

## BOOK REVIEW

DEER, HOWIE AND ZUSSMAN ROCK-FORMING MINERALS, SHEET SILICATES: MICAS, volume 3A, 2<sup>nd</sup> edition. By M.E. Fleet, The Geological Society, London, 2003, 758 pp., \$209.00

The publication in 1962–1963 of the five-volume review by Deer, Howie, and Zussman (DHZ) entitled *Rock-Forming Minerals* was a true milestone in mineralogy, both because it coincided with the acceleration of research in the earth sciences and because the authors considered mineralogy in the context of the larger picture of geochemistry. In these volumes, the *understanding* of a mineral and its structure was emphasized vs. using determinative properties for identification. Thus, a more complete picture was being presented when compared to the traditional mineralogy texts, such as Dana's *Textbook of Mineralogy* or Berry and Mason's *Mineralogy*. The 1962–1963 edition became a resource for workers not only in mineralogy, but also in allied fields such as petrology, materials science, ceramics, agronomy, and many others. For example, by correlating the results from many different fields, the importance of systematic studies to determine the effects of temperature, pressure, and composition on crystal structures (and physical properties!) became apparent. In addition, mineral chemists using the newly developed techniques in the 1960s and 1970s, such as electron microprobe analysis, found that reference to the compilations in DHZ of mineral compositions allowed for easy determination of a mineral's identity.

The DHZ volumes were in serious need of updating even within the first decade after they were published because of the enormous expansion of knowledge in mineralogy. The first revised volume of DHZ (*Orthosilicates*) became available in 1982. Now, with the publication date of 2003, comes the second edition of volume 3, *Sheet Silicates* newly titled "*Deer, Howie and Zussman Rock-Forming Minerals, Sheet Silicates: Micas*" written by M.F. Fleet. The new title specifying only micas as the topic of volume 3A is a recognition that the more general subject has grown too large for a single volume. In fact, only the true micas and brittle micas are reviewed here, "essentially micas in igneous and metamorphic rocks, hydrothermal alteration, and ore deposits."

According to the preface, a review of the dioctahedral interlayer-cation deficient micas (illite, glauconite, and brammallite) is to be included in another volume, devoted to "clay minerals." It is not clear how and when other phyllosilicates, such as the serpentines and chlorite minerals, will be reviewed, as they are not included. The preface notes that *DHZ Micas* was written as a review of the mineralogy and petrology of micas, within the limitations given above. *DHZ Micas* is organized by chapter

where the first chapter discusses the mica group in general, followed by chapters on dioctahedral true micas (muscovite and phengite, paragonite, and other dioctahedral true micas), trioctahedral true micas (biotite, lithium-containing micas, and other trioctahedral true micas), and brittle micas. As would be expected, the two chapters on (1) muscovite and phengite and (2) biotite overwhelm the other chapters in length. The chapter on muscovite and phengite and the chapter on biotite are divided into sections covering structure, chemistry, experimental (stability studies), geothermometry, thermodynamic properties, stable isotopes, geochronology, optical and physical properties (including spectroscopy), deformation, distinguishing features, and paragenesis. These sections are broken down further to cover more specialized topics. Chapters covering paragonite and the lithium micas, because the research in these areas is more limited, are divided into fewer sections than the muscovite and phengite, and biotite chapters. These sections only cover structure, chemistry, experimental (stability studies), spectroscopy, distinguishing features, and paragenesis, in addition to sections on rare species. In contrast, the brittle-mica chapter is separated only into sections for each species. There are 352 illustrations and 73 tables, mostly taken from the literature, and about 260 chemical analyses, also from the literature. Each chapter has a reference list and there are approximately 3000 references given.

*DHZ Micas* is accurate in summarizing previous work, very comprehensive in locating sources, and well written. The author has done a remarkable job in making ideas flow, without the stiltedness common to many encyclopedic reviews. The editing is also very good, with few typographical errors or misspellings. I do have two important criticisms, however. IMA (International Mineralogical Association, Rieder et al. 1998), AIPEA (Association International pour l'Etude des Argiles, International Association for the Study of Clay, Bailey et al. 1980), and CMS (The Clay Minerals Society, Bailey 1971) have recommended the usage of plane, sheet, and layer as a single *plane* of atoms, a tetrahedral or octahedral *sheet*, and a 1:1 or 2:1 *layer*. Plane, sheet, and layer refer to increasing thicker arrangements. In contrast, *DHZ Micas* discusses "layers of cations," defines "tetrahedral layers" and "octahedral layers," and refers to "t-o-t (or T-O-T) unit or 2:1 layer or 2:1 layer unit." For the most part, the book does not make distinctions between planes, sheets, and layers, and even fails to *define* a "sheet," the title subject of the book, although it does equate sheet silicates with phyllosilicates. Secondly, although all phyllosilicates are clay minerals (as defined in the joint report of the AIPEA and CMS Nomenclature Committees, Guggenheim and Martin 1995), the author uniquely places illite, glauconite, and brammallite into this category, and includes them in a future companion volume on "clay minerals."

By the mid 1970s, the Mineralogical Society of America started to produce the very successful *Reviews in Mineralogy* (RiM) series and later, joining with the Geochemical Society, the *Reviews in Mineralogy and Geochemistry* (RiM&G) series. The publication of the RiM&G volumes seems to make the rationale for a revised DHZ edition less compelling; is there a significant need for both? In the first chapter of *DHZ Micas*, the author notes that the RiM&G volume on micas (Mottana et al. 2002) appeared too late to be extensively referenced. This invites a comparison of *DHZ Micas* to the RiM&G volume, which is entitled *Micas: Crystal Chemistry and Metamorphic Petrology*, because both contain references until about mid-2002, and thus both are somewhat contemporaneous. The most obvious difference is the titles, with *DHZ Micas* being less restricted in content. The RiM&G volume goes into much greater depth within each topic and, in many cases, a more extensive synthesis of the data is given. Furthermore, there is a greater willingness by the authors of the RiM&G volume to provide a more tutorial approach. However, consistent with the goals stated in the preface, *DHZ Micas* is a successful attempt to provide a comprehensive encyclopedic review.

Clearly, there are significant differences between *DHZ Micas* and the RiM&G volume on micas, and I can recommend the purchase of *DHZ Micas* (in fact, I recommend the purchase of both volumes). Notwithstanding price differences (the RiM&G volume is about 15% of the cost of *DHZ Micas*), *DHZ Micas* is an important resource to obtain the background for nearly all

geological facets of micas, but excluding illite, glauconite, and brammallite. The excellent index is especially useful.

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