

Vacancies in the Crystal Structure of Minerals and their Role in the Mineralogical Nomenclature

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Many new minerals are analogs of known species with different occupancy of sites in the structure; the particular case is a predominance of vacancy in one or more sites. In this connection, some questions take place: what are “vacancy-dominant” phases - mineral species or no? if yes, where is border between such and “full-occupied” species? what is “species-forming” vacancy? Rules of use of vacancy as a “species-forming element” are not unified in mineralogical nomenclature. As an occasion for discussion, we propose a following: 1) vacancy can regard as full-right “species-forming element”; 2) “species-forming vacancy” is empty site only which can occupied with cation/anion without changes in geometry of the structural motif; 3) criterion of determination of interspecific border is “rule of 50%” but cat-/anions have an advantage over vacancy: vacancy-dominant species is only one with $\sum \text{cat-/anions} > \sum \text{vacancies}$ in site. If $\sum(A,B) > \sum \text{vacancies}$ where cations $A > B$, it's A-dominant species even if $\sum A < \sum \text{vacancies}$, by analogy with modified Levinson's rule for RE-minerals (Bayliss, Levinson, 1988): if $\sum \text{REE} > \text{Ca}$, it's RE-mineral even if Ca prevails over each REE taken separately.

A new mineral, litvinskite, $\text{Na}_2(\text{Na}, \text{Mn})\text{Zr}[\text{Si}_6\text{O}_{12}(\text{OH}, \text{O})_6]$ (Pekov e.a., in press), differs from lovozerite, $\text{Na}_2\text{CaZr}[\text{Si}_6(\text{O}, \text{OH})_{18}]$, with vacancy-dominant C-site ($x = 0.65$) and, as a consequence, with space group. A new mineral, kuzmenkoite, $\text{K}_2(\text{Mn}, \text{Fe})(\text{Ti}, \text{Nb})_4[\text{Si}_4\text{O}_{12}]_2(\text{OH})_4 \cdot 5\text{H}_2\text{O}$ (Chukanov e.a., 1999), differs from labuntsovite with distorted Si-Ti-O-framework and kuzmenkoite structure don't contains Na-site (unlike labuntsovite one) as empty space; so, we can't consider kuzmenkoite as an analog of labuntsovite with vacant Na-site.