

mineral species found attracted him most, yet he also drew attention to the great purity and immense quantity of the zinc ore. Not long after this some capitalists leased from him the privilege of working some of the veins for zinc, and since that time Mine Hill has been a mining centre.

DESCRIPTION OF THE VEINS.

On Mine Hill within 100 feet of each other are veins of magnetite, graphite, and franklinite, 40 feet and more in thickness, which lie on beds of garnet and pyroxene. The principal rock formations which crop out in the vicinity are gneiss, crystalline limestone, and magnesian limestone. The beds of zinc ore occur in the crystalline limestone and conform to the strata. They pitch to the N. E. and dip to the S. E. at an angle of between 55° and 65° . The large amount of manganese which is present gives a very dark appearance to the outcrops of the zinc. The white and pink calcite is also much discoloured from the same cause. The franklinite occurring here differs slightly from that found at Stirling Hill, containing more iron and dissolving with greater readiness in acids. Willemite is the most abundant of the ores. Zincite is not at all abundant, and although sometimes found lamellar, as at Stirling Hill, is generally in irregular grains. Two distinct layers of ore can be recognised in the N. E. part of the vein, one containing zincite, and the other none of that mineral. These two layers are called "the zinc vein," and "the franklinite vein." The former occupies the outer side of the outcrop, and is now more extensively mined than the latter. Most of the franklinite has been left standing. Two irregular patches of zincite occur in the vein towards the crook. The vein of zinc lies in a direct line N. W. from Stirling Hill with this crook to the N. E. at an angle of about 35° forming the S. end of the vein. (See plan, page 325.) The gangue rock is a carbonate of lime and manganese. Near to the Hamburg road the zinc vein is 10 feet wide; 300 feet S. W. it is 6 ft. wide with the franklinite vein of the same width.

In the middle of the outcrop the total width is 21 feet, and S. W. from this it reaches 29 feet in width. The deposit of zinc ore at the Southwest opening is 31 feet thick. The dip of the front vein is to the S. E. at about 60° as mentioned above, whilst the east vein is vertical.

DESCRIPTION OF THE MINES AND THE METHOD OF MINING.

The zinc ore has been extensively mined, but the mine which is worked on the largest scale is the Buckwheat Mine on the crook of the vein. The mine is said to have derived its name from the fact that the first opening made was in a field of buckwheat. There is an enormous opening, 310 feet in length, 40 feet wide and 70 feet deep, which is approached by a tunnel from the valley of the Wallkill River. The tunnel is 1,000 feet long. From this large opening, a shaft, 154 feet deep, leads down to the lower levels. Opening in from the N. is a huge grotto where they are now taking out the ore. This part of the vein was cut off from the rest by a huge trap dike which apparently ended the vein. It was at right angles to the vein and about 45 feet thick. On cutting through it the continuation of the vein was found and by the removal of the ore, a large chamber or grotto has been formed.

The ore here is composed of zincite, franklinite, willemite and other less important minerals. The process of mining is exceedingly simple. Compressed air drills are used, the ore is then blasted out with giant powder, and drawn out of the mine in small cars by means of donkeys. At the end of the tunnel there is a small platform where the ore is weighed, and then dumped on to the cars, to be shipped either to Newark, where the works of the Company are situated, or else to Jersey City. The only machinery employed, besides the air-drills, is an engine for hauling up the ore to the donkey-cars, and a small pump. Besides the Buckwheat Mine there are several mines on the main part of the vein. The principal one of these is that owned by C. W. Trotter. The ore from this mine is sent to Bethlehem, Pa.

Some zinc ore from Mine Hill has been sent to Europe, principally to Belgium. A section of the Buckwheat Mine is attached to this report. It was taken by Dr. Cook during my visit on the 17th of July, 1883.

THE PRODUCTION OF ZINC OXIDE.

The ore is first crushed between rollers and then mixed with pea coal (powdered Anthracite coal) and some of the residues from previous roastings. It is then taken to the furnace which resembles an ordinary reverberatory furnace, but which has a floor made of a thick plate of cast iron pierced with conical holes having the smaller opening uppermost.

This plate is placed two or three feet above the ground to allow space for air beneath it. The furnace floor is covered with pea coal and when this is burning well, the charge of ore and coal is put on it, and a powerful blast of air from a fan-blower is driven into the space beneath the plate. Passing through it, it causes the coal to burn violently and reduces the zinc, also supplying sufficient oxygen to re-oxidise the zinc as it rises in vapour. The oxide of zinc thus formed passes through an opening in the roof of the furnace into a tower where it is somewhat cooled by a shower of water. It then passes on in a tube into a room where the tube is connected with a large number of long muslin bags into which the oxide falls as it condenses, while the gases, etc. escape through the muslin. The oxide of zinc thus formed is taken out at regular intervals, pressed into barrels and is ready for use.

The French oxide of zinc used in painting is not made from the ore but by burning metallic zinc. In the manufacture of the white oxide as above described there is a mere trace of manganese carried over with the oxide, just enough to give it a slight buff tinge, so that it is not considered quite so pure as that made directly from the metal. The residuum left after roasting the zinc ores contains a large amount of oxide, of iron and oxide of manganese and is worked over in a blast furnace for the production of spiegeleisen. The small amount of zinc oxide escaping from the residuum is collected in a chamber at the tunnel-head and is worked over for the production of zinc oxide, or else is used in the manufacture of spelter. Some spelter is made at La Salle in Illinois and some in Missouri, but by far the largest amount is made at Newark, N. J., and Bethlehem, Pa. The two latter places are capable of supplying the whole country. I append a tabular statement of the charge of a zinc