NOTES AND NEWS

CARNOTITE AND RADIOACTIVE SHALE IN MISSOURI*

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Carnotite and possibly other radioactive minerals have been found recently in limestone in Ste. Genevieve County, Missouri. This is the first reported occurrence of carnotite, not only in Missouri but in the Mississippi Valley region. It is of interest scientifically because it is one of the few known occurrences of this mineral in limestone as contrasted with the more usual occurrences in sandstone typical of the Colorado Plateau region. From the practical standpoint this discovery opens new areas, both geologically and geographically, to the search for radioactive materials. The possibility of finding commercially valuable radioactive mineral deposits in areas and under conditions hitherto not considered favorable will stimulate prospecting and may result in the discovery of other new sources of uranium.

The Ste. Genevieve occurrence was discovered in July, 1949, in a quarry in the Spergen limestone, about five and one-half miles north of Ste. Genevieve. Mr. Charles Bussen, the operator of the quarry, observed a thin film of a yellow substance along a joint in a block of limestone dislodged by blasting. This substance was identified as carnotite by the Missouri Geological Survey and Water Resources (Muilenburg). Investigations in the quarry by means of a Geiger-Müller Counter revealed a thin bed of black shale which is highly radioactive, separating two linestone beds. From its position in the section this shale parting is thought to be the source of the carnotite in the limestone below. The original identification of the mineral carnotite was subsequently confirmed by *x*-ray methods (Keller) and by spectrographic analysis (Dr. E. E. Pickett) at the University of Missouri laboratories.

Although carnotite is visible in only a few places in the shale, the entire mass is radioactive and there is a possibility that other radioactive minerals may be present in it.

An *x*-ray diffraction pattern of the black shale where no carnotite was visible indicates that the clay mineral is illite and the spectrographic analysis† shows that the shale contains uranium and vanadium. A tentative hypothesis therefore is that the illite contains these elements. Hendricks suggested that the vanadium of some of the western shales

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might be a part of the illite mineral.[1] Possibly the illite in the Ste. Genevieve shale may contain the uranium as well as the vanadium.

Further field and laboratory work on the occurrence, mineralogy, and origin of the radioactive minerals is being carried on under the direction of the authors.

SYNTHESIS OF UVAROVITE

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During the course of an investigation of pure compounds for use in ceramic fields, the synthesis of three garnets of the general formula $3CaO \cdot R_2O_3 \cdot 3SiO_2$ was attempted by dry reaction using chemically pure oxides as follows:

	Grossularite	Andradite	Uvarovite
	%	%	%
CaO	37.3	33.0	33.5
Al_2O_3	22.7	—	—
Fe_2O_3	—	31.5	—
Cr_2O_3	—	—	30.6
SiO_2	40.0	35.5	35.9

1. Grossularite

This mineral cannot be formed by dry reaction at atmospheric pressure. Extended heat treatments (150 hours) at 835, 1000, 1155, and 1240° C. all failed to produce grossularite, the principal reaction products being pseudowollastonite and anorthite. A glass of the grossularite composition yielded only pseudowollastonite and anorthite when devitrified. These results were to be expected in view of the previous work of H. S. Yoder (1), who emphasized the hydrothermal nature of the mineral.

2. Andradite

Extended heat treatments at 1105, 1200, and 1400° C. at atmospheric pressure failed to produce the mineral. The principal phase present was pseudowollastonite.

3. Uvarovite

The synthesis of pure $3CaO \cdot Cr_2O_3 \cdot 3SiO_2$ was achieved as low as 855° C. by holding for 150 hours. A 100 hour treatment at 1200° C. and a short duration run at 1400° C. also produced uvarovite. The *x*-ray data obtained by the use of a Norelco spectrometer ($CuK\alpha = 1.537$ *k*X) are presented below:

[1] Fischer, Richard P., Vanadium deposits of Colorado and Utah: *U. S. Geol. Survey, Bull.* **936-P,** 377 (1942).