GALOPIN (R.) and HENRY (N. F. M.). *Microscopic study of opaque minerals.* Cambridge (W. Heffer & Sons), 1972. x+322 pp., 135 figs., 4 pls. Price £8·75.

Although the microscopic study of opaque minerals has seen such great developments in the post-war years and is increasingly regarded as a suitable topic for undergraduate study, the number of adequate texts for student or research worker can almost be counted on the fingers of one hand. It is therefore a pleasure to welcome the appearance of this well written book by authors who have themselves made significant contributions to the development of the technique.

In nine chapters (211 pp.) and seven appendices (93 pp.) they have covered every important aspect of theory and practice and include extensive references to the literature. A most useful historical note and bibliography (Appendix VII, 5 pp.) by Professor J. Orcel, who also writes a preface, outlines the main steps in progress from the earliest microscopes to the present day. For those who appreciate his own major contributions, the brief account of his personal experiences in the development of quantitative reflectivity measurement is of great interest.

The first chapter (7 pp.) is a short introduction to the subject and a summary of the topics covered in the rest of the book. It is obviously assumed that the reader will already be familiar with the use of the polarizing microscope for the examination of crystalline materials in transmitted light, but chapter 2 (31 pp.) includes a revision of this subject whilst introducing the basic equations for reflectivity, phase relationships, and the effect of absorption.

Chapter 3 (39 pp.) similarly reviews the fundamentals of the action of lenses and the illumination system for transmitted light before proceeding to a detailed consideration of the construction, function, and correct adjustment of each part of the reflected light optical system.

In the fourth chapter (20 pp.) the various problems related to anisotropy in absorbing substances are covered—representation surfaces and the complex indicatrix, reflectivity equations, polarization colours, and convergent light polarization figures. Chapter 5 (21 pp.) can now proceed to a description of the practical aspects of the microscopic examination of a polished section and determination of the qualitative optical properties used for mineral identification, with many examples.

Supplementary chemical procedures such as etching, contact prints, and microchemical analysis are described in chapter 6 (21 pp.). Chapter 7, Pt. I (38 pp.) and Pt. II (6 pp.) cover the quantitative measurement of reflectivity and micro-indentation hardness respectively. Apparatus, standards, procedures, and sources of error are carefully discussed.

Chapter 8 (9 pp.) is a brief but useful account of textures and paragenesis with adequate references to the more specialized literature on this large and important topic. In a final chapter of the same length, suggested exercises in determinative procedures are given together with a step by step account of the identification of various minerals in two different specimens.

Specimen preparation is dealt with rather briefly in the three pages of Appendix IV and there is no reference to other sources of information on this important topic,

although they can be found in the bibliography. Appendix V (24 pp.) has a series of determinative tables for about 100 minerals—more than adequate for student use and a good example of the types of data compilation available.

A more detailed treatment of certain aspects of important theoretical and practical topics in earlier chapters is found in the 46 pp. of Appendix VI. In particular the measurement of ellipticity, the optics of biaxial absorbing crystals, glare effects in reflectivity measurement, and the variation of hardness with load are well described. Adequate references and indexing are provided and Appendix II is a useful table of opaque mineral names in English, French, German, and Spanish.

The mathematical deficiencies of many Geology students have been catered for by extended explanations of certain points and the extensive use of graphical methods, whilst research workers will undoubtedly find interest in the excellent treatment of reflectivity measurement and the detailed optics of biaxial absorbing crystals.

There must of course be criticisms—inadequate proof reading has allowed a number of small printing errors to appear and one or two references in the text do not appear in the bibliography. None of these however are particularly serious. The treatment of quantitative colour specification is disappointingly brief and incorrect statements are made about the chromaticity diagram on p. 151. Apparently contradictory statements about colour memory are made on pp. 104 and 148. A corrigenda slip is available from the authors. Nevertheless the book is essential reading for anyone with the slightest interest in the optics of opaque materials, at any level, practical or theoretical. The text and figures are clearly printed on a matt surface paper. The quality of the black and white plates is adequate but no more. Comment on the price is these days essentially useless, but it is less overpriced than many other books in its class.

The production of this timely volume with its up to date and extensive scholarly coverage of the topic can have been no easy task for the authors. Let them then be assured of its probable establishment as a standard text, for a part of their just reward.

R. PHILLIPS

OBST (K. H.), MÜNCHBERG (W.), and MALISSA (H.). *Elektronenstrahl-Mikroanalyse (ESMA) zur Untersuchung basischer feuerfester Stoffe.* (Applied Mineralogy Series, Volume 2.) Vienna and New York (Springer-Verlag), 1972. x+125 pp., 73 figs., 16 tables. Price DM 67.

The second volume of this Applied Mineralogy Series is on the electron probe microanalyser and its use for the examination of basic refractory materials. (The first volume, *Abrasives*, was reviewed in *Min. Mag.* **38**, 777.)

After a short introductory chapter (2 pages), Ch. 2 (Apparatus and Methods, 22 pages) briefly reviews the related techniques of light microscopy, electron microscopy, X-ray emission, X-ray diffraction, microradiography, and cathodoluminescence for the examination of basic refractories and related materials.