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ZINC FROM THE JERSEY HILLS

More zinc is mined from the stubby, ragged hills of New Jersey's Sussex County than from any other state in the nation. Only an area in the mid-West, including parts of Kansas, Missouri and Oklahoma, has a greater output than New Jersey. Under the stimulus of recent scientific doscoveries articles containing zinc are found in home and office, on farms and in factories, in automobiles, airplanes and machines. Iron utensils are coated with zinc--galvanized--to make them rustproof; zinc is used in making hardware and even in cosmetics; and paint made from zinc is as common as the well-known white lead.

Like gold, silver and lead, zinc is a chemical element. It is never mined in a pure state but always combined with certain chemical impurities such as oxygen, sulphur and silicon. The New Jersey ore looks like pieces of rock, composed of tiny black, red, orange and yellow crystals. Only experts can distinguish some of these from other rocklike substances.

The "Horsehead Special" metallic zinc, which is refined from ore mined in Sussex County, is famous throughout the world for its quality--99.9 percent pure. The metal is soft and plastic enough to be rolled into thin sheets for making stair treads, fruit jar tops, eyelets for shoes and many other items. Most articles made of zinc alloys, such as automobile door handles, instrument board equipment and carburetors, are cast in sand molds, or die-cast. They contain from 93 to 96 percent of special high-grade zinc. Other metal products, which may look like iron, steel, aluminum, chromium, tin or lead, may really be zinc alloys. Typewriter frames, lawnmowers, golf club heads, refrigerators and toys, for example, all may contain zinc. Zinc dust, which is essentially zinc metal powder, is used for rust-resisting paint, textile bleaching and smoke screens.

The most important zinc compound is zinc oxide, a combination of the metal with oxygen. This white solid is used in a variety of paints, rubber goods, false teeth, paper, glass and medicinal products.

Zinc must have been known to ancient Europeans; for a zinc idol, the oldest known piece of the metal, has been found in the remains of a prehistoric settlement in Transylvania. Archeologists, digging on the Island of Rhodes, found two silver-covered zinc bracelets dating from 500 B.C., and at the ruins of Pompeii there was uncovered a fountain partly plated with zinc. The Romans as early as 20 B.C. melted zinc oxide with copper to make bright yellow brass. Only a few men knew how to separate metallic zinc from the zinc ore, but they kept the process hidden for their secret work--the formation of gold.

These men, called alchemists, apparently believed that copper could be changed to gold by combining it with zinc because the gold-colored brass had been obtained in this way. This dream led the alchemists to hide their researches and to falsify their statements on zinc. About the middle of the 16th century, however, Georgius Agricola, famous for his study of metals, accidentally

came upon a bright zinc alloy in the narrow wall-cracks of a furnace which had been used for smelting lead and copper ores. Some zinc ore had apparently been mixed with the others to produce brass. Paracelsus, the celebrated alchemist and a contemporary of Agricola, was the first person to give the name "zinck" to the metal. Before, zinc had been called spiauter, spialter or speltrum, from which comes the name for commercial slab zinc used until recently--spelter. It was probably being imported by Dutch and Portuguese merchants from China, where it had been used for centuries to make coins and mirrors.

About 1740 Dr. Isaac Lawson, who learned the smelting process in China, opened a zinc refinery in England. By 1850 the industry had spread to the rest of Europe, but not until the close of the Civil War did intensive zinc refining begin in the United States. In a very few years, however, this country became the largest producer of zinc in the world.

The early story of zinc in America is largely the story of zinc in New Jersey. The 17th century settlers who dug for valuable minerals in the Sussex County hills knew nothing of zinc ores, nor did the prospectors who followed. Iron or copper is what they sought. About 1774 one of the early iron masters of America, William Alexander (Lord Stirling), could not identify the Sussex County zinc ore. He shipped samples to England for examination, where experts declared the strange and complex ore unsuitable for commercial purposes. Stirling abandoned his claim.

In 1810 Dr. Samuel Fowler and John Odell Ford purchased 4,000 acres of land in what is now Franklin, two miles from Ogdensburg, for less than three dollars an acre. They, too, intended to exploit magnetite, a magnetic iron ore, which they believed was on the property. A few years later the doctor bought out his partner, married the heiress to the nearby Ogden lands, and thus came into control of a locality rich in metals. Fowler toiled for years with the complex ores but had little success. He was working one of the few deposits in the world which contained approximately 100 different minerals, many unknown then and some found nowhere else even today. From the research done by Dr. Fowler and many American and foreign metallurgists whom he had interested came the groundwork for the zinc industry in the United States.

About 1830 Dr. Fowler invented a process, since lost, for producing bluish-white zinc oxide powder. From the powder he made a paint which he used on his house. The paint was not very good because of poor pigments, but it increased interest in the possibilities of using zinc as a base. A zinc base makes paint last longer.

There was a widespread demand for metallic zinc to make zinc oxide. But New Jersey mining companies found it impossible to refine zinc profitably in the small amounts demanded by the paint industries.

This important obstacle still remained when the federal government brought workmen from Belgium in 1838 to make the zinc for the first standard set of brass weights and measures. Zinc ore from Franklin was used. Eleven years later the Sussex Zinc Co. opened a plant in Newark for manufacturing zinc tableware and other articles. The newspapers of the day believed that the zinc-plated knives and forks would soon replace silver.

Meanwhile chemists and metallurgists were still looking for a good, cheap way to make zinc oxide. But while scientists worked overtime in their laboratories, a furnace tender in a Newark chemical factory accidentally hit on a method for making the compound. One day his furnace cracked. To close the hole he put an iron grate across it and covered it with a mixture of coal and pieces of zinc ore which he picked up in the yard of the zinc company next door. In a short time a cloud of white powder was rising from the [illegible]. He carried his discovery to Samuel Wetherill and Samuel [illegible] of the [illegible] Company, and be-

fore long the large scale manufacture of zinc oxide was begun in America. Zinc oxide could thereafter be made directly from the ore.

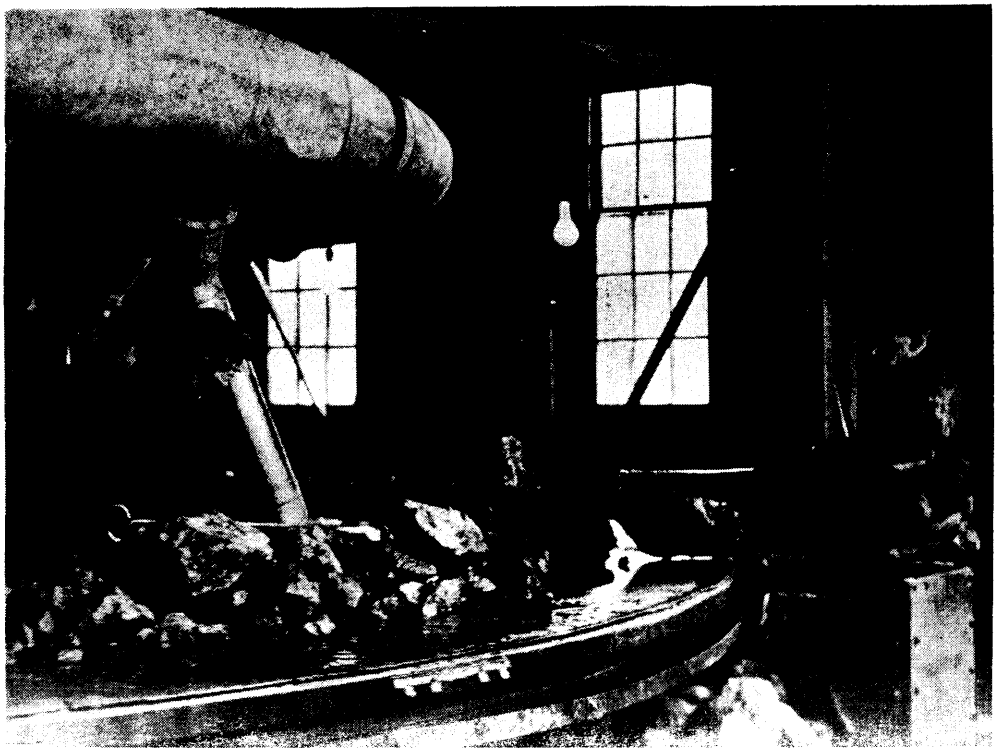
Wetherill invented the process used since 1852. Zinc ore mixed with coal is distributed over burning coal on a perforated grate, and a strong air current is sent up through the grate. White zinc oxide is formed. From the furnace these powdery floating particles of zinc oxide move through a system of cooling pipes to what are known as bag rooms. Here the zinc oxide, which looks somewhat like ordinary flour, is caught in muslin bags, about 45 feet long and 20 inches in diameter. This collecting apparatus has been changed very little since Samuel Jones invented it for use with Wetherill's furnace process.

Plants for making zinc oxide were opened in Bayonne and Jersey City. They took most of the output of the Jersey zinc mines for this purpose. The ore was mined slowly and laboriously by men toiling in faint candle light or the glow of oil lamps in the pits at Franklin and Ogdensburg. With crude explosives, picks, shovels and crowbars they crumbled the tough rock into pieces small enough to be carried to the surface. Piled on heavy wagons, the ore traveled over the hills to the canal boats at the northern end of Lake Hopatcong, from where it was shipped slowly along the Morris Canal to Jersey City.

For fifty years property rights and mining concessions in Sussex County were in a muddled state. Lawsuit followed lawsuit to determine ownership. The rights to sections of land had been leased to one company for mining zinc, while on the same property another company had bought the right to dig for manganese. No one realized that the two metals were combined in the same ore.

By 1897 all these cases had been settled by the courts, and in that year the various small mining companies and their refineries consolidated with the New Jersey Zinc Company, which was formed in 1848 at Ogdensburg. The company built a large zinc-refining plant at Palmerton, Pennsylvania, close to the coal fields, and the ore from Sussex County was carried there by railroad.

At Franklin and Ogdensburg the veins of zinc ore lie in the earth like



Separating waste rock from zinc ore at the Franklin mines

huge, slanted hockey sticks, following the slope of the hill. Near the surface a vein may be a few feet wide, but several hundred feet down it may broaden to 130 feet or more. Elevators plunge men down the inclined shafts to a depth of 1,100 feet. At various levels miners break down the walls of zinc-bearing ore with air drills and dynamite.

The ore from the working places is loaded into small rail cars which are hauled to the shaft by electric motors. These cars dump their contents into pockets at the shaft. From here the ore is loaded into "skips," small scoops on an endless chain, and carried to the surface. The zinc minerals are separated from the waste rock, with which they are mixed, in the mill situated next to the mine shaft.

The ore in pieces of all sizes is dumped through the roof of the mill and conveyed to a large circular "picking table" which rotates slowly. Men sitting on high stools skillfully remove all waste rock and pieces of wood and steel that may have become mixed with the ore. From the picking tables the lumps of ore pass through a series of great crushers where they are broken into smaller pieces. This broken ore is then carried by belts to storage bins and from there to other machines that crush the ore fine enough to break the mineral free from the waste rock.

The Franklin ores contain three main types of zinc-bearing minerals: green Willemite, red Zincite and black Franklinite. Because it is magnetic, Franklinite can be separated from the others by machines equipped with electric magnets. The Willemite and Zincite are separated from the remaining waste material by mixing them with water which is kept in constant motion. The zinc minerals, being heavier, sink to the bottom, where they are collected.

Safety first is strictly observed in mining. The miners wear safety hats and shoes with protective metal coverings to protect them from falling rock, tools or timber. Squads are always on the alert to fight fires or to give first aid in the event of cave-ins. The safety squads are trained in a unique building called the "smoke house," where the structure of the underground workings is duplicated in a huge two-story room. Stout timbers support each floor level; steep inclined walks, made of logs, lead to the upper levels.

During fire-fighting practice the men move with all the speed and purpose of a real emergency. The room is filled with smoke. Up through the different levels of the make-believe mine the men carry heavy logs which take the place of wounded comrades. On their backs are oxygen tanks, weighing 36 pounds, with sufficient oxygen for two hours.

Franklin, with a population of 5,000, and Ogdensburg, with 1,000, depend on the zinc mines for their existence. The zinc company, which employs approximately 1,200 men, provides the only industrial work in the area. Most of the social and business life of the region is centered in Franklin. The company has built and operates a small modern hospital and a completely equipped community center for the workers, their families and other townspeople. The company also furnishes water for the town and has built houses where its workers live. The homes are gradually purchased by the employees, who, for the most part, have been working in the mines for many years.

The mines have yielded more than 3,000,000 tons of zinc ore, with an average of 500,000 tons each year or one-sixth of all the zinc produced in the United States. The people living in or near Franklin and Ogdensburg know that eventually the mines will peter out. Perhaps one day the two communities will be added to older ghost towns of the State, remnants of the day when New Jersey was one of the leading producers of another metallic ore--iron.