

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

Earth's mantle. Every would-be explorer should have a copy of this guide.

A. HALL

Parsons, I. (ed.) *Origins of Igneous Layering*. Proceedings of the NATO Advanced Research Workshop, Narsarsuaq, South Greenland, 1986. NATO ASI, Series C, Vol. 196. Reidel (Dordrecht, Holland), 1987, xxiv + 666 pp. Price Dfl.280.00 (£98.00; \$124.00).

The last twenty years have seen much progress in the understanding of crystallisation in magma chambers. In the field of igneous layering 'Layered Igneous Intrusions' by L. R. Wager and G. M. Brown (1968) for long was the Bible. Since then, many resources have been devoted to experiments and field observations of igneous layering, resulting in a plethora of theories to account for the phenomena. This timely book offers a very broad presentation and discussion of igneous layering ranging, on the one hand, from thorough descriptions of features in ultramafic to extremely evolved magmatic rocks to, on the other hand, mathematical and experimental modelling of the crystallisation of magmas in chambers. Many of the foremost researchers in the field have contributed and present summaries, updates and new data.

Not being a text-book it is hardly surprising that much difference in interpretation of similar textures is evident. In fact, the book clearly illustrates the diversity and dynamism of the research effort in this field, as well as the contrasting views on the significance of processes such as crystal settling and diffusion. A major quality of the book is the wide range of views and methodologies. Of 20 papers by 36 authors, the leading eleven include detailed descriptions of field relations. These chapters are very well illustrated. Major papers are on the Klokken Intrusion by Parsons and Becker and the Fongen-Hyllingen Intrusion by Wilson *et al.* The latter paper, in addition to the field relations and mineralogical data, has a geochemical approach. In a comparison of the Duke Island peridotite and the Skaergaard Intrusion, Irvine presents an extensive discussion of *in situ* crystallisation, sedimentation processes and secondary reactions in relation to the field relations. Naldrett *et al.* give a very comprehensive and interesting review of the PGE geochemistry and the petrogenesis of the stratiform PGE deposits of the Bushveld and Stillwater layered intrusions.

The remaining nine papers deal with experimental and theoretical approaches to igneous layering. Sparks *et al.* discuss the usefulness of

experiments with aqueous solutions. McBirney offers the mechanism of constitutional zone refining, whereby intercumulus liquids travel scavenging up the temperature gradient. Hunter as well as Petersen theorize on the interstitial melts, while Tait and Kerr present experimental results on these.

Finally, Irvine in two appendices provides lists of terms for layered intrusions and processes involved in their development. This book is a very welcome contribution which may prove to be a new Testament to those involved who regarded Wager and Brown's book as the old.

P. M. HOLM

O'Donoghue, M. *Gemstones*. London (Chapman and Hall Ltd.), 1988. xiv + 372 pp. Price £37.50.

The first seven chapters deal successively with formation of gemstones, their crystal structure, the simple and sophisticated methods of testing, the origins of their colours, how they are fashioned, and finally some aspects of gems in commerce. In 120 pages an in-depth treatment of each of the above topics is not possible, but the author manages nevertheless to provide a remarkably comprehensive and up-to-date survey of the current knowledge in these fields.

Nearly half the book is devoted to the descriptive sections on inorganic and organic materials, and again, the text is concise and relevant to the materials currently on today's markets. Where a vast amount of information is available, as it is for beryl, a summary is given and the reader is very properly referred to 'Emerald and other beryls' by John Sinkankas (1981) if more detail is required. This illustrates also a feature to be welcomed by serious students and researchers and lacking in previous major books on gemstones—namely that of providing comprehensive references to species description, and a 10-page bibliography is given just before the Index.

Chapter 10 deals with synthetic and imitation stones and in particular their methods of growth and the identifiable features resulting thereby. This is followed by eight pages of identification tables listing the constants of the commoner gems and including those of some minerals not normally associated with gemmology.

At £37.50 the book is not cheap but although it is not as historically comprehensive as (the more expensive) Webster/Anderson it is more up-to-date. It is written in a lively and stimulating style and is a most appropriate book for the serious student of gemmology.

R. R. HARDING