

# Impact of Marble Industry of Raj Nagar on Human Health and Environment

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**ABSTRACT:** India possesses a wide spectrum of dimensional stones that include granite, marble, sandstone, limestone, slate, and quartzite, in various parts of the country.

The stone industry in India Raj Nagar has evolved into the production and manufacturing of blocks, flooring slabs, structural slabs, monuments, tomb stones, sculptures, cobbles, pebbles and landscape garden stones.

India's history, dating back to 3200 BC has been influenced considerably by the disposition, development and use of stones and other construction materials. Dimension stones have also left deep imprints on the architectural heritage of the country. Innumerable temples, forts and palaces of Ancient Indian Civilisation have been carved out of locally available stones. The Taj Mahal at Agra was constructed from Indian marble. Some of the rock-cut structures include Khajuraho Temple, Elephanta Caves, Lomesh rishi caves, Ellora caves and Konark Temple

**KEYWORDS:** Raj Nagar, marble industry, human health, environment, impact, materials, stones, slabs

## 1. INTRODUCTION

Besides, all major archeological excavations have revealed exquisitely carved statuettes and carvings in stone. Ancient Buddhist monuments like the Sanchi Stupa of 3rd century BC have also been carved out of stone.

This tradition of Stone Architecture has continued to the present era, with most of the important modern buildings in India like the Presidential House, Parliament House, and Supreme Court made from high quality sandstone of Rajasthan. The Bahá'í House of Worship of New Delhi stands testimony to the relevance of marble in modern Indian architecture.

Raj Nagar Stones are still the mainstays of civil construction in India, with stones being used extensively in public buildings, hotels, and temples. It is increasingly being used in homes, with the use of stones now penetrating amongst the growing middle class of India.

The success of commercial stone industry solely depends upon defects in rock/stone. Natural defects in ornamental/commercial rock deposits adversely affect the quality of rock deposit. Detection of natural defects in decorative and dimensional stone industry play vital role in the quality assessment.

India is pioneer in the exploration, mining of commercial rock deposits and in establishing a firm base for stone industry. India, with an estimated resource of about 1,690 million cubic metres, comprising over 160 shades of Dimension Stone Granites (DSG), accounts for about 205 of the world resources. Of the 300 varieties being traded in the world market, nearly half of them are from India. Commercially viable granite and other rock deposits are reported from Raj Nagar Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, Telangana, and others.

Marble was used for building tombs, temples and palaces. For a time it was considered as Royal Stone. It is, however, now used in hotels and homes too. There are many varieties.<sup>[1]</sup>

- Makrana: Raj Nagar Makrana is the source of the marble used in the Taj Mahal. It is situated at a distance of 60 km from Kishangarh and falls in the Nagaur district of Rajasthan. The region has various mining ranges, mainly Doongri, Devi, Ulodi, Saabwali, Gulabi, Kumari, Neharkhan, Matabhar, Matabhar kumari, Chuck doongri, Chosira and Pahar Kua amongst others.

# International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: [www.ijmrsetm.com](http://www.ijmrsetm.com)

Volume 3, Issue 11, November 2016

- **Rajnagar Marble:** World's largest marble-producing area, with over 2,000 gang saw units located in the nearby town of Udaipur to process the material produced. Agaria is a variety of this area, with numerous other varieties and patterns, primarily in white base. The marble is dolomitic and often has quartz intrusions.
- **Andhi Marble:** Raj Nagar Located near the capital city of the state of Jaipur (also known as the 'Pink City'), it is dolomitic marble with intrusions of tremolite, and is commonly known by the name of pista (pistachio) marble, because of the green coloured tremolite against an off-white background. One of the famous varieties of this area was known as Indo-Italian, owing to its resemblance with Satvario Marble. Most of the mining of this famous field is now banned by the Supreme Court of India because of the vicinity of the area to the Sariska Tiger Reserve.
- **Salumber Marble:** Also known as Onyx Marble, it has thick bands of green and pink hint. A resemblance to Onyx Marble from Pakistan gives it this name. This is also highly dolomitic.
- **Yellow Marble:** Jaisalmer stone is found in Jaisalmer district of Rajasthan. Though not been metamorphosed and hence is still a limestone, it is known as Yellow Marble in trade circles. It is mined in the Jaisalmer District.
- **Bidasar:** These are ultra basic rocks in shades of brown and green colour found in Rajasthan. The criss-cross linear pattern given it a remarkable resemblance to a photograph of dense forest. These are also known as forest green/brown or fancy green/brown.
- **Morwad:** Kishangarh Marble
- **Gujarat - Ambaji White Marble:** It can be compared with Makarana Marble. It is highly calcic and is produced in a town called Ambaji (famous for its temple of Durga Devi). The marble has a very soft and waxy look and is often used by sculptors.
- **Rajasthan - Abu Black:** This is one of the rare black textured marble available. Only produced in the mines of Abu road, this black textured stone is a decorative marble used in temples and sculptures.
- **Madhya Pradesh - Katni Range:** It is famous for its beige-colored marble, which is dolomitic but highly crystalline, with very fine grain size and some quartz intrusions. The marble accepts polish. Another variety in the same range is red/maroon-colored marble.
- **'Jabalpur range'** contains white dolomitic marble. Dolomitic marble is a metamorphic rock that forms when dolomite is subjected to high temperatures and pressures. Dolomite is a mineral composed of calcium and magnesium carbonate. When dolomite undergoes metamorphism, it recrystallizes into marble. And this newly formed marble is called dolomite marble.<sup>[2]</sup> It is often used as dolomite lumps for chemical and industrial uses.
- **Indian Green Marble:** It is found in Rajasthan, India; Indian Green Marble's most quarries are situated in Kesariyaji, which is 60 km far from Udaipur, Rajasthan India. This Indian green marble is known by name all over the world. In Europe, people know Indian green marble as a Verde Guatemala. Many varieties are available in Indian green marble. Indian Green Marble is exported to Africa, Europe, Australia, the Middle East, and many Asian countries. It is found in Rishabhdeo town of Udaipur District state Rajasthan of India.

## II.DISCUSSION

India has varieties of granite in over 250 shades. As of 2005, Granite reserves in India was 37,426 million cubic meters and ranked fifth in the export of processed product. Raj Nagar Resources are found in Odisha, Tamil Nadu, Karnataka, Jharkhand, Chhattisgarh, Rajasthan, Telangana, and Andhra Pradesh.<sup>[3]</sup> Sandstone reserves in India are found over the states of Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Madhya Pradesh, Meghalaya, Mizoram, Karnataka, Odisha, Punjab, Rajasthan, Uttar Pradesh, Tamil Nadu and West Bengal. Over 90% of the deposits of sandstone are in Rajasthan, spread over the districts of Bharatpur, Dholpur, Kota, Jodhpur, Sawai-Madhopur, Bundi, Chittorgarh, Bikaner, Jhalawar, Pali, Shivpuri, Khatu and Jaisalmer.

India is among the leading countries when it comes to mining and export of sandstone. Sandstone from India is available in different colors for interior as well as exterior use. Sandstone products from India include names like Tint Mint, White Mint, Mint Fossils, Modak, Agra Red, Rainbow Sandstone, Raj Green, Teak, Buff Brown, Dhoplur Chocolate, Beige, Dholpur Pink, Lalitpur Pink, Mandana Red, Jodhpur pink, Jodhpur red, and Jaisalmer yellow.

Raj Nagar Slate reserves in India are found in Rajasthan, Behror, Haryana, Himachal Pradesh, Andhra Pradesh, and Madhya Pradesh. Deposits in Rajasthan are spread over the districts of Alwar, Ajmer, Bharatpur, Tonk, Sawai Madhopur, Pali, Udaipur, Churu, and Chittorgarh.

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Few important names in slate are Jak Black, Silver Shine, Silver grey, Panther, Deoli Green, Peacock, Peacock Multi, Kund Black, Kund Multi, and so on. Being to some extent fragile in nature, it is good for interior use only and can be used in even as a washboard.

Kotastone of Kota district and Yellow Limestone of Jaisalmer district of Rajasthan are the prime limestone occurrences in India. Other deposits include the Shahabad Stone of Gulbarga and the Belgaum districts of Karnataka, Kadappa Stone of Kadapa, Kurnool and the Anantapur & Guntur districts of Andhra Pradesh, Milliolic Limestone from Saurashtra Region, Gujarat, and 'Yellow Limestone' of Kutch district of Gujarat, amongst others. Andhra Pradesh and Telangana put, together, possess 32% of the country's total reserves of limestone. World-renowned Narzi limestone is available in Kadapa district. Commercial grade limestone deposits are being exploited from Bethamcherla, Macherla, Neereducherla, Tandur, ((shahabad)), Mudimanikyam of Kurnool, Guntur, Anantapur, Rangareddy, and Nalgonda districts are widely used in our country for paneling, and flooring purposes. Sullavai limestone of Karminagar and Warangal districts, massive limestones of Mudimanikyam, Nalgonda districts. Total India's limestones are estimated about 93,623 million tonnes. Limestones are extensively utilized for the manufacturing of cement and also building stones, particularly flooring, and roofing.

There are some other dimensional stones being quarried and used in consumption, in addition to the dimensional stones already detailed above. Laterite bricks are quarried in huge quantities and are utilized as bricks in the construction of houses and for pavements in the states of Orissa, Karnataka, Goa, and in other parts of coastal states. The felspathic sandstone occurring with the coal seams as overburden is also used as building stone. The huge deposits of basalt in the states of Maharashtra, Karnataka, and Gujarat have been used as building stones since ancient times. Other quartzitic bands, occurring with phyllites and schists, are also utilized for building purposes. Khondelites from the Eastern coast are being used widely in sculptures and as a building material. Felsite from Karnataka is being extensively used as a dimensional stone as well. India also contains many stones which are semiprecious like zoisite, apophyllite, cavansite, muscovite mica, almandine, etc.

## III.RESULTS

Makrana marble is a type of white marble, popular for use in sculpture and building decor. It is mined in the town of Makrana in Rajasthan, India, and was used in the construction of several iconic monuments such as the Taj Mahal in Agra and the Victoria Memorial in Kolkata. The Makrana Marble is listed as a Global Heritage Stone Resource by International Union of Geological Sciences<sup>[1]</sup> In the Raj Nagar Makrana area, marble is found as five steeply-dipping bands.<sup>[2]</sup> They form part of the Ajmer Formation of the Delhi Supergroup, which is a sequence of sedimentary rocks that was deposited in the Delhi Basin during the Proterozoic. About 1450 Ma (million years ago) these rocks were affected by the Delhi Orogeny, causing the metamorphism that transformed the original limestones to marble and the folding that caused the steep dip and the current outcrop pattern.<sup>[3]</sup> Makrana is regarded as the oldest place in India with a marble quarry. Upon mining, Makrana marble is not subjected to any form of treatment, but used in cutting and chiseling straight away.<sup>[4]</sup> Makrana marble is one of the two calcitic marble varieties in India, with all others being dolomitic.<sup>[5]</sup> It has two varieties: white and albata.<sup>[2]</sup> The quantity of marble reserves in the region is estimated to be 55 million tonnes by the state government.<sup>[5]</sup> About 120 thousand tonnes of the marble are produced annually from over 400 mines in the region.<sup>[6]</sup>

Makrana marble has a high percentage of calcium and is therefore resistant to water seepage.<sup>[2]</sup> The water absorption of Raj Nagar Makrana marble is said to be the lowest among all types in India, and the marble is claimed to contain 98 percent of calcium carbonate and only two percent of impurities, this property of Makrana marble helps it to stay the same proportion of white for a long period of time and because it contains 98 percent of calcium the polish of this marble is considered in the best. The different shades of Makrana marble are pure white, white with grey shades and white with pink shades, depending on the level of impurities. The close interlocking property of the marble makes it strong, hard and translucent. It is said to retain its shine and white color for a long period of time.<sup>[5]</sup>

Makrana Marbles splits into various categories according to its design and pattern. The following are the exclusive marbles that are mined and manufactured at Makrana.

Makrana White Marble

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This marble is highly used in residential & commercial buildings and numerous temples, mosques, churches, and monuments, it can be used for decorative purpose in houses, hotels, corporate offices and Restaurants, western and Indian sculptures, handicrafts.<sup>[7]</sup>

## Brown Albata Marble

This marble stone is a calcite stone. It is a milky white marble and also available in grey and panther brown pattern. The stone is available in various forms such as natural blocks, large & small slabs, regular tiles.

## Dungri Marble

This is one of the oldest and finest quality marble of makrana based mines. This stone is widely used in flooring, and wall cladding due to its special qualities like no chemical reinforcement, no color changes, and no pin holes.

## Albeta Marble

This is one of the best as well as highly recommended stone for floor designs which gives luxury look to the home. Its color is milky white with a brown texture.<sup>[8]</sup>

## Pink Marble

Because of the stunning pink color it is used for decorative purposes in houses. Also, this is one of the most popular marble types.<sup>[9]</sup>

## IV.CONCLUSIONS

Prominent buildings/monuments that used Raj Nagar Makrana marble in their construction are:

- Taj Mahal, Agra, India<sup>[10][11][12]</sup>
- Victoria Memorial, Kolkata, India<sup>[10]</sup> – Makrana marble was chosen over various other European types in the construction of the Victoria Memorial, after several tests concluded Makrana marble to be superior. Sir Thomas Henry Holland, a British geologist, was given credit for recommending the use of Makrana marble in the construction of Victoria Memorial.<sup>[13]</sup>
- Sheikh Zayed Mosque, Abu Dhabi, UAE<sup>[14][15]</sup>
- Moti Masjid, Lahore, Pakistan<sup>[16][17]</sup>
- Dukhnivaran Sahib Gurdwara, Ludhiana, India<sup>[18]</sup>

Marble from Raj Nagar Makrana is exported overseas mainly to the Persian Gulf countries, the European Union, Southeast Asia, Canada, Pakistan and Russia.<sup>[5][6]</sup> In India, it is mainly used for handicraft and sculpture work, apart from construction of buildings.<sup>[5]</sup> Makrana marble was given the geographical indication status in 2015 by the Geographical Indication Registry, Chennai.<sup>[19]</sup>

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*(A Monthly, Peer Reviewed Online Journal)*

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**Volume 3, Issue 11, November 2016**

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