried officials.

In almost every case where ordinary business prudence has been exercised in the selection of a property, or in the choice of a manager, success has been the result, and not failure.

During 1893 and 1894 an impetus was given to the industry by the working, in several places, of large bodies of low grade ore. Several deposits yielding from three dollars to seven dollars per ton, were exploited and equipped with modern machinery, and each of them has prospered, having earned dividends for the companies owning them.

In many places these properties have been equipped with plants that will stand comparison, for effectiveness and economy, with those of any other gold-producing country of the world, and it is not going too far to say that the working of such properties so equipped cannot fail to remove the impression which has been so prevalent in other countries that Nova Scotia had "only narrow veins of high grade but uncertain rock."

The gold-bearing quartz lodes of Nova Scotia occur in the Cambrian or Cambro-Silurian measures, and belong chiefly to the class of "bedded veins," or perhaps are ore deposits along bedding planes, being conformable throughout with the beds of quartzite and slate with which they are interstratified, but not contemporaneous. As to whether these deposits are segregations from the enclosing silicious rocks, having formed in those openings between successive strata which have accompanied the lines of least resistance in folding, is a question better left to professional geologists. Two other classes of auriferous deposits are more seldom met with: (1) "Fissure" veins, so called, being in some cases true fault fissures subsequently filled in,

but more frequently being deposits filling crevices which were caused by secondary disturbances; (2) intercalated or "gash" veins of local origin and extent.

By far the greater bulk of the gold produced has hitherto come from the regular or "bedded" lodes. Sometimes these bedded deposits take the form of large interstratified belts of bluish fissile slate in which occur intercalated veins of quartz, thus forming large bodies of low-grade ore upon which, in the opinion of the writer, the future of the industry will ultimately depend. The districts of Goldenville, Beaver Dam and Mount Uniacke afford the best example of this class of deposits. In Mount Uniacke, a successful working of one of these deposits has been commenced, and the more promising district of Goldenville has witnessed a revival during 1896.

In the working of these extensive deposits mining departs from the speculative phase and assumes that of a legitimate business, as witness the continuous and successful workings of the "Great Belt" in the Black Hills of South Dakota, more familiarly known as the "Homestake" mines, which for many years have been steady dividend paying properties.

The large bodies of auriferous rock in this Province, like the "Palmerston" at Goldenville, are very similar in character to the Black Hills deposits, and offer equal inducements for successful working.

The regular lodes vary, as a rule, from 2 in. to 30 in. in width, instances occurring where the lodes thin down to a fraction of an inch, or swell to 26 feet wide, as notably in the Dufferin lode on Salmon river. The average width of the quartz may be taken as from 6 to 12 in. in the narrow veins, and the width of the milling stone in the low-grade deposits at from 4 to 10 ft.

The richness of these lodes varies as much as their width does, running from $3 to $16 per ton.*

Upon lodes of such variable width and nature the cost of production will, of course, also vary widely; but as a general guide it may be

* The year 1891 was remarkable for high yields. South Uniacke returned many lots of 10 ounces to 30 ounces to the ton, and Oldham surpassed its previous records with a yield of 643 ounces from eight tons of quartz.

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ACADIA COAL CO., LIMITED, STELLARTON, N. S.

stated that a lode 12 in. wide, yielding $10 to the ton, pays well to work.

During 1894, 1895 and 1896 several mines, working veins from 1 ft. to 7 ft. wide, produced and milled their quartz for prices varying from $2.27 to $3.58 per ton.†

In Stormont district one mine, having a lode varying from 2 ft. to 22 ft. in thickness, but averaging from 7 to 10 ft., is meeting all its expenses and paying a dividend on three dollar rock. In Waverley district another mine, whose vein averages only 12 in. in width, pays all expenses with rock that yields $4 per ton. Both of these properties are obliged to burn coal for fuel, which is a heavy item in the cost accounts.

There are at the present time over thirty-five localities in the Province in which workable deposits of gold have been found, and from three thousand to four thousand persons are dependent to a great extent, or entirely, upon the industry. The area of gold measures in Nova Scotia has been estimated by various authorities to be from 5,000 to 7,000 square miles, or from one-fifth to one-third the area of the Province, yet the actual area from which the gold thus far obtained has been won is less than 40 square miles

The mining laws of Nova Scotia are, in the main, good, and are yearly being amended for the better. Their essential features are:

1. All mines of gold and silver are the property of the Crown, from which titles or leases are obtained for working the same; all gold obtained is subject to a royalty of two per centum, or thirty-eight cents for each ounce of smelted gold.

2. Lands containing gold or silver are laid off in areas measuring 150 ft. by 250 ft., the lesser length being along the course of the lodes, and a lease can be obtained for any number of areas in any such one lease up to one hundred.

3. Such a lease runs for forty years, and costs the applicant $2 for each and every area contained therein. Upon each such lease in each year there must be performed a certain number of days' work, or as an equivalent, the lessee is given the option of paying annually 50 cents for each area therein contained; such labor being performed or

† See Transactions Mining Society of Nova Scotia, Volume III.

such annual payment being made, the lease is non-forfeitable. At a time prior to the expiration of said forty years the holder of the le can surrender it and obtain a new lease for a second period of fo years. Such a lease is deemed personal property and is transferabl

4. Where such areas are situate upon private lands the l requires that an agreement must be made with the owner of the for leave to enter, and if such an agreement cannot be made, a meth of arbitration is provided whereby damages may be assessed, paid and leave to enter given to the owner of the lease.

Examination into the history of any mineral industry will sh that such industry has only reached its full development and high point through a complete knowledge of the methods and proces peculiar to that industry, and applying this standard to the gold min industry of Nova Scotia, one is warranted in saying that its outl was never more promising There is to-day a greater amount of p fessional knowledge and technical skill engaged in gold mining h than ever before. The lodes are being worked with ability, with t wise economy which avails itself of every known device to save la and cost, and also with the introduction into everyday matters of t business methods. It must not be forgotten that a gold mine manufactory of gold which must be conducted, even to its minu details, with the most jealous regard to economy in all departments

The easy means of access to the Province, and consequent c veniences of personal examination, the low cost of working, the che ness of labor, fuel and supplies, the probable permanent nature of deposits, as inferred from their geological structure, are all good sufficient reasons why capital should seek investment in the g mines of this Province.

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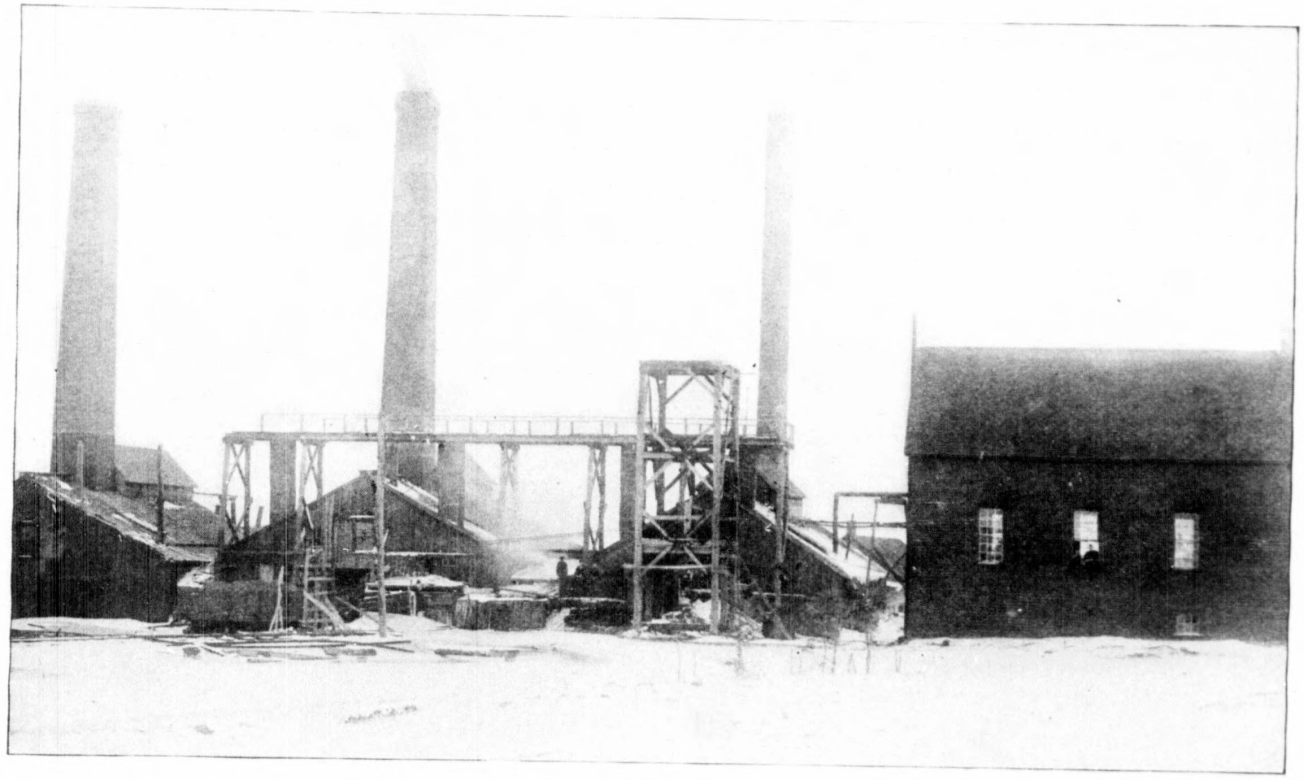

CUMBERLAND RAILWAY AND COAL CO.—NO. II. SLOPE, SPRINGHILL, N.S.

GOLD PRODUCTION BY DISTRICTS FROM 1862 TO 1899.

DISTRICT.	Tons Crushed.	Total Yield of Gold.			Average Yield per ton.			Value @ $19 per Oz.
		Oz.	Dwts.	Grs.	Oz.	Dwts.	Grs.	
Caribou and Moose River	116,152	40,180	19	19	..	6	22	$763,438 81
Montague	25,504	40,125	7	7	1	11	11	762,381 93
Oldham	46,724	51,002	4	4	1	1	18	969,041 96
Renfrew	48,142	33,869	8	2	..	14	2	643,518 68
Sherbrooke	208,458	133,643	4	..	..	12	19	2,539,220 80
Stormont	147,932	58,799	18	3	..	7	22	1,117,198 22
Tangier	46,398	22,534	12	10	.	9	17	428,157 80
Uniacke	54,325	38,447	16	7	..	14	3	730,508 48
Waverley	122,528	61,427	2	1	..	10	..	1,167,114 94
Salmon River	108,350	40,459	11	20	..	7	11	768,732 25
Brookfield	34,684	18,372	1	9	.	10	14	349,069 31
Whiteburn	6,343	9,535	15	18	1	10	1	181,179 97
Lake Catcha	22,267	23,832	14	23	1	1	9	452,822 22
Rawdon	12,178	9,594	15	10	.	15	18	182,300 65
Wine Harbor	45,379	24,783	11	2	..	10	22	470,887 53
Fifteen Mile Stream	32,893	16,226	15	5	..	9	22	308,308 45
Malaga	20,243	18,496	0	8	.	18	6	351,424 32
Other Districts	66,290	46,149	17	16	..	13	22	876,847 79
Total	1,164,790	687,481	15	20	..	..	..	$13,062,154 11

NOVA SCOTIA LEAD ORES.

By Dr. E. Gilpin, Inspector of Mines.

As yet little has been effected in the development of the or this metal in Nova Scotia. They occur principally in two geolo horizons, the lower carboniferous or mountain limestone, and the cambrian or laurentian. As the former horizon in other countrie yielded productive deposits of galena, some attention has been to it here in this respect. Observation has shown that at many l ities lead ore is more or less distributed through the limest Among the places showing it may be mentioned the East and Rivers of Pictou County; Gay's River and Musquodoboit, Ha County; Smithfield and Pembroke, Colchester County; Milford Ha Caledonia, and Salmon River, in Guysboro County; and nume points in Cape Breton Island. At Gay's River it occurs over a l tract of country, in limestone, disseminated in small crystals, in s nodules and occasionally in thin veins. The average percenta any place is small, and carries, I believe, up to 15 ounces of silv the ton of lead. At Smithfield and Pembroke it occurs in gr quantity, and a considerable amount of exploratory work has done. Here it is found in limestone also, apparently replacing part, and as a residual concentration from the removal of the roc very considerable amount of lead ore has been shown here at point, but as the silver contents of the ore were not high, the low prices discouraged prospecting. It is, however, evident that in district there are wide-spread and promising galena ores, which much more attention than has yet been paid to them. In Musqu boit, near the Crawford Settlement, pockets of ore in the granite yielded lead carrying large amounts of silver.

At Caledonia, small veins of lead ore have received occas attention. The ore is essentially galena, carrying from 15 to 18 ou of silver to the ton.

Galena also occurs in considerable amount near Arichat, I mond County, and on the head waters of the Gold and La H

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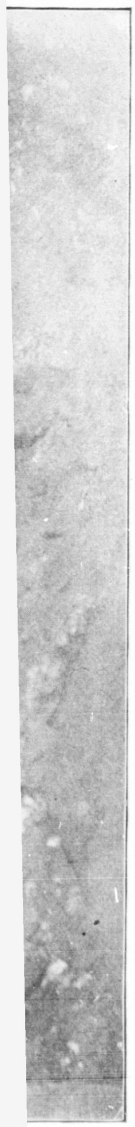
RICHARDSON GOLD MINING CO.—Face East Tunnel; width 20 feet.



RICHARDSON GOLD MINING CO.—Face East Tunnel; width 20 feet.

Rivers to the west of Halifax. The latter ores carried in some cases as much as 100 ounces of silver to the ton of lead, but, as far as I am aware, no attention has been directed to them. These ores are presumably in the precarboniferous rocks. On the Salmon River, and near Sydney, in the county of Cape Breton, galena also occurs in limestone, at the former place in considerable amount. Near Burnt and Boulacet Harbors, on the Bras d'Or Lake, are quartz veins carrying galena, copper pyrites, etc. Samples have shown 18½ ounces of gold and 97 ounces of silver to the ton. The adjoining rocks are in places heavily mineralized. On the North and Barasois Rivers of St. Ann's, in the county of Victoria, and several other places in this locality, in pre-cambriam rocks, are veins of quartz and zones of rock showing galena with copper pyrites, blende, etc. A sample of 900 lbs. of ore from McDonald's farm, one mile north of the bridge over the North River, yielded 155 lbs. of lead and 3 oz. of silver.

The most promising deposit of silver lead ore yet found is being developed at L'Abime Brook, Cheticamp, Inverness County, by S. M. Brookfield, of Halifax, and his associates. The ore occurs as a vein in the pre-cambrian felsites, etc., and has been traced for several hundred feet, and where opened shows twenty feet of very high grade galena carrying a little copper pyrites.

Mr. Mason, of Halifax, states that, from assays made by him and by others, the ore carries an average of one ounce of silver to each unit of lead. Gold also occurs in some assays as high as 14 dwts. per ton, but it does not appear to be a regular constituent.

From his examination of the openings he considers that 50 tons of ore contain 5 tons of galena, and 1,500 lbs. of copper pyrites. This would yield, allowing for loss in dressing and smelting 3 tons, 1,200 lbs. of lead, and 360 ounces of silver, in addition to the copper. These figures, coupled with the accessibility of the mine, etc., etc., and the duty on lead, would indicate very promising results. Other deposits of galena are reported in the same district, but as yet little work has been done on them. Galena ores occur northerly from the Cheticamp River, to beyond the McKenzie River, and native silver and carbonate of silver occur in the valley of the latter river and its tributaries. It is probable that the opening of the Cheticamp mine will

lead to a careful prospecting of this district, and it is, I feel sure, fr
information that I have gathered for some years, one of the m
promising localities in the province.

From these remarks it will be seen that the lead ores of the p
vince are widely scattered, and have hitherto received little attenti
It is very probable that the lower carboniferous limestones, which co
a great extent of country, may reasonably be expected to affo
workable deposits at favorable points; for instance, in proximity
intrusive rocks of later date, or wherever they appear to have been
a position favorable to the concentration, aggregation, or deposition
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RICHARDSON GOLD MINING CO.—40 STAMP MILL AT COUNTRY HARBOR, N.S.

The cost of mining and milling are about $1.60 per ton, including all charges. The owners have realized handsomely on their investment.

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NOVA SCOTIA COPPER ORES.

By Dr. E. Gilpin, Inspector of Mines.

The remarks I have made about the lead ores of this province apply in a general manner to those of copper. The metal occurs frequently, in the metallic form, in veins and joints in the Triassic trap range running along the south shore of the Bay of Fundy, and in the isolated masses of the same mineral on the opposite side of the bay. It also occurs in a similar manner in the consolidated ash accompanying the trap, and has been observed in the sandstones of the district, which are referred to the same geological horizon. As yet none of the deposits have, from the superficial tests hitherto made, appeared to be of permanent value. In some localities it is observed disseminated in the rock, and all such occurrences should be carefully tested. It is well known that in the Lake Superior district very small percentages of copper have yielded rich returns to the systematic and economical systems of mining and milling. It is true that the two districts differ widely from a geological point of view, but as both yield metallic copper in masses, etc., it does not appear unreasonable to expect, that here as at Lake Superior, it may be found in some localities, scattered in fine grains in the trap, in quantity sufficient to allow of its profitable extraction. Copper also occurs native in the Lochaber district, in Antigonish County, and at Cheticamp, Inverness County.

The carboniferous strata of Cumberland, Pictou, Colchester, Antigonish, and other counties, frequently show outcrops of nests and layers of vitreous sulphuret and green carbonate of copper, sometimes associated with coaly matter. Prospecting has shown these outcrops at Maccan, Wallace River, Pugwash, Tatamagouche, Athol, Oxford, River John, Salmon River, Caribou, Durham, and Waugh's River, in the counties of Cumberland, Colchester and Pictou. A few attempts have been made to work these deposits, but the ore although rich is variable and irregular in its occurrence, and work has been abandoned after the extraction of a few tons. A good deal of work has been done during the past two years on some defined beds of sandstone and

shale, more or less uniformly impregnated with these and other ores of copper. Among these localities so tested may be named Doherty Creek, River Philip, Malagash Point, Fox Harbor, Gulf Shore, New Annan, Wentworth, and Henderson's Settlement in Cumberland County. The ores are also present at some points in beds of clay resting on cupriferous sandstones, etc. Working samples are reported to have yielded as high as 18 per cent. of copper, with in some cases small amounts of gold and silver. It is understood that the work of testing these deposits will be continued, as the parties interested have so far been much encouraged by the results. The numerous outcrops of the ores over so wide a tract of country warrant much more attention than has hitherto been paid to them.

At East Dalhousie, in King's County, there are numerous shows of copper ore, which have hitherto been almost unnoticed. Copper pyrites occurs at Blandford, Lunenburg County, and at several points in Queens and Yarmouth Counties, and is commonly present, in small amounts, in the auriferous quartz veins of our gold fields.

The district extending from the head waters of the East River of Pictou, along the county line, to Polson's Lake, in Antigonish County, has yielded numerous indications of the presence of copper ores.

At the head waters of the East River specimens of copper ore occur with a gangue of carbonate of iron, but no attempt has been made to search for their source. In the vicinity of the Garden of Eden, there are veins of spathic iron ore, up to several feet in thickness, holding crystals of copper pyrites.

At Lochaber there are a number of veins carrying copper pyrites, and associated with diorite dykes. These veins have been prospected a little, and are apparently valuable, as the copper contents in the case of the largest vein, about six feet thick, were returned from large average samples at 19 per cent. From this point the cupriferous belt has been traced about four miles to Polson's Lake. Here the presence of large, rich boulders instigated desultory prospecting for a number of years. Finally a vein of spathic ore, holding copper pyrites, was found in the year 1875, and traced several hundred feet. Its width, as proved by several shallow pits, varied from 6 to 11 feet. Large average samples yielded from 5.6 to 11.7 per cent. of copper. The

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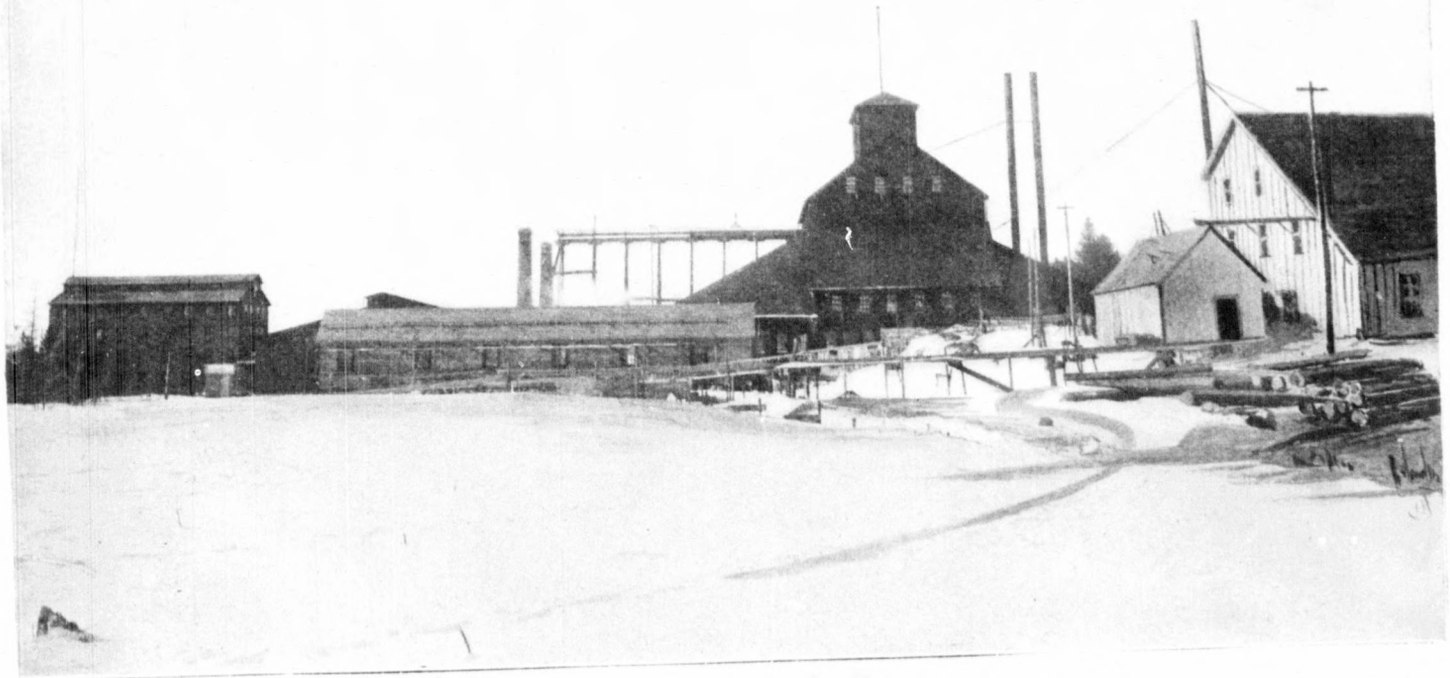

BROOKFIELD GOLD MINING CO., NORTH BROOKFIELD, N.S.

Since this property was acquired by the present owners (a little over five years) there have been extracted about 45,500 tons, which has yielded up to May, 1900, about $381,000.

distance of this district from a railroad and a shipping point, has apparently postponed indefinitely its development, although it is probably well worth the cost of a railroad. On the Salmon River, in Guysboro County, some veins were tested a number of years ago, containing copper pyrites and erubescite, and yielding as high as 39 per cent. of copper. The age of the rocks holding these deposits in Pictou, Antigonish and Guysboro Counties, is, I believe, determined as Devonian, and is in favor of their richness and permanence.

At Ohio, St. Joseph, Brierly Brook, and other points in Antigonish County, deposits of copper ore occur at the junction of carboniferous with older rocks. A little prospecting has shown small veins of rich ore, but as yet enough work has not been done to enable a correct idea to be formed of their extent.

The reports of Mr. Fletcher, of the Canadian Geological Survey, on the Island of Cape Breton, contain frequent references to copper ores. The following places may be mentioned: Benacadie, White Granite Hills, Gillis Brook, Spruce Brook, Irish Cove, East Bay, Washaback, Middle and North Rivers, French road, Gillis Lake road, Mira, Cape North, etc.

At Washaback, the ores yielded, in addition to the copper, gold up to about one ounce to the ton. At Eagle Head, in Gabarus Bay, Cape Breton County, several shafts have been sunk showing quite large beds, carrying mixtures of copper pyrites with other ores. Those acquainted with the operations consider that the deposits are well worth further examination.

At Cheticamp, Inverness County, there are numerous signs of copper deposits, and occasionally attempts have been made on a small scale to determine their value. This district shows copper ores over so large an extent of grouud, that it is probable that this metal will be found present in workable amounts, as well as the lead already referred to. At George's River, near North Sydney, a little prospecting has been done on a very promising outcrop. On the Coxheath Mountains, a few miles to the south, a quite extensive development has shown the presence of several leads carrying copper pyrites, with some silver, from 3 to 12 feet thick. The copper contents of these beds vary from 3 to 10 per cent. from extraction of large lots. The shafts and levels have yielded several thousands of tons of good ore. Several causes,

including financial ones as well as the low prices of copper, have retarded the development of this property; but as the outlook is now encouraging, arrangements are being made for working it.

In the Island of Cape Breton the copper ores occur in the pre-cambrian felsites, etc., at Gabarus, Coxheath, George's River, Cheticamp, etc., and are found also in carboniferous strata.

These brief remarks on the occurrence of copper ores in Nova Scotia will show that they are very widespread. They have as yet received almost no systematic examination, and local capital has preferred to venture in better known channels. It may, however, be justly claimed that the province presents, in several districts, unusually promising deposits, and that in better known and richer communities they would before this have supported at least several profitable mines.

OTHER MINERAL RESOURCES.

In compliance with your instructions I will not in this report proceed to consider the coal, iron ore, gypsum and other minerals found and worked in Nova Scotia. It may, however, be appropriately remarked that an extensive development has been reached in the various coal fields, assuring the miner and metallurgist ample supplies of coal and coke for their operations. The iron ores are being worked, smelted, and converted into steel. The gypsum deposits are extensively worked. The quarries yield supplies of the best varieties of building stones, of limestone, marble, freestone, etc.

There are in addition mines of barytes, manganese, etc. In short the province, in proportion to its size, has been furnished by nature with an unusual and abundant variety of useful minerals; which it is regretted, have in many cases been allowed to remain undeveloped. Lumbering, fishing, and, until a few years ago, ship building and freighting, have absorbed the energies of local capitalists, and little attempt has been made to interest outside capital in any of our mines except those of gold and coal. The field, however, for mineral investment in the province is being recognized as in many respects superior to that of other countries which have hitherto received so much attention from foreign investors, and the indications are that a short time will see the enquiries and investments of the past few years largely exceeded.

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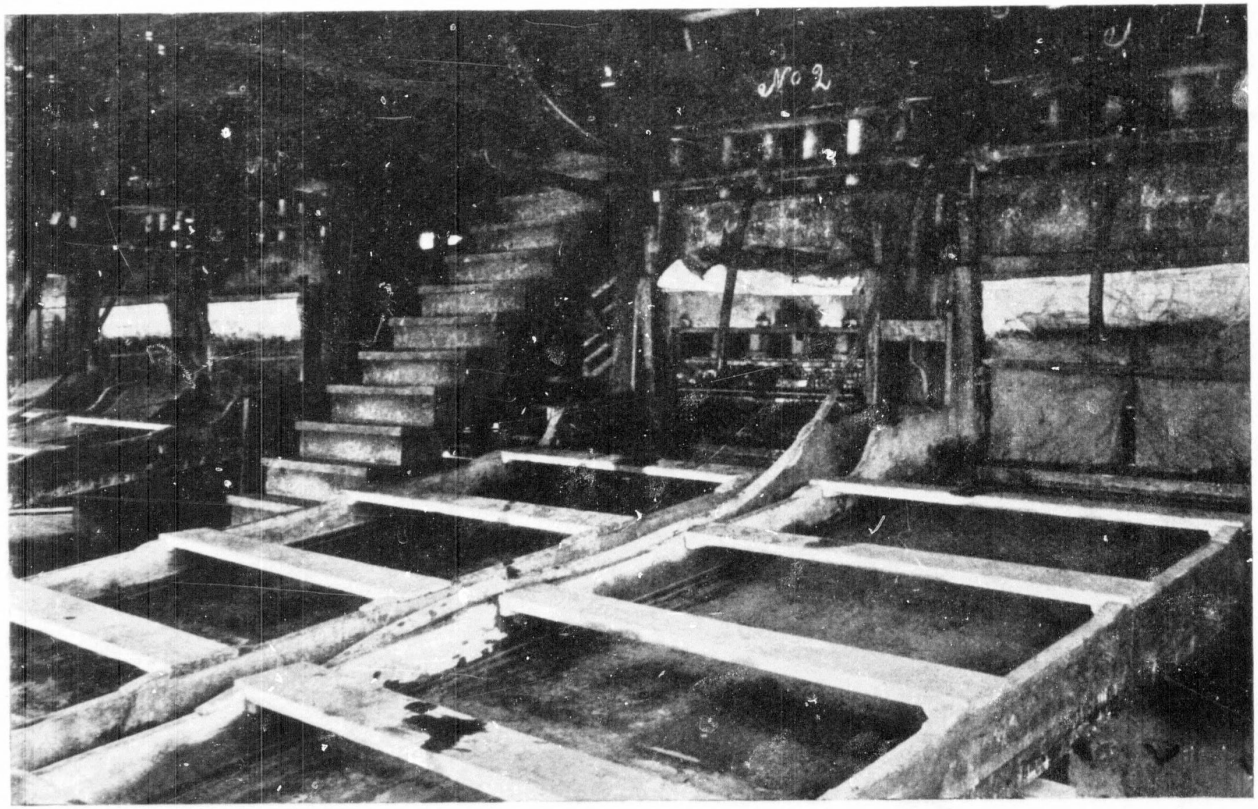

Batteries and 14-foot Plates—Brookfield Mining Co., North Brookfield, Nova Scotia.

Batteries and 14-foot Plates—Brookfield Mining Co., North Brookfield, Nova Scotia.

THE GOLD MEASURES OF NOVA SCOTIA AND DEEP MINING.

From a Paper read by Mr. E. R. Faribault, B.A.Sc., before the Canadian Mining Institute.

The gold measures of Nova Scotia became known about the year 1860. The earliest discovery was followed by so many others, that it was believed that the whole of the province was auriferous. Gradually, however, it became evident that the workable deposits of free gold were confined to the metamorphic rocks of the Atlantic coast, along which they form a continuous belt, from one end of the province to the other, a distance of some 260 miles, varying in width from 10 to 75 miles.

They cover about half the superficies of the province, exclusive of Cape Breton Island, and their extent may be roughly estimated at 8,500 square miles. Of this area, probably 3,500 square miles are occupied by granitic masses, barren of gold, leaving an area of about 5,0 square miles of gold measures.

The granite intersects the stratified gold-bearing rocks, in many places, in large masses or dykes, but for the most part it forms a prominent ridge, almost unbroken, from one end of the province to the other. Its intrusion took place at the close of the Silurian period, probably about Oriskany, and was accompanied and followed by disturbances, faults and much local metamorphism of the stratified rocks. It occurred after the folding of the gold measures and the deposition of the quartz veins; for granite dykes and veins have been observed to always cut the interstratified quartz veins wherever they come in contact with them. The granite has thus no relation to the auriferous character of the veins, and need not again be referred to.

Although no well defined fossils have so far been found in the sedimentary rocks constituting the gold measures, most geologists agree to classify them, provisionally, as Lower Cambrian.

They certainly, in many respects, resemble the auriferous Cambrian of the Eastern Townships of Quebec, and knowledge gained in the

Nova Scotia gold-fields may prove of the greatest practical importance in prospecting for veins below the alluvial deposits of Quebec.

The gold-measures of Nova Scotia fall naturally into two well deffned and distinct groups, viz., a lower or "quartzite group" and an upper or "slate group."

The mapping of the eastern part of the province by the Geological Survey, places the thickness of the quartzite group, as far as denudation has exposed these rocks to view, at about three miles, and the thickness of the upper or slate group at about two miles, giving a total known thickness of strata of over five miles.

The lower division or quartzite group is mostly composed of thick-bedded, bluish and greenish grey felspathic quartzite, locally named by miners "whin," a term used in Scotland for an igneous rock or greenstone. Interstratified with the quartzite are numerous bands of slates, of different varieties and colors, from a fraction of a foot to several feet in thickness. The upper division or slate group is mostly composed, east of Halifax, of bluish-black slate, often graphitic and pyritous, rusty-weathering, with occasional layers of flinty quartzose rock. The lower part of this group is characterized by greenish, argillaceous and chloritic, soft slate, of but little thickness at the east end of the province, but increasing to a great thickness at the west end. A few layers of magnesian, siliceous limestone have also been noticed at different places, at the base of the group, overlying conformably the quartzite of the lower division. The line of division between the two groups is thus well defined by characteristic bands, which form valuable data to work out the sequence and structure of these rocks, at any point, with certainty.

The beds of quartzite and slate, forming the gold-measures, were originally deposited in the sea, and therefore horizontally. These horizontal beds were then subjected, during a long period of time, to forces that have produced prodigious results. A close study of the present structure of these rocks shows that they have been slowly moved by a powerful and uniform pressure, which has folded them into a series of huge, sharp undulations, roughly parallel with the sea coast. They have indeed been buckled, bent and folded to such a degree that they occupy only one-half of their former width, measured at right angles to the strike.

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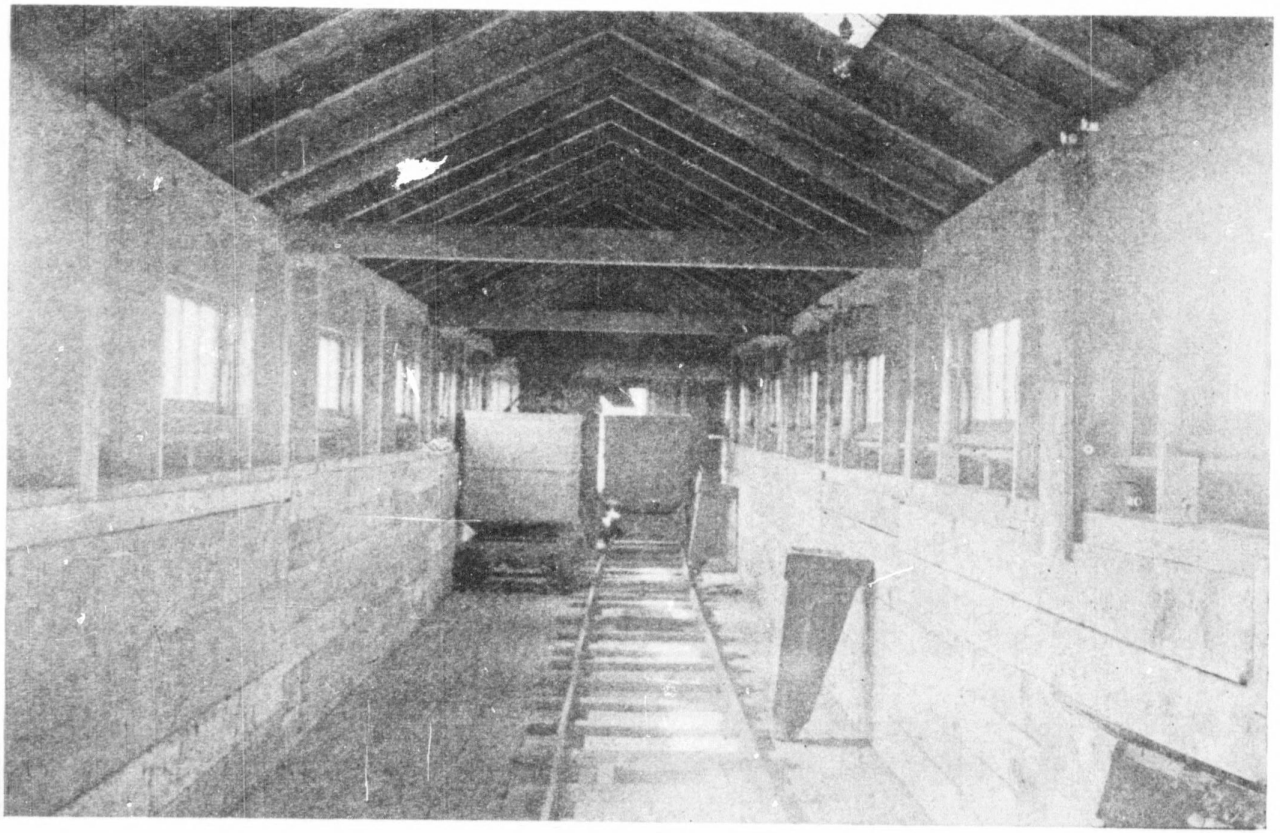


Elevated Floor for Roasted Concentrates.—Brookfield Chlorination Works, Nova Scotia.

Since these rocks were deposited and folded they have been under the unceasing influences that tend to level the hills and fill up the valleys, and, at more recent date, the greater part of the surface was subject to glacial erosion. Extensive denudation has worn away the folded measures to the present level. Some of the sharpest and highest folds have been truncated to a depth, as far as we know, of over eight miles, exposing at the surface a section of gold measures of over five miles in thickness.

The map (Fig. 2) is a reduction of map-sheets published by the Geological Survey on the scale of one mile to one inch. It represents a portion of the gold-measures, thirty-five miles wide and sixty miles long, east of Halifax, between Musquodoboit Harbor and Sherbrooke. The black lines show the anticlinal axes of eleven folds, into which the measures have been plicated; the narrow, dark shaded bands indicate remnants of the upper slate group, left undenuded along the deepest troughs or synclinal axes of the folds; the other areas indicate the granite masses.

A diagram (Fig. 3), gives a section of thirty-five miles in length, drawn across the whole belt of the gold-measures, along the line of section A B in the plan (Fig. 2).

Below (Fig. 3) is given, for comparison, a diagrammatic section of the Bendigo gold fields of Australia, on a scale ten times as large as the one above. The heavy black lines indicate gold mines on four different anticlinals, worked on the line of section.

The amplitude of the folds, or the distance between the different main anticlinal axes in these two gold fields respectively, varies considerably. The Nova Scotia section of thirty-five miles gives eleven anticlines, or an average distance of three miles between each anticline, and a maximum distance of nearly five miles; while in Bendigo gold district, it ranges from 300 to 1,300 feet. So that in Nova Scotia the amplitude of the folds is nearly twenty times greater than in Bendigo.

The mapping of the gold-measures by the Geological Survey during the last fifteen years, has been extended, under my charge, as far west as Lunenburg. The study of the structure of these rocks, over that region, has afforded an opportunity of acquiring many important facts and data by means of which gold mining may be carried

on with more confidence, under more exact conditions and with greater economy.

The most important feature disclosed, is that all the rich veins and the large bodies of low-grade quartz worked in Nova Scotia, with few exceptions, follow the lines of stratification, and occur at well defined points along the anticlinal axes of the folds.

It was during the progress of the slow folding of the measures, that the rich quartz veins and large saddle-lodes of quartz were formed, at favorable places, along the planes of bedding on the anticlinal domes of the folds.

Thus a thorough knowledge of the structure of the anticlinal folds becomes necessary, to locate the auriferous quartz deposits on the surface, and to develop them in depth.

In tracing the axes of the folds at the surface, the dip of the rocks is the chief guide. If the strata are found to dip towards each other, it is clear they form a synclinal axis or trough; while, if they dip in opposite directions they form an anticlinal axis or ridge.

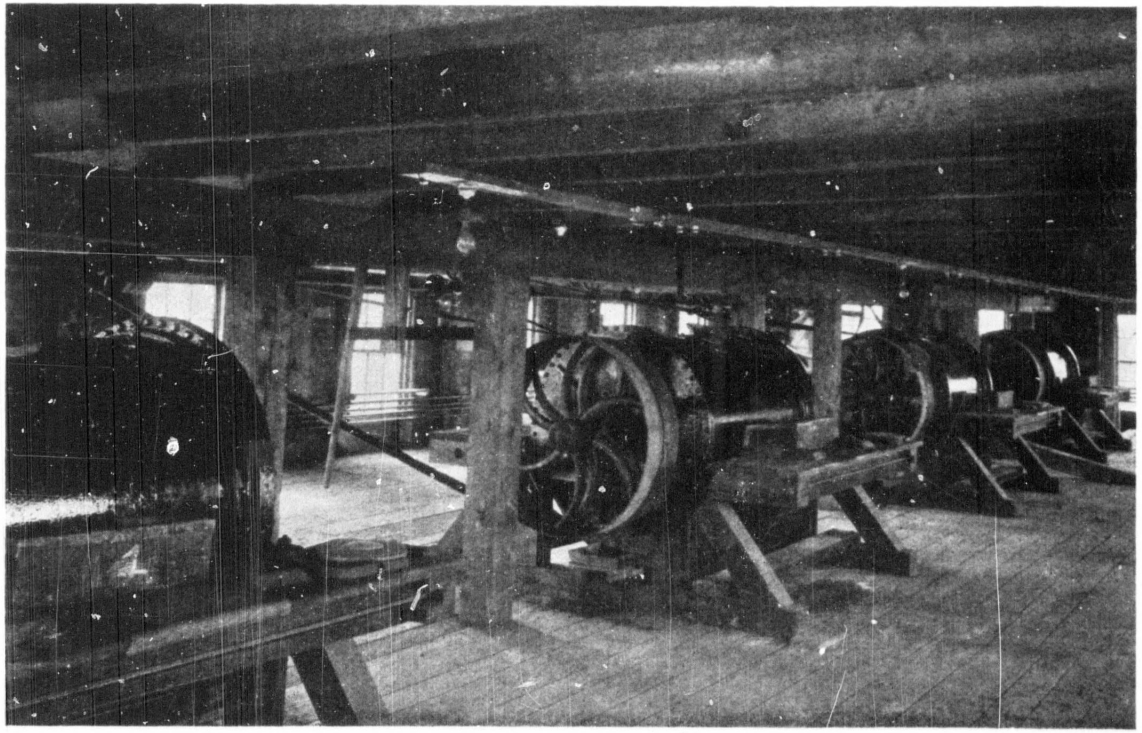
The rocks, on opposite sides of anticlinal axes, generally dip at angles varying between forty-five and ninety degrees from the horizon, seldom lower than forty-five degrees, and overturned dips are frequently noted.

The deviation of any bed from the horizontal, along the axial line, is its "pitch." A longitudinal section, made east and west along the axis of an anticlinal fold, will show the strata and the fold to pitch either to the east or west, at low angles, seldom over thirty degrees from the horizon.

Owing to the pitch, the outcrop-edges of the beds, on each side of an anticline, are not parallel to the axial line; if they converge towards the east, the anticlinal fold dips east, and if to the west, it dips to the west.

When the pitch inclines both ways from a central point, that point is the centre of an elliptical "dome," and marks the position of one of ths most favorable points on the main anticlines for the occurrence of quartz veins.

The average distance between one dome and the next, along the same anticlinal axis, varies from ten to twenty-five miles.



One Ton Chlorination Barrels (Thies' process) at the Brookfield Mines, Nova Scotia.

It has been thought by some, that these domes were caused by gentle north and south undulations, crossing the sharp east and west folds. Such does not, however, appear to be the case, generally, as it can clearly be seen by looking over the geological maps of the region, that the pitch at corresponding points on the various main anticlines is often quite different.

It will be seen that most, if not all, of the gold mining centres operated are situated on these domes.

Moreover, it has been observed that most of the anticlinal domes, upon which mines are not in operation, show indications of gold, and many will eventually prove to be important auriferous centres, only a few of them being without the structure necessary for the formation of quartz veins.

Of the twenty-one domes, in the region covered by this map (Fig. 2), fourteen have been worked more or less, six have shown auriferous quartz in situ or in float, and the remaining one has not yet been proved.

The gold districts operated to the east of Halifax are here given, together with their horizon or the distance of their strata below (and in one case above) the base of the upper slate group.

Moose River	about $3\frac{1}{4}$	miles.
Tangier	" $2\frac{3}{4}$	"
Fifteen-mile Stream and Beaver Dam	$2\frac{1}{2}$	"
Lawrencetown	2	"
Goldenville, Harrigan Cove, Gold Lake and Forest Hill	$1\frac{1}{2}$	"
Waverley and Renfrew	$1\frac{1}{4}$	"
Mooseland, Killag, Liscomb Mill, Richardson, Lower Isaac's Harbour, Wine Harbour and Montague	1	"
Ecum Secum, Middle Isaac's Harbou, Cochran Hill, Lake Catcha and Oldham	$\frac{3}{4}$	"
Salmon River	$\frac{1}{2}$	"

Caribou at the base of the Slate group.
Stewiacke about $\frac{3}{4}$ mile above the base of the Slate group.

There is no doubt that certain kinds of slate are more favourable to the segregation of gold than others, and that the prevalence or absence of the former, at certain horizons, will necessarily give zones of different richness.

The fact that important mines have already been worked at different horizons, from the top of the series to the bottom, is sufficient

proof that strata favourable to the formation of auriferous veins are met with throughout the whole thickness of the lower quartzite group, and perhaps also in the upper slate group, though apparently less frequently. This is an important fact with regard to deep mining on the domes of anticlines.

The manner in which the strata are bent over the axial lines is worthy of note. The strata in folding do not bend round a centre, to form circular curves, but their curves are more like parabolas, superimposed upon one another. This is due to the immense lateral pressure which has compressed these beds, especially the slate bands, on either side of the fold, producing a thickening of the strata and openings between them on the apex of the folds.

In a certain thickness of sheets of paper or cloth, bent into an anticlinal fold, a "slipping" of the several layers on each other will take place; the sides of the fold will be tightly compressed, while, on top, openings will be formed. In the same manner, in the folding of this great thickness of strata, the beds separated along the planes of stratification, and moved along these planes, the upper bed sliding upward on the lower inclined bed.

This slipping is clearly proved by the striations and slickensides that are to be seen in most mines on opposite bedding planes, and by a certain thickness of crushed black slates or gouge between the walls.

Such movements naturally took place between strata, where the cohesion was slightest, and thus, we find quartz veins following layers of slate, especially when the slate is intercalated between thick beds of hard quartzite.

These slips may be considered as fault-fissures along bedding planes, and it is along these fissures that the quartz began to be deposited, and as, usually, these movements were very slow and intermittent and extended over the whole period of folding, the quartz was also deposited very slowly, usually in thin coatings accumulating one over the other, as the fissures widened, until veins of different thickness and extent were formed. The quartz often holds minute scales of slate, peeled off the walls, and subsequently covered over by other layers of silica, giving a banded structure to the veins; while the gold also often occurs in streaks parallel with the banded structure.

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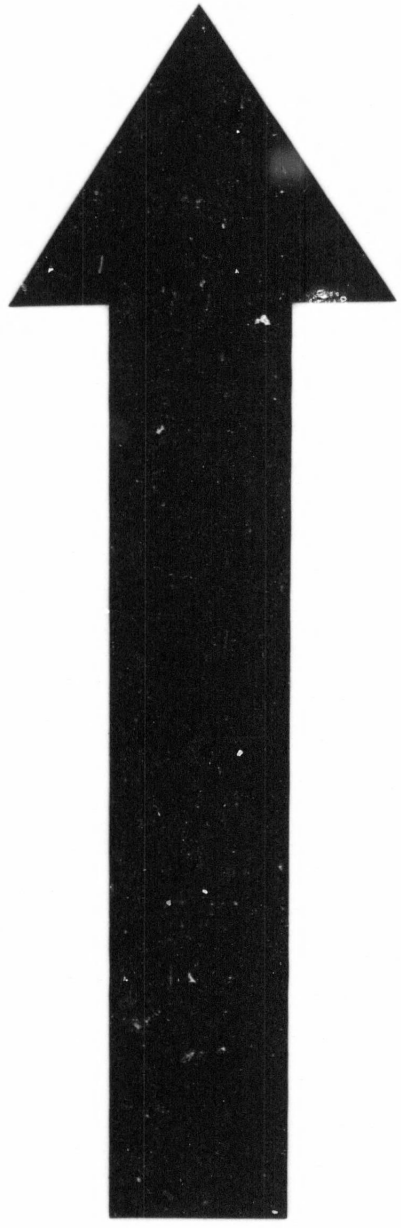

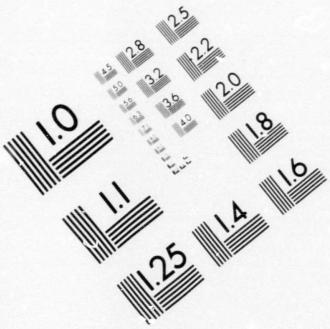

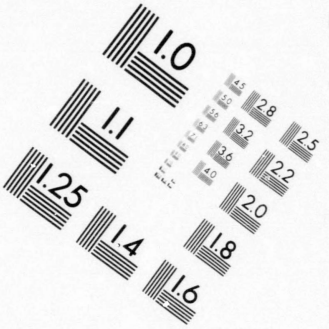

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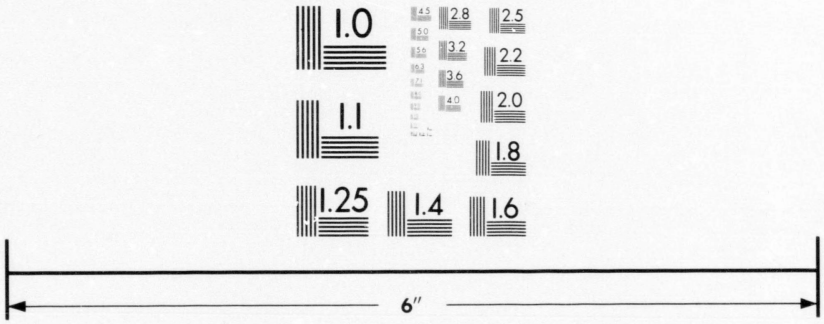

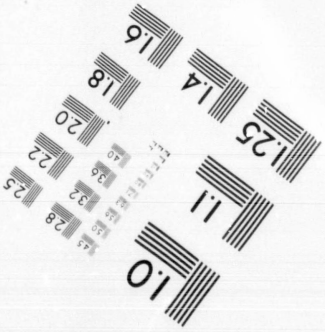

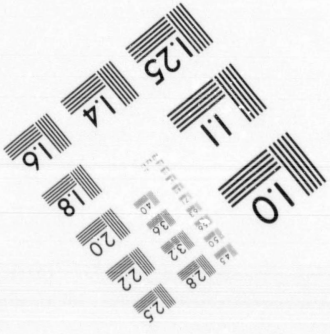

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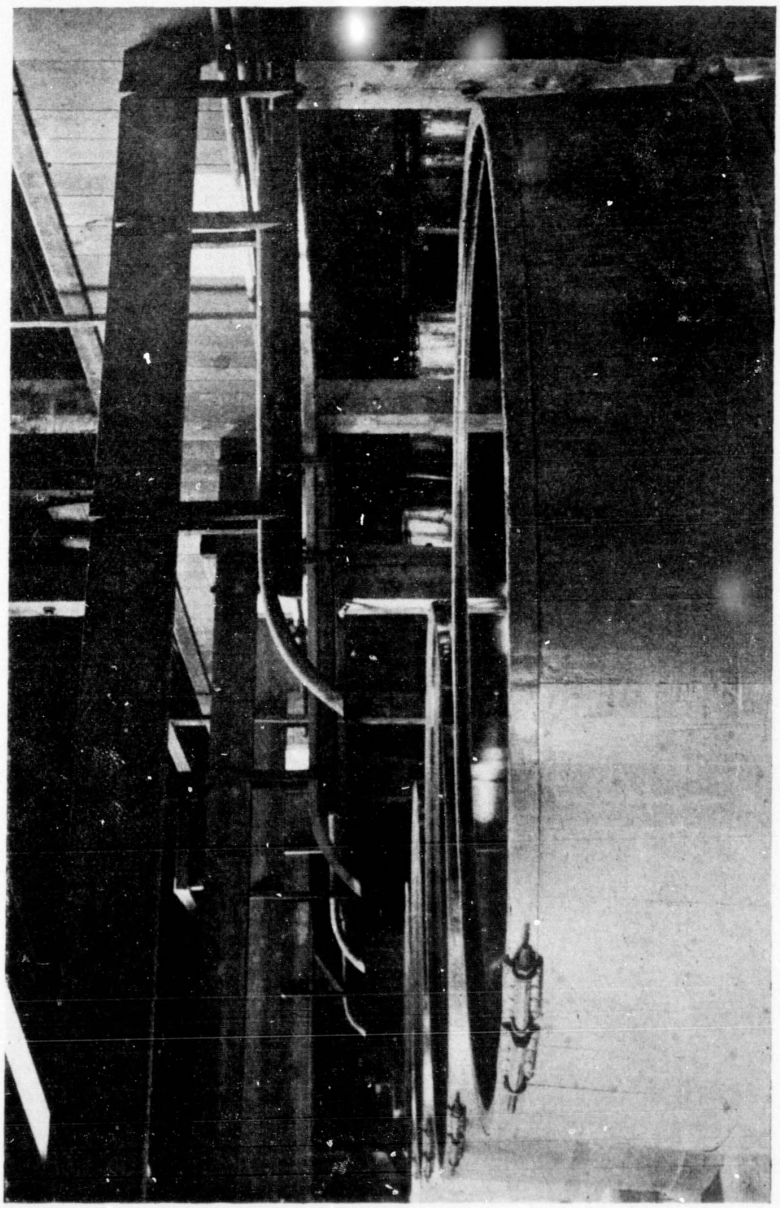

Settling Tanks—Brookfield Chlorination Works.

The large-scale plans made during the last two summers by the Geological Survey, including the most important districts to the east of Halifax, have brought to light important facts bearing on the relations of the structure of the anticlinal domes to the thickn ss, extent and auriferous streaks of the quartz veins.

In the case of sharp anticlinal domes, such as those of Salmon River, Mooseland, the Richardson mine, Fifteen-mile Stream and others, where the dip of both legs of the anticline forms an angle of less than forty or forty-five degrees, large bodies of quartz, called "saddle reefs" in Victoria, are found to occur along the anticlinal axes, and to bend conformably with the bedding.

On the course of the anticlinal axes, the saddle reefs generally keep their size for a great distance, pitching with the strata both ways from the centre of the dome, and eventually pinch out at a certain limit, which may be called the limit of the formation of quartz on the axial line.

They also curve sharply and follow the strata on the north and south dips, but generally thin out much more rapidly on the legs than on the pitch. Many legs have been mined in Nova Scotia to the depth of several hundred feet, and the quartz has still been found of a fair width. In Bendigo, where the folds are, on an average, twenty times smaller than in Nova Scotia, the legs of quartz are said to very seldom extend to greater depth than one hundred feet below the cap of the saddle reefs; which would correspond proportionately to 2,000 feet in Nova Scotia.

These saddle reefs in Bendigo are not only of great size and of remarkable persistence in length, but are also notable for recurring in depth, one below the other.

At the Lazarus mine Bendigo, there are from the surface to the 2,200 foot level, no less than twenty-four of these saddle reefs, thirteen of which are auriferous to a payable degree, and some of great size.

At Bendigo, on the 31st Dec., 1897, six mines were worked over 3,000 feet in depth, and twelve over 2,700 feet; the deepest, the Landell's 180 mine, was down 3,352 feet, and these were all worked on anticlinal folds.

No operation has yet been carried to any depth, through the

Settling Tanks—Brookfield Chlorination Works.

arch-core of the folds in Nova Scotia, but the important developments done along the anticlinal axes at Salmon River, the Richardson mine, Waverley, Oldham and Mooseland, should be sufficient to convince the most skeptical, that quartz saddle reefs and legs may be found underneath one another, to even a greater depth than in Bendigo.

The Montreal-London Gold and Silver Development Co., largely composed of Montreal capitalists, which acquired lately the Dufferin mine at Salmon River, is at present sinking on the dome of the anticlinal fold a vertical shaft, with cross-cuts and levels, which has reached a depth of over 300 feet. I am glad to call the attention of the meeting to this development, which may be considered the first important step in the introduction of a new system of mining, and will, no doubt, be the inauguration of a new era of extensive and permanent deep mining in Nova Scotia.

Few reliable data can be obtained regarding the relative richness of the different parts of the saddle reefs and legs on a sharp fold, but many veins, worked on the apex of the fold, such as the Richardson lead at Isaac's Harbor, the Dufferin lodes at Salmon River, and the Bismarck lead at Mooseland, show that the vein is richer or can be worked with more profit on the saddle than on the legs.

In the case of a broad fold, when the angle formed by the dips on both sides of the anticline is over forty-five degrees, the veins do not acquire any great development along the axial lines, and the enlargements are found rather at a certain distance from the axis.

The thickness of the strata denuded, chiefly since the folding, has already been shown to be very great, reaching on some anticlines eight miles. This superincumbent mass of rock exerted a powerful pressure which has to be taken into account in the folding process. It is evident, that in the sharp folds this pressure has been completely overcome by the lateral pressure, but it has had undoubtedly much influeuce on the shape of the broad folds and the development of quartz.

This pressure accounts, no doubt, for the fact that large veins are seldom found between strata dipping at lower angles than forty or fifty degrees.

Moreover, on a broad fold, at the surface, important veins are found only at a certain distance from the anticlinal axis, and within a

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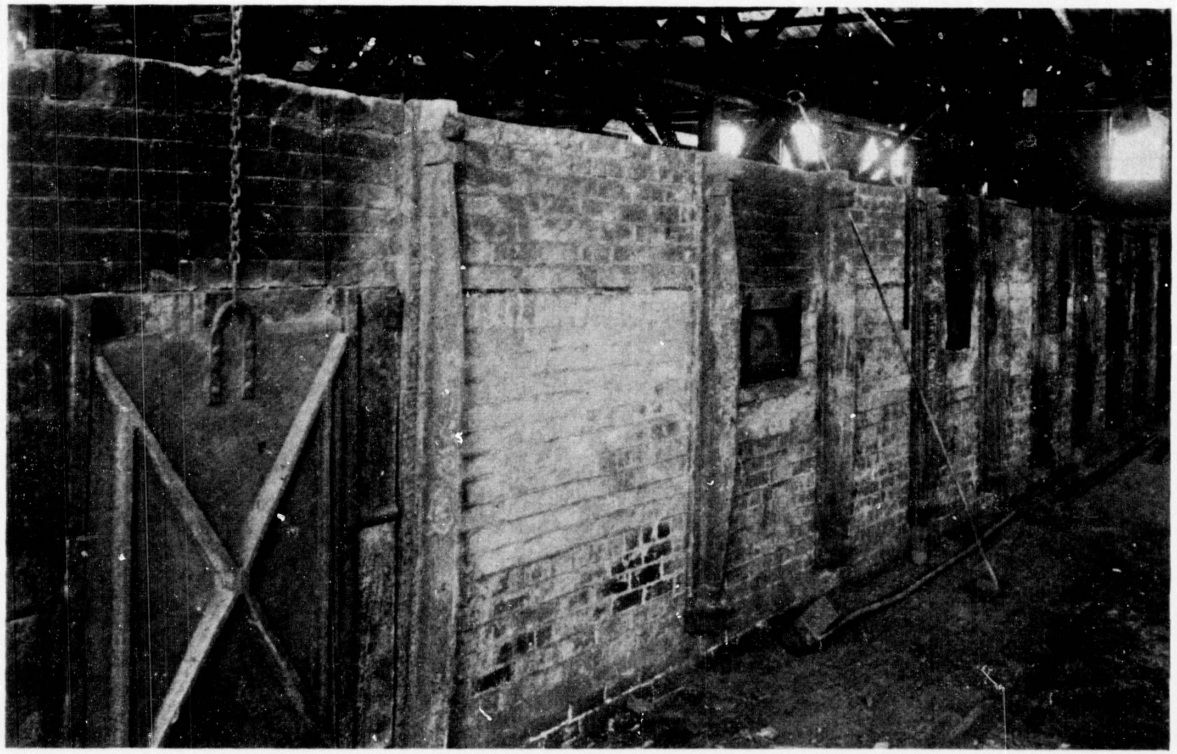

One of the Reverberatory Furnaces at the Brookfield Mine, Nova Scotia.

limited zone of strata, A B varying between 200 and 1,000 feet. That is to say, quartz veins were formed on a part C D of the fold, where the combined forces of the lateral and of the downward pressure have determined the greatest strain and have produced most sliding and fissures. The outer limit of the zone A, corresponds generally to a point at which the strata begin to dip at an angle which remains constant for some distance.

Likewise, in depth, quartz veins were formed on that part of the fold which was subjected to the same conditions, and is similarly situated. As the structure of a fold will not change much for some distance in depth, the extreme limits C D of the zone of quarz veins will be found at about the same distances from the anticlinal axis of the fold, that is to say, parallel with the axial line E F.

If the fold gets sharper in depth, the zone of quartz veins will approach the axial lines E F downward, and if it gets broader, the zone will recede from the axial line. The distance B E of the zone of quartz veins varies considerably in the different districts according to the flatness of the fold. The axial line E F may also coincide with B D, in a sharper fold, and in a still sharper fold it may come half way between A and B, and we have then the typical saddle-reef fold.

Again, at the surface, in the same district, as at Goldenville, the fold may be sharper at one end and broader towards the other end, and in that case the zone of quartz veins will recede from the anticlinal axis, towards the broader end.

The quartz veins are sometimes very numerous on both sides of the anticlinal domes. On the Goldenville anticlinal dome, where developments have, perhaps, been more extensive than in any other districts in the province, some fifty-five different veins have been worked or uncovered, in a width of strata of 1,300 feet on the north side of the anticline, dipping north at forty-three degrees, and some fifty veins in a width of 500 feet on the south vertical dip of the anticline.

They extend in many cases on the surface for thousands of feet and they have been mined to depths of 700 feet in their vertical extension.

The thickness of the veins varies considerably. The saddle-reef deposits are by far the heaviest bodies; those worked at Salmon River.

Richardson and Mooseland mines attaining fifteen to twenty five feet in thickness, and others not operated, at Fifteen-mile Stream, Cameron dam, &c., are probably larger.

The veins along the legs of the folds are much smaller, averaging from four inches to one foot, but often larger.

Many quartz veins are also found cutting the stratification at various angles; some are of great thickness, many are auriferous, and a few have been operated with notable profits. They are of later origin generally, than the interstratified veins, and some of them may be roughly contemporaneous with the intrusion of granite. Their richness is generally influenced by the nature of the adjacent strata.

In the interstratified veins the gold is sometimes distributed uniformly over considerable areas; usually, however, it is more or less concentrated within certain limits, leaving spaces on each side, comparatively barren. These enrichments are known as pay-streaks, and have hitherto been the principal source of the gold production.

Most pay-streaks are well defined enrichments of twenty to sixty feet in breadth, often accompanied by enlargement in the size of the vein. They dip at low, constant angles, parallel generally with the well defined lines of schistosity of the rocks, and often with striations and corrugations on the walls, giving the veins a crumpled structure, locally called "barrel-quartz."

These corrugations and crumplings are more pronounced in the slate and quartz, and owe their origin to the sliding of thick beds of quartzite over one another, between which the softer bands curve and buckle in a wonderful manner. The pay-streaks lie at right angles to the sliding movement, that is to say, approximately parallel to the anticlinal axis.

Many of the pay-streaks have been proved very rich and some have been traced from the surface along a gentle incline for as much as 1,800 feet, with extraordinary uniformity. In many instances, two or three pay-streaks have been determined in the same vein lying parallel under one another for some distance. This mode of occurrence is necessarily limited to the portion of that vein situated in the pay-zone.

The laws governing the position and extent of the pay-ground or

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Stream, Cameron

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Concentrating Plant of the Brookfield Mining Co., North Brookfield, Nova Scotia.

pay-streaks are intimately connected with the structure of the anticlinal folds and are similar to those already laid down for the position and extent of the zones of quartz veins. The data necessary to explain their many peculiarities in the different gold districts are difficult to obtain with any degree of precision, as few plans or records have been kept or are obtainable. As a general rule, the best pay ground, in most districts, is situated at about the middle of the zone of quartz veins A B, where fissures with angular veins are most numerous. These small angular veins or "angulars" which run into the walls at different angles, and sometimes connect one vein with the next, play an important part in the concentration or segregation of gold from the adjacent auriferous rocks, and, causing an enrichment or impoverishment of the main veins, they are well called locally "feeders" or "robbers."

In depth also, the zone of pay-ground G G, should be situated at about the middle of the zone of quartz veins G, parallel with the axial line E F.

It will then be readily understood, that one individual vein, if it cannot hold gold in paying quantity to a great depth, may nevertheless, be sufficiently rich to be worked with profit for a great length along certain lines parallel with the anticlinal axis; that a vein barren at the surface B may be rich in depth in the pay-zone, and that a vein which does not come to the surface B, may also be found payable on that pay-zone G'.

The problem then oonsists of developing a zone of pay-ground or portions of veins included within certain limits, along a plane G G, parallel with the axis E F, and that to depths practically unlimited.

This problem will, I am sure, prove interesting to mining engineers, and it only awaits their skill and knowledge to be put in practical operation and place the Nova Scotia gold-fieids among the most productive in the world.

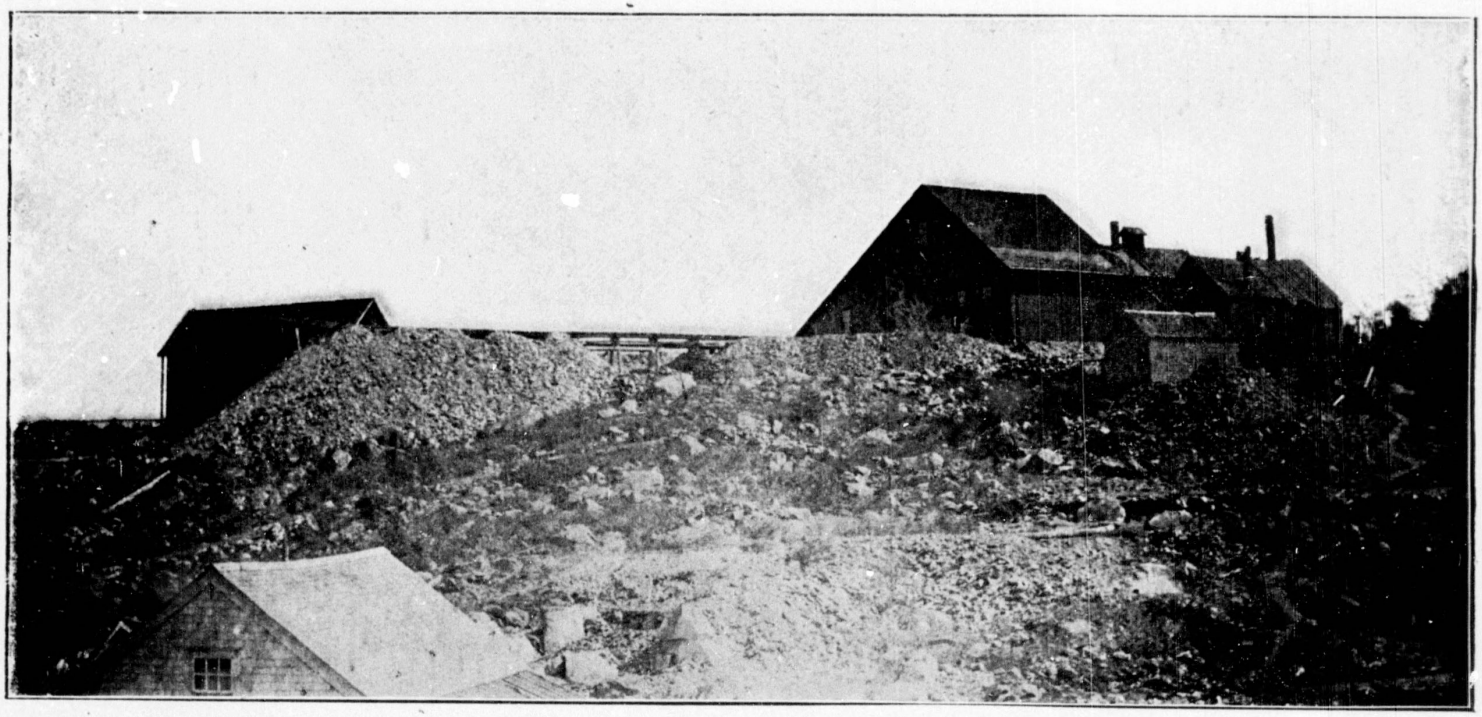
Concentrating Plant of the Brookfield Mining Co., North Brookfield, Nova Scotia.

New 60 Stamp Battery and Surface Works at the Dufferin Gold Mine, Salmon River, Nova Scotia.

New 60 Stamp Battery and Surface Works at the Dufferin Gold Mine, Salmon River, Nova Scotia.

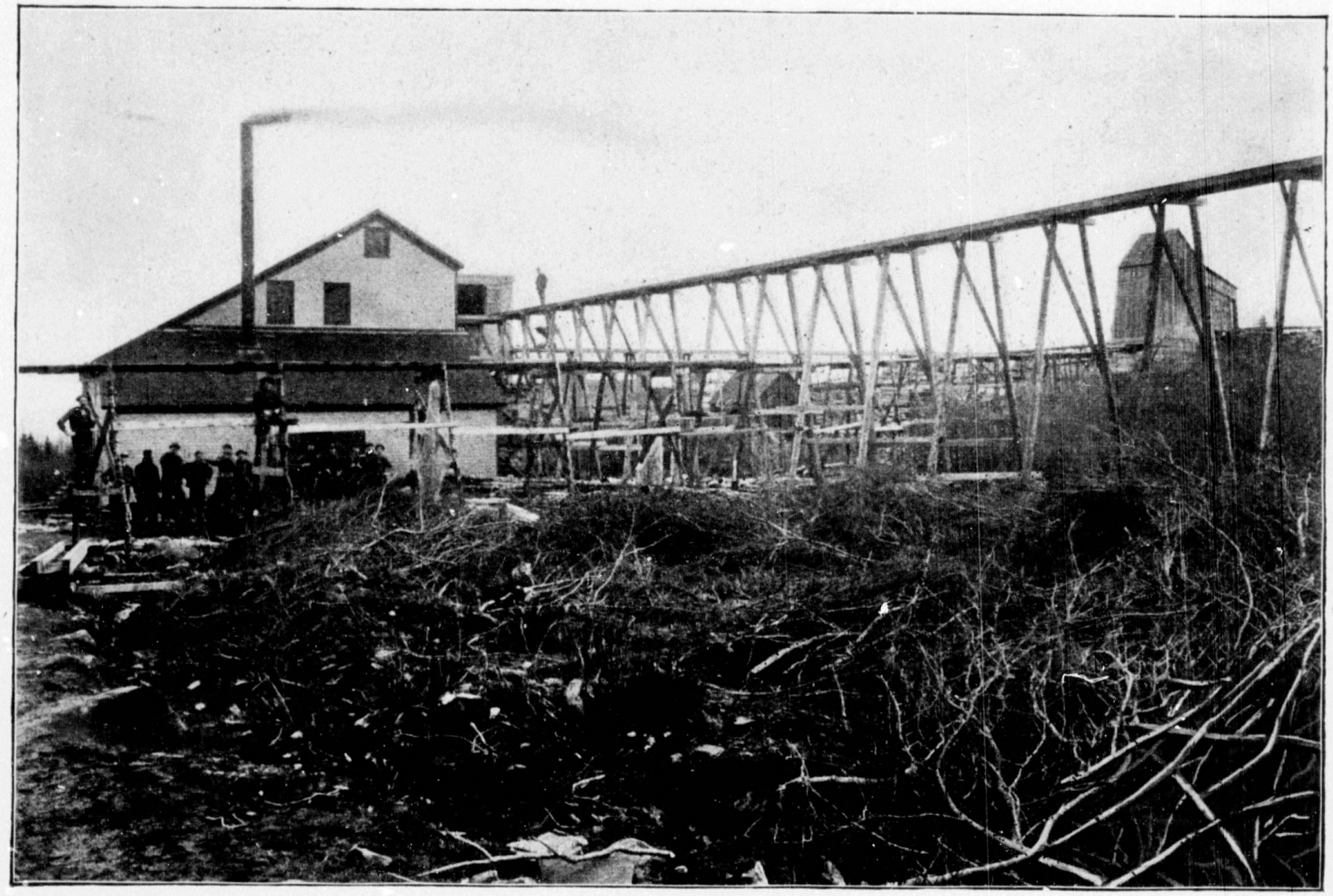
Co.—Main Shaft and Mill, Forest Hill, Stormont District, Nova Scotia.

MODSTOCK GOLD MINING CO.—Main Shaft and Mill, Forest Hill, Stormont District, Nova Scotia.



TUDOR GOLD MINING CO.—Shaft House, Waverley, N.S.

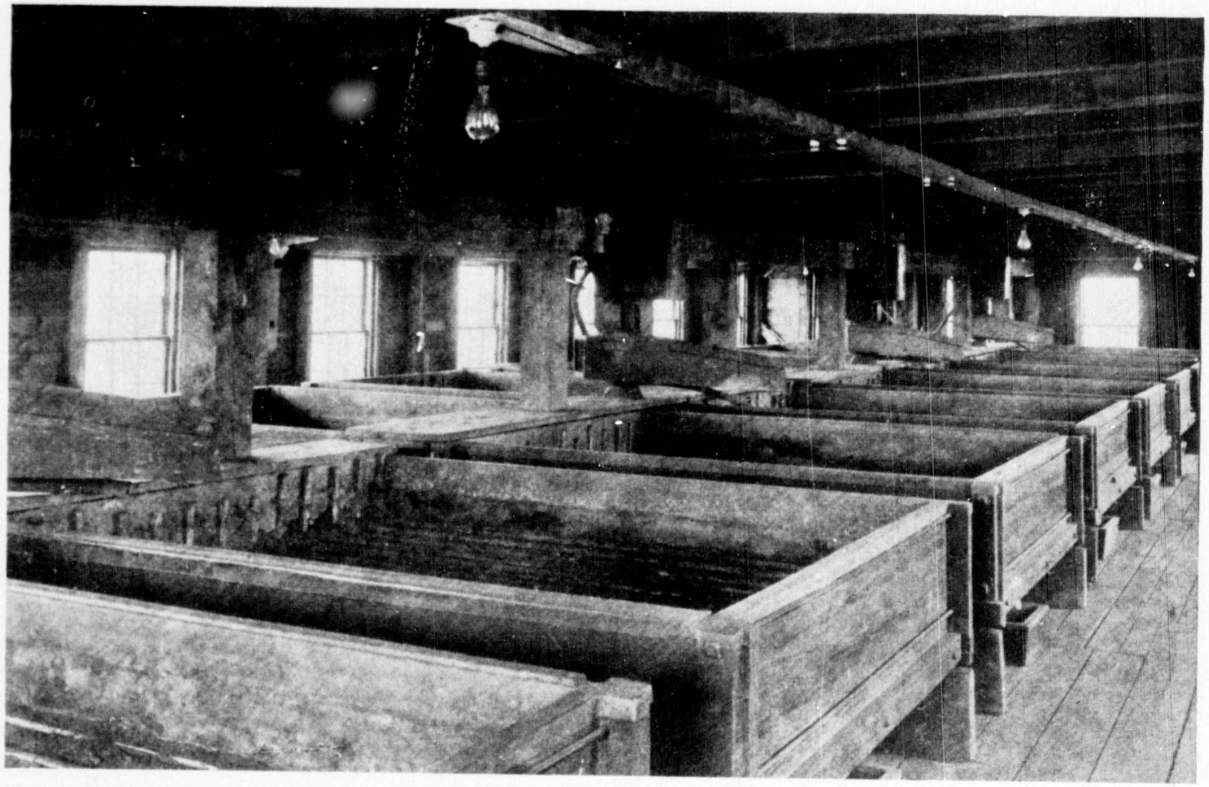
BLUE NOSE GOLD MINING CO.—20-Stamp Battery at Goldenville, N.S.



BLUE NOSE GOLD MINING CO.—20-Stamp Battery at Goldenville, N.S.

EGERTON GOLD MINING CO.—New 30-Stamp Mill and old 15-Stamp Battery at 15-Mile Stream.

EGERTON GOLD MINING CO.—New 30-Stamp Mill and old 15-Stamp Battery at 15-Mile Stream.

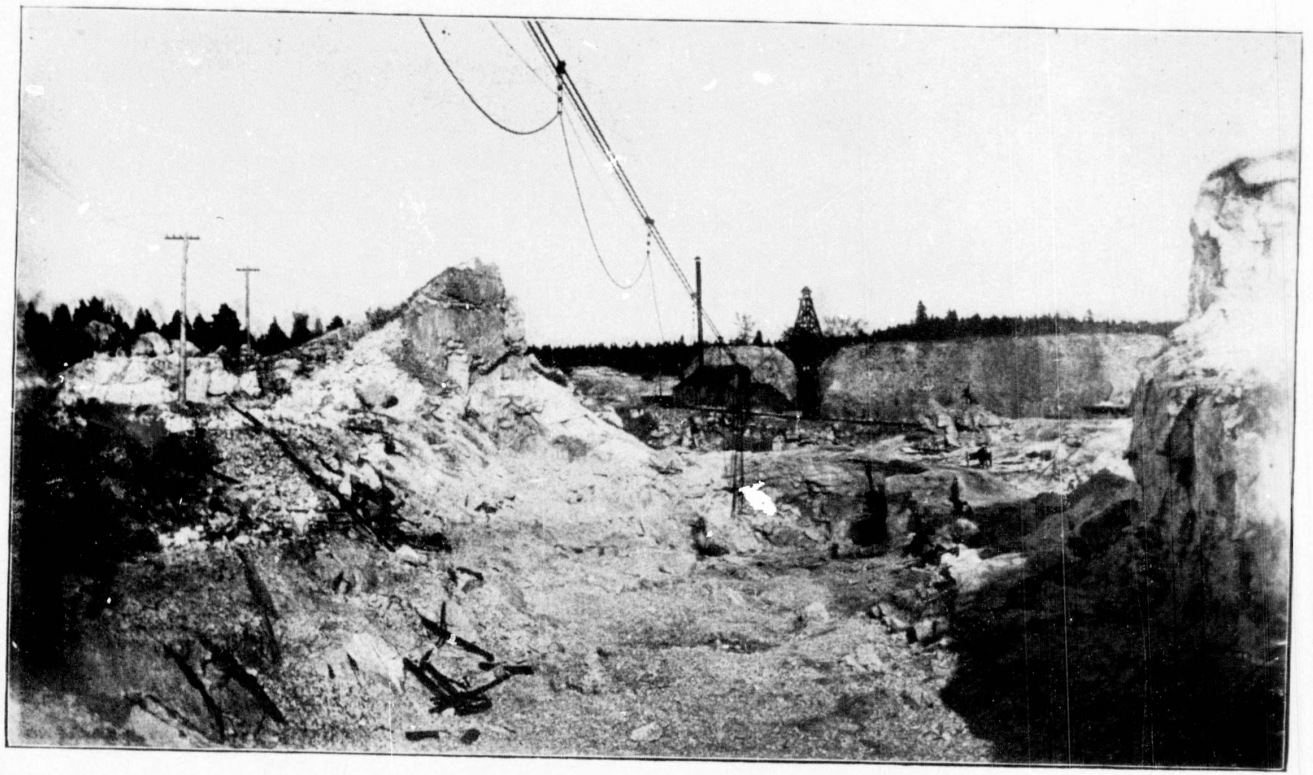


The Filters—Brookfield Chlorination Works.

—Mines at Coxheath, Cape Breton.

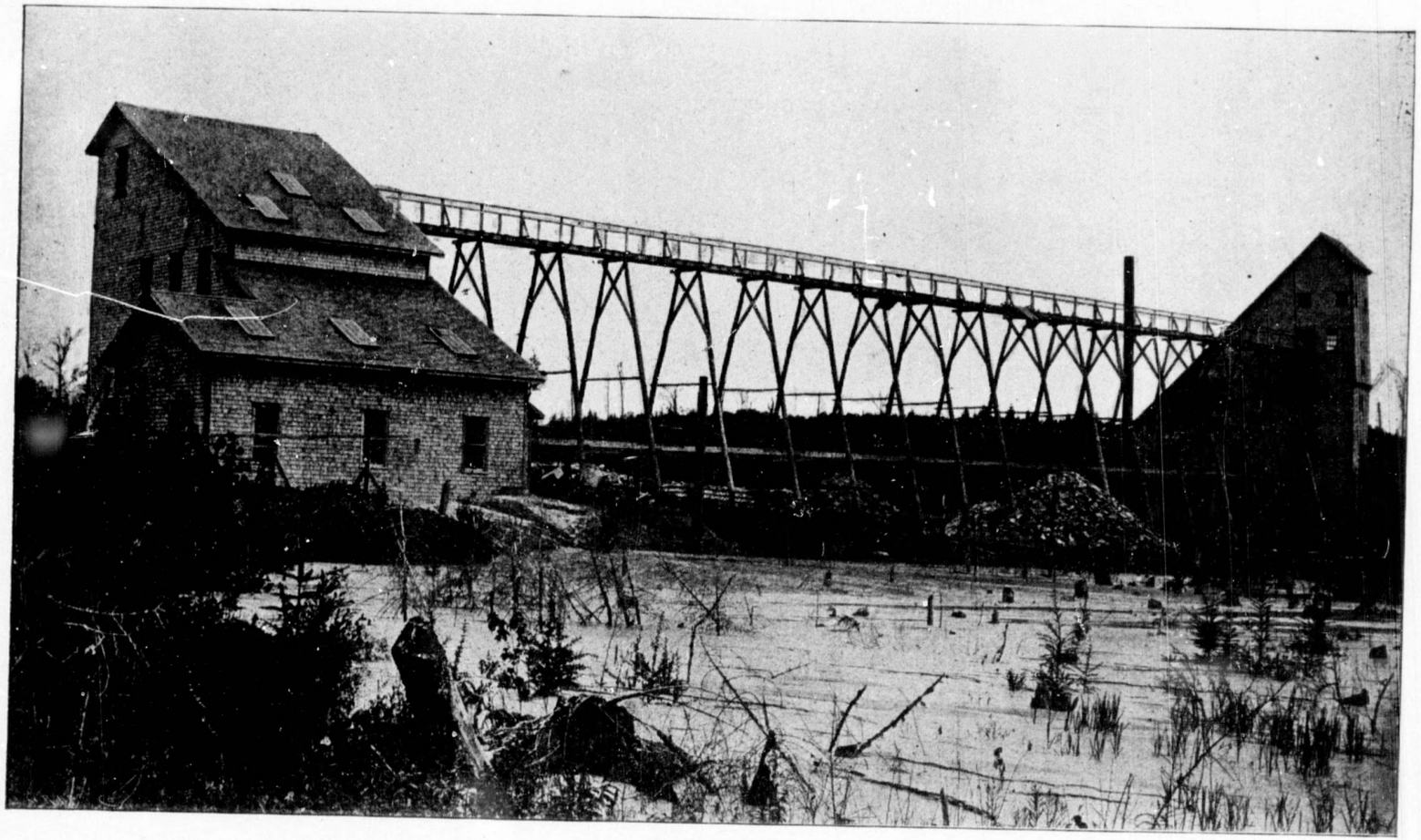
CAPE BRETON COPPER CO.—Mines at Coxheath, Cape Breton.

...ries at Wentworth, N.S.



WENTWORTH GYPSUM CO.—Quarries at Wentworth, N.S.

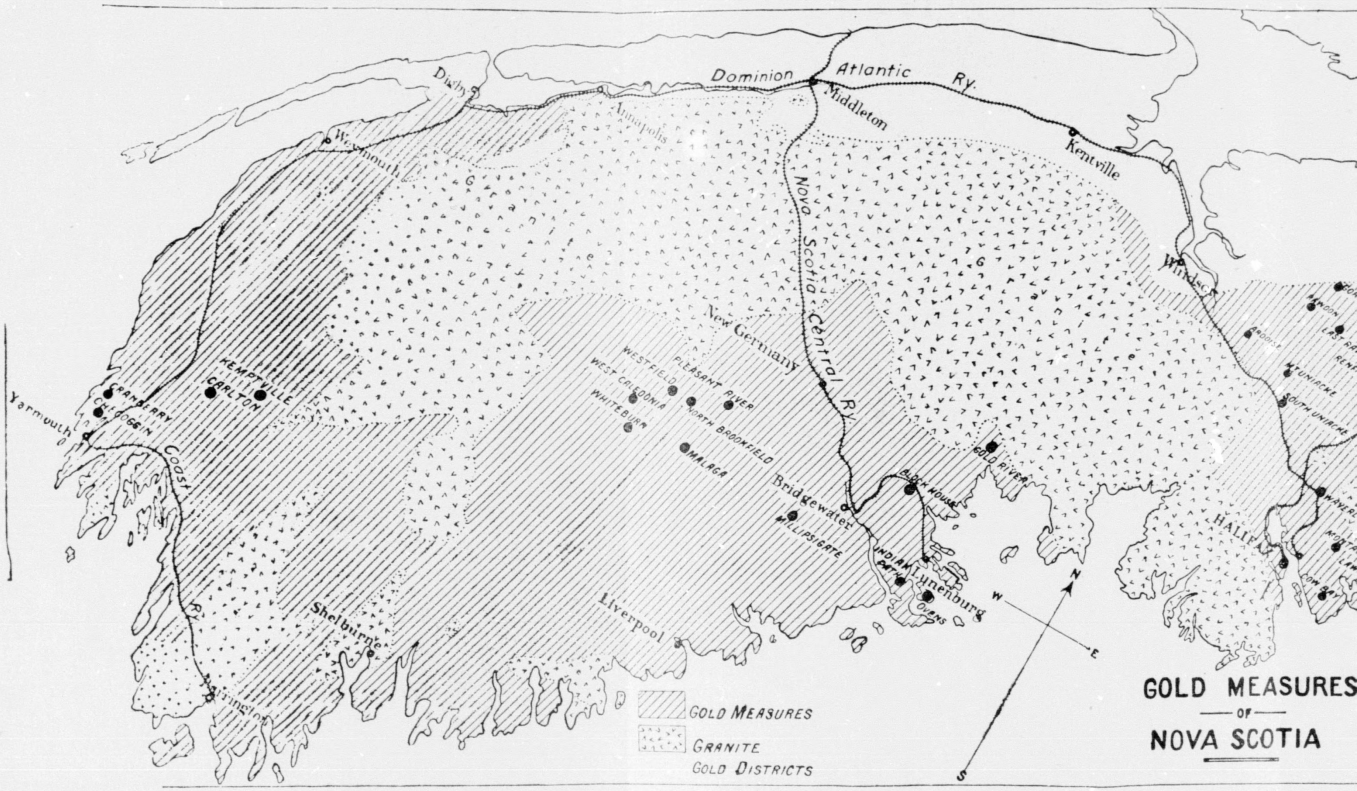
LAKE LODE GOLD MINE.—Mill and Shaft House, Caribou, N.S. (Operated by the Guffey-Jennings Gold Mining Co.)



LAKE LODE GOLD MINE.—Mill and Shaft House, Caribou, N.S. (Operated by the Guffey-Jennings Gold Mining Co.)

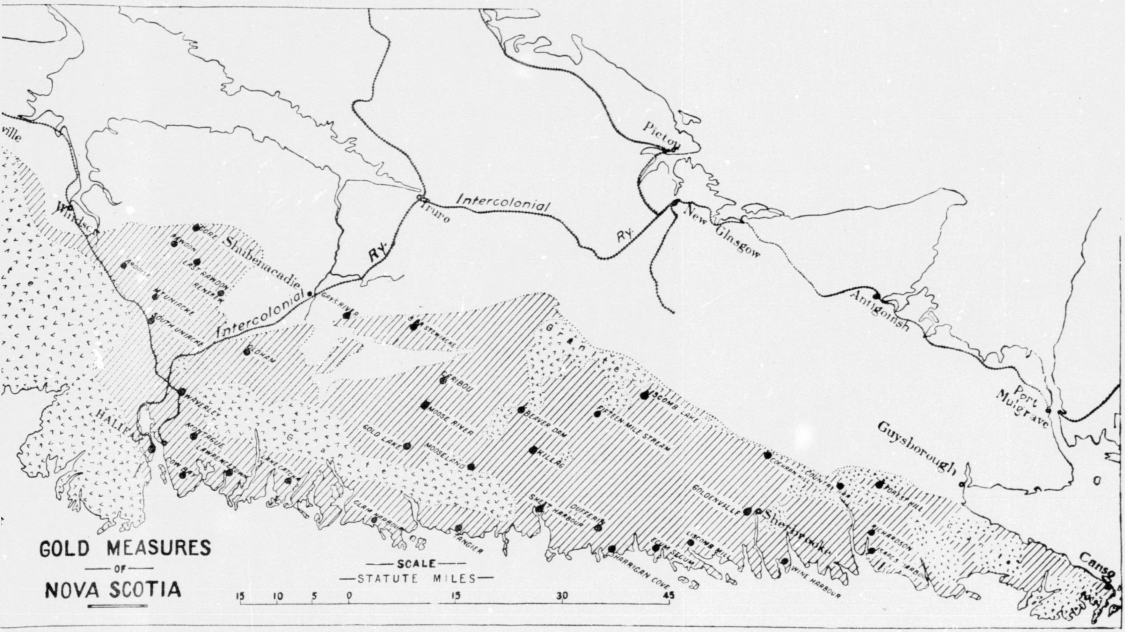
The Gold Measures of Nova Sc

PLATE I.



f Nova Scotia and Deep Mining.

PLATE I.

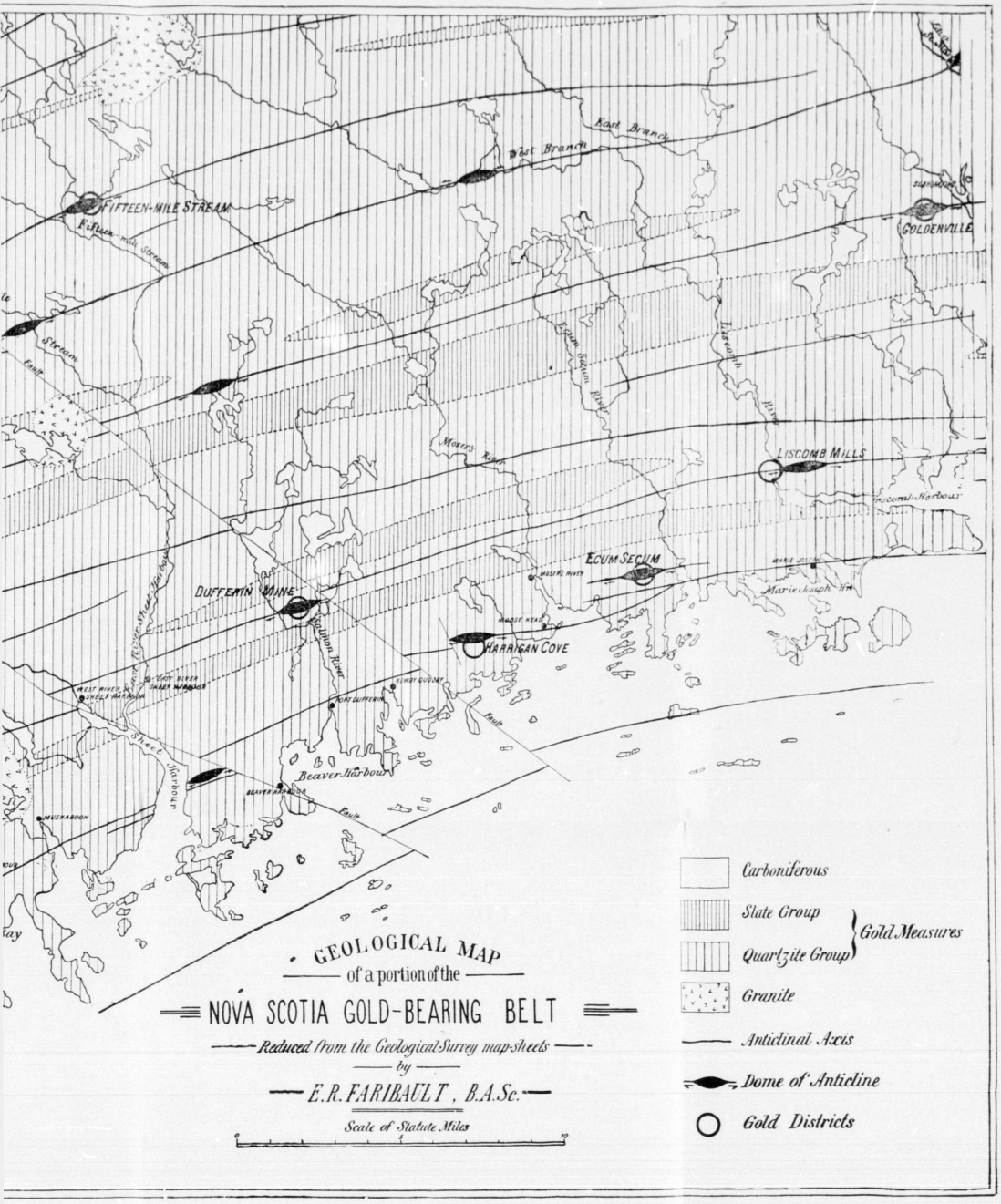


The Gold Measures of Nova Scoti

PLATE II.

Nova Scotia and Deep Mining.

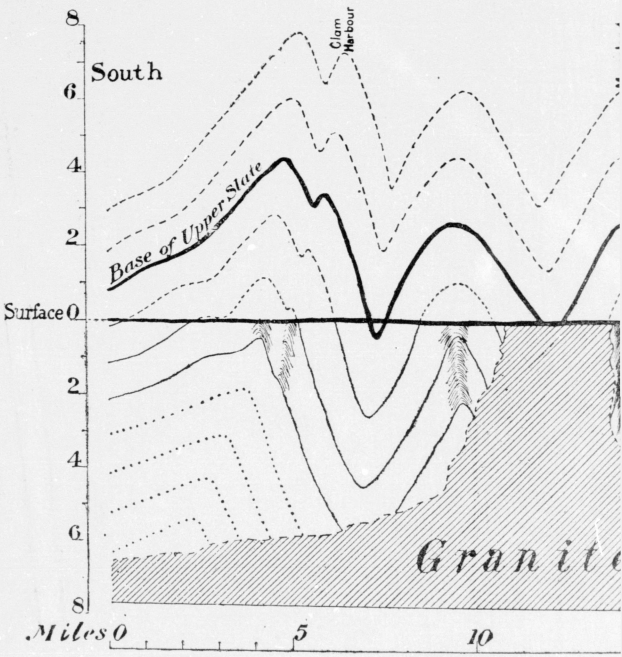
PLATE II.



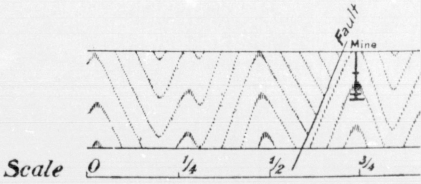
GEOLOGICAL MAP
of a portion of the
NOVA SCOTIA GOLD-BEARING BELT
Reduced from the Geological Survey map-sheets
by
E. R. FARIBAULT, B.A.Sc.

Scale of Statute Miles

Gold Measures of No



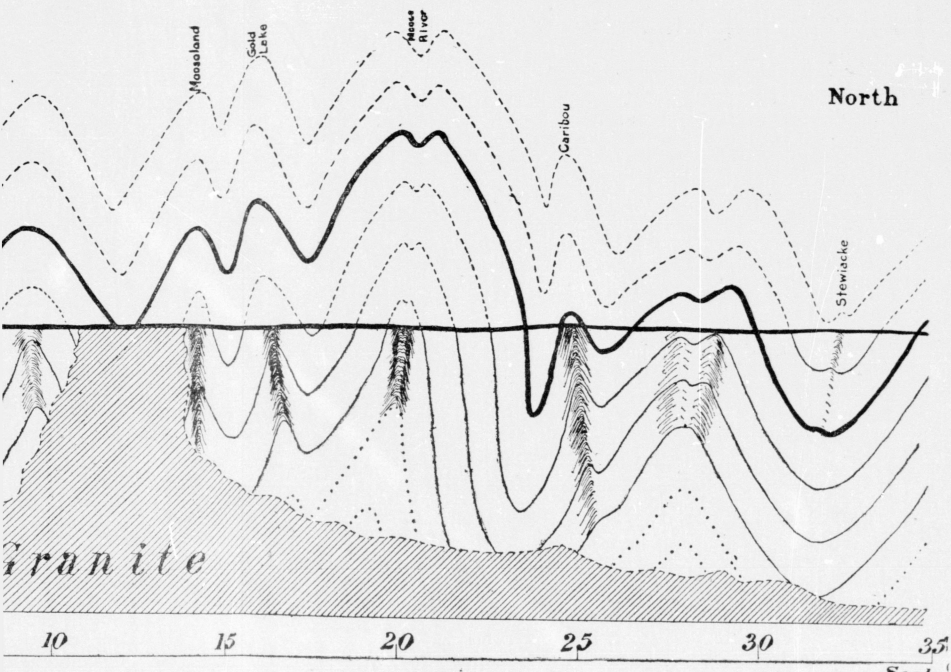
SECTION OF GOLD



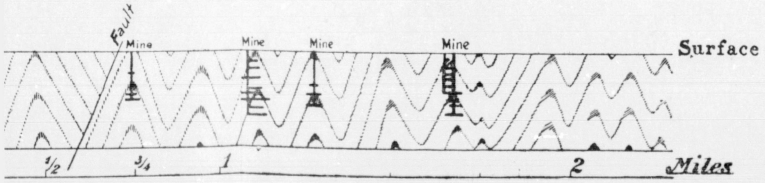
SECTION OF BENDIGO

s of Nova Scotia and Deep Mining

PLATE III.

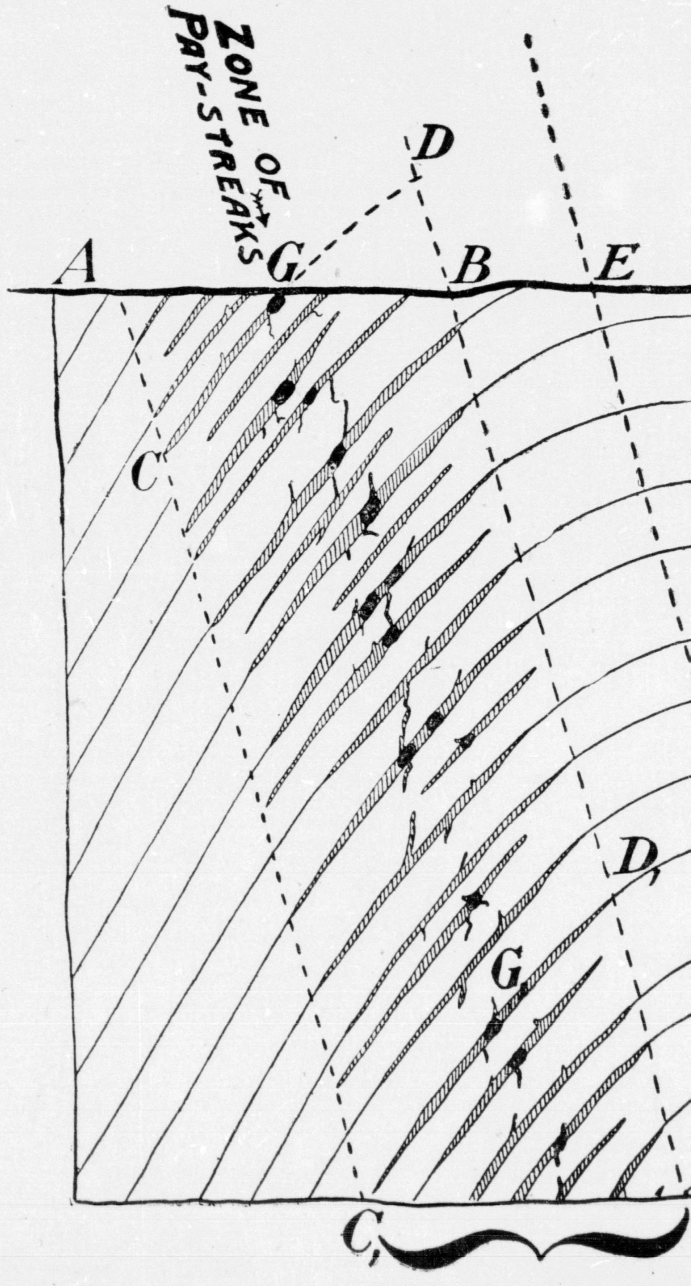


TION OF GOLD MEASURES IN NOVA SCOTIA.



TION OF BENDIGO GOLD-FIELD, AUSTRALIA.

SECTION ON BROAD FOLD

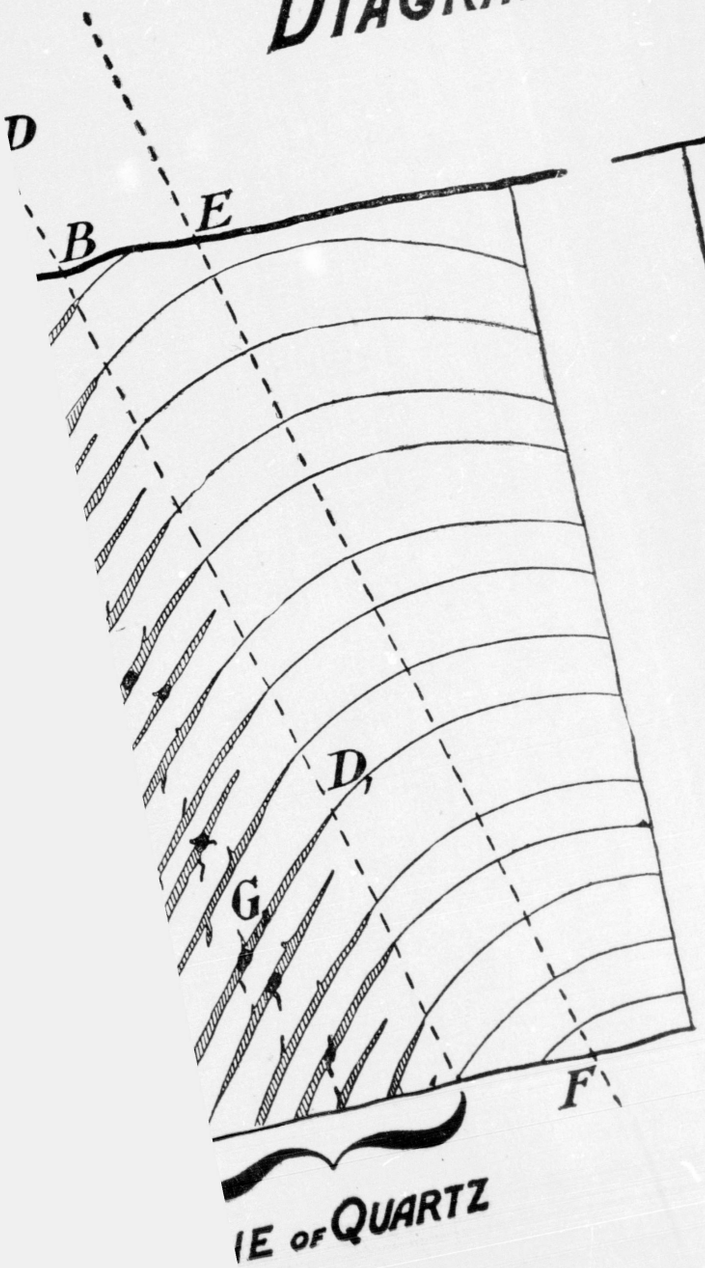


ZONE OF QUARTZ

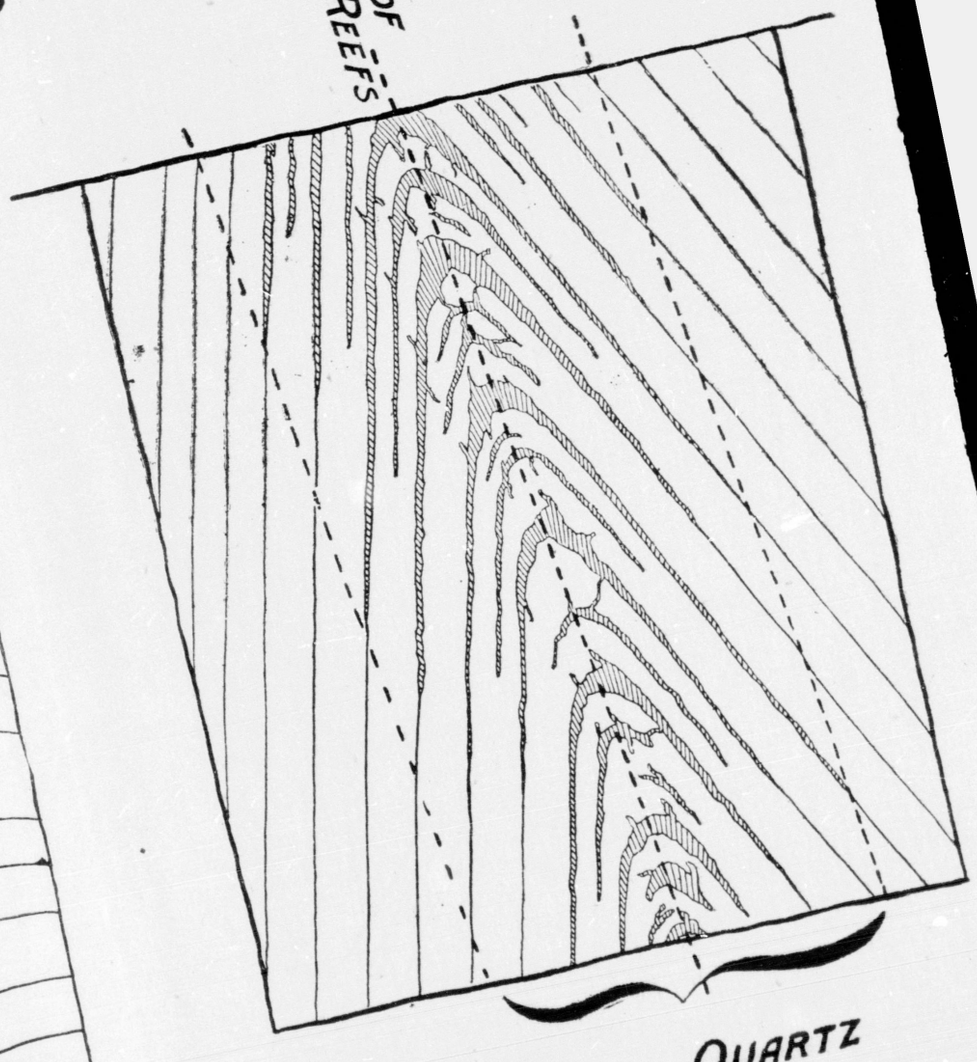
PLATES IV and V.

DIAGRAMS

OAD FOLD



SECTION ON SHARP FOLD



The Gold Measures of Nova S

PLATE V

of Nova Scotia and Deep Mining.

PLATE VI.

THE MORTIMER CO.
OTTAWA.