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PRESENTATION OF THE ROEBLING MEDAL TO J. FRANK SCHAIRER[1]

H. S. YODER, JR., *Geophysical Laboratory, Carnegie Institution of Washington, Washington, D. C.*

Mr. President, Ladies and Gentlemen:

We do honor today to a truly wonderful man and to one of the most prodigious contributors to our knowledge of mineral relations.

He is a 'positive' man to almost everything: "Yes, I will be glad to make some runs for you"; "sure, I will be glad to help"; and "yes, I will be glad to show you around the Geophysical Laboratory." Many of you have had your first introduction to the Laboratory with a hand extended and the cheery greeting, "I'm Frank Schairer." You then probably received the dollar tour—without Frank missing a single experiment in his whirlwind day at the Lab. You would be chased up and down the boundary curves at a breathless pace and with boundless enthusiasm. The inner secrets of the four-component system would be explained with his "magic cheese knife," or the appearance of olivine crystals in glass described as "obvious as an outhouse on a hill," and you were left in no doubt that "those crystals were a lot smarter in physical chemistry than we are." Those of us who have had the happy experience of working with Dr. Schairer have learned not only the quenching method, but a fine philosophy of life as well. Mr. Frank, as he is known to the mountain people of the Virginias, is one of the richest men in the world when friends are counted.

The effort and patience required to produce the precise phase equilibria data, which are the hallmark of Dr. Schairer, are indeed great. The ultimate goal, of course, is the complete physicochemical description of the multicomponent system which includes the common rocks and minerals. As Frank would say it, the goal is "to find out how the good Lord made the rocks and minerals." The systematic component-by-component ap-

[1] John Frank Schairer born in Rochester, New York, on 13 April 1904. B.S. (Chemistry) 1925, M.S. (Geology) 1926, Ph.D. (Chemistry) 1928 from Yale University. Married Ruth Naylor on 20 July 1940: two children (twins) John and Jeanne. Staff member of the Geophysical Laboratory, Carnegie Institution of Washington from 1927 to present. Served as Special Assistant of the National Defense Research Commission 1942 to 1945. Member of National Academy of Science, Mineralogical Society of America (president, 1943), Geological Society of America (vice president, 1944), American Chemical Society, American Geophysical Union (Section president, 1956–1959), Geochemical Society (vice president, 1959; president 1960), International Association of Volcanology (vice president, 1957–1960). Received the Hildebrand Award of Washington Chemical Society (1942), President's Certificate of Merit (1948), Medal of Honor (Great Britain, 1948), Arthur L. Day medal of the Geological Society of America (1953).

proach has been slow, yet most rewarding. If, as it now appears, we are on the threshold of a great step forward into the multicomponent system of nature itself, with the help of the microprobe and computer, no one has done more to prepare us for this goal than Dr. Schairer.

His earliest studies were concerned with descriptive mineralogy; however, his first phase equilibria work, a Yale thesis, was the system Na_2SO_4-$NaCl$-NaF-H_2O. The system contains the compound $Na_2SO_4 \cdot Na(F,Cl)$, which W. F. Foshag later discovered in nature and named schairerite. His work at the Geophysical Laboratory was at first mainly concerned with the ferrous iron systems in which he pioneered, with N. L. Bowen, the iron crucible and nitrogen gas quenching technique. The emphasis then shifted to the principal minerals contributing to petrogeny's residua systems, and now his chief concern is with the normative minerals in the simple basalt system. Interspersed with these are phase equilibria studies involving the feldspars, nephelines, pyroxenes, cordierites, melilites, and many other common rock-forming minerals. It is unlikely that such a feat of so many complex and careful studies will be matched, yet he is the first to suggest that all his diagrams will be improved in the future when better tools are available. His philosophy of cooperation, the pure materials he synthesizes, the phase equilibria he so carefully determines are the keystone to almost all the other programs at the Geophysical Laboratory. His unlimited energy and effervescent optimism are a stimulus to all.

The man is indeed a legend in his own time; his work capacity is tremendous and extends to his interests in orchids, fishing, hiking, and storytelling. My wish would be that all of you could enjoy at least one campfire with him in the field, and those unforgettable Schairer-broiled steaks, the burning of the underwear ceremony, and the stream of Latin names of the local flowers. His charming wife, Ruth, shares with us the great privilege in presenting to you, Mr. President, the 1963 Roebling medalist, Dr. J. Frank Schairer.

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THE AMERICAN MINERALOGIST, VOL. 49, MARCH–APRIL, 1964

ACCEPTANCE OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA

JOHN FRANK SCHAIRER, *Geophysical Laboratory, Carnegie Institution of Washington, Washington, D. C.*

President Hurlbut, Dr. Yoder, Fellows, Members and Guests, Ladies and Gentlemen:

With great happiness and pride but with humility I accept this highest award of the Mineralogical Society of America. I am honored and pleased to join the austere ranks of Roebling Medalists.

Many years ago I went down to Yale as an undergraduate in chemistry. My interest in mineralogy developed in sophomore year as a result of an inspiring course in that subject by Professor William E. Ford. At Yale there was a very stimulating atmosphere in mineralogy and geology.

John Frank Schairer

James Gilluly and William W. Rubey were the graduate assistants who passed out the "unknowns" in the mineralogy laboratory course and Tom Nolan was a graduate student. Harry Hess was an undergraduate in geology who joined our Yale Mineralogical Society. With such inspiring teachers in chemistry as Harry W. Foote and John Johnston, and in geology Adolph Knopf, Charles H. Warren, William E. Ford and Chester Longwell, I thoroughly enjoyed my sojourn in New Haven. I gave my first paper in mineralogy when this Society met in New Haven in December of my senior year as an undergraduate and shortly later had the pleasure of publishing a bulletin on the Minerals of Connecticut for the Connecticut State Geological and Natural History Survey.

With my interest in the inorganic chemistry of natural materials and in the physical chemistry of minerals and mineral associations, I wanted to go to the Geophysical Laboratory in Washington, D. C., as a graduate student to do my Ph.D. thesis work on a fellowship from Yale. At that time Dr. Arthur L. Day the Director of the Geophysical Laboratory did not want any young men on fellowships. He said that they were only there for a year, took up time and space, and in one year only found out what they should have done if they only knew how. However, he agreed to see me and talk it over. He found that I had a tremendous interest in phase equilibrium and had been working at Yale on the quaternary system Na_2SO_4-NaF-NaCl-H_2O. He said he wouldn't take me on a fellowship but would give me a job. I was surprised and pointed out that I did not yet have my doctor's degree. He said, "You know that a doctor's degree is merely a certificate that you have had the proper training and I can see that you have had that." So many students fail to recognize this truth and believe that if you have this magic degree you do not have to think or work the rest of your life and that the world owes you a living.

I came to the Geophysical Laboratory on September 1, 1927, and have been busy and happy there ever since. I wrote up my work on the quaternary salt system and got my Ph.D. from Yale in physical chemistry in June 1928. The only directive that was ever given me by Dr. Day was that I could do anything I chose to do but he hoped it would have something to do with iron oxides. I construed ferrous silicates to meet this liberal mandate. I cannot overemphasize the importance of a stimulating atmosphere for research. The Geophysical Laboratory provided such an atmosphere with colleagues like Bowen, Fenner, Washington, Morey, Adams, Day, Allen, Zies, Greig, Posnjak, Tunell, and many others.

I would like to quote the first paragraph of my presidential address as president of this Society in 1943:

"Minerals are interesting because of the story they tell of those complex physical and chemical processes that have operated in the building and modification of our earth and its crust. One of the most fascinating problems of earth science is the delineation of the physical chemistry of the crystallization of rock-forming minerals from magmas."

For these many years I have been interested in the rock-forming olivines, pyroxenes, pyroxenoids, melilites, feldspars, and feldspathoids—their compositions, relations to each other with changing temperature and to the liquids from which they may crystallize—in other words I have been interested in the whole gamut from ultrabasic rocks to granite and alkaline rocks and their origin in the crust of the earth. My experimental work has been at one atmosphere pressure to lay the fundamental groundwork for studies of these same materials by my colleagues at moderate to high pressures with and without water as a component to obtain additional information about the behavior of minerals in the crust and mantle. Most mineral systems are complex but this very complexity builds into minerals and mineral associations the clues as to origins. We need sound experimental data in order to understand the clues and read the story of origins.

Most "old timers" feel that things are not like they were in the "good old days." They are better! Today we have more tools and more information, and the young men in geology and mineralogy are better prepared in mathematics, physics, and chemistry. These keen young men provide a "live wire," stimulating atmosphere for progress in research.

In closing I wish to thank the Society for doing me honor today, to thank all of you who came, and to thank my colleagues whose help and inspiration made my researches pleasant and productive.

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PRESENTATION OF THE 1963 MINERALOGICAL SOCIETY OF AMERICA AWARD TO NOBUO MORIMOTO

J. D. H. Donnay, *The Johns Hopkins University, Baltimore, Maryland.*

Mr. President, Fellow Members and Guests of the Mineralogical Society of America, Ladies and Gentlemen:

To introduce Dr. Morimoto is the task before me. It is a very pleasant one, and I wish to thank the president of our Society for entrusting it to me.

Nobuo Morimoto was born at Omachi City, Nagano Prefecture, on

February 9, 1925, the son of Akira and Noe Morimoto. His father was a secondary school teacher. Young Nobuo received his early schooling in Nagano City and in Osaka, where he attended Senior High School. On September 30, 1943, Nobuo completed the scientific course required to enter a Japanese university. The next day he was matriculated in the University of Tokyo, where he was to make a name for himself and stay for almost 20 years.

Upon graduation as Bachelor of Science, in 1946, he was granted a government research scholarship, which he held for four years. During this time he specialized in the determination of mineral crystal structures under the guidance of our distinguished colleague Professor Teiichi Ito. On December 1, 1950 he was appointed assistant in mineralogy at the University of Tokyo. On July 6, 1954 he received his doctor's degree; his dissertation was entitled "The Crystal Structure of Orpiment, Refined." He is a charter member of the Crystallographic Society and the Mineralogical Society of Japan, and served as a secretary of the former. He held a lectureship in mineralogy at Saitama University, Urawa, near Tokyo, from 1954 to 1957, while continuing his work at the University of Tokyo. In September 1957 he was given a leave of absence to accept a post-doctoral fellowship in crystallography at the Geophysical Laboratory of the Carnegie Institution of Washington. He stayed with us for three years, returning to Tokyo in 1960. The work he did up to that time has culminated in the publication of 17 papers.

His research has proceeded along several lines. First, jointly with Ito and Sadanaga, he published crystal structures of minerals at the rate of about one a year. Let me remind you of them: orpiment (1949), anthophyllite (1950), boracite (1951), milarite (1952), realgar (1952), orpiment refined (1954), epidote refined (1954), and finally borax (1956), of which he was the sole author. He then studied the variation of crystal structure with conditions of composition, pressure, and temperature: in clinoenstatite and pigeonite (with H. Evans and D. Appleman), arsenopyrite (with Lloyd Clark), bornite and digenite (with G. Kullerud). He has described a new copper sulfide mineral, djurleite. Among his contributions I should mention a structural explanation of the alteration of realgar to orpiment, new types of complex silicate structures, and a structural mechanism for the high-low inversion of boracite. He has shown great skill in unraveling complicated intergrowth and twinning relationships. In the fields of polymorphism and twinning, which have been cultivated in Japan with particular success, he has shown himself to be the worthy disciple of Ito and his School.

Since he left us in 1960, Dr. Morimoto spent another six months at the Geophysical Laboratory in 1962, on the occasion of the meeting of the

International Mineralogical Association. He was promoted to lecturer in Tokyo in April 1962. In July 1962 the University of Osaka made him a full professor.

Mr. President, I am happy and proud to present to you the man whom our Award Committee has selected to be the 1963 recipient, my friend and colleague, Professor Nobuo Morimoto.

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ACCEPTANCE OF THE 1963 MINERALOGICAL SOCIETY OF AMERICA AWARD

NOBUO MORIMOTO, *Osaka University, Osaka, Japan.*

Mr. President, Professor Donnay, Fellows, Members and Guests of the Mineralogical Society of America:

At the luncheons of the Society which I have attended in the past I have looked up to previous recipients of the MSA Award with respect and envy—so great had been their contributions to mineralogy! Never did I imagine myself standing here as a recipient of the Award.

It is with deep appreciation and humility that I accept the Award you have bestowed on me. Such an Award, however, really goes to the whole scientific community which the individual represents. In my case two communities are involved: the Mineralogical Institute of the University of Tokyo and the Geophysical Laboratory of the Carnegie Institution of Washington.

Professor Teiich Ito got me started in crystallography and mineralogy at the Mineralogical Institute of the University of Tokyo. After the war, when most Japanese research institutions were still inactive, Professor Ito was energetically studying mineral polymorphism with *x*-ray diffraction techniques. Under his guidance I learned how to use crystallographic methods to solve mineralogical problems. I also learned how to work with others, on a team with a common purpose. This working in collaboration, discussing and learning, with Professor R. Sadanaga and other members of the Institute is what I treasure most from my research experience in Tokyo.

My second good fortune came when I received the first post-doctoral fellowship in crystallography at the Geophysical Laboratory. There Dr. Gabrielle Donnay and Professor J. D. H. Donnay unraveled for me the broad and beautiful scope of crystallography. In the special atmosphere of the Laboratory, I was also led into a domain that was soon to become

Nobuo Morimoto

my second chosen field, experimental mineralogy, through collaboration with Drs. J. F. Schairer, H. S. Yoder and G. Kullerud.

Mineralogists will agree with me that there is a large undeveloped area between crystallography and experimental mineralogy. In a broad sense it has been called crystal chemistry. It seems to me that crystal chemistry has not advanced either far enough or fast enough in recent years. Our goal should be the prediction, *in any system*, of just which phases will be stable under given conditions of composition, pressure, and temperature. Today, however, we are still far from this goal! A mineralogical approach to crystal chemistry is based on the hope that if the properties of enough crystals of various structure types are studied, certain general energy relations will emerge. Rules can then be formulated, which will form valuable guides in the study of other minerals and which may suggest fruitful lines of theoretical development. In my new position at Osaka University I hope to work on problems in crystal chemistry, problems such as crystal growth, solid-state reactions, and the mechanisms of transitions from the viewpoint of crystallography and experimental mineralogy.

The honor that you have given to me will be a most powerful incentive to me in my future research.

I am happy to have this opportunity to express my gratitude to all those who have encouraged international cooperation among mineralogists, because my chances of achieving worthwhile work would have been slight indeed had I not been so fortunate as to have been associated with mineralogists from many different countries.

Thank you again, all of you, for giving me a chance to take this Award back to Japan as a proof of your kindness, not only in scientific but also in human relations. Finally, I would like to thank the Geophysical Laboratory of the Carnegie Institution of Washington for making it possible for me to be here and receive the Award in person.