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BOOK REVIEWS

Precambrian orogenesis: the Trans-Hudson

Lewry, J. F. and Stauffer, M. R. (editors) 1990. *The Early Proterozoic Trans-Hudson Orogen of North America.* Geological Association of Canada Special Paper 37. 505 pp. Price Can. $85 members, $99 non-members.

The last decade has seen a marked renewal of interest in Precambrian orogenic belts, stimulated by attempts to create plausible plate tectonic models for the Precambrian. In the specific context of North America, this interest has been focused by the search for alternative re-arrangements of Piper's Proterozoic 'supercontinent' discussed recently by Hoffman and Dalziel, among others, and by more detailed comparisons with probable neighbouring continents such as Baltica.

This activity has been aided partly by the greatly enhanced precision offered by modern isotopic dating methods (principally U–Pb zircon dating) and partly by the availability of more detailed regional mapping. It is difficult sometimes for Europeans unaccustomed to North American geology to appreciate the immense scale and logistic problems involved in mapping the expanses of difficult Arctic and bush terrain represented in this belt, which is at least 4500 km long and up to 400 km wide, much of it still not mapped in any detail. Indeed the level of detail and sophistication of analysis of many of these Precambrian shield terrains is only now approaching that of younger and more familiar orogenic terrains such as the Alps or the Caledonides.

The Trans-Hudson orogen is a relatively new concept—the term was introduced by Hoffman in 1981—and is representative of a general refinement of subdivision of the Laurentian shield, which is gradually replacing the framework of structural provinces established by Stockwell.

The volume is the result of a symposium on the Trans-Hudson Orogen held in Saskatoon, Saskatchewan by the Geological Association of Canada in May 1987, and edited by J. F. Lewry and M. R. Stauffer. The editors point out that the volume includes only about half of the papers presented at that symposium, and that abstracts of the remaining papers are to be found in the *Program with Abstracts* volume for the 1987 joint meeting of the Geological Association of Canada, the Mineralogical Society of Canada, and the Canadian Society of Petroleum Geologists.

The volume contains 27 papers. The first two represent an overview. J. F. Lewry and K. D. Collerson describe the extent and subdivision of the orogen, and discuss its interpretation, and P. F. Hoffman discusses the orogen in the context of the subdivision of the Early Proterozoic Churchill Province of which it forms a major part. These two papers provide a useful summary of the orogen as a whole—essential reading for Precambrian geologists non-expert in local North American geology.

The remaining papers are divided on a geographical basis into those dealing, respectively, with the *western, southern* and *eastern* segments of the belt, with the *western craton* and finally with comparative studies in other areas.

The *western segment* is the Churchill–Superior boundary zone. Ten papers are devoted to this section, including both regional syntheses of the whole segment and more detailed studies of individual rock units, magmatism, geochronology and palaeomagnetism. This section is the most comprehensive.

The *southern segment* in North and South Dakota is the southern continuation of the western segment into the U.S.A. along the western margin of the Superior craton, and is addressed by three papers. The Black Hills inlier, although isolated from the remainder of the orogen, is relatively well known and reliably dated and can be linked to the Canadian outcrops by gravity and aeromagnetic data.

The following section contains two papers dealing with the *western craton,* one on the Archaean Wyoming province, the other on a buried pluton in Alberta revealed by a gravity anomaly. Their relevance to the Trans-Hudson orogen is rather tenuous.

The *eastern segment* of the orogen extends from Hudson Bay eastwards, around the northern (Cape Smith belt) and north-eastern (Labrador belt) sides of the Superior craton. One paper deals with the Cape Smith belt and five with the Labrador belt, representing a reasonable mixture of regional overview, tectonic interpretation and local detail. This section also includes a paper on the Rinkian belt of West Greenland which, although not part of the Trans-Hudson orogen *sensu stricto,* belongs to the same Early Proterozoic system.

The final section comprises two comparative studies of orogens in rather more distant parts of the world—the Karelides of Finland, and the rocks of Early Proterozoic age bordering the Congo craton in northern Cameroon, West Africa.

Inevitably, in a symposium volume of this type, both quality and coverage are variable. Some of the papers are too parochial to interest the general Precambrian reader, and the relevance of others, particularly the Finnish and West African examples, is tenuous.

Nevertheless, the volume as a whole represents an invaluable compendium of information, much not previously available, about this important orogenic belt.

It is unfortunate that the 3-year delay between the conference and the publication date means that some of the material is already out of date. This is by now a familiar problem with symposium volumes, and the reasons are universally understood; but it is nonetheless regrettable.

At $99 for non-members, the volume represents good value. There are useful general maps in the review papers and the standard of presentation is high. The book is recommended to all those with interests in the Laurentian shield, in Precambrian orogenic belts or in the Early Proterozoic generally.

R. G. Park

Keele, U.K.

Australasian volcanism

Johnson, R. W. (compiler and editor) 1991. *Intraplate volcanism in Eastern Australia and New Zealand.* Cambridge University Press, Cambridge, U.K. Price $85 cloth.

This book is primarily concerned with Cainozoic volcanic activity, and is aimed at igneous petrologists/geochemists. It represents part of the Australasian contribution to the International Lithosphere Programme (initiated in 1981), and its main purpose is to bring together a vast quantity of field, mineralogical and chemical data, some of it previously unpublished, from an igneous province which is not familiar to the majority of volcanologists and petrologists. This approach is hardly likely to make it compulsive reading for structural geologists, although it is a salutory reminder that Tertiary continental basalts are not restricted to the Northern Hemisphere, and that recent New Zealand volcanic activity is not only of subduction-related type. However, there are more positive reasons for recommending it to serious students of global geology, in that it attempts to look beyond the immediate igneous manifestations (both volcanic and subvolcanic), to the wider implications of the igneous activity in terms of mantle processes and plate tectonics.

This broader approach is introduced in Chapter 1, entitled *Framework for volcanism* (pp. 1–54), but is more fully developed in the final chapter (7), under the heading *Towards a general model* (pp. 289–354), which follows the main descriptive chapters (2–6). Chapter 7 inevitably has a strong magmatic bias, but it is a valuable attempt to integrate the mineralogical and chemical data with the available information on the regional tectonics and geophysics, as well as dealing with such topics as uplift mechanisms, mantle diapirs, underplating, etc. It ends with a section on *Problems, uncertainties and issues,* which discusses 'hotspot' (single and multiple) and 'hotline' models in the context of eastern Australia, the Tasman Sea and New

Zealand. In short, this chapter contains a wealth of stimulating ideas and hypotheses, which deserves a wider readership than the title of the book might attract.

Although of secondary significance, the hierarchical structure of this book deserves comment, especially in terms of attribution and referencing. The chapters are divided into sections, subsections and subsubsections, any of which levels may have separate authors listed (but only in the Table of Contents, not in the main text). In addition the chapters have named 'co-ordinators', who are usually major authors as well. Then there are 'associate editors', one of whom is also a major contributor (as co-ordinator and author), and, at the top of the pyramid, the senior editor/compiler whose is the only name to appear on the cover. Somewhat confusing instructions about citation are given on p. xviii, but it is the variation in the number of authors and separately citable sections in different chapters which is most disconcerting. At one extreme are chapters (e.g. Chapters 2 and 5) which are largely the work of one author (who is also the co-ordinator, not surprisingly). At the other extreme is Chapter 3 which involves 29 different authors (out of a total of 59 contributors to the whole volume) and 44 individually referenced sections (or subsections or subsubsections!). The shortest of these (3.6.1) contains approximately 150 words, but many others are only half a page in length. On the other hand, the longest continuous effort by one author (occasionally aided by co-authors) is 60 pages, and contains 32 sections or subsections. One author makes nine appearances (either alone or as a joint author) within 11 pages. On the whole, the degree of subdivision means that most sections have only one or two authors, but 4.7 has six co-authors (for 5 pages of text).

Despite these organizational anomalies, the book is a valuable compilation, effectively edited into a coherent and readable whole. It is also very well illustrated with abundant maps, diagrams, field photographs and photomicrographs (including a section of colour plates). It is obviously a useful source book for igneous petrologists and geochemists, but has plenty to offer all geologists prepared to take a global perspective.

W. J. Wadsworth

Manchester, U.K.

Fractured rock

Rossmanith, H. P. (editor) 1990. *Mechanics of Jointed and Faulted Rock: Proceedings of the International Conference on Mechanics of Jointed and Faulted Rock, Technical University of Vienna, 18–20 April,* 1990. A. A. Balkema, Rotterdam. 994 pp. Price $105.

A number of human endeavors must deal with faulted and jointed rock. Often the mere presence of faulted and jointed rock leads to great frustration because the rock does not behave as predicted by engineers and scientists. Examples are numerous. Petroleum engineers developed horizontal drilling to drain fractured reservoirs only to find that the reservoir draw-down was so fast that recovery of oil was not cost efficient. Civil engineers constructed dams for hydroelectric power and then discovered that fractured bedrock drained the reservoir so fast that a significant hydroelectric generating capacity was lost through leakage. The long-term containment of nuclear waste on military reservations has been compromised by the presence of faulted and jointed rock. Leakage from ordinary landfills is often through faulted and jointed rock. The magnitude of such problems forms the impetus for a 1990 conference in Vienna, Austria in April, on faulted and jointed rock, and a similar conference in Leon, Norway during June of the same year.

The goals of the Vienna conference were to provide a forum for presentation of new research results, to promote interaction among theoreticians, engineers and consultants, and to search for a common language in terms of testing and standardization of faulted and jointed rocks. The volume coming from the Vienna conference, *Mechanics of Faulted and Jointed Rocks,* is divided into conference themes including geology, faulting, testing, numerical modeling, hydraulics, mining and applications.

The volume consists of nine plenary papers and more than 120 technical papers: a massive volume. Structural geologists will note papers dealing with the healing of microcracks, anastomosing patterns of fractures, jointing during cylindrical folding, impact-induced fracturing, rock friction and joint roughness. Geophysicists might read about such subjects as borehole breakouts, stress measurements in jointed rock, the elastic wave propagation of cracked rocks and acoustic emissions from faulted rocks. Hydrologists will look at papers on fluid flow through channels on the fracture plane and probabilistic flow models. A large number of papers for the civil and mining engineer include such topics as block modeling of jointed cliffs, the design of a large cavern in a jointed rock mass, dam foundations and the stability of embankments.

Mechanics of Faulted and Jointed Rocks has all the characteristics of a generic volume arising from a conference in rock mechanics. Papers cover a range of interests so that the volume is not easily classified as a collection of papers in structural geology, or any other single subject such as mining engineering. Such volumes are rarely, if ever, peer reviewed which means that the quality of the papers varies greatly. I enjoyed papers by Archambault *et al.*, Kowallis *et al.*, Moore *et al.*, Müller and Ernstson, Rives and Petit, Reches, and many others. However, it is fair to say that one or more papers should have been rejected by the editor as pure nonsense.

Finally, I was impressed with the number of countries (31) represented by authors within the Vienna volume. The distribution of authorship among countries of the world was refreshingly even, compared with many volumes overwhelmed by authors from a very few countries.

Terry Engelder

Pennsylvania, U.S.A.