ABSTRACT

Bauxite occurs at the summit of the laterite profiles in the Pakri Pat and the Neturhat Plateau, in parts of Ranchi and Palamau districts, Bihar. It is underlain successively by the trap rock, infra-trappean rocks and the Chota Nagpur granite gneiss.

Petrographic, chemical and mineralogical studies of samples along four vertical profiles as also from different 'pats' were carried out. The rocks of the laterite profile are found to retain relic doleritic texture to some extent; the original texture is obliterated with the development of concretionary textures in them.

Chemically, the rocks of the laterite profiles show an almost complete absence of alkalies and alkaline earths, a sharp fall in SiO_2 content and a slight depletion of Fe_2O_3 content (with a corresponding residual accumulation of Al_2O_3 and TiO_2) relative to those of the underlying trap. This is reflected in a gradual decline of SiO_2/Al_2O_3 ratios upwards; Fe_2O_3/Al_2O_3 ratios also generally decrease upwards while TiO_2/Al_2O_3 ratios remain fairly constant. The bauxite is rich in TiO_2 (around 10 per cent) and has a very low content of SiO_2 (as low as 0.25 per cent); loss on ignition increases with alumina content.

Mineralogically also, a genetic relationship among rocks of the laterite profiles is suggested by the existence of a gradational change in mineralogy — from kaolinite at the bottom to gibbsite at the top. It is found that kaolinite generally and halloysite occasionally are the principal constituents of the lithomarge with goethite and sometimes gibbsite in traces as accessory minerals; the intermediate zone, of laterite, comprises of hematite and gibbsite; and finally the bauxite, near the top of the profile, consists mainly of

gibbsite, with boehmite as a contaminant in pisolitic varieties. Quartz is conspicuously absent. Heavy minerals identified, include ilmenite and leucoxene; these assemblages and their sizes in the bauxite are similar to those in the trap rock. No mineral of metamorphic or granitic origin is observed.

The detailed field and laboratory investigations on the bauxite deposits and associated rock types carried out by the present worker leads him to the following conclusions regarding the genesis of the bauxite deposits: (a) the trap rock is the parent material for the overlying laterite and bauxite; (b) bauxite of this area is derived neither from the infra-trappean rocks nor from the Chota Nagpur granite gneiss as is suggested for the neighbouring Lohardaga Plateau by earlier workers; in the present area the infra-trappean rocks are separated from the laterite profiles by the trap rock, and the Chota Nagpur granite gneiss occurs below the infra-trappean rocks; (c) bauxite here, is not of detrital origin contrary to as suggested by some workers; it has developed as a result of in-situ weathering of the trap rock; (d) bauxite, laterite and lithomarge are genetically related; (e) bauxitisation took place both directly as well as through an intermediate stage of kaolinisation; (f) bauxitisation of kaolinite and kaolinisation of bauxite, both have taken place in this area; (g) plagioclase felspar has been the principal source of gibbsite; (h) development of concretionary structure is a secondary process; (i) geomorphology played an important role in the bauxite formation; (j) the earliest age that may be assigned to these deposits is Upper Miocene or Lower Pliocene; (k) the laterite profiles of this area are comparable to those at Inverell, New South Wales, Australia, and Kauai, Hawaiian Islands.

The chemical, mineralogical and physical changes accompanying bauxitisation/lateritisation seem to have been controlled by the physico-chemical environment prevailing at the time of the development of the laterite profile. It is concluded that (a) the slightly acidic rain water attacked the parent material and dissolved the more soluble cations which, in effect, raised the pH of the solution and also destroyed the lattice structures of the minerals making them more susceptible to chemical weathering; (b) the alkaline solutions, thus generated, percolated downwards and facilitated leaching of silica; where good drainage conditions existed, direct bauxitisation was favoured, while poor drainage conditions promoted formation of kaolinite; (c) the gradual increase in silica content of laterite profiles in a downward direction is due to a gradual decrease in the efficacy of percolating solutions to remove silica because of the increasing concentration of dissolved silica in the hydrolysing system; (d) alternate wet and dry climate, which affected considerably the Eh and pH of the solutions, played the most important role in the separation of Al and Fe.