

Review
of the Dissertation of Anna S. Pakhomova « Crystal chemistry of natural and synthetic titanium and molybdenum oxocompounds» submitted for the degree of Doctor of Philosophy in Geology at the St. Petersburg State University

It has long been recognized that the bioavailability and mobility of radioactive elements in the environment are controlled by their speciation, i.e. their structural and chemical properties, such as oxidation state, coordination, nature of ligands, complexation, etc. Depending on the conditions, radioactive elements may be present in the form of adsorption complexes, can coexist with other elements in solid solutions, or may form their own phases. In the latter case, the structural stability of these phases plays a crucial role in determining the mobility of these elements and their release to the biosphere.

To give a brief overview of contents, the dissertation has an introduction, followed by three chapters that cover the basic results of the crystal chemical studies of alkali metal molybdates, synthetic murataites, and crystal structure of laachite, a new zirconolite-type mineral.

The first part of reviewed dissertation contains results of synthetic and structural studies of novel molybdates (K(), Rb(), , ()Br, and ()). Special interest in potassium, rubidium and cesium molybdates is clear, because the oxidation of high-level waste results in formation of crystalline molybdate compounds and their crystal chemical studies are necessary for investigations and modeling the processes accompanying the decay of unstable uranium isotopes and their release into the environment.

The second part of dissertation is devoted to investigation of complex oxides (murataite, zirconolite, and laachite) which do not form in the nuclear wastes, but instead are of special interest as promising materials for the radioactive waste immobilization.

Hence, Anna Pakhomova's dissertation has the particular interest from both scientific and public points of view.

I have some insignificant remarks.

The author wrote that «chemically murataite is titanate of heavy rare earth elements, zinc, sodium and iron», but the simplified formula of murataite-Y is (), and chemically this mineral is complex oxide-fluoride of zinc, yttrium, and titanium. The new mineral laachite is also complex oxide of calcium, zirconium, niobium, iron, and titanium.

It should be noted that zirconolite-3O, -3T и -2M are orthorhombic, trigonal and monoclinic polytypes of one mineral species, zirconolite, respectively.

In conclusion, I should say that the most of data are received by Anna Pakhomova herself or with her active participation. The results obtained are valid, most of them have been published in peer-reviewed Russian and international journals.

Finally, I can conclude that the dissertation of of the Dissertation of Anna S. Pakhomova «Crystal chemistry of natural and synthetic titanium and molybdenum oxocompounds» complies with the international standard for PhD dissertations in the corresponding field.

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