

## Sterling Mining Museum Historical Video

Restored version of NJ Zinc Original Mining Video

<https://www.youtube.com/watch?v=YcvyajaPjlc&t=7s>

### Transcript

00:06 The history of metal mining in New Jersey covers a span of 300 years ending only 30 years ago. New Jersey was a major player in iron and zinc mining and also a producer of copper. New Jersey mining had a major impact on the war of independence and the Industrial Revolution. The zinc mines and mills in New Jersey are located in the Sussex County; the Franklin mine is in Franklin Borough and the Sterling Hill mine is in the adjoining town of Ogdensburg. This is known as the Franklin District where far below the surface of the Earth by deposits of zinc ore known around the world for their richness and purity. One can search the world and will not find mineral deposits that are closely similar. The ore minerals of the Franklin District, namely Franklinite composed of oxides of zinc iron and manganese, Willemite (zinc silicate) and Zincite (zinc oxide), are unique and have not been mined commercially anywhere else on Earth.

01:18 The precursors of the present minerals, the proto-ores, were deposited as sediments in a shallow sea together with limey mud which became limestone. Subsequently the deposit was buried, heated, and strongly deformed resulting in chemical reactions, metamorphism, and a new mineral assemblage for the ores. The limestone metamorphosed to marble. Later the ore deposits were faulted intruded by igneous dikes and penetrated by hydrothermal waters, black smokers, and subjected to weathering solutions. The ore was later uplifted and oxidized. Several periods of glaciation over the past few million years ending about 11,000 years ago served to erode the softer marble thereby exposing the hard ore minerals as surface outcrops. All of these events resulted in alteration of the chemistry of the ores and creation of new minerals. Franklin District ores have their beginnings in Precambrian time and their origin and unique characteristics are obscured by over a billion years of geologic events.

02:36 The lowest working level in Sterling is at 2550 feet. Sterling Hill is a major mine with 35 miles of tunnels. The amount of ore mined in Sterling was 11 million tons averaging 20 percent zinc plus the additional iron and manganese recovered from Franklinite as an alloy named Spiegelsen and sold to the steel industry. Sterling Hill worked during a 136-year period starting in 1850 and ending in 1986. About 1 million tons of ore remain in place from when Sterling closed due to adverse market conditions.

03:21 Uses of zinc include high grade paints, exterior and interior. These impart to their products durability hiding power good color self-cleaning and wash ability. Rubber tires, boots, shoes, hose, whether natural or synthetic rubber, are reinforced against wear and tear with zinc oxide, which is also used as a chemical in rubber compounding to shorten the time of the curing process. The ceramics industry uses zinc oxide in the manufacture of tableware, enamelware, and glass. Zinc oxide imparts good color, gloss, and opacity. Pharmaceutical zinc oxide is used in face powders, creams, and ointments such as sunscreen. It is also used to improve immunity and to reduce the severity of colds. Brass is an alloy of copper and zinc. It contains approximately thirty percent zinc. Used in household hardware, plumbing equipment, rods and tubes for industrial uses, products which require brass with a high degree of ductility. Galvanizing is the process whereby a coating of zinc metal is applied to iron and steel surfaces to prevent rusting. galvanized sheets for roofing and wire fencing are zinc coated. Zinc die castings are used extensively in the automobile industry. Radiator grilles, fuel pumps, hardware, and instrument panels are a few of these castings. Zinc alloy die castings are used in washing machines, refrigerators, business machines, hardware, and small tools. Rolled zinc finds wide use in the fabrication of battery cans, weatherstrip, moldings, fruit jar tops. It is added to other products which require added stiffness and toughness.

05:36 The Franklin District has seen centuries of mining and the New Jersey Zinc Company that owned the mines in modern times operated from 1852 to 1986, a span of 134-years. Today the Sterling Mine is a museum of mining and mineralogy with the mission of preserving this site and its historical treasures. A miner from 1930 would still be able to recognize many of the buildings and structures. Historical footage has been recovered from the

archives of the New Jersey Zinc Company showing exactly what miners saw in the 1930s. This film shows a first-hand account of the danger and difficulty of mining in that time as we look back to see what was.

Start of footage:

06:29 Miners walk through a turnstile to the change house with a start and end each workday. They kept their street clothes in their lockers and damp mine clothes were suspended from the ceiling in wire baskets and hangers to dry overnight. 30 men, drill runners who are the boss drillers, muckers who move the blasted ore to the grizzly, cage men who work in the shaft bringing in and taking out men and supplies, and shift bosses enter the man cage, and they descend down the shaft at speeds up to 900 feet per minute to their working level. In miners parlance, the top or ceiling of a drift stope is called the back. The sides or the ribs and the bottom or floor is the sill. Drilling and blasting is done at the face. Prior to drilling the back and ribs of the work area is checked for loose rock and remedied. The loose is removed using scaling bars. Scaled down large chunks or slabs are drilled with a jackhammer and blasted. This operation is known as scaling or boring down. Ore must be drilled for blasting. The driller, called a runner, is the lead man and he has a helper who sets up the drill, changes drill steels, helps load the drill holes with dynamite, lights fuses, and after the blast operates the slusher and scrapes the muck to the ore chute. Notice the water running out the drill hole. This is necessary to eliminate excessive dust and to cool the drill bit. George Leyner invented the water drill in 1890 and after 1915 it became the primary drill in use in this country. Prior to the Leyner drill, the so called "widowmaker" drills, which drilled dry were used. The miner inserts the blasting cap with attached fuse to a stick of dynamite which feels like fresh putty and is wrapped in heavy brown wax paper. He inserts this first stick into the drill hole and tamps gently using a wooden tamping rod. The helper inserts the succeeding sticks, and the runner tamps forcefully. The runner cuts the fuses to appropriate lengths based on the drill pattern, and the helper slices the end of the fuses to ensure easy ignition in case the fuses are damp. Be sure to cut the fuses long enough to allow time to leave the area. Notice how smoky the lit fuses are.

09:41 The muck, which is the broken ore, is moved by use of a slusher which is a double drum dragline powered by compressed air or an electric motor. A scraper is attached by two steel cables; one to propel the scraper forward to the muck pile, and the pull-back cable to scrap the muck back to a grizzly on top of the ore chute in front of the slusher operator. The pulled back cable is thicker and heavier because of the much heavier load. In a pillar, the chute descends to the haulage drift below. On top of the chute is a grizzly with steel bars about 9 inches apart. The ore must fit through the grizzly to be sized properly for the underground crusher. If the chunks are too big the mucker breaks them down with a sledgehammer, or when necessary drills a small diameter hole with a jackhammer and uses dynamite fuse and blasting cap to break the oversize chunk down.

10:51 The miners erect the timber set which consists of two vertical posts one on each side of the pillar and a cap which lies horizontally on the posts. The posts and cap are tightly braced against the sides by hammering wedges in place. Planks called lagging are placed above the caps for additional support. The next operation is called spiling or breasting where horizontal or vertical planks are installed between the pillar posts and the filled in adjoining stope to prevent stope tailings from caving into the pillar. Miners can be seen here drilling in a development drift that core samples from diamond drilling determined that zinc ore was present. The drift will intersect the ore and follow it on the foot wall. Tracks are installed and a new drift becomes the passageway for the movement to the ore pass. Raises are started from the drift and extend to the level above. Stopes are then developed between raises leaving pillars to support the hanging wall. Upon completion and filling of the stopes the pillars are mined out. A battery powered locomotive is seen here pulling six ore cars to a loading chute. Two "trammers" who are miners, who loaded transport ore by train, open the chute and broken ore from the above stope is loaded into ore cars. This ore train goes to the main ore pass where the cars are dumped onto the grizzly. Muckers break over sized chunks on the grizzly using sledgehammers, or if necessary large chunks are blasted. At the bottom of the ore pass is a jaw crusher which breaks the ore down to about six inches in diameter. The ore then descends to the main shaft where it drops into the measuring pocket.

13:22 Ore was loaded into ore skips from the ore pocket down below then hoisted up the shaft until it reached the surface. Once at the surface the ore skip continued up the headframe seen here, and the ore was dumped

into a day bin before being sent to the mill for processing. From the skip bin the ores are run through a trommel screen where the material is washed with water and fines are separated from larger pieces. The larger pieces then go to the picking tables seen here where the material is evaluated. Waste rock is removed along with bits of wood or debris from the mining process. The rock remaining on the picking table is ore containing zinc. From the picking table the ore is dropped into a gyroscopic crusher where it is reduced to pieces of about one inch. Once crushed, the ore is dropped along a screen where pieces of the correct size fall through, and pieces too large or sent back to the crusher. Once the ore is the correct size it is conveyed to the tower dryer. The heat for the dryer was produced by a coal-fired furnace at its base. From there the crude ore was stored in a tank thus completing the coarse crushing operation. The fine crushing began by lifting the coarse material of a bucket elevator onto another screen where gravity would begin to pull pieces of the proper smaller size through the screen. Material that was too coarse would go through another round of crushing using rollers and sent back to the same screen. After this stage, the now smaller milled ore is sent to an automatic electric scale.

15:26 From here the ores are crushed yet again before magnetic separation of the Franklinite would begin. When the ore was milled to a sufficiently small size, it was possible to use magnets to remove the Franklinite as seen here. This process was first invented by John Wetherill using powerful electromagnets and later perfected by Thomas Edison during his endeavors with iron mining in New Jersey. Powerful magnets are situated just above the finely ground ore and in doing so, the Franklinite is diverted away from the Willemite and Zincite which did not react to the magnets. This is due to the fact that Franklinite contains magnetic iron allowing it to be attracted to magnets. Franklinite is closely related to magnetite which happens to be the most magnetic of all the naturally occurring minerals on Earth. After magnetic separation the Willemite and Zincite would remain mixed together. To separate out the gangue minerals, which have no value as ore, they were run through a diaphragm jig concentrator. A surge of water would disperse the particles of the ore through the volume of the water in the jig, and as the particles settle on the jig bed those with a higher density settle at the bottom and the particles with the lower density settle at the surface. This would mean that the Zincite would be near the bottom of the jig bed and a Willemite would settle near the middle and gangue minerals near the surface.

17:21 After the jigs are the Wilfley tables where ore that required further separation was poured mixed with water down a table that would shake back and forth sending the heavier particles of Zincite and Willemite off the side. The jig and Wilfley table would be repeated until the Willemite and Zincite were sufficiently separated from the undesirables such as calcite. The Willemite and Zincite would be sent up another tower dryer to finally be dehydrated one last time before it would be placed in storage tanks above the railroad bed seen here. Franklinite was stored in separate tanks also above the tracks. The ore powder of Franklinite was shipped separately and the Willemite and Zincite were kept combined. All the process ore was transported by rail to Palmerton Pennsylvania. Palmerton was the central smelting operation for the New Jersey Zinc Company as it had an abundance of coal. Five tons of coal was required to process one ton of zinc.

18:39 Just as Sterling Hill carried on after the 1930s, so too does it carry on from the mines eventual closing in 1986. After the district produced 33 million tons of ore the history the science and industry are preserved here for future generations to study, learn, and enjoy. The story of Sterling Hill is far from over. With each new visitor, each new student, that is inspired the story continues with you we invite you all to be a part of that story.