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# To Study on Physico-Chemical Analysis of Soil Around Bar-Dipawas- Lawacha-Kalab Kalan Section of Raipur Area of Pali District, Rajasthan, India

KEYWORDS: enriching the soil, urbanization, industrialization, indiscriminate mining, sandy and loam, Delhi Supergroup, Pali district, Rajasthan

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**ABSTRACT** *Minerals and organic matter are the main constituents of soils. The process of soil formation by breaking up the rock particles and enriching the soil with organic matter from aerial and subterranean parts are influenced by biological activities. River sands, gravels, cobbles, pebbles, and boulders are the main and chief sources of soil. In India, arid soils cover about 20 million ha area covering Rajasthan, Gujarat, Punjab and Haryana and most of the soils are arid soils (Dregne, 1976). The ever increasing population, urbanization and industrialization have led to generation and indiscriminate mining of large amount of ores, rocks, minerals, placer deposits and soil for domestic, commercial and industrial purposes. The investigated area is located in the great Indian Thar Desert of Rajasthan, where soil of the Raipur- Pali area is of sandy and loam type with medium grained texture. The natives and relating to the indigenous inhabitants of the Bar, Dipawas-Lawacha area of Pali district suffer and bear adverse challenges of climatic conditions along with some specific aspects related to market on rock types and soils which are used as a building material and different mineral deposits used in different industries. Its importance has not only been felt for the inhabitant but, for our country too and to the civilization at large. Sporadic small and huge rock exposures and various litho units ranging about 50 m to 200 m or even more than this are present in different locations of study area.*

**Introduction**

The roads and highways along the road sides and river valley slopes innumerable rock cutting and open cast mining generated granules and debris, occurring in the form of soil and fine clay. Heavy vehicles etc generation micro-seismic waves which add to the instability of the soil particles which are already unstable due to road cutting. During rainy season, the water that flows on the surface and simultaneously penetrated inside the fractures, pores, cavities and fissures which create devastating results. These structures are formed with partial dissolution and erosion of rocks.

The rocks of Bar-Lawacha-Dipawas area of Pali district are included under three main tectonic divisions of Delhi Supergroup from southwest to northeast viz. Banded Gneiss Complex (BGC), Barotia Formation (Barotia sequence of Heron, 1953) and Sendra Formation (Sendra complex of Heron, 1953). All the three tectonic divisions are well displaced in the study area and the same names have been followed in this paper. The BGC is made up of Precambrian basement in the southwestern side and the lower most tectonic unit of the area. It is separated from the overlying rock of the Barotia Formation with an unconformity (Gangopadhyay, P.K. and Lahiri, A. 1983).

The Barotia Formation consists of Bar Conglomerate Horizon, Calc amphibolite schist, Quartzitic schist and Calc-schist with intercalated Quartzite schist. Bar Conglomerate Horizon is further divided into Quartzofeldspathic

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|---|---|
| Heron (1953) | Lithostratigraphy of the Study Area |
| Intrusive granite | Intrusive granite is not exposed in the investigated area |

| | | | |
|---|---|---|---|
| Sendra Complex | Sendra Formation | Calc amphibolite gneiss with alternate bands of mica schist and foliated quartzite | |
| Nandana Crystalline Limestone | Dolomite | | |
| Barotiya Sequence | Barotia Formation | Calc-schist with intercalated quartzite schist | |
| | | Quartzite schist | |
| | | Calc amphibolites schist | |
| | | Bar Conglomerate Horizon | Kyanite schist |
| | | | Staurolite schist |
| | | | Garnetiferous mica schist |
| | | | Bar Conglomerate schist |
| | | | Quartzofeldspathic mica schist |
| Unconformity | Unconformity | | |
| Banded Gneissic Complex | (B.G.C) Granitic gneiss | | |

Schist, Bar conglomerate schist, Garnetiferous mica schist, Staurolite schist and Kyanite schist. The overlying Sendra Formation constitutes the northeastern part of the study area. Dolomite (equivalent to Nandana crystalline lime-

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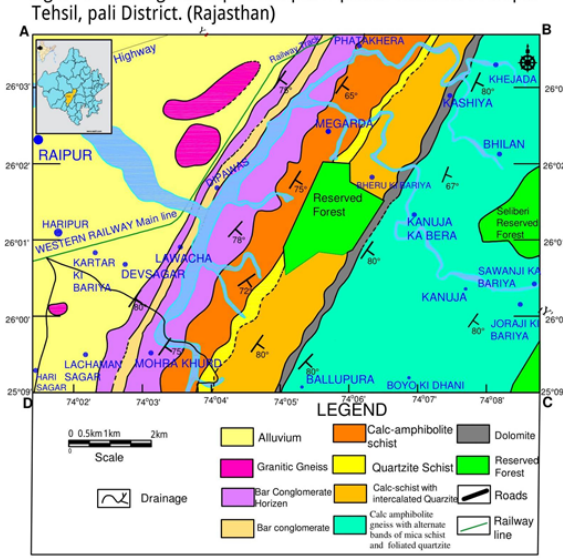
stone of Heron, 1953) separates the Sendra Formation from the underlying Barotia Formation

Figure : 1 Geological map of Haripur-Dipawas-Lawacha of Raipur Tehsil, pali District. (Rajasthan)




conformably. The Sendra Formation is constituted of mostly gneisses with alternate bands of mica schist and foliated quartzite. Intrusive granite is not present upon the Sendra Formation and is not exposed even in the northeastern part of the investigated area. The lithostratigraphy is describe in table 1, along with lithostratigraphical map in figure 1.

**Soils in arid regions**

In North American, arid regions have zonal (red desert, grey desert, sierosems, chest nut and brown soils), azonal (xegosols and lithosols) and intrazonal (calcisols, sclonets and solonchak) soils. The soils of arid North Africa are Rensisines (rendolls, Mollic, Calciorthids), brown evalcareous (Eutrochrepts), sierosems, halo and Hydromorphic soils developed, whereas in Arabian deserts are characterized by poorly developed stony soil surface with calcium and gypsum layer in soils. Soils along with rivers are medium to fine textured flood plain and are salt affected. Iranian sandy soils are in the form of aeolian, colluvial and alluvial sediments found in almost all physiographic units of the country as regosols, desert soils, sierozems and in association with the main zonal soils (Dewan and Femouri, 1964).

In India desert Lithosols and Regosols are developed (Choudhary, 1982), and arid soils covers about 20 million ha area covering in Rajasthan, Gujarat, Punjab and Haryana and most of the soils are aridisols (Dregne, 1976). The study on the soils of Rajasthan undertaken by various workers (Dhir and Singh, 1985) is restricted to routine morphological description and classification as series types or phases. Arid land spread over on the western side of Aravalli is almost flat encountering heaps of sand as soil. Soils of Rajasthan are classified into eleven types are ongoing from dune soil (Torripsamments) to medium black soil (Table 2).

Inorganic minerals and organic matter of different chemical compositions are the main constituents of soils. The process of soil formation by breaking up the rock particles and enriching the soil with organic matter from aerial and subterranean parts are influenced by different geological and biological activities Ashok et al (2013). River sands, granule, gravels, cobbles, pebbles, and boulders are the main, important and chief sources of soil. In recent years the topics of naturally occurring different soils have attracted major interest worldwide due to the fact that they may play a dominant role as possible mineral resources in the future. In India, arid soils cover about 20 million ha area covering Rajasthan, Gujarat, Punjab and Haryana and most of the soils are arid soils. The investigated area is located in the great Indian Thar Desert of Rajasthan, where soil of the Raipur- Pali area is of sandy and loam type with medium grained texture. The Indian Meteorological Department (IMD) has divided Rajasthan in two the meteorological sub-divisions i.e. western Rajasthan and eastern Rajasthan and the proposed work is belongs to western Rajasthan sub division, where most of the soil is dark grayish brown to light brown in colour with heavier subsurface and well developed sub angular grain shaped. There are three meteorological stations are located at Phalodi, Jodhpur and Ajmer in Rajasthan.

However, the role of the vegetation is relatively less in arid zones because of the scanty and sparse canopy cover and the limited development of aerial parts like roots, stems and branches. Nevertheless, the root systems often exhibit exceptional development and have the greatest influence on the cracking of the rocks influencing soils formation processes Ashok, et al (2012). The parent rocks had definite relations with the soil materials/nutrient and the vegetation it supports. But the studies on relation between parent rock material and soil and further correlation of these aspects with vegetation (trees, shrubs and undergrowth) supported by the soil is by and large lacking in western Rajasthan. This study therefore highlights by the fact that the vegetations including trees, shrubs and most importantly the herbaceous vegetation vary from soil to soil depending upon minerals present in the soil and these minerals are derived from the parent rock materials. Different types of vegetables and fruits are growing in the soil fields of the study area is being used in the market, trees used in the timber market and soil is also used as a most important masonry material gives the social and economic development.

**Demerits of modernization**

This is not the end of this ever-continuing debate on the multiple uses of rocks, minerals, ores and soil in on the development, success and prosperity of modern human civilization. While the extra ordinary exploitation of natural resources gives adverse effects on the survival of birds, animals and human beings along with herb, sherb and trees. Quarrying of sand gravel in many localities has resulted in complete destruction of river beds, estuary, tributaries and related ecosystems which has carved severs impacts of river courses and erosion of coastal zones, biodiversity and tourism also.

The extra ordinary use of fertilizers and industrial effluent for irrigation is a matter of major concern due to the presence of toxic metals and other pollutants, which ultimately contaminate the soil and the plants grown in it. Vegetables and fruits are important for human diet due to presence of vitamins, carbohydrates, proteins, fibers and other minerals, but due to heavy metal accumulation in the green leafy vegetables from waste water and industrial effluents these are causing a great deal of health hazards including skin, heart diseases, mental disorders, kidney failure, cancer etc. Vegetation and fruits contain mostly fungal spores which are known to cause spoilage to the soil and grow infected plants. These fungal spores pass from one generation to another generation and the rate of soil pollution

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increases day by day. The infected and contaminated soil produces infected vegetation and fruits which causes various allergies, infections, respiratory diseases and poisonous to human, animals and environment.

The human, industrial activities, quarrying and mining etc, which emit several toxic chemicals such as nitrogen oxide, sulfur dioxide, carbon dioxide, carbon monoxide, volatile organic compounds etc, pollute the atmosphere in which we all live. Now the time has come to prevent the natural resources and stop the unnecessary utilization on modern comforts and luxuries for the sake of economic development of our country. It is necessary to know the mechanisms of the degradation and removal of the several toxic chemicals from the atmosphere as well from the soil and to keep the earth clean. Illegal mining of these natural resources must be handled with heavy hands (Verma, 2015).

**The Demerits of Soil**

The pollution of soil is a source of danger to the health of people, even to those living in cities. Soil degradation from various inorganic and organic contaminants, is not only an ecological risk, but simultaneously it is also a socio-economic issue, such soils become poor in physicochemical properties, susceptible to erosion, loss of productivity, sustainability and diminished food chain quality. The industrial effluent directly used for irrigation at Pali district. The present study was undertaken of different soil present in Lawacha-Dipawas- Kalab Kalan area of Pali district

The various litho–units in the investigated area associated with industrial minerals and rocks which are related to refractory, small cottage industries and various other building material purposes (Joshi, 1993). Such minerals and rocks are common in study area. On the basis of above described minerals and rocks, following industries are suggested that may be set up in the area:

**Soil Physico-Chemical Properties**

Soil pH was alkaline in reaction ranging from 6.72 at Dipawas I to 7.87 at Kalab Kalan III with an average value of 7.29 across the site and soil depth (Table 3). Average value of electrical conductivity was 0.077 dSm-1, which varied from 0.017dSm-1 at Raira Khurd II to 0.197 dSm-1 at Dipawas II. Average soil organic carbon (across the soil layers) ranged from 0.09% at Kalab Kalan III to 1.12% at Kalab Kalan II with an average value of 0.485% (irrespective of sites and soil layers). While considering the soil layer (average of site for soil layers) soil pH increased downward, whereas soil organic carbon was the highest in top soil layer and decreased in deeper soil layers (Table 4). Electrical conductivity followed a similar pattern as the soil pH except in soil layer More than 100 cm deep, where EC was found lowest. When individual site was considered, soil pH and electrical conductivity increased in deeper soil layers except at Dipawas I (Plate 1) and Raira Khurd II, where these soil variables followed a reverse trend. At most of the sites, soil organic carbon was highest in top soil layer and decreased in the deeper soil layers but at Raira Khurd I and at Kalab Kalan III, soil organic carbon was relatively greater in deeper soil layers.

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**Table 2: Sampling sites, rock-outcrops and aspects and types of rocks in and around Dipawas area, District Pali.**

| Sampling site | Position | Rock | Aspect | Slope | Humus | Rock type |
|---|---|---|---|---|---|---|
| | at hill | outcrop | | (degree) | thickness | |
| | | (%) | | | (mm) | |
| Dipawas I | Slope | 70 | SSW | 10 | 0.0 | Garnetiferous mica schist |
| Dipawas II | Bottom | 0 | S | 5 | 0.2 | A depression but granite gneiss exposed rock in adjoining area |
| Kalab Kalan I | Top | 70 | NNE | 25 | 1.0 | Calc schist |
| Kalab Kalan II | Slope | 75 | W | 45 | 1.0 | |
| Kalab Kalan III | Bottom | 70 | NNE | 28 | 1.0 | Newly deposited sand along garnetiferous mica schist |
| Raira Khurd I | Top | 65 | SSE | 20 | 1.0 | Bar conglomerate |
| Raira Khurd II | Slope | 70 | S | 40 | 0.0 | Feldspathic schist |

**Table 3: Physico-chemical properties of the soil at the site selected for the vegetation study near Bar area of Pali District.**

| Site | Depth | pH | EC ($dSm^{-1}$) | % OC |
|---|---|---|---|---|
| Bar I | 0-15 | 7.44 | 0.09 | 0.57 |
| | 15-80 | 7.68 | 0.12 | 0.45 |
| Bar II | 0-30 | 7.02 | 0.08 | 1.32 |
| | 30-75 | 7.16 | 0.07 | 0.54 |
| | 75-100 | 7.67 | 0.05 | 0.36 |
| Dipawas II | 0-10 | 7.01 | 0.05 | 0.78 |
| | 10-30 | 6.72 | 0.05 | 0.33 |
| | 30-80 | 6.44 | 0.02 | 0.18 |
| Dipawas II | 0-25 | 6.38 | 0.1 | 0.63 |
| | 25-80 | 7.03 | 0.39 | 0.25 |
| | 80-100 | 7.05 | 0.25 | 0.06 |

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**Table 4: Soil characteristics near Lawacha, Dipawas, Kalab Khurd, Kalab Kalan and Raira Khurd area of Pali District**

| Sampling site | Depth (cm) | Gravel content (%) | Soil content (%) | | | Texture | pH | EC | OC | $PO_4$ – P | $NH_4$ – N | $NO_3$ – N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sand | Silt | Clay | | | ($dSm^{-1}$) | (%) | (mg $kg^{-1}$) | (mg $kg^{-1}$) | (mg $kg^{-1}$) |
| Lawacha I | 80 | 54.53 | 40.53 | 2.48 | 2.48 | Sand | 7.56 | 0.11 | 0.51 | 18.78 | 2.08 | 1.05 |
| Lawacha II | 100 | 57.54 | 39.24 | 1.40 | 1.82 | Sand | 7.28 | 0.07 | 0.74 | 12.96 | 5.10 | 1.56 |
| Dipawas I | 80 | 54.83 | 41.93 | 1.46 | 1.78 | Sand | 6.72 | 0.04 | 0.43 | 11.91 | 3.81 | 2.42 |
| Dipawas II | 110 | 8.18 | 82.90 | 3.66 | 5.28 | Sand | 6.95 | 0.20 | 0.25 | 13.89 | 3.98 | 2.04 |
| Kalab Khurd I | 70 | 52.30 | 45.66 | 0.88 | 1.15 | Sand | 7.49 | 0.04 | 0.82 | 13.32 | 3.95 | 2.63 |
| Kalab Khurd II | 180 | 11.23 | 88.78 | 0.00 | 0.00 | Sand | 7.33 | 0.04 | 0.17 | 13.05 | 3.31 | 1.37 |
| Kalab Kalan I | 60 | 43.12 | 44.94 | 6.83 | 5.12 | Loamy sand | 7.5 | 0.11 | 0.21 | 10.59 | 3.43 | 2.29 |
| Kalab Kalan II | 70 | 46.02 | 45.74 | 4.52 | 3.73 | Loamy sand | 7.37 | 0.13 | 1.12 | 16.54 | 3.12 | 2.00 |
| Kalab Kalan III | 180 | 36.81 | 61.69 | 0.56 | 0.95 | Sand | 7.87 | 0.04 | 0.09 | 15.97 | 2.33 | 2.44 |
| Raira Khurd I | 50 | 71.51 | 27.07 | 0.71 | 0.72 | Sand | 7.05 | 0.05 | 0.44 | 16.82 | 4.54 | 3.06 |
| Raira Khurd II | 140 | 44.60 | 49.69 | 3.24 | 2.67 | Loamy sand | 7.10 | 0.02 | 0.19 | 15.52 | 3.23 | 1.81 |

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