Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. O. Gould, Department of Chemistry, University of Edinburgh, West Mains Road, Edinburgh EH9 3JJ, Scotland). As far as practicable books will be reviewed in a country different from that of publication.

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Historical atlas of crystallography. Edited by J. LIMA-DE-FARIA. Pp. x + 158. International Union of Crystallography and Kluwer Academic Publishers, Dordrecht, London and New York, 1990. Price Dfl 69.00 or US $36.00 or £20.00. ISBN 0-7923-0649-X.

This is an unusual book, beautifully produced and packed with interest and information. It is an excellent resource book for the teaching of the history of crystallography.

It is the character of the book which is unusual. Its focal point is a set of novel displays of all the major crystallographic landmarks, plotted as a linear function of time: 'time-maps'. Hence the word 'atlas' in the title. The first of these displays, spread over a double page, maps the development of crystallography all-inclusively, from AD 1500 to the present date, with superposed blue, violet, green and red colourings to show up the distinction between geometrical, physical, chemical and structural crystallography. This main time map is followed by subsidiary maps, plotting (against time) geometric, physical, chemical and structure-determination crystallography in turn, in greater detail. A few relevant landmarks in related areas of physics have been included. The unique characteristic of this form of display is the ease with which features of historical development can be grasped at sight – since the eye is such a superlatively rapid processing instrument. Thus, one can see at a glance that Leeuwenhoek was a contemporary of Huyghens; that the polarizing microscope appeared some 150 years after the wave theory of light; that Haüy preceeded Dalton by a couple of decades; and so on. Of course, the disadvantage of showing historical developments in the form of linear charts is that there is insufficient space for all the items that should really be included and even those that are included are specified telegraphically. This difficulty is made up for in the accompanying text, where a very great deal of historical detail is presented in very readable form.

The idea for this novel type of display of historical landmarks is due to Professor José Lima-de-Faria, of Lisbon. Indeed, his was the idea for the book as a whole. It was conceived primarily as an instrument for teaching, not as a definitive work of historical scholarship, and it must be understood in that light. It was in this role, as an educational resource, that the preparation of this book was sponsored by the International Union of Crystallography and, specifically, by the Teaching Commission of the IUCr. Such sponsorship gives the book a certain status; however, the Forward (by the Chairman of that Commission) makes it clear that the book is in no sense an official version of the history of crystallography, but an account which can properly be valued for the personal views of its various authors.

Mention of the 'various authors' of this book leads at once to the main criticism that must be made of this volume. It suffers from a lack of coherence. Having conceived his idea of time maps, and having worked out both their design and their textual backup, covering the past five centuries, Lime-de-Faria felt that, to fill out the details and to bring the history up to the present day, he needed the assistance of others who could write more authoritatively on specific aspects of crystallography. He therefore recruited six specialists for this, with the result that, while the book is given a lot more weight, both in pages and in scholarship (six chapters) it is also rendered patchy by these additions. Each specialist article differs in style and emphasis, giving the book a rather fragmented profile. Five of these essays are detailed histories. They deal separately with geometrical and physical crystallography (by Marjorie Senechal and W. A. Wooster, respectively), inorganic and organic chemical crystallography (by P. B. Moore and Jenny P. Glusker, respectively) and crystal structure determination (by M. J. Buerger). These have varying degrees of overlap with Lima-de-Faria's survey, naturally, but each article is manifestly self-contained, independent of the others. Each is good material, but, as one of the objects of these essays was to take the historical treatment up to the present date as far as possible, Buerger's is the least satisfactory. The sixth invited author was Helen D. Megaw, whose contribution is a short essay attempting a definition of the scope of crystallography in the context of general physical science.

In his own contribution to this book – as its principal author and as its editor – Lima-de-Faria has been generous with bibliographic information (especially) and illustrations. Indeed, we are really indebted to him for his meticulous attention to detail. A human touch is given to his chapter on time maps by the inclusion of about 100 portraits; it is followed by a list of over 500 references and, at the end of the volume, by a bibliography of some 300 entries. Elsewhere in the book there are many more lists of references and there are illustrations of classic crystallographic diagrams, early microscopes, diffraction patterns

and EM images and, in addition to these, reproductions of the title pages of nearly 100 of the most important crystallographically related publications from the 16th century through to the 19th. There are bound to be minor criticisms of the selections that have been made. For example, there can be no good reason why Kathleen Lonsdale has been omitted from the portraits; and what of C. G. Darwin, Nishikawa or Zhdanov...? But it is idle to pursue this sort of thing.

It is beyond argument that this book is a mine of information. Its lack of unity in the manner of presentation is a real defect but by no means a damning one. The fact is that most of this book is absorbingly interesting to read. Crystallography is one of the most central of all the sciences. Crystals constitute a bridge between the atomic level and the macroscopic world. The slow development, over the past five centuries, of our understanding of what crystals are and what they tell us is a paradigm of the growth of modern science. Sadly, because of the burgeoning superfluity of facts, techniques and theories, we give little attention these days to the history of the development of our modern competence in science, even in our universities. However, wherever the historical dimension is dealt with, this book should be on hand for study and for reference. This book is not one we should expect to see on the shelves of the individual crystallographer but it is a 'must' wherever the history of science is taught, particularly the history of crystallography and it should certainly be available in every respectable library of general science.

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Neutron and X-ray scattering – complementary techniques. Edited by M. C. FAIRBANKS, A. N. NORTH and R. J. NEWPORT. (**Institute of Physics Conference Series** No. 101.) Pp. vii + 252. Adam Hilger, Bristol, 1990. Price £30.00. ISBN 0-85498-057-1.

In the worlds of neutron and X-ray scattering, lip-service is being increasingly paid to the concept of 'complementarity'. The advent of central facilities has further pointed up this concept, as storage rings such as the SRS at Daresbury produce bright X-ray beams and high-flux reactors such as the ILL at Grenoble and pulsed spallation sources such as ISIS at RAL increase the potential of neutron scattering studies.

What does complementarity mean, however, specifically with respect to the exploitation of X-rays and neutrons? I had, perhaps, naïvely, considered it in terms of more than one technique being applied to a single problem, the information obtained from each technique being 'complementary' in giving different but complementary information on a single system; the sum of the information gained would be greater than that obtained from either technique separately. An example might be small-angle scattering from a two-component system, where the different scattering lengths of the components with respect to X-rays and neutrons would result in different contrasts being observed by the two techniques. This I would regard as true complementarity. Many of the chapters in this book, however, deal with what I would prefer to call comparability, a related, but not identical, idea. For a given problem, we consider the advantages and disadvantages of both neutron and X-ray methods: we then choose the technique that would suit us best.

Comparability is relatively well developed: at its most trivial, it boils down to choosing the best technique in a particular case, a procedure in which you might expect any reasonable experimentalist to be competent. Complementarity is, however, despite the lip-service paid to it over many years, exploited relatively rarely. It was therefore highly appropriate, with ISIS following a full experimental programme (within its limited available funding) and the high-brightness lattice at the SRS fully operational, for a meeting to be held in Britain in early 1989, at the University of Kent. Its intention was to place '... emphasis ... on the complementary information available by using both techniques to gain a more complete understanding of the system under investigation'. Clearly complementarity, not comparability. This volume is a record of the proceedings.

The result is successful, but disappointing. There are good reviews of the well recognized and well explored complementary areas involving large-scale structures (small-angle scattering and the much newer but powerful techniques of neutron and X-ray reflection). The battery of X-ray and (inelastic and elastic) neutron techniques available to throw light on proton conductors are described in a chapter from Jones and Roziere in Montpellier. The use of X-ray and neutron techniques in ion and water location in fibres is discussed by Watson Fuller's Keele group and the joint potential of the very new technique of deep inelastic neutron scattering and X-ray Compton scattering is explored. However, many of the chapters really exemplify comparability rather than complementarity, with several papers describing studies using either an X-ray or a neutron technique almost exclusively, although sometimes results from the other technique are included for comparison.

A potentially promising area of complementarity of particular personal interest is liquid structure studies, where much lip-service has been paid to the potential value of both X-ray and neutron techniques arising from the different scattering lengths for the two probes. Here, there is a thoughtful and imaginative chapter from Delft which describes the use of both X-rays and neutrons in a careful and truly complementary study to extract the Si–Si partial pair-correlation function from vitreous silica, together with a good essay from Steve Gurman (and pipe) on conditioning for isotope substitution, neutron scattering and anomalous dispersion X-ray scattering. The controversially named reverse Monte-Carlo technique – a method which is increasingly seen as very powerful in interpreting liquid diffraction and crystal disorder data – is put forward clearly as one which is ideally suited to constructing models consistent with both neutron and X-ray results on the same system and hence one which will be increasingly used in complementary work. Perhaps it is a reflection of the attendance that there is nothing on $X-N$ methods that have been used successfully for many years by crystallographers, both in joint structure refinement and electron density studies – an unfortunate omission.

The book contains some good papers exploring the potential and problems of exploiting complementarity and