

New scope of exploration and techno-economic studies of laterites and bauxites in regions covered with Gondwana sediments

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Abstract

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Lateritic bauxite deposits have been formed from almost every type of rock containing alumina. Distribution and quantity of deposits are related to the type of parent rock. Most bauxite deposits are from sedimentary parent rocks, mostly Arkosic sandstones and siltstones. Naru Hill bauxite deposit is from arenaceous shale or siltstone parent rock, completely altered into laterite/bauxite. Laterite profile appears to rest fresh sandstones which are not the parent rocks, but are hard protecting surface for the deposits. This study is on petrogenesis of Lohardaga bauxite deposit. It was earlier established that the Lohardaga bauxite originated from trap basalts near the sea level during early Tertiary, but recent study changed this view. This study concludes: Bauxite and laterites of the Lohardaga plateau are derived from underlying clayey sediments. Diatoms and sedimentary structures indicate that these sediments were laid down in shallow fresh water and are probably of Upper Gondwana age. Recent studies on Vindhyan bauxite particularly of Satna and Lohardaga leave scope for detailed exploration of laterite and bauxite in regions covered with Gondwana sediments. The bauxite of Satna and Rewa is gibbsite-boehmite and of Lohardaga, gibbsitic. These are metallurgical and high grade refractory bauxites. They can undergo detailed techno-economic studies.

Keywords: Lateritic bauxite; Lohardaga deposit; Gondwana sediments; Satna deposit.

1. Laterites and bauxites of India

Laterite is extensively distributed in the Peninsular India. It is common in the greater part of Maharashtra, Madhya Pradesh and Bihar over Deccan Traps. In Madhya Pradesh they lie over Deccan Traps as well as over Vindhyan sandstone and shale. There are several occurrences of lateritic bauxites in Eastern Ghats over Khondalites and charnockites, however they lie over Deccan traps and charnockites of Western Ghat in Maharashtra and Karnataka. Many deposits of bauxite and laterite in Kerala and Goa are also found over gneisses and meta sediments. There are also numerous occurrences of thin crusts of laterite in many other parts of India on rocks of almost every description. Country wide search for bauxites in different lateritic terrains of India was first made by Fox [1]. He first recognized bauxite in India amongst the aluminous laterite of Jabalpur.

The Indian bauxites are mostly of lateritic origin, which occur extensively as blankets or cappings either on the high plateaux and hill ranges of the peninsular India or in certain low-level laterites in the inland areas or coastal tracts of the country.

The smaller isolated areas where plateau laterite and bauxite occur are Kharagpur hills of Bihar; Seoni, Kaimur and Malwa plateaux and Keskai-Bailadila range of Chhatisgarh, Vindhyan plateau bordering Uttar Pradesh and Madhya Pradesh (including Tikar and Naru deposits) and Kumbla in Kerala.

In the Extra peninsular India fairly extensive deposits of high grade diasporic bauxite occur in the Jammu Province of the Jammu and Kashmir state.

A survey of literature on lateritic bauxite occurrences of world shows that lateritic bauxite deposits have been formed from almost every type of rock that contains alumina. It has been also observed that there is a certain

relationship between the distribution and quantity (tonnage) of the deposits, and the type of the parent rock². Table-1 presents the statistical evaluation in this respect.

Among igneous rocks, plutonic and volcanic group of rocks are more prominent from bauxite formation point of view. In plutonic rocks bauxite was mainly derived from granite. The largest granite derived deposits occur in the Darling Range, Australia [3], and at Los pijiguaos, Venezuela. Medium size granite-derived deposits have been found east of Dalat in southern Vietnam and and at Digo - Mokouedou, Ivory Coast. Nepheline syenite and foyalite are the parent rocks of several small to medium size deposits e.g. Arkansas, USA; Los Islands, Guinea etc; In India such deposits are found in Ranchi district Bihar. Volcanic group of rocks is most frequent igneous parent rock group. Within this group, basalt is the most frequently occurring volcanic parent rock. Extensive basalt derived deposits are in southern Vietnam, in Cameroon (Adamaoua) and in Australia (North Kimberely bauxite district).

Prominent Inidan bauxite deposits which have been derived from basalt parent rock are:

- i. Surguja, Phutkapahar, Maikala range and Malwa plateau deposits, Madhya Pradesh.
- ii. Kutch Peninsula, Mewasa-Virpur, Jamnagar district of Gujarat.
- iii. Kolaba, Ratnagiri, Udgiri, Dhargarwadi and Kolhapur district in Maharashtra.

The proportion of the metamorphic rocks is the smallest among the main genetic rock groups, but few major bauxite deposits of India namely East coast bauxite deposits and deposits of Tamilnadu fall within this group of parent rock. Here parent rocks are metamorphic rocks of granulite facies such as Khondalite, Charnockite and leptynite. Chief deposits of this group are:

- i. Nilgiri hills, Palni hills, Shevaroy hills and Kollaimalai hills in Tamilnadu.
- ii. Chintapalli and Anantgiri hills in Andhra Pradesh
- iii. Pottangi, Panchpatmali, Kashipur-Kuturmali Gandhmardan and Sapatla deposits of Orissa.

Table 1 shows that a largest proportion of Bauxite deposits has been derived from sedimentary parent rocks. The most frequent parent rock types of this group are Arkosic sandstones and siltstones. In some locations these arkosic sandstones also contain glauconite.

Next in the series as favourable sedimentary parent rocks are shales and slates of palaeozoic to upper-porterozoic age, well compacted and consolidated. Here the alumina of the bauxite originated mainly from illite-sericite and chlorite type clay minerals. The largest deposits derived from these parent rocks are in Guinea (Boke, Fria, Kindia, Pita-labe) and in the adjacent Boe district of Guinea Bissau. Relatively little bauxite has been formed from kaolinitic sandstone and siltstone e.g. AzZabirah of Saudi Arabia. Even small bauxite deposits had been originated from graywacke e.g. Kibi-Atewa Range in Ghana and Benene in Ivory coast.

Table 1. The proportion of parent rock types and tonnage of bauxite in the world [2].

Rock Types	Number of Bauxite Districts	Percentage of Tonnage of Bauxite	Remark
(A) Plutonic Rocks			Plutonic Rocks 15.5%
Granite	10	9.0	
Diorite, Granodiorite	02	1.3	
Monzonite	01	0.7	
Anorthosite	01	0.2	
Lecucogabbro	01	0.1	
Gabbro, Norite	05	3.0	
Syenite	01	0.1	
Nepheline-Syenite, Foyalite	05	0.8	
Dunite, Peridotite	01	0.3	
Total		15.5	
(B) Hypabyssal Rocks			Hypabyssal Rocks 17.3 %
Dolerite	16	17.1	

field of bauxite and alumina. I pay my sincere thanks to Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Nagpur for carrying out all laboratory and analysis work.

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