NOTES AND NEWS

SPESSARTITE FROM AVONDALE, DELAWARE COUNTY, PENNSYLVANIA

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In 1926 L. Leigh Fermor,[1] after a study of several garnets from India, arrived at the conclusion that three new garnet molecules were present, which he called:

Skiagite $3\ FeO \cdot Fe_2O_3 \cdot 3\ SiO_2$
Calderite $3\ MnO \cdot Fe_2O_3 \cdot 3\ SiO_2$
Blythite $3\ MnO \cdot Mn_2O_3 \cdot 3\ SiO_2$

Subsequently, Shannon analyzed a garnet from Amelia, Virginia,[2] and from Gwynns Falls, Baltimore, Md.[3] Both of these garnets contain considerable manganese. By calculating a portion of the manganese found as the new molecule "blythite," Shannon was able to derive a formula for the Amelia garnet which gave better agreement with the garnet formula.

The large garnet crystals from Avondale, so conspicuous in every large collection, are likewise sufficiently high in manganese to be classified as the spessartite variety. It was thought advisable to reinvestigate the Avondale garnet,[4] employing all the necessary precautions which are so indispensible in mineral analysis, and exercising special care in the accurate separation of iron, manganese and aluminum.

LOCALITY. The garnet crystals are found in Leiper's Quarry, Avondale, on the east bank of Crum Creek one mile south of Swarthmore, Delaware County, Pennsylvania.[5]

GEOLOGY. The quarry is situated on the coastal plain of the Philadelphia District, in a granite gneiss that according to F. Bascom[6] is of early Cambrian age or older. Crum Creek has cut down through the thin cap of the overlying coastal plain of sedimentary formation, the Pensauken, and exposed the granite gneiss along this portion of its course. Cutting the granite gneiss are veins of pegmatite, in which the garnets occur, associated with black tourmaline, beryl, apatite, feldspar, muscovite, and occasionally secondary torbernite.

DESCRIPTION OF SPECIMEN. A specimen from the collection of the Academy of Natural Sciences of Philadelphia was selected for study. The crystal was roughly two inches in diameter, of slightly distorted trapezohedral form, modified by very small dodecahedral faces. One-third of the crystal was in contact with pegmatite matrix, consisting of muscovite, quartz, and microcline. Broken parts of two other smaller crystals were attached to the larger crystal. The trapezohedron was the (211) form, as determined by measurement of the interfacial angles (48 and 33 degrees) using a Penfield contact goniometer.

A broken corner from the larger crystal was removed for analysis and for physical determinations. The mineral was crushed to fragments of 1 mm. size in an agate mortar and examined with the microscope. All fragments attached to or containing any impurity were discarded; the main impurities being quartz, feldspar, and mica. These minerals occurred scattered through the garnet in considerable quantity even though the crystal appeared very clear. All the clear glassy grains were separated and crushed finer, and all impurities again sorted out. Only perfectly clear grains were used for the analysis. The powder when examined under polarized light was found to be homogeneous and isotropic. The powdered mineral was pale salmon in color.

Physical Determinations

Refractive Index. The index of refraction was determined by the powder immersion method, and the index of the liquid ascertained on a goniometer by means of a hollow 30° prism. This gave the value $n = 1.805$.

Specific Gravity. The specific gravity was determined by adjusting a Clerici solution until grains neither floated nor sank. The gravity of the solution was then determined by means of a pycnometer. The value 4.117 was obtained.

Chemical Analysis

The analytical methods recommended by H. S. Washington[7] for the determination and separation of the various elements occurring in minerals, were closely followed. The sample used weighed 0.5895 grams. The details of the various operations will be omitted, but the greatest care was exercised as to technique, cleanliness, purity of reagents, and proper removal of excess salts before attempting to precipitate any element.

It is necessary to emphasize the point that considerable SiO_2 comes down with the iron and aluminum and even with calcium, and that some iron and aluminum also precipitate with SiO_2. Therefore it is necessary to separate these precipitates and return the second or contaminating elements to their proper portions. Titanium was tested for but found absent.

Analysis of Spessartite
Leiper's Quarry, Avondale, Delaware Co., Pa.
Lester W. Strock, Analyst.

	I	II	III	IV	V	VI
	Analysis	Mol. Ratios	Spessartite Molecule	Almandite Molecule	Grossularite Molecule	Sum III–V
SiO_2	36.52	0.6084	0.3722	0.1983	0.0336	0.6042
Al_2O_3	21.00	0.2055	0.1241	0.0661	0.0112	0.2014
FeO	14.27	0.1983		0.1983		0.1983
MnO	26.41	0.3723	0.3723			0.3723
CaO	1.88	0.0336			.0336	0.0336
	100.08					
Mol. percentages			61.6	32.8	5.6	

It will be seen from the above that the Avondale garnet is a member of the almandite—spessartite series, with spessartite as the major constituent. Most of the garnets of granite pegmatite belong to this series.[3] Ford[8] has pointed out that whenever a garnet contains three constituent molecules, two are always present in larger amounts, while the third is present as a minor constituent—less than 10 per cent of the whole. This is true of the Avondale garnet.

It was not necessary to assume any manganese present in the trivalent state, as a "blythite" molecule, in order to compute a satisfactory formula; the analysis shows a slight excess of R_2O_3, which however is within the limit of analytical error.

REFERENCES

[1] L. Leigh Fermor, On the composition of some Indian garnets. *Records Geol. Surv. India*, Vol. **59**, Pt. 2, 191–207, 1926. This reference by Shannon is erroneously given as Vol. 49 instead of Vol. 59.

[2] Earl V. Shannon, "Blythite" and the manganese garnet from Amelia, Virginia. *Jour. Wash. Acad. Science*, Vol. **17**, No. 17, Oct. 19, 1927.

[3] Shannon and Gonyer, Almandite and spessartite garnet from Gwynns Falls, Baltimore, Md. *Jour. Wash. Acad. Science*, Vol. **17**, No. 21, Dec. 19, 1927.

[4] W. C. Robinson, Analysis of Spessartite Garnets. (An analysis was made by Robinson under the direction of Genth in 1887.) *Jour. Analyt. Chem.*, **1**, 251, 1887.

[5] Mineralogy of Pennsylvania, Samuel G. Gordon, **1922**, page 197.

[6] F. Bascom, Pre-Triassic metamorphic rocks (Granite Gneiss). *Philadelphia Folio, U. S. Geol. Surv.*, No. **162**, page 5, col. 4.

[7] H. S. Washington, *Analysis of Rocks*, 3rd ed., *New York*, (**1919**).

[8] W. E. Ford, A study of the relations existing between the chemical, optical and other physical properties of the members of the garnet group. *Amer. Jour. Science*, Vol. **XL**, page 33, 1915.

BOOK REVIEWS

PRECIOUS AND SEMI-PRECIOUS STONES. MICHAEL WEINSTEIN. VIII +138 pp., with a colored frontispiece and 16 full page illustrations. Sir Isaac Pitman & Sons, Ltd., *London*, **1929.**

This book aims to present the more important facts concerning gems in a concise, readable, and non-technical manner and should appeal to the general reader interested in precious and semi-precious stones.

The physical properties of gems, cutting of stones, artificial staining, and weight and prices are all considered briefly, as is also the subject of real, synthetic, and immitation stones. In the more general part most of the minerals used as gems, as well as pearl, amber, coral, and jet, are discussed. There is also a chapter entitled "Superstition and Gem Stones" and an appendix in which gem materials are arranged according to color, chemical composition, hardness, specific gravity, dichroism, indices of refraction, and locality.

While the material is on the whole well presented, there are a number of unpardonable errors. For example, the statements on pages 5 and 40 that nearly all synthetic stones are made in Germany and France and that "The term 'corundum' must not be confused with the abrasive material carborundum, which is corundum mixed with heavy minerals, such as magnetite and hematite, all of lower hardness," are incorrect and should be revised.

The frontispiece and the various half-tone illustrations are very good.

EDWARD H. KRAUS

DIAMOND—A DESCRIPTIVE TREATISE. J. R. SUTTON. XII+118, with 111 full page illustrations. Thomas Murby & Co., *London*, **1928.**

This book is based largely upon observations over a period of 35 years in the diamond fields of Africa, and is designed for the general reader and lover of gem stones. Although the author gives much general information concerning the various