$NaAlSiO_4$-$KAlSiO_4$-SiO_2 in which a ternary eutectic is shown at the junction of the fields of nepheline, feldspar, and leucite. In 1928, before this system had been studied experimentally, Bowen reasoned that this point should be a reaction point. When the phase diagram was first published by Bowen and Schairer in 1935, it showed a minimum on the nepheline-feldspar field boundary and the invariant point thus has to be a reaction point. Schairer (1950) omitted the arrow showing the minimum because he could not detect a difference in temperature between the supposed minimum and the invariant point, because of the difficulty of crystallizing the melts. Most subsequent authors have replaced the arrow because Bowen (1954) did so, as did Schairer (1957), and because in the system with water present it can readily be seen that the invariant point cannot be a eutectic. It seems unfortunate that this diagram continues to be copied in Schairer's version, which does away with the 'pseudoleucite reaction point' of Bowen.

On first reading the list of authors, the thought that came to the reviewer's mind was that there might be an analogy between the production of this book and that of a film in which there are a number of stars in the cast—such films tend to be disappointing if not financial failures. This book will not be a financial failure because publishers do not pay their writers well enough. What is disappointing is the very incomplete coverage of the igneous rocks and one can hazard a guess that one or two of the stars chosen for the cast did not put in an appearance.

Before the Second World War, only a few geology departments in the world would be sufficiently enlightened to recommend Bowen's book to their students so that it was published perhaps twenty or thirty years ahead of its time. At present no one could produce a useful book on any branch of petrology without reference to experimental studies. The situation is so changed that it is difficult to see how a sequel to Bowen's work could be produced. Nevertheless the aim was a worthy one; only time will tell how far the editors and authors have succeeded.

W. S. MACKENZIE

Yoder (H. S., Jun.). *Generation of Basaltic Magma.* Washington (Nat. Acad. Sci.), 1976. xii + 265 pp., 118 figs., 2 coloured pls. Price $8.25 (cloth), $5.50 (paper).

In 1972 the National Academy of Sciences of the U.S.A. awarded the first Arthur L. Day Prize and Lectureship to H. S. Yoder, with the stipulation that he should prepare this book. Those who are familiar with the author's distinguished research career might be forgiven for fearing that his views on basalt genesis would be a tangle of tie-lines and tetrahedra. Far from it, the book is extremely broadminded in its approach to the subject. The tetrahedra are well represented but they are interwoven with sections on topics as diverse as volcanic plumbing, the origin of the earth, mantle geophysics, the thermal and dynamic requirements for mantle fusion, physicochemical constraints on melting, behaviour of rare-earth elements during basalt genesis, tectonophysics of melt accumulation and uprise, and the periodicity of volcanism.

The combination of Yoder's lucid prose and careful assessments of competing hypotheses with a low purchase price should make this book a 'must' for petrologists and most final-year geology undergraduates. The standard of production is as high as we have come to expect from all major Geophysical Laboratory publications, with abundant diagrams and a meticulous index.

As it is inevitable that this volume will play a major role in petrology teaching for many years to come, it should be stressed at the outset that this is not a textbook. To use Yoder's words in his preface, 'it would be an understatement to say the points of view are somewhat controversial'. He requests 'very critical analysis of each argument' and deserves this in many cases. For instance, Chapter 7 re-emphasizes Yoder's long-held view that the one-atmosphere phase relationships in Fe-free haplobasaltic synthetic systems adequately explain the compositions and relative abundances of erupted basalts. Hence, he perpetuates the peculiar idea that the three 'parental' magmas amongst basalts contain the mineral assemblages olivine/plagioclase/Ca-rich pyroxene/Ca-poor pyroxene or olivine/plagioclase/Ca-rich pyroxene/nepheline or olivine/Ca-rich pyroxene/nepheline/melilite. Basalt with the assemblage olivine/plagioclase/Ca-rich pyroxene lies on a thermal divide in Yoder's scheme and it is clear from his text (pp. 128–31; especially footnote 1 on p. 130) that he does not regard this to be a quantitatively significant variant. Perhaps those petrologists investigating ocean-floor lavas, Iceland, the vast flood-basalt provinces, and countless other major occurrences would like to send the author a few thousand thin sections, to convince him that this is by far the most abundant terrestrial basalt type.

A final point to watch carefully is forewarned by another remark in the preface: that the reader 'should withold judgement on an issue until completing the book . . . persuasive arguments in one section may be countered with equal vigor in another'. For instance, the popular concept that basic magma genesis frequently occurs by decompression melting during adiabatic upward convec-

tion in the mantle is denigrated on p. 65, only to be accepted again on p. 204. This writing technique may be fun for the author and make the book very stimulating over all, but it is lethal for the hurried lecturer or sloppy student (or vice versa); beware!

R. N. THOMPSON

Mitchell-Thomé (R. C.). *Geology of the Middle Atlantic Islands* (Beiträge zur Regionalen Geologie der Erde, Band 12). Berlin and Stuttgart (Gebrüder Borntraeger), 1976. x+382 pp., 102 figs. Price DM. 198·00.

The area covered by the title—and by the term Macaronesia used in this book—includes the archipelagos of the Azores, Madeira, the Canaries, the tiny archipelago of Selvagens [Salvage Islands] between Tenerife and Madeira, and the Cape Verde Islands further to the south.

Because of their relative isolation, combined with their petrological interest, work on these islands has appeared not only in Portuguese and Spanish literature but even more widely in books and journals published in other European countries. Although several authors have described the geology of individual islands, notably the Finnish geologist Hausen who produced monographs on each of the main islands of the Canaries, the literature is otherwise widely scattered between official survey documents, volcanological records, congress reports, and the scientific periodicals of half-a-dozen countries in almost as many different languages. The author has thus done a great service in collecting together, reviewing, and condensing all the available geological data. In general the references are to around 1973 but there is an addendum bringing these up to mid 1975.

All are volcanic islands, with volcanism still active in the Azores, the Canaries, and Cape Verde Islands. Alkaline rocks predominate, with phonolites, trachybasalts, and trachytes in the Canaries and a tendency to a less alkaline character in the Azores, which have abundant basalts, andesites, and dolerites. The whole range of volcanic morphology is well displayed, including vast areas of ignimbritic material; dyke swarms proliferate in several islands, and plutonic xenoliths are locally abundant. The Spanish word 'caldera' (cauldron) is believed to have first entered the geological vocabulary when von Buch used the term during his visits to the Canaries in the early nineteenth century: the calderas of Las Cañadas on Tenerife and Taburiente on La Palma being particularly well known. The author is at pains to point out that some Mesozoic and Tertiary sedimentary rocks do occur and even contain fossils, but in general it is the volcanic features that dominate the geology and the whole life-style.

There are few geological items of economic importance (building stone, ceramic clays, salt); water is perhaps the most precious resource. One is struck by how little seems to have been done to utilize geothermal energy, although a study has been made of the Montañas de Fuego–Timanfaya area (Lanzarote) where at a few metres depth temperatures of up to 360 °C are encountered over an area of some 200 km^2, the heat focus being apparently a magma chamber at perhaps 4000 m depth (Arana and Fuster, *Estud. Geol.* **29**, 281, 1973).

It is immensely useful to have all available rock analyses for the various igneous complexes of this whole area assembled together in one volume together with notes on petrography and historic volcanicity, but it is equally useful to have the abundance of black-and-white geological maps of each of the main islands. It is clear that there is a lot of detailed mapping still needed and that a host of geological problems exist including plenty for the geochronologist and geophysicist, as well as the mineralogist and petrologist. Speculation on the exact place of these islands within the framework of global tectonics and in the history of the development of the North Atlantic is perhaps premature; indeed, the author entitles his last chapter 'Caetera desunt' (the remainder is wanting). This book reviews and reports but in general refrains from speculation.

R. A. HOWIE

Greenwood (H. J.), editor. *Short Course in Application of Thermodynamics to Petrology and Ore Deposits.* Vancouver (Mineralogical Association of Canada), 1977. xiii+231 pp., 64 figs. Price $7·50.

This is the handbook that accompanied a three-day short course on thermodynamics held before the April 1977 M.A.C. meeting. It follows an earlier M.A.C. short course on Microbeam Techniques, and courses on Sulfides, Feldspars, and Oxides held by the Mineralogical Society of America. The contents are listed in M.A. 77-3958, and they include fifteen chapters written by a total of ten authors. Three main topics are represented. Chapters 13 to 15 deal with the derivation of thermochemical data, errors in thermochemical calculations, and methods of checking the internal consistency of phase equilibrium results. Four chapters (6 and 10 to 12) are concerned mainly with the application of thermodynamic methods to practical problems. The remaining eight chapters are less applied, although many mineral reactions are used to illustrate the principles involved.