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Presentation of the Mineralogical Society of America Award for 2004 to Kevin M. Rosso

MICHAEL F. HOCHELLA JR.

NanoGeoscience and Technology Lab, Department of Geosciences, Virginia Tech, Blacksburg, Virginia 24061, U.S.A.

The MSA Award is about "outstanding published contributions to the science of mineralogy by relatively young individuals." Suffice it to say that in nearly all cases, we are talking about people who get this award for research done before the age of 35. Assuming a nominal retirement age of 65 and a typical Ph.D. age of 28, the age of 35 is less than 20% of the way through one's professional career. Yet, have you looked through the list of past MSA Award winners lately? It's a humbling experience. Anyone who has been around mineralogy for any length of time would recognize nearly *every* name. Let me illustrate with just a very few of them starting in the 1950s and 1960s. And remember, this is the MSA Award, 35 years old, not the Roebling medal. Hat Yoder, J.V. Smith, Gary Ernst. Let's fast forward to the 1980s. How about Alex Navrotsky, Bob Hazen, Michael Carpenter? So as you think about Kevin Rosso, ask yourself, is this the next Don DePaolo, Raymond Jeanloz, or Russ Hemley, also MSA Award winners, or any of the others that I have mentioned, or the many that I haven't mentioned? If 50 years of history were any indication, this would have to be the case.

So what was it that brought Kevin to this level, to get the MSA Award. Allow me to touch briefly upon just a few of the many highlights.

In the mid-1990s, and as presented in two papers in American Mineralogist in 1999, Kevin was able to probe the electronic structure of individual atoms on a mineral surface for the first time, and he did it on pyrite. He used ultra-high vacuum scanning tunneling microscopy and spectroscopy. Although this high wire act had been accomplished on synthetic materials like silicon a bit over a decade earlier, which led to a Nobel Prize for the developers and first users of STM, no one had bothered to do this sort of thing on a mineral which is inherently additionally challenging because of their inevitable chemical impurity and less than ideal surface microtopography that makes a big difference for these types of measurements. But Kevin did, and he went on to calculate, from first principles, what these electronic state distributions might look like from the eye of tunneling spectroscopy, and in doing so, was able to interpret what the experimentally observed spectra collected on single surface atoms where trying to tell him.

Combined with additional work with Udo Becker, another extraordinarily talented scientist also from our team and now Associate Professor at the Univ. of Michigan, here was the result: Kevin got inside a major part of the brain of *individual* atoms on a mineral surface, this part of their brain being their electronic structure around the Fermi level which is the basis for their individual bonding interactions and their individual reactivity. Of course as you would expect, he saw that different atoms, like iron and sulfur on the pyrite surface, had very different personalities, *but precisely* what those personality differences were, electronic state by electronic state. And he also saw, for example, that different atoms of the same element had different personalities depending on the surface neighborhood they happened to live in. And as reactions proceeded on the surface, he saw their personalities change again, atom by atom, reaction by reaction. This is the stuff of science fiction not too long ago. And now in reality, it is the stuff of a huge boost to nanotechnology, which is starting to affect all of our lives, and in further generations will change lives. It is also a fascinating part of the most cutting edge research in the mineral sciences today.

Another scientific highlight of Kevin's career to date came in the form of a paper in Geochimica et Cosmochimica Acta in 2002 co-authored with Jim Morgan at CalTech. Kevin lays out a brilliant construct of the kinetics of environmentally important metal oxidation (including V, Cr, Mn, Fe, and Co aquo and hydroxo ions) by molecular oxygen using density functional molecular orbital calculations and Marcus theory, the latter a sophisticated thermodynamic approach to electron transfer kinetics. The inner- and outer-sphere oxidation pathways that are developed for the different metals using Kevin's method are successful in predicting the observed oxidation rates of these metals in oxygenated aqueous solutions. This is important because the transport mechanisms, interactions with mineral surfaces, and bioavailability of redox-active metals in natural waters depend critically on their rates of reaction with dissolved molecular oxygen.

In closing, the story gets even better. Little did Kevin know that in the early 1990s, when he came to Virginia Tech from his home in the suburbs of Los Angeles, that he would meet yet another amazingly talented Ph.D. scientist in our group named Jodi Junta, who would later become his wife. And now, as Jodi J. Rosso, she has become the Series Editor for Reviews in Mineralogy and Geochemistry, taking over from the legendary Paul Ribbe. So, in Richland, Washington, home to the Pacific Northwest National Labs and one of the best environmental molecular science labs in the world where Kevin works today, they have produced two beautiful children, Ethan and Natalie, and Jodi even continues to birth new Reviews volumes.

Mr. President, ladies and gentleman, I present to you the 2004 MSA Award winner, Kevin Michael Rosso. Congratulations Kevin, and all the best to you and Jodi!

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