received the news of his appointment as Director of the U. S. Bureau of Mines in 1970 with mixed emotions, not because we doubted that good men were needed in Washington, but because we could ill afford to lose him at Penn State. We found considerable comfort in the fact, however, that the tenure of Directors of the U. S. Bureau of Mines recently had tended to be very short and that Ozzie probably would be back at the University before long. This, of course, has not materialized—yet—, but I am keeping a Research Assistantship open for him in the unlikely event that he hooks or slices one of his shots in Washington.

Mr. President, it is a great pleasure to present to you the Roebling Medalist for 1972, Dr. Elburt F. Osborn.

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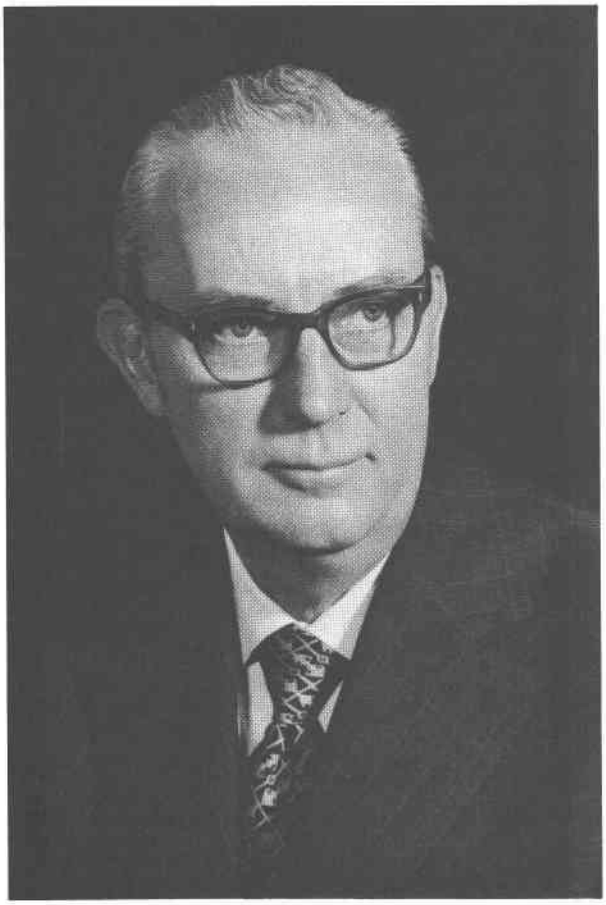
Acceptance of the Roebling Medal of the Mineralogical Society of America for 1972

E. F. Osborn, *Bureau of Mines, U.S. Department of the Interior, Washington, D. C. 20240*



Arnulf, President Yoder, members of the Society and guests:

It is naturally a pleasure to be honored by the Mineralogical Society, and to join the company of those who have been previous recipients of the Roebling Medal. I think particularly of A. F. Buddington, who was the recipient the last time the Geological Society of America met here in Minneapolis. I had the good luck of spending a little time with this distinguished petrologist in the field in the Adirondacks during the summer of 1940. He has been a great inspiration to many of us. Earlier in his career, in 1919 and 1920, he was a member of the staff of the Geophysical Laboratory of the Carnegie Institution of Washington, where he studied phase relations of the melilites, a subject I continued some years later.

In looking back over the list of Roebling Medalists, I find that over 25 percent of them served for at least a year or two, if not their entire professional lives, at the Geophysical Laboratory. This laboratory has been a unique institution. It was established as one of the principal laboratories of the Carnegie Institution of Washington, shortly after the latter was founded in 1902. Carnegie's wish was that these laboratories should be dedicated to the discovery of new knowledge of general interest to humans, but not directed to industrial problems. Carnegie made his fortune mostly in the iron and steel industry. It is a curious happening that the work of the Geophysical Laboratory has had enormously important applications in iron and steel making technology. This might seem to be an accident, but of course the reason is that it is rocks that are fed into the furnaces and out of which blast furnace and steelplant refractories are made, and so good basic research on the phase relations of rock forming minerals turned out to be a good type of steel industry research.

Why was the Geophysical Laboratory so successful? One principal reason was Dr. Arthur L. Day, who started the laboratory and was its director for the first 30 years. In 1901 he was in charge of the physical laboratory in the U.S. Geological Survey where a systematic study was beginning on the melting relations of the plagioclase feldspars, and where he was continuing work which he had been doing earlier in Germany on extending the high temperature scale. It is perhaps hard to imagine that when the silicate research was begun at the beginning of this century, there was no reliable scale of temperature above 1150°. When the new Geophysical Laboratory building was occupied in 1907, these were the two main projects, *i.e.,* the plagioclase solid solutions and extension of the temperature scale. The work of Day, Sosman, and Allen extended the constant volume nitrogen scale to the melting point of palladium, about 1550°, and using radiation pyrometry measurements, the scale was extended to the melting point of platinum, placed at 1755°. Under Day's direction the systematic application of principles of physical chemistry, especially those based on the work of J. Willard Gibbs, to geological problems continued without detour, starting with the plagioclase solid solution series, and continuing with SiO_2, then binary and more complex systems. This laboratory work simply opened up a new and large field.

I happened to get to the Geophysical Laboratory by a circuitous route. There wasn't any job waiting for me when I left school in 1937. I headed for the gold country of northern Quebec, to do some prospecting and assaying and whatever there was to do. But after only a few months in the North Country, an offer of a job at the Geophysical Laboratory came out of the blue, and I decided that that was for me.

I had three great years there with Frank Schairer, before World War II burst upon us. Frank put me to work on the quaternary system, lime-magnesia-alumina-silica, and suggested that I get going on a ternary system within this larger system, namely pseudowollastonite-akermanite-gehlenite. This led us into a lot more than we bargained for. The complete series of melilite solid solutions with a liquidus minimum occurs here, and we ran into a baffling situation with fractionation curves. With the important help of the old master, N. L. Bowen, we finally got this pretty well figured out, but there is still work to be done on this problem by some bright mathematically minded person. The principles involved carry over into other geologically important systems, for solid solutions series with minima occur not only in the melilite system but also with the alkali feldspars, some of the olivines, and some of the pyroxenes.

The war research lasted for four years. This was a unique period in our history. Almost the entire scientific establishment in this country was drafted into the program. The Geophysical Laboratory was converted completely to war research. We were on gun barrel problems, which was largely metallurgy.

I became involved in the fluoride systems work right after the war. I went to the Eastman Kodak research laboratories to work on novel optical glasses. Kodak had taken the lead, just before and then during the war, in the development of new and very useful optical glass compositions. George Morey of the Geophysical Laboratory was a consultant for Kodak and largely responsible for this research and development effort, and especially for the rare earth borosilicate glasses, which came into use in camera lens systems during the war. When I arrived, a group led by Dr. Kuan-Han Sun had a lively program going in applying crystal chemistry, especially the work of V. M. Goldschmidt, to making to order glasses with unusual, and hopefully beneficial properties, especially with respect to the relation of index of refraction to Abbe value. Fluoride models of silicate glasses were among those being studied. When in less than a year I decided to join the faculty at Penn State, Dr. C. E. K. Mees, vice president for research at Kodak, allowed me to take with me all of the equipment and supplies that I would need to continue studies of fluoride systems. In addition he arranged a research contract with the university to provide funds to cover stipends for a couple of graduate students plus operating expenses. This was the base for building a Geophysical Laboratory type of research program at Penn State. And through the years, Frank Schairer, Joe Greig and others at the Geophysical Laboratory have been extremely helpful.

For about two decades the main support of this research was industrial, especially the steel industry. Remembering the benefits that the Geophysical Laboratory research had been to the iron and steel industry, I enjoyed turning this around and using our research results to apply to geological problems, as well as to steelplant problems.

While I was a graduate student and reading the papers from the Geophysical Laboratory, the masterpiece, I thought, was the paper by Bowen and Schairer on the system MgO-FeO-SiO_2, published in 1935. In our research at Penn State we were able to carry this work a step farther by working at higher oxygen partial pressures, and therefore the system, MgO-FeO-Fe_2O_3-SiO_2. This work in my opinion gives us further substantiation of Bowen's arguments for the origin of the calc-alkaline rocks by fractional crystallization of olivine basaltic magma.

I realize fully that this award is in recognition of the work of a group. I have had some fine students, and three of them, Arnulf Muan, Della Martin Roy, and Rustum Roy, are now senior members of the faculty at Penn State. As a member of this group, I gladly accept this award in recognition of the work of several dozen people at The Pennsylvania State University over a quarter of a century, and of my former colleagues at the Geophysical Laboratory.

American Mineralogist, Volume 58, 355-356, 1973

Presentation of the Mineralogical Society of America Award for 1972 to Arthur L. Boettcher

PETER J. WYLLIE, *University of Chicago, Chicago, Illinois*

Mr. President, Fellow Members, and Guests of the Society:

It is a real privilege for me to introduce a friend and colleague for the Mineralogical Society of America Award. Dr. Arthur L. Boettcher earned this award at least in part because he has developed the art of hard work and long hours to a high degree. This is well known to his students. Because he moves so rapidly between office and laboratory, they have christened him "Art the Dart." I shall try to give you some idea of how he acquired such a distinguished title without being born into the ruling class.

"Art the Dart" does not look like Peter O'Toole of the ruling class because he grew up in Montana, and after graduating from high school he spent four years on active duty with the U. S. Air Force. Another four years at the Montana School of Mines gave him a bachelors degree with honors in Geological Engineering, and a charming wife, Mary. Mary was one of those lovely airline hostesses who make the monotony of air travel tolerable by wearing themselves out with constant cheerfulness for the passengers. After one weary flight she checked into a hotel in Great Falls, Montana, and when the elevator opened there was a good-looking bell-boy, who turned out to be Art Boettcher working his way through the School of Mines. That was in the days when Art sported a crew-cut; these days, the bell-boy's cap would not fit over his generous locks. Mary reports that she took one look at him and said "That's for me." Now, Art is a steady and persistent worker, but it seems that in Mary he found his match. In a short time they were married, and on their way to Pennsylvania State University for graduate work.

As a graduate student, our Award winner tackled a wide range of problems as a teaching assistant and in positions of research. These included various mapping projects, the kinetics of cement hydration, the identification of concrete aggregates exhibiting frost susceptibility, and teaching in a tough, three-term course in mineralogy and crystal chemistry. For his Ph.D. thesis, he completed a fine mineralogical and petrological study on the vermiculite deposit and associated rocks near Libby, Montana.