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MEMORIAL TO JOHN FRANK SCHAIRER

April 13, 1904–September 26, 1970

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On Friday, September 25, 1970, a group from the Geophysical Laboratory met at a popular restaurant in Washington to celebrate one day in advance of the 87th birthday of Dr. E. G. Zies, emeritus research associate and favorite of the staff. The well-worn stories about past campfires, the food in Japan, and the conditions for growing orchids were reviewed, and then the talk turned to retirement. There was considerable joshing and kidding, and Dr. J. Frank Schairer took the brunt of the remarks about his busy working schedule after "retirement" in 1969. All his furnaces were loaded with runs, a manuscript on a major quaternary system was under way, and plans were laid to help the Fellows with their problems. But these were not to mature. The next day, September 26, Dr. Schairer died while swimming near the summer home of his brother-in-law at Point-no-Point, Maryland.

THE FAMILY

John Frank Schairer was born in Rochester, New York, on April 13, 1904. His father, John George Schairer (1876–1965), was a master lithographer, who because of an occupational health problem and economic straits resulting from a long strike, took up farming. His mother, Josephine Marie (née Frank) Schairer (1874–1939), taught school for eight years before her marriage. Frank, as he preferred to be called, was the first of seven children; those following were girls.

At the age of five, Frank entered kindergarten of Rochester Public School No. 32, transferred to Immaculate Conception Parochial School at the first grade, and in 1917 entered the Rochester Cathedral High School, where his potential was immediately recognized and rewarded. During his first year in high school, the family moved to a farm in the town of Greece, New York. The new farm life demanded much of his spare time, but he maintained honor grades and was a member of the debating team. It is said, however, that his acumen for story-telling developed early in his life, and was aided and abetted by his

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six sisters in spontaneous fun-sessions. There was a great sense of family unity and love, and most of the activities centered in the home. Frank learned to play the piano, but a severe finger infection limited further training. He mentioned to his family in later years that he always regretted not having continued on with additional music lessons.

At the suggestion of his mentors at Rochester Cathedral High School, Frank entered competitive examination for a scholarship at Yale University offered by the Alumni Association of Rochester. A tie resulted, and after due consideration, the Alumni decided to offer both men a scholarship. A loan from an aunt, Miss Mary Schairer, provided some supplementary funds, and with part-time jobs, he was able to accept the opportunity.

Magna Cum Laude

During his freshman year he won the New York Yale Club prizes in Chemistry II and German I, was a member of the Fall Crew Squad, and also went out for boxing. His first interest in mineralogy was aroused by a field trip to Old Gillette quarry at Haddam Neck, Connecticut, on a weekend spent with a classmate's father, George N. Lawson, who had taken geology under James Dwight Dana. The beautifully crystallized pegmatite minerals captured his attention, and from that time on he was concerned with the chemistry of minerals and rocks. In his sophomore year Schairer won the Samuel Lewis Penfield Prize for excellence in mineralogy. The laboratory assistants in the mineralogy course at the time were William W. Rubey and James Gilluly, subsequently prominent members of the U. S. Geological Survey and of the National Academy of Sciences. He continued to specialize in chemistry but managed to fit in an array of courses in geology. The Yale Mineralogical Society was organized with the help of Schairer on October 5, 1923, and he was elected its first president. In 1925 Schairer was graduated with a Bachelor of Science degree *magna cum laude,* and in the following year, already having prepared five papers in mineralogy, three of which appeared in this journal, he received the Master of Science degree in mineralogy.

Chemistry still held his main interest, and his doctoral thesis under Professor H. W. Foote was a phase-equilibria study of the system Na_2SO_4–NaF–NaCl–H_2O at 25° and 35°C. The system contains the compound $Na_2SO_4 \cdot Na(F, Cl)$, which Foshag (1931) later discovered at Searles Lake, California, and named schairerite. The combination of interests in physical chemistry and mineralogy led Schairer (probably at the suggestion of a former staff member, Professor John Johnston,

then at the Sterling Chemistry Laboratory of Yale) to apply to the Geophysical Laboratory in Washington, D. C., in the hope that he could do his thesis work there on a fellowship from Yale. The Director of the Geophysical Laboratory at that time, Dr. Arthur L. Day, did not believe a one-year fellowship was practical. Instead Dr. Day offered him a staff position effective September 1, 1927, in spite of the fact that he had not yet received his Ph.D. It was there Schairer wrote up his thesis and received the Ph.D. degree in physical chemistry from Yale University, June 1928.

Duet for Genius

Dr. Day told Dr. Schairer that he could do anything he chose to do, "but he hoped it would have something to do with iron oxides" (Schairer, 1964, p. 458). He liberally interpreted this "directive" and proceeded to team up with Dr. N. L. Bowen on a series of studies on iron-bearing silicate systems. They pioneered the iron crucible-nitrogen gas quenching technique for investigating ferrous silicates. Two systems investigated early, CaO–FeO–SiO_2 and MgO–FeO–SiO_2, had great impact in both mineralogy and steel technology. Some of the primary joins for the pyroxene and olivine groups were presented, and the data contributed to an understanding of the attack of slags on refractories. These systems were later combined and expanded to include CaO–MgO–FeO–SiO_2 and CaO–FeO–Al_2O_3–SiO_2. In the latter system the principles of the "flow sheet," describing the major courses of fractionation of liquids, were laid out by Schairer. The experimental skill, efficiency, and accuracy of Schairer combined with the meticulous microscopy and geological interpretive skill of Bowen soon set a new goal for the scientific community to emulate.

During this period of intense phase-equilibria experimentation, Dr. Schairer managed to write a definitive bulletin on "The Minerals of Connecticut." He had collected the data on foot, occasionally using a streetcar or train to reach the more distant points, while he was at Yale.

Schairer and Bowen then turned their attention to the phase relations of feldspathoids and alkali feldspars. The high viscosity of melts of such compositions was the principal reason for their combining the studies of the iron silicates and the alkali-alumnia silicates. The fluxing effect of the iron silicates was first employed with albite-fayalite. The great significance to petrology of nepheline-kalsilite-silica as "petrogeny's residua system" (Bowen, 1937) was soon uncovered, and the course of research was set for some years to come. End members of each of the phases that formed early in magma (*e.g.*, enstatite,

forsterite, anorthite, diopside) were to be studied in conjunction with relevant joins in the residua system (Schairer, 1939, p. 153, Fig. 10).

The Spark Plug

Bowen's move to the University of Chicago in the fall of 1937 slowed progress on the grand plan, and World War II brought it to an abrupt halt. Schairer immediately plunged into the assignment given the Geophysical Laboratory—the solution of the hypervelocity (>3500 ft/sec) gun problem, which was dependent on the fundamental causes of gun erosion. Dr. Schairer was first a consultant and later a special assistant to Division 1 (Ballistics Research) of the National Defense Research Committee. In the official history of Division 1 (Burchard, 1948, p. 356), Schairer is described as the "spark plug," firing the enthusiasm of the contractors, traveling tirelessly to keep everyone informed, and integrating the efforts of the diverse programs. Remarkable alloys were developed as gun liners. Curiously enough, the same alloys were greatly instrumental in expanding the practical experimental range of pressure vessels used in hydrothermal research at the Geophysical Laboratory after the war. For his exceptional services Dr. Schairer received the President's Certificate of Merit (1948) and His Majesty's Medal for Service in the Cause of Freedom (Great Britain, 1948).

Nine-Component Space

By 1946 the Geophysical Laboratory was able to terminate most of its war work, and Schairer renewed his vigorous program of experiments using the quenching method. He returned to one of his original goals, completion and revision of those portions of the ternary oxide systems pertinent to rocks. Papers on Na_2O–Al_2O_3–SiO_2 and K_2O–Al_2O_3–SiO_2 followed, with N. L. Bowen, who had returned to the Geophysical Laboratory; Na_2O–MgO–SiO_2 and Na_2O–FeO–SiO_2, with H. S. Yoder and A. G. Keene; MgO–Al_2O_3–SiO_2, with M. L. Keith and later with W. Schreyer; FeO–Al_2O_3–SiO_2, with K. Yagi; and five joins in the K_2O–MgO–Al_2O_3–SiO_2 system, which he tackled alone. Solution of the many problems in the last system, involving an array of rock-forming minerals, was a prodigious effort. The soda analogue of that system, Na_2O–MgO–Al_2O_3–SiO_2 (Schairer and Yoder, unpublished), supported the general concepts deduced. The results of this work alerted geologists to the fact that the invariant point representing "granite" produced by the fractionation of "basalt" lies so close to that representing "granite" produced by the partial melting of sediments as to be almost indistinguishable in composition.

The End-Member Mineral Systems

As interest in the ternary feldspars shifted from phase relations to structure problems, Schairer turned his attention to the pyroxenes. The iron-free pyroxenes were worked on continuously after the war, each year producing modifications within the classic systems. He, better than anyone else, appreciated the difficulty, if not the impracticability, of producing liquids which lay exactly on the join $CaSiO_3$–$FeSiO_3$–$MgSiO_3$. Nevertheless, he did participate in a thermal study of natural, analyzed pyroxenes for the purpose of obtaining some clues as to the liquidus relations in the pyroxene quadrilateral. Pyroxene solid solutions involving Na, Al, Fe^{3+}, and Si were also investigated, usually with the assistance of exceptionally keen Fellows who could manage to keep up with the fast pace set by Schairer. Another major mineral group studied by Schairer and his colleagues was the melilites. A study of pseudowollastonite–akermanite–gehlenite carried out by Osborn and Schairer (1941) was a classic in experiment and theory of fractionation involving solid solutions. They also presented a preliminary diagram for akermanite—iron–akermanite. The details of the ternary system gehlenite—akermanite—soda–melilite, which was completed (Schairer, Yoder, and Tilley), remain unpublished.

The Basalt Systems

The oxide-system approach to the investigation of the major rock-forming minerals was eventually laid aside with the formulation of the "simplified basalt tetrahedron" of Yoder and Tilley (1962) and its expansion by Schairer and Yoder (1964) to include the melilites. The normative-mineral approach underlying some of the early work of the Geophysical Laboratory was revived, and a large number of systems bearing on the origin of both alkaline and tholeiitic basalts were studied. It was here that Schairer's incredible capacity for work, his broad laboratory experience, and his insistence on high precision brought success to an overwhelming task. No amount of committee work, which he always cheerfully accepted, deterred him from pursuing the mass of detailed experiments required to ascertain a single point. Visitors were accorded a full account of the procedures without delay or loss in the experiments. Many evenings he headed for home with the loud announcement that he was "saturated with regard to all solid phases." He did indeed contribute to our knowledge of all major phases pertinent to the common rocks.

The Honors

Schairer was honored by his fellow scientists for his research. He received the Roebling Medal of this Society (1963), the Arthur L. Day Medal of the Geological Society of America (1953), and the Hildebrand Award of the Washington Chemical Society (1942). The National Academy of Sciences elected him a member in 1953. He served as president of this Society (1943), vice president of the Geological Society of America (1944), section president of the American Geophysical Union (1956–1959), president of the Geochemical Society (1960), and vice president of the International Association of Volcanology (1957–1960).

The Contagious Personality

Schairer's scientific contributions, briefly and incompletely described above, are dwarfed by the gift he gave to this Society and to the world. The spirit of friendship, cooperation, and good cheer pervaded all his activities. His lectures were an inspiration to young scientists and were eagerly attended by the nonscientist because of their clarity and humor. He was not one to stand on ceremony and some of his remarks caused considerable shock, particularly his standard ice breaker at ladies' flower club meetings.

One cannot point to a time in his life when he was not young. An impressive aspect of Frank's personality was his vitality and love of life. He spent much of his leisure time with friends recalling interesting experiences. These stories constitute much of the Schairer legend and were repeated often and in exactly the same way. Each condensed so much humor and entertainment that the facts became secondary to the inflection and joy of the story teller. He was attracted to young people and each summer led a field excursion, not only to keep abreast of the critical problems in geology, but also to become better acquainted with the Fellows and new Staff at the Laboratory. It was difficult to understand his intense interest in fishing. It seemed such an incongruous hobby for a man so impatient for results. And he did get results. Raising orchids on a window sill that were the envy of the professional greenhouse growers was but one of his many avocational achievements. Many of the local growers were persuaded to include the more exotic species in their collections as a result of his success. His memory and recognition of wild flowers around the world was amazing. He helped organize the National

Capital Orchid Society, the Potomac Appalachian Trail Club, and the Allemande Lefters (a square dance group), and instilled many other organizations with the sparkle and fun of living. He was a member of Sigma Xi, Gamma Alpha, Alpha Chi Sigma, and the Cosmos Club of Washington, D. C.

To a Better Place

Dr. Schairer leaves his widow, Ruth Naylor Schairer of Chevy Chase, Maryland; their twins John (Jack) Everett Schairer of Madison, Wisconsin, and Jeanne Evelyn Rzeszut of Bowie, Maryland; six sisters, Helen and Marian Schairer of Rochester, New York, Mrs. Emily Callahan of Brockport, New York, Rosemary Schairer and Mrs. Virginia Meagher of Anchorage, Alaska, Mrs. Margaret Turner of Victor, New York; and four grandchildren.

In the words of one of his many friends, "The whole world is a better place because John Frank Schairer touched each of our lives."

References

Bowen, N. L. (1937) Recent high-temperature research on silicates and its significance in igneous geology. *Amer. J. Sci.* 33, 1–21.

Burchard, J. E., ed. (1948) *Rockets, Guns and Targets.* Little, Brown and Company, Boston.

Foshag, W. F. (1931) Schairerite, a new mineral from Searles Lake, California. *Amer. Mineral.* 16, 133–139.

Osborn, E. F., and J. F. Schairer (1941) The ternary system pseudowollastonite-akermanite-gehlenite. *Amer. J. Sci.* 239, 715–763.

Schairer, J. F. (1939) The origin of igneous rocks and their mineral constituents. *Sci. Mon.* 49, 142–154.

——— (1964) Acceptance of the Roebling Medal of the Mineralogical Society of America. *Amer. Mineral.* 49, 456–459.

———, and H. S. Yoder, Jr. (1964) Crystal and liquid trends in simplified alkali basalts. *Carnegie Inst. Wash. Year Book,* 63, 65–74.

Yoder, H. S., Jr., and C. E. Tilley (1962) Origin of basalt magmas: an experimental study of natural and synthetic rock systems. *J. Petrology,* 3, 342–532.

Bibliography of J. F. Schairer

The major portion of the bibliography of J. F. Schairer has already appeared in this journal (1964, 49, 454–456); amendments and additions follow:

(1930) Review of book, *Kristallzeichnen,* by Robert L. Parker. *J. Amer. Chem. Soc.* 52, 2590.

(1953) (with K. Yagi) The system FeO-Al_2O_3-SiO_2. *J. Japan. Assoc. Mineral., Petrology, Econ. Geol.* 38, 83–102, 193–208 (in Japanese).

(1954) Memorial of Frederick Eugene Wright. *Amer. Mineral.* 39, 284–292.

(1954) Presentation of Day Medal to John F. Schairer, by Robert B. Sosman. Response by John Frank Schairer. *Proc. Geol. Soc. Amer.* 57–58.

(1957) Memorial to Norman Levi Bowen. *Proc. Geol. Soc. Amer.* 117–121.

(1964) (with F. R. Boyd) The system $MgSiO_3$-$CaMgSi_2O_6$. *J. Petrology,* **5,** 275–309.

(1964) (with D. K. Bailey) Feldspar-liquid equilibria in peralkaline liquids—the orthoclase effect. *Amer. J. Sci.* **262,** 1198–1206.

(1964) Presentation of the Roebling Medal to J. Frank Schairer, by H. S. Yoder, Jr. Acceptance of the Roebling Medal of the Mineralogical Society of America, by John Frank Schairer. *Amer. Mineral.* **49,** 453–459.

(1966) Memorial to George Washington Morey. *Geol. Soc. Amer. Bull.* **77,** P161–P164.

(1966) (with D. K. Bailey) The system Na_2O-Al_2O_3-Fe_2O_3-SiO_2 at 1 atmosphere, and the petrogenesis of alkaline rocks. *J. Petrology,* **7,** 114–170.

(1967) Phase equilibria at one atmosphere related to tholeiitic and alkali basalts. In P. H. Abelson (ed.) *Researches in Geochemistry, Vol. 2.* New York, John Wiley and Sons, Inc., pp. 568–592.

(1969) (with H. G. Huckenholz and H. S. Yoder, Jr.) Synthesis and stability of ferri-diopside. *Mineral. Soc. Amer. Spec. Pap.* **2,** 163–177.

(1971) (with G. M. Brown) Chemical and melting relations of some calc-alkaline volcanic rocks. *Geol. Soc. Amer. Mem.* **130,** 139–157.

Because of the large number of systems investigated but not published in full, a list of the articles by Dr. Schairer appearing in the Annual Reports of the Geophysical Laboratory is available by ordering NAPS Document Number 01715 from National Auxiliary Publications Service of the A.S.I.S., c/o CCM Information Corporation, 866 Third Avenue, New York, N. Y. 10022; remitting $2.00 for microfiche or $5.00 for photocopies, in advance, payable to CCMIC-NAPS.