



The Jacksonburg Limestone and the Portland Cement Industry of New Jersey

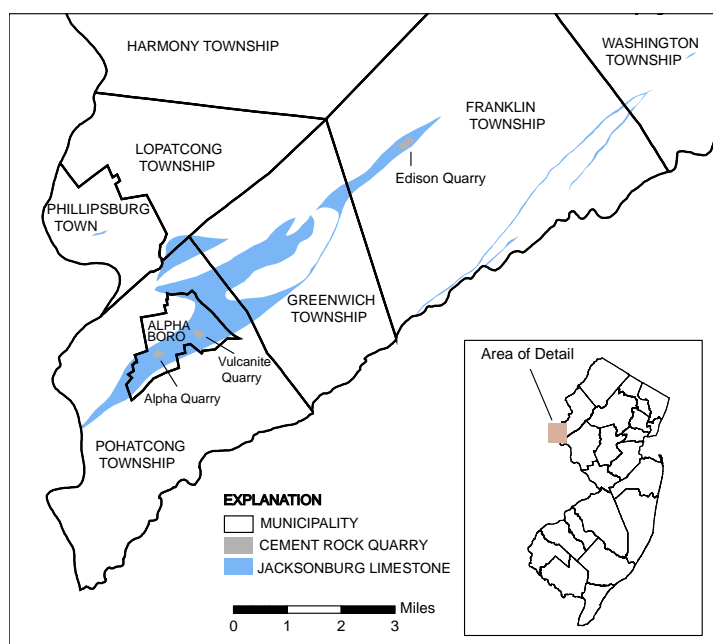


Figure 1. Location of cement rock quarries in the New Jersey Jacksonburg Limestone in Warren County.

Introduction

New Jersey was a leading producer of Portland cement during the late 1800's and early 1900's mainly because of the Jacksonburg Limestone. Part of this formation, which extends northeastward through New Jersey's Pohatcong Township, Alpha Boro, Lopatcong, Greenwich, Franklin and Washington Townships in Warren County (fig.1) is known as "cement rock" because it provided the raw material for the production of cement.

Portland cement was first mass produced in the United States during the mid-1800's. At first, the U.S. cement industry grew slowly due to the large quantities of cement imported from Europe. This started to change in the last decade of the nineteenth century and early twentieth century when Lehigh and Northampton Counties in Pennsylvania, and

Warren County started to develop their limestone resources for Portland cement manufacturing.

By 1898, New Jersey produced about 16 percent of the Portland cement manufactured in the United States, second only to Pennsylvania, which produced 56 percent (Annual Report of the State Geologist for the Year 1900). At the turn of the twentieth century, New Jersey had three producers of Portland cement, the Alpha Portland Cement Company, the Vulcanite Portland Cement Company and the Edison Portland Cement Company. All three tapped the Jacksonburg Limestone as their source of Portland cement. Though they were few in number, New Jersey's Portland cement plants were big producers. New Jersey held onto second place in production until 1908, when large midwestern cement operations started to expand (Eckel, 1909).

The term "Portland cement" was coined by Joseph Aspdin, a bricklayer and mason from Leeds, England who received the patent for it in October, 1824. He chose the name "Portland" for his cement because of its resemblance, when set, to Portland stone. Portland stone is a white-gray calcareous limestone of Jurassic age quarried on the Isle of Portland, an island in the English Channel. Portland cement is the most common type of cement in general use throughout the world today. It is usually mixed with aggregates, stone and sand to create concrete.

The calcareous rock quarried from the Jacksonburg Limestone in New Jersey helped to build dams, buildings and roads. A notable landmark, the original Yankee Stadium, was built with 180,000 bags of Portland cement from the Edison Portland Cement Company of New Village in Franklin Township, Warren County (fig. 2).

The Jacksonburg Limestone in New Jersey was deposited during the Ordovician Period, the second oldest period of the Paleozoic Era about 470 million years ago, when what is now Warren County



Figure 2. Original Yankee Stadium built with Edison Portland Cement. Photo courtesy of R. Kite.



Figure 3. Road cut along Interstate 78 in Alpha Boro, Warren County, showing outcrop of the Jacksonburg Limestone. Photo by T. Pallis.

was covered by a sea. Jacksonburg sediments record the deepening of the sea during this period. Its lower part, called the “cement lime”, formed in shallow water and contains a high percentage of

calcium carbonate and abundant fossils. The upper part of the formation, called the “cement rock”, records deeper water as noted by its increased clay content and great reduction in fossils. The deeper water of the “cement rock” sea enabled clay, which contains silica, alumina, and iron, all important cement constituents, and magnesium, to settle to the sea floor forming a thick limy mud. In the carbonate areas north of Warren County, clays are largely absent because the water was too shallow to allow deposition of limy muds that would eventually form “cement rock”. The sea continued to deepen over time and the Jacksonburg Limestone was replaced by shale and siltstone of the Martinsburg Formation.

Jacksonburg Limestone contains 67 - 98 percent calcium carbonate, 1 - 6 percent magnesium carbonate, 2 - 35 percent silica and 0 - 6 percent alumina and iron (Dalton and Markewicz, 1972). It is dark gray to black in color (fig. 3) breaking into pieces with an even fracture. The advantages of the New Jersey Jacksonburg Limestone were that the silica, alumina and iron were already in the correct proportions and only a small amount of calcium was missing. This supplementary calcium was derived from pure limestone quarried from other locations in the state and Pennsylvania. In New Jersey, it came from marble quarries in the Franklin Marble. These quarries were located in Oxford, Warren County and in Hamburg, McAfee, Sparta, and near Franklin in Sussex County (Lewis and Kummel, 1914).

Portland cement is made by preparing a finely ground mixture of calcium and clay materials in the correct proportions. These raw materials are then placed in a cement kiln and heated to more than 2000° F. In the kiln, the mixture transforms without melting into coherent masses such as lumps or nodules called clinker. The clinker is then ground to a fine powder, usually with the addition of a little gypsum, to become Portland cement.

The Portland Cement Industry in New Jersey

In 1891 the Whitaker Cement Company, founded by Thomas D. Whitaker, was the first Portland cement plant in New Jersey (Annual Report of the State Geologist for the Year 1900). Whitaker built a small rotary kiln next to his quarry at Bonneville Station (now Alpha) and began to produce Portland cement (Lesley, 1924). In 1895, he sold the plant to George Bartol of Philadelphia and the company name was changed to the Alpha Portland Cement Company (BeyondSteel.com). Cement rock was quarried at Alpha using dynamite inserted into holes created by steam drills. The loose rock was then loaded onto steam rail cars and hauled up and out of the quarry on an inclined railroad by a cable (Annual Report of the State Geologist for the Year 1903). After being hauled out of the quarry the material was sent to the mill for processing and then put into the kiln. The Alpha Portland Cement Company continued to operate in Alpha for many years before closing down just after World War I (figs. 4, 5 and 6).

In 1894, shortly after the establishment of the Whitaker Portland Cement Company, A. B. Bonneville of Pennsylvania, succeeded in convincing Dr. Ludwig Sprang Filbert of the Vulcanite Paving Company in Philadelphia to build his own Portland cement plant in Alpha to supply material for his road paving business (Lesley, 1924). Bonneville then served as Vice President of the Vulcanite Portland Cement Company for a short time. Bonneville was an innovator in the cement business and his name is on three patents involving cement production equipment. The Vulcanite Portland Cement Company was located less than a mile east of the Alpha Portland Cement quarry (fig. 7). Its plant and quarry covered an area of 300 acres. It manufactured cement until it was also permanently shut down in 1932 (Rock Products, 1943). Two adjacent quarries at Vulcanite operated independently. At each, the rock was broken down by dynamite then hoisted and conveyed by wire cable tramways to the mills. (Annual Report of the State Geologist for the Year 1903).

The third Portland cement company in New Jersey was started and owned by Thomas Alva Edison. It was in operation for more than 40 years. Edison was heavily involved in the mining and quarrying industry in New Jersey during his lifetime. From 1889 until 1900, his New Jersey and Pennsylvania Concentrating Works in Sparta Township, Sussex County mined low grade iron ore that was processed into bricks for use in the smelters of the steel industry. When a higher grade iron ore was dis-

covered close to the surface in the Mesabi Range in Minnesota which was cheaper to mine, Edison shut down his iron operations and moved much of his mining and ore processing equipment to his New Village limestone quarry in Franklin Township, Warren County. Edison and his associates bought the John W. Cline Farm and acquired options to buy several other adjoining farms in Franklin Township after they found suitable material for Portland ce-



Figure 4, 5 and 6. Quarry and works of the Alpha Portland Cement Company, from Annual Report of the State Geologist for the Year 1903. Figure 4 shows the cement plant and figures 5 and 6 show the quarry. Photos from NJGWS archives.

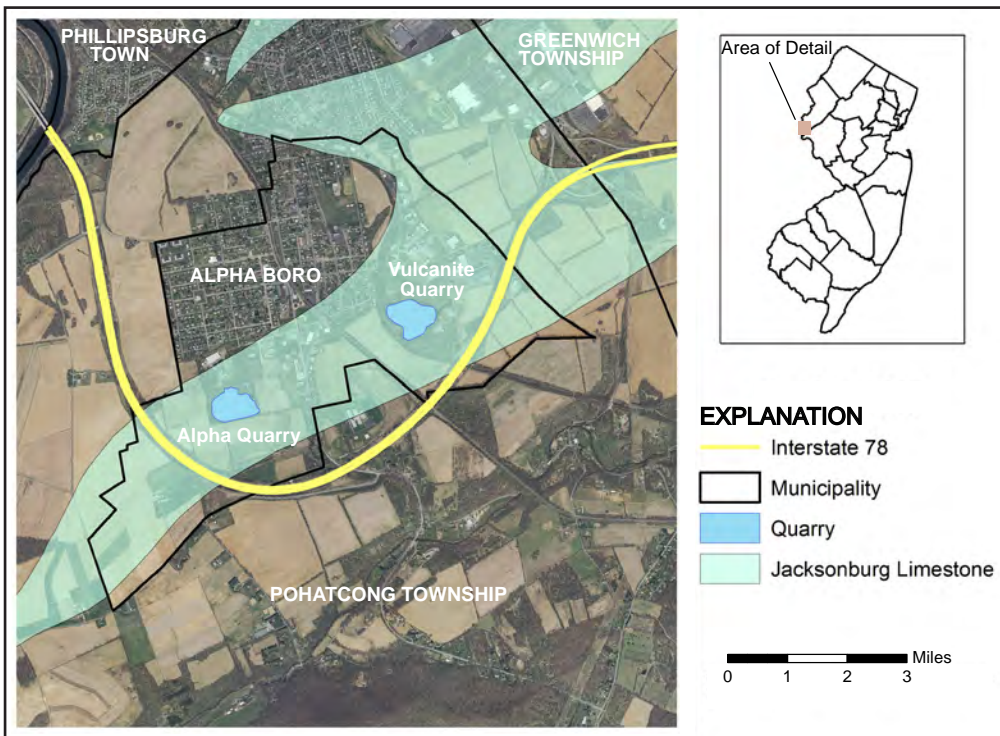


Figure 7. Alpha Cement Quarry and Vulcanite Cement Quarry in relation to the Jacksonburg Limestone in Alpha Boro.

ment manufacturing in the area. The Edison Portland Cement Company was incorporated on June 9, 1899 (New York Times, 1899) and began operations in 1901.

At the Edison quarry, the cement rock was blasted from the quarry walls with dynamite and loaded onto rail cars with steam shovels. The quarry was about two miles from the mill and kiln works; they were connected by a standard gauge railroad. Railcars conveyed the rock to the processing plant where it was processed (Annual Report of the State Geologist for the Year 1903).

Edison introduced many improvements in the cement industry and received 49 patents for cement production innovations. Probably the most important patent he was granted was for a long-rotary kiln used at his automated plant in Franklin Township. He eventually licensed it to other cement manufacturers.

Portland cement from the Edison plant was used in many applications including roads and buildings. Edison envisioned pre-cast houses built of concrete poured into large wooden molds. Some of the houses were built in a few places including Union and West Orange, New Jersey, (fig. 8) however they never caught on and were not commercially successful.

After 1910 the Portland cement industry in New Jersey began to decline because of overproduction and competition from both foreign and domestic cement producers. The final blow came when a dispute erupted after Charles Edison, the son of Thomas Alva Edison, was elected Governor of New Jersey in 1939. The dispute concerned inappropriate contracts for the purchase of Edison's Portland cement by the state of New Jersey. Edison denied any wrongdoing but thought it would be best to shut down the cement operations to refute any charges against him. On April 17, 1942 the Edison Portland Cement Company notified its workers that it was shutting down permanently. It was the last operating Portland cement company in New Jersey at the time of its closure. (New York Times, 1942).

In 2009, about 70 million tons of Portland cement and two million tons of masonry cement were produced at 107 plants in 37 states throughout the United States. Texas, California, Missouri, Pennsylvania, Alabama and Michigan were the six leading cement-producing states, accounting for about 50 percent of U.S. cement production (van Oss, 2010).



Figure 8. The two-story potting shed attached to the greenhouse on the grounds of Edison's Glenmont Estate was made with Edison Portland cement. It was built in 1909 and is now part of the Thomas Edison National Historical Park in West Orange. Photo by T. Pallis.

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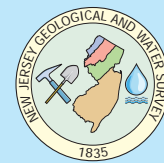
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