

Review of the PhD thesis
«Crystal Chemistry of Natural Layered Double Hydroxides»
submitted by Elena S. Zhitova for the degree of Doctor of Philosophy in Geology
at the St.-Petersburg State University, Russia

It was a pleasure for me to read and comment this interesting thesis about crystal chemistry of a rare mineral quintinite $[\text{Mg}_4\text{Al}_2(\text{OH})_{12}](\text{CO}_3)(\text{H}_2\text{O})_3$ (member of the hydrotalcite supergroup) from the Kovdor alkaline and Bazhenovo ultramafic complexes. The hydrotalcite supergroup includes 44 minerals of various compositions and crystal structures, and a study of these minerals is important for our understanding of properties, structures of their synthetic analogs. The latter are essential components in industry (e.g. catalysis, adsorption).

A large part of the thesis is very detailed interpretation of the results gotten from single crystal analyses of several quintinite samples. Four different poly types of quintinite (two of them have been previously unknown) have been identified and characterized in details – the studied samples show variations in the cation order/disorder and are characterized by a formation of the superstructures.

The thesis also includes reprints of three papers published in Mineralogical Magazine, a chapter of the monograph entitled “Minerals as Advanced Materials II” and a summary of the paper published in Vestnik of St.-Petersburg State University.

As a reviewer I have several questions and comments:

1 - with the thesis title as “Crystal Chemistry of Natural Layered Double Hydroxides” I expected to see a description of all natural "layered double hydroxides" known as "hydrotalcite supergroup", which includes 8 groups with total 44 minerals in them. However, I have found that the thesis related just to one mineral - quintinite. Why has the author chosen such a loose title? In my opinion it gives a wrong impression about the thesis content.

2 - samples occurrence(s) - the author does not provide a description of the studied samples. It is mentioned that quintinite occurs in hydrothermal veins; and just for one sample the associated minerals are listed. For example, I have seen quintinite in various rock types at Kovdor, including phoscorites and carbonatites as well. More information is needed - a precise rock type, the mineral assemblage, the relative time of a formation versus to the associated minerals.

3 - quintinite composition - several crystals of the mineral have been studied by the single-crystal analysis method, but only an average data for one crystal and two single analyses for the other crystals are presented. The average data was probably normalized to 100 %, but both single analyses have low Totals (including calculated CO_2 and H_2O contents) - 94.3-96.1 wt.% - how could one explain this? Another question is - how the CO_2 , H_2O and the mineral formulas were calculated? It seems that some calculated values of a.p.f.u are wrong (Mg, Fe and H for the average data, H for the single analyses).

4 - one of the author's conclusion is a formation of a high symmetry disordered quintinite at relatively high temperature and a low symmetry ordered quintinite at relatively low temperature. However, in thesis I have not found any evidence for a different temperature formation of different quintinite polytypes at Kovdor. The author just refers to the publication by Bellotto et al (1996). Does the author have any data about the actual formation temperature of quintinite at Kovdor?

My questions and comments do not mean that submitted thesis does not correspond to high international standards and I am confident with my conclusion that Elena S. Zhitova is worthy of the award of the PhD degree in Geology at St.-Petersburg State University.

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