Geomorphological Status of Sariska Tiger Reserve in Aravallis with Emphasis on Mineral and Environment

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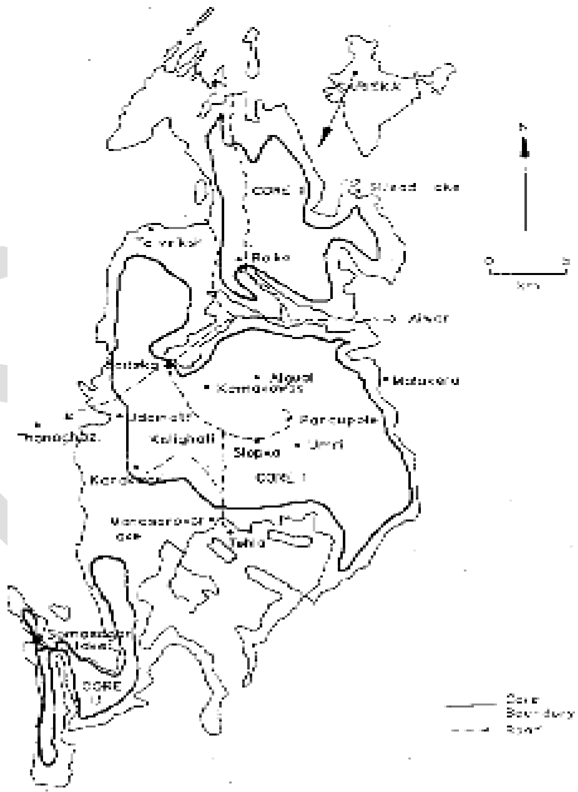
Abstract: **Geomorphology of Sariska Tiger Reserve in AravallisThe reserve has topography of undulating plateau land and wide valleys with flat vast plains to narrow and deep gorges. The terrain of Sariska Tiger Reserve is hilly maintain the character of Aravalli system with sharp log back ridges. The slopes are steeper on their southern aspects than in other direction. The ridges and plateaus are convulated and curved, and run in many directions. There is a major valley referred to as the main valley which runs in a general east west direction through the reserve. The main valleys width ranges from 0.25 km. to 2 km. comprises with Kushalgarh in the west, it forks into 2 branches towards Tulsiwasla in the north-west and Sariska in the south-west. Another major valley, the Sariska-Kalighati valley, runs in a general north-south direction. It is narrow, about 0.25 km. wide for the distance of about 5 km. before it broaden out at Karnawas. At the Sariska, where it links up with main valley, it is almost 3 km. wide. To the south of core zone–I there is a wide valley (1 km.) which runs northwards from Mandalwas to Kaniyawas near Kankwari at the Sariska. In Sariska, they are in NNE-SSW direction.Sariska in the Northern part of the Aravallis has mainly residual hills, though there is a structural control as well. The residual hills occur as isolated, linear features in the line with the trend of the mountain and are spread from each other by wide gaps (Dhabriya, S.S., 1987).**

***Keywords: Geomorphological ,Sariska tiger reserve, Aravallis, Minerals, Geology and Geomorphology*.**



Map of Sariska Tiger Reserve in Aravallis

I. INTRODUCTION

The Aravalli hills spread in 12.65 percent area of Rajasthan, influencing ecological equilibrium in 29.92 percent of the state area directly whereas climatically and hydrologically influence much large area in the state and the surrounding regions indirectly. The Aravalli hills region extend in part of sixteen districts and covers fully or partly 120 development blocks of the Rajasthan state. The Aravalli hills all through acted as a constraint and checked the spread of Indian desert towards eastern Rajasthan and Indo-Gangetic plains till it remained green and well forested (Dhabriya, 1985). The Aravalli hill region is an important mineral resource area of the country having almost complete monopoly in the mining of non- ferrous minerals like zinc and silver and having large reserves of ferrous minerals such as iron- ore and manganese, non ferrous minerals like copper-ore and lead, non- metallic minerals such as dolomite, calcite, emerald, felspar, garnet, mica, rock phosphate, magnesite and building stone like marble, limestone etc.The Aravalli hills are reported to be one of the oldest reported hills so far. According to the feedback from departments pertaining to mines and minerals both at state and national level, Aravallis are richest source of minerals and happened to be back bone of industries of a state. We have been witnessing disputes among people, environment and forest and mining department. This is basically because of lack of planning and unsustainability and under the circumstances ecological balance is gradually losing.

II. MATERIAL AND METHODS

Personal observation has made during visit and research tenure, use of different toposheets of series 54/ A from geological survey of India and demarcation of sustaining geological reserve and mining leases on them. Personal interview from mine lease holders in various places of sariska and attempt has been made to locate their occurrence position (latitudinal or longitudnal) and possibility by the help of toposheets and state department of mines and minerals.

RESULT AND DISCUSSION

Table (a) includes the major spots of mining in the study area. The buffer zone of Sariska Tiger Reserve protected areas have 128 leased areas of limestone, slatestone, marble, iron, copper, granite, quartzite, shales, barytes and masonary stones (Table(b) includes the name of the forest blocks and number of the mining leases and status of the forest area and Table (c) includes the types of minerals and their sites of mining.

Table(a) Major spots of mining in the Sariska Tiger Reserve

Anthropogenic Activity	Places of Mining in Sariska Tiger Reserve	Status / occurrence/ inference
1. Mining activities	Jaganathpura Nagalhedi Lakhedi Kalwar Palpur Baldeogarh Malana Jhiri Tehla Dabkan Khoh/Dariba Gordhanpura Khokalwad	Mining blocks are situated in the buffer zone of Sariska Tiger Reserve protected area. Total lease area are 128 for various minerals like, limestone, slate stone, marble, iron, granite, quartzite, shale, barytes and masanory stone

Table(b) List of mining leased areas located in the forests blocks of Sariska Tiger Reserve in Aravallis

	Name of the forest blocks	Number of mining leases		Status of forest
		Completely	Partially	
1.	Jaganathpura	36	05	Protected area (Buffer zone)
2.	Nagalhedi	04	-	Protected area (Buffer zone)
3.	Lekadi	01	-	Protected area (Buffer zone)
4.	Kalwar	53	22	Protected area (Buffer zone)
5.	Palpur	08	07	Protected area (Buffer zone)
6.	Baldeogarh	75	03	Protected area (Buffer zone)
7.	Mallana	38	06	Protected area (Buffer zone)
8.	Jhiri	04	04	Protected area (Buffer zone)
9.	Gordhanpura	04	-	Protected area (Buffer zone)
10.	Tilwar	-	03	Protected area (Buffer zone)

Table(c) Specific areas of deterioration in Sariska Tiger Reserve

	Name of area	Status of areas	Factor responsible for deterioration	Inferences
1.	Dabkan	Reserved forest area	Mining	Adjacent to core zone III
2.	Kalwar	Protected forest (buffer zone)	Mining	Adjacent to core zone III
3.	Tilwari / Tilwar	Reserved forest	Mining	Adjacent to core zone III
4.	Palpur	-	Mining	Marble mining intensive
5.	Malana	Open scrub forest	Mining	Marble mining intensive
6.	Govardhanpura	Open scrub forest	Mining	Marble mining intensive
7.	Khoh	Protected forest	Mining	Mining for copper ore
8.	Baldeogarh	Open scrub forest	Mining	Mining for marble intensive
9.	Tehla	Open scrub forest	Mining	Mining for marble intensive
10.	Kushalgarh	Buffer zone	Mining	Limestone and quartzite adjacent to core II
11.	Ajabgarh	Buffer zone	Mining	Marble mining adjacent to core III
12.	Rekamala	Buffer zone	Mining	Schist and quartzite mining

13.	Jhiri	Protected forest	Mining	Marble mining and iron ore near core area I
14.	Nagalhedi	Protected forest	Mining	Intrusive granite
15.	Baleta	Protected forest	Mining	Intrusive granite near core area I

The Geology of Aravallis system in study area : The area covered by the Alwar district is occupied by Precambrian rocks comprising banded gneissic complex, Aravalli system, Railo series and Delhi system. The northern part in covered mostly by alluvium, while the central and southern part have good rock exposures. The stratigraphic succession of the rock types is as follows:-Post Delhi intrusive - granite, pegmatite, and metadolerite. Delhi system Ajabgarh series (quartzite, phyllite marble), horn stone breccia.Kushalgarh series– limestone Alwar series (quartzite, grits, conglomerates and schists) In Railo series– Dolomitic marble, quartzite and schists.Major part of the study the area is occupied by rocks of Delhi system comprising quartzite's conglomerates, grits, limestone, phyllite and schist's. Structurally the area has two major unconformities and at least two stage of folding and faulting. The erosional unconformity between the older metamorphic granite and the Railos represent a major stratigraphic and structural break, reflected in diversity of the fold pattern in the rock formations below and above it. The Aravalli rocks of the Alwar district comprises of various types of quartzite, schists, marbles and granite. As per the vast study of various geological reserves in toposheet no. 54 A shows the exposed of metamorphics are near Motiwara (27° 10'45": 76° 35'), Ratanpura (27° 12': 76° 30'), Riwas (27° 45": 76° 31' 30"), Jaintpura (27° 4' 15" : 76° 30'), Gawaran (27° 2' 45": 76° 29'), Gurha (27° 3' 45": 76° 29'), Sakat (76°8' 45": 76° 30' 45"), Rajpura (27°10': 76° 31' 30"), Rajgarh (27°14' 15": 76° 31' 30"), Surer (27° 11' : 76° 37'), Kaled (27°9' 30" : 76° 13') and Nabhewala (27° 2' 30": 76° 16'). The granite is seen particularly near Raialo (27° 5' 30": 76° 13'), Thali (27° 3' 30" : 76° 12'), Nabhewala (27° 2' 30": 76° 16'), Jhiri (27° 14' : 76° 12'), Parla (27° 06' : 76° 36'), Lilod (27° 05' : 76° 37'), Thatra (27° 12' : 76° 43') Pirangpura (27° 06': 76° 40'), Baswa (27° 09' : 76° 35') etc. The quartzites show variations in compositions and texture. Three types can be recognized, (i) felspathic quartzite, which is medium to coarse, grained, (ii) sericitic quarzite, which is fine to medium grained (iii) massive quartzite, which is fine grained, and compact. Thin bands of conglomerate occur interbedded with the felspathic quartzite and massive quartzite. The quartzite also contains intercalations of schist's and marble.The schistose rocks include sericite quartz-schist, quartz-sericite chlorite and schists, garnetiferous muscovite and banded light grey phyllite. These rocks are intricately associated with the quartzite and occur as intercalations in the quartzite almost anywhere. The marble is a fine to coarse grained rock of varying shades of brown and grey. It is generally dolomitic and impure and contains variable amount of quartz and ferruginous matter. Thin bands of pink quarizite are associated with the ferruginous marble exposed near Gurha (27° 3' 42": 76° 29'), Sakat (27° 10' 45": 76° 31' 30"), and Ratanpura (27° 12' 15": 76° 31' 30"). Pure marble is exposed north-east of Nimla,east of Rajpura (27° 10' 45": 76° 31' 30") and near Kaled (27° 9' 30": 76° 13'), Kharkari (27° 13': 76° 38') highly ferruginous and partly mangniferous marble has given rise to local iron ore pockets. The granite is generally covered by soil and is exposed only at few localities such as Urawari (27° 3': 76° 25'), Thirora (27° 5' 30": 76° 30'), Todi (27° 11': 76° 32'), Parla (27° 6': 76° 36') on the ridge between Lilod (27° 5': 76° 37') and Thatra (27° 12': 76° 43'), Pirangapura (27° 6': 76° 40'), Dagada (27° 8': 76° 40'), etc. The rock is coarse to medium grained, usually rich in biotite which has often imparted a crude foliation. The composition of the rock is mainly quartz and felspar with biotite and muscovite. Pegmatite veins are also commonly seen.The Railo series mainly consist of dolomitic marble with minor quartzite and phyllite lenses and a thin band of quartzite at its base. These rocks are best exposed around Dogeta (27° 7': 76° 17') Gola ka bas (27° 5' 30": 76° 17') Kharar (27° 5' 30": 76° 7' 20") Jhiri (27° 14': 76° 13') Tilwari (27° 12': 76° 24' 30") Dantli (27° 6' 30": 76° 9'), Bashni (27° 5' 30": 76° 9'). The marble is generally white to greyish white, medium to coarse grained. Bedding is observed and rock is generally unfoliated. The marble is mainly dolomitic but calcitic marble is also locally associated with it. The marble around Dogeta (27° 8': 76° 30') and Nimla (27° 4': 76° 5') is highly ferruginous and show dissemination and stringers of magnetite and hematite. At number its contact with the basis intrusives. Several such talc bodies including the well known Dogeta (27° 7': 76° 18') deposits are being economically worked. The Railo quartzite is a light grey pink to buff coloured, fine to medium grained, and massive rock. The rocks of Delhi system can be divided into three main formations- Alwar, Kushalgarh and Ajabgarh on the basis of lithology- The Alwar and Ajabgarh formations usually have constant thickness while Kusalgarh formation is limited in distribution and shows variable thickness. The Alwar rocks which are mainly arnaceous grade into the calcareous rocks of Kushalgarh formation. The Kushalgarh rocks grade into Ajabgarh which is mainly an argilaceous formation. The Alwar rocks are predominantly arnaceous and consist mainly of quartzite, grits, conglomerate and subordinate schists. These rocks constitute most of the hill ranges in Alwar district. The quartzite is generally light grey to whitish in colour, fine grained, well bedded and jointed. It varies from massive quartzite to conglomeratic quartzite at number of places showing oval pebbles of white quartz and quartzite. The rocks of this group generally from the smaller ridges, valleys and slopes. These rocks are profusely intruded by basic rocks near Tehla (27° 14': 76° 25'), Basi (27° 8' 45": 76° 15'), Natata (27° 7' 45": 76° 11' 30") etc. The conglomeratic horizon is normally thin. Its maximum thickness is exposed near Riwas (27° 5' 45": 76° 31' 30") and it consists of rounded pebbles, boulders and pebbles of heterogenous assembly of rocks, consisting of quartzite, quartz-sericite schists, chlorite, schists, vein-quartz etc. The Kushalgarh formation comprises a conspicuously banded and locally massive marble. This occupies the eastern slope of the ridge running from south of Kalighati (27° 10' 30": 76° 25' ') Daulatpura (27° 14' 15": 76° 33' 45"), Kondla (27° 12' : 76° 29' 15"), Bindhauna (27° 7' 45": 76° 26') Birpur (27° 9' 15": 76° 28'), Ajabgarh (27°11':76° 17' 30"). The rock consists of alternating dark coloured calcareous and arnaceous or argilaceous bands. In thin sections it shows calcite, dolomite, quartz and minor amount of magnetite. The brecciated quartzite forming low, isolate ridges and hills north of Kalighati (28° 18' 20": 76° 17' 30") around Kondla (27° 12': 76° 29' 15") etc. has been grouped as hornstone breccia. The Ajabgarh formation is predominantly argilaceous comprising carbonaceous phyllite with interbanded breccia quartzite and marble. It is exposed around Ajabgarh (27° 11': 76° 17' 30"), Birpur (27° 9' 15": 76° 28') Daweti (27° 10' 30": 76° 29' 15"), Kondla (27° 12' : 76° 29' 15") etc. The carbonaceous phyllite is a dark grey to pale bluish gray rock consisting of clay minerals quartzite is generally light to dark gray, brownish, mostly occurring as band in the carbonaceous phyllite, similarly the marble also occurs as bands in the phyllites. The marble is generally fine to medium grained, bluish gray to buff coloured rock, locally showing good bedding. Post Delhi intrusive rocks include basic rocks, granite, and pegmatite and quartz veins. These are seen in all formations of Delhi group of rocks. The granites are generally confined to the Alwar series of rocks, but are found to intrude Ajabgarh rock also particularly in the western part of the area. In thin sections, it consists of quartz, microcline, orthoclase, biotite etc. The other member of this group is the basic rock, which vary from amphiolite to metadolerite and amphibole schists. It is seen intruded in the form of dykes and sills generally in all the rock formations of the Delhi System, older metamorphic and the Railos. The metadolerite consists of hornblende, plagioclase, biotitic and quartz, its maximum occurrence is in association with the upper Railo formation and the Alwar formation.Quartz veins occur traversing all the rocks in the Alwar district but are most prevalent in the Ajabgarh series of rock and the basic rocks. Similarly pegmatites are also noticed in the Alwar and Ajabgarh series.

CONCLUSION

There is a serious lacuna in our mining based economy, because there is as tug of war, between our natural resources and geological resources. Almost all kinds of geological minerals are underlie the beneath of the natural or biological wealth. As we all aware that Aravalli hills are one of the oldest mountain in world, flourish with rich geological as well as natural and biological wealth which has to be asset for human civilization, As being the part of Aravallis Sariska is rich in both resources, but above all it has a flourish vegetation forests which dictates the center of endemism for several flora and Fauna. Due to the economic proliferation the mining phenomena has been introduced since 3-4 decade back.

Mining operations are being carried out in deep open cast mines within and around the southern boundaries of Sariska Tiger Reserve. These mines produce dolomite marble. There are more than 400 mining plots in area with more than 250 major mines. Each plot of mining measures about 100 to 125sq. metre. Sariska faces the highest amount of stresses due to mining problems as major anthropogenic activities primarily for dolomite marble compared to other Project tiger reserve. After a survey in 1989 it was clear over 200 mines fell in the protected area and over 40 in the partly protected area. Mining occurs in the area around the Kho, Kushalgarh, Naraingarh, Baldeogarh, Tehla, Malana etc. About 100 to 125 sq. km. of area in the reserve has been affected by mining activities.Quarrying is being carried out in 0.05sq. Km. of the forest reserve. Till 1986 when the new Rajasthan minor minerals concession rules were passed, the mining department issued mining leases regardless of the status of land being leased, i.e. forest or revenue land. Since 1986, whenever a forest plot had to be leased in and around Sariska. Human welfare and mineral supplies have been linked for so long that scholars demarcate the ages of human history by reference to minerals, stone, bronze and iron. Although minerals remain essential for human survival but the negative factor is unprecedented extraction rates for their greed not the need. Where mining is regulated to protect the environment, it still causes substantial damage, where regulated poorly or not at all, it creates environmental disaster areas. Around the world mining and mineral processing play an important role in such environmental problems as deforestation, soil erosion, air and water pollution. The mineral sector is one of the largest area of energy, thus contributing to air pollution. The environmental impacts of mineral extraction are particularly severe in our country. Sariska sanctuary created in 1955 in a hilly terrain with wide valleys supporting good dhok forest suffers from mining. Sariska has mining units of marble, lime stone, slate stone, black granite and quartzite etc.In the Sariska marble mining units are located to Jhiri, Khokalwad Palpura, Baldeogarh and few more villages. There are three hundred seventy two recognized marble units in Sariska out of these units one hundred and twenty eight located in the protected forest. In the Jhiri there are ninety two marble mining units which include twenty eight units located in the protected forest Khokalwad has eighty nine mining units which includes forty units located in the protected forest. Gordhanpura has forty-eight marble mining units with twenty four in the protected forest Palpur has seven marble mining units and Tilwar has forty six marble mining units in the protected forest. There are eighteen marble mining units, which are scattered, and these are not falling in the protected forest. Besides marble mining units. There are forty eight lime stone and twenty seven slatestone mining unit in the Sariska forest there are forty two granite marble units two quartzite units are also located. Other then these mining units soil is excavated for break preparation and stone is taken out for building of houses. There are 724 units for marble and other materials located in Sariska is alarming and menace on status of reserve.

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