Granulomorphology: a new approach to mineral grains

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The usual way to describe the shape of a crystal or a grain is to compare them with the ideal forms already known in the scope of crystallomorphology. Another idea to consider mineral grains in rocks and ores as chromatic polyhedra with contact surfaces being the faces regardless their real geometry and face colours related to the mineral species of grains being in the contact is suggested in the paper.

Fedorov's algorithm is used to generate all the combinatorial types of 4- .. 8-hedra (301 in total), simple 9- (50), 10- (233) and, for the first time, 11-hedra (1249) from the tetrahedron. They are described by the space point groups and lexicographically ordered by the face symbols. A majority of the polyhedra is found to be asymmetric. The above algorithm is extended by two procedures to derive also all the 2- .. 6-face nets on the sphere (1393). The two characterize a huge variety of intergrain relations in both normal and poikilitic rocks.

The following theorem is proved. The number of ways to paint an asymmetric n-hedron in t colours is equal to:

$$N(n,t) = \sum_{r=1}^{t} (-1)^{t-r} C_t^r r^n .$$

Then the $N(n,t) / k^n$ fraction gives us an apriory probability that a given mineral n-hedron is surrounded in a k-mineral rock by the grains belonging precisely to t mineral species.

The above approach allows us to predict the whole spectrum of mineral intergrowths of interest in rocks and ores, given the statistics of n-hedra for related minerals.