LAURENCE L. SLOSS AWARD

Presented to
John P. Grotzinger

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California Institute of Technology

Citation by Andrew H. Knoll

John Grotzinger has made original and lasting contributions to three areas of sedimentary geology, any one of which would qualify him for the Sloss Award.

To begin, John's meticulous field studies of Neoproterozoic successions in Siberia, Oman, and Namibia have collectively transformed our understanding of the timing and environmental context of early animal diversification. With Sam Bowring, Grotzinger established the temporal framework of early animal evolution, collecting ash beds from all three successions that sharply constrain the ages of the oldest known animal fossils, the Proterozoic-Cambrian boundary, and the isotopic excursions that permit inter-basinal correlation of Ediacaran rocks. Grotzinger documented the stratigraphic and environmental distribution of the earliest known skeleton-forming animals. Moreover, through detailed stratigraphic research in Oman, he showed that these early skeletal organisms suffered abrupt extinction at a horizon near the Proterozoic-Cambrian boundary marked by major perturbation of the carbon cycle. Also, Grotzinger and his students have provided a highly resolved picture of variation through latest Proterozoic time in the carbon and sulfur isotopic compositions of seawater, supporting hypotheses of major changes in marine redox chemistry just as large and motile animals entered the geologic record.

More generally, Grotzinger has led his generation's efforts to understand the tectonic, environmental, and biological controls on carbonate deposition in Precambrian oceans. His work shows that three-dimensional geometries of carbonate platform accretion have changed little in more than two billion years, demonstrating strong overall control on shelf carbonate deposition by tectonics and seawater chemistry. Especially important, John has made key observations of Precambrian stromatolites and developed mathematical models for their accretion, providing (among other things) an abiotic null model against which hypotheses of biological accretion must be tested. Grotzinger was also the first to document the precipitation of aragonite from Precambrian seawater, and the first to show the long term pattern of decreasing seafloor carbonate precipitation through time. This stands as the most significant change identified in carbonate rocks through the first 85 percent of recorded Earth history, and it provides critical context for interpretating the stromatolite record.

Beyond all this, Grotzinger has become the undisputed leader in efforts to characterize the sedimentary geology of the oldest known well preserved sedimentary rocks—on Mars. He led the effort by NASA's MER science team to produce the first stratigraphic section measured on another planet and provided the key insights that underpin interpretations of depositional and diagenetic processes recorded by sedimentary rocks at Meridiani Planum. Indeed, in continuing research John is establishing a genuine discipline of planetary sedimentary geology. As the principal scientist on the Mars Science Lander mission, to be launched during the coming year, John will have new and unique opportunities to elucidate depositional patterns and processes on our planetary neighbor.

I have worked closely with John for many years and cannot imagine a better colleague—or a better friend. As he has done for more than two decades, John Grotzinger continues to lead sedimentary geology in new directions. Larry Sloss would be proud.

Response by John P. Grotzinger

Thank you Andy for your kind words about my love for sedimentary geology, and thanks to the Geological Society of America for this recognition. Receiving the Sloss Award is a tremendous honor, as Larry was a great inspiration to me in many ways as a graduate student.

No one arrives at a moment like this without the help of many people, and I am grateful for the opportunity to acknowledge at least a few of them. At the University of Montana Don Winston first influenced me to work on the little-known Belt basin in northwestern Montana. Paul Hoffman exposed me to a series of field campaigns in Wopmay Orogen that still remain as the most intense of my life. After 20-30 kilometer traverses he would spend hours in the summer twilight of northern Canada educating me in almost every aspect of geology. Sam Bowring shared this adventure, but on the other side of the most mosquito-infested map area on the planet. At Virginia Tech, Fred Read illuminated everything about carbonate sedimentology and we shared the thrill of running the first numerical simulations of carbonate platform development. Ken Eriksson schooled me in clastic sedimentology and along with Hoffman and Winston further instilled in me the drive to explore Precambrian Earth history. Later on, at Lamont Doherty, Nick Christie-Blick and Gerard Bond challenged me to undertake basin modeling studies that I subsequently carried to MIT in collaboration with Wiki Royden.

I have benefitted from many collaborations over the years and to mention just a few, I must begin with Andy Knoll who taught me pretty much everything I know about evolutionary biology. Sam Bowring, Roger Summons, and Dan Rothman have all drawn me into very different corners of Geobiology. Steve Squyres provided me with a career-changing Opportunity to join a remarkable team of scientists and engineers that motivate me to this day. Those first images of cross-stratified rocks in Eagle crater will be burned in my mind forever.

Finally, I have been very lucky to have a superb group of students and postdocs. David McCormick, Julio Freidmann, and Brad Ritts mapped foreland and strike-slip basins; Beverly Saylor, Shane Pelechaty, Odin Smith, Steve DiBenedetto, David Fike, and Justin Ries explored Ediacaran chronostratigraphy and paleoceanography; Linda Kah, Stefan Schroeder, Erwin Adams, Mike Tice, Abby Allwood and Woody Ficher studied microbial processes and their rock record; Roy Adams, Dawn Sumner, and Mike Pope examined Archean to Cambrian carbonates and evaporites; Jennifer Carlson, Jeff Parsons, and Bill Lyons took on analysis of turbidites and bed thickness distributions; Wes Watters reconstructed *Namacalathus* and Endurance crater; Adam Maloof worked

on Holocene parasequence development at Andros Island; Alex Hayes, Joannah Metz and Ralph Milliken helped pioneer the study of the sedimentary record of Mars. And finally, Lauren Edgar, Maggie Osborn, Katie Stack, Kristen Bergman, and Daniel Stolper form my group of current students. Many are becoming scientific leaders in their own right, and I am immensely proud of all their accomplishments.