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Presentation of the Mineralogical Society of America Award for 2023 to Shaunna M. Morrison

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Shaunna M. Morrison is an amazing early-career scientist who has pioneered the application of powerful data analytical and visualization methods to understanding complex mineral systems through deep time. Through her scores of international seminars, frequent organization of meetings and workshops, mentorship of diverse early-career scientists, and bibliography of more than 90 peer-reviewed publications, including several groundbreaking contributions to mineralogy, Shaunna has garnered an exceptional international reputation. She is a born leader with the potential to become a scientific influencer of the first rank.

Many of us have admired Dr. Morrison's work for more than a decade, first when she was a graduate student with Robert Downs's research group at the University of Arizona, and then at Carnegie's Earth and Planets Laboratory, where she worked as a Postdoctoral Fellow and Project Manager for the ambitious Keck-sponsored Deep-Time Data-Driven Discovery (4D) Project before being named a Carnegie Research Scientist.

Dr. Morrison's first two breakthroughs relate to Mars mineralogy. She is a key member of the CheMin team—the first X-ray diffractometer to fly to another world (on the Mars Curiosity rover) and the first instrument to provide a vivid picture of mineralogy on another planet. That instrument was meant to take low-resolution powder diffraction patterns to identify major Mars minerals and their relative proportions. However, lacking internal X-ray standards, more quantitative results were thought to be impossible. What Shaunna realized—what others had missed—is that Mars minerals, themselves, can serve as internal X-ray standards. As a first step, she gathered mineral compositional data and applied statistical methods to develop regression curves for mineral unit-cell parameters. These calibration curves will be used for decades to come.

In a second remarkable paper, Dr. Morrison solved the complex geometrical problem of using Mars minerals as their own internal standards to correct for errors in instrumental geometry, while calculating corrected cell parameters of Mars minerals. Many of us thought the exercise was impossible. She persevered, solved the geometric puzzle, and published the most definitive description of mineralogy on any planet beyond Earth. With Morrison's creative correction methods, the instrumental resolution of CheMin is more than an order of magnitude better than the original NASA flight specifications.

At the Carnegie Institution, Shaunna devoted herself to data-driven discovery in mineralogy. Leading a team of collaborators, her first effort focused on applications of network analysis to mineral systems. Shaunna realized that networks of mineral associations allow the analysis and visualization of mineral systems in dynamic, interactive renderings—a fresh approach to a centuries-old science. Developments in mineral informatics have since caused an explosion of discoveries, including applications to geochemistry, metagenomics, and paleobiology. Of special note is Shaunna's application of "association analysis"—a collaboration with her colleague Anirudh Prabhu to discover new minerals and deposits of critical resources.

These advances have not gone unnoticed. Shaunna Morrison receives numerous high-profile invitations, including during her tenure as MSA lecturer, and opportunities for keynote and plenary lectures at a dozen international conferences. She continues to organize frequent data science workshops, conference sessions, and "datathons," for example as Co-chair of IMA's Mineral Informatics Working Group. Dr. Morrison also speaks at scores of schools, mineral clubs, and retirement communities about mineralogy. And Shaunna and colleagues in education recently won a national 4H Club competition to develop an outreach program on Mars exploration and mineralogy—an effort that is reaching tens of thousands of children.

Two other traits impress Shaunna's colleagues. First is a desire to seek out scientists with expertise different from her own. One example: she uses network analysis to link the seemingly disparate fields of proteomics, microbial ecology, geochemistry, and mineralogy into a single framework. Working as a member of NASA's Astrobiology Institute, she is looking for previously hidden relationships among chemical environments and protein expression. That effort is remarkably creative and cross-disciplinary, requiring thoughtful and dynamic leadership of a team of diverse experts.

The second closely related trait is Dr. Morrison's exceptional ability to inspire and organize others from diverse fields. Perhaps this unusual leadership approach comes from her years co-owning and operating a successful pizza restaurant in Georgia. Perhaps it reflects her passion to reach out to numerous groups beyond the professional science establishment. It is perhaps unique in mineralogical science for a young scientist six years from the Ph.D. to list more than 180 collaborators on her diverse publication list. As she plots her scientific future, her ability to work with and inspire others will play a vital role in her growing influence and her likely rise to the highest levels of the scientific world. For these reasons, Shaunna M. Morrison is richly deserving of the 2023 Mineralogical Society of America Award.

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