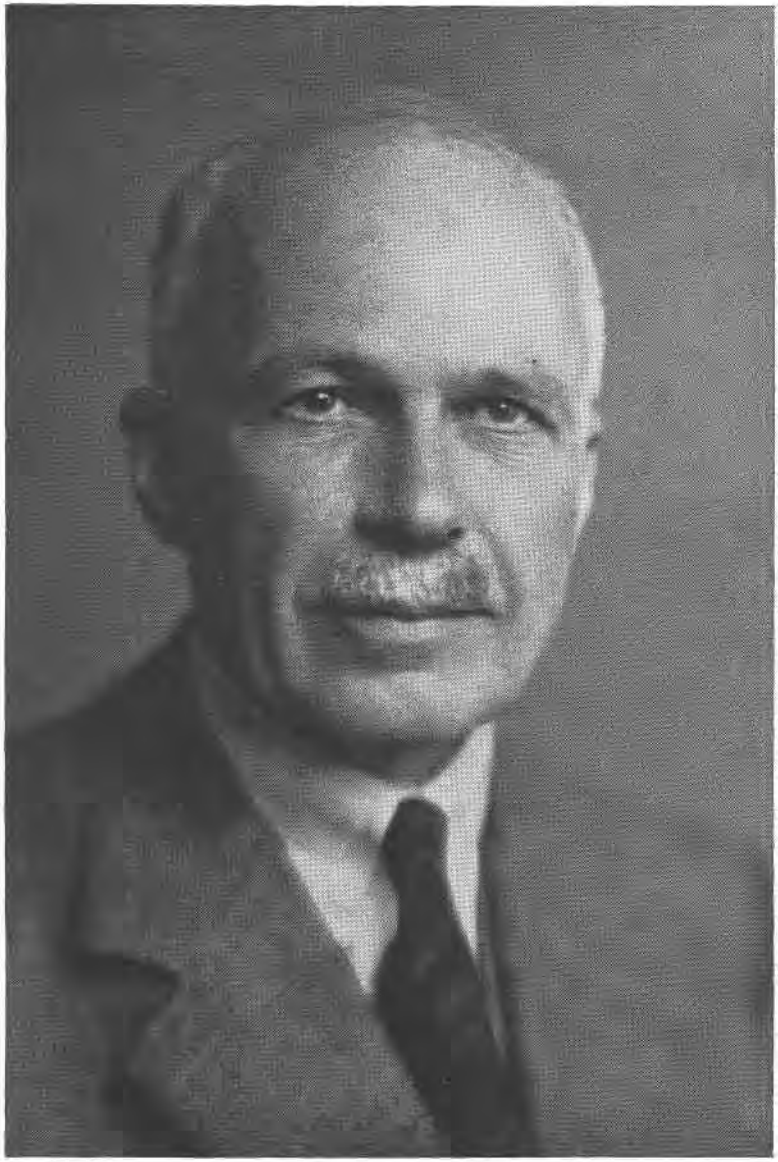

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WILLIAM LAWRENCE BRAGG

RECIPIENT OF THE ROEBLING MEDAL OF THE
MINERALOGICAL SOCIETY OF AMERICA

PRESENTATION OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA TO WILLIAM LAWRENCE BRAGG

INTRODUCTION

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In 1936 the Council of the Mineralogical Society of America directed that a medal be designed in honor of Colonel Washington Augustus Roebling. Colonel Roebling's interest in mineralogy began while he was a student at Rensselaer Polytechnic Institute. He became closely associated with the Mineralogical Society of America immediately after its organization, and in 1924 served as its Vice-President. His support of the Society and its Journal and his bequest of his comprehensive collection to the United States National Museum will long be remembered by mineralogists. The award of the Roebling Medal was to be made for notable contributions to mineralogy in America and abroad.

The idea that crystals are built up of units put together in a regular way has been in the minds of mineralogists since the time of Hooke and Guglielmini. The mathematical theory of regular three dimensional structures built up of identical units was carried to completion in the latter part of the nineteenth century largely independently by Fedorov, Schoenflies and Barlow. However, no physical method then existed by which the arrangement of the constituent particles in any crystal could be determined. In 1912 the diffraction of x-rays by crystals was discovered by von Laue with the experimental aid of two assistants, Friedrich and Knipping. At that time Sir William Bragg had been studying the ionization effects of x-rays and had concluded that x-rays are corpuscular in nature. His son, W. L. Bragg, now Sir Lawrence Bragg, attempted to find an explanation for von Laue's results in terms of corpuscular x-rays, but soon concluded that the wave explanation of von Laue was correct. However, Sir Lawrence also realized that some features of von Laue's explanation could not be correct. The shapes of the spots and their behavior when the crystal was tilted suggested to Sir Lawrence that x-rays, not just of certain specific wave-lengths as von Laue had supposed, but of a range of wave lengths—analogous to white light in the visible region—were reflected from crystal planes. From this work the fundamental equation of x-ray diffraction has become known as Bragg's law. Soon afterward he made x-ray photographs of potassium chloride and sodium chloride and deduced their complete atomic arrangements; these were the first crystal structures analyzed, and, as is well known, this achievement

has led to the development of a new branch of science which deals with the atomic arrangements in matter.

The invention of the ionization spectrometer by W. H. Bragg marked another important advance, and by its application the structure of the diamond was elucidated by W. H. and W. L. Bragg. With the aid of this new instrument W. L. Bragg in 1913 solved the structures of sphalerite pyrite, fluorite and calcite.

After these simple structures had been analyzed it became possible to attack successfully those of lower symmetry. Thus, in 1924, W. L. Bragg deduced the arrangement in the orthorhombic mineral aragonite. The silicate minerals make up most of the earth's crust; they often occur in good sized crystals suitable for investigation by the ionization spectrometer and partly for this reason they became a special object of study by Sir Lawrence and his collaborators. Their analyses of diopside, olivine, chrysotile, beryl, phenacite, willemite and others of this class revealed the basic features of the constitution of the silicates and revolutionized our conceptions of the chemical bonds that cement their crystal edifices together. In the investigations of these complicated structures use was made of the representation of the distribution of electron density in the crystals by Fourier series; this numerical and graphical method, first suggested by W. H. Bragg, has been perfected by W. L. Bragg and subsequent workers, and today is widely applied in investigations of atomic arrangements.

One of the chief reasons why we are much concerned with the fine structure of matter is that it gives us the key to so many physical and chemical properties. The nature of the dependence of the optical properties on the atomic arrangements in crystals was shown by W. L. Bragg's calculations of the refractive indices of aragonite and calcite from their structures in 1924. The properties of some metallic alloys, as well as of some sulfide and silicate minerals, depend not only on their structures, but also on the degree of ordering into superstructures. Much insight has been gained into the nature of order-disorder transformations by the work of Sir Lawrence and his school. The importance of these phenomena in rock minerals was emphasized by Past President M. J. Buerger in his address before the Society a year ago.

In recognition of these and other contributions the Council of the Mineralogical Society of America has resolved that the Washington Augustus Roebling Gold Medal be awarded to Sir Lawrence Bragg.

Professor Bragg was born in Adelaide, S. Australia. He attended St. Peters College in Adelaide and Adelaide University. Subsequently he studied in Trinity College, Cambridge, where in 1914 he became Fellow and Lecturer in Natural Sciences. In the same year he received the Bar-

nard Medal. In 1915 he was awarded the Nobel Prize for Physics jointly with his father on their investigations of *x*-rays and crystal structures. In 1931 he received the Hughes Medal of the Royal Society and in 1946 the Royal Medal of the Royal Society. From 1919 to 1937 he was Langworthy Professor of Physics in Victoria University of Manchester; in 1937 and 1938 he served as Director of the National Physical Laboratory; since 1938 he has been Cavendish Professor of Experimental Physics in Cambridge. He is a fellow of the Royal Society, Honorary Member of the Institute of Metals, Corresponding Member of the Academy of Sciences of Paris, Honorary Member of the Swedish Academy of Sciences, Member of the American Philosophical Society, Honorary Member of the New York Mineralogical Club, Member of the Chinese Physical Society, Foreign Associate of the National Academy of Sciences of Washington, Associate of the Royal Academy of Sciences of Belgium, Honorary Fellow of the Royal Society of Edinburgh, Honorary Member of the Royal Irish Academy, President of the International Union of Crystallography, and President of the British Association for the Advancement of Science. He is an Officer of the British Empire. During the first World War he served as Technical Adviser on Sound Ranging to the Map Section of the General Headquarters in France, and was awarded the Military Cross. During the second World War he acted as Coordinator of British, Canadian and American Military Research.

Most of the results of the researches of Sir Lawrence have appeared as scientific papers of which there has been a long series. He has also written a number of books, of which "*X*-Rays and Crystal Structure" and "Atomic Structure of Minerals" have been of particular value to mineralogists. Students, not only British but also of other nationalities, have gone to his laboratory to learn the methods of *x*-ray analysis, and from him they have received illuminating instruction and kind counsel. Through them, as well as directly, the stimulating influence of Sir Lawrence is felt in America and other countries.

Mr. President, it is my valued privilege to introduce Professor Sir Lawrence Bragg.

PRESENTATION

President M. A. Peacock handed the medal to Sir Lawrence Bragg with the words:

WILLIAM LAWRENCE BRAGG, in recognition of the fundamental and illuminating work you have done on the ultimate structure of crystals and the impetus and direction that this work has given to the study of minerals, I have the honour to present you with the Roebling Medal of the Mineralogical Society of America.