

BOOK REVIEWS

Berg, J.-P. and Ford, M. *Orogeny Through Time*. London (Geological Society, Special Publication, 121). 1997, 270 pp. Price £59.00. ISBN 189-7799-756.

This perhaps rather slim volume comprises three introductory papers followed by seven on aspects of orogenic episodes. A general overview by the editors is followed by two discussions of lithospheric rheology, one essentially terrestrial and the other more generally applied to planets. The seven main papers are: one comparing two Archaean low-grade terrains; one covering Palaeoproterozoic orogeny around Mount Isa; two on the Caledonian; one from the Lower Palaeozoic Lachlan fold belt in Australia; one on the Urals; and finally, a summary of Cenozoic orogenic evolution in the central Andes. References are specific to each paper and the volume is completed with a subject/place index.

The two papers on lithospheric rheology provide a comprehensive insight into the modern understanding of the basic principles. Ranalli summarises the Earth and attempts a detour into the Archaean to explore possible differences between modern and Archaean oceanic lithosphere. The conclusions reached are that some form of plate tectonics taking place at quite different rates has been the main creator of orogenic belts throughout Earth's history. Thomas *et al.* examine some of the other planets and their moons as well as the Moon to illustrate the differences between the silicate and icy systems. Using data from the differing morphologies of impact structures the secrets of what lies beneath the surface are revealed. Further, using the crater chronology they are able to say something about the evolving properties of the lithosphere with time.

The paper by Choukroune *et al.* is stated to have been written by two independent groups and compares the development of the Superior Province of Canada with the Dharwar Craton of southern India. At the start of this paper there is a considerable mix of evidence from both high- and low-grade terrains and it is at times difficult to work out where the paper is going. I feel that discussions that describe horizontal and vertical structures as being important points of difference

are, these days, hardly warranted. It has been adequately demonstrated by many workers that greenstone belts hide early horizontal nappe and thrust movements and that in high-grade terrains there have been vertical movements at different times. The data sets from the two different areas being compared are so different that I find it difficult to readily come to terms with the results of the comparison. The Canadian data set based upon seismic profiles and a long history of research and economic exploitation provides a completely different level of information. In my opinion, the Indian geology is still hotly debated but at a much lower level of understanding. In 1994, the time of the seminar, the seismic work from the Superior Province was being released and exciting the geological world. I think that there are better and more easily accessible summaries (some by Ludden and co-workers) already in the literature. To my mind this is a contribution that has been superseded and must be viewed in that light.

The description of the Mount Isa region by O'Dea *et al.* is altogether a more readily readable contribution. As a summary and description of evidence for, and models of, evolution this paper is very useful. Four periods of intraplate orogenic activity are described which, despite metamorphism and deformation, still have good stratigraphic control, which is enhanced by modern geochronology. The explanations given in the synthesis are convincing and provide a setting for the important mineralisation.

Two papers cover aspects of the evolution of the Caledonides; Milnes *et al.* discuss the timing of the Caledonides in southern Norway whilst Rey *et al.* go further in making some comparisons with the Variscan and commenting on the effects that the younger orogeny had on the older fold belt. Recent research coming out of the Caledonides in Scotland and East Greenland suggests that there are going to be some serious problems with the presently accepted models. These involve both the timing of the metamorphic events and the various tectonic models used to describe the evolution. The paper by Milnes *et al.* basically does the same thing for the south Norway sector, examining the problems regarding the Devonian conglomerates, eclogite exhumation and the nature of the

orogenic collapse model widely advocated. Rey *et al.* consider that whilst contraction was occurring in the Variscan, extension was happening over the site of the Caledonian belt. Several different proposals are examined to explain the effects observed, the conclusion being reached that the rheology of the different continental crust segments was the important control.

Another Australian fold belt, the Lachlan, is succinctly summarised by Gray. This Palaeozoic belt, approximately synchronous with some of the Caledonian, formed on the other side of Gondwanaland. A range of thin-skinned features are described across the belt and fitted into an overall model explaining the diachronous changes in sedimentary sequences, tectono-metamorphic evolution and plutonism. A main point of interest is that there seems to be no foreland-propagating sequence of thrusts. Given the stratigraphic control here this would seem to be a reasonable assumption. However, given the problems of out-of-sequence thrusting now emerging from other orogenic belts, it may, in fact, not be so unusual.

It is often very difficult to find reliable summaries of the geology of many of the remoter parts of what was once the USSR. The paper by Puchkov on the evolution of the Urals appears to be one of these rare finds. There has been a synthesis of a large number of references in Russian which, to the ordinary geologist, would probably be inaccessible. Several types of geophysical profiles are discussed and there is a substantial summary of the stratigraphy and lithological correlation, all of which appear to carry an air of authority. The contribution is unique in that it suggests lines of future research and so highlights many of the problems that are extant.

The final contribution by Lamb *et al.* is also a lucid one discussing the development of the central Andes in Bolivia and northern Chile. This is a critical area as it is located at the convergence point of the Nazca oceanic plate and the continental South American plate. The key to the argument is suggested to be the relative strengths of the lithosphere in each portion; that of the Brazilian Shield being stronger and causing the Bolivian Andes to develop a zone of thin-skinned deformation.

The editors state in the abstract to their introductory paper that they "... present a personal overview of the most notable developments in orogenic studies since the 1960s." This is indeed what is provided, as the book originated

from a series of seminars designed to provoke discussion, essentially within one Department. Therefore, the volume produced has a very different basis from a group of papers drawn together from a scientific meeting. The idea of a book which provides a summary of aspects of the geology of representative orogenies from as large a portion of geological history as possible is very attractive, however, my feeling is that this is not the book that will do it. Partly, because it has taken at least three years to come to press, the basis for some of the arguments has become dated, such is the pace of study. The balance of the seven papers dealing with the orogenic episodes does not, to my mind, reflect the present understanding of orogenic belts generally. There is always going to be a problem in trying to bring together a volume comprising several individual interpretations which are drawn from databases of very different qualities. In conclusion, I feel this is one for the libraries and not, perhaps, the individual. C. R. L. FRIEND

Cong, B. (ed). *Ultrahigh-Pressure Metamorphic Rocks in the Dabieshan-Sulu Region of China*. Dordrecht (Kluwer Academic Publishers), 1996, ISBN 0 7923-4163-5, and Beijing (Science Press) 1996, viii + 224 pp. Price £75.00.

This book brings together a series of chapters devoted to different aspects of UHPM in two regions of East China (Dabieshan and Sulu) which are widely believed to have been formerly united as the WNW-ESE-trending Qinling-Tongbai-Dabieshan-Sulu orogenic belt prior to the operation of the major Tancheng-Lujiang fault. This belt cuts right through China and marks the boundary between the Sino-Korean craton to the North and the Yangtze Craton to the South.

The book is well constructed, being composed of nine chapters which each treat one of the key aspects of the problems concerning the genesis and exhumation of UHPM rocks. B. Cong and Q. Wang (Chap. 1) provide an excellent overview which sets the rest of the book in context. In particular, they draw attention to the key geodynamic problem of whether these UHPM rocks were created *in situ* within their present geological environment or whether they were tectonically introduced as 'foreign' bodies with a previous higher-pressure UHPM history.

Chapters 2 and 3, both by Q. Wang *et al.*, describe respectively the regional geology of the