

Selected Publications of Sir Lawrence Bragg

In such a long and distinguished career, a complete bibliography would contain many contributions to journals around the world at different levels of scientific and general interest; over 180 publications have been traced but it is by no means certain whether such a list is exhaustive. An arbitrary and personal selection of his publications is given below chosen to illustrate the progression of Bragg's scientific interests that has been outlined in this memorial and his more important contributions to each field.

- 1913 The diffraction of short electromagnetic waves by a crystal. *Proc. Camb. Phil. Soc.* **17**, 43–57.
- The structure of some crystals as indicated by their diffraction of X-rays. *Proc. Roy. Soc.* **A89**, 248–277.
- 1914 The analysis of crystals by the X-ray spectrometer. *Proc. Roy. Soc.* **A89**, 468–489.
- 1921 (with R. W. James, and C. H. Bosanquet) The intensity of reflexion of X-rays by rock-salt. *Phil. Mag.* **41**, 309–337; **42**, 1–17.
- 1924 The refractive indices of calcite and aragonite. *Proc. Roy. Soc.* **A105**, 370–386.
- The influence of atomic arrangement on refractive index. *Proc. Roy. Soc.* **A106**, 346–368.
- 1926 (with C. G. Darwin, and R. W. James) The intensity of reflexion of X-rays by crystals. *Phil. Mag.* **1**, 897–922.
- 1929 The determination of parameters in crystal structures by means of Fourier series. *Proc. Roy. Soc.* **A123**, 537–559.
- 1930 The structure of silicates. *Z. Kristallogr.* **74**, 237–305.
- 1933 *The Crystalline State*, Vol. 1, *A General Survey*. Bell, London.
- 1934 (with E. J. Williams) The effect of thermal agitation on atomic arrangement in alloys. *Proc. Roy. Soc.* **A145**, 699–730.
- 1935 (with E. J. Williams) The effect of thermal agitation on atomic arrangement in alloys. II. *Proc. Roy. Soc.* **A151**, 540–566.
- 1937 *Atomic Structure of Minerals*. Cornell University Press.
- 1939 A new type of X-ray microscope. *Nature*, **143**, 678.
- 1940 The structure of a cold-worked metal. *Proc. Phys. Soc.* **52**, 105–109.
- 1945 (with A. R. Stokes) X-ray analysis with the aid of the “fly’s-eye”. *Nature*, **156**, 332–333.
- 1947 (with J. F. Nye) A dynamical model of a crystal structure. *Proc. Roy. Soc.* **A190**, 474–481.
- 1949 (with W. M. Lomer) A dynamical model of a crystal structure. II. *Proc. Roy. Soc.* **A196**, 171–181.
- Giant molecules. *Nature*, **164**, 7–10.
- The strength of metals. *Proc. Camb. Phil. Soc.* **45**, 125–130.
- 1952 (with M. F. Perutz) The structure of haemoglobin. *Proc. Roy. Soc.* **A213**, 425–435.
- 1954 (with E. R. Howells, and M. F. Perutz) The structure of haemoglobin. II. *Proc. Roy. Soc.* **A222**, 33–44.
- 1958 The determination of the co-ordinates of heavy atoms in protein crystals. *Acta Crystallogr.* **11**, 70–75.
- 1965 First stages in the X-ray analysis of proteins. *Rep. Prog. Phys.* **28**, 1–14.
- (with G. F. Claringbull) *The Crystalline State*. Vol. 4, *Crystal Structures of Minerals*. Bell, London.
- 1966 The art of talking about science. *Science*, **154**, 1613–1616.

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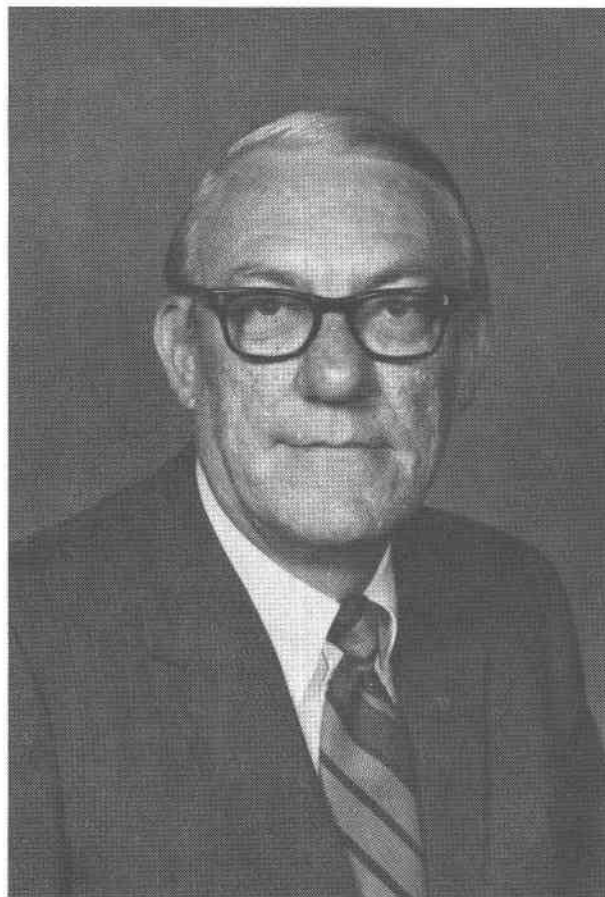
Memorial of Kent Combs Brannock July 20, 1923—February 21, 1973

JOHN S. WHITE, JR.

*National Museum of Natural History, Smithsonian Institution,
Washington, D. C. 20560*

Kent Combs Brannock was one of a relatively small number of modern vintage “amateur” mineralogists with sufficiently high levels of technical competence and constant interest to give him a professional’s understanding of mineralogy. His love of minerals was contagious, and was a continuing

source of inspiration to those around him less dedicated than he to their collection and study. The amateur group lost one of their most outstanding members when “Casey,” as he was known to his friends, passed away on February 21, 1973, at the age of 49, in Kingsport, Tennessee.



Born in Independence, Grayson County, Virginia, on July 20, 1923, Kent early displayed a precociousness by learning to read at the age of three. On the basis of a test given him at the age of six when he first entered school, he was placed in the third grade. Thus he graduated from Independence High School in 1939, at fifteen, an accomplishment that did not hamper his social development as he played in the school band, was class president and Valedictorian, and was awarded the Scholarship Medal. The wide range of his interests is revealed by the fact that he was at this time also studying piano and pursuing the hobbies of stamps, minerals, photography, and especially chemistry. He had been given a small chemistry set at the age of eight or nine and this gift certainly must have influenced his professional pursuit. He loved music (especially classical and semiclassical), animals, wildflowers, and old people.

In the Fall of 1939 Kent entered nearby Mars Hill College, Mars Hill, North Carolina. He was a model student, appearing on the honor roll every

semester; he joined the science club, was an officer in the Philamathian Literary Society, and a staff member for the school annual. He received the Associate of Science degree in 1941 and then entered Virginia Polytechnic Institute in Blacksburg. As an undergraduate at VPI he was a superior scholar, earning a grade-point average of 2.99/3.00. He received the B.S. degree in chemistry in March 1943, graduating first in his class of 523.

He was employed by the Eastman Kodak Company in Rochester, New York, in 1943, where he worked as a chemist in the Research Laboratories. In 1944, he transferred to the Clinton Engineering Works (which was operated by Tennessee Eastman Company) at Oak Ridge, Tennessee, where he worked as a production supervisor. He served in the U.S. Army for seven months during his assignment at Oak Ridge. Tennessee Eastman relinquished its participation in the atomic project, and in 1947 he transferred to Tennessee Eastman Company in Kingsport, Tennessee, to become a chemist in the Acid Division. In 1951, he left the Company to commence graduate study at Emory University in Atlanta, Georgia. He received his Ph.D. in chemistry from Emory in 1954; his thesis was entitled, "Studies of Hydroxymethylene Ketones." The Ph.D. degree was obtained under the direction of Dr. E. Earl Royals.

In 1954, Dr. Brannock returned to Tennessee Eastman and was reemployed as a Senior Research Chemist in the Research Laboratories. He became a Research Associate in 1963, and a Senior Research Associate in 1967. He was responsible for organic chemistry research, consisting of several research laboratories, 14 chemists, and 4 technicians.

Dr. Brannock's main research interest was exploratory research of aliphatic compounds, enamines, ketones, and small ring compounds—aimed primarily at discovering new syntheses of all types. He was a highly regarded specialist in the chemistry of enamines and in the discovery of synthetic methods related to these compounds. He was involved, also, in the synthesis of polymer intermediates and polymer additives.

Kent has presented papers at meetings of the American Chemical Society and the Gordon Research Conference. He was an invited speaker at the ACS Enamine Chemistry Symposium, held in Chicago in 1961. In recognition of his scientific esteem, he was an invited speaker on the Tennessee-Alabama-Georgia ACS speaking tour during 1966–

1967 and was the Northeast Tennessee ACS Section speaker for 1966. He has published more than 30 papers in chemistry and has been granted 33 patents. Nearly all of his publications are in organic chemistry and, therefore, are not here recorded.

His academic and professional trail is strewn with scholarships, awards, honors, and enthusiastic praise from his associates. As recently as 1972 he won the Herty Award which is given annually by the American Chemical Society (Georgia Section) in recognition of the work and service of outstanding chemists from the southeastern section of the country.

Casey started collecting minerals when he was a young boy. In more recent years, weather permitting on weekends, Casey was in the field searching for new localities or digging further into old ones. Nearly ten years ago he became fascinated with the minerals of the Foote Mineral Company's spodumene mine near Kings Mountain, North Carolina. He sent many specimens from this locality to museums and collectors around the world. His discoveries there stimulated a serious study of Foote mine minerals by several mineralogists, so it is entirely appropriate that a new mineral species from this mine has been named brannockite in his honor. Casey was just beginning to write papers on mineralogy, and had many that he planned to write, when cancer abruptly terminated his production. Even though he was deprived of publishing more papers in mineralogy, he can be credited with many substantial contributions. Just prior to his death he was made a member of the editorial board of the *Mineralogical Record*. This recognition was late in coming, for he had played an active role even before the magazine made its appearance, having provided sound counsel, encouragement, and advice; and he offered editorial assistance throughout its first three years of existence. His ideas were always absolutely sound, his reasoning extremely logical, and many of his suggestions were implemented.

Although he began to collect minerals early in life, it wasn't until the nineteen-sixties that mineral collecting became, for him, an obsessive preoccupation. In the last ten years of his life his collection

grew at a remarkable rate and had reached approximately 1500 specimens by the time he was hospitalized. Casey purchased many minerals but an impressive number of fine specimens were personally collected and from these he derived his greatest pleasure. He was also an extremely active trader, conducting exchanges with mineral collectors all over the world. The obvious strength of his collection was the high quality and good representation of material from the localities he could most easily visit, particularly those in Tennessee, North Carolina, and Virginia. Had he lived longer the Brannock collection would have become a major systematic private collection. In his will Casey bequeathed to the Smithsonian Institution its "unlimited choice of specimens from my collection," with the remainder given to VPI. Approximately 450 specimens were selected by the Smithsonian.

Casey was a fine gentleman admired by all of his associates. He was happiest out-of-doors collecting minerals, but when collecting was slow he could display an impressive knowledge of wildflowers and birds. Those of us who knew him well looked forward, on these collecting trips, to the evenings when he would tell jokes and relate anecdotes in his deep, slow, distinctly-southern-accented voice, a voice so perfect for story-telling that frequently I tried to persuade him to make records of bedtime stories for children. His relaxed manner and wonderful sense of humor put people at ease immediately in his presence. Casey Brannock was truly a great man; his greatness derived from a rare blend of excellence as a chemist and as an amateur mineralogist with a remarkable degree of humility and love of mankind.

Casey is survived by his mother, his former wife Bea, five daughters, and two grandsons.

Mineralogy Publications of K. C. Brannock

- 1970 Specimen cleaning reagents. *Mineral. Rec.* 1, 45.
- Louis Shrum, profile of a collector. *Mineral. Rec.* 1, 54.
- 1971 Minerals of the spinel group from Allegheny County, North Carolina. *Mineral. Rec.* 2, 43-44.
- 1972 Sphalerite and associated minerals from East Tennessee. *Mineral. Rec.* 3, 90-91.