

It appears to the writer that such structures as the smaltite-chloanthite and the niccolite-breithauptite intergrowths afford some evidence of the degree of isomorphism exhibited by the minerals concerned, granting, of course, that these structures have resulted from practically simultaneous precipitation of the constituents from the same mother solution. The term isomorphism, of course, implies more or less complete identity of crystal symmetry. In this sense, these minerals are isomorphous. The property of mutual overgrowth is possessed by substances which have not the slightest chemical or crystallographic similarity and has accordingly been rejected by Retgers as conclusive evidence of isomorphism. Accepting complete miscibility or the property of forming homogeneous mixed crystals in all proportions as the most decisive criterion of pure isomorphism, as advocated by Retgers, we are led to the conclusion that the minerals with which we have been dealing, such as niccolite-breithauptite, smaltite-chloanthite, probably do not form molecular mixtures in every proportion and, therefore, do not exhibit the highest degree of isomorphism, in spite of their similar crystal form and analogous chemical composition. The same holds true for the cobaltite crystals with their gersdorffite (?) inclusions.

Following the classification of miscibility according to Retgers, these minerals appear to display limited miscibility of a sort.

Order of Deposition of Cobalt Minerals

The writer has not been concerned primarily with the study of the paragenesis of Cobalt minerals, but the apparent order of formation has been indicated for the associations which have come under his observation. For a complete study of this question very complete data would be necessary and final conclusions probably



Fig. 30. Diagram of portion of vein from Silver Bar mine, natural size, showing order of deposition. The shaded part represents smaltite-chloanthite intergrowth with chloanthite in the centre of dendritic growths. The hatched part is later niccolite and the white is calcite.

not justified by a microscopic study of isolated specimens alone. As the writer's conclusions, however, agree in the main with those of W. G. Miller and C. W. Knight they are here summarized.

From the numerous extremely intimate intergrowths which have been observed among the Cobalt minerals, e.g., smaltite-chloanthite, niccolite-breithauptite, etc., it is believed that certain of these minerals were precipitated in greater or less