

With the desperate need for conservation of geological and mineralogical sites in Britain, the use of explosives should be considered completely unethical. For the section in chapter two, dealing with explosives, to fall into irresponsible hands is unthinkable.

In spite of these criticisms the book has much to offer. The nine chapters take the prospective mineralogist, in an easily readable and practical manner, through the planning of a mineral collecting excursion, the use of tools, how rocks and minerals are formed, collecting techniques, the curation of material acquired, and finally suggestions for the disposal of excess acquisitions. With the rapidly increasing value of mineral specimens, chapter nine, which deals with this latter aspect, should help the young collector towards a better understanding of the value of his collection. Throughout the text figures are excellent and self explanatory.

In view of the current dearth of curatorial literature in the geological field, the book should provide the budding mineralogist with a valuable outline on preservation techniques; cataloguing; labelling and storage and their accompanying problems. The question of 'pyrite-rot' could have been dealt with more fully and the new and much more efficient techniques in the use of bacterial inhibitors explained.

This is a book written by a man who has obviously experienced the conditions and circumstances, used the tools, and applied the techniques he writes about.

R. J. KING

NEWALL (G.) and RAST (N.), editors. *Mechanism of Igneous Intrusion*. Liverpool (Seal House Press), 1970. xii + 380 pp., 118 figs. (4 coloured), 24 pls. Price £7.00.

This book, which forms Special Issue No. 2 of the *Geological Journal*, is a collection of 21 articles, which were delivered as lectures at a Symposium held in 1969 in the University of Liverpool. In the preface the editors state that the theme of the book is 'the physical conditions of initiation, ascent and emplacement of magmas, at various levels of the Earth's mantle and crust'. However, there are chapters on experimental model studies and rock mechanics. The subject-matter has been divided up into 6 parts: Part 1, Introduction; Part 2, Field aspects of igneous complexes (5 contributions); Part 3, The form and emplacement of igneous intrusions (5 contributions); Part 4, Experimental data and the generation of magma (5 contributions); Part 5, The theory of magmatic ascent and emplacement (4 contributions); Part 6, A discussion summary.

In the introductory article, E. K. Ustiyev describes the geological relationships between volcanism and plutonism during the evolution of various orogenic belts of the U.S.S.R. and adjacent areas.

A. C. Dunham discusses three specific problems in considering the emplacement of the Tertiary igneous complex of Rhum, these being the emplacement of the layered ultrabasic rocks, the emplacement of the granophyres and felsites and their structural and genetic relationship to the ultrabasic rocks, and, thirdly, the reason why there is an igneous complex situated on Rhum. A description is given by C. J. Stillman of the sequence, form, and mode of emplacement of the various intrusions comprising

the Northern Ring Complex, Nuanetsi Igneous Province, Rhodesia. Also, there is a discussion on certain regional aspects concerning the Karroo igneous activity of this area. For part of the Galway Granite (Ireland), J. W. Aucott has, by means of a detailed examination of the textural and geochemical variation, gamma activity, and structure, been able to determine a sequence of magmatic and tectonic episodes. The conclusion is reached in a paper by D. Bridgwater and K. Coe that the principal mechanism for the emplacement of four syeno-gabbro giant dykes ('elongate discontinuous bodies') from Isortoq, south Greenland, was stoping even though remarkably few inclusions are present. Also from Greenland there is a most interesting description given by B. F. Windley of primary dolerite/garnet-amphibolite dykes. Their geological setting, internal structure, rock types, modal variation, and chemical composition are given. It is proposed that in a syn-kinematic environment a hydrous basic magma would initially crystallize as a hornblende-quartz dolerite and that later magma, because of sufficient stress and high water pressure, would crystallize in the central part of the dykes as foliated garnet amphibolite.

To ascertain the structure of the lower crust beneath the Armorican granites of S. W. England, M. H. P. Bott, A. P. Holder, R. E. Long, and A. L. Lucas carried out an off-shore seismic refraction experiment. Their results indicate that the granites grade downwards into the lower crust, which beneath the batholith is 23–30 km thick, the granite magma being due to partial fusion of the lower crust. A summary of the mineralogy, petrology, and tectonic history of the basic and ultrabasic rocks of Connemara, Ireland, forms a chapter by B. E. Leake. He describes methods used to determine the way-up of these masses, which represent parts of a larger mass, which was syntectonically emplaced, deformed, and broken-up. In a review essay, W. S. Pitcher describes, mainly with Donegal examples, that aspect of the internal structure of granite plutons now known as ghost stratigraphy. It is stressed that the presence of this structure is rarely evidence for a metasomatic replacement origin, stoping and 'sheeting of magmas' being more likely explanations. By studying the lava sequences and a plexus of intra-volcanic intrusions on Réunion, B. G. J. Upton and W. J. Wadsworth are able to suggest an evolutionary sequence for the form and structure of a sub-volcanic magma chamber. This part of the book is concluded by H. Tazieff who discusses the mechanism whereby an ignimbrite sheet could either be of lava flow origin, or, more likely, of pyroclastic flow origin.

For ascending basic magma, B. G. Jamieson erects a model, based mainly on the synthetic system Di-Fo-silica, of magmatic evolution that takes into account polybaric, polythermal crystal-liquid relationships. In an article by D. K. Bailey there is presented an hypothesis to account for the alkaline and volatile-rich magmatism of the stable continents. He suggests that regional uplift and rifting would produce zones of de-gassing in the mantle, and that the upward migration of volatiles would result in heat-transfer causing partial melting of the mantle and deeper crust. The concept of plutonic and volcanic associations is brought up to date in an interesting paper by P. G. Harris, W. Q. Kennedy, and C. M. Scarfe. These authors consider the influence of chemical composition, in the light of recent experimental work, on the mode of occurrence of igneous rocks. They conclude that in addition to the plutonic

and volcanic associations there may be a third, the diatremic association, consisting of kimberlites and lamprophyres found in dykes and diatremes. An evolutionary sequence outlining the method of generation and ascent of granitic magma to form a batholith is given by W. S. Fyfe. He considers that such granitic liquids, which are often deficient in water, are produced by partial fusion of dry, high-grade metamorphic rocks; the liquid collecting together to form drops (3–7 km radii), which move upwards due to buoyancy. A chapter, which the reviewer considers to be out of place in this volume, by J. M. Ade-Hall and E. A. Lawley describes and discusses the differences in opaque mineralogy between Tertiary Icelandic basalt lavas and dykes from Mull.

It is a pity that S. A. F. Murrell did not devote the whole of his contribution to rock mechanics, rather than embark on an elementary account of global tectonics. An article by J. W. Elder is mainly concerned with quantitative studies of dynamical models, in particular penetrative convection as it might occur in the mantle, to account for the origin or sources of some of the processes that ultimately lead to intrusion. One of the most stimulating chapters, and undoubtedly the redeeming feature of Part 5, is by H. Ramberg who describes the results of centrifuged model experiments that were constructed to simulate the intrusion of plutonic bodies. To illustrate some of the results there are 14 excellent plates, comprising 40 photographs. Those who have mapped in detail igneous complexes and the adjacent country rocks will closely study these photographs to ascertain the extent to which the models imitate known geological structures. J. L. Roberts considers from a theoretical aspect the mechanics of the intrusion of magma into brittle country rocks. Doubt is cast on the value of this chapter in that the interpretation given to the complexes quoted by the author, to substantiate his theoretical models, may not always be the correct ones. Also, some of his conclusions, in particular about dyke swarms, are not endorsed by field observations.

The final part of the book consists of a discussion chapter by N. Rast. In it he not only summarizes, under the headings of initiation, ascent, and emplacement of magmas, the papers and any pertinent points made in discussion by various people at the Symposium, but adds some of his own views.

The standard of production and printing of this book is good, there being very few typographical errors. Also, the diagrams and the photographs that form the plates are of high quality. Unfortunately, the price is high, which puts it out of the range of the average undergraduate, who would benefit by reading it.

The reviewer enjoyed reading this book and thoroughly recommends it to others, for, by and large, the theme as stated by the editors has been adhered to. However, the point that blatantly emerges is the lack of numerous, quantitative studies on the form and structure of igneous complexes and their country rocks. R. R. SKELHORN

KLEBER (W.) *An Introduction to Crystallography*. Berlin (VEB Verlag Technik), 1970. 366 pp., 361 figs., Price £3·80.

This is a well-established textbook that has gone through 10 German editions in 15 years and is now published for the first time in English. It is written mainly for