MINING

Low-Grade Ore Yields Iron

Taconite is a plentiful, low-grade ore which is difficult to mine. Jet-flame drills, by making mining easier, may make taconite a new U. S. resource.

By ANN EWING

➤ THE danger of the end of the "Iron Age" in America due to the lack of high-grade iron ore can be averted.

A way has been discovered to turn vast quantities of low-grade ore available in this country into satisfactory material for the iron and steel industry.

A Second Mesabi

Taconite is the name for the low-grade extremely hard iron ores found in almost unlimited supply. Taconite promises a second Mesabi, for these ores are abundant in the same district from which our high-grade supplies have been coming.

Iron is found in the earth's crust in extremely large quantities, approximately 5% of the entire earth's surface consisting of this vital element. Recent figures indicate that the world has billions of tons of actual and potential iron ore, but much of this is low-grade and inaccessible.

In addition to the vast deposits of the Lake Superior region, large iron ore beds occur in South America, Africa, India, Russia, Sweden and Canada. Recently the rich deposits of Labrador and the so-called "mountain of iron" in Venezuela have received much attention.

Delivery of high quality Labrador ore to a St. Lawrence River port involves 400 to 500 miles of overland rail shipping. Without the St. Lawrence Seaway, it is doubtful if this ore could compete commercially with other foreign ores or with taconite ores after concentration.

An Iron Mountain

The Venezuelan iron ore deposits are rich and extensive. Cerro Bolivar, as the recently discovered iron mountain is known, contains more tonnage of iron than the largest open pit in the Mesabi Range ever produced or ever will produce.

Shipment of these or other high-grade foreign ores to the blast furnaces and steel mills in this country during an emergency might leave the ore-laden boats open to submarine attack, however.

Our supplies of top-grade rich-in-iron ore, the stuff that can be dug and shipped for blast furnace use without further treatment, are being used up rapidly. Two world wars took great hunks out of the reserves of the Mesabi region. And there is slim, if any, chance that new deposits of high-grade ore will be found in the Lake Superior district.

But the hundreds of millions of tons of taconite that surround the now almost exhausted rich iron pocket of the Mesabi Range can be the domestic ore supply of the future.

Taconite is so hard that it is extremely difficult to mine. This has delayed its use. But now, a promising aid in the development of taconite has been perfected—a jet flame that pierces this solid rock at an unprecedented rate.

Where previously a churn drill could bite through only about one foot of taconite per hour, the jet-flame drills will burn a nine-inch diameter hole at the rate of 20 to 30 feet an hour.

Jet-piercing works on the same principle as that which propels rockets. Instead of thrust propulsion, however, use is made of the flame itself and the speed of the flame. Oxygen and a fuel such as kerosene are burned in a specially designed chamber to give the violent combustion.

High-Temperature Jet

Temperature of the flame that pierces this tough rock is probably over 4000 degrees Fahrenheit, yet the ore does not melt. It does not even fuse. The jet flame just disintegrates a hole in the solid rock. When a series of holes have been jet-burned in this manner, they are filled with explosive and blasted. Thus can taconite be mined.

The rock itself contains about 40% iron. Of this, about 25% to 30% is magnetic and can be recovered without too much difficulty after the ore is ground fine and concentrated.

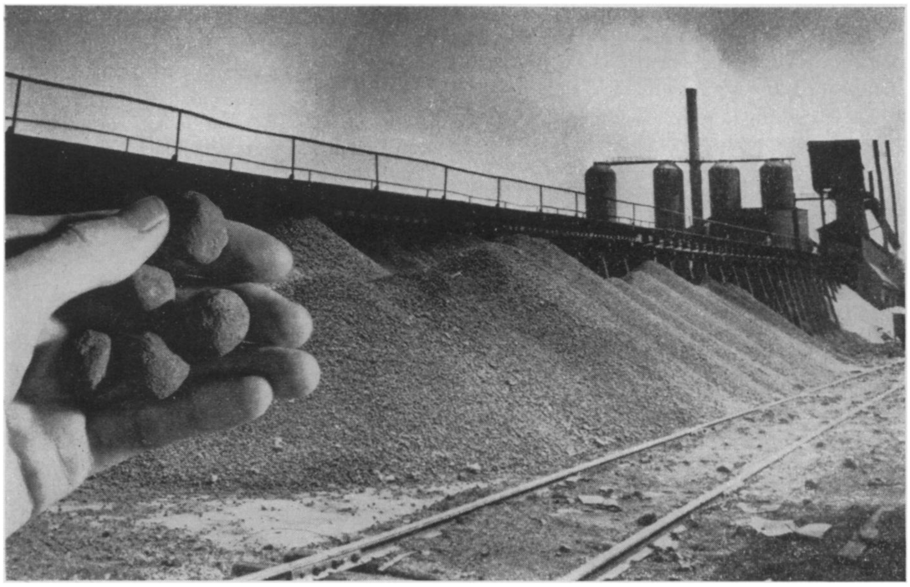
Engineers have worked out on pilot-plant scale methods that can make these magnetic taconites commercially competitive with the high-grade direct-shipping ores now being dug.

Taconite is much more abrasive and harder than granite. The hardest crushers yet made in the United States have been developed to crush taconite to the proper fineness.

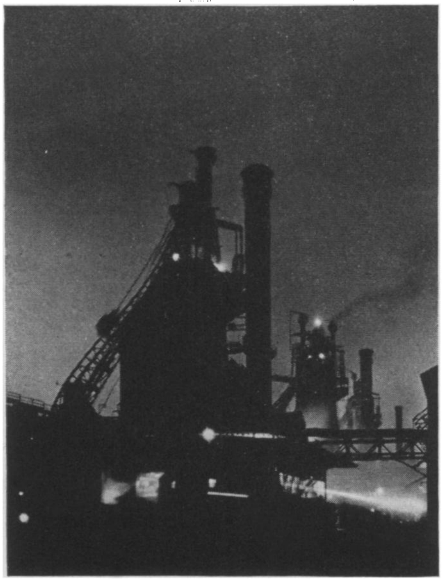
Crushing is done in successive stages, until the rock is reduced to about ¾ inch size. Then the stone chunks are put into a rod mill. This is a big drum containing steel rods. As the drum revolves, the rods fall and grind the ore. In this manner the rock is ground to the same fineness as face powder. Or until about 85% of the material will pass through a screen having 105,000 openings to the square inch.

By passing this fine powder between magnets, it is concentrated to the point where it contains at least 63% metallic iron. This fine, powdery concentrate must then be put back into a form that is suitable for shipping and for blast furnace use.

There are three methods of processing that have been tried: sintering, briquetting and pelletizing, which transform the taconite powder, respectively, into irregular lumps, brick-like blocks, or small round



ORE OF TOMORROW—A stockpile of our domestic iron ore of the future is shown. Taconite, as in the pellet form above, can be concentrated and substituted for the rich Mesabi ore that has kept our industrial pot boiling for years.



INDUSTRIAL NOCTURNE—Taconite-concentrate pellets can be used to feed the ravenous appetites of the hungry blast furnaces. Never satiated, knowing no night and day, their giant maws are ever open for more ore to transmute into iron.

balls. Of these, pelletizing promises to be the least expensive method.

Because of their uniform size, pellets are easily fed into the blast furnace. And engineers now believe that pilot plants have demonstrated that pelletizing can be done on a large-scale, mass production basis without difficulty.

In order to make pellets, the magnetic concentrate is dampened. In a huge revolving drum, this damp powder is rolled up into small balls about the size of large marbles.

These iron marbles are then heated in a furnace at an even temperature. If the furnace is allowed to become too hot, mass fusion instead of pelletizing takes place. Careful temperature control, therefore, is required.

The pellets must be porous in order that the blast furnace gases will attack and melt the iron they contain. They also have to be hard enough to withstand the rough treatment they receive during shipment to the ore boats, in the boats going down the Great Lakes and in the stockpiles awaiting use.

It takes three tons of crude rock to produce one ton of taconite concentrate. The material thrown away is known as tailings. Gray in color, tailings are almost pure sand or silica.

Because of the huge amounts of taconite that will have to be concentrated to keep the iron and steel industry going at the present or an increased rate, the disposal of tailings presents a problem. They could be dumped on the ground, but it would take vast areas to accommodate them.

Or they could be put into Lake Superior. If this is done, it is believed that the sand thus added to the lake will be helpful for the spawning of fish.

The huge grinding, separating and agglomerating operation for making taconite-concentrate pellets will require enormous quantities of water, electric power and fuel. Forty-eight tons of water must be pumped for each ton of iron concentrate produced. An adequate water supply, therefore, is a major necessity.

Adequate Financing Needed

Building of the full-scale plants now awaits only adequate financing. Plans that would eventually bring taconite production to 30,000,000 tons a year would require some kind of government help. Since it would take about four years to build a plant with a capacity of 2,500,000 tons, many persons are anxious to see a start made on this project at the earliest possible date.

Even for such a relatively small production of taconite concentrate, the initial investment has been estimated at $15,000,000 to $20,000,000 for the processing plant and accessory equipment.

Development of large scale production of taconite is essential if we are to avoid complete dependence on foreign sources for our iron ore. Although the time factor to complete exhaustion varies with different estimates, both government officials and private industry agree that the high-grade iron ores are being depleted, and that the chances of finding new high-grade resources are fairly remote.

We must, therefore, have some domestic source that can keep our vast steel industry going, especially in an emergency period. Taconite, many people claim, is the only answer.

Send 50c to Science Service, 1719 N Street, N. W., Washington 6, D. C., for the Iron Ore Unit of Things of Science telling more about taconite.

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