It is not seriously proposed that this function be used in actual structure work, for the labor of calculating four- or six-dimensional functions would be too great. What is interesting is the fact that a geometrical interpretation has been found for certain analytical relations among the F's; that is, a link has been made between the so-called 'reciprocal-space methods' and 'direct-space methods' which may be of use in further work on the phase problem.

As an example of such a use, I shall indicate how one might explain the fact, noted by Cochran (1952), that the sign relationships among the F's appear to hold better with highly unequal atoms than with equal ones. The height of the origin peak of DP essentially measures the preponderance of positive Fourier coefficients over negative ones. But the height of the origin peak is proportional to $\sum Z_j^3$, where Z_j is the weight of the jth atom, and this quantity is greater for a set of unequal Z's than for a set of equal Z's of the same total weight.

Triple and higher multiple Pattersons also exist.

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Book Reviews

Works intended for notice in this column should be sent direct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 99 Livingston Street, Brooklyn 2, N.Y., U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.

Erzmikroskopisches Praktikum. By H. SCHNEIDERHÖHN, Pp. xii+284, with 48 figs., 39 tables and 64 microphotographs on special paper. Separately added **Erzmikroskopische Bestimmungstafeln,** pp. v+24. Stuttgart: Schweizerbart'sche Verlagsbuchhandlung. 1952. Price, bound, DM. 40·60.

The descriptive part of Schneiderhöhn & Ramdohr's *Lehrbuch der Erzmikroskopie*, Volume II, appeared in 1931. Three years later this standard work was completed with Volume I, in which the theoretical and methodical problems were treated. In these volumes practically the complete knowledge of ore microscopy at that time was compiled and presented in an instructive and systematic manner. It could be expected, therefore, that this work would become a classic in the literature of this young branch of science, and that the need for it would be felt for many years. Unfortunately, this work has been out of print for some time, so it was good news when in 1950 an entirely rewritten and enlarged edition of Volume II appeared under the title *Die Erzmineralien und ihre Verwachsungen* by Ramdohr. Now Schneiderhöhn presents a new edition of Volume I, likewise under a new name, though the old title would have been appropriate since it deals with the fundamental knowledge which is indispensable to a successful worker in this field.

Compared with the first edition, about 80 per cent of the book appears unaltered. This is, first of all, due to the high standard and the completeness of the original work. Secondly, the nature of this matter is such that technical improvements have been made rather than theoretical ones. Some chapters have been abridged by omitting part of the theoretical discussions. This is the case with the chapter on ore microscopes and accessory instruments (which deals only with the products of Leitz) and with that on optical investigation methods. At the same time, however, these chapters, as well as the other material, have been brought up to the level of current knowledge. This is also shown by the bibliography which comprises 262 separate articles, 83 of which have been published since 1933. The chapter on microchemical and spectrographic analyses and that on the orientation of random sections are only briefly summarized in this book, which is no serious loss. However, the epoch-making work of L. von Hamos in the field of Röntgen spectrography since 1933 would have been worth mentioning.

The 39 tables in the text elucidate the subject in a graphic way. As to Table 15, which aims at giving a comparison between photocell and photometer reflectivity values, the cited literature has not been interpreted correctly. According to this table each of the listed minerals has been investigated with a photocell, whereas in the original work it has emphatically been pointed out that only some of these minerals have been studied by photocell methods. The author's conclusions are consequently erroneous.

Concerning the usefulness of micro hardness methods for reliable determinative purposes, the author concludes that a generally applicable method can be obtained only after exhaustive and critical experiments on very extensive material of undoubted nature.

Emphasis has been laid upon the importance of well-polished surfaces and this problem has therefore been treated in detail. Since the preparation of polished sections is usually left to others it is recommended that the author and the publishers agree to the separate publication of the 43 pages of this chapter (*Die Anfertigung von Erzanschliffen*).

This edition contains three new chapters (pp. 39), which, in a general way, deal with the tasks of ore microscopy, with morphological features of ore minerals, and with their intergrowths, exsolutions and textures. These subjects have been treated with much more detail in Ramdohr's work, to which the reader is referred in many cases. The author's classification of ore mineral textures, however, is new. Its viability beside the classifications of Bastin (1950) and Schwartz (1951) will have to be proved. To illustrate these chapters, 64 excellent microphotographs are added. The explanations of Figs. 52, 53, 63, 64 and 104 are given as for sitaparite; this must be bixbyite. Names like sitaparite should not be used any more in modern literature.

The determinative tables which are appended are an

improvement on those published in 1931. They consist of two parts: the first (pp. 3) contains the 'key' to the second (pp. 21). The 'key' has been constructed with the help of divisions according to: (*a*) polishing hardness—galena and pyrrhotite are chosen as standard minerals, and three main groups are obtained; (*b*) anisotropy (isotropic, weakly anisotropic, strongly anisotropic); (*c*) colour (pure white, slightly coloured, distinctly coloured); (*d*) reflectivity as it appears in white light in air (7 subdivisions). In this scheme there are 189 categories into which the ore mineral names have been classified. In the second part the ore minerals are listed alphabetically and their main properties are tabulated in 15 columns. No information is given as to textures, intergrowths, exsolutions, paragenesis and literature; for further information the reader is referred to Ramdohr's work (to which these tables actually form a 'key').

Compared with the carefully written text, the tables give the impression of having been composed with less attention to detail. Leaving out of consideration the listed silicates, carbonates, sulphates and chlorides, the intergrowths and the discredited minerals, it appears that in the alphabetical tables 161 ore minerals are listed, whilst the 'key' gives only 136. This is highly unpractical for a useful 'key'. Another inconvenience is that many common ore minerals (e.g. gudmundite, tellurbismuth, sternbergite, stromeyerite, frieseite, coronadite, chalcophanite, hetaerolite, cosalite) are not found in these tables, whereas some very rare minerals (e.g. cooperite, beegerite, livingstonite, stibiopalladinite) have been inserted. Therefore, since the principles of the 'key' are, of course, sound and practical, the tables, in their present form, are not as appropriate for scientific work and not as useful for students as they could have been.

Finally, tables like these should be published separately, at least for the benefit of students, who, in the German literature, are now entirely dependent upon the extremely expensive combination of Ramdohr's and Schneiderhöhn's works.

Misprints are few, but slightly more frequent in the determinative tables than in the text. The paper is of good quality, the binding attractive and strong.

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Schwingende Kristalle. By L. BERGMANN. Pp. 51, with 51 figs. Leipzig: Teubner. 1951. Price DM. 2·10.

This small booklet represents a summary of the well known book *Der Ultraschall* by L. Bergmann. It can be recommended for people who are new in the field of piezoelectricity and vibrating crystals. Though this booklet does not go into details, it gives a short summary of the main properties of vibrating crystals and describes the most important applications.

In the first chapter Bergmann describes the direct and indirect piezoelectric effect, including as examples quartz and rochelle salt. He then describes a few methods for investigating piezoelectricity in crystals. In the second chapter we find a short description of how piezoelectric crystal plates and rods vibrate. The third chapter gives a few examples of how these crystals are used in applications, such as the quartz clock, the piezoelectric oscillator, piezoelectric filters, piezoelectric loudspeakers and microphones. The fourth and fifth chapters deal with ultrasonics and, in particular, the use of vibrating crystals to generate ultrasonic waves for testing materials and for medical investigations. The book also includes a short description of the Schaefer–Bergmann method for the determination of the elastic constants in solids.

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A Thousand and One Questions on Crystallographic Problems. By P. TERPSTRA. Pp. 195, with many figures and tables. Groningen: Wolters. 1952. Price 24*s*.

This book contains 174 crystallographic problems, most of which include several supplementary questions. There is a general index, but no list of chapters. The English is good and clear, although a few awkward expressions are to be found. The chapters are as follows, the number of problems in each being given in parentheses: Millerian indices in the rhombohedral system (5); geometrical crystallography (33); rhombic section (4); transformations (7); twin crystals (11); gliding (17); lattices (19); drawing (7); optics (34); Laue patterns, space-groups and Weissenberg patterns (29); equivalent positions and structure factors (8).

In his preface the author says: 'The present volume is intended mainly for junior students in crystallography' and later he adds that he '... presents a selection to our *junior students*' (author's italics). This may be somewhat misleading because many of the problems and questions are quite difficult. Not only junior students, but senior students and their teachers would profit by working through several of these problems.

The value of solving problems in crystallography cannot be overstressed, and this book is a very useful teaching manual. Its publication draws attention to the present state of crystallographic teaching in which classical crystallography has had to be reduced, relatively, to its proper position in the now greatly enlarged field of the subject. Unfortunately, a division between the 'old' and the 'new' in crystallography still persists, although it ought to disappear with the development of a modern syllabus of crystallographic education. At present it is certain that a considerable proportion of the large number of students in X-ray crystallography have not received an adequate education in subjects such as projections, the geometry and symmetry of crystals, crystal twinning and calculations. This book will be useful in developing such teaching.

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