American Mineralogist, Volume 74, pages 1394–1396, 1989

Memorial of Werner Nowacki
March 14, 1909–March 31, 1988

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Werner Nowacki, one of the leading crystallographers in Switzerland, died in a hospital at Zollikofen, near Berne, on March 31, 1988, after a long period of suffering. On January 6, 1986, he was struck with an apoplexy that brought to a close his unresting work. He did not recover from his illness and remained for more than two years partially paralyzed and unable to communicate.

Werner Nowacki is survived by his wife, Trudy Kaeser Nowacki, whom he married in 1936. Throughout their life together she was a great help to him and made it possible for him to follow his successful scientific career. Survivors also include his two children, Anneliese Nowacki and Rainer Nowacki, and a younger sister Annemarie Nowacki, a doctor in jurisprudence.

Nowacki was born in Zürich on March 14, 1909, the first child of Karl and Anna Nowacki. The family lived at the Zürichberg in a house built by his grandfather in 1880. The young Werner attended primary and secondary school in Zürich and then enjoyed a stimulating education at the Gymnasium from 1921 to 1927. He was very fond of his teachers in mathematics, physics, chemistry, and drawing. During the upper classes he became acquainted with the books *Geometrische Kristallographie des Discontinuums* by Paul Niggli and *Klassische Stücke der Mathematik* by Andreas Speiser, which determined his future interests.

In the fall of 1927 he entered the Swiss Federal Polytechnic School (ETH) at Zürich, where his grandfather, Anton Nowacki, had earlier been offered a professorship. Werner became a student in mathematics, physics, and mineralogy. His professors were H. Hopf and A. Speiser in mathematics, W. Pauli and P. Scherrer in physics, and Paul Niggli in mineralogy and crystallography. Nowacki also attended lectures of H. Wölfflin in history of art and C. G. Jung in psychology, which influenced his later work very deeply. In 1932 he graduated with a concentration in theoretical crystal chemistry. In the same year Nowacki spent the summer term in Göttingen (Germany), where he continued his studies in crystal chemistry under V. M. Goldschmidt. With the rise of the Nazis in the early 1930s the political climate in Germany became unpleasant. Therefore in the fall of 1932 he returned to Switzerland as an assistant to Paul Niggli at the ETH. In 1935 he earned a Ph.D. in crystallography. His dissertation dealt with mathematical crystallography, in the investigation of homogeneous space partitions into domains of influence. In 1936 Nowacki obtained a position as a head assistant at the Mineralogical Institute of the University of Berne, where, in 1939, he made his habilitation.

In 1947, on the invitation of Linus Pauling, Nowacki spent the summer term at the California Institute of Technology in Pasadena. In 1949 Nowacki became a professor in crystallography at the University of Berne, and in 1952 he founded the Department of Crystallography. Under Nowacki's leadership his department soon developed to a reputable center of research. In 1956 he became a full professor and in the academic year 1958–1959 he served as chairman of the faculty of natural sciences. After becoming professor emeritus in 1979 he continued his research and came regularly to his office until his sudden attack of apoplexy.

Throughout his career Nowacki was particularly interested in mathematical crystallography. Over the years he

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published more than 60 papers in this field. In group theory he investigated the Euclidean three-dimensional space forms, showing their connection to the fixed-point free space groups. Together with Paul Niggli, in 1935, he determined the arithmetic crystal classes. Nowacki showed that the 230 space groups cannot be derived using the parallelohedra and their subdivision into stereohedra, as was proposed by Federov.

The manuscript of his book *Fouriersynthese von Kristallen* was finished in 1948, but its publication was delayed until 1952. In this book Nowacki showed the relation of symmetry between crystal space and Patterson space. The study of the crystal chemistry of organic substances led him to investigate the homogeneous packings of ellipses in the plane. Later this work was continued to investigate packings of ellipsoids in space. Nowacki's extended bibliography of mathematical crystallography was published in 1981 by the International Union of Crystallography (IUCr).

Nowacki had a long-standing fascination with the symmetry of crystals. The investigation of the realization of crystal structures among the 230 space groups was his main contribution to theoretical crystal chemistry. Together with J.D.H. Donnay, in 1954, he published these results in Memoir 60 of the Geological Society of America. An update was published in 1967 in ACA Monograph 6. From this work, Nowacki realized the predominant importance of densest sphere packings in inorganic crystal structures and of densest ellipsoid packings in organic crystal structures.

In 1958 Nowacki began his most productive cooperation in the Arbeitsgemeinschaft Lengenbach (working community of Lengenbach) to investigate the sulfosalt minerals of the Lengenbach deposit in the valley of Binn, Switzerland. During this time 122 publications resulted from these activities. In 1963 he traveled to Paris to determine the composition of some very small sulfosalt crystals with the electron microprobe, an instrument newly developed by Casting. This led Nowacki to found the Laboratory of Electron Microprobe Analysis at the University of Berne in 1964, which was equipped with a Cameca-type electron microprobe.

During the years 1963 to 1965 five new sulfosalt minerals were discovered in the Lengenbach deposit: rathite-IV, sinnerite, wallisite, imhofite, and nowackiite. On the basis of the crystal structures of the known sulfosalts, many among them determined by his coworkers, Nowacki was able to propose a comprehensive classification of sulfosalts in 1968. In 1976, in collaboration with A. Edenharter, Nowacki also started hydrothermal synthesis, mainly of Tl-containing sulfosalts, in order to complete his classification and to study the conditions of their growth.

Nowacki had a very broad and general idea of symmetry. He observed symmetry in its most perfect geometrical realization in the crystals. In addition he also recognized the important impetus of symmetry in modern natural science. Influenced by the lectures and books of C. G. Jung, Nowacki proposed an analogy between the symmetry operations and the archetypes of C. G. Jung. This deep insight was always very important for him.

For Nowacki, teaching was an important part of his scientific work. His lectures were always well prepared and demanding. For young students it was not easy to follow his lectures, but those who were willing to work hard could profit immensely from his experience and his broad knowledge. In particular, his lecture on symmetry in science and art gave testimony of his profound knowledge. Nine doctoral theses were completed under Nowacki's direction, and 42 postdoctoral fellows from 13 different foreign countries worked with him over his career. Nowacki officially represented Switzerland at several meetings of the IUCr. In 1961 he organized the meeting of the French Crystallographic Association, and in 1968 the meeting of the German Sektion für Kristallkunde at Berne. He was the initiator in 1968–1969 and first president of the Swiss Society of Crystallography. In 1970 he was the official representative of Switzerland at the meeting of the International Mineralogical Association at Tokyo and Kyoto.

As a result of Nowacki's fruitful scientific activities, four books and over 350 papers were published, and his work has found international recognition. In 1969 he was elected an Honorary Fellow of the Mineralogical Society of America. He received honorary membership in the Swiss Society of Crystallography in 1975 and in the German Mineralogical Society in 1981.

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