

Obituary

Fredrik William Houlder Zachariassen 1906–1979

W. H. Zachariassen passed away, after a sudden brief illness, on 24 December 1979. He remains vividly in our memory as a gracious, wise and witty human being and as a profound and original scholar in physics and chemistry. He found the greatest satisfaction in doing his work well and thoroughly, and he was his own best critic. What he has done remains with the mark of his genius upon it, and it will not fade.

Willie – that was the name he wanted friends to use – was born in Langesund, Norway on 5 February 1906. He entered the University of Oslo in 1923 at seventeen; five years later he emerged with a PhD obtained under the guidance of V. M. Goldschmidt, the great Oslo geochemist. He was the youngest recipient ever of the PhD in Norway. In him, Goldschmidt found the genius who was to unravel more inorganic crystal structures and contribute more understanding to crystal chemistry than any contemporary. His thesis, entitled *Untersuchungen über die Kristallstrukturen von Sesquioxiden und Verbindungen ABO₃*, contained more (correct!) structure analyses than most X-ray analysts accomplish in their entire careers, and that when the X-ray method was at a primitive stage.

Willie was appointed assistant professor at the University of Oslo, but granted leave in 1928–29 to accept a postdoctoral fellowship in Sir Lawrence Bragg's laboratory. He returned for a year to the Oslo professorship and married the handsome granddaughter of the pioneer Norwegian geochemist W. C. Brøgger. Ragni Zachariassen – Mossa, to the many who know and love her – became Willie's lifelong companion, matching him in graciousness, warmth, and sensitivity. At the end of the 1920's, the University of Chicago physics faculty was searching for the world's most promising young X-ray crystallographer and found him in Oslo. Willie accepted an assistant professorship at Chicago in 1930 and remained there for 44 years; assistant professor until 1940, associate professor 1940–45, professor 1945–62, Ernest DeWitt Burton Distinguished Professor 1962–74. He became Professor Emeritus in 1974. He served as chairman of the physics department 1945–50 and 1956–59 and as dean of the Physical Sciences Division 1959–62.

Willie's first publication appeared in 1925; his last, the 203rd, will appear this year. Two-thirds are single-authored. The list of titles is itself fascinating, ranging from structural geometry to bond character to crystal physics, in one after another well-selected compound or family of compounds; following a series of silicate structure studies, there appears the famous

paper on *The Atomic Arrangement in Glass* and thereafter several papers on scattering from polyatomic molecular fluids; there is the long series of reports on oxo-radical salt structures of ever-increasing complexity; next appears the series on temperature diffuse scattering. Then comes a gap of a few years (1941–48) except for the book *Theory of X-Ray Diffraction in Crystals* (1945); a succinct and beautiful development of crystal symmetry and modern X-ray diffraction theory. Willie had been invited to write it in 1938 for Springer but, when the war began and Norway was invaded, he of course broke the contract with the German publisher. Wiley eagerly agreed to publish it. '... A considerable fraction of the material presented in this book represents the results of original researches.' Willie writes in the preface, 'Indeed, the modest size of the book is not a fair measure of the time I have spent on it.' As one among his many admiring readers remarked, the latter sentence applied equally well to serious students of the work.

In 1941 Willie became a US citizen and began another chapter of his career, for the Metallurgical Laboratory of the Manhattan Project on the University of Chicago campus. The work was classified; declassification began in 1948, and only then did crystallographers begin to learn of his brilliant contributions to the crystal chemistry of the transuranium elements. He had worked with microscopic amounts of radioactive materials, made many of the compounds he studied and – as Robert Penman of Los Alamos has aptly put it – 'performed his X-ray miracles on them'. He worked entirely from powder diffraction patterns, and no one was his equal in interpreting these. Willie was first to predict and develop evidence that the new elements were part of a new rare-earth-like (*5f*) series. The studies were reported in a series of 25 papers in *Acta Crystallographica*, under the general title *Crystal Chemical Studies of the 5f-Series of Elements*, between 1948 and 1959. Other aspects of these and later structural investigations of the *5f* elements and their compounds appear in 47 other papers.

In 1952 Willie contributed a paper of fundamental importance on the phase problem in X-ray crystal analysis, in which statistical methods were introduced for its analytical solution; again and again he demonstrated its practicality. In 1963, following some very accurate diffraction measurements on quartz which could not be accounted for by extant treatments of extinction, he discovered that Darwin's early theory of that effect contained a fundamental error. He applied his own new theoretical treatment of extinction to precise experimental observations on a variety of

crystals, thereby achieving a level of accuracy in experimentally derived structure-factor magnitudes and electron-density distributions never before attained. He served for over a quarter of a century as a consultant and sometimes summer resident research associate at Los Alamos Scientific Laboratory (LASL). He and Mossa increasingly enjoyed the northern New Mexico environment and upon his retirement from the University of Chicago they moved to Santa Fe. A third of his publications from 1953 on, and about a half in the 1970s, were the result of collaboration with LASL investigators on the structures of 5f-series elements and compounds. From 1955 to 1970 there appeared jointly authored papers on structures with superconducting transitions; the fruit of collaboration with his friend Bernd Matthias at Bell Telephone Laboratories and the University of California at La Jolla.

Willie was elected to membership in the Norwegian Academy of Sciences in 1938, in the US National

Academy of Sciences in 1949 and in the American Academy of Arts and Sciences in 1965. He was president of the American Society for X-Ray and Electron Diffraction in 1945 and a member of the Executive Committee of the International Union of Crystallography from 1966 to 1972. He was a Fellow of the American Physical Society and a founding member of the American Crystallographic Association. He was awarded a DSc from Brooklyn Polytechnic Institute in 1954.

As much joy as he found in science, in nature, and in his love of family and friends, he found equally in art songs. He was transported by happiness when he listened to the songs of Grieg or Kjerulf, and in Schubert *Lieder* he found the ultimate beauty and peace.

Hvil i fred.

RAY PEPINSKY

Notes and News

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CHESSE

Cornell high energy synchrotron source

Proposals are now being accepted for experiments to be carried out at CHESSE, the new high energy synchrotron radiation facility at Cornell University, Ithaca, New York. Presently, three beam lines are fully operational and supply radiation to four experimental stations. These stations have available intense polarized radiation at energies in the hard X-ray range (a few keV and above). The characteristic energy of the radiation will be in a range up to 35 keV. Proposals exploiting this unique feature of the facility will receive preference. CHESSE will provide the capability to facilitate

studies in EXAFS, X-ray topography, small-angle scattering, Compton scattering, deep-level spectroscopy, and X-ray crystallography, but proposals need not be limited to these areas.

Proposals should be submitted by 31 August 1980. Beam time will be allocated according to the recommendation of a proposal review panel and the expected schedule of operation of the CESR storage ring.

Proposals should be sent to Proposals Secretary, CHESSE, Clark Hall, Cornell University, Ithaca, New York 14853, USA.

Details on current instrumentation and available facilities can be obtained from B. W. Batterman, Director, or N. W. Ashcroft, Associate Director. Telephone: (607) 256-5161.