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Environmental Aspects of Kota Stone Mining in South-East Rajasthan

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Introduction:

Mining is defined by UNEP as "the extraction of minerals from the earth. "The extraction of valuable minerals or other geological material from the earth is a process that begins with the exploration and discovery of mineral deposits and continues through processing to the closure and remediation of worked-out sites.

Mining is one of the most important economic activities of the country. The present trend is to opt for open cast mining in place of underground mining. At present country's 25 lack hectare area is under mining lease conditions, out of which ninety percent area is subject to opencast mining techniques.

In general, all the mines affect their surrounding environment to a little or more extent, but opencast mining in particular lead to complex nature of environmental problems. In the present paper an attempt has been made to evaluate the mining activities of Kota Stone mining and their impact on environment.

Study Area:

Kota and Jhalawar districts of Rajasthan have been subsisted with about 100 million tones limestone, better known as 'Kota Stone'. The Kota Stone deposits are located between latitudes 24 32'N and24 49'N and longitudes 75 50'E.

The Kota Stone deposits are spread over150sq km area and the total probable reserves up to minable limits is about 100 million tones. The fair area wise distribution is given in the table: 1.

Table: 1

Area-Wise Kota Stone Reserves

Sr. No	Area	Minable reserves in million tones
1.	Chechat	30.00
2.	Pipa kheri Naya gaon Belt	2.00
3.	Suket-atraliya Sahravada-kukra Belt	4.00
4.	Suket-Dingsi Panpakhri'Atraliya Dhabadeh Belt	10.00
5.	Dhabadeh- Teliyakheri Sahravada, Kukada Belt	10.00
6.	Manpura-Dhani Extendings Jhalawar District	4.00
7.	Jagankheri Kumbhakar Laxmipura- Satalkheri Pipakheri Belt	30.00
8.	Julmi Belt	5.00
9.	Atraliya Deposits	5.00

The various Kota Stone laminations are nomenclature locally in a uniform language. Geologically speaking Kota Stone is a part of semi series of lower Vindhyan group. The local nomenclature is well understood and prevailing from the inception of mining in this area. The regional stratigraphic sequence of deposit is given in table: 2.

Table: 2

Regional Stratigraphic Sequence

(A)		**Upper Vindhyan**
	1.	Bhander Series
	2.	Rewa Series
	3.	Kaimur Series
	4.	Semi Series
(B)		**Lower Vindhyan**
	1.	Suket Shales
	2.	Nembahera Lime Stone
	3.	Jhalrapatan Sand Stone

Kota Stone deposits are part of Vindhyan range of sedimentary rocks overlain by sand stone capping. In general Kota Stone mining areas are free from sand stone covering and the entire profile consists of different grades of lime stone beds.

The floor grade lime stone is available in a variety of different color including blue, green, brown or spotted type.

Color pattern is governed by the chemical composition where main player is iron, titanium and aluminium**.**

Discussion and Results:

The workable lime stone beds amenable to splitting are located at a depth range from 15.00 meters to 25.00 meters from the surface and part of anticlinal-synclinal type of sedimentary laminated structure.

Strike and dip of the deposit is primarily location specific, but generally the deposit dips at 7.5 percent away from the anticlinal-synclinal common axis.

The lime stone bed is divided into fine prominent sacks which are separated from each other by clay partings.

Thickness of laminations in each sack increases with depth and texture improves with higher silica fractions in the sacks, as given in the following table:

Table: 3

Silica Percentage in Different Sacks

Sr. No.	Sacks	Average Silica Percentage	Quality Considerations
1.	Top Kota Stone Sacks	18.00	Thin laminations with rough Texture
2.	Middle Sack	22.22	Aggregated laminations Thickness increases better Texture
3.	Third Sack	22.24	Product size have larger Portion of thick laminations and very good texture
4.	Fourth Sack	24.27	Thick laminations and very good texture

Stratigraphic profile also varies from place to place and can be divided into three categories depending upon the type of waste material overlying the workable deposits viz.

1. Overburden comprising soil, subsoil and mixed calcareous like Chechat area.
2. Overburden comprising soil and subsoil and basalt rock like Pipakheri, Zulmi area.
3. Overburden comprising soil, subsoil to a large extent underlain by a narrow band at calcareous rocks like Jhalawar deposits.

The stratigraphic rock profile of all three deposits is shown in table: 4.

Table: 4

Stratigraphic Rock Profile

Sr. No	Rock	Thickness in meters		
		Chechat Group	Pipakheri Group	Jhalawar District Mines
1.	Topsoil/subsoil	0.00-2.50	0.00-1.50	10.00-11.00
2.	Overburden comprising mixed calcareous rocks	10.00-25.00	-	3.4-4.00
3.	Basalt	-	10.00-12.00	Nil
4.	Top sack	4.00-5.00	4.00-5.00	-
5.	Middle sack	2.50-3.00	2.50-3.00	-
6.	Third sack	3.00-4.00	3.00-4.00	-
7.	Fourth sack	1.25-2.00	1.25-2.00	1.25-2.00

Mining activities may broadly be classified into two categories:

1. Removal of overburden; and
2. Extraction of Limestone.

The topsoil and subsoil exist for a thickness of 0-2.5 meters is dozed off and is transported by dumpers, loading them using front end loaders. Thus, the hard overburden strata are exposed. After moving the soil and subsoil the exposed overburden layer needs drilling and blasting. Blasted overburden is roved and transported using front end loader-dumpers/dump truck combination. A general statement of Kota stone production is given in the table: 5.

Table: 5

Year-Wise Kota stone Production

(Figures are approximate)

Sr. No.	Year	Production (In M.T.)
1.	2001-2002	22.00
2.	2002-2003	23.00
3.	2003-2004	30.00
4.	2004-2005	28.00
5.	2005-2006	35.00

Sr. No.	Year	Production (In M.T.)
6.	2006-2007	30.00
7.	2007-2008	40.00
8.	2008-2009	45.00
9.	2009-2010	40.00
10.	2010-2011	50.00
11.	2011-2012	55.00
12.	2012-2013	55.00

The average yield of acceptable quality of Kota Stone per hectare land area is about 1.00 lakh M.T. and with current trend of yearly production level 55.0 to60.0-hectare lands is brought under stone mining every year. In all cases this land belongs to farming sector and is completely degraded as far as agriculture is concerned. In a rough estimate, till the date almost 900-hectare agriculture land has been lost to Kota stone mining alone in Kota and Jhalawar districts. Damage to land surface from sand stone mining is not included in this assessment.

In addition to the environmental problem cropping up due to permanent loss of prime agricultural land, there is one more dimension to this activity i.e., formation of waste dumps over agricultural land. Most of the mining leases are at 4.0 hectare to 25.0-hectare size areas where side by side pit reclamation is not possible. The angle of repose of the blasted overburden is almost 38, which requires a sizable space in the operative sections of apart from productive platforms, facility recess and water sink and other utility space.

As a result, large quantities of blasted wastes are dumped over prime agriculture tracts, specially purchased for making these waste dumps. The quantum of problem can be understood by the figure that 2.5 cum. Waste has to be stripped off and dumped in the dump yards for each metric tons of Kota Stone production. Capacity of the dump yards retaining waste materials depends upon many factors such as size, shape, angle of repose etc. but on an average I.0-hectare area dump yard may yield about 1.75 lakh cube meter waste material taking into account angle of repose, optimum square shape and space for having roads and benches etc.

The present trend of production level is likely to generate about 138 lakh meter cube of waste material every year. Presently, only 35% of this bulk quantity is filled back in the mined areas, leaving behind 90.00 lakh meter cube waste dumped over prime agricultural land, requiring 45.0 to50.0-hectare fresh lands for dumping waste generated in a year. As per our estimates around 1800 lakh meter cube waste material is dumped in random formations covering about 900-to-100-hectare area.

The third dimension to this problem is of the disposal of the fine slurry released from the cutting polishing industries. Every year about 2.5 to 3.0 lakh M.T. of stone polish is discharged into local convenient places. This affects about 5 to 10 hectares land every year.

In total both Kota and Jhalawar districts are losing about 120-to-150-hectare prime agriculture land every year for facilitating stone mining, which is quite alarming.

In addition to this, one more point needs immediate attention. Kota stone is a localized non-renewable natural resource and its limited reserves may not last for another fifteen years with the current policy of liberated lease of sanctioning process and increased production level.

This production aspect needs introspection from the point of sustainable growth and regulation.

The mining in the districts is losing valuable top soil at the rate of 8.0 to 8.50 cube meters per year, which is another loss of ecosystem.

Conclusions:

The mining activities have created a number of environmental problems in the year. Broadly these problems could be grouped as:

(A) Landscape deterioration:

a) Loss of prime agricultural land
b) Formation of waste dumps over agricultural land.
c) Disposal of the fine slurry released from the cutting polishing industries.
d) Formation of open vast pits.
e) Encroachment in the forests.

(B) Health hazards and pollution:

a) Potable water pollution.
b) Noise and dust pollution.
c) Open abandoned mines.
d) Sudden failure of open pit side wall.

(C) Loss of biodiversity

a) Destruction of ecosystem.

The above listed problems are interrelated and have been compounded because of mining activities in the study region.

In these circumstances it became imperative to mine planners and operators to plan and execute mining programmers in such fitting manner so that the impact of mining on the local environment is brought to a negligible state. This requires a careful planning as well as more attentive work.

Execution on day-to-day basis:

To overcome the environmental problems as highlighted above, following corrective measures are recommended:

1. Mining activities should be checked particularly, illegal mining. It should be made mandatory to the mining lease holders to rehabititate degraded mining are by using suitable techniques.
2. Fresh mining leases should be considered exclusively on the land presently occupied by the old waste dumps.
3. Mine owners should be pressed to dump their waste generations into nearby old abandoned quarries.
4. The case agreements should have special provisions to force con- current refill after an initial grace period to facilitate development and space for such refills.
5. Cutting polishing industries should be forced to dump their slurry into old mined out areas or in the active dumps. Any violation should be penalized.
6. Waste material formed by the mining activities can be used in the buildings, roads, cement industries etc.
7. Top soil should be mined out separately and conserved for reclamation purposed.
8. Reclamation of waste land should be taken up.
9. Mandatory afforestation programmed should be taken up by mine holders.
10. Awareness among the local people for the protection and conservation of their environment should be created.

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