MINING MATTERS

THE VAST ORE DEPOSITS OF CUBA — 500,000,000 TONS AVAILABLE — FURTHER AREAS RICH IN ORE

The discovery that Eastern Cuba is over-laid with a deposit of iron, accessible for mining without tunneling or shafting, which aggregates fully 500,000,000 tons or more, means that a new source of supply is available for the American iron and steel industry that is of the greatest importance. Less than ten years ago was this deposit investigated. In 1904 samples of ore were taken from a small area that were found to contain over 50 per cent of iron. This was followed by a more exhaustive study of what is known as the Mayari district, by pits 300 feet apart, with borings made with a 2-inch carpenter's auger in the bottom of each pit. At first, each foot of pit the borings were analyzed separately; but the ore proved of such uniform quality that samples were then taken of each 6 feet, by borings only, and the distance between these was increased to 1,000, 1,500 and 1,750 feet.

The only iron ranges in this country that can be contrasted with the Cuban deposits in extent are the Superior, which in their earlier history supplied 75 per cent of the ore consumed by American furnaces.

The ore in its natural state contains a very large percentage of water, which increases to some extent with the depth below the surface. Near the surface it is red in color, with somewhat granular structure. The color gradually changes with depth, finally reaching a bright yellow. The consistency also changes toward the bottom to a clay-like, sticky mass. The relative proportion of red and yellow ore is quite variable; in some places the yellow reaches close to the surface, while in others the red extends almost to the underlying serpentine.

In the Mayari division of the Spanish-American Iron Company, the ore lies on an irregular plateau, about 15 miles long and 5 miles wide at the widest point, entirely covered with pine trees and brush, which grow directly on the ore. The elevation at the northern extremity, which is approached by the railroad, is about 1,700 feet above sea-level. At the southern end the general elevation is about 2,000 feet. Ore is removed by means of scraper-bucket excavators and steam-shovels, these machines loading into special standard-gage, side-dump steel cars of 100,000 pounds capacity.

The Spanish-American Iron Company is also operating hard-ore mines of the Daiquiri group, on the south coast of Cuba, about fifteen miles east of Santiago. The main ore property at Daiquiri, once considered as three separate mines, San Antonio, Lola and Magdalena, has now developed into a practically continuous body of ore. The ore in the Lola mine can easily be distinguished from the waste by its darker color. The waste-banks are on the right and the ore-lowering inclines on the left. Both the ore and the over-burden are removed from a series of benches. Fourteen steam-shovels are employed for stripping, the largest of which is a 90-ton Marion carrying a 4-yard dipper. All are served by locomotives and trains of side-dump cars for removing the rock to waste-banks on the back side of the hill.

On account of the rock being mixed more or less with the ore, it is necessary to load all of the ore by hand into small cars, which are run to lowering-inclines. These inclines carry the ore in skip-cars to the main-line railroad, which runs from the foot of Lola hill to La Playa, the shipping-port at the coast, four miles from the mines.

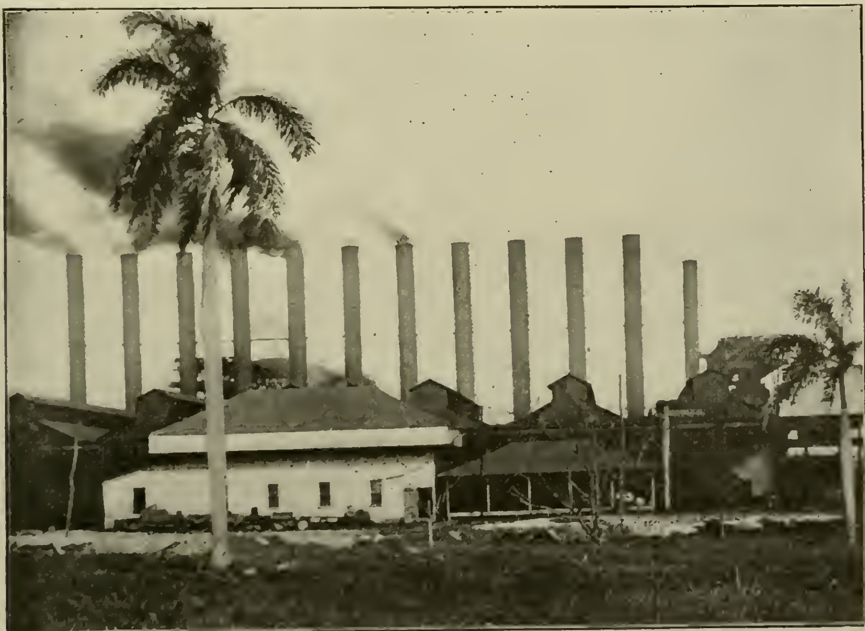
A hoisting-incline is provided for raising coal, machinery and general supplies from the main-line railroad to any level of the mine. A modern air-compressor plant is located along the railroad near the San Antonio mine, and a pipe-system is arranged to furnish compressed air for tunnel-exploration and for general service to any part of the mine. Steam-drills are used in the principal blasting-work. Ore is also brought from the Berraco and Sigua groups of mines, located to the east of Daiquiri, over a narrow-gage railroad joining the standard-gage main-line about two miles below Daiquiri mines. All of the ore is crushed before shipment in a Gates crusher-plant to sizes suitable for use in the blast furnaces.

The contour of the ground at the point where excavations were begun, in the Mayari district, though appearing to be quite regular, is not ideal for steam-shovel operation. The depth of ore is not uniform, in many places the underlying rock projecting far up into the ore, even to the surface. The general slope of the ground, even in the most nearly level places, is quite irregular. Therefore, it is difficult to find many places where it is possible to operate a steam-shovel for an extended period in a cut of economical depth without including a considerable portion of the rock with the ore excavated. For this reason the scraper-bucket excavators are more satisfactory as well as more economical for excavation, although their capacity is considerably less than that of the large-size shovel used. Three of these excavators are now at work, together with one 90-ton Bucyrus steam-shovel. The excavators operate 1.25-cubic yards Page buckets, although a larger capacity of bucket is contemplated. The bucket swings through a radius of 60 feet, and without difficulty removes all the ore for a width of about 100 feet down to the rock bottom, the projecting rock and stumps being discarded. Each machine-crew consists of one operator, one fireman, and three pitmen. As the machine works up hill or down hill continually, and the track follows the same grade, cars can be dropped down by gravity to be loaded as needed, with a minimum aomunt of locomotive service.

The nodulizing plant, located on the east side of the raw-ore yard, consists of twelve rotary kilns, 10 feet in diameter, and 125 feet long, set at an inclination of ⅝ inch per foot, and 20 feet apart. The kilns are of the type commonly used in the manufacture of cement. The diameter, however, is unusually large in order to overcome trouble from "ringing-up" in the hot zone, which often causes serious delays in the operation of kilns of smaller diameter. Each kiln is carried by two steel tires rigidly fastened to the shell. The cut-steel driving-gear attached to the shell close to the tire near the cold end is 152.78 inches in diameter, and 4 inches in pitch. Each kiln is driven by a 35 horse-power variable-speed motor. A 7.5-ton over-head electric traveling-crane, carrying a man-trolley with 3 cubic yards grab-bucket, is provided for removing the nodules from the trough of the nodulizing plant and loading them into 50-ton electric transfer-cars on the track passing alongside of the trough.

The construction at the water-front is somewhat unusual. Close to the front leg of the bridge, and parallel to its runway, is a trestle extending over one side of a trough. A transfer-car brings the nodules from the nodulizing-plant, and discharges from one side into this trough, in position to be readily loaded into the vessel, or to be moved back to storage under the main span of the bridge by the grab-buckets. The bottom of the trough is one foot above high tide. Its outer wall is formed by planking spiked to a row of piles. All of this construction, being above the water-line, is not subject to damage by the *teredo navalis*. From the outside of the trough-wall the bottom drops off at an angle of 45 degrees to 28 feet deep at the fender-line, which is approximately under the hinge of the boom of the bridge.

Considerable dredging was necessary in order to provide a suitable harbor. A basin 1,500 feet long, 200 feet wide at each end, and 400 feet wide at the widest point, was



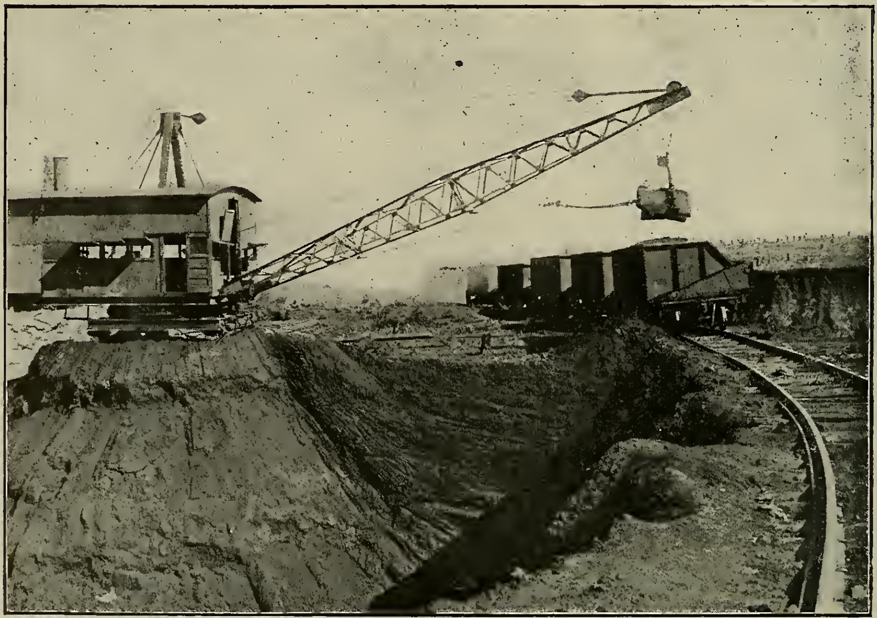
General view of nodulizing plant at Felton. Twelve kilns are in operation.

dredged to a depth of 28 feet. The approach-channel, 2,500 feet long and 200 feet width, was dredged to the same depth. Felton, on Cagimaya Bay, a well-protected branch on the south side of Nipe Bay, close to its entrance, has proved a very safe and satisfactory harbor.

Each year more investigations are made of the deposits beyond the mines opened, and the results confirm the statement that this and the Mayari beds contain fully 500,000,000 tons with an extensive area still unexplored. The tonnage available for steel making may be 600,000,000 or more, as only a half million tons or more of ore are mixed annually.—Henry Hale, in the *Scientific American*, New York.

The *Mining and Engineering World* recently printed abstracts of discussions before the American Institute of Mining Engineers in February, 1912, on the valuation of iron mines for taxation. In the course of the proceedings comparisons were made of the Cuban ore with that of the Lake Superior mines, and Mr. E. E. White of Ishpeming, Mich., prepared a table of costs of nodulized Cuban ore, which is as follows:

COST OF CUBAN ORE AT PITTSBURGH	Cts. per Unit
Mining, 27 cts. per ton, 40 cts. nodulized	0.76
Nodulizing, $1 per ton	1.89
1,200 miles sea-haul at 0.0522 = 62.6 cts. per ton	1.19
25 miles land-haul in Cuba at 0.336 = 8 cts. per ton	0.15
328 miles land-haul to Pittsburgh at 0.336 = $1.10 per ton	2.09
Loading and unloading boats, 10 cts. per ton	0.19
Terminal costs in Cuba, 18 cts. per ton	0.34
Terminal costs in U. S., 15 cts. per ton	0.28
Royalty, 5 cts. per ton	0.095
Taxes, 5 cts. per ton	0.095
Premium for Bessemer quality, 48 cts. per ton.	7.080
Premium for phosphorus, 0.025 per cent, 25 cts. per ton.	
Total premium, 73 cts. per ton	1.38
Total cost per unit to compare with cost of average Lake Superior ore at 5.57	5.70
Duty, 12 cts. per ton	0.23
	5.93



Steam drag at Felton mining properties owned by the Spanish-American Iron Company.