Hutchinson, R. W., Spence, C. D., and Frankin, J. M., eds. *Precambrian Sulphide Deposits* (H. S. Robinson Memorial Volume). Waterloo, Ontario (Geol. Assoc. of Canada; Special Paper 25), 1982. viii + 791 pp., 232 figs., 152 pls., 1 map. Price (non-members $57 (+ $2.50 postage and handling).

This special volume contains twenty-three papers covering a wide variety of Precambrian sulphide deposits.

Four pages outline the regional geological and metallogenic framework of various portions of the Precambrian shield of North America, and these are followed by eighteen papers covering case histories of individual sulphide deposits. Each of these papers has been abstracted [MA 83M/4256, 4269–73 and 4305–21].

In the concluding review paper, Dr Hutchinson reviews the contributions of the other papers. The understanding of the genesis of Precambrian sulphide deposits has changed markedly during the past twenty years. The timing of the metalliferous hydrothermal fluids is now generally believed to have been syn-depositional (or only slightly post-depositional) rather than epigenetic. Sulphide emplacement was by chemical precipitation on the sea-floor, diagenetic reaction within already deposited sediment, or sub-sea-floor infilling of pores, rather than by large-scale replacement of rock. Hydrothermal fluids were generated mainly be deep convective circulation of marine or meteoric waters rather than by magmatic differentiation.

This authoritative and up-to-date account of many recently discovered deposits expresses their wide range in both type of environment and through time, from the earliest Archaean to latest Proterozoic. It forms a welcome addition to our knowledge of these important sulphides deposits and should find a place in all libraries dealing with economic geology.

R. A. Howie

Steadman, R. *Crystallography*. New York and London (Van Nostrand Reinhold), 1982, viii + 120 pp., 125 figs. Price (paperback) £3.95.

This excellent little book will be welcomed by any student of solid-state science who is meeting this, often battling, subject for the first time. The author states that his aim is 'to convince students that crystallography is based on a few simple ideas which are very easily understood'. This he does with commendable clarity. The style is informed and reassuring; the illustrations are simple and clear. There are numerous worked examples and excerises. I found commendably few errors (typographical or otherwise), though, unfortunately, one I did spot was the answer to a problem (on p. 7 the first lattice said to be centred rectangular is actually oblique).

Dr Steadman begins each section by summarizing what is to follow and, after each topic has been covered, the important concepts are reiterated. It is the simple formula that new lecturers are encouraged to use: tell them what you are going to say, say it, then say it again. But how often is it used in a book (or lecture for that matter)?

Section 1 introduces the concept of the lattice and its relation to crystal structure by means of many excellent two-dimensional examples. The three-dimensional lattices and the seven crystal systems are discussed from the point of view of the shape of the unit cell, but without using examples of simple structures at this stage.

Sections 2 and 3 cover planes, directions, and their nomenclature. Miller indices are defined as the number of intercepts the family of planes makes of each axis. However, the author does not point out that if, for instance, $h = 3$ then the first plane from the origin cuts the $x$ axis at $a/3$. This information would, I think, help the student to draw the three-dimensional planes on p. 35.

Section 4 is entitled 'Atomic co-ordinates'. Some simple structures, e.g. Cu, Mg, CsCl, ZnS, NiAs, are described, and their lattice types are deduced. The description of atomic positions by co-ordinates is explained together with their representation as two-dimensional projections.

Section 5 very clearly explains X-ray powder diffraction and the powder camera, though, curiously, Dr Steadman assumes that students have already met the Bragg Law and it is not derived. Fourteen powder patterns are illustrated, either as examples or exercises.

Section 6 is a lucid exposition of the reciprocal lattice and its relationships to the Bragg Law. Electron diffraction is covered in Section 7; thirteen actual patterns are illustrated. The student is shown how to index them if $\lambda L$ is known and the measurement of $\lambda L$ itself is described. Finally, the relationship between the diffraction pattern and the image in the microscope is explained, though diffraction contrast in the electron microscope is not covered.

The content of this book is so laudable that I am a little reluctant to criticize it. However, the print of the text could have been larger and clearer and, if the paper (in the paperback edition) were thicker one would not have to look at three diagrams at once! As a mineralogist I was surprised to learn that 'it is highly unlikely that you will ever meet [examples of forms in other systems than cubic]' (p. 38). For the student of mineralogy inclusion of the stereographic projection, symmetry, and point groups would have been useful. Perhaps Dr Steadman would consider writing a sequel?

P. E. CHAMPNESS

Bollman, W. *Crystal Lattices, Interfaces, Matrices: An extension of Crystallography.* Geneva (Bollman), 1982. viii + 360 pp., 109 figs. Price SFr. 70 (available from 22 Chemin Vert, CH-1234 Pinchat, Geneva, Switzerland).

Although this book was published privately by a distinguished scientist because a commercial publisher would not take the risk, a potential buyer should not worry about the quality of the book. This is essentially a tutorial work-book on the mathematical basis of O-lattice theory. Consider two perfect crystals, not necessarily of the same type, meeting at an interface. The geometrical misfit between the lattice nodes provides the simplest possible guide to the energy at the interface, and can be used in understanding the textures of polycrystalline metals and of mineral intergrowths.

This book develops the mathematical theory of the misfit geometry between two lattices, and provides questions and exercises to test a reader. The flavour can be obtained from three quotations: 'The primary O-lattice is the O-lattice due to the deviation from the primary PS (preferred state), the single crystal state. Secondary O-lattices, due to the deviation from secondary PSs will be discussed later.' 'The O-lattice models describe boundaries as dislocation networks with the complete Burgers vector balance within the boundary.' 'This town of crystallography has a twin town, a mirror town, namely that of the reciprocal lattices. On the P-level (possibility level) there are the interpenetrating reciprocal lattices of the bi-crystals and the reciprocal O-lattices, and on the R-level (real level) are the actual diffraction patterns, obtained by the intersection of the Ewald sphere with the reciprocal lattice configuration.' Fifteen chapters cover crystal lattices and geometrical aspects (point lattice, structure matrix, reciprocal lattice, rotation, shear, mirror imaging, inversion, translation, etc.) in 110 pages; nine chapters cover interfaces, and applications to interface structure (primary O-lattice, choice of unit cells, etc., secondary dislocation networks, etc.) in 139 pages; thirteen chapters cover matrices and algebraic methods, (vector algebra, matrix operations, eigen values, etc.) in 100 pages. The style is mathematical but easy to follow because of full explanations. Minor criticisms are: absence of Cottrell (1953) and Read (1953) in the bibliography; absence of $\bar{3}$, $\bar{4}$, and $\bar{6}$ in Fig. 14/1; presence of spelling and other minor errors. I did not detect mathematical errors in selective reading.

All scientists interested in interface theory will wish to consult this book for possible purchase. They will also wish to set the book in the context of other theories for coherent and partly coherent phase boundaries in which strain energies are calculated (e.g. references in R. A. Yund's articles in *Feldspar Mineralogy*, ed. P. H. Ribbe, 1983).

J. V. SMITH

Jawson, M. A., and Rose, M. A. *Crystal Symmetry: Theory of Colour Crystallography.* Chichester (Ellis Horwood/Wiley), 1983. 190 pp., 85 figs. Price £18.50 hardback; £8·50 paperback.

This book from the Ellis Horwood Series in Mathematics and its Applications is theoretical in tone, and lacks detailed discussion of applications to crystals and minerals—indeed the only reference to a mineral in the index (diamond crystal) is incorrect! Nevertheless it is a useful book for crystallographers and mineralogists who have proceeded past the elementary stage, and wish to follow a formal and rigorous development of colour crystallography.

The subject headings are: Part I: Crystallographic Point Groups. 1. Symmetry Patterns, 2. Mathematical Formulation, 3. Cubic Symmetries, 4. Colour Point Groups; Part II: Space Lattices. 5. Lattice Geometry, 6. The Seven Crystal Systems, 7. Non-primitive Unit Cells, 8. Translation Groups; Part III: Space Groups. 9. Symmorphic (Bravais) Space Groups, 10. Screw Axes, 11. Principal and Secondary Screw Axes, 12. Glide Planes, 13. Diamond Glide, 14. The Colour Space Groups; Appendices.

Jawson and Rose start with crystallographic point groups and assume that $n = 1, 2, 3, 4$, and 6 because of a later theorem involving lattices. They do not consider general point groups. After a logical treatment with group theory, they derive the thirty-two classical crystallographic point groups and the fifty-eight colour ones; an important feature is the stereographic representation in black and red of the equivalent positions. The key relation between a lattice and rotation symmetry is given on pp. 69–70. Fig. 6.12 lacks perspective. Chapter 7 considers the simple forms of sphere packing as part of the development of face-centred cells. Colour translation operators are introduced in Chapter 8, and the colour Bravais lattices are given in Fig. 8.3. The authors introduce the term 'groupoid' to denote the set of space-group operators which interrelate all the equivalent positions of a motif pattern; this is the basis of their abstract development of space groups. Two-dimensional classical and colour space groups are listed in appendices 7 and 8, rather than being presented in Chapter 6. A thorough review would take at least one week