



## New Jersey Brownstone

**Brownstone** is regarded as the unofficial state rock of New Jersey. It is a reddish- to chocolate-brown sandstone used extensively as a building stone in the eastern United States during the nineteenth century. Its place in geologic history, however, dates back to Late Triassic and Early Jurassic times, about two hundred million years ago when the dinosaurs were establishing their domination over the lands. During this time, rivers poured sand-laden water far and wide over low-land plains of central New Jersey. Subsequently, the quartz grains, in company with particles of orthoclase feldspar and sometimes muscovite mica as well, were transformed by natural cementation into sandstone. This hardening process was accomplished by the mineral hematite, a red oxide of iron, which not only bound the sand particles together but imparted the characteristic color as well. Because of its feldspar content, geologists refer to this rock as an arkose, or arkosic sandstone” (Yolton, 1960). These sandstones occur in the Stockton and Passaic Formations, which are found in Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Morris, Passaic and Somerset Counties (fig. 1).

### Introduction

In the eighteenth and nineteenth centuries brownstone became prized by the building industry. Despite its history as an inexpensive substitute for marble or limestone, brownstone came to epitomize luxury and architectural sophistication. When first quarried, the stone is pink, but soon weathers to an even, rich, attractive brown, making it a desirable building material. Brownstone could also be worked fairly easily using available tools, giving it another advantage over competing quarry stone (Lockwood, 1972). Though brownstone was quarried and used in building construction for over 200 years in

New Jersey, it eventually fell out of favor. Changes in architectural styles and the rock’s susceptibility to deterioration lead to its decline as a building material in the late nineteenth and early twentieth centuries (Guinness, 2002).

### Brownstone Quarrying

Brownstone quarrying was labor intensive. In order to remove the stone as efficiently as possible, a worker knowledgeable with the mechanics of extraction such as a company prospector, geologist, or rock boss decided where to cut the stone. This was accomplished by studying the rock structure (Guinness, 2002). Brownstone was quarried most efficiently where the rock was regularly layered in massive beds that were obliquely cut by numerous fractures. The channeling and wedging process was the main method used to remove the brownstone (fig. 2). Channels were first cut into three sides of the rock face. Wedges were placed into the channels and the rocks were then split off into blocks of the desired size. The channeling and wedging process was done by hand during the eighteenth to late nineteenth centuries.

At times, blasting was also used to free the stone from the quarry wall

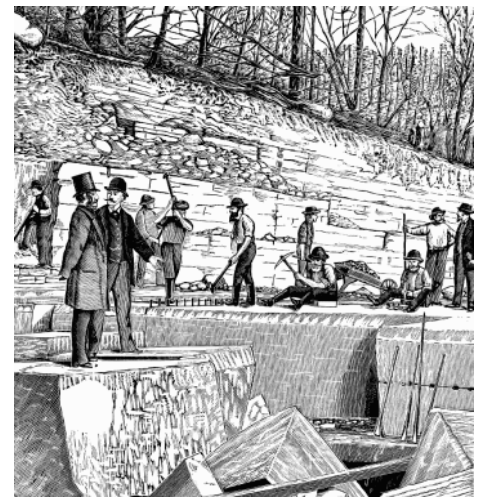


Figure 2. Channeling and wedging by hand (from the trade magazine “The Manufacturer and Builder”, 1891).

because it was cheaper and easier than channeling and wedging. The drawback of blasting brownstone was that more stone was lost. Most of the time, blasting was only used when quarrying for rubble and stone for cellar walls (“The Manufacturer and Builder”, 1891).



Figure 3. Channeling and wedging with power equipment at a brownstone quarry in Upper Montclair, N.J. (NJGWS Archives).

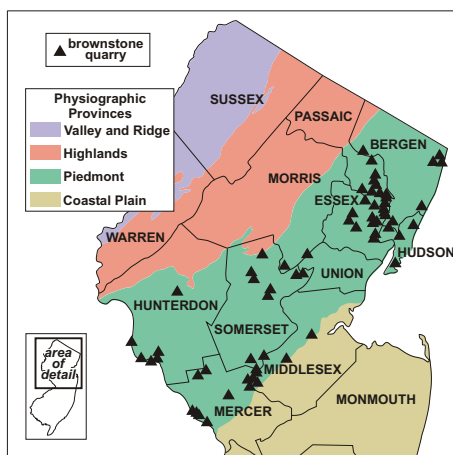


Figure 1. Map of former brownstone quarries in New Jersey (locations from Zdep-ski, 2002).





Figure 4. Wagon for removal of stone in sandstone quarry, Upper Montclair, N.J. (NJGWS Archives).

Quarrying technology continually improved throughout the brownstone era. Machines were used after the late nineteenth century (Guinness, 2002). Figure 3 shows mechanical equipment used to quarry brownstone.

Techniques of moving brownstone from quarries also evolved during the brownstone era. In the early years, oxen, mules, and horses were used to haul the rock from the quarry (fig. 4). Later, narrow-gauge railroads were built (fig. 5), replacing these animals (Guinness, 2002).

When it became available, steam power was used in the excavation and removal of stone from the quarry floor. Huge derricks were set up on promontories jutting into the quarries at right angles to the quarry face to remove the stone (fig. 5). The derricks would pivot around a base so that nearly every



Figure 5. Raven Rock Brownstone Quarry with narrow gauge railroad and derricks, Delaware Township, Hunterdon County. May 19, 1932. (NJGWS Archives).

part of the quarry floor was within easy reach (Guinness, 2002).

Once brownstone was removed, the blocks of stone went to the

scrapping yard for cutting and seasoning. Seasoning or “drying” of the stone was necessary because the rock, as it came from the quarry, contained a large amount of quarry water called “sap” (Guinness, 2002). This quarry water allowed the stone to be carved easily, but if not properly seasoned the water would cause damage to the stone later. Seasoning was achieved by covering the stone with soil for about four months (Guinness, 2002). Once the stone was properly seasoned, the exposed surfaces were considered case-hardened, creating a finish more resistant to weathering. At this point, the stone was shipped for dressing and carving.

Some New Jersey brownstone quarries did their own dressing and carving on site while other quarries had the brownstone sent to different locations. Dressing and carving buildings contained saws, lathes, planers, cutting, rubbing and carving equipment (Zdepski, 2002).

### **Brownstone and the Building Industry**

In colonial times the Stockton Formation was recognized as the



Figure 6. Nassau Hall, Princeton University. (T. Pallis, 2006).

best building stone in the Delaware Valley. This brownstone was chosen for Nassau Hall (fig. 6), completed in 1756, at Princeton University (Yolton, 1960).

During the first half of the nineteenth century, sandstone quarries



Figure 7. Derrick at the De Flesco Brothers Quarry, Wilburtha, Ewing Township. One of many central New Jersey Brownstone quarries. May 20, 1932. (NJGWS Archives).

were operated in many locations throughout central New Jersey. They furnished handsome brownstone fronts for houses and public buildings. All of the quarries were advantageously located to transport the stone by railroad or canal. Near Princeton and northward from Trenton to Raven Rock in Delaware Township, quarries along the Delaware and Raritan Canal (fig. 7) supplied excellent building stone from the Stockton Formation. Many thousands of tons were quarried annually and often the demand exceeded supply (Yolton, 1960).

Brownstone quarried from the Passaic Formation near Newark provided the building stone for the Old First Presbyterian Church in



Figure 8. Old First Presbyterian Church, Newark. (Z. Allen-Lafayette, 2006).



Newark (fig. 8). It was dedicated in 1791 and for many years was the largest church in New Jersey (Yolton, 1960).

Brownstone quarries in thick beds at Little Falls in Passaic County produced a superior, fine-grained red building stone from the Passaic Formation. The sandstone was dubbed “liver rock” by



Figure 9. Lambert Castle, located in Paterson, was built with a brownstone exterior in 1893 by wealthy silk manufacturer, art collector, and amateur architect Catholina Lambert. (Z. Allen-Lafayette, 2006).

local workmen, due to its deep, rich color (Yolton, 1960). Shipped via the Morris Canal, this stone was used in the construction of mansions and churches in Paterson, Newark and New York City (fig. 9).



Figure 10. Brownstone fronted row houses, Van Vorst Park, Jersey City. (Z. Allen-Lafayette, 2006).



Figure 11. Old Queens, Rutgers University, New Brunswick. (Z. Allen-Lafayette, 2006).

Quarries in the Passaic Formation in Belleville near Newark, however, were the most productive, supplying more material for the fronts of brownstone houses (fig.10) than any other source in the country (Yolton, 1960). A light chocolate-brown sandstone from the area was noted for its quality to rub down to a smooth surface. Old Queens, completed in 1809 at Rutgers University (fig. 11), was built of Belleville brownstone from the Passaic Formation.

By the mid nineteenth-century, many of the quarries, especially in



Figure 12. The Navesink Twin Lights lighthouse south tower in Highlands Boro. The lighthouse sits 200 feet above the Atlantic Ocean. (L. Pallis, 2006).

the vicinity of Newark, were abandoned as cities expanded. Brownstone continued to be used for public buildings, but not as frequently as before. An example is the Navesink Twin Lights lighthouse in Highlands Boro, Monmouth County. It was built in 1862 of local New Jersey brownstone at a cost of \$74,000 (fig. 12). Architect Joseph Lederle designed the structure with two non-identical towers linked by keepers’ quarters and storage rooms.

By the turn of the twentieth century, quarrying was on a much



Figure 13. St. Mary’s Church in Wharton Boro, Morris County, was designed by Jeremiah O’Rourke, and erected in 1872. The church is unusual for the use of local mined stone, Little Falls brownstone trimmings, open truss roof, and pre-opalescent glass (N.J. Historic Trust). (Z. Allen-Lafayette, 2006).



Figure 14. St. Mary’s Church brownstone trimmed window. (Z. Allen-Lafayette, 2006).





Figure 15. St. Mary's Church brownstone cornerstone with date. (Z. Allen-Lafayette, 2006).

smaller scale (Yolton, 1960) with most brownstone now going into foundation work and windowsills of buildings (figs. 13, 14, 15).

Presently, there are no operating brownstone quarries in New Jersey. The last one ceased activity in the 1930's (Zdepski, 2002). After approximately two hundred years of popularity, the brownstone era in New Jersey was over, but its products remain visible today.

### Brownstone Maintenance, Care and Preservation

Though the period of quarrying and building with brownstone in New Jersey has ended, the need for maintenance and repairs to brownstone buildings will always be part of the brownstone legacy. Almost as soon as the sandstone became prominent as a building material, it became known for its tendency to decay. Its layered composition and high porosity made it especially susceptible to deterioration by the action of water, salts, freeze-thaw cycling, and air pollutants.

In some cases the architects designing brownstone buildings had the stone placed with the bedding vertical or on edge for economic reasons and a better finished look. This design made it easier for water to penetrate cracks and work its way into the rock, eventually causing parts of the outer layer to break off due to frost action (Annual

Report of State Geologist for the Year 1908, p. 89). When the stone peels or flakes along these bedding planes, the process is known as exfoliation (Zdepski, 2002).

Proper façade maintenance specific to sandstone is critical to prevention of deterioration. Repairs may be complex and are best performed by a professional restorer (fig. 16).



Figure 16. Repaired brownstone. (Z. Allen-Lafayette, 2006).

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Karl Muessig, *State Geologist*



By **Ted Pallis**  
2012

Comments or requests for information are welcome.  
Write: NJGWS, P.O. Box 420, Mail Code: 29-01,  
Trenton, NJ 08625

Phone: 609-292-2576, Fax: 609-633-1004

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