Presentation of the O. E. Meinzer Award to Joseph F. Poland and George H. Davis

CITATION BY STANLEY N. DAVIS

The O. E. Meinzer Award in Hydrogeology is given to the "author or authors of a published paper of distinction advancing the science of hydrogeology or some related field." Today's award goes to two authors, Joseph F. Poland and George H. Davis, whose paper, "Land Subsidence Due to Withdrawal of Fluids," has already become an essential reference work for hydrogeology, engineering geology, and petroleum engineering. Although the paper is broad in scope, it is based on an immense quantity of carefully reviewed field data which is coupled with the application of advanced concepts of soil mechanics. Also, if the combined time of both authors is considered, the paper represents the distillation of more than 45 years of active interest and work on problems of land subsidence.

One of O. E. Meinzer's outstanding contributions to hydrogeology was his insistence that confined aquifers should not be considered as rigid systems. Work by Terzaghi, Theis, and Jacob gave strong theoretical support to Meinzer's hypothesis. More than any other individuals, however, our award recipients of today have gathered and presented the actual field evidence which was needed to change this hypothesis into a natural law.

The paper which we are recognizing today has also made significant contributions to the applied aspects of hydrogeology. An emphasis on the wide-spread geographic occurrence of subsidence has served to alert the profession to areas of undetected present-day subsidence as well as to areas of possible future subsidence. Several spectacular examples of the economic effects of subsidence are given in the paper. And most important of all, the relation between subsidence and the amount of fluids produced from the subsurface is demonstrated clearly both by equations and field data.

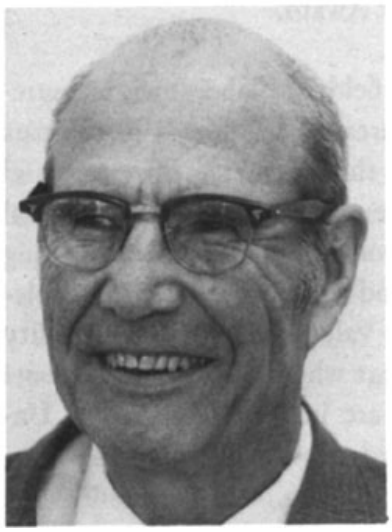
Joseph F. Poland, senior author, was born and reared in Massachusetts. He attended high school in Concord and went to Harvard for his undergraduate training. Kirtley Mather's introductory course at Harvard directed his interest into geology where he was fortunate enough to have further instruction and inspiration from other great teachers such as Kirk Bryan. After graduation and a brief time as a petroleum geologist in Colombia, he returned to the United States to finish a master's degree at Stanford University. Courses with "Chief" Tolman fixed his career in ground water. His first investigation of subsidence was in the Santa Clara Valley of California. This pioneer work was done with Professor Tolman of Stanford. Most of Joe Poland's subsequent professional career has been centered in California where, as a member of the U.S. Geological Survey, he has either directed or personally completed ground-water studies in almost every part of the state. He not only has made countless contributions to hydrogeology but, perhaps even more

important, has through his patience and unselfish guidance been a positive influence on the careers of an entire generation of ground-water geologists.

George H. Davis was born in Detroit and reared in Detroit and Chicago. After graduating from high school in Chicago, he completed his undergraduate training in geology at the University of Illinois. Shortly following his studies at Urbana, he was introduced to hydrogeology for the first time while working with K. O. Emery, who was directing a geophysical investigation of ground water for the Illinois State Geological Survey. Unfortunately, this work was cut short by Army duty. Graduate studies at the University of California at Los Angeles followed his military service. He joined the Ground Water Branch of the U.S. Geological Survey in 1948 and began his well-known work in the San Joaquin Valley. He moved from California in 1959 and has since worked in Washington, D.C., with the exception of a two-year period with the International Atomic Energy Agency in Vienna. During the past several years he has perhaps been best known for his skilled but sometimes thankless work as an editor for various publications of the U.S. Geological Survey and for the journal *Water Resources Research.*

I take great pleasure in presenting to my respected colleagues, Joe Poland and George Davis, the O. E. Meinzer Award for their outstanding work which started with the study of subsiding benchmarks but resulted in a monograph which stands as a nonsubsiding landmark for the science of hydrogeology.

RESPONSE BY JOSEPH F. POLAND



Until today, I was concerned about whether we deserved the Meinzer Award. Now that I have listened to the remarks by Stan Davis, I think we should each be given a golden cup to keep.

My interest in land subsidence began in 1932—40 years ago—when the Coast and Geodetic Survey found 3.6 ft of subsidence in San Jose. As a result of the excitement aroused, Chief Tolman and I laid out a network of survey lines in the Santa Clara Valley that was first surveyed for vertical control in 1933–1934. By 1967, man had lowered much of downtown San Jose 13 ft by continued ground-water overdraft.

I first met Mr. Meinzer in the middle thirties when he visited Professor Tolman concerning the Santa Clara Valley subsidence. This was about seven years after publication of his classic paper on "Compressibility

and elasticity of artesian aquifers" (*Econ. Geology*, 1928). In that paper, he had recognized that water withdrawn from storage was released both by compression of the aquifer and by expansion of the water—also that reduction in storage may be permanent (inelastic) as well as elastic.

In 1940, I began work with the U.S. Geological Survey in Long Beach, California, studying salt-water encroachment and the effectiveness of a coastal fault zone as a hydraulic barrier. The Wilmington oil field, a few miles from our office, already was on its way down and, as many of you know, subsidence there eventually reached 29 ft before repressuring stopped it.

Mr. Meinzer came to Long Beach several times during the forties because, fortunately for us, his brother lived there. I well remember that in 1943, on his first visit to our office, the conversation soon turned to subsidence and compaction of aquifers. After I had mentioned *sub*sidence several times and Mr. Meinzer had countered with sub*s*idence, he inquired gently if I was English. When I replied "only by ancestry," he explained that *sub*sidence was the English usage and sub*s*idence the American. (After he left, I checked Webster's Dictionary, and of course he was right.)

The assembly of a library on subsidence due to fluid withdrawal provided much of the background material for the GSA paper; it also provided the opportunity for communication and the development of friendships with many scientists concerned with land subsidence—in Europe, Japan, and Mexico, as well as in the United States. Thus, the assembly of the library and preparation of the paper had many benefits. One of the greatest is receipt of the Meinzer Award.

As an epilogue to the paper, and as a result of the field and laboratory measurements made by my colleagues and me in subsiding areas in California in the past decade, we have been struck by the great difference in the parameters of storage and compressibility for compacting aquifer systems, depending on whether the total applied stress exceeds preconsolidation stress. Hydrologists planning or making aquifer tests should be aware that in unconsolidated and semiconsolidated multiple-aquifer systems containing fine-grained interbeds, the values of the compressibility and storage parameters may be 50 to 100 times as great when total applied stresses are in the virgin range of stressing than when they are in the elastic range. Unfortunately, many aquifer tests have produced applied stresses spanning the transition.

In closing, I am very proud to receive the Meinzer Award with my co-author George Davis. I thank the Hydrogeology Division for this honor, and thank you, Stan Davis, for your kind remarks.

RESPONSE BY GEORGE H. DAVIS

I wish to add my thanks and appreciation to the Hydrogeology Division for the honor and recognition represented by the Meinzer Award. We have come a long way from the early 1950s when it was difficult to convince other geologists that land subsidence due to fluid withdrawal was more than a figment of our diseased imaginations—now even in the *National Geographic Magazine* I find descriptions of subsidence of Venice ascribed to groundwater production. Notwithstanding the increasing recognition of this phenomenon, in places where it has become painfully evident, I feel that there is still in the geologic profession a general lack of appreciation of the significance of the inevitability of compaction of earth materials under increasing stress induced by pressure decline, and that much more missionary work may be needed. On several occasions over the past year, in considering geothermal developments, I have been assured by reputable geologists that land subsidence will not prove a serious problem in specific areas, despite tremendous pressure reductions planned in what necessarily must be confined aquifer systems. For the most part, these geologists have not been hydrogeologists, but it suggests to me a need for better communication within geological circles to say nothing of with the lay public.

In conclusion, I wish to express my appreciation to my co-author, who was my first supervisor in the Geological Survey, for his always patient help and advice on my early stumbling efforts at technical work for the Survey. I count myself most fortunate to have had the benefit of working closely with Joe Poland at the outset of my professional career.

Presentation of the E. B. Burwell, Jr., Memorial Award to Richard J. Proctor

CITATION BY EMERY T. CLEAVES

On behalf of the Burwell Award Committee, it is my pleasure today to present the Edward B. Burwell, Jr., Memorial Award to Richard J. Proctor for his outstanding paper "Mapping Geological Conditions in Tunnels."

The paper appeared in the *Association of Engineering Geologists Bulletin*, v. 8, no. 1. It has become an extremely useful guide to geologists and engineers engaged in tun-