phlogopite at temperatures below 450° C.; and that if desired, F-micas could be converted to OH-mica by mild hydrothermal treatment in KOH solutions. It also indicates in connection with the data of Romo and Roy (*loc. cit.*) that at room temperature exchange by partial substitution of F for OH in the mica lattice should be very limited and that the "decomposition-reaction" mechanism for the fixation of F^- by micas is the more likely explanation. This poses a problem in connection with the genesis of phlogopites which may appear to contain large amounts of both fluorine and hydroxyl.

Acknowledgment

The support of the U. S. Army Signal Corps, under *Contract SC 63099* is gratefully acknowledged.

References

1. Noda, T., Saito, H., Tate, I., Fukasawa, T., Fukase, M., and Sekine E.: *J. Chem, Soc. Japan (Ind. Chem. Section)*. In press.
2. Romo, L. A., and Roy, R.: *Proceedings of Third National Clay Conference*, Houston, Texas (1954).
3. Yoder, H. S., and Eugster, H. P.: *Geochim. Cosmochim. Acta*, **6**, 157–185 (1954).

A NEW OCCURRENCE OF EUCOLITE NEAR WAUSAU, MARATHON COUNTY, WISCONSIN

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Eucolite, a rare sodium-zirconium silicate, which has not been recorded before from north-central Wisconsin, was found in lujaurite while making a laboratory and thin section study of the rocks from an area 8 miles west of Wausau, Marathon County. Only 3 other localities for eucolite are known in the United States, and this is the first, as far as the writers are aware, in which the mineral is associated with the finer grained, aegirine-rich variety of nepheline syenite.

The syenites and nepheline syenites in the area are the latest in the series of the complex, crystalline rocks of Huronian age, which form a portion of the Canadian Precambrian shield, extending southward into Wisconsin. Both have aplitic and pegmatitic phases. Emmons (1953, p. 71–87) believes that the syenite and nepheline syenite occur as dikes along shear zones; and that the nepheline syenite originated by the replacement and recrystallization of granite, in an apparent roof-section of a batholith, effected by sodic feldspar solutions derived from the unmixing of potassic feldspars of the wall rocks.

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During July and August, 1950, Miss Elaine Geisse, accompanied by Mr. H. L. Geisse, collected specimens from a road metal quarry located in Stettin, T. 29 N., R. 6 E., Section 22, SE $\frac{1}{4}$, SE $\frac{1}{4}$, and from a $\frac{3}{4}$ square mile area adjacent to it, Section 26, NW $\frac{1}{4}$, NW $\frac{1}{4}$ and Section 27, NE $\frac{1}{4}$, NE $\frac{1}{4}$. The area is accessible from State Highway 29. It is on the central edge of the U. S. Geological Survey topographic map of Marathon County, Wisconsin, latitude 44°59′, longitude 89°46′.

The main quarry rock is syenite. Nepheline syenite, however, occurs to the south and west of the quarry in Section 22 and in the adjacent corners of Section 26 and 27. It crops out in the southeast corner of the quarry area, 10 yards southeast of the excavation, next to a knoll of greenstone country rock, and may be traced in a northwest direction across Section 22 for nearly a mile and southward into Sections 26 and 27. Only a few outcrops were found, although the rock occurs abundantly as float. A characteristic pitted surface, where the nepheline has weathered out, aids in distinguishing the rock from the syenite. Coarser textured dikes cut the nepheline syenite, and considerable pegmatite float was found but no outcrops could be located.

The specimen which carries eucolite (Wis. 14) was found only as float, and came from Township of Stettin, T. 29 N., R. 6 E., Section 27, NE $\frac{1}{4}$, NE $\frac{1}{4}$. It is a dark, green-gray to black nepheline syenite of the variety lujaurite; fine-grained (.5 mm), gneissic almost schistose, with white stringers and blebs of nepheline and albite and abundant brown zircon. Microscopic examination reveals albite, microperthite, nepheline, aegirine, zircon, fluorite and eucolite in parallel alignment.

The eucolite is pale yellow in color with some patches, especially along the edges or the interior of the mineral, showing the rosy-pink color and pleochroism characteristic of eudialyte. It has grown anhedrally and parallel to the other minerals, as shown in Figs. 1 and 2. It is associated with both aegirine and albite.

The following optical properties were determined: color, pale yellow; interference colors, maximum—first order yellow, minimum—first order gray; birefringence, .022; indices of refraction, $\omega=1.655$, $\epsilon=1.633$; interference figure, uniaxial; optic sign, negative. Known specimens of eucolite and eudialyte were obtained from Dr. William F. Foshag of the National Museum, Washington, D. C., and x-ray diffraction patterns were taken by Professor B. M. Shaub of Smith College. The x-ray examination confirmed the identification of the eucolite.

Its occurrence and properties are similar to those from other localities. The indices of refraction, however, are somewhat higher, and the mineral may therefore contain considerable cesium. A comparison with thin sections in the collection of the Department of Mineralogy and Petrology

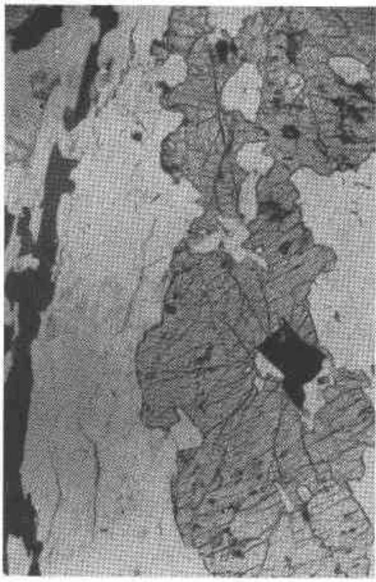

FIG. 1. Eucolite (gray) associated with albite (white), and aegirine (dark) in elongated bands as shown in the left of the picture. Inclusions in the eucolite are albite, aegirine and zircon. The dark, euhedral crystal, to the right of the center, is zircon. Plane light, ×44.6.

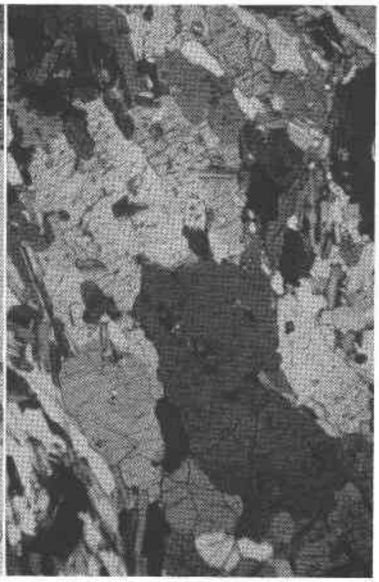

FIG. 2. Eucolite (light and dark gray) diagonally through picture, with finer grained albite (white and gray) in lower left and upper right corners. Dark to black mineral is aegirine. Crossed nicols ×44.6.

of Cambridge University showed that the Wisconsin eucolite is lighter yellow in color than that from the Bearpaw Mountains, Montana, and from Oslo, Norway. The Pilansberg, Western Transvaal, eucolite occurs in good hexagonal and rounded crystals, is colorless, and the associated eudialyte is a pinkish to bright rose color.

The three other localities where eucolite has been found in the United States are Magnet Cove, Arkansas, (Williams, 1891, p. 163–343); Bearpaw Mountains, Montana, (Pecora, 1942, p. 415); and Cornudas Mountains, New Mexico (Clabaugh, 1949, p. 1879–80). At Magnet Cove and in the Bearpaw Mountains the eucolite and eudialyte occur in nepheline syenite pegmatites; in the Cornudas Mountains they are associated with analcime nepheline syenite.

The occurrence of eucolite and eudialyte in lujaurite and also tinguaites, as well as in nepheline syenite pegmatites, is well known in foreign localities. Recently Nockolds (1950, p. 27–33) has reported the first occurrence of neptunite and associated eudialyte in the British Isles, at Barnavave, Carlingford, Ireland; an unusual occurrence because the minerals are associated with quartz-bearing syenite.

After this article was in press, Dr. Fred A. Hildebrand of the U. S. Geological Survey, informed the authors that he found eudialyte in tinguaite dikes, probably of Cretaceous age, which have intruded the northwest edge of a 400 square mile province of phacolithic syenite intrusives in central Arkansas.

References

Clabaugh, S. E. (1949), Eudialyte and eucolite from southern New Mexico: *Bull. Geol. Soc. Am.*, **60**, 1879–1880 (abstract).

Emmons, R. C. (1953), Petrogeny of the nepheline syenites of central Wisconsin: *Memoir Geol. Soc. Am.*, **52**, 71–87.

Nockolds, S. R. (1950), On the occurrence of neptunite and eudialyte in quartz-bearing syenites from Barnavave, Carlingford, Ireland: *Mineral. Mag.*, **29**, 27–33.

Pecora, W. T. (1942), Nepheline syenite pegmatites, Rocky Boy Stock, Bearpaw Mountains, Montana: *Am. Mineral.*, **27**, 397–424.

Williams, J. F. (1891), The igneous rocks of Arkansas: *Annual report of the Geol. Survey of Arkansas*, **2**, 163–343.

A STEREOGRAPHIC CONSTRUCTION FOR DETERMINING OPTIC AXIAL ANGLES

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The derivation of the optical axial angle from the three chief refractive indices is a task often carried out graphically with the aid of nomograms. Of these several have been described in the course of time. A good example is the diagram constructed by H. Waldmann (1945) who also quotes and discusses the work of previous authors. A more recent paper on the same subject is that by C. P. Gravenor (1951). The purpose of the nomogram in all these cases is to supply a solution to a problem which in essence can be stated as follows: Given an ellipse, the main axes of which are proportional in length to $n_x(n_\alpha)$ and $n_z(n_\gamma)$ of a given optically biaxial crystal; required the position within the ellipse of the two radius vectors having a length proportional to $n_y(n_\beta)$. These radius-vectors of the ellipse are also radii of one of the circular sections through the optical indicatrix and hence are perpendicular to one of the optical axes. The position of the latter within the ellipse and the angle between them therefore follows from that of the radius vectors n_y.

The construction of ellipses is not usually thought of as one that can easily be based on a stereographic projection. But this is actually the case as the following considerations show. An ellipse having the major axis a and the minor axis b can be thought of as the intersection of a right circular cylinder of radius b with a plane inclined at a certain angle to the horizontal. If $ABCD$ in Fig. 1 be four points on a random axial section through such a cylinder and PQ be the trace on this section of