BOOK REVIEWS

Nisbet, E. G. *The Young Earth: an Introduction to Archaean Geology*. Boston and London (Unwin Hyman Ltd.), 1987. xviii + 402 pp. Price £18.95 paperback.

Nisbet's book *The Young Earth* arose out of an advanced course given to undergraduates in which he set out to convey something of the excitement and the challenge inherent in the subject. The author says it is a personal view: as such it is a testimony to his scholarship, for we are offered the opinions of many, led through hypothesis and counterhypothesis and given the benefit of the author's own (he admits to being biased) views. The book has a relaxed style, humour comes through, many appropriate and thought-provoking quotations from the great literature of the world—even a reference to Dan Dare(!). The book abounds with appropriate graphs, tables, sketches and photographs, with the reader being assisted through even the most complex topics with simpler analogies and summaries. There are over 700 entries on the reference list and for those not into the specialist jargon of the geological sciences there is a splendid glossary.

The book is virtually *all* about the Archaean—that span which takes us from the last moments of the ordering of the Earth as it was accreted, roughly 4400 m.y. to around 2500 m.y., the generally agreed beginning of the Proterozoic. At the outset the author tells us that the book will study the Earth's history as revealed by Archaean rocks—and there is a very splendid account of those rocks early in the book—but his story goes well beyond those rocks which may have been by no means typical of the Archaean; after all they must have been special to have remained virtually undeformed since 2500 m.y. ago.

The second and major part of the book takes the reader into the key themes which make the Archaean so significant. The evidence for and the nature of Archaean life, the Archaean seas and oceans and their sediments, the thermal regime of the Archaean continental crust, metamorphism, granitoids and the necessity and possible nature of Archaean plate tectonics, which leads into Archaean volcanism and the evolution of the Archaean mantle. The significance of the Archaean mineral deposits, their origin and preservation makes fascinating reading.

The last chapter of the book should have been a separate, third part. Here more than anywhere the author seems to be expressing his personal views—his deep feeling for the significance of the Archaean as he examines the Archaean Earth from mantle to atmosphere. There is much to excite the reader including the early dichotomy of the continent and oceans—something which set Earth apart from its planetary neighbours—and that water which comprises 0.1% of the mantle was the key to much that followed. He relates how fortunate Earth is to have the CO_2 'greenhouse' effect working as a control through life's CO_2 demand: the constancy of the Earth's surface temperature in the 0–40 °C range (the optimum conditions for life) over a 4000 m.y. period is at once one of the most astonishing and one of the most natural features of the planet. The role of life as the controlling factor of Earth's special, indeed unique, existence is dealt with in a speculative but intriguing way.

Nisbet's entertaining account will make all, especially those to whom the Archaean is remote in interest as well as in time, think again about the inter-relation of the many facets of the Archaean story and of how the foundations of the Earth and life as it is today were well and truly laid. There was nothing chaotic about that young Earth.

A. J. SMITH

Park, R. G. and Tarney, J., Eds. *Evolution of the Lewisian and Comparable Precambrian High Grade Terrains*. London (Geological Society: Special Publication No. 27) and Oxford (Blackwell Scientific Publications), 1987. viii + 315 pp. Price £39.50.

In the twenty to thirty years since some of the current 'old men' of Lewisian geology and others of similar vintage listened as undergraduates to accounts of the early work attempting to understand the then enigmatic Lewisian Complex, Geology as a science has advanced enormously in all of its branches. Whilst much of this early work remains relevant, and in many cases essentially correct, the profound consequences of these advances in enhancing our undestanding are reflected in the papers contained in this volume. Fourteen of the twenty-four papers give us an 'in depth', modern appreciation of the origin of much

of the rock material making up the Lewisian, its long and complex history, its metamorphism, possible tectonic settings, and its palaeomagnetic history. In addition, two papers deal with interpretation of seismic profiles and the significance of the physical properties of Lewisian rocks at the surface in relation to deep crustal structure.

For both those involved in research on similar rocks and problems world-wide and the interested, informed non-expert, this collection of papers provides a balanced view of current interpretations and problems relating to the geology of this tiny but nevertheless important British fragment of an early Precambrian high-grade terrain. It also demonstrates the importance of a multi-disciplinary approach to geological problems.

Inclusion of six papers concerned with the geology of similar terrains in Greenland, Western Australia, Antarctica and China is useful in as much as they provide comparison for the Lewisian. But, because these are not comprehensive and most are presented as accounts of the geology of particular, sometimes spatially limited, areas, they are of only limited value to the reader trying to assess the full extent, variation, and significance of such terrains.

This special publication of the Geological Society offers extremely useful information and interpretation to those involved in similar researches, to the informed but more generally interested geologist and, no less importantly, to the undergraduate.

DEREK POWELL

Wilson, M. *Igneous Petrogenesis: a Global Tectonic Approach*. London (Unwin Hyman), 1989, xx + 466 pp. Price £50.00 (hardback); £24.95 (paper).

Marjorie Wilson's new book is a major synthesis of modern knowledge on the formation and diversification of magmas in relation to global tectonics. It integrates the results of major and trace-element geochemistry, isotope studies and geophysics for each of the major tectonic environments, and offers a general model for magma genesis in each environment.

According to the preface, the book is addressed to advanced undergraduate and postgraduate students. It is very well illustrated, with lots of variation diagrams, isotopic plots, and many examples from the recent literature. A thorough grounding in geochemistry and petrography is assumed on the part of the reader, and my guess is that undergraduate students will find this text heavy going, but researchers or teachers of igneous petrology will welcome its up-to-date and detailed coverage and extensive bibliography.

The basis from which this ever-expanding subject has been reviewed has been to concentrate on the products of present-day volcanism. This is a sound and logical approach: it is difficult enough to work out the origin of present-day magmas in known tectonic settings, so how much more difficult it must be to interpret ancient rocks or those which do not reach the Earth's surface. This approach has drawbacks as well as benefits, however, since some major categories of igneous rock are effectively excluded from consideration, for example granites, peridotites, and carbonatites. From this point of view, the broad title *Igneous Petrogenesis* is really rather misleading. However, the resulting emphasis on basaltic magmas gives the text a greater coherence than it would have otherwise, and permits a more detailed examination of mantle sources.

The first four chapters (about 100 pages) review the distribution and composition of igneous rocks, and describe some of the more important petrogenetic processes. The remaining chapters consider the individual tectonic environments, starting with oceanic ridges and ending up with continental intra-plate magmatism. Much of the content is factual, but where appropriate the author gives her own opinions, with which the knowledgeable reader may sometimes agree and sometimes disagree. I particularly agreed with the stipulation in the very first paragraph that petrogenetic studies must be based on sound field observations, involving careful mapping and sampling. I was less happy with the description of the tholeiitic and calc-alkaline curves in the AFM diagram (fig. 1.4) as 'differentiation trends', a reminder of how deeply entrenched in igneous petrology is the notion that differentiation is the answer to everything. An interesting point is the decision to jettison the use of norms. Perhaps they are an obsolete way of describing rocks, but they do have some value for plotting rock and magma compositions onto appropriate phase diagrams, and it is a lot easier to sum up a basalt composition by looking for normative quartz or nepheline than to assess its character from the raw analysis.

A recurring theme of the book is that the heterogeneity of mantle sources rivals the familiar processes of fractionation, contamination and mixing as a cause of magma diversity. This is perhaps best summed up in the global maps of lead isotope variation (fig. 9.27), which set the scene for the major petrological task of the next few decades, the exploration and mapping of the