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Presentation of the Mineralogical Society of America Award for 2006 to Daniel J. Frost

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It is a very great honor to present my good friend and colleague, Dan Frost, the recipient of the MSA Award in 2006. Dan is first and foremost an experimental petrologist who studies problems relating to the mineralogy, petrology, structure, and evolution of the Earth's mantle and core. He got off to an excellent start during his Ph.D. by studying the properties of H_2O-CO_2 fluids under mantle conditions at Bristol University under the supervision of Bernie Wood. He then moved to the Geophysical Laboratory for one year where he greatly expanded his experience by working with Yingwei Fei on the crystallography, stability, and equations of state of hydrous mantle minerals using a broad range of high-pressure experimental techniques. He moved to the Bayerisches Geoinstitut in 1997 and is a tenured Staff Scientist responsible for pursuing research, supervising and developing the high-pressure multianvil laboratories, and collaborating with a large number of external users of this facility.

During his brief career, Dan has contributed to the understanding of an impressive range of mineralogical issues, all of which have important geophysical implications. These include the width and mineralogical structure of mantle discontinuities, the cycling of water in the Earth's interior, the mineralogy and properties of the lower mantle, early differentiation of the Earth including core formation and magma ocean crystallization, and the composition (light element content) of the outer core. As an example, in one of his most important contributions he showed that a very small amount of metallic iron must coexist with silicate perovskite in the Earth's lower mantle. The explanation for this phenomenon is the dissociation of ferrous iron to a mixture of ferric iron plus metallic iron at high pressure due to the crystal chemistry of silicate perovskite. This contribution provides elegant explanations for the oxidized nature of the Earth's upper mantle and why the mantle became oxidized during or after formation of the Earth's core, and may also help to explain the siderophile element anomaly of the mantle. There may also be implications for the compositional evolution of the atmosphere although these have yet to be explored.

Dan has been central in bringing about major advances in high-pressure technology at the Bayerisches Geoinstitut. His contributions include the development of a unique 5000 ton large-volume multianvil system. The important advantages of this system is that sample volumes (e.g., silicate perovskite) are 10 times larger than in conventional systems and very high stable temperatures are possible (e.g., 3000 K). This development has recently enabled silicate perovskite samples with a diameter of 3 mm and a length of 2 mm to be synthesized as starting materials for shock wave experiments at CalTech—to our knowledge, these are by far the largest samples of silicate perovskite ever made. He has been central in developing rheological experiments at pressures up to 25 GPa using the multianvil apparatus and contributed significantly to the development of the D-DIA cubic anvil deformation apparatus.

Dan's scientific productivity has been extraordinary in recent years with more than 50 published papers, including four publications in the journals *Science* and *Nature* in the period 2004–2005. This productivity can be attributed to a number of factors. First, he processes the ability to identify major problems that are of broad interest to solid-Earth geophysicists. Second, he is not only an extraordinarily careful and innovative experimentalist but also has the ability to develop sophisticated thermodynamic models in order to interpret and extrapolate experimental data on a sound basis. Third, his outgoing and sociable personality has enabled him to develop numerous productive collaborations with scientific colleagues from all over the world, including countries such as U.S.A., Japan, U.K., France, Austria, and Italy.

Dan is still at an early stage of his career and I anticipate that the future will have much to offer in terms of his scientific contributions. In addition to the MSA Award, Dan is also one of three recipients of the 2006 Macelwane Medal of the American Geophysical Union. For the Bayerisches Geoinstitut, these awards are a double-edged sword because the number of job offers that he is now receiving from other institutions is on the sharp increase. In spite of this, I am thoroughly delighted that he is the recipient of the 2006 MSA Award in recognition of his scientific leadership, creativity, and enthusiasm.

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