MEMORIAL OF SAMUEL GEORGE GORDON

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The unexpected death of Samuel George Gordon came as a shock to his many personal friends and colleagues. The mineralogical world has lost one of its outstanding men. "Sam" was admired and respected by many people in all walks of life. He had a keen mind, was extremely competent, unassuming and was loyal to his friends.

He was born in Philadelphia, Pa., June 21, 1897, the son of Isadore and Flora Gordon. He is survived by his wife, Bertha May Landrum of Nacogdoches, Texas, and two sisters Julia and Gertrude; there were

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1897–1952

no children. He died of a coronary occlusion on May 17, 1952, in Cincinnati, Ohio.

Gordon was one of the founders and a fellow of the Mineralogical Society of America. He played an important role in starting the *American Mineralogist* and was an associate editor from its beginning in 1916 until 1949. He was an early member of the Philadelphia Mineralogical Society, an officer-elect of the Crystallographic Society of America, American Crystallographic Association and the Mineralogical Society of Great Britain.

As a young boy in the years around 1911–12, Gordon took a course in mineralogy and geology under Professor Edgar T. Wherry at Wagner Free Institute of Science of Philadelphia. He and a number of other students who attended these courses joined the Philadelphia Mineralogical Society and formed the enthusiastic kernel of members who were mainly responsible for the continued success of this club. Gordon planned and led numerous collecting trips around the Philadelphia area and reports of the trips and exhibits of the specimens collected were for many years features of the Philadelphia Mineralogical Society's monthly meetings.

Gordon never had an opportunity for a complete formal university training. In addition to the lectures at Wagner he later took occasional courses at University of Pennsylvania and Drexel Institute and spent six months (1926–27) with Victor Goldschmidt at Heidelberg, Germany.

Gordon's long association with the Academy of Natural Sciences of Philadelphia began in 1913 when he became Jessup student and later assistant curator of minerals, working under Frank J. Keeley, curator of the Vaux collection. His many mineral collecting trips around the Philadelphia and adjoining areas gave the Academy the best existing collection of local minerals. When he was not yet 24 he completed *The Mineralogy of Pennsylvania* which became the standard source book on mineral localities in this state.

Gordon made five major mineralogical expeditions under Academy auspices to secure new specimens for the Vaux collection and to obtain new research material. On each of these trips he returned with 25 to 30 cases of minerals. On his first trip in 1921 he visited the famous mineral localities in the Andes of Peru, Bolivia and Chile, and collected magnificent suites of brilliant, highly modified tetrahedrite, bournonite, enargite, translucent cassiterite, many rarer and some new species. In 1923 he went to the Julianehaab District of Greenland and collected suites of aegirite and albite as well as kalithomsonite, rinkite, etc. In 1925 he returned to Bolivia and Chile, in 1929–30 he went to the Bolivian Andes and Africa (radioactive minerals, azurite and malachite, meteor-

ites, etc.) and in 1938 he visited the Atacama Desert of Northern Chile. On the latter trip he took along a special three-wheel motorcycle provided with storage compartments for tools and specimens. This was characteristic of Gordon's disregard of personal comfort in order to minimize the Academy's expenses and to reach localities which otherwise would be inaccessible. His accounts of these trips in the Academy Year Book make interesting reading even today.

Gordon was particularly interested in the minerals of the great tin mines of Cerro de Llallagua, Bolivia. He visited these mines on three of his trips and examined and collected specimens from more than 100 working stopes as well as many of the accessible pillars in the abandoned stopes. His memoir, *The Mineralogy of the Tin Mines of Cerro de Llallagua, Bolivia*, published in 1944, contains some of the most remarkable crystal drawings ever made.

Gordon described nine new mineral species, shown in the following table.

Year	*Mineral*	*Composition*	*System*
1922	Vauxite	$FeAl_2(PO_4)_2(OH)_2 \cdot 7H_2O$	Triclinic
1922	Paravauxite	$FeAl_2(PO_4)_2(OH)_2 \cdot 8H_2O$	Triclinic
1926	Penroseite	$(Ni,Cu,Pb)Se_2$	Isometric
1926	Trudellite	$Al_{10}Cl_{12}(OH)_{12}(SO_4)_3 \cdot 30H_2O$?	Hexagonal?
1927	Metavauxite	$FeAl_2(PO_4)_2(OH)_2 \cdot 8H_2O$	Monoclinic
1941	Cadwaladerite	$Al(OH)_2Cl \cdot 4H_2O$	Amorphous
1941[a]	Sarmientite	$Fe_2(AsO_4)(SO_4)(OH) \cdot 5H_2O$	Monoclinic
1948[a]	Sanmartinite	$(Zn, Fe, Ca)WO_4$	Monoclinic
1950[b]	Wherryite	$Pb_4Cu(CO_3)(SO_4)_2(OH, Cl)_2O$?	(Biaxial)

[a] With Victorio Angelelli.

[b] With Joseph J. Fahey and E. B. Daggett.

Keeleyite, described in 1922, was later shown to be identical with zinkenite.

In 1930 Larsen and Shannon[1] gave the name *gordonite* to a new mineral, $MgAl_2(PO_4)_2(OH)_2 \cdot 8H_2O$, found in the phosphate nodules near Fairfield, Utah, after Gordon. It is related to paravauxite with Mg replacing Fe.

In 1928 Goldschmidt and Gordon published *Crystallographic Tables for the Determination of Minerals*. This book contains data on 759 minerals arranged in tabular form for identification with the two-circle goniometer. Gordon developed remarkable ability in using this classical technique to its fullest advantage. He could set up tiny faced mineral

[1] Larsen, Esper S., and Shannon, Earl V. The minerals of the phosphate nodules from near Fairfield, Utah: *Am. Mineral.*, **15**, 307–337 (1930).

crystals and usually could make an identification faster than one could prepare an x-ray powder photograph. Gordon was extraordinary in the identification of minerals in hand specimens using only a hand magnifier and in micromounts using a binocular microscope. The latter is particularly difficult since the morphological habit of these tiny crystals is usually markedly different from those of larger crystals.

Gordon was an expert in museum displays. The mineral and gem exhibits he prepared attracted the layman as well as the serious student. Many members of the Philadelphia Mineralogical Society were first attracted to mineralogy by his beautiful arrangements of the mineral collections. There is probably no mineral collection in the world that was displayed more efficiently and effectively. His magnificient exhibit of fluorescent minerals installed in 1928 has continued to attract thousands of visitors. He helped in the development of new types of museum cases which were so well designed the exhibit seemed to be floating in air.

Since the Academy is a public institution many people brought mineral and rock specimens for identification. Gordon spent a great deal of time doing this somewhat thankless chore and whenever he found a person with unusual interests in minerals he spent considerable time explaining the nature of the specimens and sometimes in encouraging the person to further studies.

In early 1942 Gordon obtained a leave of absence from the Academy to take a position in Office of the Chief Signal Officer, Washington, D. C. He joined our group (Quartz Crystal Coordination Section) working on the problems arising from the sudden unprecedented demand for quartz oscillator-plates. These plates which control the transmitting and receiving frequencies in communication equipment were in critically short supply for tanks, planes, walkie-talkies, etc. The manufacturing equipment and know-how had to be built very quickly and here Gordon showed some rare gifts. Since none of us knew the "best" orientation and cutting schemes at that time, we visited many plants to survey the problem. Sam always showed unusual perception in piecing together the procedures used from the noncrystallographic crude descriptions given by the workers using the methods. He quickly saw the importance of the parallelogram light figure obtained from etched XZ sections, the necessity for making an inspection after each step in the procedure and was a key figure in the development of procedures for cutting crystals which had no faces. He developed various rule-of-thumb procedures for quickly evaluating the efficiency of a plant, which were valuable in predicting production rates. His visits to the many crystal plants were always accompanied by amusing but accurate reports and personal letters which were so clear the reader felt that he was also there. In

early 1943 we collaborated in the publication of *Manual for the Manufacture of Quartz Oscillator-Blanks*, the first integrated scheme worked out for large scale production of precision cut blanks. The *Symposium on Quartz Oscillator-Plates*, the May–June 1945 issue of the *American Mineralogist*, contains four papers by Gordon on this subject. He returned to the Academy in 1944 after the emergency had been successfully met.

Unfortunately the facilities and funds available at the Academy were never adequate to support more than the most modest work. Although Gordon's salary was far less than he could obtain as a professional mineralogist he was so devoted to his work that I never once heard him complain. His equipment consisted only of a two-circle reflecting goniometer, an old petrographic microscope and a few odd mineralogical tools. In recent years a war surplus *x*-ray machine was obtained and Gordon with the help of a friend constructed some crude cameras. Finally even this modest program could no longer be supported and Gordon reluctantly left the Academy in the fall of 1949.

He returned to Government work and became senior metallurgist on the NEPA Division of Fairchild Engine and Airplane Corporation at Oak Ridge. Here he conducted crystallographic studies of intermetallic compounds and high temperature alloys. He developed efficient schemes of using minute amounts of powder for *x*-ray analysis. When the project terminated in 1951 he was given glowing letters of appreciation for essential services. He then became a staff member of the Chemistry and Metallurgy Research Division at Los Alamos Scientific Laboratory and did *x*-ray work on classified problems. He remained there nearly a year and was hired to join the staff of the Air Nuclear Propulsion Division of General Electric Company, Lockland, Ohio, a few days before his untimely death.

Another biographical note has been prepared by his close friend Harry W. Trudell and appeared in *Rocks and Minerals*, **27**, 478–480 (1952).

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