REVIEW

of the PhD thesis

"**Crystal chemistry of novel oxide compounds of Se^{4+} and Se^{6+}**"

by Vadim M. Kovrugin

The PhD thesis by Vadim Kovrugin on oxygen compounds of tetra- and hexavalent selenium is undoubtedly actual and could be interesting for specialists in not only inorganic chemistry and crystal chemistry but for mineralogists, geochemists, technologists, and for chemists who work in environmental sciences.

The thesis reviewed is at the first time a research in the field of structural inorganic chemistry but chemical synthesis itself is its important part. Almost forty (!) novel oxygen compounds of selenium were synthesized by the author or with his participation and many elements and chemical groups (uranyl, vanadyl, organic groups, etc.) are involved as cations in the selenites and selenates studied that makes the work especially interesting in the light of fundamental chemistry. Note that some compounds were synthesized using chemical vapour transport reactions that is close in conditions to the processes of the formation of selenite minerals in fumarolic exhalations of the Tolbachik volcano at Kamchatka (more than ten natural selenites are discovered to date at this outstanding locality); it seems very interesting that all compounds synthesized by Vadim Kovrugin using this method are copper chloroselenites with additional oxygen atoms (except of one H-bearing phase without O atoms not included in the coordination polyhedra of Se), like the majority of the Tolbachik selenium minerals. The chapter on uranyl and selenium compounds is a subject of special interest for environmental geochemistry; the results given in this chapter could be used for the development of knowledge on the fixation of uranium in the form of organics-bearing selenite/selenate compounds in the oxidation zone of U-Se deposits, very common rich uranium deposits.

The major part of the PhD thesis reviewed is devoted to crystal structures and comparative crystal chemistry of novel oxygen compounds of selenium, including representatives of earlier unknown structure types. This is the most developed part of the work, and the PhD degree would be given, at the first time, basing on these results. The data presented in the thesis are correct and accurate that is confirmed by publications in serious, first-rank international scientific journals specializing in crystal chemistry and inorganic chemistry. Specially mention the approach based on the dimension reduction principle which was used for the investigation of the correlations between chemical composition and structure topology of the selenium compounds (chapter 2.6.3). This approach, still rarely used in structural mineralogy, seems prospective for the

comparative crystal chemical analysis of minerals with complex anions (at the first time, silicates).

Some criticism is caused by the absence of the comparison of the studied synthetic compounds with natural selenites and selenates in the thesis (except of ilinskite and some related phases discussed in corresponding article). It would be really interesting to involve both the Se minerals formed in the oxidation zone of selenide-bearing ores and selenites of the fumarolic origin to the crystal chemical discussion together with related synthetic phases. And, in my mind, in title of the thesis the formulation “oxide compounds” is not too good: the author has studied oxysalts but not oxides; the term “oxygen compounds” seems better there.

In any case, my rating of the PhD thesis by Vadim Kovrugin is high. His thesis and publications contain much new, scientifically valuable data. The work is well-organized and well-illustrated. It can be considered as significant contribution to the chemistry and, especially, crystal chemistry of oxysalts of both tetra- and hexavalent selenium. Vadim Kovrugin seems a highly qualified crystallographer, crystal chemist and chemist who undoubtedly deserves the PhD degree of Saint-Petersburg State University.

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