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Petrographic and Ore Microscopic studies of laterite, K Sathyawara Gudda, Hoskote, Karnataka

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***Abstract*— Laterite and Lateritic soils in India are found in the Eastern Ghats of Orissa, the Southern parts of Sahyadri Mountains (Western Ghats), Malabar Coastal plains, coastal plains of Karnataka and Ratnagiri of Maharashtra and some part of Andhra Pradesh, Tamil Nadu, Meghalaya, western part of West Bengal and some other parts. In all these soil caps a lot of lateritic profiles have been observed, each and every zone showing different geochemistry, genesis, and geomorphologic characters. By keeping the above viewpoints on laterites Sathyawara gudda area is selected for the study.**

The major factors influencing the course and consequence of laterite profile development in the study area are suggested to be the bed rock character and topographic features to a limited extent. Prolonged rock-water interaction resulted in varying pH regimes in the rock provenances, influencing differential mobility and enrichment of elements leading to the formation of Fe or Al rich laterites. It is proposed to carry out the geomorphic significance, mineralogy and genesis on laterites of Sathyawara gudda area. The study involved systematic geological, geomorphologlcal, mineralogical and geochemical study of laterites developed over various lithological units in the Sathyawara gudda area. Discerning of the geochemical course and consequence of laterite profile development and its relation to landform evolution was also lacking. In addition, studies on the occurrences of exogenic mineralisations in Sathyawara gudda associated with weathering profiles also remained fully unattended to. With this background and with aims of achieving these objectives the present study was initiated.

I. INTRODUCTION

Laterite is a characteristic weathering product, first discovered in India and later found in the whole of the tropical belt. Fermor (In Fox, 1936) characterised Buchanan's laterite as 'Lithomargic laterite' and even in part as 'Lateritic lithomarge' while the high-level laterites of the Deccan were termed as the finished products - fully formed laterite. Initially, geologists were interested in the study of laterite as a rock, and on account of its relationship with bauxite. Later, during the first half of the twentieth century pedologists got interested in the study of laterite, as the upper parts of laterite profile were referred to as "soil forming", and they regarded it as their domain of investigation. Occurrence of laterite at the surface was believed to be due to the removal of "soil". Soon, those who described laterite as a rock qualified this by saying that it was a weathered or altered rock or, it was the product of alteration or weathering of an original rock.

Presence of various mineral deposits associated with the laterites contributes to the general economy of the warm, humid parts of the world. Worldwide we can see the laterite deposits. Laterite soils are said to ferruginous aluminous rock. They are formed by decomposition; because of they are found in black soil regions having heavy rainfall. The rocks are completely leached out having a high proportion of iron and aluminum as residue. High temperature and heavy rainfall transformed the black soil into laterite. In this process the weathered product carries important minerals like gold, copper, aluminum etc. and it concentrate in the lateritic deposits, because of these laterites are having great scope.

II. OBJECTIVE OF THE RESEARCH

- Preparation of geological map of the Sathyawara gudda area using various geo informatics techniques.
- Mineralogical studies of the laterite deposits.
- Geochemistry of laterite profiles.
- Laterite genesis as related to geomorphology of the region.
- Petrographic and Ore Microscopic studies for understand the formation of Laterites.

III. METHODOLOGY TO BE FOLLOWED:

A. Field studies included

- Preparation of geomorphic map of the study area and map showing the distribution of laterite (scale 1:50000);
- Laterite profile description and systematic collection of samples from the profiles developed over various litho units.

B. Laboratory investigations included

- Petrography of bed rocks and laterites.
- Petrographic and ore microscopic study of laterites

IV. STUDY AREA

A. Location

The study area Sathyawara gudda, Hoskote lays in between latitude 13° 09′ to 13° 11′ and longitude 77° 62′ to 77° 71′, And falls within the portion of the Survey of India toposheet No. 57G/16. SathyawSara gudda is located in K. Sathyavara village, Hoskote taluk, Bangalore rural district of Karnataka.

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The study area lies west to the Hoskote-Chintamani road. Hoskote is the nearest town to K. Sathyawara and is around 22.6 km from Hoskote town and 51km from Bangalore. Good metal road passes through study area the Bangalore-Tirupati highway is 20km away from study area.

B. Geology of the study area

The area is predominantly underlain by peninsular gneissic complex rock formations of Archaean age consisting of granite, gneiss and pegmatite. Laterites as capping are observed at several places. The gneisses are exposed as mounds and hillocks which rise from 20 to 80m above the surrounding ground level. The gneisses are hard. Compact and massive and are well foliated at places with the strikes of foliation generally in NNW-SSE direction. The major set of joints strike ENE and dip easterly. The other set of joints is strike ENE-WSW and WNN-ESE dipping steeply to East and West. The gneisses and granites have undergone alteration and decomposition which range in thickness from 12m to 25m. The granites are traversed by pegmatite and quartz veins and dolerite dykes at places.

Laterite outcrop are seen as capping in the northern and northeastern parts as well as East of Hoskote town. The thickness of Laterites capping is 10 to 20m.

Alluvial soils and deposits are seen along the nala courses consisting of silty and clayey soil. These are essentially wash material (colluviums) from the adjacent hillocks, elevated region and having been deposited in the topographic lows and depressions.

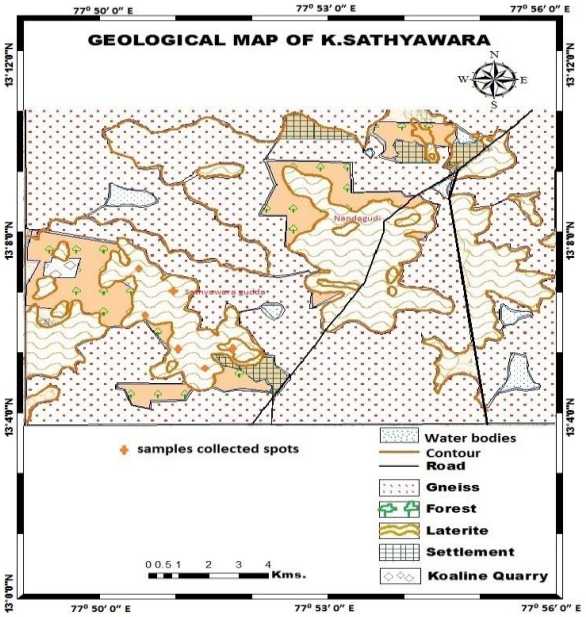

Fig. 1. GEOLOGICAL MAP OF K. SATHYAWARA AREA

C. Physiography and Drainage

The study area is belongs to the southern Karnataka plateau, the area shows gently undulating topography with gentle slope towards southwest. The general elevation of the ground is around 860m above mean sea level. The highest elevation is seen in the study area is 946m which is highest elevation point in Hoskote taluk.

The main drainage of the district is from north to south, The Arkavati, Kanva and Dakshina pinakini. The Dakshina Pinakini River passes through the taluks of Devanahalli and Hoskote where it forms the large lakes known as Jangama kote kere and Hoskote kere. There are no perennial rivers draining the area.

The study area shows upland laterites, this Laterite occur in the elevated zones of Hoskote taluk, as the study area is well known for high elevation 946m is the highest elevation point in Sathyawara gudda. So the groundwater potential of this zone is poor to moderate, but forms favorable zones for groundwater recharge.

D. Climate and Rainfall

The area lies in hoskote taluk enjoys pleasant and salubrious climate and free from extremes and is classified as the seasonally dry tropical climate with four seasons. Cold from December to February generally free from cloud cover with clear blue skies. Generally no rainfall occurs. The hot weather begins in March and extends up to may end. Considerable rainfall occurs during these two months which will meet the soil moisture deficit. South-west monsoon season starts in June and extends up to September end and it is the main rainfall season, during this period fairly strong wind blow from south-west to west. The north –east monsoon stars from October and is also a moist and rainy period but less cloudy compared to south-west monsoon period. The marked thunder storm during April-May and during September-October is also very typical.

The study area is belongs to Hoskote taluk, There are 5 rain gauge stations are located in Hoskote. The normal rainfall of the area is 850 mm. the area receives rainfall during the three distinct periods i.e., during hot weather (March to May), Southwest monsoon (June to September) and Northeast (October to November) closely followed by one after another.

Coming to the seasonal rainfall southwest monsoon contributes nearly 54% and north-east monsoon 34% with pre-monsoon or thunderstorm occurring in April-May contributing nearly 12% to the annual rainfall. In terms of actual rainfall received, the southwest monsoon contributes about 457 mm, the northeast monsoon 274 mm and pre-monsoon. The rainfall increases from June to September with the maximum rainfall occurring during September.

V. PETROGRAPHIC AND ORE MICROSCOPIC STUDIES

Petrographic study deals with the classification and description of rocks, the mineral and textural relationship within the rock are described in detail. The petrographic analysis is done by both macroscopically and microscopically. The most important tool for the petrographic study is the petrographic microscope. The detailed analysis of minerals by optical mineralogy in thin section and the micro-texture and structure are studied under petrographic microscope.

Ore microscopy is the study of polished surfaces of ore or ore minerals by means of a polarizing reflected light microscope and the interpretation of the minerals association and textures so observed. Mineralogical composition of the Laterites and associated clays of the study area was established through the petrographic investigations.

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As revealed by petrographic observation, all the silicate minerals have been transformed to a mixture of large quantity of Goethite and less percentages of limonite. The presence of Quartz is noticed in many samples which were undergone for petrographic studies.

Petrographic observations of Laterite observed over Gneiss also reveal that all the silicate minerals have been transformed to a mixture of Fe and Al oxide and hydroxides. The petrographic studies shows that the Goethite minerals are underwent for lateritization and formed Bauxite minerals such as Gibbsite and Boehmite. Quartz is being more resistant minerals in the rock.

Ore microscopic observation shows that massive presence of Goethite of showing colloform texture. The study also reveals presence of Hematite and the Ag (Silver) rich gold in some samples in a minute quantity. In some samples the relict mineral shapes are observed viz. magnetite, Chlorite and amphibole.

A. Petrographic studies

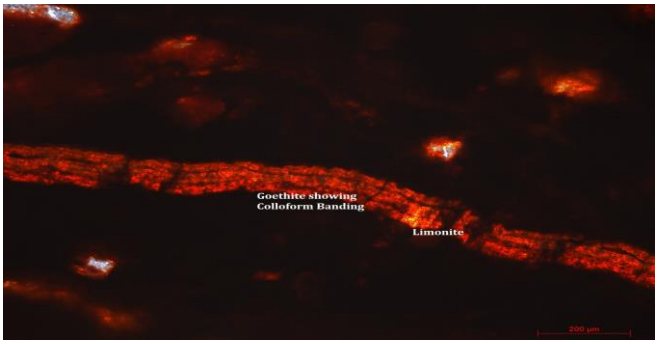

Fig. 2. The photomicrograph showing colloform banding typical of Goethite.

The sample contains mainly Goethite (Goethite is dominant in this sample), Limonite as essential minerals, and quartz as accessory mineral. Goethite is showing typical colloform banding. Limonite is characterized by its yellow internal reflection.

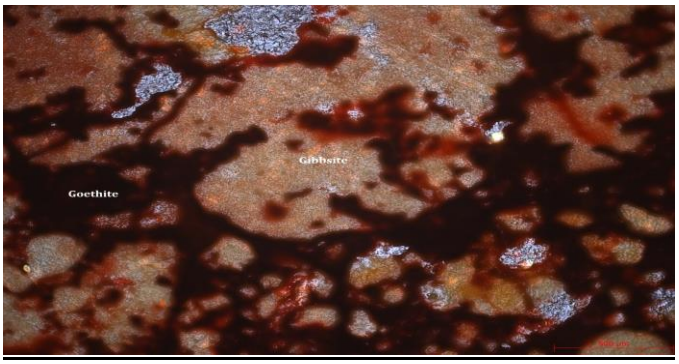

Fig. 3. The photomicrograph showing Ore minerals of Bauxite - Gibbsite along with Goethite.

The rock is mainly composed of Goethite and hydrous aluminium oxides i.e. Gibbsite an ore of Bauxite along with minor quartz. Pissolitic texture is noticed, progressive lateritization is observed in the sample. The presence of gibbsite is more where the lateritization is gradually more.

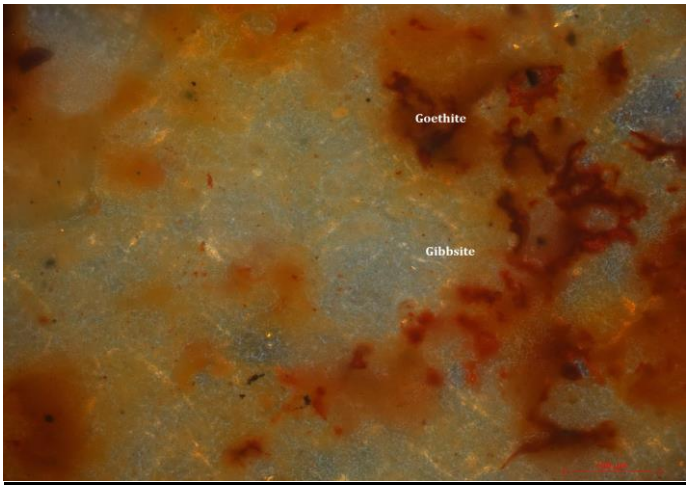

Photo 3.3 - the photomicrograph showing Ore mineral of Bauxite - Gibbsite along with Goethite.

The Laterite sample composed Goethite and Gibbsite. Gibbsite is colorless to pale brown. The Gibbsite is noticed where the lateritization is taken place, the lateritization is observed in the left portion of the sample. The rock sample is aluminous Laterite.

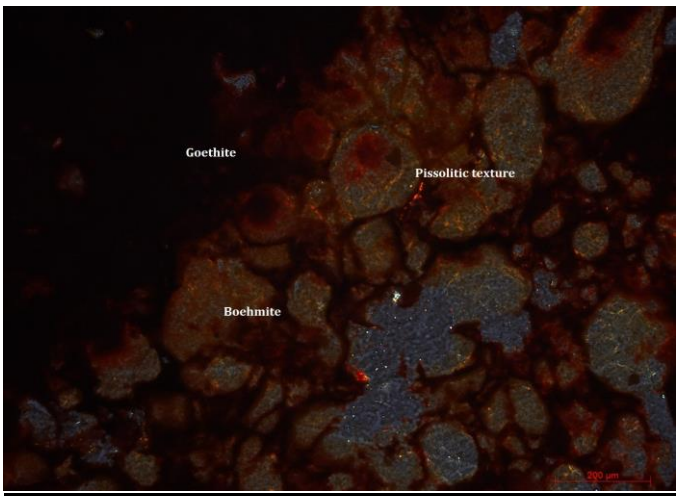

Fig. 4. Photo 3.4 - the photomicrograph showing development of Pissolitic texture in Laterite.

The sample contains mainly Goethite with minor Quartz and Boehmite. Characterization of host rock is difficult except the presence of quartz which suggests their parentage is of mainly granitic composition. Development of Pissolitic textures suggests that they are further in the process of Bauxite formation where the progressive lateritization indicating that. This Pissolite probably represents Boehmite.

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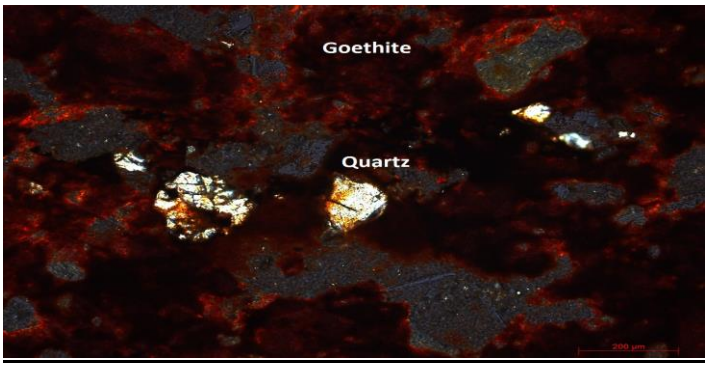

Fig. 5. Photo 3.5 - the photomicrograph showing Laterite sample composed of mainly Goethite and Quartz.

The Laterite sample mainly composed of Goethite and quartz. Characterization of host rock is difficult except the presence of quartz which suggests their parentage is of mainly granitic composition.

B. Ore microscopic study

Fig. 6. Photo 3.6- the photomicrograph showing Goethite showing colloform banding and a high reflectance grain probably Ag rich gold.

The ore sample shows Goethite and Ag (silver) rich Gold. Goethite is showing colloform banding and a high reflectance grains probably Silver rich Gold. The sample is being a lateritic which usually undergoes lateritization which turns to form hydrous aluminium oxides. High reflectance grains are termed Silver rich Gold as because of they have not oxidized where the native minerals won't oxidizes.

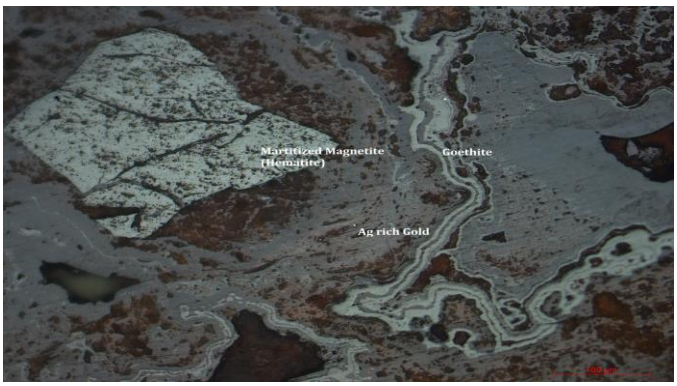

Fig. 7. Photo 3.7 - the photomicrograph showing martitized Magnetite (Hematite) and Goethite showing colloform banding.

The sample shows Goethite showing colloform banding, martitized Magnetite (Hematite) and Silver rich Gold. The sample contains mainly Goethite and martitized Magnetite. Martitized Magnetite which forming Hematite, the colloform textures are Goethite minerals and high reflectance minerals are probably Silver rich Gold. The Goethite is gray color with bluish tint.

Fig. 8. Photo 3.8 - the photomicrograph showing Relict mineral shapes viz. Magnetite-Amphibole-Chlorite.

The ore mineral sample shows relict mineral shapes which are Magnetite-Amphibole-chlorite. Micro size colloform structures are also observed in the sample. The lath shaped structures may be chlorite.

VI. CONCLUSION

- The study area K. Sathyawara gudda is located in Hoskote taluk of Bangalore rural district. The area is covered by Lateritic deposits and Gneiss. The area has not found any structures like fold, faults, and cleavage planes. Veins are found in the study area.
- The samples which are collected for petrographic and ore microscopic studies shows reddish brown, yellowish red and white patches, this white patches indicates the presence of hydrous aluminous oxides i.e. bauxite minerals.
- By the laboratory studies i.e. petrographic and ore microscopic studies we could found the presence of silicates minerals which are transformed or lateralized into mixture of large quantity of Goethite and less percentage of Limonite, and presence of Quartz minerals are also found.
- By the petrographic and ore microscopic observation, the sections shows presence of Fe rich minerals such as Limonite, Magnetite, Goethite and hydrous aluminous oxides which are Bauxite minerals such as Gibbsite and Boehmite. The minerals which exhibit Pissolitic textures are transformed from Goethite to Gibbsite or Boehmite.
- Colloform banding is commonly observed. The ore microscopic study also showed the presence of Gold, which is rich in Silver.

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