FRONDEL (JUDITH W.). *Lunar Mineralogy*. New York and London (John Wiley & Sons), 1975. x+323 pp., 100 figs. Price £11·75, $23.50.

It is now about seven years since the first man landed on the moon in the Apollo programme. Nearly 400 kg of lunar rock has been brought to Earth and publications on a wide variety of physical and chemical properties of lunar specimens have appeared throughout the scientific literature and in the accounts of annual Lunar Science Conferences. Gradually, from this work, a better understanding of lunar history and processes is emerging, though many of the fundamental questions remain to be answered. Equally significant are the intensity with which lunar minerals have been studied, the potential importance of this to mineralogy in general, and the stimulus that has been given to the subject. Thus both for lunar and terrestrial mineralogy, Judith Frondel's book performs a very valuable service.

The book is a development from two editions of a Glossary of Lunar Minerals, compiled as an aid to Principal Investigators in the Apollo Programme. It now contains summaries of the occurrences and descriptions of all the minerals found in Apollo 11 to 17 and in the Soviet Luna 16 and 20 samples, and has a very comprehensive coverage of references to the literature. The mere collection of this work on about sixty or seventy mineral species is a difficult task, but the author has also managed to produce a narrative tying together scattered observations and distilling conclusions of mineralogical and petrological significance.

For each mineral species there are sections dealing with synonymy, occurrence and form, optics, chemical composition, and X-ray diffraction data. For many minerals the peculiar lunar environment has imposed rare features—extreme compositions, low oxidation states, unusual morphology, shock effects—and in some conditions, a completely new mineral has resulted. These are all described, as are also a number of minerals for which there is at least some probability that they are contaminants introduced during the investigations; since nobody can be quite sure, it is therefore entirely appropriate to list them. An introductory chapter gives a useful short account of the geology of the Moon and a comparison of lunar and terrestrial mineralogy. The book is liberally illustrated by the highly photogenic lunar specimens as seen by transmitted or reflected light or by transmission or scanning electron microscope.

This book comes as the right time and can be recommended to mineralogist and petrologist researchers whether or not they are involved with lunar samples.

J. ZUSSMAN

SHELLEY, D. *Manual of Optical Mineralogy*. Amsterdam, Oxford, and New York (Elsevier Sci. Publ. Co.), 1975. xiv+239 pp., 133 figs., 1 coloured pl., 25 tables. Price: cloth Dfl. 65.00 ($26.95); hard Dfl. 85.00 ($35.50).

Optical mineralogy very properly forms a major part of most university courses in geology and is a prerequisite for petrography. In this text the author has successfully combined data on the properties of minerals with descriptions of those aspects of crystallography, the polarizing microscope, the optics of anisotropic materials, and

necessary laboratory techniques that are required for their proper study. The emphasis throughout is on the practical use of the optical techniques, and only the bare essentials needed to understand the inter-relationships of optics and crystallography are given. Nevertheless there are clear expositions of the biaxial indicatrix and interference figures and useful sections of the interpretation of interference figures, orientation diagrams, and the universal stage. This part of the text ends with a series of ten determinative tables, ranging from minerals listed in order according to their refractive indices to minerals that commonly display anomalous interference colours.

The chapters on principles and techniques occupy almost 100 pages: the remainder of the book is devoted to mineral descriptions. Here there is a fairly standardized format with details of optical properties, orientation diagrams, occurrence, and distinguishing features. The text throughout is well illustrated with a nice blend of text-figures and photomicrographs. A Michel-Lévy interference colour chart is bound in at the end of the book.

The over-all impression is one of a crisp practical approach to this facet of determinative mineralogy and the book would be unhesitatingly, indeed enthusiastically, recommended but (and it is a big but) for the price. The text has been typewriter-set, a style perhaps acceptable if it reduces the cost, and admittedly there are many diagrams, but a price of over £15 is so far beyond the range of the average student as to render this book inaccessible to its major market. Nor is this a book for libraries—it is essentially a laboratory manual—and one can but recommend one of the several cheaper well-established alternatives available. R. A. HOWIE

ALLÈGRE (C.-J.) and MICHARD (G.). *Introduction to Geochemistry.* Dordrecht, Holland, and Boston, U.S.A. (D. Reidel Publ. Co.), 1974. xii+142 pp., 85 figs. Price cloth Dfl. 50.00 ($19.00); paper Dfl. 32.50 ($12.00).

This is designed as an undergraduate textbook on geochemistry; it was first published in French in 1973 and has now been translated into English with a few additional figures and paragraphs.

After an introductory chapter, considering the Earth as a chemical system, there are chapters on the equilibria of phases in the lithosphere and in the hydrosphere: the former although essential for the general plan of the book will bring little new to petrologists, but the latter will be of interest to all geochemists. The second half of the book turns to topics of wider geochemical interest, dealing first with the geochemical fractionation of trace elements—mainly with the behaviour of trace elements in magmatic processes but also covering the entrapment of trace elements in sediments. The consideration given to partition coefficients is rather meagre, but the differentiation of the rare earths is expounded clearly and the crystal-field theory is touched upon. The chapter dealing with irreversible processes of element transfer relies very much on the work of Helgeson to unify the principles of mineral equilibria with the behaviour of solutions, and continues with the concept of residence time (the box model) and chemical diffusion-reaction coupling. The transference of elements in a non-equilibrium state is illustrated by the development of manganese nodules on the ocean-floor.