Taconite Iron Ore

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Taconite iron ore was not considered profitable to mine until the early 20th century, having an iron concentration of only 20-30% the steel mills were unable to use it in its mined form, whereas other forms of iron or such as magnetite and hematite with iron concentrations of 70% or better could. The reason for the interest in mining was not sparked by it becoming so profitable but by the depletion of the ores with higher concentrations of iron, particularly in the Mesabi Iron Range, near Hibbing, Minnesota. As the higher quality iron ore was depleted in the area all that was left was taconite. Taconite is found in a hard sedimentary flint-like stone also known as chert. The only early interest was for the use of its flint like characteristics as well as it hardness for early stone tools. Basically it was mined by individuals almost on an as needed basis.

With the depletion of the higher grade ores it was in the best interest of the state and the mining industry to cooperate and find a profitable process to extract the iron from the chert and ship it to steel mills in a usable form. In 1912 Dr. Edward W. Davis a professor at the University of Minnesota teamed up with colleagues and the mining industry to start researching a way to do just that. It would take 40 years of research; however, on August 29, 1955 in Silver Bay, Minnesota Dr. Davis started the first commercial application of the pelletizing process. As a result of his research Dr. Edwards is often referred to as “Mr. Taconite” by the colleagues of his era. Dr. Davis is also credited with saving iron mining in the state of Minnesota.

Like many purification processes, the pelletizing process is a multistage process that starts with the open pit mining of the ore.

First the chert is extracted by using explosives to dislodge it in small pieces. A jet piercing machine which consists of a drill with an attached high temperature flame thrower is used to drill into the chert, as the drill is turned the flame heats the rock to a temperature of about 4500 degrees Fahrenheit, water is pumped down the hole to cool the drill head and the steam produced pushes the drilling debris from the hole. The pattern and depth of the holes as well as the size of the explosive charges are determined by mining engineers to produce the highest yield. The blasted rock is transported to the next process.

The second phase in the process is crushing the stones into the size of marbles then grinding them to the consistency of flour. This process involves the rocks being dumped into a hopper with rotating heads that crush the rocks between them after which the crushed stone passes of a screen. Stones that pass through the screens are then mixed with water and ground in rotating mills.

The third step of the process consists of separating the iron from the waste or tailings. The resulting higher iron powder which is not pure is called concentrate. It should be noted that, initially the tailings were disposed of into Lake Superior where it polluted the lake and killed fish, however, the government through extended litigation forced Reserve Mining Company to find a more eco-friendly disposal method for the tailings.

During the fourth and final phase of the process, the taconite slurry is combined with clay and sent through heated rotating cylinders until it is white-hot then cooled. The resulting product is brittle taconite pellets the size of marbles. The pellets are now ready for shipment to the steel producers.

The Reserve Mine Company ships its taconite by rail to the port Duluth, Minnesota then by ship to steel mills on other ports on the Great Lakes.

1 Taconite Pellets

Taconite Pellets ready for the steel mill

References:

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