

**Review of the PhD thesis**  
**«Crystal Chemistry of Novel Oxide Compounds of Se<sup>4+</sup> and Se<sup>6+</sup>»**  
**submitted by Vadim M. Kovrugin for the degree of Doctor of Philosophy in Geology**  
**at St-Petersburg State University, Russia**

The PhD thesis of Vadim Kovrugin presents results of the detailed investigation of various synthetic selenites, selenates and selenite-selenates compounds. 39 new phases containing Cu<sup>+2+</sup>, Ni<sup>2+</sup>, Co<sup>2+</sup>, V<sup>4+/5+</sup>, Mn<sup>2+</sup>, Fe<sup>3+</sup>, Pb<sup>2+</sup>, Bi<sup>3+</sup> and U<sup>6+</sup>, have been synthesized using different approaches (chemical vapour transport reactions method, low temperature hydrothermal method and isothermal evaporation method) and they have been studied by a single crystal analysis. The presented work is in line with current research at the Department of Crystallography that focused on synthesis and crystal-chemical studies of new compounds which can be used in modern hi-tech industry.

The thesis includes reprints of eight research papers published in peer reviewed international journals (including Mineralogy and Petrology, Journal of Solid State Chemistry, Crystal Growth & Design) and for me it is a clear evidence of high quality of the presented results of single crystal studied and their interpretation. Vadim Kovrugin is the first author in six of the eight publications and this shows that his leading role in the research group.

The thesis is well written and illustrated, but nearly 99% of it is a description of crystal structures of the synthesised compounds. If the thesis "...is at the interface between solid-state chemistry and mineralogy." (p. 10) why the author did not include any "mineralogical" characteristics of the studied phases? e.g. crystal morphology, physical, optical properties. Also, the author emphasised the "geo-inspired" synthesis approach, but whether the conditions of synthesis correspond to the natural conditions (e.g. T, P, pH, Eh)? Particularly, I am interesting in comparison of conditions used for "chemical vapour transport reactions" and conditions during formation of minerals from volcanic gases.

My major concern is about lack of any analytical data for the studied compounds – they are rather complex phases, some of them contain elements with different valence state. My experience, with both natural minerals and synthetic phases, shows that compositional data (obtained either by SEM/EDS or WDS) and results from single-crystal analyses are not always comparable.

Despite my critical comments and questions to the author, I am happy with my conclusion that the submitted thesis is an important contribution to the field of fundamental crystal chemistry of oxocentered compounds. It corresponds to high international standards and Vadim Kovrugin certainly should be awarded with PhD degree in Geology.

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