Written in Stone

MOHEGAN QUARRY HISTORY

Welcome to the Mohegan Quarry, once a major industry in Yorktown. Between 1890 and 1941, the quarry provided granite for buildings and monuments in Westchester and Putnam counties, New York City, and other cities in the Northeast US. A series of six panels along the trail describes the quarry's history.

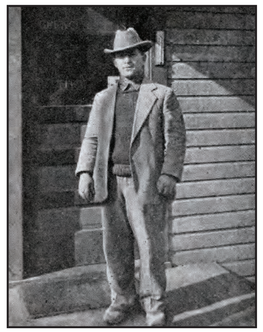
Granite ledges in Sylvan Glen were quarried by farmers in the 1800s for their own use. In 1890, the Mohegan Granite Company was formed, and two years later the company provided granite for the gatehouses at the Carmel and Purdys dams in Putnam County. From 1893 to 1920, the quarry supplied granite for buildings in New York City, including the Cathedral of Saint John the Divine.

In 1920 Grenci & Ellis purchased the quarry, and in 1925, after being awarded a major contract from the Cathedral, the new owners expanded and modernized quarry operations. The improvements included constructing new granite cutting and finishing sheds and adding new equipment run by electricity and compressed air. The late 1920s were the quarry's busiest years, and depending on the number of contracts the company was working on at the same time, the quarry employed from 60 to 200 workers.

During the 1930s, in the midst of the Great Depression, the quarry remained open on a sporadic basis with fewer employees. The quarry ceased operations in 1941 and never reopened, in part due to the introduction of new building techniques and materials, like structural steel, reinforced concrete, aluminum, and glass, and a halt in construction at the Cathedral.

MOHEGAN QUARRY | This 1926 view from near where you are standing shows quarry workers drilling the rock before splitting off a large block. The mast, boom, and support guy wires for one of the stone-lifting derricks are visible in the background. *Source*: Milestone Heritage Consulting.

PIT AND GROUT | The quarry's major landscape elements are quarry pits and "grout" piles of stone rejected for poor appearance or irregular splitting. Mohegan granite was hard to split straight, and workers made efforts to conserve the stone. *Source*: Frank Goderre.



BRUNO GRENCI | Grenci, shown here, came to the US from Italy in 1898 at age fifteen and worked in several Northeast US quarries before coming to Mohegan after 1900. He was said to inspect every finished stone before it left the property. Thomas Ellis was the quarry's superintendent and secretary of the Mohegan Granite Company before becoming a partner in Grenci & Ellis. *Source*: New York State Library.

STONE CARVING | The high quality of Mohegan granite, used in monuments and architectural ornaments like this one from the Louis J. Lefkowitz State Office Building in New York City, was a reason many builders sought this stone. Great skill was required to carve the granite this way. *Source*: Yorktown Museum.

CATHEDRAL OF SAINT JOHN THE DIVINE | The Mohegan Quarry's history and prosperity were directly tied to this building, the source of increasingly large orders for Mohegan golden granite from the 1890s through the 1930s. *Source*: Bruce Starrenburg.

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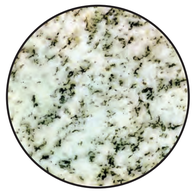
Rock and Stone

GEOLOGY AND QUARRYING

QUARRY BLASTING | Blasting was the first step in the quarrying process. As shown in this 1916 photograph, workers first drilled several deep vertical holes in the quarry ledge, filled them with blasting powder, and set off the charges with an electric blasting machine. Once a large block was split from the rock, rows of shallow holes were drilled in the block to hand-split it into smaller blocks, such as that seen at the right. *Source*: New York State Library.

EXPLOSIVES STORAGE | The small stone shed nearby was an explosives magazine where blasting powder was kept secure, dry, and a safe distance from workers at the large quarry. Explosives were expensive, dangerous, and used sparingly. Blasting powder, a form of "black powder," was made of charcoal, saltpeter, and sulfur. It was manufactured in large, uniform grains yielding a slower, less powerful explosion that split—but did not shatter—the rock. The flooded quarry in front of you, the smaller of the two Mohegan quarries, was abandoned and became a reservoir supplying water for steam boilers and stone saws in the cutting shed.

MOHEGAN GOLD | Golden granite tinted by iron minerals was much prized for its rich, warm and mellow tones. *Source:* New York State Library

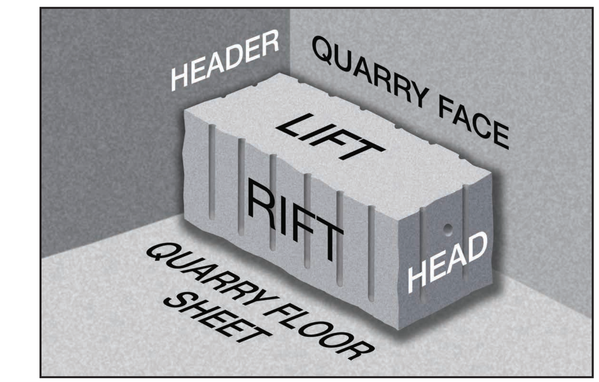


YORKTOWN GRAY | This whiter, hard, fine-grained Mohegan granite was well suited for carving ornaments and sculptures. *Source:* New York State Library.

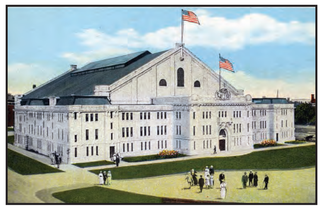
Granite is valued for buildings and monuments for its hardness, uniformity, weather resistance, and ability to be carved and take a fine polish.

MOHEGAN GRANITE | The granite bedrock in Sylvan Glen was formed in the Devonian Age, about 370 million years ago when molten magma flowed upward through faults in the overlying rock. After cooling to form solid granite, it was gradually exposed due to crustal uplift and erosion. Granite contains three key minerals: feldspar, mica, and quartz, the varieties of which determine the rock's color. The Mohegan Quarry produced two shades of granite: a light gray stone with a pinkish tone well suited for carvings, and a golden or buff colored stone known as "Mohegan" or "Golden" granite that was prized for its warm, mellow hue.

FRACTURES AND PLANES | Granite fractures naturally along visible horizontal "sheet" and vertical "joint" planes. At Mohegan, these natural fractures form large, roughly rectangular blocks, which aided quarrying. To make rough quarried blocks truly rectangular, workers had to split the blocks along three planes: the rift, which was easier to split, and the lift and head, which were more difficult.



SPLITTING PLANES | An illustration using quarry workers' terms, showing a block of granite split away from its surrounding rock. Granite blocks have the greatest load-bearing strength on the lift plane, while the head plane takes the best polish for use in monuments. *Source:* Milestone Heritage Consulting.



MOHEGAN GRANITE | Examples of Mohegan quarry stone used in US buildings and monuments.

CONNECTICUT STATE ARMORY, Hartford, 1909. *Source:* Milestone Heritage Consulting.

CATHEDRAL OF SAINT JOHN THE DIVINE, New York City, 1892-present. *Source:* Milestone Heritage Consulting.

EUGENE FIELD MEMORIAL, Chicago, 1922. *Source:* Milestone Heritage Consulting.

CHARLES M. SCHWAB MANSION, New York City, 1906. *Source:* Milestone Heritage Consulting.

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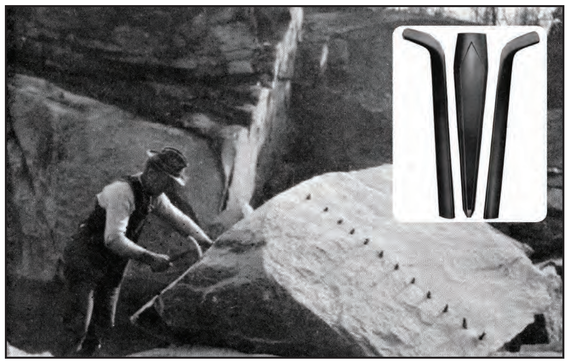
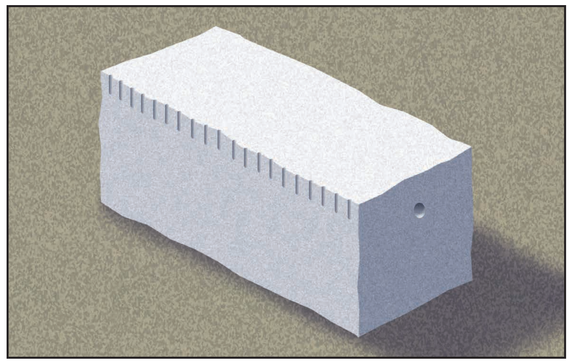
Removing the Stone

DRILLING AND SPLITTING

METHODS AND MARKS | Granite blocks around the quarries bear characteristic marks expressing how they were drilled and split. This was laborious work, and Grenci & Ellis kept pace with labor-saving technology, replacing hand drilling with steam drilling, and in the 1920s, with compressed-air drills, the air fed by aboveground pipes, which are still visible around the quarry. New drilling machinery and splitting methods enabled the owners to quarry one-third more marketable granite.

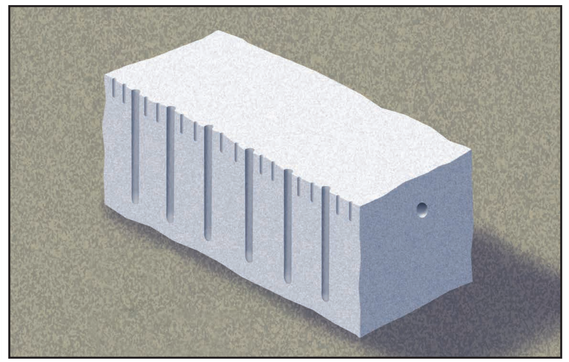


WEDGE-AND-FEATHER SPLITTING | *Source:* Peggy Perazzo, Stone Quarries & Beyond, Paul E. Wood Collection (inset).



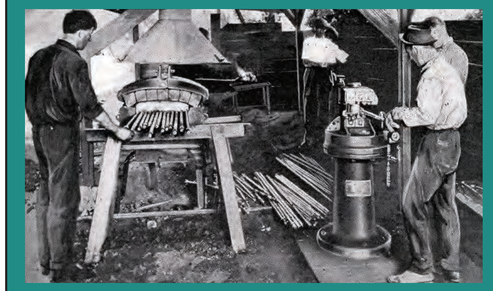
WEDGE-AND-FEATHER SPLITTING MARKS | *Source:* Milestone Heritage Consulting.

COMPRESSED-AIR DRILL | *Source:* Milestone Heritage Consulting.



DEEP HOLE SPLITTING MARKS | *Source:* Milestone Heritage Consulting.

WEDGE-AND-FEATHER SPLITTING | Invented in about 1800, this stone splitting method involved drilling a row of small, closely-spaced holes a few inches deep, then placing iron wedge-and-feather tools in the holes. Tapping across the row of wedges with a hammer built up pressure and split the stone, ideally on a flat plane. Shallow "dog holes" chipped in opposite sides of the blocks provided grip for lifting hooks.



THE BLACKSMITH SHOP | Near here stood a blacksmith shop, housing a forge, anvil and tools for repairing equipment. Keeping tools and drill bits sharp was among the blacksmith's most important tasks. This skilled job was done entirely by hand until Grenci & Ellis installed a compressed air-powered drill sharpener in the mid-1920s. This illustration shows blacksmiths heating drills in a forge at left, and reshaping the chisel-like bits in a sharpening machine at right. *Source:* Milestone Heritage Consulting.

DEEP HOLE SPLITTING | This less common type of wedge-and-feather splitting combined short and long holes, the latter made with mechanical drills, initially steam-powered and later replaced with compressed-air drills. At Mohegan, because the granite was difficult to split on flat, perpendicular planes, the limited supply of golden granite could be wasted. Deep hole splitting produced flatter planes, resulting in less waste and more usable stone.

GROUT PILES | **Granite quarrying generated large quantities of "grout," a Scottish term for rock rejected for poor splitting or quality. Workers lifted grout from the pit with derricks and discarded it in grout piles. The largest piles extend away from the pit on its downhill side. These piles were built using short railways running along their flat tops so they could be more easily extended away from the pit. The tunnel in the grout pile here was a safe path for workers underneath the railway loading platform above.**

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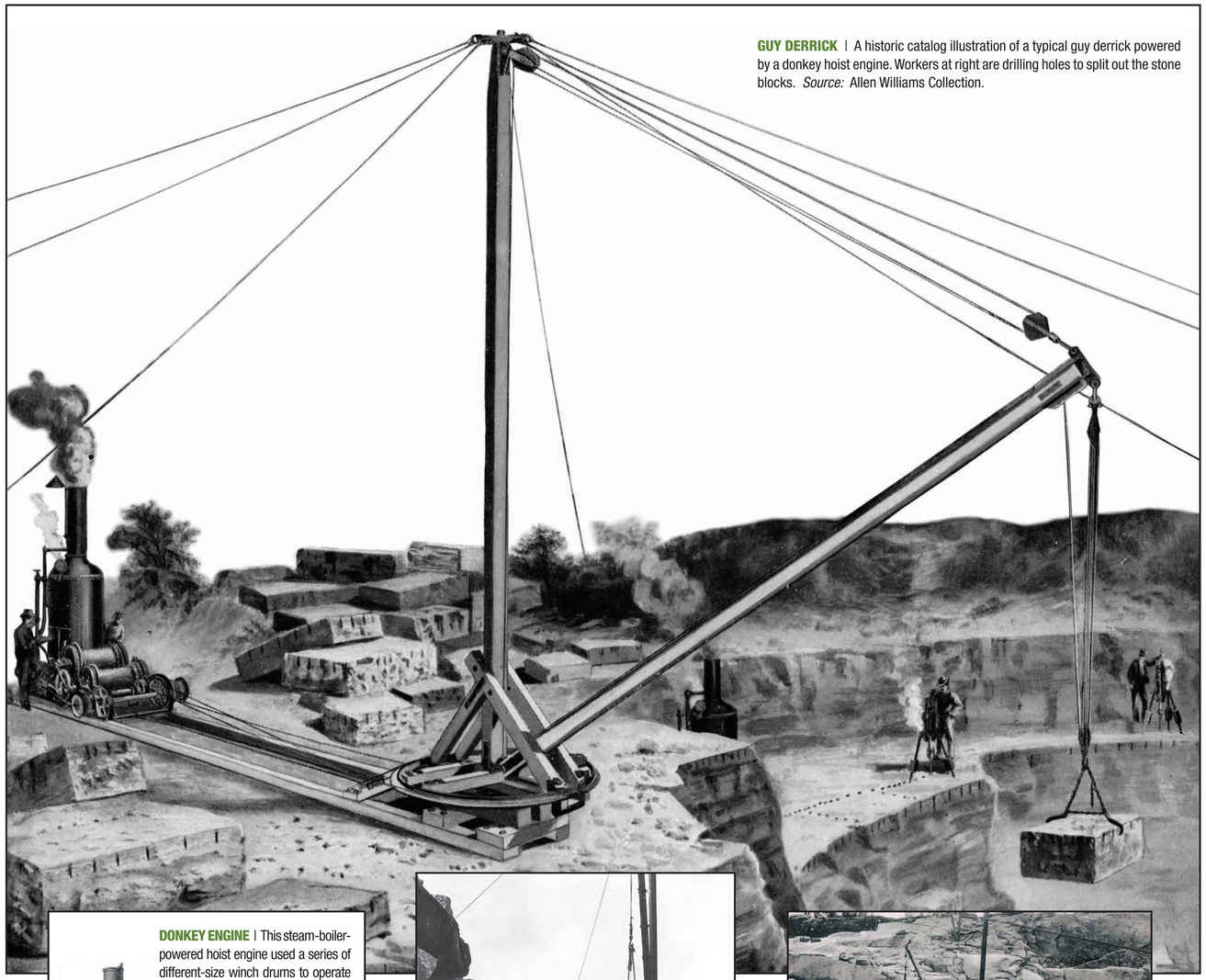
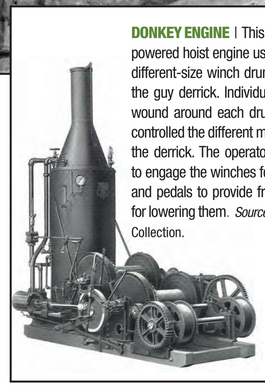
Lifting the Stone



GUY DERRICK | A historic catalog illustration of a typical guy derrick powered by a donkey hoist engine. Workers at right are drilling holes to split out the stone blocks. *Source:* Allen Williams Collection.



DONKEY ENGINE | This steam-boiler-powered hoist engine used a series of different-size winch drums to operate the guy derrick. Individual wire ropes wound around each drum separately controlled the different moving parts of the derrick. The operator used levers to engage the winches for lifting loads and pedals to provide friction braking for lowering them. *Source:* Allen Williams Collection.

MOHEGAN QUARRY | A 1924 photograph of a large derrick at the edge of the quarry pit. Stones were lifted using chains and hooks called "lifting dogs" that gripped notches chipped into each block, visible throughout the quarry today. A waste "grout" pile is visible at left. *Source:* Frank Goderre.

TEMPORARY DERRICK | This World War I–era postcard of the quarry shows a small, temporary derrick loading waste granite for disposal via a temporary railway. This photo clearly shows the natural horizontal and vertical splits in the rock that influenced how workers quarried it. *Source:* Dolores Pedi.

GUY DERRICKS

A guy derrick was a crane used to lift large blocks of split granite from the quarry pit to begin the journey to the cutting and finishing sheds. At any one time, about a half dozen derricks operated in and around the pit. A large derrick that stood here served the incline railway that moved blocks down to the cutting shed. This derrick was permanent; others were temporary and were relocated as work progressed.

HOW A DERRICK WORKED

A guy derrick had a vertical timber mast supported by guy wires radiating out from the top to anchors in the surrounding rock. A wooden boom, angling up from the base of the mast, rose and fell in a vertical plane. When the boom was placed directly over a stone block to be moved, a wire rope with lifting hooks was lowered and attached to the block. The boom and hooks could be independently raised and lowered by wire ropes and pulleys. The boom itself rotated 360 degrees by means of a "bull wheel" at the bottom of the mast. The wire ropes used to move the boom and hook were wrapped around rotating winch drums on a hoist engine near the derrick.

When the quarry opened in the 1890s, derrick winches were powered by "donkey engines," a type of stationary, coal-fired steam hoist engine. As part of the Grenci & Ellis mid-1920s improvements, at least one derrick was converted to run on an 80-horsepower electric motor.

Operating a derrick took teamwork: an engineer ran the hoist, a derrickman at the pit edge oversaw activity and gave hand signals to the engineer, and a rigger in the pit hooked up the heavy loads. Derrick remains are still visible at this location, including the mast's cast-iron pivot base, a small hoist drum, and the donkey engine's footing and plumbing.

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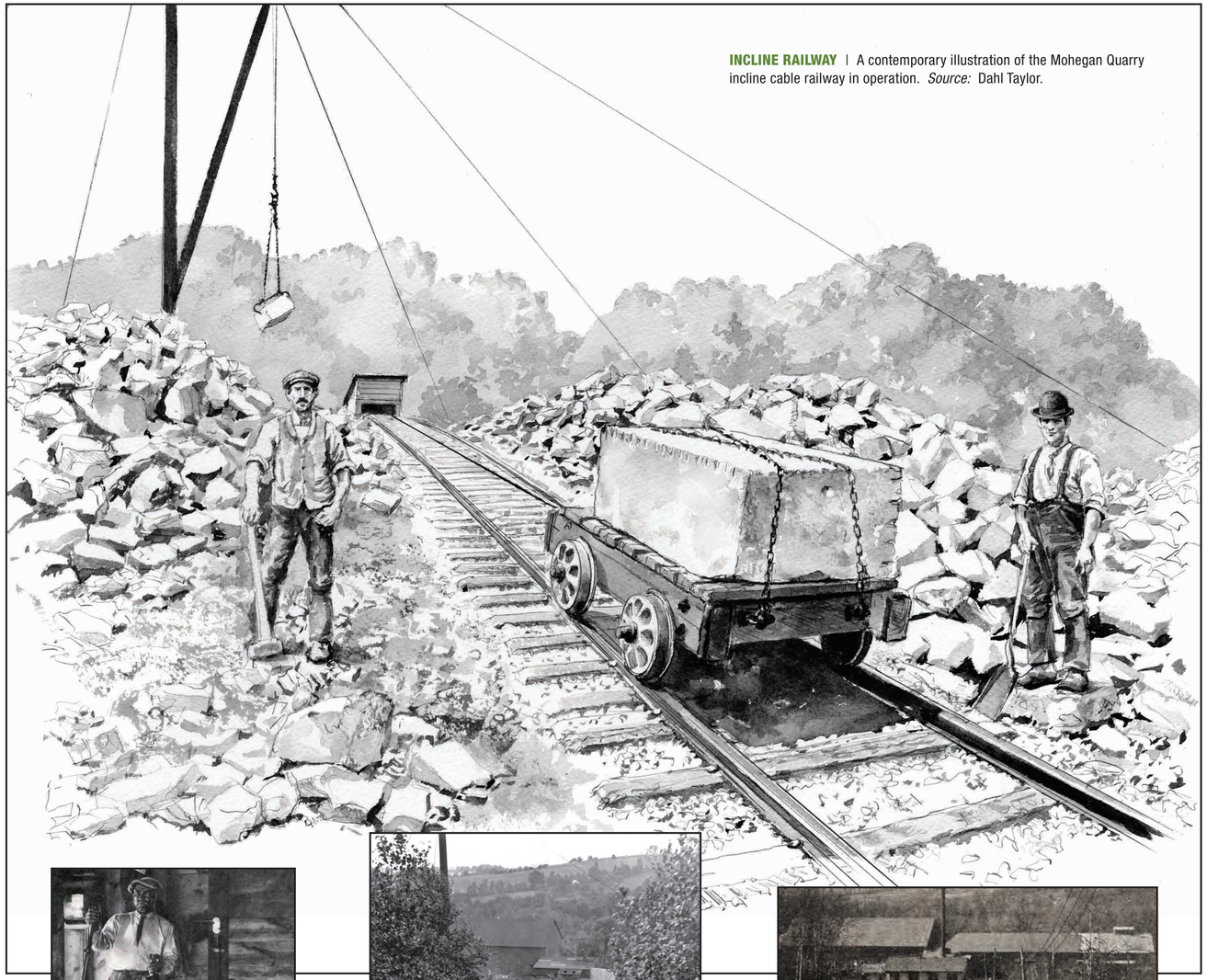
Lowering the Stone



INCLINE RAILWAY | A contemporary illustration of the Mohegan Quarry incline cable railway in operation. *Source:* Dahl Taylor.

THE INCLINE RAILWAY

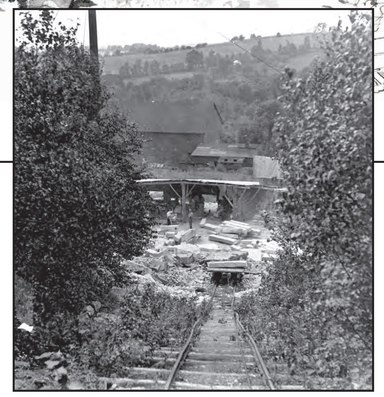
Once the granite blocks were hoisted from the quarry pit, they had to be moved to the sheds at the bottom of this steep hill for cutting and finishing. At first, teams of horses were used to move the blocks. Later, horses were replaced by a cable railway that ran down this man-made slope. This system used a hoist engine and wire rope to move loads on tracks too steep for a conventional railway.

HOW THE INCLINE WORKED

The derrick lowered the stone block onto a small railway flatcar, which waited on level ground in front of the railway hoist house. The flatcar was connected by wire rope to an electric hoist engine with a large winch drum. Using a hand-lever-operated drum brake to control the speed, the hoist operator lowered the loaded flatcar down the almost 1,000-foot-long incline to the cutting shed. Once the flat car was unloaded, the operator pulled it back up to the top of the quarry pit using a 60-horsepower electric hoist motor with a lever-operated clutch. Return trips at up to 600 feet per minute carried boiler coal, supplies, tools—and even workers back to the top. The concrete foundation of the hoist house is visible at the top of the incline.

MOTIONS | Small, short-lived quarries called motions, some likely made before the quarry became a commercial operation, can be found alongside the incline and scattered throughout the Park. Stone chip piles around the motions are evidence of workers trimming stones. Also visible around the quarry are soil pits dug by workers looking for good granite.

HOIST HOUSE | A 1928 photograph of the incline railway operator in the hoist house at the top of the incline. The electric hoist drive motor is in the center, and the cable winding drum is in the foreground. The operator controlled the brake and clutch with levers and the hoist speed with the controller in his left hand. *Source:* Milestone Heritage Consulting.



RAILWAY TRACKS | A 1924 photograph of the incline cable railway looking downhill from the hoist house to the cutting shed. The flatcar loaded with stone is visible at the bottom of the railway tracks. The early shed here was a primitive open-sided building with work stations arranged in a curve following the swing arc of a guy derrick. *Source:* Frank Goderre.

1920s MODERNIZATION | The quarry cutting and finishing sheds after the 1925–1927 Grenci & Ellis modernization. As part of the modernization, the incline railway tracks ran right into the new cutting shed housing the stone saws. *Source:* New York State Library.

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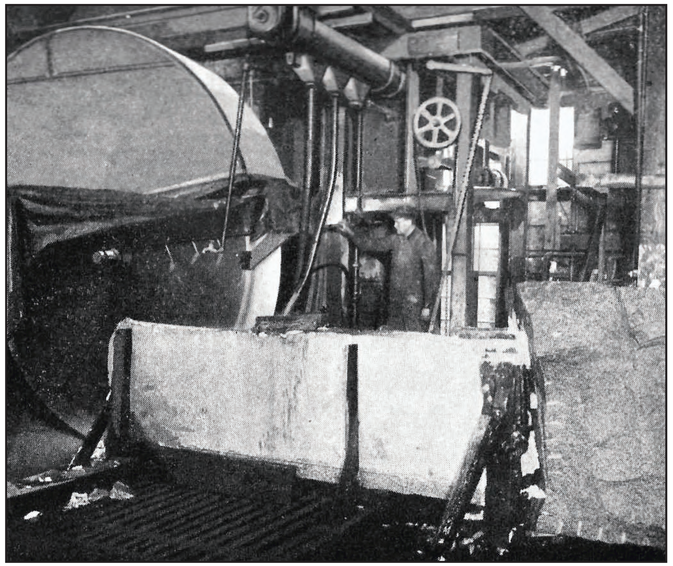
Working the Stone

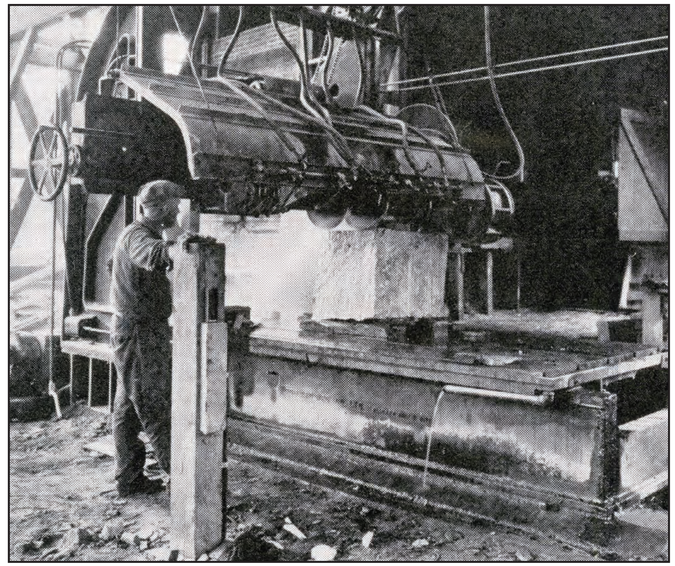
THE GRANITE SHEDS

Near here stood the quarry's granite cutting and finishing sheds, where stone blocks lowered via the incline railway were processed before being shipped to construction sites.

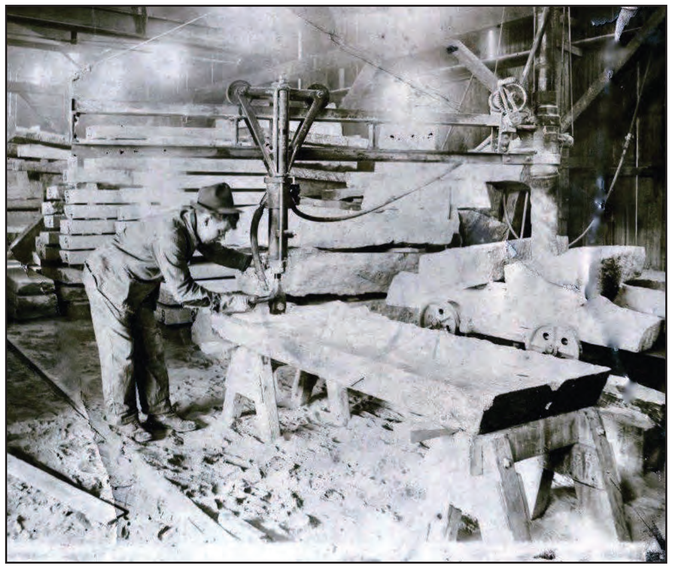
After the sheds were modernized between 1925 and 1927, the quarry was able to increase output and simultaneously fill multiple contracts, including for the Cathedral of Saint John the Divine in New York City. The new complex, over 400 feet long, also allowed stone from other quarries, including a Grenci & Ellis quarry in Maine, to be processed here. In 1928, the quarry put on an extra eight-hour shift and erected floodlights so work could be done at night.



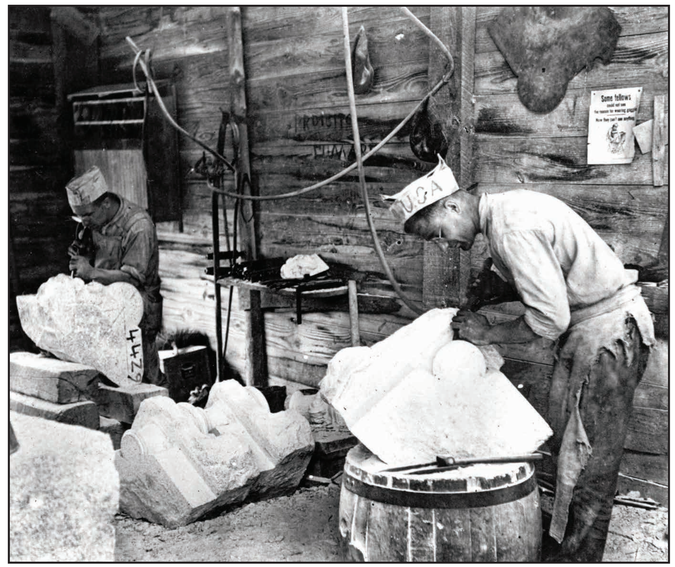
1 **SAWING** | Large granite blocks were sawn into smaller sizes as shown in this 1928 photograph. Saws worked by abrasion, using steel "shot" pellets to grind through the stone. The pellets were directed at the blade using water pumped from the abandoned quarry on the hill. *Source:* New York State Library.



2 **EDGING** | After they were sawn, blocks were further cut using three electrically driven edgers like the one in this 1926 photograph. These carborundum-bladed, water-cooled radial saws were used to make finish cuts including faces, bevels, and slots. *Source:* Milestone Heritage Consulting.



3 **SURFACING** | Stone was finished with hammers, either by hand or with pneumatic surfacers. These machines had a sliding vertical air hammer suspended from a pivoting arm that could be swept across a stone, using interchangeable bits to make different surfaces. Polishing machines were added in 1929. *Source:* Jim Forbes.



4 **CARVING** | Skilled carvers used hand and compressed-air tools to create architectural ornaments and monuments. Carvers like the ones in this 1924 image were the quarry's elite workers with the most training and highest pay. Note the flat sheet-metal pattern template hanging on the wall behind the carver at right. *Source:* Frank Goderre.

SHED WORKERS | A group photograph taken at one of the sheds. The quarry employed workers of many ethnicities: Scots brought quarrying skills and Italians cutting and carving expertise. *Source:* Jim Forbes.

FINAL JOURNEY | Finished granite architectural ornaments leaving the Grenci & Ellis granite sheds on their fleet of delivery trucks in 1924. *Source:* Frank Goderre.

Mohegan Quarry operations ceased in 1941, victim of declining demand and the onset of World War II. Today, examples of sawn, surfaced, polished, and carved granite are visible along the trail here. The shed foundations can be seen in the woods just west of this point.

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