

Mineralogy and Geochemistry of Bauxites of Kasarsada area, Chandgad Taluk, Maharashtra, India

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Abstract

Present investigation highlights studies of bauxites of Kasarsada of Chandgad taluk of Maharashtra with reference to its geology, mineralogy and geochemistry. Geologically, forms part of Deccan Traps. Lithology is in the sequence: Laterite – Bauxite - Lithomargic clay - Basalt (unaltered). Dominant mineral in bauxite is Gibbsite. From the geochemistry of major and minor oxides of bauxite ore samples of Kasarsada it is found that alumina content ranges from 34.1% to 53.4%. The produced bauxite ore is fed mainly to aluminium and cement industries.

Keywords: *Geochemistry, IR studies, Bauxite, Gibbsite, Chandgad, Maharashtra.*

1. INTRODUCTION

Bauxite is basically an aluminous rock containing hydrated aluminium oxide as the main constituent and iron oxide, silica and titania in varying proportions. Bauxite is an essential ore of aluminium which is one of the most important nonferrous metals used in the modern industry. It is also an essential ore for refractory and chemical industries. The country has abundant resources of bauxite which can meet both domestic and export demands (IBM, 2012).

The major bauxite deposits of India are generally associated with laterite that occurs as cappings and blankets on the plateaus of high elevation. Predominantly found in the states of Orissa, Andhra Pradesh, Bihar, Madhya Pradesh, Maharashtra, Karnataka, and Tamil Nadu. Fox (1923) was the first to search for bauxites in different lateritic terrains of India and he first reported bauxite in India among the aluminous laterite of Jabalpur. Bauxite occurs as thick, uniform capping on Deccan basalts on the plateau. The uniform thickness of the

capping well-defined scarps, and marginal nudes give a distinctive feature to the topography. The plateau is about 1 mile in length, 1500 feet in width, and is aligned in a NNE-SSW direction, along the drainage pattern of the region. This type of bauxitic/lateritic capping, generally termed as 'pats', is described as high level laterite, by Oldham (1893) and Fox (1923). The classification according to altitude or level is now known to be untenable although McFarlane (1971) maintains that the laterite on the mesas may be described as high-level laterite by virtue of its topographical position. However, the bauxitic capping positions at Tungar plateau near Bombay (Balasubramanian 1972) and Nagardaswadi Plateau in Kolhapur District, both in Maharashtra State, suggest a lithological control (Subramaniyam and Paropkari, 1975).

2. STUDY AREA

Kasarsada bauxite deposit is located in Chandgad Taluk of Kolhapur District of Maharashtra State. Geographically, bounded between 76°6'58" & 74°9'27" East Longitudes and between 15°55'4" & 15°56'55" North Latitudes and covered in Survey of India (SOI) toposheet 48I/01. The highest elevation in the area is 1036 meters above MSL. Average rainfall in the study area is 4500mm. Several seasonal streams originate from the plateau top exhibiting dendritic pattern while some of them drain into River Tamraparni in South and some in River Ghataprabha in North. Geologically, the area corresponds to Deccan Traps of Upper Cretaceous to Lower Eocene Age. Main lithounits include laterite, bauxite, lithomarge and basalt.

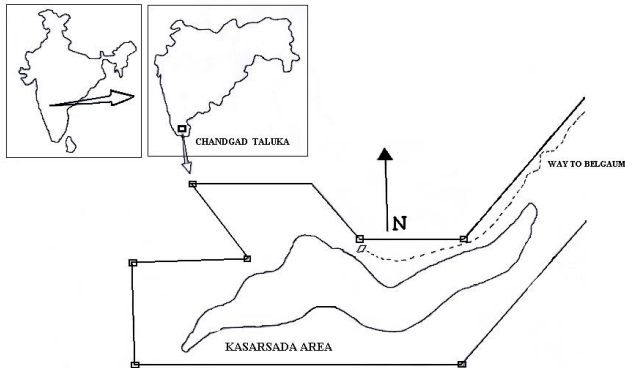


Fig. 01 Location map of Kasarsada Bauxite Deposit

3. METHODOLOGY

A detailed field work was carried out to study and map geology of the area. Systematic fresh representative samples of the bauxite were collected throughout the study area. Collected samples were labeled and each sample weighed about 2 to 2.5 Kg. The collected representative samples were subjected to geochemical analysis to know its major and minor oxides. To study its petrography thin sections were prepared using the facility available in the ore dressing room, Dept. of Studies in Geology, KUD. Further, IR studies were subjected to analysis at University Science & Instrumentation Center facility at KUD. The results of geochemical analysis and IR studies is tabulated in Table 1 & 2. Figures showing sections and IR peaks is shown in (Fig. 2 to 12).

4. RESULTS AND DISCUSSION

4.1 GEOLOGY AND PETROGRAPHY

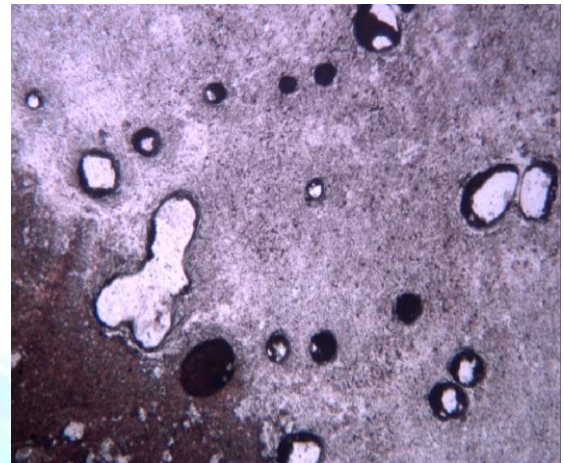


Fig. 02 Formation of iron oxide mineral along the rims of the clay mineral.

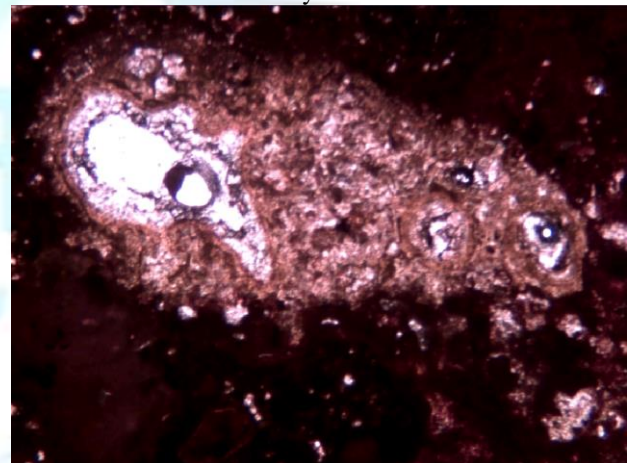


Fig. 03 A mineral grains showing zoning of two smaller grains.

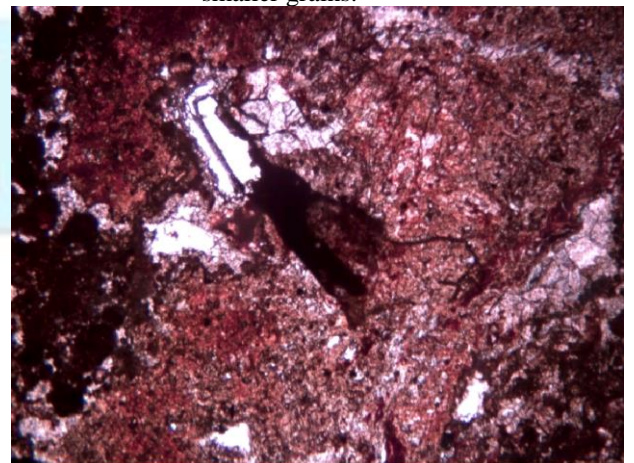


Fig. 04 A zone mineral showing shattered nature.

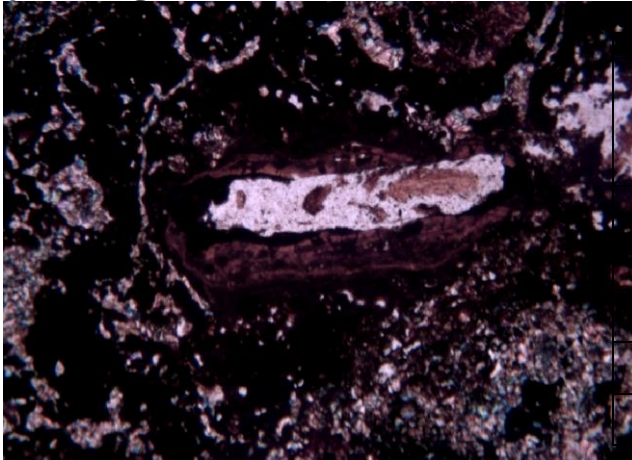


Fig. 05 An elongated grain showing clay in the centre & Al rich zone forming the outer rim. Fe oxide is replacing clay in the centre.

Table 1 Geochemical analysis of bauxite samples

| Sample No. | Loss On Ignition (%) | Fe ₂ O ₃ FeO (%) | TiO ₂ Ti ₂ (%) | SiO ₂ Si ₂ (%) | Al ₂ O ₃ Al ₂ (%) |
|------------|----------------------|--|--------------------------------------|--------------------------------------|--|
| BXT-1 | 28.1000 | 4.5 | 7.82 | 5.22 | 53.4 |
| BXT-2 | 27.5000 | 12.3 | 7.97 | 1.57 | 49.7 |
| BXT-3 | 20.3000 | 36.5 | 3.81 | 4.28 | 34.1 |
| BXT-4 | 20.3000 | 32.3 | 4.39 | 6.51 | 35.5 |
| BXT-5 | 26.0000 | 22.1 | 4.81 | 1.35 | 46.0 |

4.3. IR STUDIES



Fig. 06 Field view of profile

4.2 GEOCHEMISTRY

From the chemical analysis it can be interpreted that the aluminium content in the ore sample ranges from 34.1% to 53.4%, silica content ranges from 1.35% to 6.15%, titanium content ranges from 3.81% to 7.92% and the iron content ranges from 4.5% to 36.5%. Some other conclusions could also be made such as., as the silica percent in the sample increases the aluminium percent also increases, similarly in the case of titanium, but as the iron content increases the aluminium content decreases. Loss on ignition ranges from 20.3000% to 28.1000% in the ore samples.

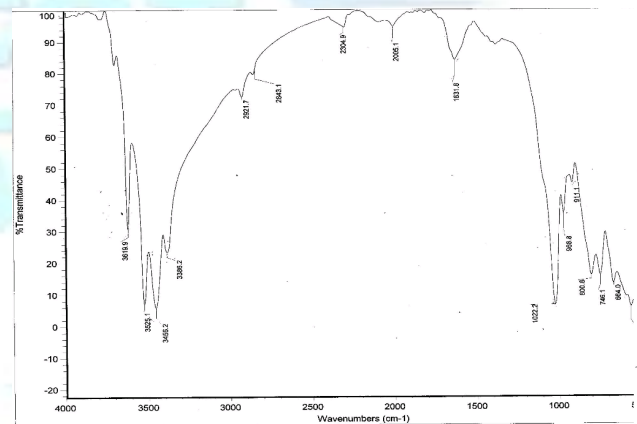


Fig. 07

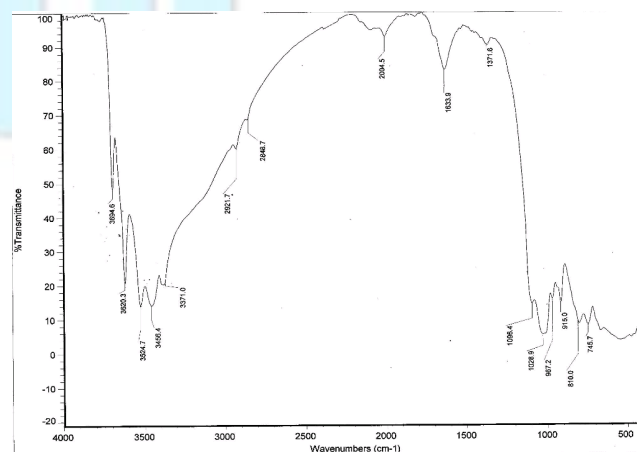


Fig. 08

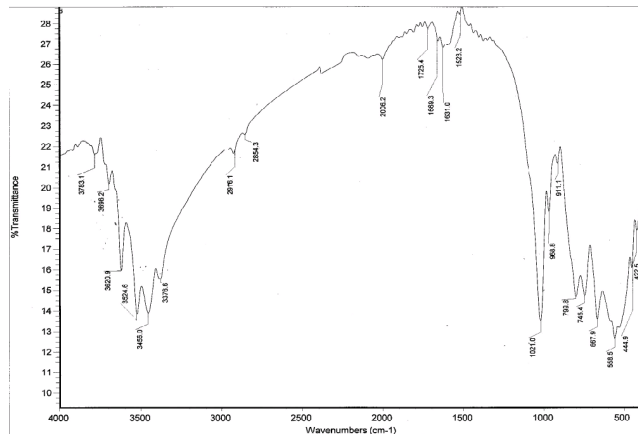


Fig. 09

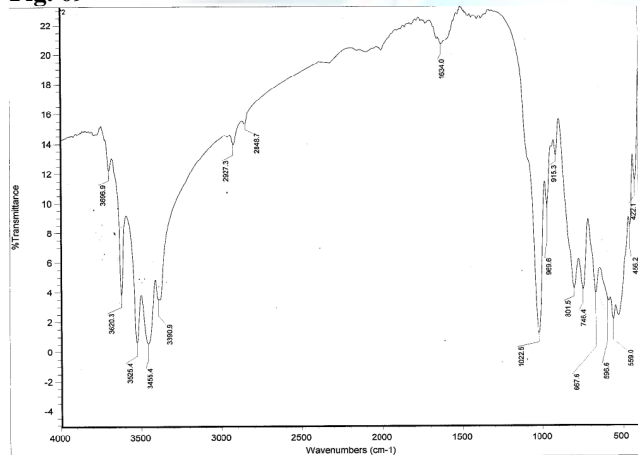


Fig. 10

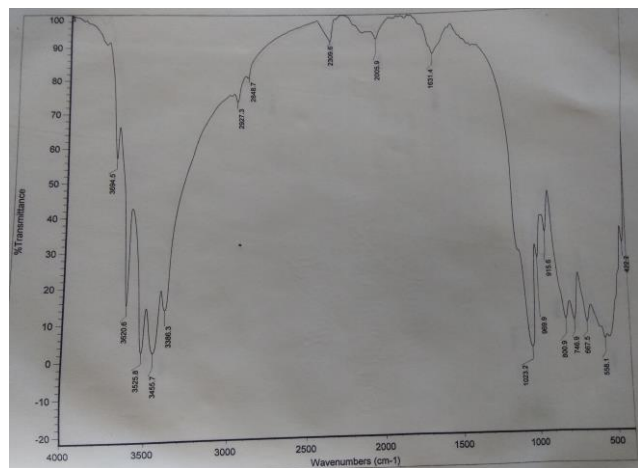


Fig. 11

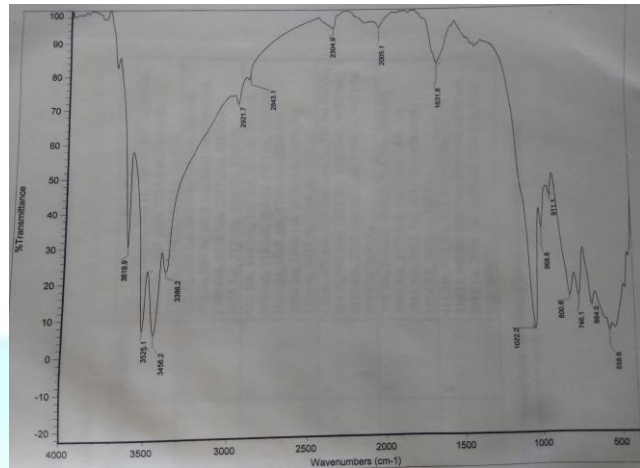


Fig. 12

Table 2 IR data for Kasarsada bauxite samples

| Sample No | Wavelength |
|-----------|--|
| 1 | 558.6sh, 664.0s, 746.1s, 800.8s, 911.1s, 968.8s, 1022.2s, 1631.8svb, 2304.9sb, 2843.1sh, 3386.2s, 3456.2s, 3525.1s, 3619.9s. |
| 2 | 422.2s, 558.1sh, 667.5sb, 746.9sb, 800.9sb, 915.6s, 969.9s, 1023.2sb, 1631.4sb, 2005.9sb, 2309.6sb, 2848.7sh, 2927.3sh, 3386.3sb, 3455.7sb, 3525.8s, 3620.6s, 3694.5s. |
| 3 | 422.5sh, 444.9sh, 558.5sb, 667.9s, 745.4sb, 799.8sb, 911.1sh, 968.8s, 1021.0s, 1523.2sh, 1631.0d, 1669.3sh, 1725.4sh, 2006.2sb, 2854.3w, 2916.1sh, 3376.6 sb, 3456.0sb 3524.6s, 3620.9s, 3696.2s, 3783.1d. |
| 4 | 422sh, 478.6sh, 534.8sh, 664.0s, 745.9s, 800.3s, 914.7s, 961.6sh, 1023.3sb, 1102.0sh, 1633.9sb, 2837.4sh, 2927.3sh, 3391.0d, 3456.5s, 3525.0s, 3619.9s, 3694.4s. |
| 5 | 745.7sb, 810.0sb, 915.0s, 967.2sh, 1028.9d, 1096.4sh, 1371.6sb, 1633.9sb, 2004.5sb, 2848.7sh, 2921.7sh, 3371.0d, 3456.4svb, 3524.7sb, 3620.3s, 3694.6s. |
| 6 | 411.2sh, 433.7sh, 523.5sh, 669.6s, 793.1s, 916.7s, 968.0s, 1020.0sb, 1633.6sb, 2004.6sb, 2843.1w, 2921.7sh, 3376.6d, 3459.1sb, 3525 3s,b, 3620.0s. |

Here s = strong band, sb = strong broad, svb = strong very broad, sh = shoulder, w = weak.

Sample No. 1:

From the Fig.07 it follows that Kaolinite is present at wavelength 911.1, 3619.9cm⁻¹, Goethite is present at 800.8cm⁻¹, haematite is present at 911.1cm⁻¹, Bohemite at 746.1,911.1cm⁻¹, quartz at 800.8cm⁻¹, Anatase at 1022.2cm⁻¹, Gibbsite at 558.6, 1022.2, 3456.2 and 3619.9cm⁻¹.

Sample No.2:

From the Fig.08 it follows that Kaolinite is present at wavelength 3694.5, 3620.6, 915.6 cm^{-1} , Goethite present at 800.9 cm^{-1} , Bohemite at 915.6, 746.9 cm^{-1} , Allophane rich with Al and Fe is present at 1631.4 cm^{-1} , Gibbsite present at 558.1, 667.5, 3455.7, 3620.6 cm^{-1} .

Sample No.3:

From the Fig.09 it follows that Kaolinite is present at wavelength 3620.9, 3696.2 cm^{-1} , Goethite present at 799.8 cm^{-1} , Lepidocrosite at 745.4 cm^{-1} , Haematite at 911.1 cm^{-1} , Bohemite at 745.4, 911.1 cm^{-1} , Quartz at 799.8 cm^{-1} , Anatase at 1021.0 cm^{-1} , Al and Fe rich Allophane at 1631.0 cm^{-1} and Gibbsite at 558.5, 667.9, 1021.0, 3456.0, 3620.9 cm^{-1} .

Sample No.4:

From the Fig.10 it follows that Kaolinite is present at wavelength 914.7, 1102.0, 3694.4 cm^{-1} , Goethite present at 478.6, 800.3 cm^{-1} , Lepidocrosite at 478.6, 745.9 cm^{-1} , Haematite at 478.6, 534.8 cm^{-1} , Bohemite at 745.9, 914.7 cm^{-1} , Diaspore at 961.6 cm^{-1} , Quartz at 478.6 cm^{-1} , Al rich Allophane at 1102.0 cm^{-1} , Gibbsite at 3456.5 cm^{-1} .

Sample No. 5:

From the Fig.11 it follows that Kaolinite is present at wavelength 915.0, 3620.3, 3694.6 cm^{-1} , Goethite at 915.0 cm^{-1} , Lepidocrosite at 745.7 cm^{-1} , Bohemite at 745.7 cm^{-1} , Anatase at 810.0 cm^{-1} , Al and Fe rich Allophane at 1028.9 cm^{-1} and Gibbsite at 3620.3 cm^{-1} .

Sample No. 6:

From the Fig.12 it follows that Kaolinite is present at the wavelength 433.7, 3620.0 cm^{-1} , Bohemite at 746.5 cm^{-1} , Anatase at 1020.0 cm^{-1} , Al rich Allophane at 1633.6 cm^{-1} and Gibbsite at 669.6, 1020.0, 3620.0 cm^{-1} .

5. CONCLUSION

An attempt has been made to formulate the genesis of bauxite/laterite based on the field characters, petrography, mineralogy and geochemistry of major and minor elements of laterite and basalts. Bauxite deposits of Kasarsada consists of lithomarge zone to bauxite zone. Presence of clayey horizons beneath the laterite/bauxite. Thickness of bauxite zone is more compared to laterite and lithomarge zone. High grade bauxite occurs as lenses, patches, pockets with gradational laterites and aluminous laterite. Laterites and aluminous laterite contains more amount of clay minerals. Pisolitic, oolitic and stalitic characters invariably present in the laterites and bauxites. Laterites and bauxites are earthy, compact, less porous, fine to coarse grained. The petrographic studies show bauxite is resulted from direct transformation of plagioclase feldspar-pyroxenes-gibbsite. The thin section studies of the samples of aluminous laterite/bauxite show the presence of aluminous

material intimately associated with ferruginous material. From the IR spectroscopy it can be concluded that there is present of strong bands of Gibbsite at wavelengths 3620, 3455, 1020 and 560 cm^{-1} , strong bands of Bohemite at 77 cm^{-1} .

As there is an appreciable amount of titanium oxide present in the ore of the study area, it can be suggested that beneficiation processes could yield a good amount of titanium.

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