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Presentation of the Mineralogical Society of America Award for 2013 to Wendy Li-Wen Mao

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Fellow mineralogists, I am honored to present to you Wendy Li-Wen Mao, a friend and colleague of mine in the Department of Geological and Environmental Sciences at Stanford University as well as the Department of Photon Science at SLAC National Accelerator Laboratory. Wendy is receiving the 2013 MSA Award for her exceptional contributions to the field of mineral physics. However, before I tell you about Wendy's blossoming scientific career and her many outstanding scientific contributions, I would like to share a few personal things I have learned about Wendy from Agnes Mao, her mother who is here today, and from my own observations of Wendy over the past six years. According to Agnes, Wendy was a quiet and exceptionally well-behaved baby, in contrast to Wendy's 5-month old son, whom I call "Action Jackson". Action Jackson is in the audience with his father Benson. According to Wendy, Jackson has kept her awake most nights since his birth. Agnes also told me that Wendy loved to collect things as a child, including minerals, coins, stamps, and Cabbage Patch dolls. I can vouch for this because every flat surface in Wendy's office at Stanford is covered by things she has collected recently, including many pieces of serpentine and other minerals, large cones from Sugar Pine trees, and many plants. She also has a collection of animals, including two cats, three chickens, four ducks, and a number of fish. In addition to her expertise in mineral physics, she is an expert in the game called Trivial Pursuit because she watched so much television as a child, so much in fact that her not-so-well-behaved older sister Linda used to cover the TV screen with a cloth in the evening and read the classics to young Wendy. Wendy also loves food, particularly shellfish and steak, which she consumes in large quantities on our annual mineralogy field trip. Enough about Wendy the mother, the child, the collector, and the carnivore. Let me tell you a few things about Wendy the mineral physicist and materials scientist.

Wendy has had an exceptional early career following completion of her B.S. degree in Materials Science and Engineering at MIT in 1998 and her Ph.D. in Mineral Physics at the University of Chicago in 2005. From 2005 to 2007 she held a prestigious J. Robert Oppenheimer Post-Doctoral Fellowship at Los Alamos National Lab, where she carried out neutron scattering studies of hydrogen molecules in clathrate compounds and continued her work on minerals under extreme pressure conditions. She joined Stanford as an Assistant Professor in 2007, where her research on materials under extreme conditions has thrived. Since arriving at Stanford, Wendy has published 62 of her 81 papers, with six more in review, and she shows no signs of slowing down.

Following in the scientific footsteps of the pioneers of mineral physics, including Percy Bridgman, Francis Birch, Alvin Van Valkenburg, Bill Bassett, Russ Hemley, and David Mao, among others, Wendy has taken full advantage of two major scientific developments that have had profound impacts on the field of matter under extreme conditions in general and mineral physics in particular. These were the development of diamond-anvil cell technology in the late 1950s and the introduction of synchrotron radiation sources in the early 1970s. Wendy has become an experimental virtuoso and leader in the applications of synchrotron radiation and diamond-anvil cell technology to mineral physics and high-pressure materials science. Her research career started with Ph.D. work on the properties of iron in Earth's core and has grown to include the following: (1) The discovery of various clathrate compounds, including high-pressure forms of ice, methane, and ammonia borane, that can store significant amounts of molecular H_2. Her discovery of ammonia borane clathrate has attracted the attention of the U.S. Department of Energy because it can store 19.6 wt% H_2, which exceeds the 2015 US-DOE target of 9 wt% H_2 for on-board H_2 storage systems. Four of her publications on these types of clathrates in 2002, 2004, and 2007 have already been cited almost 800 times. (2) Her discovery of several new high-pressure allotropes of carbon, including a superhard form of graphite as well as a new superhard amorphous diamond structure. (3) Confirmation that the silicate post-perovskite phase in Earth's D″ layer can be highly enriched in iron, which may explain the origin of the ultralow-velocity zone in this region. (4) Her discovery that the dislocation velocities of iron under core conditions can be quite high due to the low strength of iron at high temperatures. And (5) the first demonstration that the 3D iron melt distribution in a silicate matrix changes from isolated pockets at 25 GPa to an interconnected network at 64 GPa, indicating that intergranular melt percolation is an efficient mechanism for planetary core formation. This last study required Wendy to develop a new non-destructive synchrotron-based nanoscale X-ray computed tomography method inside a diamond-anvil cell to achieve the 40 nm resolution needed to distinguish among multiple crystalline and amorphous phases under in situ conditions.

In addition to these spectacular achievements, Wendy has collaborated with colleagues in materials science, applied physics, and photon science on diamond-anvil cell studies of strongly correlated systems, including materials displaying colossal magnetoresistence and superconductivity, which have applications in next-generation electronic and spintronic devices, and Li-ion battery materials, where internal stresses can reach GPa pressures and result in irreversible damage to the batteries. This body of work reads like a listing of the scientific accomplishments of a Roebling Medalist rather than an MSA Award winner for outstanding early career accomplishments.

I have thoroughly enjoyed watching this brilliant, young scientist blossom into an international expert on the mineralogy and physical properties of Earth's deep mantle and core, the storage of molecular hydrogen in various clathrate structures, and applications of synchrotron-based diamond-anvil cell methods to important problems in materials science and engineering. Wendy has achieved all of this in a seemingly effortless fashion and is an outstanding role model for her graduate students and postdocs as well as for young scientists in general who are interested in an academic career in the Earth sciences.

Mr. President and fellow mineralogists, I am very pleased to present Wendy Li-Wen Mao to you.

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