



Dimension and Cut Stones Deposits in Sindh

Mines and Mineral Development Department
Government of Sindh



Dimension and Cut Stones Deposits in Sindh

1. INTRODUCTION

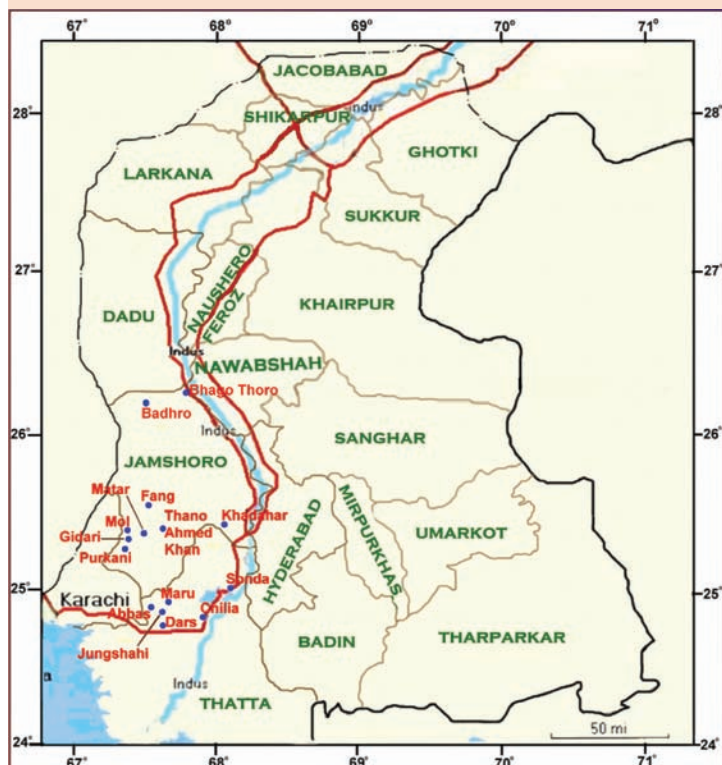
A wide variety of dimension stones, with thousands of shades and colors, are present in nature. Some known names are marble, granite, limestone, travertine and sandstone. Extensive resources of such dimension and cut stones deposits are present in the mountainous areas of Sindh. Dimension stones are cut and trimmed to specific sizes and shapes. Some stone varieties can be polished to increase their attraction.

The stones occur naturally in rocks and are geologically known as igneous, sedimentary and metamorphic rocks. Marble is a metamorphosed form of sedimentary rock, called limestone. However, commercially all calcareous rocks capable of being polished are termed marble.

The best quality marble deposits of Sindh are commercially known as Golden and Coral Marbles. While the large deposits of Golden Marble occur at Sonda (Daduri area) in Thatta district, significant reserves of Coral Marble are also present in Bado Jabal, Bhago Thoro Jabal and other parts of Jamshoro district. In addition, huge reserves of limestone deposits of cut stone quality are present at numerous locations in Thatta and Jamshoro districts. Dimension and cut stones have played a dominating role in the rich architectural and construction history of Sindh and their influence can be found in majestically built historical buildings in Karachi and other parts of Sindh. The use of dimension stone was affected with the invention of reinforced concrete technology. However, in recent years there is worldwide trend of increase in limestone use as building blocks, outdoor decoration slabs and as polished tiles for flooring and elevation.

Based on detailed geological surveys and laboratory investigations carried out as part of the ongoing project “Exploration and Evaluation of Dimension and cut stones deposits in Thatta, Jamshoro, and Dadu districts of Sindh” of the Mines and Mineral Development Department, Government of Sindh, a number of potential/target areas suitable for mining of dimension stone on a commercial basis have been studied. The location of these deposits and other details are shown in the following map and table.

Map showing location of Dimensions and Cut stones deposits in Sindh



Location/target areas of dimension and cut stones deposists in Sindh

| Target Areas | Latitude - Longitude | Type of rock | Formation |
|------------------------|----------------------------------|--------------|-------------|
| Jungshahi | 24°-51'-56.5" N 67°-43'-55.20" E | Limestone | Nari/Laki |
| Maru | 24°-55'-45.9" N 67°-46'-42.40" E | Sandstone | Nari |
| Abbas | 24°-53'-26.4" N 67°-39'-02.40" E | Limestone | Nari |
| Dars (16 Million tons) | 24°-46'-43.3" N 67°-44'-24.90" E | Limestone | Nari |
| Chilia | 24°-49'-43.9" N 68°-00'-50.90" E | Limestone | Lakhra |
| Sonda (50 M Tons) | 25°-01'-07.4" N 68°-12'-05.20" E | Limestone | Lakhra |
| Thano Ahmed Khan | 25°-23'-48.1" N 67°-44'-10.60" E | Limestone | Kirthar/Gaj |
| Gidari | 25°-19'-40.8" N 67°-30'-10.90" E | Limestone | Gaj |
| Matar | 25°-21'-54.8" N 67°-36'-35.50" E | Limestone | Gaj |
| Purkani | 25°-16'-32.0" N 67°-29'-34.60" E | Limestone | Gaj |
| Mol | 25°-23'-40.9"N 67°-29'-20.10" E | Limestone | Gaj |
| Fang | 25°-32'-30.0" N 67°-38'-28.50" E | Limestone | Gaj |
| Badhro | 26°-11'-18.6" N 67°-37'-45.00" E | Limestone | Kirthar |
| Khadahar (15 M Tons) | 25°-25'-24.2" N 68°-11'-05.6" E | Limestone | Lakhra |
| Bhago Thoro Jabal | 26°-20'-16.7" N 67°-52'-00.6" E | Limestone | Kirthar |

2. HISTORY

The use of dimension and cut stones goes back thousands of years. The beauty of dimension and cut stones lies in the fact that it is real or natural and can not be duplicated; it can give an exceptionally long life to buildings with minimal maintenance. The special character and history of dimension stones is reflected in great buildings of the past times constructed thousands of years back. Large blocks of many tons of granite and limestone were used to make great Egyptian pyramids and temples more than 2500 years B.C. In 80 B.C, a multi-story building “The Colosseum” (50 thousand capacity stadium) was built in Rome, using large blocks of travertine stone. Since then, world’s numerous small and large magnificent buildings, such as the Taj Mahal, have been constructed using dimension and cut stones.

In Sindh, the use of limestone and sandstone as a dimension stone dates back to the construction of Ranikot Fort. The historical graveyards/monuments of Chaukundi, which is 29km east of Karachi and Makli in Thatta are more modern examples (14th to 18th century) of the use of dimension and cut stones. These monuments represent the rich cultural and architectural heritage of Sindh. In the past 200 years, numerous buildings in Karachi, Hyderabad, Thano Bula Khan, Sari Singh and other parts of Sindh have been constructed using a variety of limestone and other rocks quarried locally.

Chowkandi Art



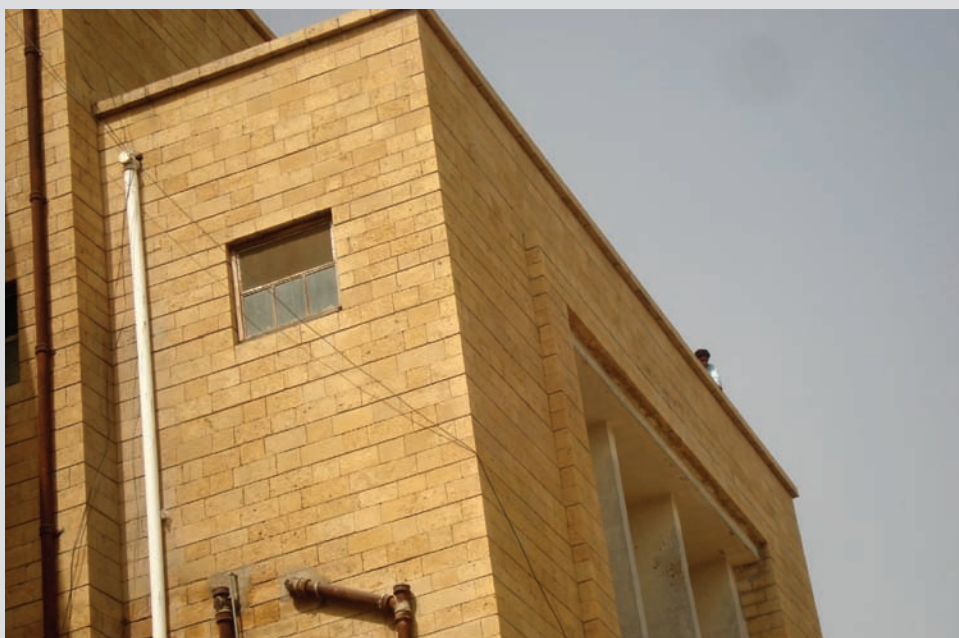
Ranikot Fort



3. TOPOGRAPHY AND CLIMATE

The general topography of the area with dimension and cut stones deposits is that of valleys and hill ranges with nala cuttings. The most prominent features are Kirthar and Laki ranges, which represent major structural highs, due to the anticlinal folds. Valleys have been formed in the large synclines, possessing long axis and have general strikes trending in northeast-southwest direction.

The famous towns in synclines of Jamshoro district are Sari, Mol, Thano Bula Khan and Thano Ahmed Khan. The most prominent physiographic features are Surjan Anticline. The famous Kirthar range is exposed in the west of Karchat, leading to Kanbhu Jabal and ending at Kothar and Hundi Jabal.



4. WATER RESOURCES

The rainfall in these areas is minimum, except in the monsoon season. Total rainfall is about 200mm per annum, making water scarcity common feature. However, in some areas, surface and ground water resources are available, for domestic and agricultural needs of the local communities.

a. Surface Water

As these areas are mostly mountainous, canal system is almost non-existent, except in Sonda area of Thatta, where Kalri Beggar feeder, Kinjhar Lake and river Indus are close to the potential target area. In other areas, the natural depression is usually filled during the rainy season, acting as source of water for the local people, for a short period.

b. Ground Water

In many areas, the ground water quality is poor and water is not fit for drinking. However, there are some target areas like Dars, Jungshahi, Abbas, Sari Singh, Thano Bula Khan, where potable quality ground water is being exploited for domestic and agricultural purposes. The ground water is obtained through dug wells, hand pumps. In some areas tube wells have also been installed.

5. GENERAL GEOLOGY OF DIMENSION AND CUT STONES IN SINDH

Geologically, the western Sindh consists of hilly terrain and largely comprises of sedimentary rocks. In most cases, the dimension and cut stones quality limestone occur in geological horizons ranging in age from Upper Paleocene to Miocene. Structurally, the accessible horizons with dimension stone are generally characterized by gentle dips, whereas in certain locations, such as Bado Jabal and Bhago Thoro Jabal, the potential horizons lie at the axis of the anticline where nala cuttings are common. The dimension and cut stones deposits occur in the following geological formations.

Lakhra Formation

The limestone horizons of dimension quality occur in B and C units of Lakhra formation of Paleocene age (60 million years), at around Sonda and Chilla areas of Thatta and at a distance of about 5km west of Liaquat Medical University in Jamshoro. In Sonda areas, the massive limestone bed is about 3-5 feet thick, covered with up to 5 feet overburden, at present. Its fresh surface is golden yellow and because of this color it is named as golden marble. The huge blocks of 10-20 ton are trimmed at onsite processing plant.

Kirthar Formation

The dimension quality limestone of Kirthar Formation of Upper Eocene age (40 million years) is exposed mainly in the Bado Jabal, Bhago Thoro, Thano Ahmed Khan and Tikku Baran areas. It weathers grayish white and at the fresh surface it is cream to creamy white and in places it becomes white. Some beds are highly fossiliferous, which gives the stone a very attractive appearance, hence this form is known as coral marble. It is present in more than one layer and its cumulative thickness can be more than 10 feet. This stone can contribute significantly if further reserves can be found during the ongoing exploration project.

Nari Formation

The cut stone belonging to Nari Formation of Oligocene age (25 million years) has a unique homogeneous color, giving it a cool and sophisticated appearance. The blocks are either used with plain surfaces, or various designs are made to make the stone more attractive. These types of plain and designed bricks/blocks are used for the decoration of boundary walls and front

Sonda, Thatta District



elevations of buildings. Large deposits of Nari Formation Limestone occur at a few miles from the Sari Singh town in Jamshoro district and west of Jungshahi.

Gaj Formation

The deposits of Gaj formation limestone of Miocene age (20 m years) are found in Mattar area, near Sari Singh. 5-10 square feet. blocks of these stones are mined for making rock and plain faced slabs, for exterior decoration of walls and buildings. This limestone has a very attractive pinkish color, which makes it popular.

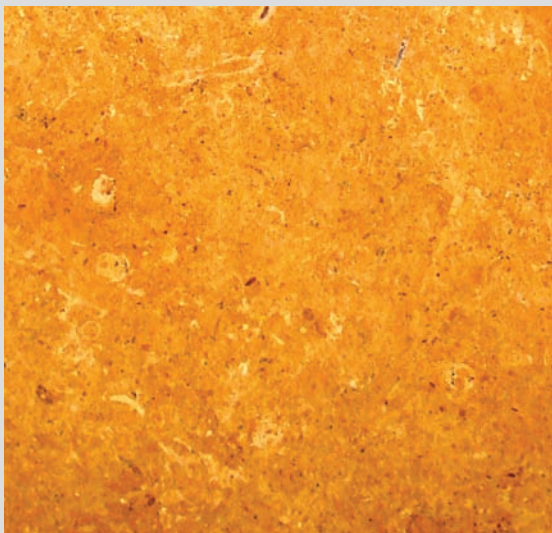
6. DIMENSION AND CUT STONE DEPOSITS

Golden Marble, Sonda

(Resources over 50 Million Tons)

The scattered outcrops of Golden marble in Sonda area spread over nearly 100 sq. km. The limestone beds occur predominantly in B and C units of Lakhra formation. It is light to dark yellow, with a golden hue. Major chemical constituents are CaO (63-91%), and FeO (Average 10%). Calcite is the major mineral present in the marble. The rock is highly lithified, with strong intergranular bonding.

Polished Golden Marble



Location & Accessibility

The target area, Sonda, is situated near the famous Kinjhar Lake in Thatta district. The main locations are Lakho Pir, Dadori, Sheikh Ismail, Pir Fatah Ali Shah, and Sumar. There are quite a few locations which are close to the main national highway. Many other quarry locations near the national highway are also easily accessible by four wheel vehicle, as all the remaining roads are unmetteled.

THIN SECTION ANALYSIS

Thin Section.1 GOLDEN MARBLE

This limestone is texturally Grainstone, comprising of 60% Bioclast, 20% intraclast with 5% quartz embedded in micritic ground mass, with about 10% organic/opaque matter and Intragranular and Fenestral porosity. Bioclast containd Assilina, Alveolina, Nummulites and Orbitolites embedded in Spary Calcite.

Thin Section.2 GOLDEN MARBLE

This limestone is texturally Packstone, comprising of 10-15% Bioclast, more than 30% intraclast, with 2% Quartz and 1% Muscovite, embedded in micritic ground mass, with about 60% organic / opaque matter and Fenestral porosity. Bioclast contains Assilina and Cibicides.

Geochemical analysis results of Sonda samples on XRF

| Sample I.D. | CaO | MgO | SiO2 | Al2O3 | Na2O | P2O5 | Fe2O3 | TiO2 | K2O | MnO |
|-------------|-------|------|------|-------|------|------|-------|------|------|------|
| SO – 7 | 91.47 | 0.58 | 1.89 | 0.99 | 0.24 | 0.08 | 4.11 | 0.13 | 0.06 | 0.44 |
| SO – 8 | 67.51 | 0.42 | 1.44 | 0.63 | 0.07 | 0.07 | 2.93 | 0.09 | 0.04 | 0.25 |

Geochemical analysis results of Sonda samples

| Sample I.D | Compressive Strength in psi | Specific Gravity | % Water Absorption | Hardness |
|------------|-----------------------------|------------------|--------------------|-------------|
| SO – 6 | 9200 | 2.49 | 1.74 | More than 3 |
| SO – 8 | 12300 | 2.60 | 1.57 | 3-4 |

KIRTHAR (CORAL) LIMESTONE

Kirthar limestone, also called coral marble, is another important dimension stone which is largely found near Sehwan (Bado and Bhago Thoro Jabal) areas. The preliminary results of the ongoing project indicate that this limestone can also compete in the market due to its beautiful texture. Its unique appearance is largely due to the presence of large fossils. Polished tile of Kirthar limestone is shown in top left photograph and some outcrop photos are shown below.

Bado Jabal



The Kirthar Limestone is of good quality and occurs in Kirthar formation. The limestone is in light milky white and offwhite colors, at fresh surface. It is highly fossiliferous and is commonly crystallized. The reserves seem to be of reasonable size. The mining of large size blocks (of 10-15 ton) is occasionally carried out from the top of the Bado jabal. The ongoing exploration project is focusing upon finding more reserves of this important dimension stone.

Location and Accessibility

Bado Jabal is about 21km to the South of Manchar Lake, Jamshoro district. This target area covers an area of about 46 sq. km. However, the desirable horizon is not accessible due to topographic and structural complexities. The area in general is easily accessible in all weathers.

Bhago Thoro is about 5km to the south of Sehwan town, Jamshoro district. Indus River and Lal Bagh are famous here. This target area covers a significant area where Kirthar formation is exposed.

SARI SINGH DEPOISTS

Huge deposits of dimension and cut stones are found in Sari Singh area of Thano Bula Khan Taluka. The yellow colored limestone of Nari formation and light pink colored limestone of the Gaj formation are the main varieties used for making blocks, designed bricks and rock and split faced small slabs. The deposits occur in Mattar, Gidari, Purkani, and Mol areas. The stones from this area are being used locally and also are supplied to markets in Karachi and Hyderabad.

Location and Accessibility

The deposits in Sari Singh area are located at 5 to 10km distance from the Sari Singh town and are accessible in fair weather conditions, by a four wheel or other suitable vehicle.

7. MINING TECHNIQUES

In Sonda area (Daduri) of district Thatta, large blocks of about 10–20 ton are quarried by split and wedge method. Mobile cranes are used for tilting, lifting and loading of the blocks. In other areas, the dimension and cut stones are generally mined manually. At other places, the small blocks of stone are separated from the rock mass by initiating cracks, through manual hammering on the sharp edged or chisel shaped tool.

Sari block Factory



At various locations where quarrying activity is carried out, skilled workforce is locally available; they have been engaged in this work since a long time. Under the existing methods, significant proportion of excavated dimension stone goes waste, in the form of crushed material. Their methods, however, can be improved through the intervention of stakeholders, by introducing mechanized and cost effective mining methods for producing ideal end-products i.e. large, solid, relatively flawless blocks of stone of attractive texture and color at a minimum cost.

8. Processing Plants

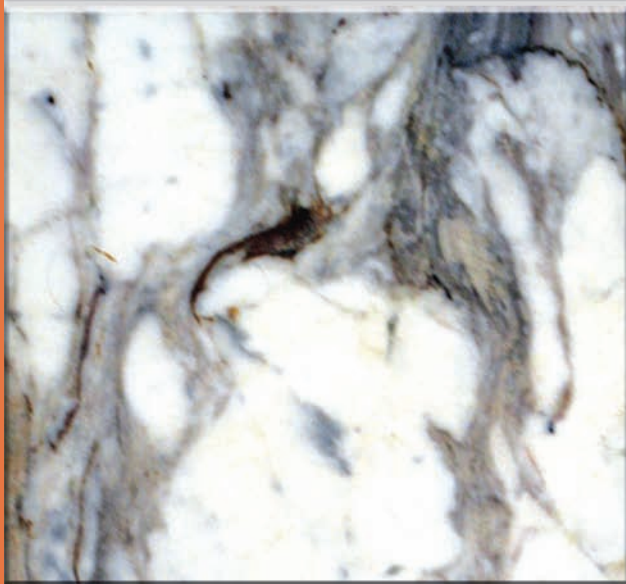
Realizing the potential of the area, two plants; one dressing yard in Daduri and the other a complete processing plant in Jamshoro, have been installed by the private sector. The dressing plant in Daduri has the capacity of handling 10–20 ton blocks. The plant in Jamshoro has a complete range of facilities, from making slabs from blocks to cutting and polishing of tiles.



9. Infrastructure

The good quality golden marble deposits in Thatta district are located on both the sides of the national highway within a short distance, therefore it is connected to country wide road connections. Electricity, telephone and water supply is also available in the villages of Sonda and Daduri, which are not far from the quarrying sites. Though water scarcity is common in most of the areas, Sonda area is close to the Indus river and Kalri Beggar feeder, so required water is easily available.

In other areas, the dimension and cut stones deposits are mostly located at a short distance away from the metalled roads and are accessible through a suitable vehicle.



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