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1993 C.V. THEIS AWARD

Citation

Philip Cohen thirteen years ago became the first hydrogeologist to head the Water Resources Division of the U.S. Geological Survey, a position he has since held with great distinction. This, however, is only one of the reasons for his selection as the 1993 recipient of the C.V. Theis Award.

Phil was born in New York City and received degrees in geology from both City College and the University of Rochester. Prior to his selection for top-level administrative positions in the Geological Survey, he made important contributions to ground-water science. In fact, as a field investigator, he demonstrated the same singleness of purpose that marked the career of C.V. Theis. As with Theis, when confronted with a problem, he would spare no effort to solve it. He first made his mark on the ground-water profession in the early 1960s with a series of reports on ground-water conditions in the Humboldt River Valley in the Winnemucca Area of Nevada. From Nevada, he moved to Long Island, New York, where his first major assignment was to determine the feasibility of using tertiary-treated sewage effluent to prevent saltwater encroachment into the deeper aquifers that underlie Long Island. Within a remarkably short time, he became an expert in advanced well-construction technology and in sewage treatment and geochemical reactions.

In 1972, he moved from Long Island to the National Headquarters of the U.S. Geological Survey where his first assignment was as Associate Chief for Research and Technical Coordination. In this position he led the Survey's efforts to communicate the results of its investigations and research in reports and maps understandable to the non-scientific community. Since 1980, he has served as the Survey's Chief Hydrologist and Chief of the Water Resources Division. His accomplishments as Chief Hydrologist have included, among many others, the establishment of programs of national scope in Toxic Substance Hydrology, Acid Rain, Assessment of National Water Quality, Global Change Hydrology, and National Water Summaries.

It is appropriate that Phil Cohen's contributions to ground-water science and his outstanding leadership of the Survey's water-resources program be acknowledged by his selection for the Theis Award. It, therefore, gives me great pleasure to present the 1993 C.V. Theis Award of the American Institute of Hydrology to Philip Cohen.

Ralph C. Heath

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1993 C.V. Theis Award

Acceptance Speech

Mr. Chairman, fellow colleagues and members of the American Institute of Hydrology, fellow visiting scientists from the former Soviet Union, and distinguished guests:

I am pleased and greatly honored to receive this award which is named after a distinguished pioneer in the science of hydrogeology. I am also honored to be in the company of so many distinguished people.

It is truly an honor to be placed in the company of other Theis Award recipients--people whom I am privileged to call colleagues and friends"

1987 -- Roger DeWiest
1988 -- Isaac Winograd
1989 -- Thomas Prickett
1990 -- Shlomo Neuman
1991 -- Herbert Skibitzke

Like so many hydrologists of my generation in the U.S. Geological Survey (USGS), I had the great privilege of knowing and working with C.V. Theis. Most of my formal early training in ground-water hydrology was in-house USGS training courses. I first met C.V. at one of those courses, and I was exposed to his research in numerous courses that I participated in thereafter. I also had the great pleasure of his guidance and support related to work that I did in Nevada in the 1950s and 1960s and on Long Island in the 1960s and the 1970s. My meetings with him in the field (Winnemucca, Nevada and Long Island, New York) are among the most memorable experiences in my career.

In my remarks this evening, I'd like to review some of the changes that have taken place over the last 35 years in ground-water hydrology investigations, with special emphasis on ground-water quality, and from the perspective of my career with the U.S. Geological Survey's Water Resources Division.

The theme of this conference is "Industrial and Agricultural Impacts on the Hydrologic Environment" and we will hear presentations on ground-water quality studies conducted by investigators from around the world.

1993 C.V. THEIS AWARD - ACCEPTANCE SPEECH

Thirty-five years ago an international hydrogeology conference such as this would certainly have had a different focus, probably concentrating on ground-water availability, aquifer properties, and perhaps techniques for pumping test analysis. Papers on ground-water quality would probably have focused on (a) suitability of the water for use, and (b) inorganic constituents,m and, perhaps, (c) geochemistry.

In my years with USGS, I have seen a major change in emphasis of ground-water studies. Analog and digital simulation have revolutionized the way in which quantitative hydrogeologic studies are done. and in the past 10-15 years, emphasis o in ground-water studies has shifted dramatically from water quantity to water quality. That shift has been caused mainly by the rapid growth of the environmental movement, and the social and political response thereto.

I began my career in the mid-1950s with the USGS in northern Nevada assessing ground-water resources and studying ground-water and surface=-water interactions. We did some ground-water chemistry, and largely with the objective of determining suitability for use, but also with the goal of using simple mixing equations to help quantify various elements of the hydrologic cycle.

When I began my work on Long Island, New York, in the mid-1960s, the era of quantitative ground-water analysis on the island had peaked and the water community was rapidly turning its attention to matters of ground-water quality. Recall, that such people as Max Leggette, John Ferris, C.E. Jacob, and Whity Luszynski, had made fundamental contributions to ground-water physics when they worked on Long Island in the 1930s, 1940s, and 1950s.

The 1960s were transition years when the USGS and others began to turn more of their attention to ground-water quality. The initial emphasis on Long Island was on characterizing the suitability of water for use and on salt-water intrusion. This was followed by some of the earliest work in the United States to define and characterize plumes of ground-water contamination involving hexavalent chromium from a plating plant and seepage from sanitary landfills.

We and others around the country then began to investigate the physics, chemistry, and biology associated with artificial recharge of treated (and sometimes untreated) sewage through injection wells and basis. Simultaneously, we studied widespread ground-water contamination by synthetic organic detergents and nitrate from cesspools, septic tanks, and agriculture..

Please recall that all of this work predated the Clean Water Act, Superfund, RCRA, and the other major pieces of U.S. federal environmental legislation, which now play such a major role in driving the assessment activities and research of the ground-water community. Also note that our work preceded coining of the terms point and nonpoint source contamination--we in the USGS claim no special credit for that jargon.

In the mid- to late 1970s, the nation became aware (and frightened) by stories about places like Love Canal, where ground water had been highly contaminated by mixtures of toxic organic chemicals. The USGS, the recently-created Environmental Protection Agency (EPA), and the academic and private-sector ground-water community began to increase their focus on contaminant hydrogeology, a focus that continues to this day. We realize now how much more we have to learn and what a tremendous problem the United States and the world is facing in trying to clean up contaminated ground water. Once it was though that we had a successful technology for ground-water remediation. Now we know that in most cases pump-and-treat technology cannot completely clean up contaminated ground water and may not be economically feasible for many sites. We also realize that so-called dense non-aqueous phase liquids, such as TCE and many other organic solvents, present special problems for remediation. We are making progress. We are beginning to understand the limits of existing technology and some of our best scientists are working on new technologies--especially new technologies for in-situ treatment using biological and chemical reactions.

In the past few years in the United States, nonpoint source ground-water contamination has emerged as perhaps the most politically significant ground-water issue. On Wednesday at this conference, I will present some details about recent USGS studies of the effects of agriculture on water quality. Let me say briefly now that we need much new scientific information to address this issue. The Social and economic costs of preventing further ground-water contamination and of cleaning up contaminated ground water will be enormous--well above the hundreds of billions of dollars now being talked about. We in the USGS and other workers are intensively studying the chemistry, physics, and biology contaminant transport from the land surface through the unsaturated zone, and within the saturate zone. As we explore these phenomena, we uncover more and more research issues that the rapidly expanding ground-water community needs to consider--research that assuredly will have a very large pay back to society.

At the same time that we and much of the developed world have seen these shifts in emphasis in ground-water studies from water quantity to water quality, we have seen significant improvements in the technology available to conduct such studies.

Examples of the tools that are making our investigations more effective include:

-- ground-water flow models and the computer technology that allows them to be widely applied,

-- geochemical models,

-- geophysical techniques,

-- microbiology of ground water

-- new analytical techniques that allow us to collect water-quality data in the field, and

-- finally, the rapid development of powerful GIS technology.

Clearly, these tools represent a significant beginning, but much more needs to be done, and hydrologists and hydrogeologists such as those attending this conference will play the major role in providing the needed technology.

I will close with a few thoughts about the ground-water issues that conference such as this may be considering 10 years from now.

Ground-water quality will continue to dominate our science. We will still be struggling with the problem of remediating highly-contaminated ground water at Superfund and other sites and we will have only begun to prevent much less clean up nonpoint ground -water contamination. The United States alone will spend hundreds of billions of dollars on this issue during that period.

In the next decade we will make significant strides in ground-water chemistry and biology and in the analysis of the relationships between land use and nonpoint source ground-water contamination. In this country, regulation of land use presents many difficult political and social questions. Before our federal government enacts such legislation, people will have to be assured that land-use restrictions are needed and will have the desired results. Great leadership and political courage will have to be brought to bear if environmental and human health concerns are, in reality, appropriately balanced against short and intermediate term economic concerns. The concept of "appropriate balance" will be the subject of continuing, and sometimes heated debate.

In conclusion, I recognize that I have been very fortunate in my career. I have had a chance to be involved in and to observe first-hand many of the developments I have spoken about this evening. I look forward to the issues and the technology that will emerge in the future and I intend to play an active part in that future.

Again, I thank the American Institute of Hydrology for honoring me with the Theis award. This is a wonderful moment in my professional life.

Philip Cohen