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F. W. Clarke Award Acceptance Speech

ANDRÉ M. SCHEIDEGGER

Waste Management Laboratory, Paul Scherrer Institute, 5232 Villigen, Switzerland

Thank you, Don, for the generous introduction. Thank you, President Drake and you, the members of the Geochemical Society for giving me the Clarke Award. The award is a great honor for me and I am very thankful to be here today. I am thinking of the many people who have influenced and shaped my scientific path and personal growth over the past years.

My path began as a student at the Swiss Federal Institute for Technology (ETH) in Zurich. I studied chemistry and completed my studies with a Master thesis in catalysis. Thereafter, I decided to the surprise of many to leave traditional chemistry and go for a Ph. D. in soil chemistry. My new adviser was Prof. Hans Sticher, the former head of the soil chemistry laboratory at ETH. He taught me much about chemical processes in soils. Hans Sticher was known for his field trips. Equipped with a shovel we went to the Swiss mountains to study the development of the various soil types and soil horizons. In the evenings then, we sat all together and enjoyed a glass of wine.

In the laboratory, however, my real scientific adviser was Michal Borkovec. He is a brilliant scientist and he taught me to question school book opinions and to develop ideas on my own. Briefly, he taught me science. My external advisor was Prof. Willem van Riemsdijk from Wageningen University. His way of thinking and questioning things did in no way stand behind. I could profit so much from his experience and his way how he was looking at reactions at surfaces.

The topic of my Ph.D. thesis was on reactive transport of contaminants in iron oxide columns. I developed a heterogeneous coating procedure in which well characterized iron oxides were bound to sand grains. I then used the material as a column matrix to study reactive transport phenomena. The studies demonstrated that column experiments are well suited to determine adsorption isotherms of sorbing species over a wide concentration range.

One of the meetings I attended during my Ph.D. studies was a NATO-ASI meeting in Italy. The meeting was special in many ways. It lasted 2 weeks and was located in a very isolated spot in southern Italy with no chances to escape. I never experienced such bad food in Italy. What made it worse, the menu for the second week was exactly a copy of the week before. On the positive side, the meeting offered an interesting scientific as well as cultural program with plenty of time for discussions and other activities such as swimming at the nice private beach. Most important for me was, however, that I had the chance to get to know Don Sparks. I was attracted by the way he combined the kinetics with various state of the art spectroscopic techniques to determine mechanisms in soil systems. Since he had an opening and I was interested in a postdoctoral position abroad, my next step after the Ph.D. was soon clear.

At the University of Delaware things were different in many ways to what I experienced back home in Switzerland. Our



A. M. SCHEIDEGGER

offices were located in a trailer which promoted stimulating discussions and lasting friendship. We were a hard working team, but we didn't forget about humor and social events. In this sense I wish to acknowledge Jerry Hendricks and all the graduate students and postdoctoral students in Don Sparks group, in particular Dan Strawn, my office mate who made me laugh so many times.

Our research group had access to an EXAFS beamline at the National Synchrotron Light Source in Brookhaven. I vividly remember the trips up there with all its highlights and lowlights. EXAFS measurements can be very stressful. How did I like these moments when in the middle of the night the computer system crashed, a detector broke or simply the data quality got worse for seemingly no reasons. Fortunately, there was this notice on the wall with the phone number of Gerry Lamble, the beamline scientist of X11A at that time. Herewith, I would like to thank her for all her support. She did not only help me with the alignment of the beamline, she also showed me how data analysis is done.

My research at the University of Delaware focused on the determination of sorption mechanisms of Ni onto clay minerals and aluminum oxides using macroscopic, microscopic and spectroscopic approaches. The EXAFS studies soon revealed the formation of a Ni nucleation phase in the sorption systems, growing in extent with increasing reaction time. Surprisingly, the studies demonstrated that the nucleation phase was not a

Ni(OH)₂-like product as one might expect, but a mixed Ni-Al hydroxide phase. At this point I wish to acknowledge the work by Jean-Baptiste d'Espinose de la Caillerie, Steven Towle and Hillary Thompson, the later two former students in Gordon Brown's research group. Their EXAFS studies, which came out at about the same time, revealed similar results in clays and aluminum oxide sorption systems.

Since then, the EXAFS findings have initiated a significant number of further studies, either at the University of Delaware or elsewhere. EXAFS studies by Eef Elzinga and Darryl Roberts revealed that mixed-cation hydroxide-like phases are equally fast formed in an artificial clay mixture as well as in a natural soil clay fraction. An AFM study by Kirk Scheckel visualised the growth of Ni nucleation products over time on clay surfaces and studies by Andreas Scheinost and Robert Ford confirmed the growth of mixed Ni-Al hydroxide phases using diffuse reflectance spectroscopy and thermogravimetric analysis.

I was told that I am the first recipient of the Clarke Award for studies using EXAFS. In this context I wish to acknowledge and share the award with the entire EXAFS community in geochemistry. Over the past 10 years there have been many outstanding EXAFS studies which have helped that EXAFS became an important spectroscopic tool in geochemistry. I was also told that I am one of the first recipient of the Clarke award for studies related to soil sciences. I am glad that the society acknowledges soil chemistry and other environmental related studies as research areas important to geochemistry.

Don Sparks meant more for me than only an experienced scientific teacher and adviser. He taught me things such as for example how to write grant proposals. That is a rather important skill to be taught to young scientists. He also taught me that the best science is not much of worth when it can not be presented in an appropriate way. I remember the practice sessions with our group before meetings or interviews. The idea was never to simply criticize the work, rather the comments were always constructive. Once gone through these internal practice sessions, we were prepared to respond to all sorts of questions and criticism. I think as a scientist we all need a constructive feed-back from colleagues to further improve and widen our horizon.

Other important skills I could learn from Don Sparks were personal skills. I never ever experienced Don losing his calm-

ness when things went wrong. Rather he always encouraged people to try again and offered his support. I also learnt that a successful team should also do something together socially. Since we all liked good food, Don Sparks often took the whole group out for lunch to celebrate an achievement or Don and Joy Sparks invited us over to their house for events such as wine tasting and BBQ or Fondue parties. In this context I wish to thank Joy and Don Sparks for the many social events and that they always welcomed us so warmly.

Back in Switzerland I joined the Waste Management Laboratory at the Paul Scherrer Institute in Villigen and I am currently in the process of building up a small research group. At the present time our institute is building the Swiss Light Source (SLS) and I am involved in the planning of an EXAFS beamline which will of course be well-suited for geochemical applications. My research focus has shifted insofar as the studies are closely related to geochemical processes of radionuclides in a waste repository. Complex problems such as the long-term safety of a waste repository need to be addressed by a group of scientists with different backgrounds. I feel fortunate to closely work together with a group of experienced geochemists, geologists, hydrologists, chemists, physicists and mineralogists. The combination creates a very stimulating scientific environment. In this context I wish to acknowledge Jörg Hadermann, Mike Bradbury, Bart Baeyens, Erich Wieland, Rainer Dähn and all my other co-workers at the Waste Management Laboratory at PSI.

This acknowledgement wouldn't be complete without mentioning the most important persons in my life. I wish to thank my parents for their loving support through my entire childhood and education. Special thank also to my wife and best friend, Meret. Over the many years of friendship, Meret continues to be my confidant and strength through our best and most stressful of times. With Chantal, my one and a half year old daughter, somebody new came in my life which keeps my perspectives on track when I am in danger that work becomes too important in life. Not until I became a parent, I could imagine how rewarding it is to go home in the evening to hug her, to play together and to care for her. I also wish to mention the importance of my Christian faith which gives me strength to try to face the various demands in life. Finally, I like to thank the Geochemical Society for the trust that they have shown in giving me this award. Thank you.