

Local vs. modern mechanized mining of marble, a case study of quarry up-gradation at Tor Warsak, Buner, Khyber Pakhtunkhwa (KPK)

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Khyber Pakhtun Khwa and FATA regions are home to some of the finest and purest marble, slate and granite in the world. According to a report by Pakistan Stone Development Company (PASDEC) there are an estimated 297 billion tone reserves of marble and granite in Pakistan. Of these reserves, deposits in KPK and FATA account for about 85% production. But the point of concern is the mining techniques employed for its extraction. An estimated 98% mines of marble in these two regions are employing the primitive techniques, which are not only less profitable to miners but also affecting mines and environment.

The mining techniques can be categorized into three types. These include traditional mining (blasting), wire saw technology and chemical technology. Local mining technique, a common practice in Pakistan, dominantly relies on blasting and includes equipment like winch, stands, blasting material, drill machine, etc. This method of mining and extraction gives 20% regularity blocks and is not environment friendly. Wire saw technology includes the use of wire saw, chain saw, DTH (Down the Hole) machine, jack hammer, hydro pressure bags, excavator, pneumatic drill machine, etc. The chemical technology involves the use of a non explosive demolition agent (chemical stone cutter) and a drilling machine. Chemical technology is employed in only a few mines in Pakistan.

Tor Warsak marble deposit in district Buner, KPK is one of the best places to study the comparison between these three techniques. The marble in Buner is present in Nikanai Ghar Formation of Mesozoic age. The varieties of marble include, Karrara White and Sunny Grey.

The traditional mining methodology costs are in the range of \$30-\$32 per ton with an estimated loss of the precious resource to the tune of 73%. The wire saw technique results in \$60-\$80 per ton cost and about 40% loss of the resource. In this method the wastage is mostly in the advance stage of mining. In contrast the costs of production with the chemical technique are \$25-\$30 per ton with only 20-25% wastage of the resource. Our study revealed that compared to traditional blasting technology and wire saw technology, chemical technology was more productive and environment friendly. The chemical technique avoids waste of valuable stone, high cost of insurance, blasting permit, storage and labor costs.