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BOOK REVIEW

Kukisvumchorr Deposit: Mineralogy of Alkaline Pegmatites and Hydrothermalites. By Igor V. Pekov and Alexander S. Podlesnyi. Association Ecost and Ocean Pictures Limited, Moscow (Russia) and Denver (Colorado), 2004 (translated from Russian). 168 pages, softbound, US$45. ISBN 5–900395–53–7. Available from Terry Huizing, 5341 Thrasher Drive, Cincinnati, Ohio 45247, U.S.A. (http://webcenter.ru/~minbooks).

The word "KUKISVUMCHORR", written across the cover, reads like a magic spell. I know I would want to pull this book off a stand and peek inside at least to learn the story behind the title. Actually, this thirteen-letter loan from Lapp translates roughly as "Long Wooded Range", and the book has nothing to do with sorcery or crystal healing. Do the names villiaumite, donnayite or labuntsovite ring any bells for you? If not, but for whatever reason you wish they would, this monograph may be a place to start. If, on the other hand, you are no stranger to the wonderfully bizarre mineral realm of Mont Saint-Hilaire, Ilímaussaq and a few other, less well-known occurrences of agpaitic rocks in the western hemisphere, the present monograph, most recent in the *Russian Mineral Localities* series, will provide a wealth of information on similar mineral parageneses at the famous Khibiny alkaline complex in the Kola Peninsula. Those interested in the history of mineral exploration will find here many fascinating details on how it was done some 70–80 years ago in an extraordinary geographical (mountainous tundra) and historical (post-Civil-War Stalinist Russia) setting.

Why was Kukisvumchorr picked from among all the "-chorrs", "-pors" and "-pakhks" dotting the topographic map of Khibiny? The discovery of the Kukisvumchorr apatite deposit in the early 1920s led to the very first mine in the Russian Arctic (presently, the Kirovskii mine), and to the first industrial center and multidisciplinary research facility in the region. The in-depth scientific study of Kukisvumchorr rocks that followed revealed the astonishing mineral diversity of pegmatitic and hydrothermal veins criss-crossing the apatite ores and associated alkaline rocks, and the complexity of geological processes that had created this mineralogist's paradise. Of some 450 mineral species described from Khibiny to date, about one-half are known to occur at Kukisvumchorr, including seven species [bussenite, isolueshite, kalifersite, kukharenkoite-(La), kukisvumite, shirokshinite and tuliokite] not currently found anywhere else in the world, plus 12 more for which Kukisvumchorr is the type locality (p. 127-129).

The senior author hardly needs an introduction, for most readers will probably be familiar with at least some of his widely published work on diverse mineralogical topics (including labuntsovite-group minerals, rare-earth carbonates, and topomineralogy of Russia). Alexander Podlesnyi is a mineral enthusiast with some 25 years of collecting experience. Of the 19 species "native" to Kukisvumchorr, 11 were found in the material collected by Podlesnyi in the Kirovskii mine over the years. As we learn from the editorial preface (p. 5), were it not for his dedicated efforts, much of Kukisvumchorr's mineral wealth would have never become available for study.

Following the preface, the book opens with *Introduction* explaining the significance of the Kukisvumchorr deposit from a mineralogist's standpoint; the authors acknowledge all those who assisted them in their archival research, fieldwork, analytical studies, interpretation of the results, and preparation of the manuscript.

The next section (*Geological and Petrological Sketch*) is a very succinct (one page of text) description of the geology of the Khibiny complex, supplemented by four maps and cross-sections (including well-reproduced and fairly detailed geological schemes of the Kukisvumchorr deposit), and three black-and-white photographs illustrating some of the characteristic textures of apatite-rich rocks.

The following twenty-five pages unveil the history of mineral exploration, mining and research at Khibiny through period photographs and excerpts from archival documents. The largest segment of this section deals with the early phase of exploration and mining (1920–1953); the more recent history is given only a cursory treatment. The final four pages give a retrospective of the detailed mineralogical investigation of Kukisvumchorr pegmatites and their minerals, which, as we learn from this section, did not really start until the late 1940s, and gained most of its contemporary momentum only after the discovery of numerous mineralized veins in the underground workings in the 1970s. These veins proved a cornucopia, and, over the past 25 years, have produced some of the finest museum-caliber specimens

of rare minerals, along with many other exciting mineralogical discoveries, and inspired countless publications and doctoral theses.

Since pegmatitic and hydrothermal parageneses are also at the focus of Pekov's and Podlesnyi's book, they are characterized there in painstaking detail. The authors distinguish five major types of pegmatites. Their description covers some 3.5 pages of text, and is augmented by diagrams showing the structure of pegmatite bodies. The following 4.5 pages contain a detailed account of the mineral composition of several most remarkable pegmatites, whose individual mineral registries run in the dozens of species. This section concludes with a description of hydrothermal parageneses notable for their enrichment in diverse zeolite-group minerals.

The core of the monograph is the 73-page-long section entitled *Minerals*. It contains descriptions of 212 mineral species accompanied by 29 tables of chemical data from the literature (132 analyses) and the authors' own unpublished work (180 analyses), 125 indexed crystal drawings, 92 color photographs (appended after the subject index), and 63 scanning-electron microscopy (SEM) images of individual minerals and mineral associations. The amount of detail varies a great deal from one mineral to another; generally, the more exotic the mineral, the more comprehensive its description (that of donnayite, for instance, exceeds four pages in length). The section concludes with a three-page registry of the most "remarkable mineralogical finds from the Kukisvumchorr deposit", including a list of museum-caliber specimens, and a list of minerals "native" to Kukisvumchorr (arranged chronologically from magnesium astrophyllite, dating back to 1959, to neskevaaraite-Fe and three other species described in 2003).

The final chapter is a brief discussion of the petrogenesis and geochemical evolution of the pegmatites and hydrothermal veins. These two pages tie Kukisvumchorr's mineral wealth to ionic radii, polyhedron sizes, silica activity, and temperature of fluids. The most characteristic paragenetic sequences are interpreted in the context of changing fluid regime, and compatibility and mobility of individual elements.

The reference list (163 entries, in total) is an invaluable key to anything and everything published on the geology and mineralogy of Kukisvumchorr since the landmark papers by Antonov, Feyveg and Vlodavets. The references are followed by a comprehensive index listing all 212 minerals with references to page numbers (for general descriptions), tables (for compositional data), and plates (for color photographs of hand specimens and micromounts). The color plates showcase some of the best material that has ever come out of the mine. With a few exceptions (*e.g.*, nos. 64 and 107), these photographs do not seem to have been published previously. About three-quarters of all photographed specimens are from Podlesnyi's private collection. However, the accompanying descriptions are professionally precise and detailed; for example: "Belovite-(Ce) crystal (12 × 4 mm) and white gaidonnayite pseudomorph after eudialyte in natrolite. Belovitovoye Pegmatite" (no. 102). The specimens range in size from a 1.5-mm pirssonite crystal to a 15-cm feldspar–natrolite pseudomorph after sodalite. But big or small, any of these pieces would send a museum curator's heart beating at twice the normal rate.

With the exception of the historical section, edited by Peter Tarassoff, *Kukisvumchorr* is not a fluent read. The translation suffers from heavy (and, in places, downright wrong) sentence construction, numerous errors in spelling, missing prepositions, and unnecessary "revisions" to the existing mineralogical and petrologic terminology. I should think one needs to be a professional mineralogist (preferably, with some knowledge of Russian) to understand passages like this one: "In some cases the origin of crystals is supported by the "support of relatives" – at epitactic build-up of one minerals after the other, having analogous or related in something structure: donnayite after mckelveyite and on the contrary, tainiolite and polylithionite after phlogopite" (p. 131). Instead of consulting the literature for appropriate English terms, the translators often resorted to *ad litteram* translations of the equivalent Russian terms, or even coined their own. For example, crystallographic zones are referred to as "belts", resorbed prismatic crystals as "sucked around prisms", trillings as "triples" or "tripled intergrowths", hopper crystals as "case crystals", striation as "hatching", steeply dipping bodies as "high-angle bodies", and fourfold symmetry axes as "4-order axes". I have checked several comprehensive dictionaries (including Jackson 1997, and Treivus 1999), and none of them could have been a source of such neologisms as "fibra", "crownites", "petrogenic mineral", or "pseudo-base-pinacoidal" (among quite a few others). Throughout the book, several rock and mineral names (*e.g.*, rischorrite, khibinite, spreustein and, occasionally, aegirine) are misspelled, and diacritical marks (as in ulvöspinel) are omitted altogether. Finally, I have found the proliferation of morphological terms somewhat overwhelming and potentially confusing. To me, the difference between bar-like, flat-prismatic, flattened prismatic, or slab-shaped is not at all obvious, and the reasons for describing the same (?) habit in so many different ways are not certain. Even some of the crystal forms are described under different "aliases" (*e.g.*, ditetragonal dipyramid as "bitetragonal bipyramid" and "ditetragonal bipyramid" on p. 102).

On the scientific side of things, I have found relatively few errors and inconsistencies deserving of criticism. First of all, some of the mineral names used by the authors are obsolete (*e.g.*, aegirine-hedenbergite and aegirine-salite), and a few others are hyphenated names that refer to compositional varieties (*e.g.*, Nd-ewaldite and Ti-magnetite) and, thus, do not comply with the IMA guidelines (Nickel & Grice 1998). Several of the formulae, given in the descriptive section, are inaccurate. The formulae of lamprophyllite, barytolamprophyllite, murmanite, carbonate-fluorapatite and carbonate-hydroxylapatite are not charge-balanced; those of ancylite-group minerals and merlinoite refer to a range of compositions, but are balanced only in part of that range (*i.e.*, at $x = 1$ for the ancylites, and K + Na = 9–12 for merlinoite). The formulae of magnesium astrophyllite and nepheline are at variance with the crystal chemistry of these minerals (Piilonen *et al.* 2003, Tait *et al.* 2003, respectively). However, I must note in the authors' defense that some of these errors are clearly carry-overs from the literature. In a few places, the term "polysynthetic" is used incorrectly to refer to repetitive twins with nonparallel contact planes (such as the well-known aragonite-type trillings), which should instead be termed cyclic twins. Finally, isolueshite is described as a species endemic to Kukisvumchorr on pages 62 and 127, but is not listed among the Khibiny minerals "found only at the Kukisvumchorr deposit" on page 129. The addition of isolueshite will increase the total number of species on that list to 40.

In summary, *Kukisvumchorr* is an authoritative source on late-stage (*nota bene*!) mineralization in alkaline pegmatites, the source well researched and excellently illustrated, but leaving a lot to be desired in terms of its language and style. This publishers' oversight is very unfortunate, given all the indisputable merits of Pekov's & Podlesnyi's work. The book combines scholarship with a genuine passion for rocks, which can be seen, for example, from the description of "mouse" and "porcupine" varieties of natrolite on page 99. The value of this monograph is further amplified by the fact that many of the mineralized veins in the Kirovskii mine either no longer exist or are no longer accessible. If you are a mineral enthusiast with a slant toward exotic minerals, or a habitué of the Alkali-Nuts website (http://www.saint-hilaire.ca), *Kukisvumchorr* will be a worthwhile addition to your library. Every museum curator should, in my opinion, also have a copy of this book. At the same time, academic readers, looking to learn more about agpaitic rocks, will probably be somewhat disappointed by the paucity of information on the rock-forming minerals from the Kukisvumchorr veins (the description of donnayite takes up more space than those of nepheline, feldspars, clinopyroxenes, amphiboles and micas combined), complete absence of compositional diagrams, and lack of comparisons with similar parageneses elsewhere. All I could find was a brief note-in-passing on page 131 contrasting the mineralogy of Kukisvumchorr and Mont Saint-Hilaire ("samples from these two deposits have a lot of individual features and are easily discriminated visually"). I think the potential readership of *Kukisvumchorr* could have been substantially more extended had the authors found a better balance between science and passion.

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Anton R. Chakhmouradian
Department of Geological Sciences
The University of Manitoba
Winnipeg, Manitoba R3T 2N2