

## Geology of Kuroko Deposits

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p. 504 and p. 506 that show them to consist not of one phase but of two "perthite-like" intergrowths (the "Huttenlocker intergrowths"). Petrologists interested in meteorites and in rocks associated with meteorite impact structures will appreciate the discussion on shock-metamorphic features and "maskelynite" on p. 578-589.

On the whole Volume 2, *Chemical and Textural Properties*, embodying as it does more geochemical/petrological material than Volume 1, is likely to find the wider readership of the two volumes. Part 3 (the first Part in Volume 2) on Chemical Properties and Experimental Techniques, consists of one short Chapter, 12, on Analytical Techniques, and one long (128 pages) Chapter, 13, on Chemical Properties (in which reference is made to more than 400 papers!). The many tables of modern analyses of major, minor and trace elements in all varieties of feldspar minerals, and the discussion of these, make this Chapter invaluable to anyone interested in the chemistry of feldspars. By the same token, many sections in the second and last Part of Volume 2, Part 4 on Growth, Diffusion, Defects and Intergrowths, will prove indispensable to most igneous and metamorphic petrologists, both because of the detailed descriptions, and the postulated processes from the literature, and because of Smith's own critical assessment at the conclusion of each section. Following are the topics (with page numbers in brackets) in this part of the book that will likely be of most widespread interest: the growth of feldspar crystals (196-106); zoning (206-247) in which the last 15 pages describe theories of zoning and Smith's evaluation; "tracht" (= crystal habit in relation to environment) (247-274); oriented plagioclase inclusions in K-feldspars and related topics (274-293); the optical and X-ray characteristics of all types of feldspar twins (303-390); perthites, obviously one of the most important topics (401-519); plagioclase intergrowths (peristerites, etc.) (519-544); and intergrowths of feldspars with other minerals - myrmekites (554-581); graphic granites (581-608), and clouded feldspars (623-630).

Such is the breadth and depth of this work. The two volumes are beautifully produced with large numbers of excellent drawings and photographs

and with thorough indexing in several different ways; the printing, paper and binding are of the highest quality. These books should be in every earth science library, and almost every mineralogist and petrologist will be amply rewarded if he takes the time and effort to read the parts of interest to him of this gargantuan description and analysis of the group of minerals that constitutes over half the earth's crust.

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## Geology of Kuroko Deposits

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Edited by S. Ishihara, K. Kanehira, A. Sasaki, T. Sato, and Y. Shimazaki  
*Mining Geology Special Issue No. 6.*  
435 p., 1974.  
*Society of Mining Geologists of Japan*  
*Nihon Kogyo-Kaikou Bldg., 8-5-4*  
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Apparently acceding to international demand, the ever-accommodating Japanese geoscientists have published this classic among economic geology texts. Comprising 41 papers by 76 industry, university and government authors, Special Issue 6 is a rather complete review of the geology of the Kuroko deposits, defined in the first paper as "a stratabound polymetallic sulphide-sulphate deposit genetically related with Miocene felsic volcanism". The stated scope of the book is "to bring together the available geological and mineralogical data in one volume, so that individuals can make their own interpretation of the Kuroko deposits". About half the papers have previously appeared in *Mining Geology* in Japanese but have been up-dated for this volume; the remainder are new contributions.

The volume consists of three parts. Part I includes the definition of Kuroko Deposits and describes their geological characteristics for Japan as a whole, as well as for two of the more important mining regions of the country. Part I also includes a discussion of the relationship between the deposits and plate tectonics. Part II is a collection of 21 papers describing the geology of more than 20 selected mines and deposits. Judging from the remarkably similar content of the 21 "deposit-papers" the authors must have received strict guidelines from the editors. For example, the following topics are common to all 21 papers: stratigraphic sections of the mine area, geologic maps and cross sections of the deposits, and ore grades and tonnages. In addition, at least half of

the papers in Part II contain a short discussion of exploration guidelines (which, as it turns out, are almost entirely geological in nature, a factor to be considered in this age of ever-increasing technology in exploration). The geological descriptions are clear, concise, and accompanied by numerous diagrams, maps, and photomicrographs. All but three of the papers in Part II are authored by a member of the mine staff. Most of the 21 "deposit-papers" deal with the base-metal type of Kuroko ores but two describe barite and gypsum Kuroko-type deposits. One remarkable paper describes the sedimentary features found in one Kuroko deposit and contains a series of extremely convincing diagrams and photos. For the paleontologists, one paper contains a two-page list of fossils found in the Matsuki mine. Part III comprises 17 pages dealing with Special Topics. The papers can be conveniently grouped in the following manner (the number of papers dealing with each topic is shown in parentheses): magmatism (1), tectonics(1), associated volcanic rocks (1), alteration (4), ore minerals (4), ore textures (1), chemistry of sulphides (2), fluid inclusions (1), isotopes (1), and basement geochemistry (1). The last paper is interesting as it attempts to examine the effect of basement geochemistry on Kuroko mineralization and concludes that the base metals of the basement are reflected in the Kuroko ores. The isotope paper, in contrast, rules out the possibility of extracting metals from the immediate basement.

The book contains three pages of ore photos and photomicrographs in colour. Author, subject, and locality indices are included but a list of figures is not.

So complete is the coverage of Kuroko deposits that it is difficult to identify topics not covered in the Special Issue. Two, however, which are not included have been consciously omitted by the editors. The first, a discussion of the physico-chemical limitations in the formation of these ores, was omitted because the two papers pertaining to this subject have appeared in English in other journals (references for these papers are given). For completeness' sake, however, it would have been both relevant and convenient to have

included them. A reader searching the book for a summary of current Japanese theories on genesis will not find one. Neither the word "genesis" nor "origin" appears in the subject index. Only two papers contain "genesis" in their titles and only a half dozen or so papers include even a brief discussion of the topic.

Presumably the light treatment of genesis is in keeping with the editors' objective of presenting largely factual data so that the reader is free to make his own interpretations. Nevertheless, a separate summary chapter, perhaps written by the editors, could have provided a useful insight into the breadth and nature of genetic ideas currently favoured by the geologists closest to the subject who, as shown by the bibliographic references, have been studying these deposits for decades. Reading between the lines of the various papers, however, the reader is left with little doubt that a majority of Japanese geologists favour some form of volcanic-exhalative process for the formation of these ores.

Spelling and typographical errors are remarkably few considering that over half the papers had to be translated from Japanese and all papers required clarification of the English. All maps, sections, photos, and photomicrographs include scales and are of generally high quality except the photomicrographs on p. 84-85, some of which are too dark to be of much use.

The title is somewhat misleading because, to best describe the contents, it should read "Geology of *Japanese Kuroko Deposits*". Kuroko ores are a deposit-type and there is nothing in the definition which specifies that Kuroko deposits must occur only in Japan even though it is understandable that the Japanese feel they are the first authority on the subject. Nevertheless, other texts on specific deposit-types have either been international in character (e.g., *Magmatic Ore Deposits, Economic Geology Monograph 4*) or have specified a particular area (e.g., *Geology of the Porphyry Copper Deposits, Southwestern North America, Univ. of Arizona Press*).

Nevertheless, the breadth of the topics covered and the general high quality of the contained papers will ensure that this book will become a classic on the subject of volcanogenic deposits and this reviewer unhesitatingly recommends that it be added to the bookshelf of every serious economic geologist.

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