

2007 MEDALS & AWARDS

O.E. MEINZER AWARD

Presented to Shaun K. Frape



Shaun K. Frape
Professor
University of Waterloo

Citation by F. Edwin Harvey

It is an honor for me to present Dr. Shaun Keith Frape, of the University of Waterloo's Earth Sciences Department to receive the 2007 O.E. Meinzer Award. For over twenty-five years, Shaun's research has focused on understanding the hydrogeology and hydrogeochemistry of deep crystalline shield rocks and brines and has included the use of major ions, trace metals, stable isotopes and gas chemistry to characterize and trace brine formation and migration. Shaun is a hydrogeochemist, who like numerous other Meinzer Award winning hydrogeochemists such as William Back, Bruce Hanshaw, John Hem, Neil Plummer, and Fred Phillips, applies innovative geochemical tools to understand and characterize complex hydrogeological problems in what can only be described as unique aquifer systems. Cited in support of this award are three of Shaun's seminal contributions related to the hydrogeochemistry of crystalline rocks:

(1) *Water-rock interaction and chemistry of groundwaters from the Canadian Shield*, 1984, Frape, S.K., P. Fritz, and R.H. McNutt, *Geochimica et Cosmochimica Acta*, 48(8), 1617-1627—which describes his original work related to groundwater-rock interactions within the fractured crystalline aquifers of the Canadian Shield. In this paper, Shaun used a combination of major ion chemistry along with stable oxygen and strontium isotopes to differentiate groundwaters of various origins across the shield and to delineate ion sources during their hydrogeochemical evolution.

The paper discusses a number of evolutions histories responsible for the shift of shield brines toward a Ca-Cl end member chemistry, and sets the stage for subsequent research and debate related to brine chemistry and origin that continues today.

(2) *Geochemical trends for groundwaters from the Canadian Shield*, 1987, S.K. Frape and P. Fritz, p. 19-38, in *Saline Water and Gases in Crystalline Rocks*, P. Fritz and S.K. Frape editors, Geological Association of Canada, Special Paper 33, 259 p.—is part of a classic and highly cited collection of papers edited by Shaun and his colleague Dr. Peter Fritz, describes geochemical trends for groundwaters from the Canadian Shield. This work, documented the stark differences of shield brines from those found in sedimentary basins or hydrothermal environments, and noted a different origin for groundwater and dissolved solutes. Contrary to accepted sedimentary basin brine emplacement theories of the day, the paper suggests an autochthonous salt source and stresses the importance of water-rock interaction in the formation of brine chemistry as evidenced by a lack of non-equilibrium mixing or dilution, and

(3) *The Sr⁸⁷/Sr⁸⁶ values of Canadian shield brines and fracture minerals with applications to groundwater mixing, fracture history, and geochronology*, 1990, McNutt, R.H., S.K. Frape, P. Fritz, M.G. Jones, and I.M. MacDonald, *Geochimica et Cosmochimica Acta* 54(1), 205-215—demonstrates the use of ⁸⁷Sr/⁸⁶Sr ratios to study groundwater in crystalline rocks. This paper presented ratios indicative of water-rock interaction with feldspars, and mixing of brines having different origins as well as mixing with meteoric waters. Subsequent to this paper, this method has become a standard for identifying solute sources and mixing in not only brine studies, but also in studies investigating the origin of salts in regional freshwater aquifers such as the Great Plains (Dakota) and High Plains (Ogallala) aquifers, for example.

Shaun's lifetime dedication to his research has made Shaun one of the world's leading authorities on the hydrogeology and hydrogeochemistry of crystalline rocks. Shaun's dedication and loyalty to his students and colleagues has made him a trusted and valued friend who is routinely sought after for his experience and expertise. Shaun's extensive body of work has unquestionably impacted his chosen field and the direction of research within it. So, these contributions to the hydrogeological community and his

research related to the hydrogeology and hydrogeochemistry of crystalline rocks as demonstrated in, and represented by the cited publications that have unquestionably impacted and altered the way scientists study groundwater flow in crystalline rock environments, it is my distinct pleasure to present to you my good friend, this years GSA Hydrogeology Division O.E. Meinzer Award recipient, Dr. Shaun K. Frape.

Response by Shaun K. Frape

I would sincerely like to thank the members of the award committee and my many friends and colleagues within our division and discipline. As Ed Harvey has so nicely put in his nomination, I have a long standing and ongoing interest in flow systems within deep saline crystalline rock. This extends to sedimentary basinal systems and the impacts of salinity and saline intrusions into shallow and surface groundwater systems.

Many individuals have had an impact on my research and scientific training. My supervisors at Queen's University, Kingston, Dr. Alan Gorman and Dr. Ronald Patterson taught me that studying hydrogeochemical and hydrogeological problems was also a key element of the geological sciences. I came to Waterloo for one year in 1979 to study isotopes with Dr. Peter Fritz. I am still at Waterloo and still learning. Peter taught me that persistence and good thinking would usually come out ahead of vast amounts of funding thrown at a problem. He also taught me that funding sure helps the thinking part. Peter is still a great friend to this day. Dr. Fritz and several early colleagues at Waterloo offered me another unique opportunity. This was to stay at Waterloo in a hydrogeology rich environment with many exciting professors and to meet two of my best friends, Bob Drimmie and Ed Sudicky. Bob has taught me and my graduate students more about isotopes than anyone else I know. Ed and I are academically on the opposite ends of the hydrogeology spectrum, but we write together, supervise students together and enjoy sharing and expanding the thinking realm of "what if you could do that".

External to Waterloo, Dr. Fritz, in the early 1980's, introduced me to a group in Reston, Virginia that has a profound impact on my research interests. The U.S. Geological Survey Hydrogeology Division contains some of the most dynamic and interesting people in our field of research. Dr. Blair Jones, Dr. Warren Wood, Dr. Neil Plummer and Dr. Kirk

2007 MEDALS & AWARDS

Nordstrom have all had major influences on how I think about saline fluids in the earth's crust. I would recommend to any young researcher in the audience that if you can strike up friendships with the U.S.G.S. it can be a great collaboration. I would also thank my friends and collaborators of the Finnish Geological Survey, particularly Dr. Runar Blomqvist and Dr. Timo Ruskeeniemi for friendship and research stimulation over the last 22 years.

To my graduate students, I would say thank you for the friendship, the hard work and the faith in trying to make often intuitive ideas that appeared to be scientific challenges succeed in working. To those that supported my nomination, Ed Harvey, Ed Sudicky, Don Siegel, Blair Jones, Kirk Nordstrom, and Warren Wood, thank you; you are a fine group of colleagues and friends. Ed Harvey is one of best friends that I could have ever wished for. He continues to be one of my closest ex-

students and pays me the supreme compliment of still wanting to work on projects together. Thank you Ed, for all the hard work. And finally, to my family, my wife Nori and my children Liam and Erin, I hope the positive side of being part of my research efforts, knowing my colleagues and friends and the graduate students, has been more fun than problems. Again, thank you to the Meinzer Committee, the nominators, particularly Ed Harvey, and the Hydro Division of GSA.