"Quarrying Methods in Ancient Greece"

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QUARRYING METHODS IN ANCIENT GREECE

MANY of the methods of the early quarryman are known through the writings of Pliny, Herodotus, Paulus Silentiarius and others. Also, through the splendid results obtained by the many expeditions sent out by the museums of this country, England and France, we are finding out gradually but surely the secrets of the ruined temples and tombs that are scattered so widely over the lands that felt the tread of the conquering Romans.

The following excerpt from "Greek Architecture," by Allan Marquand, Ph.D., LL.D., is an interesting account of the devices employed in the quarries of early Greece, and we are constantly surprised at the similarity between the methods of the ancients and those in use today in the marble works of the Mediterranean countries.

"The Greek quarry, whether subterranean or not, differed little from the quarries of Egypt. When subterranean and large, various devices, such as piers and curved ceilings, were employed to prevent the superincumbent mass from falling in. Like the Egyptians, the Greeks made deep cuttings and inserted wedges. The wedges were probably of wood; their simultaneous expansion, when wet, making the rift in the rock. In the quarries at Selinous and Syracuse may be seen evidence of the cross cuttings for quadrated blocks and the broader, circular cutting for the drums of columns.

"There were many instruments used by the stone-cutter in common with the carpenter, but he had also implements peculiarly his own. His hammer and his chisels had to be adapted for heavier work. He had his pick or pointer, his smooth-edged chisel, and his toothed chisels, some adapted for rough work and others for finer work; also a graving tool. For deep cutting he required a drill, and for the final polish he used the file and Egyptian sand or Naxian Corundum. In fine jointing it was necessary that the surface of the joints should be as nearly as possible absolutely plane surfaces. A washing with nitre and water made the surface absolutely clean.

"The transportation of stone blocks from the quarry to the building was not always an easy matter. Wagons and sledges sufficed for smaller blocks, but special devices are said to have been invented by Chersiphron for rolling columns and by Metagenes for revolving epistyles to the Temple of Artemis at Ephesos. Similar devices are thought by Koldeway to have been used at Selinous. Columns, or drums of columns, were dragged by a modern roller, being held to a frame by means of small cylinders, which served as axles.

"In transporting epistyles the framework was provided with wheels. To elevate the largest blocks to their places, inclined planes were employed by Metagenes at Ephesos; but ordinarily, cranes and derricks sufficed. The derricks consisted of one or more beams set on end and provided with ropes, pulleys and a windlass. A derrick with two beams and one with four beams were used during the second century restoration of the Temple of Apollo near Miletus. The derricks were stayed by means of ropes and carried pulleys. The pulleys contained usually three wheels, but not infrequently five or more. Windlasses of various forms were used, of

which one of the most interesting, figured on a relief from Papua, is in the form of a treadmill.

"Various devices were employed in preparing the blocks, so that they could be easily lifted by means of the derricks. Sometimes projecting tenons were left, so that the blocks could be easily caught by a sling. Sometimes, as at Akragas, grooves were cut on the outside of the blocks into which the lifting ropes might be fitted; sometimes a channel was cut into the heart of the block, as in the Sikyonian Treasury at Olympia; sometimes, as in the same Treasury at Olympia, they were lifted by means of a gripping instrument; and finally, at Akragas and Selinous, Olympia and Athens, the lewis was frequently employed."

Vitruvius, in his Ten Books on "Architecture," gives a very detailed description of the ingenious procedure of Chersiphron mentioned by Marquand in the article above. The extract is from Book X, of the translation by M. H. Morgan. After telling how Chersiphron was afraid to entrust carts for the conveying of the columns from the quarry to the temple of Diana at Ephesus, for fear of getting mired in the soft roads, he devised the following plan: "Using four-inch timbers, he joined two of them together, each as long as the shaft, with two cross-pieces set between them, dovetailing all together, and then leaded iron gudgeons shaped like dovetails into the ends of the shafts, as dowels are leaded, and in the woodwork he fixed rings to contain the pivots, and fastened wooden checks to the ends. The pivots, being enclosed in the rings, turned freely. So, when yokes of oxen began to draw the four-inch frame, they made the shaft revolve constantly, turning it by means of the pivots and rings." However, the distance was only eight miles and quite level at that.

Vitruvius also gives in the same book a description of a hoisting machine. He says: "Two timbers are provided, strong enough for the weight of the load. They are fastened together at the upper end by a bolt, then spread apart at the bottom, and so set up, being kept upright by ropes attached to the upper ends and fixed at intervals all round. At the top is fastened a block, which some call a 'rechamus.' In the block two sheaves are enclosed, turning on axles. The traction rope is carried over the sheaves at the top, then let fall and passed around a sheave in the block below. Then it is brought back to a sheave at the bottom of the upper block, and so it goes down to the lower block, where it is fastened through a hole in that block. The other end of the rope is brought back and down between the legs of the machine."

The method that one unfortunate named Paconius adopted in hauling a pedestal from the quarry to the building site is related by Vitruvius. The pedestal was 12 feet long, 8 feet wide and 6 feet high. He enclosed the ends of the stone in wheels 15 feet in diameter and fastened 2-inch cross bars from wheel to wheel at intervals of a foot. Wrapping a rope around these bars, he fastened the end of this to his oxen. The contraption refused to run straight, however, and persisted in running off the road. "Hence it was necessary to draw the machine back again. Thus, by this drawing to and fro, Paconius got into such financial embarrassment that he became insolvent."