

## Book Reviews

**FLUID-ROCK INTERACTIONS DURING METAMORPHISM.** Edited by J. V. Walther and B. J. Wood. *Advances in Physical Chemistry*, Volume 5 (Series Editor: S. K. Saxena). Published by Springer-Verlag, New York Inc. (1986)

Metamorphism is a dynamic process involving changes in pressure, temperature and fluid composition. Characterising the behaviour of fluids and their interaction with rocks are crucial in understanding the evolution of metamorphic rocks. Starting with fossil fluids sealed in fluid inclusions, the 5th volume in the series on *Advances in Physical Chemistry*, attempts to present, through eight chapters, the various aspects of deep crustal fluids, reaction progress, fluid flow, fluid migration, isotope systematics, mineral kinetics, microtextures, and mineral fluid reaction rates, so as to give a summary of fluid-rock interaction processes during metamorphism.

In the first Chapter, M. L. Crawford and L. S. Hollister give a description of the nature of metamorphic fluids as evidenced from fluid inclusions.  $H_2O$ , saline brine,  $CO_2$ ,  $CH_4$ ,  $N_2$  and the mixtures of these constitute the dominant fluid types documented in metamorphic rocks. Analysis of composition densities and distribution pattern of micron-sized fluid inclusions suggests that many of them preserve the syn-metamorphic fluid itself.

R. C. Newton deals exclusively with granulite facies fluids in Chapter 2. After a lucid synthesis of the physical chemistry,  $H_2O$  activities and oxidation conditions of granulite fluids, he evaluates the three important desiccation mechanisms by which granulites are produced from precursor rocks, namely, partial melting with absorption of  $H_2O$  into anatectic melt, dilution of  $H_2O$  with  $CO_2$ -rich volatiles and fluid-absent metamorphism involving the baking-out of rocks in shallow contact aureoles.

Chemical reactions occur between fluids and minerals during fluid infiltration. J. M. Ferry describes in Chapter 3, how the progress of reactions serve as a natural fossil flux-meter. He gives a quantitative appraisal of the measurements of fluid-rock interactions in a variety of regionally metamorphosed rocks.

J. V. Walther and B. J. Wood, the editors of the book, have contributed two Chapters. In Chapter 4, they discuss fluid flow during metamorphism and in Chapter 8, mineral-fluid reaction rates. The authors show that at depths in excess of 6 km, fluid pressure exceeds hydrostatic pressure and convective circulation is no longer viable. Studies on the rate of mineral-fluid reactions (Chapter 8) indicate that at high temperatures, most of the minerals dissolve in aqueous and mixed  $CO_2$ - $H_2O$  fluids.

Fluids are driven off from rocks during progressive metamorphism. In Chapter 5, B. W. D. Yardley reviews the factors which control fluid pressures and flow of fluids. A detailed case study of quartz veins which presumably represent pathways of fluid flow in the Connemara schists of Ireland is included. It is shown that the formation of veins in a rock during metamorphism is primarily controlled by the rate of fluid production or influx and the pervasive permeability of the rock.

Degree of fluid-rock interaction greatly influences the stable isotope systematics of mineral pairs. In Chapter 6, R. T. Gregory evaluates this aspect in the light of oxygen isotope study of quartz-magnetite pairs from Precambrian iron-formations. The study shows that the iron formations behaved as open systems and underwent multistage oxygen exchange events.

J. Ridley and A. B. Thompson (Chapter 7) discuss the role of mineral kinetics in the development of microtextures. With a detailed theoretical base of kinematic

process, they emphasize that free energy difference between reactants and products, after the 'overstepping' of a reaction boundary, provides the impetus for textural development. Growth mechanism of porphyroblasts and their compositional changes with regard to geothermobarometric applications are also elucidated.

The book, with contributions from ten renowned workers, 59 illustrations and a useful index, should be regarded as a commendable effort in summarising the recent advances in understanding metamorphic processes. However, it suffers from some short comings which could have been probably avoided with a more careful treatment. The fundamental question regarding the source of fluids—especially carbonic fluids—is not considered seriously by any of the authors. The only effort towards this is the rather blunt attempt made in Chapter 1, which eventually drifts away to criticise those 'who jump into the bandwagon' of the CO<sub>2</sub>-streaming theory and ends up proposing another equivocal model. Carbon isotope work, an efficient tool in probing fluid source, has been left out in Chapters 1 and 2. While focussing attention on South Indian charnockites in Chapter 2, the author quotes mainly the works of his own group. The important and relevant works and views of other researchers on the same terrane (Karnataka and Kerala) do not find a place. The presentations in Chapters 4 and 8 would have benefitted by specifically considering cases of fluid infiltration and buffering. A few typical examples rather than an exhaustive treatment of field aspects of the Connemara schists would have improved the contents of Chapter 5. Chapter 6—the only one devoted to isotope studies—deals with oxygen isotopes in a single rock type. Chapter 7, even though it attempts to address P–T–t paths, does so only empirically and fails to include many of the excellent examples.

While compiling a book, it is better that all the Chapters have a common format. It has skipped the notice of the editors that some chapters have a 'summary' at the end; some have 'conclusions' and some others just end abruptly.

Nevertheless, students and researchers of metamorphic petrology will find the book an informative compilation of important reviews and I recommend it as a worthy acquisition to all Earth Science Libraries.

*Centre for Earth Science Studies,  
Trivandrum-695 031*

M. SANTOSH

#### GONDWANA GEOLOGICAL MAGAZINE Vol. I No. 1. 1986 Nagpur, India.

We have received the first issue of the Gondwana Geological Magazine—the organ of the Gondwana Geological Society at Nagpur. The Society proposes to bring one number of the Journal every year. The current number includes articles on Korean Geology with special reference to ophiolite and new palaeontological Evidence for the age and initiation of the Deccan Volcanics. Other articles include some which are remotely connected with Gondwana Geology. There is a place for specialist Journals dealing with specific characteristics of individual geological formations. We do sincerely trust that the Journal will strive to focus attention on problems of Gondwana Geology.

B. P. R.