

REVIEWS

LATERITISATION PROCESSES. Proceedings of the International Seminar on Lateritisation Processes, Trivandrum, India, 11-14 December 1979. V. Venkatesh and P. K. Ramam (Eds.), Oxford and India Book House Publishing Co., New Delhi 110001, 450 pages, Price Rs. 425/-.

It is in India that Francis Buchanan first came across a unique type of stone extensively used in construction and named it as laterite. Since then the rock has been reported from many countries and it is now realised that a variety of physical and chemical properties characterise this rock and the name given by Buchanan was only to one of its varieties.

It was appropriate, therefore, that the first international seminar on lateritisation processes was held in India at Trivandrum, from 11th to 14th December 1979 to review the work on various aspects of laterite formation the world over. The papers presented and discussed at the seminar have now been brought together in the form of a handsome volume of 450 pages with a large number of text figures and illustrations. The most encouraging and commendable part is the speed and efficiency with which the entire material has been assembled processed and published within a year of the close of the seminar. The publication of this volume containing detailed accounts of researches on laterite in different countries should provide the necessary fillip for accelerating research on laterites. Our country can ill afford to neglect basic research on this important and unique rock type.

The volume under review contains 51 papers of which 21 are from India. Papers from India with one or two exceptions have tended to be either descriptive of local occurrences or mineragraphic studies of selected samples. The larger aspects of definition, classification and geomorphic peculiarities and environmental conditions of formation of different types of laterite encountered, do not appear to have attracted the Indian authors.

The contributions in the volume can be classified under the following heads: Definition and nomenclature, Mineralogy and geochemistry, Regional distribution, Paleo-environments and global tectonics, Exploration, sampling & analysis and Applied aspects. As it always happens in such compilations distribution and emphasis is uneven. It is difficult to single out particular papers for detailed review. We can only attempt to highlight some of the significant contributions.

The first paper by Schellmann on the definition of laterite forms an excellent introduction to the subject. It contains an useful summary of chemical analyses of main elements in laterites from different countries classified according to the parent rock giving rise to laterite. Schellmann has suggested defining laterite as a product of intensive subaerial rock weathering, with high Fe and/or Al and low Si made up predominantly of kaolinite, goethite, gibbsite and quartz. He has suggested giving the name '*Buchanan laterite*' to that type of laterite which is capable of hardening on exposure. Buchanan at the time he coined the name 'laterite' knew only of laterite formed over granites and gneisses. The varieties of laterite discovered in all continents having different properties of colour, fabric and consistency, therefore, are to be considered as belonging no doubt to one family, although showing different properties. Kaolinisation is considered as an earlier stage in lateritisation. Several instructive triangular diagrams are presented showing the fields of weak, moderate and strong lateritisation.

Ida Valetton, the well-known authority on bauxite, in another key paper has discussed process of bauxite formation on (i) peneplaned metamorphic and magmatic

rocks, (ii) detrital sediments and (iii) karst topography. The bauxites over Deccan trap and Gujarat are examples of the first category. Their occurrence at different altitudes is caused by intense step-faulting with uplift and downwarping in different parts of the Peninsula in Tertiary times. High Al concentration is shown to be related to the border areas of the fossil drainage system. High rate of peneplanation, seaward drainage and seasonal water-table fluctuations are indicated as factors responsible for bauxite formation.

There are a number of papers dealing with geochemical and mineralogical aspects of laterite from different regions: S.W. Australia (*Gilkes and Sudhiprakaran*), Philippines (*Mercado*), S.W. Pacific (*Ogura and others*), Nickel rich laterites of Orissa (*Sahu; Sahoo and others*), laterites of Kerala (*Nair and Mathai, Nambiar and others*), of Ethiopia (*Augustithis and Vgenapoulos*), of W. Africa (*Leprun*), of Venezuela (*Schorin*), of Surinam (*Pollack*), of Brazil (*Melfi and others*), of U.S.S.R. (*Sapojnikov*), of Jammu (*Mohan Lal and others*), of Vindhya (*Murthy and others*), of Madhya Pradesh (*Srinivasa Rao*) and of Maharashtra (*Sahasrabudhe and Deshmukh*).

Electron probe study of east coast bauxite by Jagannatha Rao and Krishnamurthy is the longest paper in this compilation. They have dealt with the mineralogy and geochemistry of Amarkantak bauxites and have presented a model correlating stages of chemical weathering and phases of lateritization/bauxitisation. Infra-red studies of bauxite minerals from Maharashtra is presented by Balasubrahmaniam and Gopinath. Krishnan and Mukherjee present new data on X-ray diffraction studies on some bauxites and laterites of India and come to the conclusion that a different crystallographic variety of gibbsite is present in Indian bauxites.

Geomorphic surfaces over which laterites have developed are of polycyclic nature. There are several interesting studies of this aspect. Karunakaran and Sinha Roy have identified at least four surfaces in Kerala consisting of residual as well as detrital profiles. In most cases described, residual laterite is covered by a thin veneer of detrital laterite. They point out that low level laterites are not always detrital and *in situ* laterites not necessarily confined to upland regions. Subramaniam and Mani point to the concretionary and accretionary character of the ferruginous nodules with nucleus of quartzite pebbles in low level laterites of Kerala and state that they do not strictly qualify for being classified as laterite. They also point out that lateritisation was active from upper Cretaceous times, and that laterites found at different levels throughout the length and breadth of the Peninsula are not only separated in space but in time as well. As opposed to this view Sambandam and Prasad consider five different cyclic landforms identified by them in Kerala as due to repetitive regional uplift with intermediate periods of still stands permitting formation of laterites.

Laterites of Rhodesia developed over Tertiary African surface are described by Grubb. His study is significant on account of its description of laterite texture and composition in relation to slope elements. Aleva has presented an interesting study of bauxitic and other duricrusts in the Guiana shield. He has presented useful triangular diagrams illustrating the mineralogical nomenclature of duricrusts and their approximate chemical composition. The polyphase development of the duricrusts is revealed by their textures and structures. The thickness and chemical composition appear to be related to the composition of the parent rock.

The broader aspect of the effect of global tectonism on bauxite formation is discussed by Bardossy. He points out that most lateritic bauxites were formed on

tectonically quiet platformal areas, while karstic types were developed on orogenic belts. Photos in colour identifying continental plates and ocean belts with the occurrences of karstic and lateritic bauxites superposed so as to bring out the association clearly. Changing positions of continents have been used to explain the formation of bauxite of different periods at different latitudes. An important aspect which has emerged out of the study is the role of vertical movements in bauxite formation. Epeirogenic movements, by bringing laterite to optimum altitudes, by determining the rate of erosion and by influencing the planation of land surfaces have aided in bauxite formation.

Ramam and Vaidyanadhan have raised important issues relating to laterite formation and bauxite concentration in the Eastern Ghats and the coastal plains of India. They ascribe the topographic differences to a single planation surface. Babu has attempted at a sequential evaluation of the geomorphological features of the Indian peninsula by taking laterite as an unconformity plane both on the plateau and the bordering basins. Topographically controlled variations in economically important laterites are emphasized by McFarlane with examples from Uganda and Darling bauxites. She has advocated morphological mapping in conjunction with profile analyses to elucidate geomorphic histories of laterites.

A few papers are devoted to exploration aspect and a few others to analytical techniques like DTA, SEM, XRF as applied to bauxite analyses. Geochemistry of laterite profiles in a Cu-Mo disseminated mineralisation in upper-Volta (West Africa) is described by Zeegers and others, while Butt has presented certain aspects of geochemical exploration in laterite terrain in Western Australia. He has emphasized the importance of gossan search as an effective exploration technique in laterite covered terrains. Limitation of present analytical techniques and the need to evolve partial analytical methods is emphasised. The paper will be read with considerable interest by those engaged in base metal exploration in terrains covered extensively by laterite.

The last section includes papers dealing with applied aspects like fertiliser response to laterite soils, role of groundwater, engineering properties of laterites, and geophysical surveys for iron ore under laterite cover. The review paper by Robson and Gilkes on fertiliser response in laterite soils in southwestern Australia should prove valuable to those engaged in improving laterite covered non-productive barren land.

This brief review will serve to give a general idea of the types of information contained in this well got up volume, refreshingly free from mistakes of printing and proof reading, testifying to the great care taken by the editors and the publishers. Several summarised accounts of the large amount of work being carried out in an active area of research in different parts of the world are contained in this volume which should stimulate the interests of geologists, geographers, geomorphologists, analytical chemists and exploration geologists. We wish the papers had been grouped into sections and each section preceded by a brief introduction by the editors to stimulate and guide the reader. A serious defect which is unfortunately common to all such compilations is the absence of author and subject indexes. These are essential and editors should not shirk from the responsibility of preparing indexes. A carefully selected list of appropriate texts and monographs on laterite and a summary record note at the end outlining a programme for future work would have been welcome.

The book is a valuable addition to the literature on laterite and we have no hesitation in recommending it as a useful addition to most libraries.