sum (e.g. percentages). This is a perennial problem, which particularly faces petrographers concerned with modal proportions of minerals in rocks and geochemists preoccupied with chemical analyses of minerals and rocks, and both when they try to relate mineral compositions and proportions to rock compositions.

Although this is a book based on lectures given to students in two university geology departments and claimed to be written for students, the mathematics will certainly confound most students of geology—and their teachers also. It is most abstrusely written from the very first paragraph where r and ρ are introduced without any definition or explanation (also λ on p. 8, δ on p. 9, and C on p. 11). Clearly a sound knowledge of elementary statistics is assumed. If the author had made explicit reference to more actual petrological or chemical situations in deriving his general equations, the significance of the conclusions—which are not very many or positive—would have been more readily apparent. As it is, the reader is generally left to imagine a geological problem to which the discussion could be applied. The whole text only cites eight examples of petrochemical problems and although some of the suggested exercises are some help, as a teaching manual it fails dismally. A final chapter summarizing the conclusions and suggesting where petrologists now stand could have been particularly helpful.

Most surprisingly, no reference is made to the work of Vistelius or even Miesch (particularly A. T. Miesch 'The constant sum problem in geochemistry' *in* Computer Applications in the Earth Sciences, Plenum Press, 1969) and although Chayes has tried to answer Miesch's criticisms of the Chayes–Kruskal test elsewhere, the main criticism by Miesch appears to be valid.

This book may help us to rationalize our delusions and realise the assumptions and uncertainties inherent in many commonly accepted procedures but it gives us little to use in the place of these procedures. I acknowledge helpful comments from Drs. Atkinson and Howarth.

BERNARD E. LEAKE

KORZHINSKIĬ (D. S.). *Theory of metasomatic zoning*. Transl. from the Russian by Jean Agrell. London (Clarendon Press: Oxford University Press), 1970. vii+162 pp., 45 figs. Price £2·50.

Those of us who live in the world of petrology always welcome a translation of the works of a leading Russian colleague and even more when a good translation rapidly follows the first Russian edition. Certainly we are most interested in another work from D. S. Korzhinskiĭ, for in the past he has many times stimulated consideration of important problems.

To those of us familiar with the works of Korzhinskiĭ the title of the book is no surprise. Korzhinskiĭ has been fascinated for a long time with this subject: 'Metasomatic rocks commonly show a more or less regular zoning, each succeeding zone being of different mineral composition. The boundaries between these zones are usually sharp' (page 1).

For some time I have been just a little critical of Korzhinskiĭ's former treatments of metasomatic events (surely the result of diffusion processes) in terms of classical

thermodynamics (a subject that does not concern itself with mechanisms but only states) and hence breathed a sigh of relief when on p. 13 the first velocity or rate parameter appeared. At least now chemical potentials were to be mixed in equations with rate coefficients. 'On the other hand, the principle of differential mobility of components that is so clearly manifested in metamorphic and metasomatic processes has necessitated the development of a kinetic model to demonstrate the conditions for this differential mobility' (p. 1).

Essentially the book is a theoretical or model analysis of two limiting cases of metasomatism termed diffusion and infiltration metasomatism. 'In pure diffusion metasomatism, material is transferred by diffusion through stationary pore solutions. . . . Incomparably more effective are infiltration metasomatic processes, in which the components are transferred by a stream of aqueous solutions percolating through pores in the rocks' (p. 3). The book is divided into five chapters: the general introduction and definitions, isothermal infiltration systems, infiltration with a temperature gradient, diffusion zoning, and geological conclusions. The last chapter is perhaps smaller than one might have hoped. The treatment is basically an ideal model treatment developed to show how zoning originates and could be a useful introduction to students interested in the field.

I am always worried about equal volume processes or assumptions. How does one prove the statement (p. 6) 'Metasomatism usually occurs without any change in the volume of a rock, as indicated by the preservation of relicts of the rock structure and of the form of minerals in pseudomorphs'. How does one know the pseudomorph had the same volume even if they had the same shape? I am always reminded of the beautiful experiment where a copper ball is oxidized and ends up as a copper oxide ball with a hole in the middle! Surely all metamorphic events are to some degree metasomatic. The vast volumes of fluids involved in regional metamorphism dissolve and deposit along P–T gradients and yet regional metasomatism is not equal volume. Surely the cases of perfect zoning, equal volume, are only interesting limiting cases compared to the large scale events!

I was particularly interested in discussions at various places in the book on 'differential mobility' or filtration effects. This topic is concerned with the different velocity of migration of components during solvent flow through rocks. Clearly a great deal of work on this significant subject is being conducted in the U.S.S.R.

There are many points in the book where one could start a long argument. For example, I consider the statement (p. 16) 'For ores to be deposited, the chief requirement in my opinion is an alteration in the acidity of the solution' far too general. There are vital cases where acidity is not the controlling feature and at high temperature, when chemistry tends to become molecular, I often wonder what 'acidity' means. Often, too, we face a chicken and egg situation and few would deny that changes in wall-rock chemistry or oxygen partial pressure are often as significant as acidity in this context.

In conclusion I think that this book will be of value to those whose interest is developing in the subject. But frankly I was disappointed. The treatment is far too 'idealistic' and there is too little quantitative discussion of examples on the ground.

I must compare this treatment with developments in the theory of chemical transport reactions by physical-inorganic chemists. The problems, the variables, are similar, but I think modern quantitative chemical treatments are more advanced and probably more useful even geologically.

W. S. FYFE

LIPSON (H.) and STEEPLE (H.). *Interpretation of X-ray powder diffraction patterns.* London (Macmillan) and New York (St. Martins Press), 1970. viii+335 pp., 129 figs., 3 pls. Price £4·00.

This book is a revised edition of that part of the earlier text *Interpretation of X-ray diffraction patterns* by Henry, Lipson, and Wooster (M.A. **11**–357, 15–87) dealing only with powder methods. Although powder methods may be of less fundamental significance than single-crystal methods, they are of considerable importance in determinative mineralogy and this text will be of use to mineralogists as well as to X-ray crystallographers. For the former perhaps the most useful section will be the chapters on the interpretation of powder photographs and on the accurate determination of cell dimensions. These chapters have been considerably expanded over those in the previous editions and now include details on the techniques of assigning indices in the monoclinic and triclinic systems, Ito's procedure for transformation of axes, various graphical methods of indexing, and an important section on checking the validity of a result. A new feature is the inclusion of a new 20-page section of problems and their solutions, whose completion should ensure a thorough grasp of space groups, the problem of selecting suitable radiation, and the determination of cell parameters. This new version of part of a well-established text-book will be welcomed widely.

R. A. HOWIE

ANDERSON (B. W.). *Gem Testing* (eighth edition). London (Butterworths), 1971. xiv+384 pp., 129 figs., 5 colour pls. Price £7·00.

In the latest edition of this well-known book, the text has been brought completely up to date and the section on the detection of synthetic and imitation stones has been enlarged to include the more important of the recently developed man-made materials. As before, the emphasis is full practical instructions, based on the author's considerable experience, with the provision of just enough theoretical background to allow intelligent use to be made of the observations. In view of the increasing number of simulants with high refractive indices, a useful innovation in this new edition is a description of the direct measurement method of determining the refractive index of stones that have values for this property above the range of the refractometer; any microscope with an accurate scale measuring the amount of vertical movement of the body tube will serve. The arrangement of the text is generally as before, with the early chapters dealing with principles and techniques and chapters 10–26 devoted to the major gems and the natural and synthetic materials resembling them. The importance of fluorescence as an aid to identification is recognized by its inclusion as a separate chapter