Book review

"A practical guide to ore microscopy" by Ricardo Castroviejo

Volume 1 - Mineral identification: Switzerland, Springer Cham, 980p. ISBN: 978-3-031-12653-6. https://doi.org/10.1007/978-3-031-12654-3
Volume 2 - Ore textures and automated ore analysis: Switzerland, Springer Cham, 308p. ISBN: 978-3-031-18954-8. https://doi.org/10.1007/978-3-031-18954-8

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BOOK REVIEW

Ore microscopy, based on reflected light, is the most appropriate and widely used technique for the identification and characterisation of 'opaque' minerals in polished sections (blocks or thin sections). This methodology is essential in exploration, characterisation and evaluation of ore deposits. Moreover, it is helpful in petrographic studies of rocks containing opaque minerals and the characterisation of synthetic solids, as well as in mineral processing, metallurgical testing and environmental impact of mining exploitation.

In *A Practical Guide to Ore Microscopy*, Prof. Castroviejo provides excellent learning tools and all the necessary information for the observation, characterisation and correct identification of the most common ore and gangue minerals using the ore microscope (reflected light microscope). The optical properties of minerals, and their textural relationships, are illustrated with a selection of excellent photomicrographs, with accurate colour match, of samples from collections around the world. The overall objective of the book is to present an up-to-date introduction to reflected-light microscopy for students, researchers and professionals in mineral resources and mineral processing. This book does not aim to be a treatise on ore microscopy, but an extensive and comprehensive work with updated, rigorous and useful information, from a practical point of view, on the use of reflected light microscopy (including automation of image analysis) in the study of mineral deposits, geometallurgy and environmental impact assessment in mining.

The book has been published in two volumes. Volume 1 has 980 pages and is subdivided into three parts. Part I includes a brief, but essential, introduction to metallic ore microscopy and useful recommendations for beginners. Part II contains a detailed description of the optical properties of more than 150 opaque minerals, using both single polariser and crossed polars at 90 degrees. The minerals have been selected based on their abundance in nature, their relevance to mineral resource studies and their economic interest for the mining industry. The descriptions for each mineral include the main paragenesis and identification criteria, as well as spectral information measured in air with the Automated Microscopic Characterisation of Ores (AMCO) system in the range 370–1000 nm (visible and near-infrared, VNIR, and near-UV). The methodology followed in the descriptive sheets corresponds to the most widely used mineral identification strategy, which

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is endorsed by the Commission on Ore Mineralogy of the International Mineralogical Association (IMA). Part III includes the characterisation of the most common gangue minerals coexisting with the ore minerals. These are non-opaque minerals (silicates, carbonates, some oxides and hydroxides, halides and sulphates), whose identification and characterisation are also highly significant in the study of mineral deposits, metallurgical processing and environmental impact assessment.

Volume 2 has 308 pages and is subdivided into two parts. Part I features the textural analysis, classification criteria and keys to define and interpret the different mineral textures. In the characterisation of ore deposits, the study of the textural relationships between ore minerals, and with gangue minerals, requires a combination of precise observation, systematic description and rigorous logical analysis. This textural characterisation is the basis for establishing the mineral assemblages that are coeval and usually in equilibrium (paragenesis), as well as ordering them chronologically (paragenetic sequence). In this part of the book, Prof. Castroviejo provides a set of very useful recommendations on observation methodology and basic interpretive keys, which are illustrated with simple examples of the most common natural processes. Three fundamental criteria for textural classification are followed in this book: descriptive, genetic and technical (oriented to geometallurgical characterisation). Therefore, the author avoids the unnecessary proliferation of textural types – many of them obsolete – previously documented for the recognition and interpretation of ore mineral textures. Part II covers relevant information on automated analysis of ores and plant concentrates , which includes a detailed explanation of the AMCO system, a multispectral specular reflectance microscopy system that encompasses at least the visible and near infrared (VNIR) range of the spectrum. In addition, Part II describes the methodology used for the quantitative measurement of the specular reflectance spectra of minerals in the VNIR (or VNIR + SWIR) range, image acquisition and analysis, as well as the construction and validation of a multispectral specular reflectance database. Part II also presents examples of a practical application of automated identification and a geometallurgical purposes. According to the author, the AMCO system offers a performance comparable to commercial automated electron microscopy systems at a fraction of the price. Finally, the book contains five annexes. All of them will prove useful to the reader, in particular those focusing on Common Mineral Associations (Annex 2), Compared Properties of Ore Minerals (Annex 4), and Determinative Tables (Annex 5).

A Practical Guide to Ore Microscopy may be of great interest to ore deposit geologists and metallurgists, and in general to Earth science professionals and researchers. These two volumes should be included in the libraries of all universities teaching geology, mining engineering and mineral processing engineering, as they are suitable for undergraduate (and postgraduate) courses in ore mineralogy, ore deposits geology, process mineralogy and mining environmental management. It can also be highly appreciated by companies working on mineral exploration, mining, geometallurgy and process optimization. I fully agree with the beginning of the prologue of this book, written by Jonathan G. Price, "Congratulations on acquiring the most useful book on ore microscopy!"