

“The Marble Quarries of Carrara”

By Day Allen Willey

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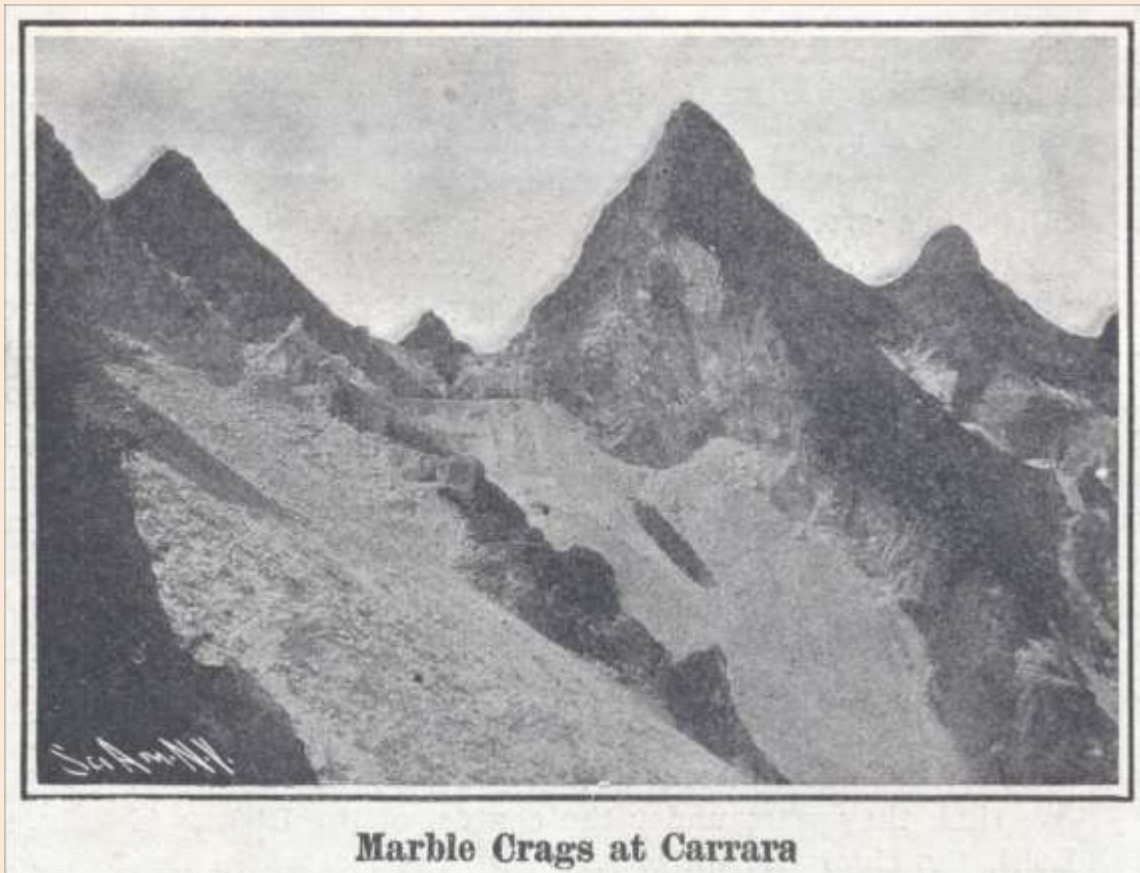
“Miners Making the Electrical Connections for Blasting a
Monster Block of Carrara Marble”

“Few, if any, industries in the world have a greater percentage of waste than marble quarrying as it is done in Italy, yet the famous Carrara deposits have been worked over 2,000 years, and according to the statements of experts who have examined the mountains of marble in this locality, the quality of high grade marble yet to be excavated is so great that Carrara promises to supply the present rates of demand for its marbles for centuries to come.

“When Nature created this section of the Apuan Alps, she formed a storehouse of marble that is truly marvelous in extent, for beds of the finest quality of the Carrara grade are known to exist as high as 5,500 feet above the level of the sea. The exact depth is unknown, as the deposits have as yet not been thoroughly investigated by the use of machinery. Test borings which have been made, however, show that a considerable portion of the mountain formation in the commune of Massa, in which Carrara lies, seems to be entirely of marble, and it is believed that in places the formation extends fully 500 feet downward, with not even a layer or thrust of other stone. One reason why the extent of the resources has thus far been merely guessed at, so to speak, is because so much of it is hidden by great masses of debris – the waste from workings that date back many centuries. The quarrymen of olden times opened the beds which were most convenient on the mountain slope, and much of the refuse fell into valleys. Some of these piles are hundreds of feet in thickness, and the labor of removing them would require so much time and expense, that it would not be profitable until the formation now accessible has been taken out, and the marble advances in price.

“The grain of the marble quarried at the present time is said to be fully as fine as that secured a century ago, as is shown by comparing the blocks of the waste taken from the older workings. It still has a greater reputation among sculptors than the Pentelic, Hymetian, or even the finest Parian, both by reason of its grain and the fact that it can be fashioned with such ease into statuary and other forms. In recent years the quarries of Carrara have had an annual aggregate output of about 200,000 tons. They supply the bulk of the marble used in Italy and Europe today for sculpture and other ornamental work, while, as is well known, a large amount is sent to the United States, in blocks in the rough or in the finished form.

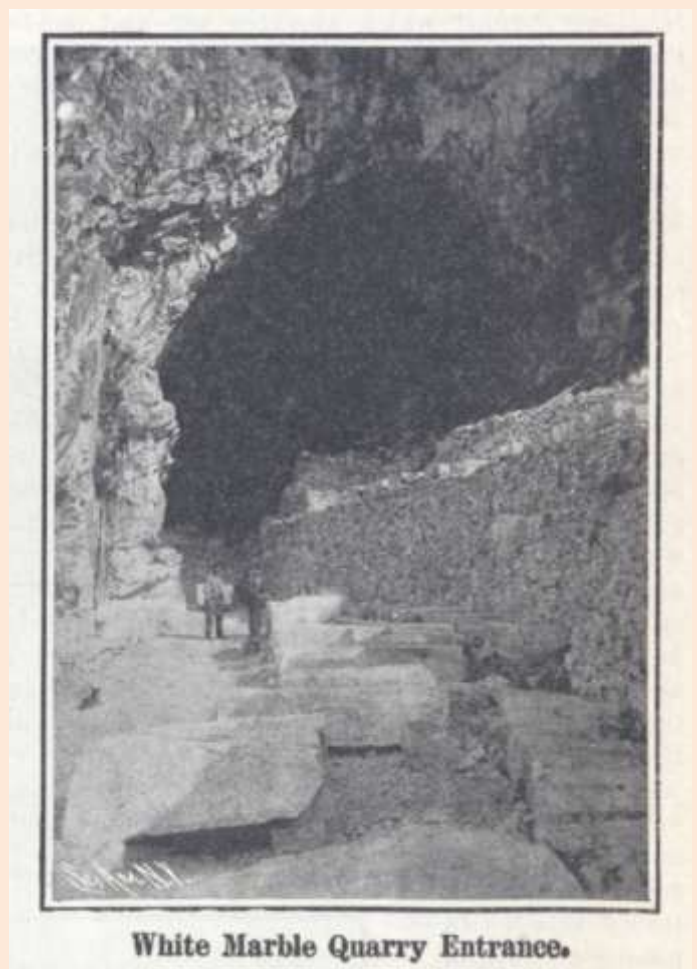
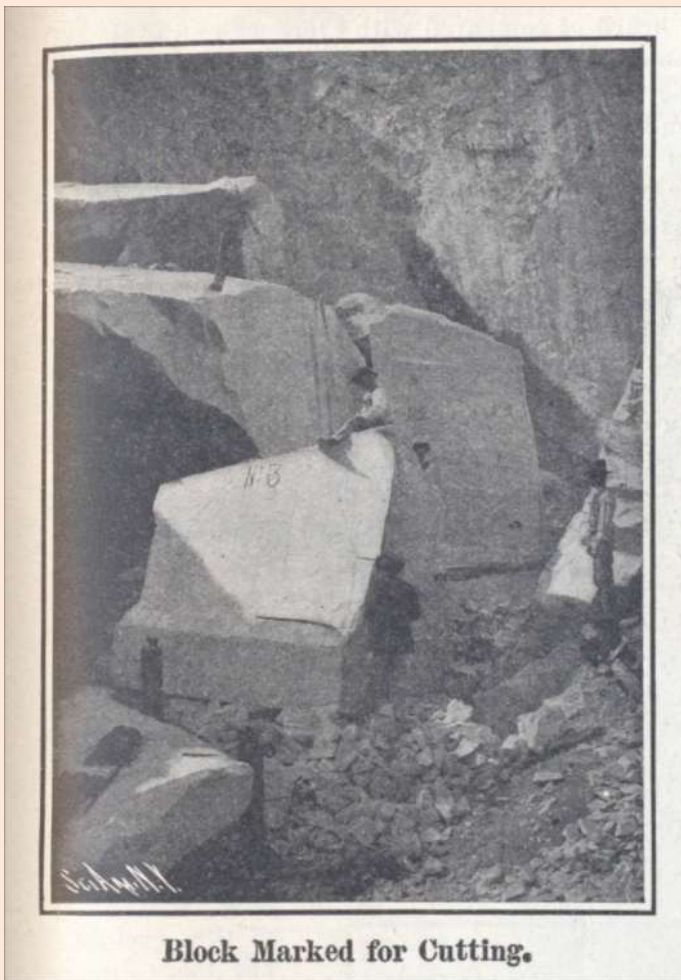
“These deposits are quite accessible, especially since the principal workings are now reached by a railway which connects them with the principal shipping point – the little seaport of Avenza on the Gulf of Liguria. Avenza is really only three miles from the town of Carrara itself, but the quarries are distributed over an area which extends several miles beyond its borders. The nearest large city is Pisa in North Italy, thirty-two miles distant. Most of the marble as it comes from the quarries to Avenza is placed on sailing vessels and small steamers and carried to Genoa and Leghorn, where there are extensive marble works. These cities are also the principal places for shipping it to other parts of Europe as well as America. At the present time about six hundred quarries in all are in actual operation. Of these, more than half are in Carrara or its vicinity, about fifty are in the city of Massa, and the rest scattered principally in the commune of Massa. They give employment to about 6,000 men and boys, and are the sole support of a population of nearly 75,000 in this part of Italy.



As in other old industries, tedious and wasteful methods are still employed extensively at Carrara. Although steam and electric-driven machinery for stone cutting has been invented for a period of years, the Italians continue to use hand drills extensively, and employ explosives freely in getting out the material, so that the visitor familiar with the system in America regards their antiquated ways with surprise. In the Vermont quarries, for example, most of the blocks of all sizes are secured by channeling entirely with power tools. Where these cannot be placed in service, pneumatic and electric-driven drills are substituted. The channeler travels back and forth on a track which is pinned to the solid rock, making a ridge or channel which averages one and one-fourth inches in width and ranges from four to ten feet in depth. This incision is made parallel with the rails of the channeler track, but a few inches to one side. The machine cuts but one channel at a time, and in its operation is somewhat similar to the ordinary steam drill, with this exception, that the rotary motion is avoided. In order to cut the channel evenly, no less than five drills are assembled, each having a separate bit.

“Another type of cutting machine is operated either by steam or electric power as desired. It is also moved back and forth on a track, but makes a channel on each side of the track and parallel with it. In this apparatus the drills are also arranged in clamps in groups of five, the up-and-down stroke of the drills where operated by steam being obtained through a double system of levers connected with a crankpin on the crankshaft of the engine. Between the levers is a system of springs, also between the lower lever is a system of springs, also between the lower lever and the frame, and the motion of the machine along the track is secured by connecting the crankshaft of the engine with the trucks through a system of gears. With this type of channeler there is a constant relation between the speed of the machine and the strokes of the drill. When electricity is used in place of steam power, a connection is made between the electric motor and the shaft by means of bevel gears.

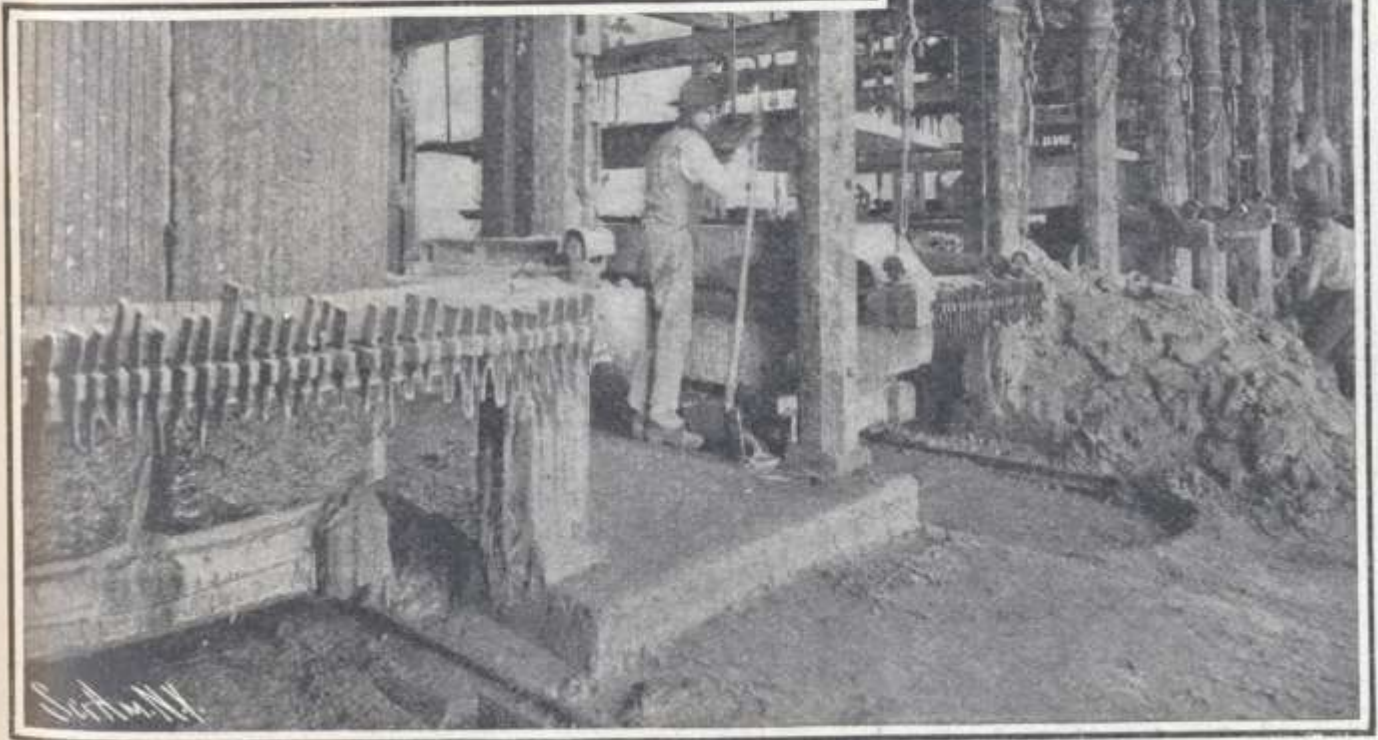
The use of this labor-saving mechanism is one reason why the American quarries can be operated at a profit, although most of the marble has to be lifted to heights ranging from 50 to 300 feet from the beds, necessitating the installation of powerful boom derricks and hoisting cranes. The Italians have one great advantage owing to the elevation of so many of their quarries. As already stated, beds exist in the Apuan Alps at an altitude of 5,500 feet, while many of the workings are more than 2,000 feet above the sea. Therefore, much of the expense of derrick machinery is avoided, and the force of gravity is an economical factor that partly makes up for the enormous waste incurred by the methods of quarrying. While some of the lessees have installed drills actuated by steam and electric power, such are only occasional instances, much of the drilling being done with the hand-power ratchet type of drill. Neither the channeler nor any other apparatus for grooving the marble has yet been employed except in a few works, the bulk of the product being obtained by blowing it up. The holes are drilled where in the judgment of the quarry director the explosive will be most effective, but before being charged they are usually enlarged by pouring nitric acid into them, which eats away the interior. The explosive, which is usually blasting powder, is then inserted. In recent years the electric current has been introduced to ignite it, but in many of the larger operations the fuse is still employed.



“The charges are not always so distributed that the block desired is loosened, so a second blast is frequently necessary to completely detach the mass, when some of the needless surface is cut off on the spot with chisel and mallet. Then the material is ready to be transported to the marble mills in the valley or to Avenza for shipment by water. As the quarry may be several miles from the railroad, advantage is taken of its elevation. If it is a very large piece, an inclined plane may be made, down which the block slides upon a wooden sledge, controlled by ropes fastened about it, which are run through pulleys, so that the speed can be regulated. At the foot of the incline it is jacked up on a clumsy but strong cart drawn by oxen. Sometimes a string of twenty or more of these beasts are hitched to the cart by means of wooden yokes of the pattern used a hundred or more years ago. Thus it is transported to the railroad or mill.

“To save the expense of transporting refuse material, a considerable amount of the marble is sawed and finished at Carrara, but here again most of the work is performed by antiquated machinery. Plants where the slabs are actually sawed by hand are numerous. A crude frame somewhat resembling the old-fashioned American bucksaw, but much larger, holds the saw blade, which is usually of steel and when new is about five inches in width. This is pulled back and forth across the surface of the stone by two men, one at each end of it. Water flows along the cut from a wooden trough resting on one end of the block, and thus the metal is cooled. The work is so slow, however, that a groove four inches deep is considered a fair day’s work, for which each man receives the equivalent of about thirty-five cents in American money. Recently several mills have been established containing gangs of saws moved by water power, as in Vermont, but they cut only a small portion of the marble. Power is used more extensively for operating the finishing tables, where the slabs are smoothed and polished while rotating beneath pumice and wooden polishing blocks, although some of this labor is still performed by hand.

(Continued on the next page.)



Slab Cutting Saws Operated by Steam and Water Power.

“Slab Cutting Saws Operated by Steam and Water Power.”



Steam Power Marble Planers.

“Steam Power Marble Planers.”



Where Carrara Sculptors Learn Their Art.

“Where Carrara Sculptors Learn Their Art.”



Making the Gigantic Statues.

“Making the Gigantic Statues.”

“Strange as it may seem, the Carrara deposits are not absolutely owned by any private individuals or companies. Since the era of the Roman republic, they have been what is termed state property in Italy. At one time they were under the control of the Bishop of Luni, the chief Roman city, which was located in this portion of Italy, being ceded to the Bishop in 1183. This will give an idea of the long time during which the quarries have been in operation. The present method of working them is for a person to lease a certain portion. The price paid the state for this lease, however, is so small that it is but nominal, and the lessee practically secures the revenue from the industry without any expense except that incurred for the wages of the laborers, the cost and care of the draft animals and the machinery which he may install. These are reasons why the processes followed are still so antiquated in comparison with quarrying in other parts of the world.

“The different kinds of marble are not arranged in layers, but blend with one another like the colors of the rainbow. A little sandy coating covers the blocks, and divides each from the other. It is noticed that where marble is exposed to the sun, it becomes harder; where it is placed in the shade, it becomes finer and softer. From an admixture of metallic substances, the marbles are sometimes marked, speckled, veined, and spotted. Though the marbles are of great variety, they may all be reduced to threefold classifications of *brecciate*, *bardigli*, and *bianchi*. Although the elegant *brecciato* is much like for ornaments, and the flowered *bardiglio* is useful, still it is the *bianco* which is of the greatest importance, and the white statuary marble is the noblest of all. It has many varieties. Sometimes it is of dazzling whiteness, sometimes it inclines to blue, sometimes to flesh color, as is the case with *crestola*, which is by far the most beautiful. It rises in value in proportion to its freshness, its tint, its crystallization, and the size of the piece. Its freedom from impurities is also a matter of much consideration. The *crestola* is the choicest of all, either on account of the beauty of its surface or because, from being less liable to chip, it can receive from an expert hand more finely chiseled and delicate features. A beautiful proof of the excellence of this marble was given by the sculptor Moli in his ‘Pompeian Mother,’ now in the possession of Mr. Mitchell Henry, of London. The woman, flying with her child from the disaster, tries to shield herself from the burning rain with some drapery or a sheet, which she holds high above her head. The air which she displaces in running swells of folds of the drapery, which, owing to the masterly way in which these folds are executed, and the delicacy of the work, is so fragile that it seems as then and transparent as if it were linen. The most colossal monuments, however, the loftiest columns and the most sumptuous vestibules, are made of *bianco-chiaro*.

“Nearly one hundred and fifty years ago the famous Academy of Fine Arts was established at Carrara; but as far back as the fifteenth century, these marble mountains attracted the sculptor, and the little city has long been one of the actual art centers of Europe, though seldom heard of compared with Florence and other Italian communities. Michelangelo worked here for years, and was one of the first *savants* to realize the extent and quality of the beds. Bondinella and many other masters of the chisel had studios in Carrara, and some of their creations are to be seen in the museum, which contains one of the most valuable collections of sculpture in existence, including pieces which date back nearly to the era of the Roman republic. Carrara has also been a great school for sculptors. It has been said that even the quarrymen inherit a talent for fashioning with the chisel, handed down through generations. Certain it is that a large number have become expert with the use of this tool.”