NOTES AND NEWS

A UNIQUE OCCURRENCE OF BOBIERRITE, $Mg_3(PO_4)_2 \cdot 8H_2O$

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Bobierrite has been found in several places as small crystals in guano, and also as nodules. The occurrence described here is in a fossil elephant tusk. The tusk belongs to the species *Archidiskodon imperator* (Leidy) the type of which was found in Pleistocene gravels of Nebraska. The specimen under discussion was found in 1941 in a gravel pit of the Hallett Construction Company one mile southwest of Edgerton, Pipestone County, Minnesota. It was on top and partly embedded in a hard bouldery blue clay (probably Nebraskan till) which is overlain by 9 to 11 feet of terrace gravels and 3 feet of fine black soil, the whole being a terrace along Rock River. The tusk, the front end of which is missing, is about 7 feet long and 8 inches in diameter at the larger end. It tapers about half an inch in its whole length. When found, the middle part was embedded in the clay, and the curved ends projected into the gravel. The portion in the clay was unusually well preserved, but the ends in the gravel were badly decomposed. As drying occurred, the outer shell, $\frac{3}{8}$ inch thick, peeled off the tusk. Between this outer shell and the inner core, the layers of bobierrite were found.

There is really only one important layer of the mineral about 1 to 2 mm. thick, but thinner ones separated by paper-thin ivory partitions may be seen. The main layer is made up of three parts, a middle portion consisting of large well crystallized bobierrite and two border zones which consist of minute fibrous aggregates. The fibers point toward the center and are white in color. These zones are not more than two to three-tenths of a millimeter thick and may become almost invisible. The center layer consists of rosette-like flattened aggregates. The cleavage (010) of the crystals is commonly more nearly normal to the layer than parallel to it. The largest cleavage pieces may be several millimeters long and half a millimeter wide. They are practically colorless.

The physical properties of the mineral are: perfect cleavage parallel (010), hardness 2, specific gravity 2.2 (with Jolly balance). Optically +, axial plane parallel to (010), $Y=b$, $Z \wedge c = 28°$. Indices very close to those given by Larson and Berman,[1] $\alpha = 1.510$, $\beta = 1.520$, $\gamma = 1.543$. The x-ray powder photograph is very similar to that of vivianite.

The mineral dissolves rapidly in cold HCl. No chemical analysis of the mineral has been made, but tests for Fe, Al, and Ca show merely traces

[1] *U. S. Geol. Survey Bull.* **848,** p. 101 (1934).

of these elements. The absence of calcium was carefully checked by Dr. R. B. Ellestad, to whom the writers are indebted for his help. It is significant that a magnesium phosphate can develop from calcium phosphate—the ivory has the structure of apatite—to the complete exclusion of calcium. This fact is particularly interesting as the mineral hautefeuillite described by M. L. Michel[2] is said to be isomorphous with bobierrite. It has been given the formula $(Mg, Ca)_3(PO_4)_2 \cdot 8H_2O$. Its actual analysis showed 5.71% CaO according to Michel.

The absence of Fe in the bobierrite needs some explanation since it is isomorphous with vivianite $Fe_3(PO_4)_2 \cdot 8H_2O$.[3] Either the ground water which brought in the Mg contained no Fe or the latter was in the ferric state, which is improbable.

[2] *Bull. soc. franc. mineral.*, **16,** 40 (1893).

[3] Barth has also called attention to this in this journal, **22,** 338 (1937).

BOOK REVIEW

ECONOMIC MINERAL DEPOSITS by Alan M. Bateman, Professor of Economic Geology at Yale University. 898 pages, John Wiley & Sons, Inc., **1942.** Price $6.50.

This textbook deals with the origin and occurrences of mineral resources. The discussion of General Principles and Processes (Part I) constitutes the first half of the book and the remainder is almost evenly divided between Metallic Mineral Deposits (Part II), and Non-metallic Mineral Deposits (Part III).

The first four chapters of Part I cover general discussions of mineral deposits and include (1) Introduction, (2) Brief History of Economic Geology, (3) Materials and Modes of Formation, and (4) Relation to Magmas. These chapters comprise a resumé of the economic aspects of mineralogy, petrology, and general geology.

Chapter 5 contains the principal contributions of this book as a text in economic geology for the detailed discussion of Processes of Formation of Mineral Deposits covers 237 pages. The treatment follows a classification proposed by the author which is outlined under the following headings: magmatic concentration, sublimation, contact metamorphism, metasomatic replacement, cavity filling, sedimentation (exclusive of evaporation), evaporation, mechanical concentration, residual concentration, oxidation and supergene enrichment, and metamorphism. While most texts in economic geology contain much of the same material concerning the formation of mineral deposits, this chapter is undoubtedly one of the better presentations of the concepts because of its clearness, scope, and organization.

The next two chapters in Part I contain discussions of Controls of Mineral Localization, and Folding and Faulting of Mineral Deposits. The remainder of Part I consists of synopses on Classification of Mineral Deposits; International Relations and Conservation in Minerals; Geology in Prospecting, Exploration, Development, and Valuation of Mineral Deposits; and on Extraction of Metals and Minerals. The inclusion of these chapters in Part I makes it sufficiently comprehensive and independent that it might serve as an introduction to the subject of economic geology. This opinion differs somewhat from that of the author for he suggests that "For short courses in economic geology Parts II and III can be used separately from Part I. For longer courses all three parts can be used."