European Mineralogical Conference
Vol. 1, EMC2012-577, 2012
European Mineralogical Conference 2012

Three generations of quintinite from the Kovdor alkaline massif (Kola peninsula, Russia): an X-ray single-crystal diffraction study

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Crystals of three generations of quintinite, $[Mg_4Al_2(OH)_{12}][(CO_3)(H_2O)_3]$ (denoted in the order of appearance as Q1, Q2 and Q3), from the same vein from the Kovdor alkaline massif (Kola peninsula, Russia) have been studied using single-crystal X-ray diffraction. Crystals of Q1 are hexagonal, space group $P6_3/mcm$, [U+FFFD] = 3.046(5), [U+FFFD] = 15.121(5) Å (R_1 = 0.0436). The sample can be described as Mg,Al-disordered quintinite-$2H$ and is similar to the sample studied in [1]. The structure of quintinite Q2 was solved in the space group P-$3c1$, a = 5.272(1), c = 15.113(3) Å (R_1 = 0.060). The structure is characterized by the Mg,Al-ordering and can be characterized as Mg,Al-ordered quintinite-$2H$-$1c$ [2]. Crystal structure of quintinite Q3 was solved in the monoclinic space group [U+FFFD]$2/m$, a = 5.286(5), c = 7.767(5) Å (R_1 = 0.057) and is identical to the structure reported by Krivovichev et al. [3]; it can be described as quintinite-$1M$.

The observed sequence of phases (from disordered high-temperature $2H$ polymorph through ordered $2H$ to the low-temperature ordered $1M$ polytype) is in agreement with the general trend of formation of high-entropy ordered phases with the decreasing temperature.

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