MINING & METALLURGICAL SECTION

(*Stated meeting held Thursday, November* 4, 1909.)

THE MINERAL WEALTH OF THE ISLANDS OF NEWFOUNDLAND AND JAMAICA.

INTRODUCTORY ADDRESS OF THE PRESIDENT OF THE SECTION

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[The island of Jamiaca is best known as one of the garden spots of the earth and a haven for those seeking to escape the rigors of our winter climate. The extent and accessibility of its mineral wealth are but little known and Professor Outerbridge's account, dealing with the mineral producing localities and their environment, will lend added interest to this region both from the point of view of the tourist and mineralogist.]

IT has been my annual custom since my appointment several years ago by the Board of Managers "Professor of Metallurgy of the Franklin Institute," to open the autumn sessions of the Mining and Metallurgical Section with a résumé of Mining and Metallurgical progress during the year. It is my purpose this evening to vary this programme slightly by giving a brief account of some of the mineralogical deposits of two important colonies of Great Britain; namely, the Islands of Newfoundland and Jamaica; one almost bordering on the Arctic Regions, the other in the Tropical Zone.

NEWFOUNDLAND.

At the inaugural meeting of the Mining and Metallurgical Section of this Institute, held April 28, 1897, the paper of the evening, presented by myself, at the request of the President of the Franklin Institute, who occupied the chair on that occasion, was entitled, "The Undeveloped Mineral Wealth of Newfoundland," and was printed in the JOURNAL OF THE FRANKLIN INSTITUTE of September, 1897, embellished with photographic illustrations of the "Iron Mine at Belle Isle, Conception Bay," showing ore chutes and loading pier, and another view showing the surface workings of this mine. Other pictures showed the

" Pyrites Mine at Pilley's Isle " which, even then, employed a fleet of ships. Still another illustration showed the " Copper Mine at Little Bay," which had a total output at that time of about 200,000 tons. Particular attention was paid in this paper to the remarkable iron ore deposits at Wabana, Belle Isle, found near the surface, and the paper stated that " there is little doubt that in future years an extensive export of hematite iron ore will be developed."

How fully that prediction has been realized may be seen by a glance at the following figures, obtained from an interesting paper on " Mining Iron Ore at Wabana, Newfoundland," by B. S. Stephenson, in the *Iron Trade Review* of October 14, 1909.

" During the past ten years there has been shipped from the piers at Wabana over 3,750,000 tons of ore, distributed as follows:

To Germany	1,500,000
To Great Britain	500,000
To United States	1,000,000
To Canada	750,000
Total	3,750,000

Deliveries (to the United States) during the current year will exceed 200,000 tons, sales (bespoken) for 1910 in this country aggregate 250,000 tons and, with the completion of development work already under way on Belle Isle, there is every reason to expect a steady increase in importations from that source."

A few years before the date of my paper the whole of Belle Isle was purchased by the Nova Scotia Steel & Coal Co., Ltd., for a few thousand dollars, and one year later, in 1898, when the Dominion Iron & Steel Company, Ltd., was organized, the lower half of the bed of ore on the land, and a submarine area adjoining the shore, was sold to that concern for a consideration which was reported at that time to have been one million dollars cash. Both companies have since then been operating continually on their respective properties and have now extended their mining operations under the sea.

One year ago the Nova Scotia Company entered on its own submarine areas, after driving a distance of practically 4000 feet. The article in the *Iron Trade Review* says:

" A conservative estimate, made recently by a well known

London engineer, places the amount of ore that may be mined from the land and near submarine areas—after making very liberal allowances for pillar and other losses—at 104,000,000 tons of mineral 'practically proved' and 291,525,000 tons of 'mineral reasonably supposed to exist.' . . . The management of the Nova Scotia Company is fully satisfied that the inner submarine areas alone will yield over 500,000,000 tons of shipping ore, while the total ore underlying the inner and outer submarine areas of this company will exceed 2,500,000,000 tons."

This reads more like a fairy tale than an actual recital of facts and it is within the memory of merchants in St. Johns, New-

FIG. 1.

CLARENDON HILLS, JAMAICA.—The heart of the mining district, showing cultivation of the estates. The copper-wood mine is above the cottage, right hand side.

foundland, who were in the habit of picknicking on the little island and ballasting their sail boats for the return trip across the narrow strip of water, in case of an unexpected gust of wind, with lumps of the ore found lying at the base of the cliffs, when the entire island could have been purchased for a few hundred dollars!

It is evident from what has been here shown, even without referring to other mining operations, that there has been considerable development of the mineral wealth of Newfoundland since the publication in the JOURNAL OF THE FRANKLIN INSTITUTE of my brief paper on its undeveloped mineral wealth.

As I am to be followed this evening by Professor Bradley

Stoughton, who has kindly come here to give us an address on "The Open Hearth Process," I will not take time even to refer to other mineralogical developments in Newfoundland in recent years, but will pass on to a brief account of some observations concerning the undeveloped and partially developed mineral wealth of Jamaica.

FIG. 2.

Highway between the copper mines and shipping port. Old Harbor, 11 miles distant. The military roads in Jamaica are equalled only by the finest park roads in U. S.

JAMAICA.

In March last I visited this beautiful tropical island and saw many evidences of mineralogical deposits of interesting character in the interior and also not far from the coast, but very little had apparently been accomplished in the way of their economic development.

I found that there is a general—if not universal—belief that Jamaica, like many other West India Islands, is of volcanic

origin, but this impression is evidently unwarranted, as will be seen presently.

In the year 1869 there was published in London, by order of the Lords Commissioners of Her Majesty's Treasury, a voluminous and valuable report on the "Geology of Jamaica," by James G. Sawkins, F.G.S.; this is now a rare volume of 339 pages, with numerous tables and maps giving complete accounts of surveys of the entire island; its geological formation, the

FIG. 3.

JAMAICA COPPER MINES.—Open cut showing width of vein between two dark lines. Superintendent and mine boss examining ore.

minerals, rocks, rivers, mountains, etc., and I propose to draw freely from this fund of reliable information for the facts here given. The author says, "The only vestiges of volcanic action occur in the northeast portion of the central range of mountains, below the summit of Blue Mountain Peak (over 7000 feet high) which consists of sand and gravel, represented by quartzite, conglomerate and indurated phosphatic clays."

The island is situated between 17° and 19° north latitude, and 75° and 79° west longitude; it is 135 miles long, 35 to 50 miles broad and comprises 3250 square miles area.

Over 115 rivers and streams are known to find their way to the sea, exclusive of the numerous tributaries from every ravine in the mountainous districts, the abundance of water justifying the name "Island of Eternal Springs" given to Jamaica by the Spanish discoverers. This never failing source of power is practically unlimited but for the most part not utilized.

The following is a condensed list of metallic minerals taken from the geological report referred to:

FIG. 4.

JAMAICA COPPER MINE.—The general manager inspecting a pile of copper ore at the mouth of mine. This ore contains a little gold and several ounces of silver to the ton.

"*Gold.*—This precious metal is found associated with some of the oxidized copper ores of the Clarendon Mines." There is a tradition that the Spaniards obtained gold here and they named an adjacent elevation "The Gold Mine." These workings have long since been abandoned.

"*Copper.*—The ores of this metal are very widely diffused in Jamaica and assume different characteristics according to the geological circumstances and form in which they occur, viz.:

as carbonates in crystals, silicates and even native in granular form. Copper also occurs in veins both in Portland and Clarendon but are most distinctively so in the latter parish. The metal occurs usually in detached deposits among disintegrated rocks on the sides of the mountains either in the form of silicates, carbonates or oxides."

FIG. 5.

COPPER-WOOD MINE, showing opening at top of mountain. Tobacco field and cocoanut grove in the valley. Jamaica.

In the geological report of the parishes of St. Thomas and Portland no less than twelve pages are devoted to descriptions of the various copper deposits. In the chapter entitled "Economic Geology of the Parish of Clarendon" the following account appears: "The Clarendon Mines afford a nearer approach to true lodes of mineral veins than any of the other metalliferous deposits of Jamaica. Without being contained in mechanical fissures, still, the deposits are bound by definite walls and characterized by distinct gangue and ribs of ore. . . . During the year 1858 some specimens of blue and green carbonates of

copper were given to the Hon. Lewis Mackinnon as specimens of copper ore from the Clarendon mines and on leaving Halse Hall these specimens were thrown away. While I was surveying this (Clarendon) parish I occupied Halse Hall, and the Assistant Geologist, Mr. C. B. Brown, while on a visit, found a small piece of the discarded rock and on close examination discovered that what had been considered by the miners copper pyrites was truly

FIG. 6.

PAY DAY AT THE MINES.—The negroes receive about 36 cents per diem. There are 150 men working, night and day shifts. Jamaica copper mines.

gold. Large pieces were afterwards found containing sufficient gold to be considered gold ore, the value was established at from £60 to £70 per ton, besides the copper which would yield from 12 to 15 per cent."

It is of record in the archives of the colony that in the year 1857, 207 tons 15 cwt. of copper ores were shipped from the Clarendon mine and Mr. Sawkins states that had these mines been worked intelligently and due attention given to the under-

taking, the mining would have then proved a success instead of a failure. It is the same region that is now being developed by Boston capitalists and is in the centre of an agricultural district under high cultivation.

In Appendix III of Mr. Sawkins's report there are quite a

FIG. 7.

Free hand sketch of narrow trail to top of Blue Mountain Peak, Jamaica, (7443 feet elevation), showing one of many sharp turns on dizzy heights with conical peaks below. The trip required two days of hard riding on sure footed mountain ponies.

number of analyses of evidently selected specimens of copper ores from different localities, among which are the following:

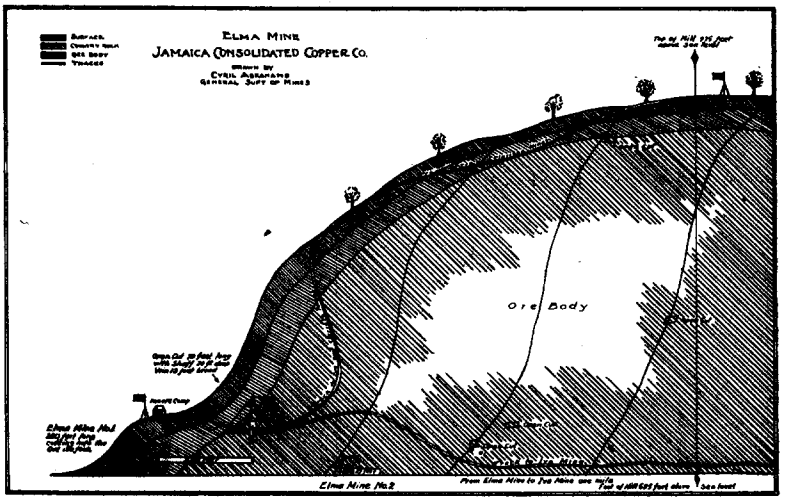
	COPPER
Copper Pyrites	35.93 per cent.
Purple or Peacock ore	62.50 per cent.
Mixed purple and gray ore	70.99 per cent.
Gray copper ore	79.80 per cent.
Native copper	98.97 per cent.

Among other minerals described in the report as being found in Jamaica are cobalt, lead (galena), zinc (sulphide), manganese (pyrolucite), iron, arsenic, and antimony. No mining operations have been established so far as I have been informed, except for

copper in the Clarendon hills where extensive developments are now in progress.

In 1906 several Boston men obtained a lease of 2276¾ acres of land in these hills, with option of purchase within a few years, and since then have been vigorously prospecting and tunnelling into the hills. At the time of my visit to Jamaica (March, 1909) there were about seventy-five laborers at work blasting out ore and sixty-two openings had been made, from more than forty of which it was said that different kinds of ore had been taken showing profitable copper values and carrying more or less value in silver and gold.

FIG. 8.



Sketch of Elma Mine—one of ten mines now opened on the property.

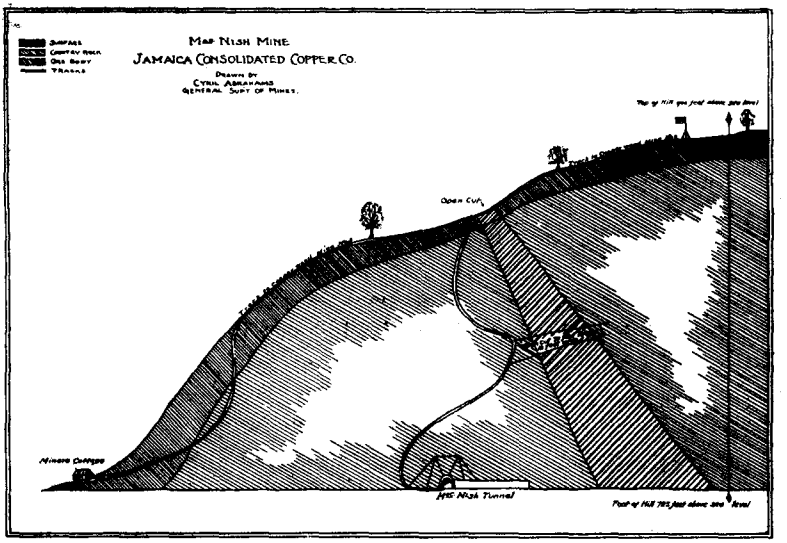
I secured a collection of samples of these copper ores from several of the mines and they have all been classified at the Academy of Natural Sciences. Duplicate samples, duly labelled, are on the table for inspection at the close of the meeting.

Several of the specimens are very rich ores. I have also obtained copies of forty-seven analyses made by six different firms in New York, Boston, Denver, Jamaica, and London, of samples taken from the run of the mines that have been analyzed for the purpose of obtaining definite information regarding the average value of the deposits, these show, of course, wide variations, ranging from a minimum of 4.06 per cent., to maximum

69.32 per cent. copper, also showing gold, ranging from a mere trace up to 1.72 ounces per ton, and from a trace of silver up to 56.44 ounces per ton of ore.

At the time of my visit in March last, a little over 1200 feet of tunnels had been made, since that time the force of laborers has been doubled and development work has progressed rapidly, as

FIG. 9.



Sketch of MacNish Mine, recently opened.

will be seen from the annual report of the General Manager of the Jamaica Consolidated Copper Co., dated October 13, 1909, just issued.

"I am pleased to report most satisfactory progress at the Mines during the past twelve months. Our development now stands as follows, in tunnels, cross-cuts, upraises and drifts:

	FEET
Sylvia Mine	819
Victoria Mine	205
Cheltra Tunnel	403
Iva Mine	341
Elma Mine	384
Clarissa Mine	156
Copper Wood Mine	557
Cyril Tunnel	47
Congo Hill Mine	1271
MacNish Tunnel	173

making a total of 4356 feet, with more than 2000 feet of open cuts and prospect shafts not included in the above.

"The Mines have recently been examined by one of the ablest mining men in America. He reports as follows:

Ore in sight ready for extraction,—	TONS
Congo Hill	1,332,000
Victoria Mine	66,500
Sylvia Mine	150,000
Iva Mine	19,800
Elma Mine	16,500

with all breasts and drifts in ore. This makes a grand total of 1,585,800 tons."

Some of the peculiar or distinctive features of copper mining in the Clarendon hills in Jamaica may be enumerated as follows:

1. A great portion of the estate is under cultivation, furnishing considerable revenue, besides all the food stuffs required to feed all the hands now, or that may be in the future employed on the plantation or in the mines, the balance is mainly forest land containing all the timber that could ever be used in the mines or in the erection of buildings and also precious woods of various kinds.

2. Native labor is employed with success at an average wage of about one shilling and six pence per diem. The negroes are apparently a contented class and the wage is a little more than is paid agricultural labor on the neighboring plantations.

3. The distance from the shipping point "Old Harbor," or from the railway station, "May Pen," is a little more than 10 miles over highways so perfect as to be compared only to park roads.

4. The climate is such that work can be carried on day and night throughout the year.

5. Abundant water is available for power and for electrolytic refining operations at low cost.

The following classification of the samples of copper ores from seven different mines on the property of the Jamaica Consolidated Copper Company has been kindly furnished by the Curator of the Academy of Natural Sciences. Duplicate specimens have been presented to the Academy and to the Franklin Institute.

No. 1.—Bornite with azurite and malachite; from Iva Mine.
No. 2.—Chalcocite with malachite and chrysocolla; from Victoria Mine; very rich ore.
No. 3.—Chrysocolla and chalcocite; from Sylvia Mine; rich ore.
No. 4.—Bornite and malachite with chalcocite and chrysocolla; from Clarissa Mine.
No. 5.—Metallic mineral, dorneykite or mohawkite; red portion, cuprite (copper oxide); from Sylvia Mine.
No. 6.—Chalcocite and chrysocolla; from Elma Mine.
No. 7.—Red part, cuprite; blue green portion, chrysocolla; bright green, garnerite; tarnished patches, Mohawkite. (The garnerite is nickel and magnesium silicate.)

In conclusion I think it proper to repeat what I said in my address given in 1897; namely, that I am merely an observer from an outside standpoint and chronicler of these exploitations, and am not connected in any capacity with any of the mining companies. I am not, therefore, prepared to express an authoritative opinion as to the future commercial value of any of the operations described, but I have verified, as far as possible, statements furnished to me before presenting them in this paper. Should the development of the mineral wealth of Jamaica in the next decade compare favorably with that of Newfoundland since my address in 1897, I hope I may have the pleasure ten years hence of calling attention to it, as I have just now done with respect to the remarkable developments of mineral wealth of Newfoundland in the past twelve years.

NOTE.—At the conclusion of this address a number of lantern slides made from kodak pictures taken by the author and his party were exhibited showing the general character of the country, together with views up the trail leading to the top of Blue Mountain Peak. This is a difficult and rather dangerous trip, occupying two days of very strenuous riding; skirting numerous precipices and affording magnificent views. Since the earthquake of 1907 few, if any, visitors to the island have made this ascent, and the path is somewhat overgrown and partly obscured in many places. It is necessary to employ guides also to carry warm clothing, and to arrange in advance for accommodation over one night, or possibly longer, in case of bad weather. at one of the coffee plantations on the side of the mountain. It is not always possible to obtain such shelter.