Editors' Message: the Hydrogeologist Time Capsule — archival video recordings of influential hydrogeologists

Craig T. Simmons · Philippe Renard

If we look back through history, we can all recall scientists and engineers who have made a material difference to the society in which we live. Hydrogeology is no exception. From Henry Darcy to Charles Vernon Theis, from William Smith to Thomas Chrowder Chamberlin, from Jacob Bear to József Tóth, the many achievements of our hydrogeologic ancestors form the very basis for the work we do today as groundwater scientists, engineers, and professionals. But how well do we really know these people and their achievements? It is probably true that we usually know the technical details of the work of these individuals. However, rarely have we gained insights into them as people—to better understand their personal motivations, aspirations, and living philosophies. It is interesting to ponder, even momentarily, upon questions like: What were they like as people? What motivated them? What lead them to make their discoveries? What thoughts did they have about the state of science in their time? What visions did they have for the future of hydrogeology? Science is after all more than just a collection of theories, equations, experiments and journal papers, it is also vitally about people—the scientist who makes a discovery, the hydrogeologist who has a vision or an idea, the inspirational leader who makes a tangible difference to a community, the student who works with a professor in a vibrant research team where science and discovery are infectious.

How do we get answers to these often non-technical and perhaps seemingly personal questions? Sometimes, if we are lucky enough, we might find an occasional answer in an original monograph or paper. However, this is usually very unlikely because journal papers and archival records are most often technical documents that do not reveal answers to these fundamental questions. In some cases, we may be able to find either biographical, or even better, autobiographical information—but there are few of these that are widely available.

One compelling example can be used to illustrate why searching for our historical roots and getting to know the scientists behind hydrogeologic science is important. Every hydrogeologist, geoscientist and engineer knows Darcy's Law. For many of us, Darcy's Law brings to mind his frequently used equation, a column filled with sand, a bundle of manometer tubes, and some flow-rate calculations in aquifers. Discovered in 1856, Darcy's Law is now hydrogeologic mantra. However, until very recently, we did not know very much about Darcy's life and the process of his discovery. One often wondered: Did he stumble onto his law? Did he know he had discovered something deeply profound about nature? Did he die not knowing? We did not even know what he looked like, or why his name was spelt Henry Darcy and not Henri d'Arcy. Recently, we have begun to exhibit curiosity about Darcy's life and science (Freeze 1994; Sharp and Simmons 2005; Simmons 2007). These and other accounts reveal that Darcy was a selfless citizen who was deeply inspired to make a change in this world by building the impressive water distribution system for his native town of Dijon in France. His work transformed a city rid with filth and squalor to one whose water supply was second best only to Rome in Europe by 1840. He waived all fees, which would have amounted to near US $1.5M in today's currency. Darcy's life and science has been brought to life through the discovery of old portraits, letters and archival records. Critically, we also learn of the important details of the process of his scientific discovery. We now know with certainty that Darcy suspected his law before he did his now famous column experiments in the unnamed hospital courtyard in Dijon in 1856 (Simmons 2007). He knew his discovery was significant, but he was not surprised by it. Imagine if we could have asked Darcy about his life as an engineer, why research was important to him, and how it was that he came to make a number of major scientific and engineering contributions (outlined in Simmons 2007). Imagine if we could have asked Darcy about the day he plotted his experimental data from his column experiments to find that his experimental data fell

Received: 19 November 2007 / Accepted: 22 November 2007
Published online: 19 January 2008

C. T. Simmons (✉)
School of Chemistry, Physics and Earth Sciences,
Flinders University,
P.O. Box 2100, Adelaide, SA 5001, Australia
e-mail: craig.simmons@flinders.edu.au

P. Renard
Centre for Hydrogeology,
University of Neuchâtel,
11 Rue Emile Argand, CP 158,
CH-2009 Neuchâtel, Switzerland

 DOI 10.1007/s10040-007-0256-z

on a straight line—that very moment when he discovered that the flow rate of water through sand was linearly proportional to the head gradient across the sand layer, something he had already foreseen based on his earlier research work on water flow in pipes. Imagine hearing answers to these questions in Darcy's own words. If only technology in that French Renaissance period had permitted us the opportunity to capture live footage of Darcy. Like Darcy, many other opportunities to capture distinguished and influential hydrogeologists have already been missed.

We cannot change the past but we, as a community of hydrogeologists, can change the future. We can make a conscious decision and effort to make visual and sound records of the reminiscences of some important and influential hydrogeologists of our time. We do have the capability to preserve their thoughts about their careers, their lives, their discoveries, their legacies, and messages for future generations.

This Editors' Message announces that we have begun a project to accomplish the above goals. Indeed, we now have the possibility of hearing from eminent groundwater hydrologists personally, in their own words and visually. We have the possibility that every hydrogeologist, student, professor and consultant, across the world can listen, watch and learn from influential individuals in our field. Add the flexibility of being able to do this at any chosen time, from anywhere in the world including a home computer, and consider that this is free of cost. Until the advent of modern internet and digital technology, this would not have been possible, but now these capabilities have been made available to everyone with the launch of a new project supported by the International Association of Hydrogeologists (IAH) called the *Hydrogeologist Time Capsule*. A new website (http://timecapsule.iah.org, IAH 2007) provides a collection of video and audio interviews of eminent and influential hydrogeologists who continue to change the face of our profession. Upon release of most videos online, a companion 'Profiles of Eminent Hydrogeologists' article will appear in Hydrogeology Journal, usually written by the interviewer. This issue of *Hydrogeology Journal* presents the first such pair.

We are delighted to launch this project with an interview of C.V. Theis (1900–1987), conducted by John Bredehoeft in 1985 and taped by Ben Jones, all members of the US Geological Survey. Theis gave groundwater hydrology the now universally used Theis equation for estimating transmissivity and storativity values near a pumping well from drawdown data collected during an aquifer pump test, but Theis' contribution is deeper. John Bredehoeft describes the context of Theis' professional work as follows:

> Hydrogeology in the 1920s was stuck—totally stymied. They had equations for incompressible groundwater flow that did not fit their observations. They needed a transient equation, but they did not know what form that equation took—O.E. Meinzer wrote about this in 1928. Along came Theis, the most junior member of the US Geological Survey group, and solved the problem by suggesting the analogy with heat flow. By all accounts, Meinzer was stunned; he could not believe that this new geologist had solved "the problem"—of course, he told Theis he did not believe it, he had his doubts. How would you like that? You solve the biggest problem of the day, and your boss—the great man O.E. Meinzer, doubts you accomplished it! At any rate, Jacob settled the issue.
> ...It takes real genius to see the basic form of the underlying theory—this was Theis' contribution. He got hydrogeology as a science unstuck and rolling—it never looked back.

Readers are urged to delve further into the context of Theis' work by reading Bredehoeft's personal account of his interview (Bredehoeft 2008).

The 1985 taped interview has until now been languishing in the US Geological Survey library, and has apparently been seen by very few individuals. Now, the original tape has been edited and converted to modern day formats, and is available online at the Hydrogeologist Time Capsule site. In both the online video and Bredehoeft's profile of Theis in this issue, we learn a lot about how Theis approached problems of the day, not only the issue of pump tests, but also the parameterisation of aquifers. We see firsthand his visionary ability to predict many of the important issues that face us today in hydrogeology such as contaminant transport and dispersion. The interview makes it abundantly clear that Theis was a man whose thinking was well ahead of his time. To watch Theis talk with Bredehoeft about his work and life is an extraordinary experience. We hope that hydrogeologists across the world will enjoy the interview, learn something from it and get to know Theis a little better. We also hope that the new availability of the interview online supports educational uses and that teachers will employ it in their courses; one can easily imagine using the video to bring pump-test theory to life by bringing C.V. Theis into a classroom.

The second set of videos already available on the Time Capsule web site was prepared by Alex Cheng and his colleagues at the University of Southern Mississippi and the University of Memphis, USA. Two videos were produced. One is an interview of Jacob Bear by a group of faculty members and students. The other is a lecture in which Jacob Bear presents his views on the past and a vision for the future of transport in porous media. One of the particularly interesting aspects in those videos is the description of the links between fundamental research, applied engineering problems, and teaching that interact deeply in Jacob Bear's works and motivations.

Other video recordings currently in production include Paul Witherspoon, interviewed by R. Allan Freeze, and József Tóth. Indeed, József Tóth was interviewed in October 2007 at the Geological Society of America conference in Denver by Ben Rostron (University of

 DOI 10.1007/s10040-007-0256-z

Alberta, Canada) and taped by Craig Simmons. József Tóth remarked on the Hydrogeologist Time Capsule upon completing this momentous interview:

> This is an extremely creative idea and an exceptionally important one. The time has come to more deeply understand how our science was born and has grown, to hear from influential groundwater scientists first hand about their life's work, and for us, as scientists, to share our reflections and future visions with both current and future generations. I am extremely honoured and humbled to have been invited to contribute to this project and to have had the opportunity to discuss my life story and my scientific legacy on tape. I encourage the international scientific community to support this new project in the strongest possible terms.

Acknowledgements IAH has provided financial support for this project. Thanks to Cliff Voss, Andrew Skinner, Sue Duncan, Sylvain Tissot, Laslo Kiraly, and Javier Jueda for their ongoing support, invaluable suggestions and vital contributions to the project. We are indebted to John Bredehoeft, Jacob Bear, Alex Cheng, Paul Witherspoon, Allan Freeze, Iraj Javandel, József Tóth, Ben Rostron, Todd Halihan, Jack Sharp and Tim Sickbert for their role in numerous interviews that are currently in preparation or online. We would like to thank all others who supported the interviews in some way. Craig Simmons and Philippe Renard are coordinating the Time Capsule project for IAH.

References

Bredehoeft JD (2008) An interview with C.V. Theis. Hydrogeol J This issue

Freeze RA (1994) Henry Darcy and the fountains of Dijon. Ground Water 32:23–30

IAH (2007) Hydrogeologist time capsule. http://timecapsule.iah.org

Sharp JM Jr, Simmons CT (2005) The compleat Darcy: new lessons learned from the first English translation of Les Fontaines Publiques de la Ville de Dijon. Ground Water 43(3):457–460

Simmons CT (2007) Henry Darcy (1803–1858) Immortalised by his scientific legacy. Aquifer Systems Management: Darcy's legacy in a world of impending water shortage. In: Laurence Chery, Ghislain de Marsily (eds) IAH selected papers on hydrogeology, vol 10. Taylor and Francis, London, pp 3–24

 DOI 10.1007/s10040-007-0256-z