eight feet of water between him and the freighter. Only the most vivid imagination can properly picture the consternation of his Brazilian colleagues as their charge—the world famous crystallographer (who by the way does not include swimming among his accomplishments)—disappeared from sight with a resounding splash. But they need not have feared, for by the time they had the courage to peer over the edge, bridge-builder-Brindley, lacking other construction materials at hand, had bridged another gap—this time by pushing hands against the pilings of the dock and feet against the side of the ship. In response to the expected query from above he is reported to have stated that yes he seemed to be all right but he was afraid his glasses were missing.

Mr. President, it is with very great pleasure that I present to you our Roebling Medalist of 1970, Dr. George W. Brindley.

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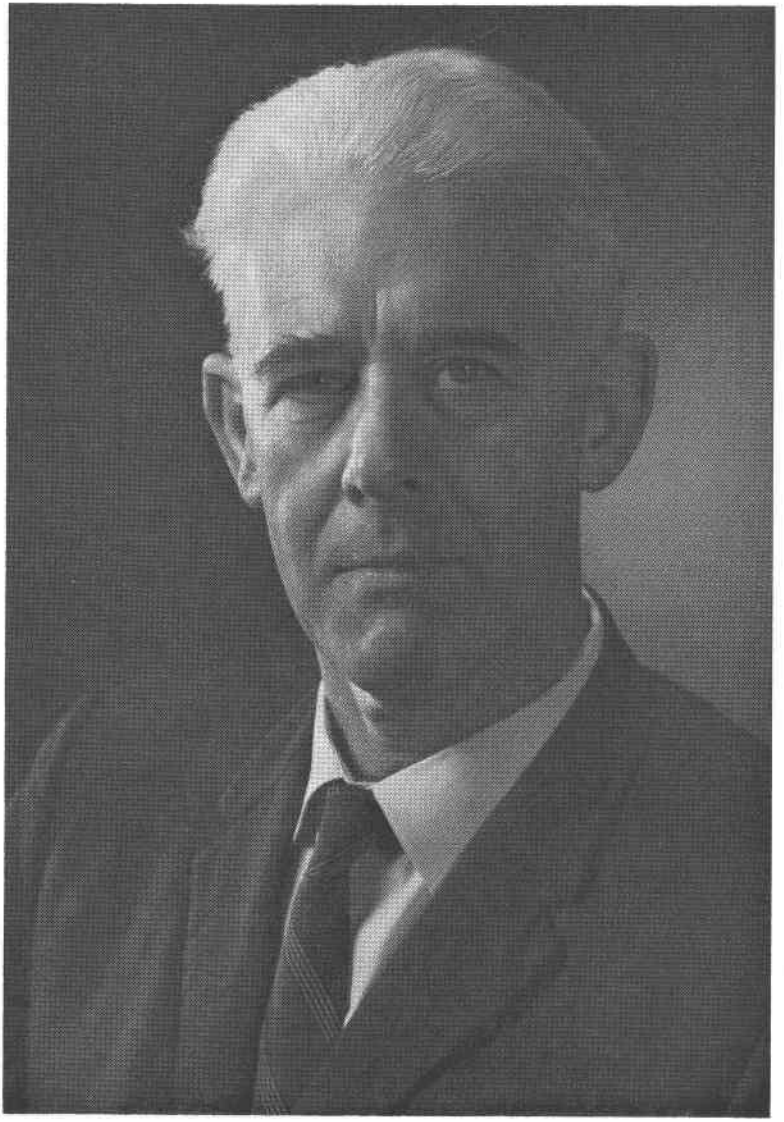
ACCEPTANCE OF THE ROEBLING MEDAL OF THE MINERALOGICAL SOCIETY OF AMERICA FOR 1970

G. W. BRINDLEY, *The Pennsylvania State University, University Park, Pennsylvania 16802.*

Mr. President, Dr. Bates, Honored Guests, Fellows and Members of the Society, Ladies and Gentlemen:

I am deeply conscious of the great honor you bestow on me by this award of the Roebling Medal. When I have looked at the names of previous recipients, I have never thought of myself as measuring up to their achievements. To be enrolled in this company is indeed the ultimate honor for a mineralogist and especially for one who qualified as a physicist. As a student in the laboratory of Sir Lawrence Bragg and R. W. James in Manchester at the time when Jackson and West were working on the structure of mica, I was probably nucleated with interests which only developed 20 years later.

Quite a few times I have been asked how I came to be interested in the study of clay minerals, for up to 1945 my interests had been mainly in X-ray scattering factors, in the deformation of metals, and in lattice vibrations. During World War II, when normal university research in England was largely suspended, I occupied myself with some amateur geological field work. Stimulated by reading Bagnold's book, *The Physics of Blown Sand and Desert Dunes*, I turned to a study of some windblown



George W. Brindley

sands of Permian age. I was planning vaguely that when the war ended I would undertake work combining X-ray diffraction and mineralogical problems, though I had no particular desire then to take up crystal structure analysis.

By a lucky chance, Professor A. L. Roberts of the Fuel and Ceramic Department in the University of Leeds where I was Reader in X-ray Physics brought me the problem of what was the basic difference between china clay (kaolinite), fire clay, and halloysite. The names meant little or nothing to me. It did not take long to recognize that this was the opportunity I had been hoping and looking for. Perhaps I may quote the well-known lines from Shakespeare's *Julius Caesar*:

> "There is a tide in the affairs of men,
> which, taken at the flood, leads on to fortune . . . "

and so it was for me. It soon became apparent that different degrees of order were involved in these minerals, but we did not expect to have a crystal structure problem on our hands. It seemed to be just a simple matter of indexing a powder pattern for a known structure. But the more we examined the powder pattern of kaolinite, the less were we able to index it. New focussing cameras were built, in some respects like the design of diffractometers, and soon we were involved in a structure analysis of kaolinite. Before very long we were occupied with chlorites, chamosite, serpentine minerals, chloritoid, and so on. This was the beginning of a glorious adventure, involving structure analysis, order and disorder, diffraction by two-dimensionally ordered crystals, thermal reactions, and what is now called topotaxy. The tide which launched me on these studies still runs strong.

A second "tide" occurred in 1953 when the opportunity occurred to move to the U.S.A., a change I have never regretted. I still owe allegiance to Her Majesty the Queen, but Uncle Sam has been very good to me and I shall continue to contribute all I can to The Pennsylvania State University and to the U.S.A. as long as my efforts are wanted. I hope they will be wanted for a long time.

Professor Bates has referred to my "bridge building" activities, and in this connection perhaps I may mention briefly a renowned ancestor, James Brindley, 1716–1772, who was responsible for developing a canal system in England which involved, among other problems, carrying a canal over a river by a masonary aqueduct which still functioned into the present century and through a mile and a half long tunnel, the boats being propelled by human leg power. This canal carried the Cornish china clay to the famous Wedgewood potteries in Etruria (now part of Stoke-on-Trent) where I attended the local elementary school. In a cer-

tain sense, therefore, I became aware of ceramic clays and their thermal treatment at an early age.

Clay mineralogy has meant much more to me than just a professional activity. It has meant a succession of friends and acquaintances throughout the world, a succession of graduate students from this country and abroad who have been to my wife and myself like members of a family, an opportunity to travel to far away places, and many other things for much of which I am deeply grateful to the U.S.A. But at no time have I felt more endebted than I do today when the Mineralogical Society of America confers on me their highest award.

Mr. President, I accept this medal with more thanks than I can adequately express; thank you very much.

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PRESENTATION OF THE MINERALOGICAL SOCIETY OF AMERICA AWARD FOR 1970 TO BERNARD W. EVANS

W. S. FYFE, *Manchester University.*

Mr. President, members of the Mineralogical Society of America, guests:

It gives me very real pleasure to introduce to you the recipient of the Mineralogical Society Award for 1970; Bernard Evans, Professor of Geology at the University of Washington, Seattle; formerly of King's College, London, Oxford University, Glasgow University, and the University of California, Berkeley. I think that as all of us grow a little older and see less significance in our ideas, it is some consolation to see that some younger people who suffered with us at one time or other have survived despite our influence.

It was about 1960, while I was at Berkeley, that I received a letter from a young man at Oxford saying that he had interests in geochemistry and metamorphic petrology and would like to learn some experimental techniques. I liked the letter and it just so happened that some funds were available. Naturally we did some checking on this character and I seem to remember that we did not take all opinions too seriously. At any rate it was so unusual for an Englishman to want to come West, past the established seats of wisdom, that I guess we were a little flattered.

So Bernard arrived and I persuaded him, like so many grant holders, to take on a nasty one. We had been worried from time to time about the methods being used to study low temperature equilibria and we wanted