Presentation of the Oscar E. Meinzer Award to Shlomo P. Neuman and Paul A. Witherspoon

CITATION BY STANLEY N. DAVIS

Shlomo P. Neuman and Paul A. Witherspoon are the 1976 recipients of the O. E. Meinzer Award in hydrogeology. Dr. Neuman was born in Czechoslovakia in 1938 and moved to Israel in 1949. After receiving his B.S. at Hebrew University, he continued his graduate work at the University of California at Berkeley, where he completed his Ph.D. in 1968. He did further research and some teaching at Berkeley before he returned to Israel to work with the Institute of Soil and Water of the Agricultural Research Organization at Bet Dagan. Recently, he returned to the United States and is presently professor of hydrology at the University of Arizona. Dr. Neuman's thesis adviser at Berkeley was Dr. Witherspoon, whose academic career started in his home state of Pennsylvania where he received his B.S. in petroleum engineering from the University of Pittsburgh in 1941. After graduation, Dr. Witherspoon worked eight years for Phillips Petroleum Company. He returned to school in 1949 and received his M.S. from the University of Kansas in 1951 and his Ph.D. from the University of Illinois in 1957. He also worked for the Illinois Geological Survey while he was in Urbana. Since 1957, Dr. Witherspoon has been teaching at the University of California at Berkeley.

In 1948 when one of our recipients was a schoolboy in Czechoslovakia and the other was a young petroleum engineer in the United States, the probability of these two individuals collaborating some day in high-level research would have been calculated by most rational statisticians as almost zero. Luckily, the very small, but still finite, probability became a reality and has resulted in one of the most fruitful teams in the history of hydrogeology. Together, they have published 15 outstanding research reports. Although they have written on a large number of topics, their best known works deal with leaky aquifer dynamics, free surfaces, and the application of finite element methods to these and other problems.

The O. E. Meinzer Award is given for a single publication. Out of several possibilities, the award committee has wisely chosen to honor the article on "Field Determination of the Hydraulic Properties of Leaky Multiple Aquifer Systems," published in 1972 in *Water Resources Research,* volume 8, number 5, pages 1284–1298. In this paper, the authors summarize and demonstrate the practical applications of several of their previous theoretical papers dating back to 1967. They also propose a new field method for determining the hydraulic properties of aquifers and aquitards in leaky systems. They review existing methods of analyses and demonstrate that the usual restricted information gathered from only the aquifer yields, at best, approximate results and sometimes can be very misleading. They conclude their paper with a convincing demonstration of their new technique using actual field data from the Oxnard area in southern California.

In a broader view, this paper has not only provided important new insight and working tools for the hydrogeologist, but it has done much to force us into a more realistic view of the complexities of nature. The contribution that is honored today, happily, has already hastened the abandonment of some primitive rituals whose incantations revolve around a straight edge and semilogarithmic paper. For these and other accomplishments, we extend our thanks and our congratulations to Shlomo P. Neuman and Paul A. Witherspoon, researchers and innovators, but, above all, responsive individuals whom we are proud to claim as friends and colleagues.

RESPONSE BY SHLOMO P. NEUMAN

Thank you very much, Stan, for those beautiful words. I want to start by thanking the O. E. Meinzer Award Committee for the honor they have bestowed on Paul and myself. It is gratifying to know that colleagues consider our work to be useful, and I greatly appreciate this recognition.

The particular paper that brought us this award culminates several years of joint efforts on the part of Paul and myself. It may, therefore, be appropriate on this occasion to tell you a little bit about how Paul and I came to work together. When I received my degree in geology from the Hebrew University in Jerusalem, I was searching for an opportunity to combine a genuine interest in the Earth sciences with an equally keen interest in mathematics and physics. It was a lucky coincidence that my search landed me in Berkeley at the time when Paul was absorbed in a most interesting research project sponsored by the American Gas Association. The objective of this project was to devise field techniques that would help evaluate the hydraulic properties of a cap rock overlying a potential gas storage reservoir. The basis for such new techniques was an original idea by Paul to place observation wells not only in the aquifer as had been done in the past, but also in the low-permeability cap rock above the intended reservoir. His approach was to study what happens around the pumping well by simulating the flow on a digital computer with the aid of a finite difference technique. This took place in 1962–1963, and it appears to be one of the early attempts, if not the very first, to simulate a pumping test on the computer. Paul's unique combination of imagination, intuition, and enthusiasm immediately fired my own interest in the subject. It was then and there that I decided to become a hydrogeologist.

When the time came for me to develop a master's thesis, Paul recommended that I try to reproduce his numerical results by constructing a thermal model. This, however, would have required considerable time and effort, which I, as a typical student, wanted to avoid. In order to find an easy way out of my predicament, I came up with an alternative suggestion to develop an analytical solution for the case of a slightly leaky cap rock. Paul agreed, provided that I would be able to show him tangible results within two weeks. Because I was determined to avoid the hard work involved in building a model, I had little choice but to accept the challenge. With a great deal of luck and very little sleep, I somehow managed to come up with the finished product within the time so graciously allotted to me by my teacher. You may be interested to

know that Paul kept his promise and the subject of a thermal model was never mentioned again. In subsequent years, I had the privilege of continuing to work with Paul in an atmosphere of mutual trust and cooperation, some of the fruits of which we are reaping here today. I wish to take this very unique opportunity to thank Paul for those years as well as for everything I learned from him about hydrogeology, about the scientific method and about plain human relations.

Finally, I would like to express in a few words my opinion about the possible future of pumping tests in hydrogeological practice. Many of us will probably agree that pumping tests will continue to stay our main tool of aquifer evaluation for many years to come. However, it is becoming more and more evident that classical pumping test techniques may not be sufficient to provide us with the kind of information we need to reliably predict how a groundwater system will react in the future. The alternative may perhaps be found in divising large-scale tests in which several wells will be pumping simultaneously. The rate of pumping in each well will be designed in accordance with modern control theory to enable us to extract the maximum amount of information from the field data. The analysis of these data will, in most cases, have to be done numerically through a process known as the inverse method or parameter identification. Furthermore, the resulting information will be of a statistical nature, giving us an insight into the uncertainties involved in trying to predict the future behavior of a ground-water system.

Some of us here today have already started working in this or similar directions, and we all recognize that much still remains to be done. With this in mind, I enthusiastically accept the O. E. Meinzer Award not only as a compliment for past work, but also as a challenge for the future. I thank you all very much.

RESPONSE BY PAUL A. WITHERSPOON

Shlomo Neuman and I are very pleased to receive the O. E. Meinzer Award for 1976. A very distinguished group of hydrogeologists has been so recognized over the years and we feel honored to be able to join this group. My particular interest in hydrogeology started some years ago when I was working as a petroleum engineer. After several years in the field, I recognized the necessity of returning to graduate school to get a better background in geology. In the process, I was fortunate to be able to meet a number of prominent geologists, among them are John Frye, George White, Ralph Grim, Frank Foley, and Burke Maxey. The hydrogeologists in this group soon convinced me of the importance of their field and of the many problems that need attention. After completing my graduate work, I was able to join the University of California, and after a few years, I became a professor of geological engineering with emphasis on certain aspects of hydrogeology. Of course, in order to make any progress academically, it is imperative that the faculty be fortunate enough to work with competent graduate students. In this regard, I have been extremely fortunate in the caliber of the young men who have come to Berkeley to work in hydrogeology. Shlomo Neuman is one of this group of able young men and it has been a very pleasant and stimulating experience to work with Shlomo. Our joint effort on the paper selected for this award has been most enjoyable, and the recognition of our efforts by the O. E. Meinzer Award Committee is very much appreciated. I agree with Shlomo's analysis that the application in the field of some of the things that we have been working on in hydrogeology has many exciting possibilities. Perhaps this award will serve to draw attention to some of this work, and if it does, then we will be very much satisfied.

Presentation of the E. B. Burwell, Jr., Award to David J. Varnes

CITATION BY FRANK W. WILSON

The E. B. Burwell, Jr., Memorial Award is made to the author or authors of a published paper of distinction that advances knowledge concerning principles or practice of engineering geology or of the related fields of applied soil or rock mechanics where the role of geology is emphasized. The award generally is made annually, but it may be withheld if no suitable paper is chosen.

The recipient or recipients of the award are selected by a committee appointed by the Management Board of the Engineering Geology Division. Members of the present committee are James W. Skehan, J. Hadley Williams, Murray R. McComas, Lloyd B. Underwood, Bernard W. Pipkin, and myself, as chairman. Nine papers were nominated for consideration by the committee in 1976. After careful review and several rounds of balloting to narrow the field, one paper consistently remained in first place and the committee recommended to the chairman of the Engineering Geology Division and the Council of the Geological Society of America that the 1976 E. B. Burwell, Jr., Memorial Award be presented to David J. Varnes for his paper, *The Logic of Geological Maps, with Reference to Their Interpretation and Use for Engineering Purposes,* which was published in 1974 as U.S. Geological Survey Professional Paper 837.

Dave Varnes received his B. S. in geology (with honors) from the California Institute of Technology in 1940. He did additional work in geology at Northwestern University the following year. Since 1941, he has been a geologist with the U.S. Geological Survey. From April 1961 to August 1964, he was acting chief, and later, chief of its Engineering Geology Branch.

He was a previous recipient of the E. B. Burwell, Jr., Award with Glenn R. Scott in 1970.

Dave, it is with considerable pleasure that I present to you the 1976 E. B. Burwell, Jr., Memorial Award.