ACCEPTANCE OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA

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President Hess, Professor Kerr, Fellows and members of the Mineralogical Society of America, and Guests:

The Mineralogical Society of America is conferring a very great honor in awarding to me the Roebling Medal and it is with sincere and deeply felt appreciation that I take this opportunity to give my thanks to the Council for their very generous estimate of my merits.

Whatever has been accomplished by me is of course due in large part to my training and I hope you will pardon me if I review briefly some parts of it.

Rather indirectly, but still very definitely, I think I was influenced very early in my life by my uncle, Alexander Winchell, who lost his position on the faculty of Vanderbilt University because he accepted the theory of the evolution of man; soon afterward he became professor of geology at the University of Michigan, where he spent the rest of his life. Much more directly was I influenced by my father, Newton H. Winchell, who spent most of his active life as State Geologist of Minnesota, and in that position aided in the development of the vast iron ore deposits of the Mesabi Range. My older brother, Horace V. Winchell, studied at the University of Michigan and later did much toward introducing geology and mineralogy to the mining industry of this country by establishing the Geological Department of the Anaconda Copper Company.

However my first actual study of mineralogy at the University of Minnesota was directed by Charles P. Berkey, whose recent passing away is a source of deep sorrow to us all and a great loss to science. He was called soon afterward to Columbia University and later became known all over the world as the Secretary of the Geological Society of America—an organization which has been most cooperative and helpful to our own society.

I continued the study of mineralogy (especially optical mineralogy) under the guidance of Professor Lacroix at the University of Paris for two years. At that time mineralogists accepted the idea that a mineral was a product of nature having a *definite* chemical composition. This idea was useful as a means of making clear the difference between a mineral and a rock, but it led to the conclusions that (for example) albite was pure sodium aluminum silicate, anorthite was pure calcium aluminum silicate and labradorite was exactly half sodium and half calcium aluminum silicate. But even at that time mineralogists were in doubt about oligoclase—was it four parts albite or three parts albite to one part anorthite? Then Tschermak, the famous Vienna mineralogist, proposed the new idea that plagioclase feldspar was a continuous series from pure sodium to pure calcium aluminum silicate. That marked the beginning of a new

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era in the history of mineralogy which has led to our present knowledge that nearly all minerals vary in composition.

I have tried to show graphically the relations between variations in composition and variations in optical properties in many minerals. Indeed I have developed more than three-fourths of the hundred and twenty such diagrams which are now in use. In the past such diagrams have been based almost wholly on the chemical analyses and measured physical properties of minerals found in nature. I have repeatedly warned mineralogists that the diagrams should be considered as approximations rather than highly accurate presentations. This is true even if the chemical analyses and measurements of properties are absolutely correct because natural minerals almost always contain minor variations in composition which are not (and usually cannot be) included in the diagrams, but nevertheless have some effect on the physical properties. As a simple illustration of this condition one may cite plagioclase which almost invariably contains some potassium. However some elements have a much greater effect upon the optical properties than other elements and that has made it possible for our president, Professor Hess, in a recent study of natural clinopyroxenes to obtain results which show remarkably high accuracy as far as the tenor of Fe is concerned. Since minor variations in composition can be eliminated by making artificial minerals it seems clear that they furnish a possible source of greater accuracy. Some excellent work along this line has been done by the staff of the Geophysical Laboratory and others, but much more is needed.

In 1934 the University of Wisconsin granted me a leave of absence which made it possible for me to study *x*-ray methods briefly with Linus Pauling at the California Institute of Technology, and then go to Manchester, England, to study with W. H. Taylor and W. L. Bragg. Roentgenographic studies are proving very helpful to our science and will undoubtedly continue to do so. Of course you all know that it was Bragg who first taught us how to determine the crystal structure of minerals by *x*-ray studies, but you may not remember that it was Taylor who first proved that plagioclase is a double (not a single) series.

These are the men, who, during half a century, influenced my studies and work in the field of mineralogy; indeed it is true that without their training my work in mineralogy would have been impossible. Therefore in a certain sense the honor coming to me should really be awarded to them. Please let me repeat how highly I appreciate the honor you have conferred on me by the award of the Roebling medal.