

DISCUSSION.

This department has been established by the editors in order to afford to those interested in questions relating to economic geology an opportunity for informal discussion. Contributions are cordially invited either in the form of discussion of more formal papers appearing in earlier numbers or bearing upon matters not previously treated. Letters should be directed to the Editor, Sheffield Scientific School of Yale University, New Haven, Conn. The full name of the author should be attached to all communications.

THE MAGMATIC ORIGIN OF BARITE DEPOSITS.¹

Sir:—Professor Tarr's paper² on the Missouri barite deposits and the recent review of his monograph³ bring prominently forward the question of the origin of such deposits in general, since the author's conclusion, that in Missouri they were formed by ascending hot solutions of deep-seated, presumably magmatic, origin, directly controverts the generally accepted view.

We have long been accustomed to think of barite deposits as belonging to two strongly contrasted types:

1. The widespread occurrence of the mineral in metalliferous veins in many parts of the world in close and obvious connection with igneous rocks. In some of these deposits barite constitutes the bulk of the gangue and may be mined as a by-product, while in others it furnishes the chief value and the ores are by-products. For many years such veins have been generally recognized as of deep-seated origin.

2. Barite in breccias, veins and replacements in many kinds of rocks, especially massive limestones, and in residual soils from such formations, but without apparent relation to igneous activity. Here belong the deposits of Missouri and the Appalachian states. In the absence of known igneous rocks or other recog-

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² W. A. Tarr, "The Barite Deposits of Missouri," *ECON. GEOL.*, Vol. XIV., pp. 46-67, 1919.

³ *Idem*, Vol. XIV., pp. 267-269, 1919.

nized evidence as to the mode of their formation, these deposits have been the subject of much speculation, in which it has been generally assumed that they were formed by the circulation of shallow meteoric waters. No particular significance was attached to the presence of the sulphide ores—galena, blends and chalcopryite—nor even to the occurrence of fluorite, and the origin of these minerals was accounted for by similar hypotheses.

The Missouri barite deposits are in a belt of disturbance that is marked by anticlinal folds, faults, dikes and veins from Missouri to north central New York.⁴ Basic dikes cut Ordovician, Silurian and Devonian strata at several places from north central to south central New York; similar dikes intersect the Coal Measures in southwestern Pennsylvania, in both eastern and western Kentucky, and in southern Illinois; and pegmatite occurs in Ordovician strata in central Missouri. In Kentucky and Illinois also occur numerous veins carrying galena, blende, fluorite and barite, both in association with dikes and in many places along this belt where no dikes appear at the surface. The occurrence of blende and galena with the Missouri barite is equally well known.

This curved line of disturbance is roughly parallel to the Appalachian-Ouachita axis of folding. Possibly the Cincinnati geanticline and the Ozark Plateau may owe their origin to the operation of closely related diastrophic and batholithic movements which were concentrated in these regions and of which the veins, dikes, faults and folds in various parts of the belt are but the farthest upreaching manifestations. Similar processes, although not necessarily synchronous, may have operated in the Adirondacks, at the opposite end of the line.

My observations on the occurrence of barite in New Jersey seem to throw some light on the origin of the Appalachian deposits. Pending the completion of a report now in preparation on the ores and minerals of the Triassic belt in New Jersey, the relations can be only briefly outlined here. The deposits were formerly mined near Hopewell, about twelve miles north of

⁴ J. H. Gardner, *Bull. Geol. Soc. Am.*, Vol. 26, pp. 477-483, 1915; J. F. Kemp and J. G. Ross, *Annals N. Y. Acad. Sci.*, Vol. 16, pp. 509-518, 1907.

Trenton, where the mineral fills fissures and cements fault-breccia in a plug-like intrusion of diabase which cuts the red Triassic shale near the great Hopewell fault. Smaller amounts of barite occur in fissures and brecciated zones in both shale and diabase at several other localities in the New Jersey Triassic, and its association with the disturbances that marked the closing stages of Triassic time in this region is unmistakable.

Barite deposits also occur in similar faulted zones with or near diabase intrusions in the Triassic shales and sandstones of Massachusetts, Connecticut, Pennsylvania and Virginia—in several places intimately associated with copper, lead and zinc sulphides. Furthermore, the Appalachian deposits in other rocks also occur typically in fissured and brecciated materials with similar mineral associations, in some places with diabase dikes, and in or near normal faults of the Triassic type. Some of these are found in faulted schists and gneisses and some in sedimentary strata of various kinds, but the majority occur in or near massive limestones. Mining has demonstrated the close association of many of the residual deposits in clay with similar veins and breccias in the underlying strata.

The accompanying faults are in striking contrast with the overthrusts that characterized the period of Appalachian folding, and the obvious inference is that the deep fissuring which accompanied and immediately followed the igneous activity of late Triassic brought into play the processes that gave rise to the barite deposits.

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A PUBLICATION FOR GEOLOGICAL ABSTRACTS.

Sir—With the rapidly increasing activity of geological research in all its branches, it becomes more and more difficult for any one student to possess a detailed knowledge of more than two or three branches of the subject. This difficulty is intensified when the student has not an easily available bibliography of the modern