

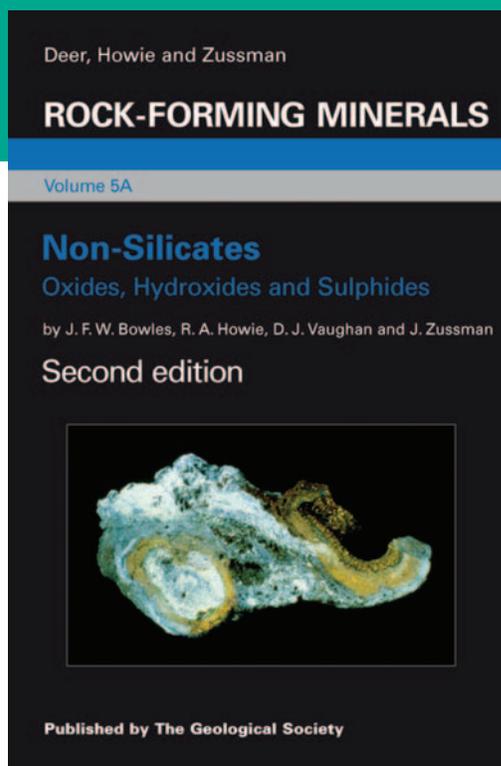
## ROCK-FORMING MINERALS VOL. 5A – NON-SILICATES: OXIDES, HYDROXIDES AND SULPHIDES<sup>1</sup>

Few books on our shelves are pulled more often than mineralogy reference texts. It was thus a great pleasure to dive into a new edition from the classic series Rock-Forming Minerals (aka Deer, Howie and Zussman). This particular release, *Non-Silicates: Oxides, Hydroxides and Sulphides* (volume 5A), is a vastly grown-up second edition of its predecessor of 50 years prior. Authors Bowles, Howie, Vaughan, and Zussman have compiled a comprehensive look at a subset of the mineral classes covered in the original, with the up-to-date version expanded to an impressive 920 pages in length. While the identification and description of additional hydroxide minerals contribute to the new content, most of the expansion is because of new developments concerning previously studied minerals. Perusing the book is a virtual walk through decades of discovery and advances in mineralogical science, a transcendent look spanning everything from what was known in the past to present-day understanding. Mineral-specific research growth vectors are obvious within, enabling an equipping feel for what will be important in the future. In the present day and age, when very few such efforts are commissioned and undertaken, these reasons alone are enough to bring a special appreciation to this book and the field it represents.

The organization is simple and modeled after the original. Selected oxides, hydroxides, and sulfides are covered mineral by mineral in discrete chapters, most of which are subdivided into six major headings: Structure, Chemistry, Experimental Work, Optical and Physical Properties, Distinguishing Features, and Paragenesis. While self-explanatory in content, it is noteworthy that collecting these six topics together integrates the often distinct perspectives of crystallographers, mineralogists, and petrologists. In this book one thus finds a remarkable range of coverage—from atomic and electronic structure, to thermodynamics and phase diagrams, to diagnostic identification tools and conditions in the laboratory or in nature where these minerals are formed, another unique selling point of the book. Though at times each section or mineral appears to have a different “voice,” topics are cross-referenced where they need to be, a feature that adds valuable depth for the reader.

The six-topic strategy is often stretched because of asymmetries in developments or important distinct properties of a particular mineral or group. But the structure remains logical in flow and usefully systematic on the whole. Selected points of deviation increase the book's stock, including stand-alone sections on the magnetic properties of hematite and ilmenite, and detailed sections on the surface chemistry and electronic structures of pyrite, pyrrhotite, chalcopyrite, sphalerite, and galena. Sections such as these reflect massive developments in analytical spectroscopies and microscopies, synchrotron X-ray sources, and first-principles calculations that have transformed mineralogical science. Structure, magnetic properties, and crystal chemistry sections are combined for the spinels, helping to draw out correlations between them. More along these lines is provided in the “Introduction” sections for the spinels and sulfides. Complex topics that have ties across mineral groups are given extra attention. An introduction to the Fe–Ti oxides covers the major binary solid solutions in useful detail, with relevance to, among other things, geothermometry and geobarometry. An introduction to the hydroxides is curiously absent, and the fewest pages are devoted to this class in total, but the range of minerals selected and the content on each remain satisfyingly robust.

The extent of information for each mineral appears to correlate roughly with its natural occurrence or mineralogical and geochemical importance within a class, but it is also inescapably related to the preferences of the authors. In this reviewer's opinion, the minerals of pri-



mary coverage are the oxides periclase, cassiterite, corundum, rutile, perovskite, hematite, ilmenite, and magnetite; the hydroxides gibbsite, diaspore, böhmite, goethite, and ferrihydrite; and the sulfides pyrite, pyrrhotite, chalcopyrite, sphalerite, and galena. Less coverage in terms of pages is given to minerals for which less information is generally available, including the oxides anatase, brookite, pseudobrookite, armalcolite, pseudorutile, spinel, gahnite, galaxite, hercynite, magnesioferite, maghemite, ulvöspinel, qandilite, franklinite, jacobsite, Trevorite, magnesiochromite, chromite, and ferrian chromite; and the hydroxides brucite, akaganeite, lepidocrocite, and feroxyhyte. However, because these phases are less familiar to the average reader, the chapters are extremely valuable, comprehensive in their own right, and leave one full of intrigue.

The book is well organized and coordinated throughout, with systematic use of abbreviations and symbols tabulated up front for the reader's easy reference. Each chapter is initiated by a table of key optical and physical properties for that mineral, and cited references close the chapter. Both are convenient and useful for the purpose of the reader's further research. The book concludes with an index that is nicely replete with keywords and topics to search out their multiple occurrences. Key data tables and illustrations are carefully selected, well presented, and there when you need them.

With respect to value versus cost, one only needs to make the observation that this volume was written by intellectual giants in the mineralogical sciences, well recognized and esteemed experts on this non-silicate subgroup. Though every effort seems to have been made to craft the book in a standardized reference-text form, the insightful perspectives and biases of the authors are tacitly evident. In this regard, and given its 50-year mark, the book is without a doubt a significant milestone. Because of this, I ascribe a higher return on investment relative to other reference books of its kind.

All things considered, I find it easy to recommend this volume to student and professional alike, to those seeking a solid foundation for pursuit of the next 50 years of mineralogical research on these minerals and beyond.

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1 Bowles JFW, Howie RA, Vaughan DJ, Zussman J (2011) Rock-Forming Minerals Vol. 5A – Non-Silicates: Oxides, Hydroxides, and Sulphides. The Geological Society, London, ISBN 978-1-86239-315-8, 920 pp