γ pale yellow, $\alpha > \beta = \gamma$. One small elongated humite grain showing (001) parting and parallel extinction has a positive optic axial angle of about 68°.

In an extensive collection of specimens from the crystalline limestone lenses of the two paragneiss belts of South Harris, humite and chondrodite have only been found at this one locality in Bay Steinigie.

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[1] Min. Mag., 1935, vol. 24, p. 84.

BOOK REVIEWS

KORZHINSKY (D. S.). *Physicochemical basis of the analysis of the paragenesis of minerals.* Consultants Bureau, Inc. (New York), and Chapman & Hall (London), 1959. 142 pp., 86 text-figs. Price $7.50 or 63*s*.

Korzhinsky is concerned with elucidation of the factors that have led to the simultaneous formation of mineral assemblages, especially in metamorphic and metasomatic rocks. Relict and retrogressive minerals are therefore excluded from his analysis. In his view, processes of mineral formation represent reactions between two systems, one comprising the minerals in a rock and the other a pore fluid. Components of these systems are termed inert and mobile, respectively. He suggests that the circulation of mobile components in a chemically active pore fluid is essential for the occurrence of metamorphism. Korzhinsky sets up a thermodynamic model in which the chemical potentials of inert components are dependent upon their fixed masses and those of the mobile components are controlled by external conditions. The mobile components are then 'perfectly mobile' and their masses in a rock at any equilibrium stage depend only upon the content of inert components and the external conditions. The factors of equilibrium controlling mineral parageneses are thus the masses of the inert components (extensive parameters) and the intensive parameters pressure, temperature, and the chemical potentials of perfectly mobile components. The purpose of the book is to study the dependence of mineral parageneses on

these known factors of equilibrium. This Korzhinsky regards as a necessary basis for the reverse process of discovering the factors of equilibrium during natural processes from the study of mineral parageneses in rocks. Since natural systems only approximate to true thermodynamic equilibrium the 'relative mobilities' of mobile components have to be considered.

The approach can be illustrated by the content of successive chapters. I, Thermodynamic basis of the analysis of paragenesis of minerals, 27 pp. Gibbs's phase rule is applied to open systems with perfectly mobile components. II, Methods of representing chemical composition, 27 pp. Methods of projective geometry are emphasized. III, Relation between chemical and mineralogical composition under constant external conditions, 19 pp. Triangular composition–paragenesis diagrams are used to illustrate mineral parageneses, and multicomponent systems are resolved into partial systems containing only three inert components. Consideration of metamorphic, metasomatic, and igneous processes leads to a discussion of mineral facies. IV, Dependence of mineralogical composition on external conditions, 56 pp. Changes in external conditions (intensive parameters) cause changes in mineral parageneses and mineral composition that are illustrated in composition–paragenesis and chemical potential diagrams. The latter permit illustration of all possible parageneses in a multicomponent system on one plane. The chemical potentials of H_2O and CO_2 are frequently used as co-ordinates for metamorphic reactions, and those of K_2O and Na_2O for igneous reactions. V, General remarks on the application of paragenetic analysis of minerals in geology, 3 pp. Numerous observations of mineral parageneses over large areas and covering the entire range of composition are required before the data can be successfully analysed with the consequent development of physico-chemical theories of mineral formation.

The translation is good and there are few misprints; the addition of an index would have been most welcome. Although much of the text is theoretical there are many geological examples selected from Korzhinsky's own extensive field and petrographic studies. The reviewer is unable to comment on the rigour of the thermodynamics but he is convinced that the paragenetic diagrams will find wide application when the methods are more generally known. A useful sequel would be an enlargement of chapter V. The book can be recommended to all geologists interested in processes of mineral formation.

P. J. W.