Book Review

ARCHAEAN GEOCHEMISTRY The origin and evolution of the Archaean Continental Crust. A. Kroner, G. N. Hanson and A. M. Goodwin (Editors), Springer Verlag, 1984, pp. 1-286.

The first conference on Archaean Geochemistry was held at Leicester in 1975 and has been followed by similar conferences at Moscow (1976), Hyderabad (1977), Thunder Bay (1978), Perth (1980), Lake Baikal (1981), Salvador (1982) and Beijing (1983). Proceedings of these conferences have appeared in separate volumes adding to the sum total of our knowledge about the geochemical processes operating in the early earth. The present volume under review is the latest, and presumably the last, in the series of Proceedings under the IGCP Project No. 92. It is on all counts one of the best produced and handy volumes in the series and contains several articles which keep our interest on problems of the Archaean alive. Many outstanding questions still remain to be solved and the editors in their prefactory note state that the data base against which they can be tested are getting broadened, so too the promise of new breakthroughs in our understading of the early earth. The present volume should be of particular interest to research workers in India as three out of the thirteen articles deal with problems of the Archaean of South India. This points to the growing importance of the Indian shield in understanding processes operating in the early Archaean.

The first of the article by Wanke and others relates to mantle chemistry and accretion history of the earth. The observed elemental abundances pattern of the earth's mantle is described and a two component inhomogeneous accretional model has been proposed.

Sun, in an interesting article discusses the geochemical characteristics of Archaean mafic and ultramafic volcanic rocks which throw light on such aspects as the composition of the bulk earth, the core and the primitive mantle, the chemical effect of core-mantle differentiation process, the early history of the actively evolving mantle-crust system, the chemical effect of meteorite bombardment, chemical and isotopic inhomogeneities in the Archaean mantle and such other aspects. Integrated isotopic and chemical studies of Archaean rocks from Archaean terrains emerges as an important field of future research in evaluating mantle evolution models.

McLennan and Taylor repeat their now familiar thesis that information on the nature of the Archaean upper crust can be obtained from an analysis of Archaean clastic sediments. Basic and felsic magmatic components of the Archaean point to a source at mantle depths (> 40 km) while the post-Archaean crust points to intercrustal melting, forming K-granite and granoditorite with Eu depletion.

Diversity and intensity of metallogenic association in Archaean greenstone belts is reviewed by Groves and Bott, taking their examples from the granite-greenstone terrain of Australia. Intensity of faulting, rapidity of burial, water depth and extent of irruption of komatiitic and felsic magmas appear to have controlled the intensity of mineralization. A useful discussion on platform-greenstone and rift-phase greenstone has been attempted throwing new light on tectonic environments of greenstone formation.

Arndt and Nesbitt discuss the genesis of komatiitic lavas from Munro Township. Oxygen isotopic composition of minerals and rocks and alteration patterns in pillow lavas from the Barberton greenstone belt form the subject matter of another paper. $\delta^{18}O$ values of komatiitic magmas are shown to be similar to modern basalts. Absence of variation in certain elements and differences in others as between margins and cores of komatiitic basalt pillows are pointed out.

Three important papers, specially dealing with rocks of South India are included in the collection. One by Srikantappa, Horman and Raith relate to the petrology

and geochemistry of the layered ultramafic complexes emplaced into Sargur supracrustals of Karnataka. An intra-crustal development rather than rifting is favoured. Average analysis of ultramafic and mafic rocks from Sargur are furnished.

Hansen, Newton and Janardhan further strengthen their thesis of granulite grade metamorphism of amphibolite facies gneiss to charnockite across an unbroken transitional zone in south Karnataka. They confirm that CO_2 streaming is the major agency of metamorphism and metamorphic dehydration (charnockitization).

A geochemical study of the Archaean charnockites from south India, south of Bangalore is presented by Condie and Allen. Depletion of Rb, Ca, Th, U and Pb in charnockites is shown to be the result of fluid phase metamorphism. Extensive migmatisation in the transition zone suggests to them a fluid phase rich in CO_2 purging H_2O from the system and concentrating in a chain of granite leucosomes in the transition zone.

A paper by Jahn and Chang presents radiometric ages (Rb-Sr, Sm-Nd, U-Pb) and REE Geochemistry of Archaean granulite-gneiss from the Hebei province of China—a new province which is coming into prominence in studies of the early Archaean. A consistent age of 2.5 b.y. has been obtained for the granulites representing the age of granulite facies metamorphism. Early Archaean ages of 3.5 b.y. is not substantiated. Mineral isotope systematics seem to point out another important thermal event around 1.7 b.y. Crustal underplating combined with intra-crustal thin-skinned thrusting and stacking of crustal slices, according to these authors, can satisfactorily account for the juxtapostoon of lithologies of different origin and the exceptionally high pressure conditions (>10kb) characteristic of many granulite terrains.

Bibikova presents data on the existence of high-grade rocks as old as 3.4 b.y. forming an early Archaean core within the Aldan shield of USSR. An important outcome of the U-Pb isotope study is the changing geochemical character of zircons. A low content of U and a distinctive Th/U ratio characterizes zircons from greenstone belts. Considerably higher U and lower values of Th/U define zircons from tonalitic to granulitic gneisses. Secondary zircons formed during granulite metamorphism generally have low U and considerably higher Th/U ratios than the other groups. These geochemical features, it is claimed, can help in making a correct interpretation of the resulting age.

The evolution of the early Precambrian continental crust of the Ukranian shield is the subject of a paper by Shcherbak and others. An oldest Auly series (as old as 3800 m.y.) is recognized made up of metagabbros, meta-anorthosites and meta ultrabasites intruded by tonalites.

The last paper in the collection is by Glikson on the significance of early Archaean mafic-ultramafic xenolith patterns. Early greenstone belts are considered as large xenoliths within orthogneiss dominated suites. Descriptions are mainly from the Pilbara region of Western Australia and the Karnataka region of south India. Glikson suggests that the unravelling of greenstone distribution is central to the understanding of the relations between the pluton and supracrustal components of Archaean terrains and to early crustal evolution.

This brief survey will serve to indicate the rich store of information contained in this volume. The study of Archaean is posing many new challenges and is a most active field of research at present. No student of Archaean can afford to ignore this well documented and exceedingly well produced book, specially those from India.

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