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BOOK REVIEWS

The Transantarctic Mountains

Stump, E. 1995. *The Ross Orogen of the Transantarctic Mountains*. Cambridge University Press, Cambridge, U.K. 284 pp. ISBN 0-521-43314-2. Price: £60; US$99.95 hardback.

This is the right time for a geological syntheses of orogenic belts in the Antarctic Continent. Edmund Stump's monograph is devoted to the Early Palaeozoic Ross Orogen of the Transantarctic Mountains, one of the great mountain ranges of the world, spanning the continent of Antarctica for 3500 km and rising to heights in excess of 4000 m.

The intracontinental Transantarctic Mountains are a physiographic and geological boundary between the East Antarctic Precambrian crystalline shield (craton), and an assembly of West Antarctic terranes. The latter include an Early Mesozoic orogenic belt of the Ellsworth Mountains and a paired Middle–Late Mesozoic through Tertiary magmatic arc of the Antarctic Peninsula, South Shetland Islands.

The Ross Orogen is best recognizable in parts of the Transantarctic Mountains adjacent to the Ross embayment. There is a geological continuity in the Thiel and Pensacola mountains adjacent to the Weddell embayment with the rest of the Transantarctic Mountains. However, the former two areas lack intense deformation attributable to the Ross orogeny.

The history of the Ross Orogen commenced in the Neoproterozoic, with passive continental margin sedimentation. The margin became activated by compressional deformation and plutonism in the later part of the Neoproterozoic. This resulted in a full orogenic cycle during the Cambrian, followed by exhumation and cooling of the belt during the Ordovician.

Following the Introduction, there are six chapters divided by geographical area, dealing with the regional geology of particular segments of the Transantarctic Mountains: Northern Victoria Land, Southern Victoria Land, Central Transantarctic Mountains, Queen Maud and Horlick Mountains, Thiel Mountains, and Pensacola Mountains. Although a common geological history runs through all of the areas, each has distinct characteristics, and uncertainties remain regarding correlation of many rock units from one area to another.

Each chapter starts with a geological summary, followed by chronology of exploration and description of the geology of a particular segment. A concept of fault-bounded terranes provides the framework for geological and structural/tectonic development of the Transantarctic Mountains. In the best known segment of Northern Victoria Land, the Wilson Terrane (Neoproterozoic to Permian–Mesozoic), the Bowers Terrane (Middle Cambrian to Permian–Mesozoic), and the Robertson Bay Terrane (?Cambrian through Devonian to ? Early Carboniferous) are a standard subdivision, traceable with some success in the other segments of the mountain range. The closing chapter (Synthesis) summarises the major known stages of development of the Ross Orogen, as follows. A passive margin-basin, mainly turbidite sedimentation in the Neoproterozoic, which commenced perhaps around 750 Ma, was established during rifting of the East Antarctic craton. Limited volcanism indicative of rifting was found within the deeper-water turbidites in a part of the orogen. Varied lithologies present in another part, including carbonate rocks and also some volcanics, may indicate shallow-water development.

The onset of tectonic activity, as based on radiometric ages of some plutonic rocks in Victoria Land, approximately 544–550 Ma, straddles the Neoproterozoic/Cambrian boundary. Within portions of the Transantarctic Mountains, the metamorphism and plutonism appear to be more or less continuous features until the final cooling of the orogen in the Ordovician, between 500–480 Ma, perhaps even about 450 Ma.

Unconformably upon the folded and eroded Neoproterozoic rocks, a thick carbonate-shelf sedimentation, including shallow-marine archaeocyathan-microbial facies, was established in the Middle Cambrian from Victoria Land to the Pensacola Mountains. In the Queen Maud–Horlick Mountains, the Early and Middle Cambrian carbonates are associated with a bimodal-suite, primarily felsic volcanics, possibly indicating an extensional tectonic regime. Strike-slip fault-bounded terranes might account for the differences in Cambrian development. The overall tectonic setting is still difficult to rationalize. A left-lateral oblique subduction model might be a possible explanation.

This book reflects the present state of knowledge of geology and structural development of the Ross Orogen. This knowledge varies from fair to poor, depending on the duration of field surveys by different expeditions in particular segments of the Transantarctic Mountains, and on the accessibility of the rock exposures. Perhaps it is still too early to give a more consistent synthetic account than that given by E. Stump in the closing chapter. I would have expected, in this chapter, an attempt at correlation of rock units between the segments of the Transantarctic Mountains, set against stratigraphic and radiometric scales, and presented as a synthetic table. Unfortunately, this is not the case.

Very numerous informal and formal rock-units are used in this book, as originally published by various authors. They are listed in the Index together with geographical names etc. The reader would certainly be helped if an annotated glossary of these units was added.

A number of good photographs, including the aerial but not the satellite ones, of the Transantarctic Mountains and their geological exposures add to the value of this book. However, in some of the photos, geological features mentioned in explanations (e.g. thrust fault in Fig. 2.24; mafic dykes in Fig. 3.13; unconformities in Figs. 4.11 & 18) are not easily recognizable. Some indicative lettering, and lines drawn onto these photos, as done elsewhere (e.g. Fig. 4.7), would be helpful.

The geological and topographic maps are of varying quality. Based on original drawings by the authors, some are very instructive, while others merely sketchy. There are very few detailed geological sketches of the exposures, and geological cross-sections are infrequent in this book.

The above remarks should not diminish the overall value of this book, which lies in a detailed presentation of the state of geological knowledge of particular segments of the Transantarctic Mountains, with a major emphasis on the Ross Orogen. With laboriously assembled data on the history of geological surveys of particular segments of these mountains, supplemented with an extensive bibliography, E. Stump's monograph is an invaluable source of information for any reader, whether an experienced Antarctic geologist or just a beginner.

Kraków, Poland. *K. Birkenmajer*

The Oman Mountains

Glennie, K. W. 1995. *The Geology of the Oman Mountains—An Outline of Their Origin*. Scientific Press Ltd, Beaconsfield, U.K. Price: £20; $40.

The Oman mountains of southeastern Arabia provide us with easily the most impressive, extensive and best-exposed example of an ophiolite complex obducted onto a passive continental margin anywhere in the world. Not only is Oman famous for its ophiolite, but the mountains also provide a unique view down into the allochthonous Tethyan rocks in the thrust sheets beneath the Semail ophiolite, into the Permian–Mesozoic shelf carbonates of the Arabian passive margin beneath, and even further down into the pre-Permian basement, exposed in the cores of the huge anticlinal structures of Jebel Akhdar and Saih Hatat. The Oman mountains are a geological masterpiece; the almost complete exposure makes them the promised land for a wide range of earth scientists from igneous petrologists to carbonate and deep-sea sedimentologists, to structural geologists. Ken Glennie led a team of geologists from Shell Research (KSEPL) and Petroleum Development (Oman) Ltd (PDO) during the early 1970s, who carried out the first detailed survey of the whole mountain belt. The resulting report and map (Glennie *et al.* 1974) has widely been regarded as the 'Bible' of Omani geology, a position it still retains today. They laid out the first comprehensive stratigraphy of the mountain belt, made the first detailed sections through the Semail ophiolite sequence and constructed the first proper cross-sections across the allochthonous thrust sheets. A comparison of the Glennie *et al.* (1974) map with the subsequent 1:100 000 maps, produced mainly by the BRGM group, shows just how good the original mapping was.

This book is a very short (92 page) précis of the original volume, but it has been written in a manner that the interested amateur can understand as well as the professional. The first four chapters lay out the basic points of plate tectonics and present a brief history of research in the Oman mountains. The major rock units of the mountains are described briefly in Chapter 5 and a history from the Permian breakup of Gondwana to the present is described in Chapters 6 and 8. Unfortunately there is very little on structural geology and the treatment relies far too much on stratigraphy alone. There is almost no reference to a huge amount of very detailed structural work on the Hawasina, Haybi and Semail ophiolite thrust sheets. The stratigraphic treatment suffers most in the thrust sheets beneath the ophiolite where the BRGM group have renamed several units in adjacent thrust slices. The most profound criticism can be made of this approach which fails to realise that the same time-equivalent rocks occur in adjacent thrust slices and should not be given different formational names. The northwestern continuation of the Tethyan suture zone in the Zagros 'Crush zone' and the geology of Makran, the area north of the Gulf of Oman, are described very briefly in Chapter 7.

Although there is no oil and gas present in the shelf carbonates of the Oman mountains, which have been buried beneath the allochthonous thrust sheets and the ophiolite, there are numerous oil and gas fields spread across the Arabian platform southwest of the mountain front. The same shelf carbonate rocks penetrated in oil wells in the desert interior are exposed along numerous cross-cutting wadi sections cutting through the Jebel Akhdar massif. Oman has over 70 oil and gas fields producing some 800 000 barrels/day from a wide variety of reservoirs. Source rocks range from Infracambrian in the Southern (Ghaba) Salt basin of Oman to early Cretaceous in the Fahud Salt basin. The petroleum potential of the Oman mountains is discussed briefly in Chapter 9 before a final 2½ page Summary and Conclusions.

This paperback book has been cheaply published by Scientific Press. The quality of the paper is low and the black-and-white photographs are in places as bad a reproduction as that from a photocopier. There are three colour plates including one Landsat (Thematic Mapper) image of Oman which again are of a poor quality. The brevity of each chapter makes the entire book little more than a long paper. Most professional geologists working on the fascinating geology of Oman will either have their copy of the Glennie *et at.* (1974) Memoir, or have access to one. This book is not really aimed at them. It is aimed at interested amateurs, students and geo-tourists to Oman, and for these individuals the book can be highly recommended. It gives a brief, concise and simplified version of the geology of one of the most remarkable and classic mountain ranges of our planet.

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Oxford, U.K. *Mike Searle*