MINERALOGY.—*Crocidolite from eastern Pennsylvania.*[1] EDGAR T. WHERRY and EARL V. SHANNON, U. S. National Museum.

The occurrence of a glaucamphibole in the Highland belt of pre-Cambrian rocks of eastern Pennsylvania was noted by D'Invilliers in 1883.[2] He classed the mineral as an amphibole on the basis of a "rough analysis" by State Chemist McCreath made on "a portion of the mass more or less mixed with feldspar" which yielded, when the meaningless decimals are omitted: SiO_2 51.7, Al_2O_3 17.5, "FeO" (probably at least half Fe_2O_3) 9.2, MgO 8.8, CaO 5.1, and "undetermined" (no doubt $Na_2O + H_2O$) 7.7%. This corresponds more or less to a mixture of labradorite with a high magnesium glaucamphibole. In the absence of optical data, however, the exact identity of the latter could not be established.

Another occurrence of the mineral in the pre-Cambrian was studied by Mrs. Eleonora Bliss Knopf in 1913.[3] She classed the mineral as glaucophane on the basis of an analysis by Dr. Edwin DeBarr, but judging from the silica percentage of 83.3, this was made on a sample containing a large amount of quartz in addition to feldspar, and is accordingly unsuitable for establishing the exact nature of the mineral. Mrs. Knopf obtained in addition some optical measurements agreeing with those recorded for the glaucamphibole group, but not characteristic of any individual member: extinction angle $X/c = 3°$ to 15°, and pleochroism Z blue to violet, Y pale green, and X colorless to pale yellow.

While the senior writer was connected with Lehigh University, Bethlehem, Pa., he observed glaucamphiboles at many localities in the region, in both pre-Cambrian and Triassic rocks. On removal to Washington, he presented a number of specimens to the National Museum, and made a study of their optical properties, by the immersion method. Much of the material proved to be cryptocrystalline, with n = about 1.66 and intense blue color. At some localities, however, microscopically fibrous to bladed material occurs, and this gave alpha = 1.64 to 1.65, beta = 1.65, gamma = 1.66. The pleochroism is X yellow, Y green, Z blue. The double refraction varies from one specimen to another, but is sometimes so low that

[1] Presented at the meeting of the Mineralogical Society of America, December 29, 1921. Published by permission of the Secretary of the Smithsonian Institution. Received Dec. 31, 1921.

[2] Second Geol. Survey Penna. Rept. D 3, II, 1: 93–94. 1883.

[3] Bull. Amer. Mus. Nat. Hist. 32: 517–526. 1913.

anomalous interference colors due to high dispersion in some indeterminate direction are shown. One of the best samples for optical study came from a road metal quarry southwest of the town of Mohnton, Berks County, the rock being a highly metamorphosed Triassic sandstone. Other noteworthy localities in similar rock, as well as in the Triassic diabase causing the alteration, lie three miles—5 kilometers—south of the city of Reading, and just east of Little Oley, south of Boyertown, Berks County. In addition to the pre-Cambrian gneiss occurrences listed by Mrs. Knopf, it is abundant in these rocks north of Oley Line, Berks County, and northeast of Dillingerville, Lehigh County. It also occurs for some miles northeastward from Riegelsville, Pa., in the state of New Jersey. In all perhaps fifty localities are known.[4]

TABLE 1.—ANALYSIS AND RATIOS OF CROCIDOLITE FROM OLEY LINE, PA.

	Analysis	Ratios	Theory
SiO_2	51.62	0.86 or 6	50.7 (6)
Al_2O_3	0.92	0.01	
Fe_2O_3	18.36	0.12 or 1	22.4 (1)
Ti_2O_3	2.27	0.02	
FeO	10.93	0.15 or 1	10.1 (1)
MgO	5.92	0.15	5.6 (1)
CaO	0.48	0.01 or 1	
Na_2O	5.62	0.09 or $^2/_3$	8.7 (1)
K_2O	0.66	0.01	
H_2O^+	2.57	0.14 or $^4/_3$	2.5 (1)
H_2O^-	1.04	0.06	
Sum	100.39		100.0

Becoming interested in the identity of the mineral, the junior author analyzed a sample from the locality north of Oley Line, which was kindly selected and purified by Mr. C. S. Ross of the U. S. Geological Survey, and proved to be cryptocrystalline and homogeneous on microscopic examination. The analysis, the first made on pure material, showed the mineral to be a semimagnesium crocidolite, with the formula $H_2O.Na_2O.MgO.FeO.Fe_2O_3.6SiO_2$.

The high percentage of titanium present suggests that this element, in its lower state of oxidation, may partially account for the extremely intense color of the mineral, although admittedly part of the color is due to iron. Titanium has therefore been regarded as replacing aluminium and iron, rather than silicon. The low content of alkalies

[4] Professor A. H. Phillips reports it also in the highlands of New York State. It is represented in some mineral collections under the name vivianite.

is evidently connected with partial replacement of sodium by hydrogen, total alkalies plus total water amounting to the theoretical ratio of 2. The rôle of water in the glaucamphiboles appears never to have been studied, but as most of the analyses show on the average 2% of this constituent, it is probably at least in large part essential.

It is interesting to consider the mode of occurrence of the material: it is found as impregnations and coatings in gneissoid rocks of pre-Cambrian age, in diabase of Triassic age, and in sediments of the latter age intruded by the diabase. The gneisses thus impregnated are usually greatly shattered; the crocidolite not only fills the resulting crevices, but also replaces the original minerals of the gneiss. Replacement of hornblende was described by Mrs. Knopf, and it may be added that the rocks, which usually contain considerable primary quartz where unaltered, are practically free from this mineral in extensively crocidolitized zones. Some of the silica has been redeposited, with the crocidolite, in the form of secondary quartz. The same phenomenon is noticeable in the replacement of these gneisses by sericite[5] which is of frequent occurrence in the region, namely that the primary quartz is replaced more rapidly than the feldspar. This points to the deposition of the crocidolite, like the sericite, from hydrothermal solutions. The shattering of the crocidolitized gneisses is, in the experience of the senior writer, almost always connected with faulting of late Triassic date, and since the same mineral occurs in the late Triassic diabase and the sediments it has metamorphosed, the suggestion is here made that the hydrothermal solutions which deposited the crocidolite in the various occurrences came alike from the Triassic diabase magma.

PALEONTOLOGY.—*Middle Eocene Foraminifera of the genus* Dictyoconus *from the Republic of Haiti.*[1] WENDELL P. WOODRING, U. S. Geological Survey.

In 1900, Chapman (1, pp. 11–12, pl. 2, figs. 1–3) described as *Patellina egyptiensis* a curious conical species of Foraminifera that was collected in northern Egypt between Cairo and Suez from rocks that were then supposed to be of lower Miocene age. The generic name *Patellina* was used by Chapman as the equivalent of *Orbitolina*. Blanckenhorn (2, pp. 419, 432–435) showed that the rocks from which Chapman's specimens were collected are part of the lower Mokattam group of mid-

[5] WHERRY. Bull. Geol. Soc. Amer. 29: 383. 1918.

[1] Published by permission of the Engineer in Chief, Republic of Haiti, and of the Director, U. S. Geological Survey. Received April 24, 1922.