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PENROSE MEDAL

Presented to
Paul F. Hoffman

Paul F. Hoffman
Harvard University (Emeritus)

Citation by Raymond A. Price

I am pleased and honored to present the citation for GSA's 2011 Penrose Medalist, Paul F. Hoffman. The Penrose Medal is *"awarded in recognition of eminent research in pure geology, for outstanding original contributions or achievements that mark a major advance in the science of geology"*. Paul Hoffman is an eminent world leader in the elucidation of the Proterozoic evolution of the continents, and also of Proterozoic paleoceanography and paleoclimatology, particularly the Neoproterozoic "Snowball Earth" episodes of global glaciation. Paul's outstanding original research contributions mark major advances in the science of geology. His insightful interpretations are firmly rooted in meticulous geological mapping and related field and laboratory studies, as well as in a broad and deep understanding of how the Earth system works. He knows how to read the rocks.

Paul Hoffman went to McMaster University to study geology; but also, at the invitation of the track coach, to train as a marathon runner. Inspired by his teachers, and by summer work on field parties of the Ontario Geological Survey and the Geological Survey of Canada, Paul flourished academically, graduated at the top of his class, and moved on to The Johns Hopkins University for post-graduate studies. Following the dictum of one of his undergraduate professors, that orogenic belts should be studied from the outside in, he set out to study and map one of the best exposed and most accessible belts of Paleoproterozoic sedimentary rock in the Canadian Shield, the region around the East Arm of Great Slave Lake, between the Slave Province, an Archean craton, and the deformed Paleoproterozoic rocks of the Churchill Province. He expected to find a south-facing continental terrace sedimentary wedge and overlying foreland basin along the southern margin of the Archean Slave craton, comparable with those of Paleozoic age in the Appalachian foreland belt. Instead he discovered and documented a west-facing failed rift arm, the Athapascow aulacogen, containing a wedge of shelf, slope, and ocean basin deposits, overlain by foreland basin deposits that recorded a reversal in paleocurrents and sedimentary provenance. This pointed him toward a north-trending collisional orogenic belt between the western Slave Province and the Paleoproterozoic rocks of the Bear Province. Paul had demonstrated that the stratigraphic, sedimentologic, and tectonic concepts and techniques used for deciphering the tectonic evolution of Paleozoic rocks of the Appalachians are just as effective in rocks that are about four times as old. However, he also had shifted his quest for a Paleoproterozoic collisional plate boundary from the south side to the west side of the Slave Province. There he subsequently demonstrated the presence of a Phanerozoic-type orogenic belt that he named the Wopmay orogen.

While working on his Ph.D., Paul Hoffman became the third all-time fastest Canadian marathon runner; spent several months investigating Holocene stromatolites in Florida, the Bahamas, Western Australia and Abu Dhabi; and spent a year teaching at Franklin and Marshall College in Pennsylvania. After completing his thesis, Paul joined the Geological Survey of Canada and began the systematic exploration and mapping of the Wopmay orogen.

During this long-term project, Paul and his student-assistant collaborators convincingly documented the role of plate tectonics in the Paleoproterozoic evolution of the northwestern Canadian Shield. In a dozen years, eight 1:250,000 scale geological maps and a very large number of scientific papers and Ph.D. theses were produced, documenting the tectonic evolution of the foreland thrust-and-fold belt, the metamorphic internal zone and the volcano-plutonic arc of Wopmay Orogen, and also two associated aulacogens, and the Great Slave Lake intracontinental transform shear zone. This work provided a conceptual framework for using aeromagnetic anomaly maps, Bouguer gravity anomaly maps, and radiometric dating of borehole samples for plate tectonic interpretations of Precambrian rocks that are concealed by overlying Phanerozoic strata within the interior of the North American continent. It led to Paul Hoffman's masterful review of the Proterozoic tectonic history of North America, published in two GSA Decade of North American Geology volumes and in Paul's classic review paper: "United plates of America, the birth of a craton".

After he left the Geological Survey of Canada in 1992, Paul Hoffman's main research focus shifted to Neoproterozoic global tectonics and glaciations and to Earth system evolution. As Sturgis Hooper Professor of Geology at Harvard University, he launched an ambitious fifteen-year field program in Namibia. There his careful documentation of structural and stratigraphic relationships provided the geological framework for important geochronologic, tectonostratigraphic and chemostratigraphic investigations of Neoproterozoic glaciations. In collaboration with his graduate students and academic colleagues, these investigations were extended to Svalbard, Arctic Alaska, northwest Canada, Mauritania, Mongolia, and several parts of Australia. Paul's ensuing elucidation of the Kirschvink model of a Neoproterozoic Snowball Earth has provided important new insights on the nature and significance of the abrupt shifts in the global climate system between protracted intervals of global "icehouse" conditions followed by global "hothouse" conditions that occurred during an important interval in the evolution of the Earth system: -- the interval encompassing the break-up of the supercontinent "Rodinia" and the emergence of the first multicellular animals in the fossil record.

Paul Hoffman's articulate and skillfully illustrated oral presentations and publications are characterized by a combination of succinct, insightful observations, and elegantly innovative interpretations, and by an uncanny ability to integrate scientific data and concepts across disciplinary boundaries.

These scientific achievements have been recognized with major honors and awards from the European Union of Geosciences, the Geological Society of London, the Geological Society of Namibia, the Geological Society of South Africa, as well as from many organizations in Canada and the U.S.A., and now with the Penrose Medal.

Response by Paul F. Hoffman

My first geological conference was a Northeastern Section Meeting, my first talk was at a GSA Annual Meeting, a Penrose Conference was my international debut, and my first Plenary Lecture was at The Decade of North America Geology (DNAG) Meeting in Denver. GSA is my home Society. This high honor is therefore unique.

Thank you, Ray, for bringing the past back to life. Thanks to all those who wrote letters of support, and the selection committee that decides who waits.

Three excellent geology departments fashioned my early development—at McMaster a hobby became a nascent urge to decipher the tectonics of the Canadian Shield, at Johns Hopkins I learned from "the most elegant mountain range on earth", and at Franklin and Marshall I experienced thrills in teaching I never quite managed to recreate elsewhere.

My catapult as a geologist was a thesis project sponsored by Geological Survey of Canada (GSC). The east arm of Great Slave Lake is packed with more interesting geology than anywhere else its size. My thesis led to fifteen years of 1:250K-scale mapping in northern Wopmay orogen with GSC. Mapping entire orogens dovetailed perfectly with a comparative approach to tectonic change over geologic time. It bred familiarity with sedimentary, structural, metamorphic and igneous geology. Thesis projects by some of today's leading geologists fostered academic-government symbiosis. Some were by U.S. nationals, which did not always sit well north of the border. Our student assistants included women, an innovation that quickly spread. We practised 'non-stop' mapping to cope with aerial haemotrophy, the price of admission to the Canadian Shield in summer.

Bert Bally and John Wheeler invited me to participate in the DNAG project. Wopmay write-up was curtailed, but I had summer months in Ottawa when my son Guy was a child. Being at the office, however, didn't relieve the burden on his mother Erica of having two Hoffmans to support. Synthesizing the Precambrian of North America was surprisingly like mapping a 250K sheet—published maps, reports, theses and papers being outcrops. Like any map-sheet, the structure of Laurentia is rudely truncated at its margins, so formerly adjacent continents must also be known. This led naturally to Rodinia and the grand procession of supercontinents—Nuna, Rodinia, Pangea and Amasia.

Strange to say, mining and fossils fuels were seen as 'sunset' industries for most of the '80's and '90's. Support for geological mapping and teaching sank, tracking the price of oil. McMaster and GSC were among the victims. Accepting Chris Barnes' invitation to University of Victoria, I began another mapping project in newly-independent Namibia, with an eye on the problem of Neoproterozoic low-latitude glaciation. After Mike McElroy beckoned me to Harvard, my grasp of the issues blossomed thanks largely to geochemical oceanographer Dan Schrag and our respective graduate students. Our stand in favor of Snowball Earth caused consternation, but next to all the observations our interpretation is conservative.

The first forum on Snowball Earth was a Pardee Symposium, at the 1999 Annual Meeting.

Thank you, GSA, for a lifetime of support.

View the images along with the full text from Paul Hoffman's Gold Medal Lecture at http://www.geosociety.org/awards/11speeches/GML-Penrose.pdf

ARTHUR L. DAY MEDAL

Presented to
Susan L. Brantley

Susan L. Brantley
Pennsylvania State University

Citation by Lisa L. Stillings and Richard B. Wanty

We are highly honored to give this citation for Dr. Susan Brantley, the 2011 Day Medalist. Although we organized her nomination package, a number of distinguished scientists contributed letters in support. Each letter contained fabulous superlatives: She was described as the "outstanding aqueous geochemist of her generation", as "one of the most impressive earth scientists" with an "enormous global impact", and as the "epitome of a scientific star". We hope to convince you that these are understatements….

As a reminder, the Day medal is awarded for "outstanding distinction in contributing to geologic knowledge through application of physics and chemistry to the solution of geologic problems". It is noteworthy that this award is intended to recognize past accomplishments as well as potential for future research. Sue has been the type example of a Day Medalist from the beginning of her career, with a signature style that combined advanced chemical/physical tools with a seamless integration of field and laboratory methods. She began her research career as an undergraduate, with the study of the geochemistry of a modern marine evaporate in Bocana de Virrila, Peru. In this 1984 study she used Pitzer equations to model the ionic activity coefficients in a late stage brine. At the time this was a cutting edge approach because Harvey and Weare, and Pitzer, were just publishing their work on brines, mineral solubilities, and electrolyte theory.

Sue's research soon focused on quantification of rates of geochemical processes. She, together with students and colleagues, has produced data on rates of dissolution and precipitation reactions for many of the primary, rock forming minerals. These data have been collected with other literature data and summarized in two volumes: "Chemical Weathering Rates of Silicate Minerals, MSA volume 21 published in 1995, and the 2008 volume "Kinetics of Water Rock Interaction", edited by her and Art White. Both volumes quickly became 'must have' references for geochemists. The latter presents, in one place, theory and techniques for measuring and modeling mineral dissolution rates from laboratory experiments and field studies. Its extensive appendix compiles and synthesizes dissolution rate data for many of the major rocsk forming mineral phases, and models these rates over a range of pH with a uniform data-fitting approach.

From work on individual minerals Sue became interested in relating geochemical kinetics to soil forming processes. She and her long-time colleague Art White, along with their students, have worked to develop a quantitative approach to soil profile development. This represents a quantum advance in our understanding of weathering processes. To illustrate, one important contribution was the derivation of a generalized equation to describe chemical depletion profiles in regolith. This relationship is especially powerful because for decades there have been questions on why laboratory dissolution rates differ from field rates. Now, when given an observed elemental weathering profile, the model can estimate a "field" dissolution rate comparable to other values from the literature. This is crucial research for understanding of earth surface processes.

Sue is furthering this approach by working to develop quantitative reactive transport models for soil development. In a simulation of albite weathering to kaolinite, Sue and her students have demonstrated that the thickness of regolith depends upon 1) the dissolution rate, 2) the erosion rate, and 3) the advective velocity of the pore fluid. This approach is a potentially an enormous breakthrough for modeling weathering on a geologic time scale.

Finally, Sue's interests are not limited to physical and chemical processes. She has embarked upon a program to understand the effects of microbial processes on mineral dissolution and soil development. Her interests include of the role of biofilms on weathering, the uptake of metals by bacteria, the effect of bacteria on iron isotope fractionation in weathering reactions, and the use of whole bacterial genomes to infer biogeochemical signatures. This work is truly on the cutting edge of biogeochemistry, widely recognized and pioneering.

This summary illustrates Sue's drive to integrate geochemical kinetics with hydrology and microbiology. Her vision and creativity have given her a leadership role in interdisciplinary, global efforts to understand, quantify, and model processes in the Critical Zone, i.e., the system of coupled chemical, biological, physical, and geologic processes that operate to support life at the Earth's surface. This is research of fundamental importance because Critical Zone processes are the ultimate control on soil production, nutrient availability, and atmospheric CO_2 concentrations on geological time scales. She has led efforts to secure NSF funding to establish the Critical Zone network in the US, and has become a key advisor to European efforts to establish soil observatories.

To conclude we hope we have convinced you that Dr. Susan Brantley is highly deserving of the Day Medal for her pioneering approach to the study of earth surface geochemistry. While this is an award for scientific accomplishment, not teaching, we need to make the point that Sue teaches by example. She has shown her students and colleagues that it is the scientific question that matters, and that we need to use all possible tools, --be it a simple hand auger, NMR imaging of pore volumes in shale, or a chemical engineering approach in the lab. Above all, it's important to have fun while you're doing it. Sue, on behalf of GSA we offer a warm and heartfelt congratulation. Your achievements have set a very high standard for our science, and we're certain you will continue to lead the way, for many years to come.

Response by Susan L. Brantley

When Rich Wanty and Lisa Stillings first tried to reach me to tell me about this award, I was stuck on the tarmac at Philadelphia Airport because a turtle was trying to cross the runway. Really! Eventually I got back to Penn State and talked to Rich. I was flabbergasted and honored when I learned that the Geological Society of America had awarded me this medal.

In many ways I identify with that turtle. I too like to wander around outside. Looking back, I know I love wandering out-of-doors because my mother shooed us outside to play in the mud under our backyard tree—a tree not unlike my own backyard tree today. Outside, my brother and I wandered across the boundaries between backyards and teamed up with peers to do the work that kids do—play. We laughed, got bored, argued, and challenged one another. I am lucky to still be doing those things in my work today.

Along the way, three institutions helped me wander from backyard mud to international science. The first is Princeton University. In 1977, David Crerar, a wonderfully intelligent and thoughtful Princeton professor, became my PhD advisor. At that time, he was crossing into the relatively unknown fields of environmental geochemistry and geomicrobiology. David taught us that geochemistry is really BIOgeochemistry and to understand it we must use fundamental thermodynamics and kinetics. But I was also mentored at Princeton by Brian Evans who taught me that water-rock interaction is not just chemical or biological, but that the processes of cracking, healing, and sintering must also be understood. Likewise, Rob Hargraves and Linc Hollister showed me real rocks. At Princeton, I mostly worked on these problems in the laboratory, where I was guided by another wonderful Princetonian, Maria Borcsik.

The second institution I highlight is the US Geological Survey. I benefitted from two sabbaticals at the USGS at Menlo Park. While at Menlo, Survey scientist Art White and I wandered around and puzzled about why geochemical reactions are faster in the laboratory than in the field. Almost all the work I have pursued can be related to that central puzzle–how can we measure rates in the laboratory and extrapolate them to the field.

I am especially indebted to Art and other USGS scientists who taught me how to auger, make field measurements, and understand water flow through rocks and soils. On one memorable trip to Yosemite, Art and I hammered out the idea of a network of observatories–a rocket ship for scientists to wander together while investigating what we now call the Critical Zone. During a second trip to Yosemite, this time on skis, we figured out how to estimate rates of processes controlling Earth's weathering engine. I have wandered around that problem for about 20 years, looking at it from this and that angle, often not understanding even how to phrase a good question and sometimes not understanding I was working on the same problem over the years.

I could not have wandered around in a better place than the third institution I highlight. We ARE Penn State. At Penn State, Lee Kump challenged me to think more globally. Jim Kubicki and Peter Heaney helped relate dissolution mechanisms to underlying crystal lattices. Don Fisher showed me quartz veins and weathering rinds and we tried to understand how they formed. Ray Fletcher taught me that models are never right but sometimes helpful. Kate Freeman helped me find humor and understanding in a faculty that was, for too long, 30 men and 2 women.

But my biggest influence at Penn State has been my students. To use a football metaphor (after all, I am at Penn State), teaching in graduate school is the ultimate head fake–I start out teaching each student, and then they earn their degree, but I am the one who learns.

In fact, I assume that one day my students, like me, will look back at graduate school and their careers and realize that they learned more from their peers along the way than from the faculty or the books. Friends I made at conferences -- now renowned geochemists, environmental specialists, teachers, department heads, U.S. water specialists, and Deans—helped me cross the boundaries to learn what I needed to know.

But my favorite friend and coauthor is my husband–Andy Nyblade–who himself deserves a daily medal. While my family when I was growing up launched my drive and curiosity, and my family of scientific friends inspired and challenged me along the way, my own family today enables my focused thinking.

Lately I have been wandering around the same observation I assume the Philadelphia turtle made in his wander across the airport runway: it is increasingly hard to find the natural world hidden beneath the built environment. Luckily, laboratory measurements, field observations at Critical Zone Observatories, and computer models are teaching us to decipher the code written in soils–the code that tells us where the water flowed and the organisms lived and why. GSA has long been important because it promotes geologists to decode the record of change written in rocks: now geologists are decoding the record of change in the soil so that we can build models to predict the future. Geological knowledge of soils will let us go back to the future to help ourselves, and the turtle. This is especially important because, as Bruce Wilkinson says, humans are now the dominant geological force on the planet.

In closing, I would like to go back to my own future by speaking to the only two kids that sometimes listen to me: my own. Madeline and Lena, if you read this, please remember to go outside, look at the world and read its signs, and have the courage to cross all the boundaries you find. Thank you for this honor.

View the images from Susan Brantley's Gold Medal Lecture at
http://www.geosociety.org/awards/11speeches/GML-Day.pdf

YOUNG SCIENTIST AWARD (DONATH MEDAL)

Presented to
Jasper A. Vrugt

Jasper A. Vrugt
University of California at Irvine

Citation by Terry Wallace

The Donath Medal is named for a truly remarkable earth scientist who made fundamental contributions to our understanding of rock rheology, and proved unambiguously the role of fluids in controlling the mechanical properties of rocks. It is fitting that the 2011 recipient of the GSA's Donath Medal is a remarkable scientist who also has made deep contributions to our understanding of the fluids in the Earth. Dr. Jasper Vrugt is an outstanding computer modeler who has taken on the very challenging task of bridging the theoretical understanding of environmental systems with the often confusing experimental data that is collected both in the laboratory and in the field. Jasper has the uncanny ability to find the scientific "soft spots" that prevent progress and craft solutions that move the field forward. Recent examples include Jasper's innovations in quantifying conceptual model uncertainty and his path-breaking new concepts for advancing the field of evolutionary optimization, stochastic inversion, and Bayesian statistics. He has brought to practice his theoretical advances, often in the form of new numerical techniques for exploiting high-performance computing to the study of natural systems, through self-initiated collaborations with others in the field. The quality and scientific diversity of his list of collaborators is remarkable, a testament to the excellence of his science and an uncommon desire and skill in engaging world-class scientists. A recurring theme for Jasper is to pursue fundamental advances and then to apply these breakthroughs to real-world applications in a variety of different fields. Although he is a numerical modeler by current practice, his ability to craft solutions to real earth science problems is a testament to his creativity and collaborative spirit and points our field in a direction in which new levels of fundamental understanding can be attained through the concerted integration of experiments and observations, theory, and modeling.

I am extremely pleased that GSA has honored Dr. Jasper Vrugt as a recipient of the Young Scientist Award; I expect that future contributions will be even more extraordinary!

Response by Jasper A. Vrugt

It is a great privilege and honor to receive this prestigious medal of the Geological Society of America (GSA). I remember very well my first trip to the United States on an Iceland Air Boeing jet on October 17, 1998. The boarding embarked a long and exciting journey and headed off the start of an unimaginable journey that has led me to visit many places in the world, where I have been blessed to come in contact with some remarkable and extraordinary people. They exude enthusiasm for my research and work, and have provided important guidance and valuable advice when I was lost on an odyssey of personal discovery and cultural differences within the realm of model – data merging.

I remember very well my excellent education at the University of Amsterdam (UvA), and setting up my multi-step outflow experiments in the laboratory to describe and predict soil moisture flow through variably saturated porous media. This soon led to numerical modeling and ultimately led us to understand why so many studies demonstrated non-uniqueness of the hydraulic functions. My PhD research at the UvA forced me in yet uncharted waters and led to extended visits to UC Davis and the University of Arizona, Tucson to work with experts in environmental modeling, hydrogeology, optimization, and data assimilation. Later, my Oppenheimer Fellowship at Los Alamos National Laboratory provided an unprecedented opportunity and helped me to embrace a career outside Europe, far away from my family, friends and childhood. This appointment and the many extraordinary colleagues and friends at LANL have been paramount to receiving this recognition. My current position at UC Irvine provides a wonderful educational and research environment under the sunny skies of Southern California. Teaching is a nice break from my research and it is a pleasure to interact with the young and energetic minds of students.

I reckoned early on that to really do something substantial, I should embark upon a journey and leave my hometown, friends, family and culture to go to the States, and work with people there. But, the idea was never to win awards. I just wanted to do what I really liked to do and try to help others along the way. If there is one thing I am proud of then it would be that many of the model-data synthesis algorithms we developed over the past years are used widely in many different scientific disciplines. This is a very rewarding experience, and has resulted in publications on a wide range of topics including ecology, bird migration, hydrogeology, soil physics, hydrology, agriculture, and atmospheric chemistry. And today, with all the attention and recognition the Donath Medal brings with it, I am humbled.

No one can succeed alone, and I have been fortunate to have the proverbial village behind me. I would not be here today without the encouragement of others and the many opportunities they provided which helped to jumpstart my research, publications and career. I have been blessed by counting many of you not only as my mentors but, also as good friends. I would like to mention Willem Bouten, Sierd Cloetingh, Hoshin Gupta, Soroosh Sorooshian, Shlomo Neuman, Jan Hopmans, Rien van Genuchten, Cajo ter Braak, Cees Diks, Steve Burges, Keith Beven, Martyn Clark, Jim Freer, Rafael Bras, Bruce Robinson, Ty Ferre, Sander Huisman, Harry Vereecken, Terry Wallace, Mac Hyman and George Zyvoloski. Without your advice, help, and support I simply would not be here.

My girlfriend, Kirstin and her pug dog, Norman Bean, remind me every day that there is more in life than just work, data, priors, algorithms, and posteriors.

The unconditional love of my parents has been instrumental at all stages of my life. Their care, steadfastness and never ending support, have provided a very solid foundation on which I was able to build and succeed. My years in America have been wonderful – and I owe that to the fantastic support of my family back home - allowing me to keep my feet in both worlds. Thank you Mom and Dad!

In closing, I would like to thank my

nominators, citationist, and the GSA Donath Medal Committee for selecting me to receive this award and honor. It is my hope that my students, collaborators, and I can continue to produce meaningful research and publications.

View the images from Jasper Vrugt's Gold Medal Lecture at http://www.geosociety.org/awards/11speeches/GML-Donath.pdf

GSA PUBLIC SERVICE AWARD

Presented to
Scott F. Burns

Scott F. Burns
Portland State University

Citation by Monica E. Gowan

Scott F. Burns embodies the GSA mission to be a leader in advancing the geosciences, enhancing the professional growth of its members, and promoting the geosciences in the service to humankind and stewardship of the Earth.

Scott also personifies the spirit of the GSA Public Service Award, established in honor of Eugene and Carolyn Shoemaker by Council in 1998, to be awarded for contributions that have materially enhanced the public's understanding of the earth sciences, or significantly served decision-makers in the application of scientific and technical information in public affairs and public policy related to the earth sciences.

For one individual to exemplify the visionary charter of an organization and live the aims of one of its most prestigious awards is an extraordinary accomplishment. Scott has done so consistently throughout his career and with his characteristic joy and generosity of spirit. These singular yet multi-dimensional qualities of Scott have yielded outstanding results for GSA and for Society.

Scott is a scientist. Through his field research and practice in soils, geomorphology, and environmental and engineering geology, he has contributed to advancing scientific knowledge about the physical nature and distribution of phenomena in localities around the world. His characterizations have laid the groundwork for understanding the mechanisms, development and evolution of surficial processes and features in places of immediate public concern. He then takes his work yet another step by contextualizing his understanding of the landscape in terms of its meaning for soils, natural hazards, land use, and human and ecosystem health.

Scott is an educator and a mentor. While satisfying his own thirst for knowledge and understanding in both a foundational and applied sense, Scott is also devoted to enhancing the growth of these intellectual capacities in students, colleagues and lay professionals. He demonstrates this through his extensive record of teaching achievements, student advising from K-12 science fair projects on up to graduate committees, and through the many professional courses, workshops and field trips he has led on understanding the hazards, unique features and special characteristics (terroir!) of the physical environment. His desire to share his knowledge comes from a palpable dedication to both supporting their individual growth and promoting an ethic of service toward humankind and stewardship of Earth.

Scott is an advocate and a leader. He is actively engaged in finding new ways to increase public awareness of geoscience and how geoscience can positively contribute to public affairs and public policy. He fulfills this personal charge to himself through public speaking in local schools, service clubs and science clubs, and to community groups and realtors. We can see it in his illustrious list of publications and his acclaimed presentations. It is part and parcel of his ever-present leadership in GSA and other international scientific organizations. Through his willingness to share his expertise and his enthusiasm for people and the landscape, he regularly captures the attention and interest of the general public on earth science and societal issues through his 200+ media appearances in the US Pacific Northwest. These types of activities are precisely how GSA encourages its members to contribute to the affairs of Society.

All of these roles synergistically combine with Scott's insight and rare talent for making geoscience available in the right place at the right moment – and translating it effectively for decision-makers and the public. The result is he frequently contributes directly and substantially to the scientific resolution of earth-science problems of societal concern, and has significantly expanded public understanding of the geosciences.

Scott is a fantastic model for all of us – embodying and living the GSA ethos of 'science, stewardship and service'. We are fortunate as a professional society to call him one of our own and to be able to honor his inspiring example as the recipient of the 2011 GSA Public Service Award.

Response by Scott F. Burns

First of all, I want to thank GSA for this award. I am truly humbled to be added to such an incredible list of previous recipients!

Second, many thanks to Monica Gowan for nominating me for this award. Working with her over the past many years has been wonderful – she is really devoted to geology and the GSA.

Why did I get this award? Well, "why" is the answer. I have a true passion for asking "why?" all of the time. I do this inside and outside of the classroom. Let me explain.

Teaching is one of my passions. With my students, I am always asking them why this rock is red, why is this landform here? I tell them that "Mother Nature is shouting out to them all of the time, and that they need to develop a new set of eyes to see what is happening, and a new set of ears to hear what she is telling them". It is being a forensic scientist – you are asking why did something happen. It is important to teach them how I got there to my conclusions so they can get there the next time.

I take that passion outside of the classroom and use the same approach when dealing with the public. When I am giving a talk to interested citizens on a geological topic such as landslide, earthquake, or radon hazards or the great Missoula Floods, I ask them to do the same thing – ask why. Develop a new set of eyes and ears!

I enjoy working with the news media and helping them develop a story for their audience using the same approach. Why did this landslide happen? What are the implications for us? How can we apply these ideas to our lives? I want to show them how to become forensic reporters. Right after the recent Japanese earthquake, I spent 24 hours helping explain why we on the Cascadia Margin should pay attention to this incredible event – it was the exact scenario for the Big One that will happen in the Pacific Northwest in the future.

Through the written word, I love turning non-geologists onto geology. Mother Nature is shouting out to all of us all of the time – get out and talk to her! Why is the Grand Coulee there? Why is the reason for that erosional line in the Columbia Gorge?

When working with producers and directors of films, I use the same approach. What is the essential science that needs to be conveyed in a short period of time? It explains why.

So many of us use the same approach. There are many in this room who are more deserving than me, because we reach out to the public and pass on our passions for the earth. Special thanks to all of you who do that! Thanks to all of you who volunteer and reach out to the public and help other in making important decisions for society.

For those who do not use that approach, I encourage you to develop a similar approach. As geologists we have been given an incredible ability to listen to Mother Nature and hear her. Pass it on! Turn your passions for geology into public service.

Many thanks to all of my colleagues, mentors, students and family – I have really enjoyed learning from you.

GSA PRESIDENT'S MEDAL

Presented to
Dava Sobel

Dava Sobel
Author
"Galileo's Daughter and Longitude"

Beginning fresh out of college as a technical writer for IBM, I moved quickly into journalism in 1970, just in time for the first Earth Day. My favorite jobs were as science writer for the Cornell University News Bureau, where my beat included everything from astronomy to veterinary medicine, and reporter in the Science News department of *The New York Times*, covering psychology and psychiatry. My most unforgettable assignment required me to live 25 days as a research subject in a "chronophysiology" laboratory, where the boarded-up windows and specially trained technicians kept me from knowing whether it was day or night.

I was born in 1947 in the Bronx, right near the Bronx Zoo and the New York Botanical Garden, so that I could walk to either by myself from an early age. My best academic credential is undoubtedly my diploma from the Bronx High School of Science. My home life, too, provided excellent career preparation, since my mother had trained as a chemist, and no one in my family thought it odd or unusual for a girl to be interested in science.

I am extremely gratified by the warm reception my books have received—not just in terms of good reviews or ratings on bestseller lists, but also events that followed their publication. *Longitude* helped place a memorial to John Harrison in Westminster Abbey. Astronomers who read *Galileo's* Daughter named a crater on Venus for Suor Maria Celeste, and also a feature on the asteroid Eros for her mother, Marina Gamba. Thanks to *The Planets*, an asteroid discovered in 1994 by David Levy and Carolyn Shoemaker has been officially registered as (30935) Davasobel.

Right now I am writing a play about Copernicus and the events that made him buck common sense and received wisdom to defend the Earth's motion around the Sun. The theme of the piece is a familiar favorite of mine: the great transformation of humankind's worldview through science.

BROMERY AWARD FOR THE MINORITIES

Presented to
A. Wesley Ward

A. Wesley Ward
U.S. Geological Survey (Emeritus Scientist)

Citation by Robert J. Johnson

The recipient of the GSA Bromery Award is an individual who has been selected for recognition of their persistent passion for the geosciences, significant contributions to research in the geological sciences, and the dissemination of knowledge and mentorship, which has enhanced the professional growth of minority geoscientists.

Wes Ward once gave a talk to students called "From the South Side of Chicago to the North Pole of Mars", in which he related his personal journey from playing beside features along the shores of Lake Michigan to studying the eolian landforms of another world. And it's been quite a journey.

Honored this year as the 2011 Bromery award winner, a few of you know him as the recent USGS Chief Geologist of the Western United States, and some know him as a tireless worker for a variety of organizations, from youth-serving associations even to railroad historical societies. A select few might even have been lucky enough to have actually seen him in community theater as Harold Hill, King Mongkut, Ben Franklin, or the Mikado. His dedication is highlighted by his public service as past GSA committee member or chair, Chief Scientist of the USGS Astrogeology Program, two-term President of the NABGG -- all interesting way stations along a life of science, service, and participation.

Wes received his formal education by earning a BS degree in geology at Washington State University, and his MS in volcanic geology and PhD in planetary geology and geomorphology at the University of Washington. He then completed a postdoctoral fellowship at Arizona State University. His entire professional career was spent with the United States Geological Survey spanning 30 years of professional development, as he progressed from a Summer Intern to Regional Geologist!

As a Staff Scientist, he conducted geologic mapping in five states in the Southwestern United States. He was tasked with correlating changes in eolian features with regional and site-specific meteorological incidents, while also mapping both terrestrial and Martian eolian features, all the while literally following in the footsteps of Gene Shoemaker, who stated that " In order to be a successful planetary geologist, you had to have a simultaneous terrestrial research project as well." Some of his published works include papers on terrestrial and Martian yardangs, and there roles in identifying ancient wind patterns.

As the USGS Astrogeology Chief, Wes rebuilt the post-Apollo USGS program with new post-doc personnel and staff enticed from Pasadena and NASA headquarters to Flagstaff, AZ. Dr. Ward served as the leader of the Geology and Geomorphology Operations Group for the 1997 Mars Pathfinder mission, and also built a new research center, library, and museum at the USGS facility in Flagstaff, a complex now known as the Shoemaker Center for Astrogeology.

As Western Regional Geologist for the USGS, Wes oversaw the activities of all seven geology teams in the nine states of the west, and helped establish and guide major new programs and facilities for oceans, climate, and megahazards research.

In addition to all his scientific and leadership achievements, he led the USGS Minority Participation programs in the Southwest. These programs were designed to increase the inclusion of ethnic minority, female, and financially disadvantaged students into the geosciences. His management entailed locating mentors, funding salaries, and approving project work that could be translated into either academic or thesis credits for as many as 20 undergraduate and graduate students for each of the seven years he administered the program His efforts were very successful, as he was recognized to receive the USGS Public Service Award in 1993.

Wes served two terms as Chair in advancing the GSA Ad Hoc Committee on Minorities to the standing Committee on Women and Minorities in the 1990s. This advocacy was essential in setting new purpose, hopes, and direction for the committee. With representatives of other GSA committees and associated societies, he hosted several GSA Annual-Meeting Symposia on the education, recruitment, training, and advancement of Women and Minorities in the Earth Sciences, and Environmental Justice. He has also served on the Nominations Committee and the Presidential Committee on the Environment, and currently, he is a new Trustee for the GSA Foundation.

Wes has served tirelessly with dozens of other organizations, NSF, AGI, NASA, federal and state advisory boards, community arts and sciences organizations, and universities, but his greatest love and contributions have been and are directly for the youth in our society, and especially those who have yet to learn the wonders and the importance of understanding our home, Planet Earth.

I am personally profoundly honored to know Wes as an effervescent, uniquely genuine person, with a very keen sense of humor and a brilliant mind. He never uses the word "No" in tough situations, but always considers all the options and then selects the positive path.

Response by A. Wesley Ward

In addition to my nominators and the Bromerys, I wish to thank Chairman Joseph Mills at Washington State University, who set me on a path of learning from Gary Webster and Peter Hooper; Chairman John Whetten, who invited me to the University of Washington, where I found Stu McCallum and Steve Porter; and Lou Pakiser at the US Geological Survey, who accepted my proposal to work in Flagstaff, with Jack McCauley and Gene Shoemaker.

In preparing for tonight, I began to wonder where 40 years of diversity efforts have brought us. Personally, I have had a wonderful time with Columbia River Basalt flows; San Juan River terraces; trimodal volcanic fields; Mariners, Vikings, and Pathfinders; and yardangs. And I have met many, many wonderful people.

I have also struggled with being the only minority employee in some organizations and in large ones where, at managerial levels, diversity is but one person deep (if at all) -- so fragile that one retirement or one stroke of a

bad supervisor's pen can set an organization back decades in its efforts for diversity.

Being mindful that geoscience is a wonderful career and that every citizen should at least know about geohazards and resources in our daily lives, I have always participated in outreach programs targeting women, minorities, and financially disadvantaged students.

NSF reports that diverse students have been earning a constant 5% of all geoscience degrees awarded over the last decade, which is still low compared to other sciences. Diversity is even lower in decision-making roles in our profession in industry, academia, and government.

To an emerging workforce where diversity is the norm and the expectation, a profession where diversity is rare at decision-making levels gives them pause.

Certainly GSA, although having a small leadership cadre, has worked hard and demonstrated diversity multiple times at the presidential, counselor, and committee-chair levels. In the larger world of the earth sciences, industry has made some progress in developing minority managers; academia has a fair record; in government, middle and upper-level diversity is very slow in coming.

To be sure, any detailed analysis is hampered by the statistics of small numbers from a pipeline that for too long has been too narrow or too leaky; also, we know that it takes a decade or more for entry-level employees to attain managerial positions and, given the ratios of minority employees to the entire geosciences workforce, the numbers simply could not look encouraging. But we have been working on the issue for *40 years*. What will the next 40, or 20, or even 10 produce? What should they produce?

So much of our efforts are focused on entry-level recruitment using institutional partnerships, mentoring, and internships. As we compete for the best and brightest of today's students, if we cannot demonstrate to their increasingly diverse workforce that diversity is not just a recruitment tool but standard practice throughout our ranks, then we cannot expect much of this emerging workforce to have a strong interest in our profession.

If we do think that, for business or ethical or other reasons, diversity is important to our profession, then we need to ensure that its practice is widespread, effective, practical, affordable, and continuous.

Unless diversity becomes more widespread throughout our ranks, it is geology that is disadvantaged, it is geology that will not be able to compete, and it is geology that is going to be left behind. And, after all that I have gotten from and all that I have given to geology, that is not the future I want to see.

We must be mindful of the resources we have in both recruitment and advancement of our workforce. By ignoring our opportunities and hard-won tools, we can find ourselves both out of step and out of touch with the changes and progress the rest of the world is making.

GSA DISTINGUISHED SERVICE AWARD

Presented to
Richard C. Berg and Brendan Murphy

Richard C. Berg
Illinois State Geological Survey

Brendan Murphy
Saint Francis Xavier University

Citation by Craig Schiffries and Jean M. Bahr

We are pleased to nominate Richard C. Berg for the 2011 Distinguished Service Award based on his record of service to the Geological Society of America. His volunteer activities for the Society have been particularly noteworthy over the past five years during which he served as Chair of the Geology and Society Division (2005–2006), chair of the Geology and Public Policy Committee (2008–2009), and chair of the Joint Technical Program Committee for two very successful Annual Meetings (2009 and 2010). In addition, he has been an active member of the Annual Program Committee since 2006, organizing the hot topics for the 2007 Annual Meeting, and he also served on the ad hoc Committee to Review Committees. He has also been active in organizing public policy–related sessions for North Central Section meetings and is a regular participant in Shlemon Mentor events at those meetings.

While each of these activities would be meritorious on its own, the combination is unusual, and his leadership on the Geology and Public Policy Committee (GPPC) is truly exceptional. During his service as chair, GPPC completed work on nine GSA Position Statements that were approved by Council, including GSA's first statements on such key topics as water resources, energy and mineral resources, and government funding for Earth science research. Dick also developed a new and improved template for Position Statements that has been used for all subsequent statements. Dick reached out to committee members and galvanized the group, making committee service a rewarding and productive experience.

Response by Richard C. Berg

I am honored to be a 2011 GSA Distinguished Service Awardee. GSA over the years has provided me with tremendous opportunities, and to be able to give back and receive an award for service is doubly rewarding. My service to GSA began in the 1990s when I served as GSA representative on the selection committee for the John C. Frye Memorial Award in Environmental Geology. This appointment

Citation by Nancy Riggs

Brendan Murphy is a leader in his dedication to the geoscience discipline, to his university (St. Francis Xavier University in Nova Scotia) and to the Geological Society of America.

Brendan has published 164 papers in his 35-year career. He specializes in large-scale orogenic processes, mantle plumes, isotopic systems (especially U-Pb), and other topics within those larger frameworks; his grant activities are greater than $2 million. This takes place at an undergraduate-focused university where he teaches two classes per term, plus the field school. Brendan has supervised 12 M.Sc. theses and 50 undergraduate theses.

Brendan's service to GSA is exemplary. He became a GSA *Bulletin* science editor in January 2007, and worked with Karl Karlstrom until 2009. At the end of Karl's term, Brendan had the pleasure of training two new science editors, at the same time that the *Bulletin* was moving from AllenTrack to Editorial Manager. Brendan's wonderful demeanor and delightful sense of humor made him wonderful to work with, always available to answer questions, provide advice, smooth ruffled feathers, and encourage all the ideas that come with any new "blood" to an organization. In 2009, he joined the Publications Committee. GSA staff members in Boulder are unanimous in their praise and appreciation. Brendan has served on the Editorial Board of *Geology*, and is now an associate editor of the *Bulletin*.

Few geoscientists today have the record of excellence in professional endeavor, dedication to education, and record of service to the profession, and to the Society, that Brendan has offered. Brendan Murphy strongly deserves the GSA Distinguished Service Award.

Response by Brendan Murphy

I am pleased and humbled to receive GSA's Distinguished Service Award. For many years, I had benefitted greatly from my participation (along with my students) in GSA conferences and field

Response by Dick Berg (continued)

followed about 15 years of experience with three-dimensional geological mapping and development of subsequent interpretive/derivative maps for land- and water-use planning. The Frye committee selects the best paper among those published by state geological surveys and the GSA over a three-year period. This experience permitted me access to about 20 publications per year, all dealing with explaining geoscientific issues, and in so doing permitting lay users to understand often complex geology and then implementing strategies for solving a myriad of environmental problems.

In 2004 I was asked to serve as First Vice Chair and Newsletter Editor of GSA's newly created Geology & Society Division; the latter post I served until 2009. As Division Chair (2005-6) and Past-Chair (2006-7), and up to the present, Division officers have striven continually to increase Division membership with the phrase "Geology Working for Society". We think that every member of GSA should be a member of the Geology & Society Division because of the relevance of geological research in dealing with numerous groundwater/surface water and other environmental issues, climate change, earth hazards, evolution, shores and coastlines, and many more. Particularly emphasized was the need to translate geological discoveries so that more than just scientific colleagues could understand outcomes. Although some refer to this popularization as "dumbing down" research, it actually "smartens up" research by making it more accessible to a wider audience, and particularly useable by planners and politicians, so that they can make informed, unbiased conclusions and base their decisions on the "best available information".

As Chair of the Geology & Society Division in 2006, one of my duties was to also serve on GSA's Joint Technical Program Committee (JTPC), with responsibilities to review and help organize public policy sessions for the Annual Meeting in Philadelphia. This work eventually led to being a member of the Annual Program Committee (APC) as Technical Program Chair (TPC) for the Annual Meetings in Portland in 2009 and Denver in 2010. The TPC serves as chair of the ~45 member JTPC and has overall responsibility for organizing sessions for the Annual Meetings. The process begins in December and January when the TPC addresses numerous questions from members who have submitted session proposals and seek sponsorships. After selection of sessions by the APC, the February to July period involves regular updates to the JTPC and overall GSA membership regarding proactively seeking speakers to ensure session viability, and also to keep everyone informed of particular session conflicts with other sessions as well as personal schedules. The most concentrated effort as TPC occurs in the three-week period following the abstract deadline submission date. Working with the JTPC, session chairs, and GSA staff, the entire technical program is organized into meeting rooms, keeping sub-discipline sessions in close proximity to one another while avoiding "like sessions" and some personal schedules, and trying to minimize problems.

The effort to balance competing interests in the Annual Meeting program is the biggest challenge for the TPC. However, it is the culmination of a very rewarding personal experience. I cannot think of another opportunity where I could get exposed to all of the sub-disciplines within the geosciences and work directly with JTPC representatives and session chairs who all have vested and strong research, service, and educational interests in their sub-disciplines. Working to bring these diverse interests into a coherent and seemingly flowing program with a minimum of glitches has been indeed rewarding. I particularly want to recognize GSA staff members Nancy

Response by Brendan Murphy (continued)

trips and from its peer review system when I submitted manuscripts to various GSA publications. When asked to be a co-editor of the BULLETIN, I jumped at the chance to contribute to a society that had played such a significant role in nurturing my academic life. As a co-editor of the GSA Bulletin I was fortunate to inherit from my predecessors a journal with a global reputation for data-rich, archival articles with a long shelf-life. As such, the BULLETIN continues to fill a very important niche in the ever-increasing array of geoscience journals. Its papers are cited for decades after they are published and they constitute a firm foundation upon which ideas can gestate and testable hypotheses can develop. Although we may be biased, many current and former editors believe that the success of the BULLETIN is one of the foundations for the success of the society.

Such a reputation is forged by a peer review system which encourages authors to submit their best science to the BULLETIN. In my experience this peer review process, although not perfect, is about as fair as any process mediated by humans can be. My particular role was to continue the efforts of my predecessors to strengthen our reach into the international community so that the BULLETIN would continue to be a prime option for publishing world-class geoscience. Even before my official term as co-editor commenced, I was struck by the team approach fostered by the GSA Publications team. This approach made sure that the end-product was better than the sum of its parts. I was well schooled and received sound advice from outgoing co-editor Yildirim Dilek. I had the pleasure of working with some great co-editors, Karl Karlstrom followed by Nancy Riggs and Christian Koeberl. Sound advice was only ever a phone call away.

It was also a privilege to work with the GSA Publications team. As science editor, I worked most closely with Jill Rothenberg, Jeanette Hammann and Jon Olsen. The positive culture of the entire GSA Publications team was immediately apparent from my first meeting and the GSA is indeed fortunate to have this team of outstanding professionals. They made my task as science editor much smoother than I anticipated and I would advise anyone who is thinking of contributing to GSA Publications to become involved: it is truly a rewarding experience. My Editorial Assistant, Cindy Murphy, did much of the day-to-day heavy lifting that smoothed and expedited the flow of hundreds of manuscripts through the peer review process. She would not only remember to do the things I had forgotten to do; she also did the things that I forgot I had forgotten! Among many duties, this involved direct communications with Associate Editors and reviewers gently reminding them of the deadlines for their reports and reviews and with authors, encouraging them to submit their revisions in a timely manner or helping them with on-line submission issues.

A lot of the credit for the success of the BULLETIN is due to the diligence and expertise of the Associate Editors and the reviewers. The vast majority of their inputs provided insightful and constructive advice. Annual meetings with the Associate Editors were a major source of inspiration and energy. Their dedication to the BULLETIN is clearly evident. Of course, the authors and the quality of the manuscripts they submit is the most important factor in the continuing success of the BULLETIN. One of my most important roles was to make sure that my decision letter to the authors explained the reasons for the decision reached, and the insightful reports and reviews from Associate Editors and reviewers certainly facilitated that task. I can confidently state that virtually every manuscript submitted benefitted from the peer review process. I was also impressed with the good

Response by Dick Berg (continued)

Wright and Melissa Cummiskey for their efforts in working with the JTPC, APC, and me. They "know the ropes", and they made sure that there was never too much slack.

Also beginning in 2006, I became the GSA North-Central Section's Representative on the Geology & Public Policy Committee (GPPC). The GPPC is charged with providing advice on public policy matters to GSA Council and leadership, and it conducts a wide range of activities, prominently including the development of Position Statements. The specific charge of the GPPC is "developing and disseminating information about the geological sciences to promote the use of such information in the formulation, discussion, and decisions regarding public policies". As GPPC Chair in 2008-9, I noticed that the Committee had fallen behind in updating existing position statements. Therefore, with a very willing and hard-working Committee, we successfully updated all expired statements and initiated and moved through a very tedious review system to produce several new statements. Many of these statements dealt with very delicate and highly politicized issues of climate change, evolution, and water and land use, to name just four. The development of Position Statements, which represent the GSA membership perspective, is the biggest duty of the GPPC and its Chair. Knowing that these statements are used directly for policy decision making required intense scrutiny of every word and its possible nuances, as well as agreement over wording by not only the GPPC, but also GSA Council and GSA membership.

Particularly challenging during my tenure was the suggestion that the GPPC be restructured to eliminate section representation. This I felt was a mistake, since each of GSA's sections emphasizes different aspects of geology and how that geology impacts citizens, commerce, industry, transportation, agriculture, mining, and recreation. In the North-Central Section, for example, glacial geology and the Great Lakes dominate the region and directly affect issues related to water resources, the rust belt, and intense row-crop agriculture. Based on our collective wisdom, the structure of the GPPC remained intact. I want to particularly thank Jack Hess and Craig Schiffries for their assistance and contributions to the GPPC, and for always keeping me and the GPPC on the straight and narrow.

Finally, as I mentioned above, none of my achievements could have been accomplished without outstanding committee members and GSA headquarters staff who more than "shared the load" at a time when there was much to be done, and when many people relied on our outcomes. Thank you very much for this award.

Response by Brendan Murphy (continued)

nature of the vast majority of authors, irrespective of the decisions made or when some delays occurred in processing their manuscripts.

The professionalism and dedication of GSA Publications team, my co-editors, Associate Editors, reviewers and authors made my tenure a truly rewarding experience. I thank Nancy Riggs, my citationist, for nominating me for this award; I am truly grateful. Finally, it is a great pleasure to be a member of a society that values the science it fosters as well as the activities of all its members, from student members to seasoned professionals.

SUBARU OUTSTANDING WOMAN IN SCIENCE AWARD

Presented to
Naomi E. Levin

Naomi E. Levin
Johns Hopkins University

Citation by Jay Quade

Naomi Levin is an outstanding choice for the 2011 Subaru Outstanding Woman in Science Award. Naomi has a background in both anthropology and geology, which ideally positioned her to study several aspects of the geology of early hominids in East Africa for her dissertation. She started down that road with a Master's degree focused on the geology of fossil sites in central Ethiopia, and broadened her scope for her Ph.D. under ThureCerling (University of Utah) to include other parts of Ethiopia and Kenya. The main theme of Naomi's dissertation research was to establish through isotopic analysis the paleoenvironmental context of our early human ancestors, including the Pliocene *Ardipithecusramidus*. Considerable controversy surrounds the question of whether this earliest of bipeds was a savanna or forest dweller. For her dissertation, Naomi produced an impressive isotopic dataset from several geologic archives associated with these hominids, including fossil soils, and teeth from the fossil and modern mammals. Assembling these datasets proved a daunting task. Naomi claims she capitalized on her experiences growing up in New York to overcome the many logistical challenges posed by sub-Saharan Africa. Among other things, Naomi applied this data to a paleoaridity index newly developed with her advisor to reconstruct changes in aridity over time in East Africa. Isotopic analysis of soils and fossil teeth is a powerful means of reconstructing paleoenvironments, and in a short time Naomi has emerged as a leader in this field in East Africa. Naomi's story is a nice example of how bridging disciplinary boundaries—in her case, isotope geochemistry, anthropology, and paleoclimatology—yields really great science.

Response by Naomi E. Levin

I feel very honored by this award. I foremost want to thank pioneering geologists, like Doris M. Curtis, who have brought the field to the point where it is today. I am grateful to GSA for its broad and steady support of student research.

I have been fortunate to have many encouraging advisors throughout my education. Among them, Jay Quade and Thure Cerling have provided me with opportunities, taught me to be a solid colleague, and pushed me to go big. They are still doing these things.

I also thank Gail Ashley for her guidance over the years and the nomination for this award.

I am grateful to my parents, Carol and Jack, who have been a constant well of support as I leave for Africa, year after year. And to my husband Ben, who gives me that much more incentive to get the work done, and come home.

AGI MEDAL IN MEMORY OF IAN CAMPBELL

Presented to Harrison H. Schmitt

Harrison H. Schmitt
Geologist, Apollo 17 Pilot and Astronaut, and former United States Senator

Citation by Clive R. Neal

I first met Dr. and Astronaut Harrison Hagan "Jack" Schmiatt in 1992 at the workshop on The Geology of the Apollo 17 Landing Site. Before being introduced to him, I was (of course) in awe of one of the chosen 12 who have walked on the Moon, especially as he is the only trained geologist to do so. Jack's easy going and friendly demeanor immediately put me at ease and little did I know that this gentleman would be pivotal in my career by, for example, giving me the opportunity to serve at the Chair of the Lunar Exploration Analysis Group (LEAG) during a time when NASA was gearing up to go back to the Moon under President Bush's Vision for Space Exploration, and also as a letter writer for my various promotions at Notre Dame. Jack Schmitt's experience and enthusiasm for the geosciences, and specifically lunar geology, is infectious, and his uncanny ability to "think outside the box" enables him to be a visionary for space exploration.

I will diplomatically state that Jack was born a "few" years before me in Santa Rita, NM! He married Theresa Fitzgibbon of Los Alamos, NM, in 1985, and their marriage continues to flourish 26 years later. He received his B.S. in Science from Caltech in 1957 after which he worked for the Norwegian Geological Survey, the U.S. Geological Survey in New Mexico and Montana, and for two summers as a geologist in southeastern Alaska. He became a teaching fellow at Harvard in 1961, where he assisted in teaching a course in ore deposits, and received his doctorate from there in 1964. As a civilian, Jack received Air Force jet pilot wings in 1965 and Navy helicopter wings in 1967, logging more than 2100 hours of flying time. Before joining NASA, he was with the U.S. Geological Survey's Astrogeology Center created by Gene Shoemaker at Flagstaff, AZ. He was project chief for lunar field geological methods and participated in photo and telescopic mapping of the Moon.

Selected for the Scientist-Astronaut Program in 1965, Jack organized the lunar science training for the Apollo Astronauts and represented the crews during the development of hardware and procedures for lunar surface exploration. He also oversaw the final preparation of the Apollo 11 Lunar Module Descent Stage, and served as Mission Scientist in support of the Apollo 11 mission. After training as back-up Lunar Module Pilot for Apollo 15, Jack flew in space as Lunar Module Pilot for Apollo 17, which commenced at 11:33 p.m. (CST), December 6, 1972, and concluded on December 19, 1972. After landing the lunar module "*Challenger*" at Taurus-Littrow (located on the southeast edge of Mare Serenitatis) Jack and Eugene Cernan activated a base of operations facilitating their completion of three days of exploration. This last US manned mission to the Moon broke several records set by previous flights and include: longest manned lunar landing flight (301 hours, 51 minutes); longest lunar surface extravehicular activities (22 hours, 4 minutes); largest lunar sample return (an estimated 115 Kg, 249 lbs); and longest time in lunar orbit (147 hours, 48 minutes). Apollo 17 ended with a splashdown in the Pacific Ocean approximately 0.4 mile from the target point. As one of the last men to walk on the Moon, Jack has been inducted into the International Space Hall of Fame (1977) and the Astronaut Hall of Fame (1997).

In July of 1973 Jack was appointed for 2 years as one of the first Sherman Fairchild Distinguished Scholars at the California Institute of Technology. This appointment ran concurrently with his other activities in NASA. In February 1974, he assumed additional duties as Chief of Scientist-Astronauts and was appointed NASA Assistant Administrator for Energy Programs in May 1974. This office had the responsibility for coordinating NASA support to other Federal Agencies conducting energy research and development and for managing NASA programs applying aeronautics and space technology to the generation, transmission, storage, conservation, utilization and management of energy for terrestrial applications.

In August of 1975, Jack resigned his post with NASA to run for the United States Senate in his home state of New Mexico. He was elected in 1976, where he served a six-year term in the U.S. Senate beginning in 1977. Senator Schmitt, the only "natural scientist" in the Senate since Thomas Jefferson was Vice-President of the United States and President of the Senate. As senator, he worked as a member of the Senate Commerce, Banking, Appropriations, Intelligence, and Ethics Committees. Jack also held the position of Chairman of the Commerce Subcommittee on Science, Technology, and Space and of the Appropriations Subcommittee on Labor, Health and Human Services, and Education. He later served on the President's Foreign Intelligence Advisory Board, the President's Commission on Ethics Law Reform, the Army Science Board, as Co-Chairman of the International Observer Group for the 1992 Romanian elections, and as Vice Chairman of the U.S. delegation to the 1992 World Administrative Radio Conference in Spain. Jack became a consultant to the Fusion Technology Institute at the University of Wisconsin in 1986, advising on the economic geology of lunar resources and the engineering, operational, and financial aspects of returning to the Moon. In 1994, he was appointed as an Adjunct Professor of Engineering at the University of Wisconsin. His affiliation with Wisconsin has stimulated interesting research into the use of Helium-3 as an energy source (a resource that is rare on Earth but is relatively abundant on the Moon), and he also teaches a course on "Resources from Space". He is the author of "Return to the Moon" (2006, Springer-Praxis) that describes a private enterprise approach to providing lunar Helium-3 fusion energy resources for use on Earth. In 1997, Schmitt cofounded and became Chairman of Interlune-Intermars Initiative, Inc., advancing the private sector's acquisition of lunar resources and Helium-3 fusion power and clinical use of medical isotopes produced by fusion-related processes.

In November 2005, Jack became Chairman of the NASA Advisory Council and served until October 2008. [It was during Jack's tenure as Chair of the NAC, that he approached me to become the Chair of the LEAG.] He led the Council's deliberations

on issues related to Aeronautics, Audit and Finance, Biomedicine, Exploration (human flight systems development), Human Capital, Science, and Space Operations. It was in 2006 that he encouraged Brad Jolliff (Washington University) and I to organize the "NASA Advisory Council Workshop on Science Associated with the Lunar Exploration Architecture", which was held in 2007 in Tempe, AZ. Learning from his experience with Apollo, Jack wanted to make sure that science was involved at the start of this new era of lunar exploration! The workshop results have been incorporated into the Lunar Exploration Roadmap produced by LEAG.

Jack now consults, speaks, and writes on policy issues of the future, the science of the Moon and Planets, history of space flight and geology, space exploration, space law, climate change, and the American Southwest. He presently is Chair Emeritus of The Annapolis Center (risk assessment) and is on the staff of the Institute for Human and Machine Cognition of Pensacola, Florida. Current board memberships include Orbital Sciences Corporation, Edenspace Systems Corporation, PhDx Systems, Inc., and The Heartland Institute, and, as a retired Director, he continues as an emeritus Member of the Corporation of the Draper Laboratory. He also has served as a member of the Energy Department's Laboratory Operations Board.

Among Jack's many honors and endeavors are the following:

- NASA Distinguished Service Medal (1973); Honorary Fellow of the GSA (1973);
- Fellow of the AIAA (1977);
- Honorary Member of the AAPG, Norwegian Geographical Society, New Mexico Geological Society, and Geological Association of Canada (1977);
- Engineer of the Year Award, National Society of Professional Engineers (1981);
- NASA Distinguished Public Service Medal (1982);
- The Public Service Award, AAPG (1982);
- The G.K. Gilbert Award, Planetary Geology Division, GSA (1989);
- The Aviation Week Legend Award (2002);
- American Association of State Geologists Pick and Gavel Award;
- Honorary Fellow of the GSA; American Institute of Mining, Metallurgical and Petroleum Engineers; and Geological Society of London (2008).

In recognition of past service, the U.S. Department of State in July 2003 established the Harrison H. Schmitt Leadership Award for U.S. Fulbright Fellowship awardees. In 2007, Schmitt was awarded the first Eugene M. Shoemaker Memorial Award by Arizona State University and is the first recipient of the National Space Society's Gerard K. O'Neill Memorial Space Settlement Award. He was also awarded the inaugural Columbia Medal by the Aerospace Division of the American Society of Civil Engineers in 2010.

In closing, I have to conclude that Harrison Hagan "Jack" Schmitt is a national treasure. He is still involved in science and space policy, and continues to publish in the scientific literature, where he is never shy in questioning established paradigms and makes us all think carefully about our science. For example, in lunar science Jack continues to point out inconsistencies with the origin of the Moon by a "giant impact". He continues to keep us all honest! He has been selfless in inspiring the next generation of scientists and engineers, as well as the general public, to "reach for the Moon and beyond". I am deeply honored to give this citation and it is very fitting that Jack Schmitt is receiving the AGI Medal in Memory of Ian Campbell for Superlative Service to the Geosciences.

Response by Harrison H. Schmitt

Thank you, Clive, for that history as well as the wonderful embellishments. Teresa and I have enjoyed very much being with the members and friends of the American Geological Institute and its affiliated Societies.

Following in the footsteps of many friends who have received the Institute's Campbell Medal, including Dick Jahns, Dallas Peck, and Sam Adams, this evening comes as an unexpected and humbling experience. Ian and Kitty Campbell will always be treasured friends of memory.

Harrison A. Schmitt's GSA associate, our collective great friend and former GSA and AGI President, the late Ian Campbell, served as my undergraduate advisor at Caltech in the 1950s. In many ways, Ian provided a major push along a path that led to some remarkable opportunities. In addition many childhood learning experiences created by my father and mother, Ethel Hagan, Ian set my first, post-college milestone by suggesting during the sophomore year to start considering applications for a Fulbright Fellowship. By the time senior year arrived, I had to apply for the Fulbright because he just would not let up.

Exposure to the principles of field geology began with working as my mining geologist father's field assistant and plane table operator. I recall going down old shafts near Hachita New Mexico inside an ancient ore bucket with Dad straddling the rim while holding on to the rope from a windless…being warned of possible javelina and rattlesnakes coming out of old desert mine adits at Hilltop and Silverbell, Arizona…taking channel samples across veins exposed in numerous tunnel workings from Mogollon to Vanadium, New Mexico… cleaning and filling the ubiquitous carbide lamps of the time…finally being chased out of operating underground workings around Hanover, New Mexico by union rules… hand splitting hundreds of feet of drill core for assays…operating a plane table alidade on maps Dad had begun in the 1930s over the famous Pewabic Mine…hand coloring copies of report maps using colored pencils and carbon tetrachloride-soaked stubs. Maybe that carbon-tet explains some of my problems today.

Extensive course work in basic principles of field geology provided by Dick Jahns, Barkley Kamb, and Bob Sharp followed this early exposure to mining geology. The names Bouquet Canyon, Tick Canyon, and Sacramento Mountains will be familiar to many of you, as well as to Mike Duke, Larry Griffiths, and Robert White my fellow classmates. While at Caltech, I also spent many highly instructive months with Neil Irvine mapping the ultramafic layered intrusives of Duke Island in Southeastern Alaska. Later, Harvard's Hugh McKinstry would add an ore deposits and mine evaluation perspective to this background.

Receiving a Fulbright to Norway in 1957, with subsequent work there on the Pre-Cambrian metamorphic rocks of the western Basal Gneiss region added immeasurably to experience in the field. This detailed mapping project, largely concerned with the origin of eclogites, proceeded under the research guidance of Harvard's Jim Thompson and the cultural guidance of Norsk Polar Institute geologist Tore Gjelsvik. We picked Norway for the Fulbright because of Ian's and Dick Jahns' strong respect for petrologist Thomas Barth and Norway's extensively glaciated surface that encouraged highly detailed field investigations.

Studies of the Eiksundal eclogites of clearly metamorphic origin raised conflicts with some formidable colleagues of the time who believed these same eclogites had been plucked off the Earth's mantle. Additionally,

a layered laccolith of ultramafic to noritic composition now largely changed to eclogitic assemblages, included rhythmically layered hydrous mineral suites. This layering suggests that pulsating pressure release at a cotectic could be an important factor in producing rhythmically layered plutonic rocks. This stay in Norway also coincided with Sputnik and drew my attention to the implications of space flight for human civilization.

Geologist in Space

In November of 1964, during the first few months of working for Gene Shoemaker in his Geological Survey Branch of Astrogeology, an announcement appeared on the bulletin board stating that NASA and the National Academy of Sciences wanted applicants for the first selection of scientists to become astronauts. I thought about 10 seconds, decided I would regret not applying if someone actually went to the Moon, and sent in my application. Gene strongly encouraged me to apply, having wanted nothing more than to also apply if he could have. It turned out, of course, that Gene would chair the initial selection committee for the Academy.

Out of about 1400 applicants, the Academy selected 16, only four of whom were geologists. NASA down-selected to six based on physical and physiological criteria. Successful completion of jet and helicopter pilot training were the next hurdles. Assignment to a flight mission, of course, constituted the final barrier to getting a geologist on the Moon. NASA Deputy Administrator George Low became the most important person in overcoming a professional pilot bias in crew selection and making a mission assignment of a pilot-geologist possible.

Having a geologist inside the Apollo Program to land on the Moon, an open response to the Soviet Union's challenge during the first Cold War, offered many opportunities to add to the scientific return of that program, as well as to contribute to its operational success. Most importantly, field geological experience made possible the internal development of a focused, mission simulation approach to training natural pilot observers in field observation, rapid synthesis, critical sampling, and verbal and photographic documentation. As you all are aware, only time spent on coherent field projects can develop the experience and confidence necessary to carry multiple working hypotheses to a satisfactory conclusion. Although that time was not available for specific Apollo missions, the week-a-month field training on real geological problems provided to the Apollo 12 through 17 crews took advantage of their natural talents and enthusiasm and produced an unbelievably rich suite of samples, observations, photographs and geophysical data. This talent and enthusiasm is clearly illustrated by Neil Armstrong's spontaneous addition of a large amount of lunar regolith to a partially filled Apollo 11 sample container before he sealed it and Jim Lovell's willingness to have Apollo 13 lead the way with the new geological training plan.

The treasure horde of samples and data from Apollo continuously produce major new findings about the origin, evolution and structure of the Moon with increasingly significant implications about the early history of the Earth. Most recently, the discovery of significant indigenous water in the Apollo 17 orange pyroclastic glass samples has re-invigorated consideration of alternatives to the giant impact hypothesis of the origin of the Moon. Immediately after this latter hypothesis was proposed, previous indications of deep reservoirs of indigenous lunar volatiles made further objective testing necessary, but difficult given the unfortunate "consensus" that developed around it.

After I was selected as one of the first scientist astronauts in 1965, by the way, Ian created the GSA's "First Extraterrestrial Field Geologist" Award, embodied by a beautiful, Lucite encased and illuminated cluster of amethyst crystals. Then, after the field exploration of the Valley of Taurus-Littrow, Ian thought that the best way for the GSA to recognize that a geologist had explored a part of the Moon was to bestow the designation of GSA Honorary Fellow - the logic being that, like other Honorary Fellows, these field studies had been conducted outside the United States! **Made sense to me.**

Geologist in the Senate

Having a geologist in the Senate may not have been as productive as it had been in the Apollo Astronaut Office. Footprints on the Moon will last a couple of million years – footprints in Washington, not so much. An overly full plate there included science and energy policy, healthcare appropriations, regulatory restraint, immigration, defense, intelligence, federal patent policy, telecommunications, Senate ethics, retirement and health security reform, and strategic materials. That adventure in politics would be hard to beat as a personal learning experience. Success might have been greater if there had been more than two or three others in Congress genuinely interested in solving major problems rather than in surviving the next election by only treating the symptoms of those problems. Most people can't run their lives that way, nor can a country do so in the long term.

On the other hand, I probably was not very good at politics. A field geological heritage of standing above a field area to see the big picture led me largely to take on major issues of the future with less emphasis on more achievable, near term goals. Examining a Dick Jahns' Pacoima roadcut structures from the opposite side of the road; looking across Storfjord in Sunnmöre, Norway at the Eiksundal eclogite complex exposed on the opposite cliffs; or scanning the valley of Taurus-Littrow from the side of the North Massif tends to impress one with the value of perspective.

Geologist in Education

Having a geologist involved in education, and one with experience in the Apollo Program, provides a special opportunity to help stimulate new thoughts among young people. There have been over 45 years of lectures and Q&A with students from K-12 to graduate students to public audiences of all kinds around the world. The most intense of these activities occurred as a Fairchild Fellow at Caltech, while an Adjunct Professor of Engineering at the University of Wisconsin-Madison, and during extensive domestic and foreign travel.

Discussions with students and the public have covered everything from describing a trip to the Moon, to lunar and planetary science, to lunar helium-3 fusion energy, to space policy. The best part of this has been the questions I could answer, such as "How do you go to the bathroom in space?", "Did you eat the salmon salad they gave you?, and "How fast could you run on the Moon?" Equally interesting have been the questions I could not answer, such as "Why did you use pizzas for the Lunar Module's landing pads?", "How big was your boot?", and "What is the origin of the Moon?" The most often asked question has been "What was it like on the Moon?" and that is the most difficult to answer because "being there" is the essential human ingredient to such an experience.

One role I have assumed in work with undergraduate and graduate students has been to encourage their questioning of prevailing hypotheses that may have reached a "consensus" in acceptance but that still have some important contrary evidence to explain.

As many of you know, the hypotheses for which I have suggested contrary explanations are those related (1) to the origin of the Moon by giant impact on the Earth, (2) a short inner solar system cataclysm as an explanation for concentration of Apollo sample and lunar meteorite impact ages around 3.85 billion years, and, (3) of course, that recent slow global warming is due to the burning of fossil fuels. Capture of an independently accreted Moon; multiple cataclysms of planetary impacts with an age bias toward the last of these; and natural causes of climate change, respectively, appear to be at least as strong if not stronger hypotheses in those three cases.

Actually, consensus should have no place in science. Ian Campbell and his colleagues taught that science always should be about developing hypotheses and then trying to disprove them. Unfortunately, many students are being taught only "consensus" hypotheses such as lunar origin by giant impact and climate change by human activities. They are encouraged to conduct research that assumes those ideas are correct. Rather, students should be encouraged to be "skeptical" about consensus hypotheses until they have stood the rigorous tests of all relevant data and logic long enough to warrant being "theories". Astrophysicists understand this best as they continue to test even Einstein's Theory of Relativity.

Geologist in Management

Management of a NASA Energy Program Office, two biomedical research entities, NASA's Advisory Council, a state energy department, and many Board committees always present special individual challenges. Management success requires the ability to recognized and correlate as much available information as possible that is relevant to the solution of a problem or to seizing an opportunity. Sampling and synthesizing all data and ideas available and determining on the best solution to a problem worked well for Apollo and has served others well since. Sounds just like the key to success in geological field studies to me.

Geologist and the Constitution

When jobs were scarce in 1963 and '64, I almost decided to see if a scholarship could be found that would permit a geologist to study constitutional law. Gene Shoemaker save me from that fate by offering a job with his Astrogeology Branch in Flagstaff. Over the last two years, however, I have migrated back to looking at the Founders' view of the Constitution; but also looking at that document and related writings as a deposit of recoverable resources that provide guidance to solutions for national problems we face today. Anyone interested in seeing the on-going results of that exploration project should visit a web site called "America's Uncommon Sense."

The common theme in all this past activity seems to be that Field Geologists look at the discernable facts and synthesize those facts in to working hypotheses. They continually test, revise, discard, and add to those hypotheses based on available information and the reason that grows with experience. We need more field geologists! Everywhere!

Thank you, again. I am deeply honored by the American Geological Institute's Campbell Medal.