

Using Graph Theory to describe a mineral series variety

VOYTEKHOVSKY, Y.L. Geological Institute, Kola Science Centre, RAS, Apatity, Russia.

The mineral species form the continuous compositional and structural rows so often that this should be taken as a fundamental fact of the nature. An idea to consider all the near-related species as one mineral series was suggested in The System of Mineralogy by J.D. Dana et al. (1946). We propose a suitable mathematical background to handle these sometimes complicated sets of mineral species.

We define mineral series to be any sets of minerals forming, at least, restricted solid solutions with each other and denote them by the graphs in which vertices mean ideal mineral compositions while edges denote continuous solid solutions between them, if any. The problem of a mineral series taxonomy is turned to that for related graphs. All the 7-vertex graphs were generated from the 6-vertex ones given by F. Harary (1969). Two ways of graph ordering are suggested, based on their incidental matrices and decompositions into the full subgraphs.

Two variants of the graph evolution are considered provided some vertices and / or edges are deleted in it. These simulate all the possible evolutions of real mineral series when some minerals and / or intermineral solid solutions become unstable and disappear from the series under new conditions. At the same time, this approach allows us to build The System of Minerals as a real mathematical structure with an order relation of evolutionary character.

The above theory is illustrated by the most perfect series of garnets, spinelides, calcite carbonates, pyroxenes, amphiboles, PGE minerals etc.