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Presentation of the Mineralogical Society of America Award for 2024 to Denis Fougerouse

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Nano is a big deal. This sentence summarizes in a few words the mindset of the recipient of the 2024 Mineralogical Society of America Award, Dr. Denis Fougerouse. Denis's research is centered on the advanced characterization of minerals to develop our understanding of geological and geochemical processes. His contributions span a range of geological disciplines, including ore deposit research, geochronology, metamorphic petrology, volcanology, planetary sciences, environmental sciences, biogeology, and mantle petrology.

Through his peer-reviewed publications and demonstrated hands-on capabilities, Denis has become an internationally recognized expert in the characterization of minerals using a range of advanced analytical techniques. Denis's impressive scope of technical expertise is the result of countless hours spent in the lab, open-mindedly seeking innovative solutions to mineralogical research questions.

Arguably, his most significant contribution to the field is his pioneering use of atom probe tomography, or APT, in the geosciences. APT is a novel analytical technique with respect to geologic materials, and it is a powerful means of quantifying the three-dimensional heterogeneity in isotopic and trace element compositions at sub-nanometer resolution. Such measurements provide fundamental insights into mineral chemistry and challenge our understanding of element mobility and segregation across the mineral spectrum.

Over the past few years, Denis has dedicated considerable time to conducting the thorough research that is essential for establishing new methodologies, including standardizing protocols and analyzing new materials. This significant investment of Denis's time has laid the groundwork that will support future studies. In addition to the technical optimization of atom probe tomography, Denis has made significant advances in three key areas of geoscience research. Firstly, the development of atom probe tomography for geochronological applications, where he has been able to demonstrate the potential to generate dates for analytical volumes six orders of magnitude smaller than conventional techniques. Although the APT technique has inherently low precision compared to other geochronology approaches, Denis's work in this field has shown the potential of APT to date mineralogic features only a few nanometers in size and provide meaningful temporal constraints on geologic processes. Secondly, the application of atom probe tomography to investigate the relationship between trace element geochemistry and mineral defects, in particular the coupled migration of trace elements and dislocations and the nanoscale mechanisms responsible for mineral dissolution and reprecipitation. Thirdly, Denis's research exploring the nanoscale characterization of critical minerals reveals nanoscale heterogeneity in many of the important elements needed to enable alternative energy sources. His discoveries in this area provide a fundamental framework for optimized extraction technologies and will play a significant role in moving us toward a net-zero energy economy.

Dr. Fougerouse is passionate about communicating with the general public and is a self-taught outreach advocate. His research on gold and diamonds has attracted an inundation of media attention, including TV and radio broadcasts and newspaper articles, including the New York Times. His media interactions regularly grasp the attention of people who otherwise would not have had exposure to Science, Technology, Engineering, and Mathematics (STEM) research. The pieces he writes for The Conversation are extremely popular, reaching downloads of 0.5M and enabling the broader community to engage with new discoveries in mineralogy.

Denis regularly participates in school events, where he shares his passion for STEM and encourages pre-teen and teenage students to take up STEM-related further education. A recent initiative is Denis's prison outreach activities, with STEM programs delivered to four prisons, a first-time initiative in Western Australia.

Denis Fougerouse is a complete researcher and science communicator. His innovative approach to nanoscale mineral analysis has yielded unique insights into geological processes and how Earth works. It is an honor and my pleasure to present Dr. Denis Fougerouse as this year's recipient of the Mineralogical Society of America Award.

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