

## BOOK REVIEW

### MINERALOGY OF HYPERAGPAITIC ALKALINE ROCKS.

By A.P. Khomyakov. Oxford University Press, Oxford, 1995. 223 pages. \$105.00.

This book represents the culmination of the more than two decades that A. P. Khomyakov has dedicated to conducting both field and laboratory studies of the hyperagpaitic alkaline rocks of the Kola peninsula in northeastern Russia. For many years, such rocks have been relegated to the "back of the class" when it has come to petrological studies, not only because of their rarity (i.e. they constitute <1% of the Earth's crust) but also because of their mineralogical complexity (i.e. they host between one-tenth and one-seventh of all known minerals). Through this publication, Khomyakov has sought to provide both detailed information on many of the exotic phases found in these rocks (e.g. sodium and *REE* carbonates, titanosilicates, zirconosilicates, silicophosphates, etc.), as well as attempting to apply the concept of *mineral paragenesis* as means of understanding the evolution of such geological bodies. In doing so, he provides not only insight into the physical, chemical, and diagnostic properties of a host of unusual minerals but also rational explanations as to why they crystallize in particular sequences in specific areas of these deposits.

This is an updated, English-translation version of the same work written by the author (originally in Cyrillic) and first published in 1990. In addition to containing all the information available in the original version, this revised version has an expanded reference list (from 320 to 400) and descriptions for 19 new IMA-CNMMN approved mineral species.

The book is divided into four well-written chapters. Chapter 1 serves to introduce and define hyperagpaitic alkaline pegmatitic rocks and their relationship to more "normal" nepheline syenites. Khomyakov also introduces a novel classification scheme (based essentially on the types of mafic, feldspathoidal, and accessory phases present) to subdivide these rocks into more practical, working lithologies. He also provides a relatively detailed discussion of the geological setting and composition of the units making up the Khibina and Lovozero massifs (the two most important massifs in the Kola peninsula and the focus of Khomyakov's career). Chapter 2 focuses on the numerous water soluble and unstable phases (predominantly sodium carbonates/silicates and titanosilicates prone to a variety of hydration states) that are often indicative of hyperagpaitic rocks. Phase-equilibria data as well as information on the synthesis of some of these phases are also presented.

Chapter 3, which is real strength of this publication, presents descriptions and data (chemistry, physical features, optical prop-

erties, strongest lines on XRD patterns, etc.) for approximately one-third of the 500 or so minerals discovered at the Khibina and Lovozero massifs. It also includes data for 19 new minerals along with 40 or so unnamed minerals (designated *M\**), a necessity for anyone working on the complex mineralogy of these or similar rocks. The mineralogical descriptions are neatly arranged by chemistry (oxides, carbonates, phosphates, etc.) and range from a few sentences to about a page in length. Several summary tables for particular mineralogical groups (e.g. *REE* carbonates), optical stereograms, crystal line drawing, and the like are scattered throughout the text.

The final chapter deals with the economic viability of hyperagpaitic alkaline rocks and methods for exploration. Khomyakov points that such deposits are not simply mineralogical "rainforests" but also important ore deposits containing high concentrations of Al, P, Zr, *REE*, Ti, Ta, etc., large deposits of natural sodium carbonate, and unusual zeolites and zeolitic-like minerals with unique ion-exchange and sorptive capacities. The chapter also includes eight photographic plates, including those of some of the rare rock types found in the Kola peninsula, mineral *SEM* micrographs, and a few photomicrographs from thin sections.

This book is an important compendium, providing data and references that were previously unavailable or obtainable only with great difficulty. It really is directed at the research level, although the information would be useful to anyone working on highly alkaline rocks. It suffers from several relatively minor flaws. For example, the reader is not presented with a map outlining the geographical position of the Khibina and Lovozero massifs of the Kola peninsula nor similar world-wide localities (Mont Saint-Hilaire, Canada; Ilimaussaq, Greenland); the geological maps for the Khibina and Lovozero massifs are complicated and difficult to read; the classification scheme used to subdivide the hyperalkaline rocks is mineralogically based, and may not stand up to the nuances and rigours of whole rock geochemical investigations; some of the minerals are not valid species (e.g. "tetraedingtonite") or have incorrect formulas (e.g. lovoz-erite); the *XRD* data for the minerals (usually the six strongest lines) lack complementary intensity information and there is no indication of the type of radiation used. However, these errors and omissions are minor and do not significantly detract from the impact of this work.

The price is relatively steep for most of us. Still, I have already purchased a working copy for myself and, considering the data available in it, highly recommend it to others in the field.

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