American Mineralogist, Volume 75, page 714, 1990

Presentation of the Roebling Medal of the Mineralogical Society of America for 1989 to Helen D. Megaw

Robert E. Newnham
Materials Research Laboratory, Pennsylvania State University, University Park, PA 16802, U.S.A.

Helen Megaw was born in 1907 and now lives in retirement in Northern Ireland. Most of her career was spent at Cambridge University, where she received her Ph.D. in the Department of Mineralogy and Petrology in 1934. During her graduate studies she was deeply imbued with the ideas of Bragg's *Atomic Structure of Minerals* as communicated and supplemented by J. D. Bernal. This reinforced a natural tendency to visualize crystal structures as three-dimensional models with specified bond lengths and angles. Another big influence was Bernal's work on water and the hydrogen bond. In 1935 they collaborated on a classic paper, "The Function of Hydrogen in Intermolecular Forces," which incorporated Dr. Megaw's thesis work on gibbsite and ice. Many of the principles described in that paper were amplified in later investigations of afwillite, portlandite, tobermorite, and other hydrogen-bonded cement minerals.

Following post-doctoral appointments at Vienna (with Professor H. Mark) and Oxford (with Professor F. Simon), Dr. Megaw began a brief career as a high school science teacher at Bedford High School and Bradford Girl's Grammar School, but when World War II began she returned to research as an X-ray crystallographer at the Mitcham Works, Ltd., a small subsidiary company of Philips of Eindhoven. Early in 1944 she undertook the study of a new ceramic capacitor that had just arrived from America. The ceramic had an enormous dielectric constant with peaks at three-phase transition temperatures. Using Debye-Scherrer photographs, Dr. Megaw determined the structure of the new dielectric, $BaTiO_3$, and followed the changes with temperature from cubic to tetragonal to orthorhombic to rhombohedral. Her pioneering studies of the polar atomic motions associated with ferroelectric phase transformations were published in 1945 and 1946, after wartime secrecy restrictions were lifted. Barium titanate has been widely used in multilayer ceramic capacitors, piezoelectric transducers, and PTC thermistors for the past forty years.

A series of papers on phase transformations in oxides were written in later years that describe the structural origins of ferroelectricity and antiferroelectricity in $KNbO_3$, $NaNbO_3$, $LiNbO_3$, and $Ca_2Nb_2O_7$. In 1957, Dr. Megaw wrote "Ferroelectricity in Crystals," the first comprehensive study of chemical bonding, crystal structure, and physical properties of ferroelectric materials.

After World War II, Dr. Megaw returned to Cambridge University as a fellow and director of studies at Girton College. She also held positions as lecturer and assistant director of research at the Cavendish Laboratory until her retirement in 1972. In 1967 the University of Cambridge awarded her the Sc.D. degree. She is a fellow of the Institute of Physics and the Mineralogical Society of America.

Her interest in feldspars began in 1956 in collaboration with W. H. Taylor and the crystallography group at the Cavendish Laboratory. Structure analyses of anorthite, albite, celsian, and other feldspars appeared in the next few years, along with a series of papers on order-disorder phenomena in the plagioclase feldspars and their effect on the diffraction patterns.

Thermal expansion and its relation to crystal structure was another long-time interest. Dr. Megaw was one of the first to point out the inverse relationship between bond strength and thermal coefficients. She also investigated and explained the peculiar behavior of the expansion coefficients near displacive phase transitions where polyhedral rotations and distortions occur.

A number of American crystallographer-mineralogists were trained at Cambridge, and all of us remember her meticulous style of teaching symmetry and crystal chemistry. *Crystal Structures--A Working Approach*, her last book, published in 1973, contains many of the concepts and interesting home problems presented in her classes. She had a kind heart and a patient way with students that cause many of us to look back with great fondness on our days at the Cavendish. Along with Kathleen Lonsdale and Dorothy Hodgkin, Helen Megaw is one of the grand old British school of women crystallographers who serve as role models for many of us—men and women alike. I am proud to have been one of her students.

0003–004X/90/0506–0714$02.00