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GSA Medals & Awards

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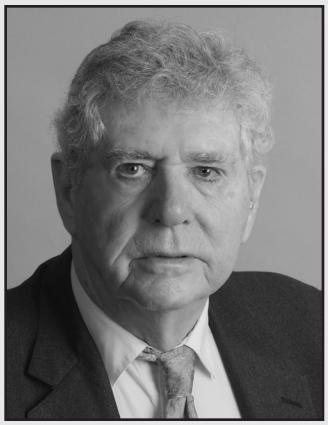
PENROSE MEDAL

Presented to Kevin Burke



Kevin Burke
Professor
University of Houston

Citation by Celâl Şengör

I appear before you today to undertake a task that marks one of the happiest occasions of my entire life: to present to you Professor Kevin Burke as this year's Penrose medalist. A simple way of presenting him would have been to say that Kevin Burke has massively furthered geology during his lifetime. In Kevin's case, "furthering geology" must be taken at its literal sense, implying furthering the entire earth sciences taken at one embrace, as, for example, did Sir Charles Lyell in his time, or Eduard Suess in his, for I am unable to think of any branch of geology, taken at its Lyellian breadth, that Kevin has not furthered.

Kevin's contributions start in the fifties with field descriptions in his Ph.D. area in western Ireland and continue, till the mid-sixties, through his field papers concerning the geology of Africa and the Caribbean. Already, in these early years, through the problems tackled (such as granite problems in Ireland, marine geology in Jamaica, beryllium prospecting and the gases in the African lakes in the Great Rift Valley, classical field descriptions, geomorphological problems ranging from processes of tropical erosion to pedology, and gravity studies), one sees the inclination to diversify and a predilection to put forward explanations in the form of daring, but testable hypotheses in the best Popperian spirit. In those days this was not common among field geologists. When plate tectonics came about in the mid-sixties, Kevin was therefore one of the readiest geologists to receive it.

Kevin's contributions to geology since the late sixties are great in range, including: models of the birth of rift valleys; ocean basins; vast areas of collision-related basement reactivation; influence of oceanic plateaus on the evolution of oceans and continental margins; the nature of the Archean and Proterozoic tectonics and related environments; the tectonic controls of basaltic volcanicity; the nature of mantle plumes and their relations to hot spots; how tectonic processes interact and control the hydrosphere and the atmosphere and how they act on other rocky planets such as Mars and Venus; and, how extraterrestrial intervention in terrestrial affairs influence geological and biological processes.

Ladies and gentlemen, trying to list Kevin's contributions is impossible; impossible even if one keeps only to the general topics he has tackled throughout his professional life. This is so, not only because the large numbers prevent us from doing so in a short time, but also because of the ways Kevin contributed to science. In addition to his published books, papers and abstracts, he has always been a great debater in meetings and an enthusiastic conversationalist. During his numerous conversations he has generously given ideas and data to many a future author. He purposefully annoyed many to drive them to produce better arguments and more data to support their positions and thus to enrich our understanding of the problems under debate. His memory is unequalled; his knowledge of world regional geology is truly staggering. I have not yet met a geologist anywhere more knowledgeable in the entire sweep of the earth sciences, i.e., geology in the old, Lyellian, that is to say, proper sense, than Kevin Burke. His incredible quickness of mind and the speed with which he can review and bring to bear upon whatever may be at hand the relevant information, are a wonder to watch. Equally wonderful are his generosity and selflessness in sharing his ideas, his data, his time.

I have been Kevin's student in Albany for 6½ years. I have admired him as a great teacher not only in geology, but also in literature, music, history, philosophy, geography, and many subjects pertaining to general culture. The atmosphere he and John Dewey created in Albany was the best academic and research atmosphere I have ever breathed anywhere in the world. The most valuable thing I learned from him was how to think in and about science. His boldness in generating hypotheses and his mercilessness and unbending honesty in testing them, including his own most cherished views, and his sincerity and generosity in communicating his knowledge, have been the best lessons for a budding researcher.

I must say honestly that I do not have the capacity to judge Kevin as a geologist or as an intellectual. He towers far too high above me in brains and in knowledge. I have been both a student of geology and of its history. Three giants of geology remind me of Kevin most by their character and the nature of their accomplishments and by their love for what Kevin calls "our beloved planet": Alexander von Humboldt, Sir Charles Lyell and Eduard Suess. Giving Kevin the Penrose Medal honors not only Kevin Burke, but also the Geological Society of America, and will add further luster to its already illustrious annals. That this honor comes to Kevin (and to the Society) at this stage in Kevin's career is I think the best testimony to his being so much further ahead than most. Its bestowal reflects on us all as members of the international geological community comprehended under the celebrated umbrella of the GSA and we, the recipients of Kevin's light, all bask in the glory that Kevin Burke has added to the attainments of our wonderful science.

Mr. President, Ladies and Gentlemen, I consider it as one of the most wonderful moments in my life to present to you this year's Penrose medalist, Professor Kevin Charles Antony Burke, geologist.

Response by Kevin Burke

The Penrose medal is an overwhelming honor. The humbling terms of the endowment say:

> *"The award shall be made in recognition of outstanding original contributions or achievements which mark a decided advance in the science of geology."*

I make little claim to "contributions or achievements" but I do confess to having spouted "new ideas" as a result of spotting unfamiliar, or overlooked, relationships. But "new ideas" rarely prove to be original and are eventually always proved wrong so I am both delighted and astonished by the award. Luck and career diversity have helped in the path I have followed.

I spent time in greenstone belts in my first two jobs, at a University in Ghana (1953–56) and with the British Geological Survey traveling in Africa (1956-61). While teaching at the University in Jamaica (1961–1965) I realized that the Cretaceous rocks of the Greater Antilles and greenstone belt rocks

were the same—but I did not know why. It was not till the plate tectonics thunderbolt hit that I understood.

Plate tectonics struck me in a 1967 paper by Lynn Sykes on earthquake mechanisms in the equatorial Atlantic. Lynn demonstrated that the sense of ridge to ridge transform motion was as had been predicted by Tuzo Wilson in 1965. I read Sykes because I was teaching at the University of Ibadan in Nigeria and thinking about the structure of the Guinea coast I ran to the nearest library and read Wilson's paper. Geology changed for me. My experience in Africa and the Caribbean immediately showed me that the record of Earth history was likely to be the record of ocean opening and closing by plate tectonic processes. Reading *Nature* and the *JGR* kept me from isolation and in Cambridge during the fall of 1969 John Dewey rounded out my education in plate tectonics.

To avoid unrest in eastern Nigeria we did field work in the Benue rift and took a student field class to my old haunts in Ghana where I found that I had lived on a suture marking a Precambrian continental collision (later with Lew Ashwal and Sue Webb I confirmed the suture location from occurrences of nepheline gneiss). I realized how rifts and sutures fitted in to what later came to be called the Wilson cycle.

In 1970 my wife Angela, whose strong support has been vital to me and who with my three children has suffered from my inattention, explained to me that it was time to go somewhere with children's schools—but I couldn't get a job. All I could find was for one-year at Erindale College in the University of Toronto **BUT** Tuzo Wilson was principal of that college. Tuzo showed me that tectonics is "The large scale evolution of planetary lithospheres." He encouraged my interest in hot spots and mantle plumes and together we related the unique topography of Africa to arrest over shallow mantle convection. Canada was great for learning more about the Precambrian especially from Paul Hoffman.

I abandoned Tuzo because John Dewey, to whom I am eternally grateful, arranged a tenured job for me at Albany. There for ten years (1973-83) with Dewey, Bill Kidd, Celal Sengor and other outstanding graduate students we wrote papers based on Tuzo's recognition that you cannot know too much regional geology and geophysics and that the oceans and continents must be considered together. I got back into Caribbean geology where I made my first contact with a Large Igneous Province.

A NASA project: "Basaltic Volcanism on Terrestrial Planets" introduced me to the solar system and by 1983 I found myself director of the Lunar and Planetary Institute and a professor at the University of Houston. I was a poor space geologist because I failed to get excited by the data then available. Today would be different.

Houston put me in contact with oil geologists. I have given talks and written reports for them but I have learned more from oil geologists than they have from me. Twenty years on an ocean drilling safety panel helped keep me up with global geology and I manipulated that and other national and international panel memberships to see the geology of parts of all the continents except Antarctica.

South Africans invited me to give their Du Toit lecture in 1994. There is no greater honor for a student of Africa. Realizing that my audiences knew all about the Precambrian I chose to review (in 50,000 words) what had happened on the African plate during the past 30 My. Many of my present interests stem from writing that review. Yanni Gunnell, Bill Bosworth, Nick Cameron and Duncan MacGregor have guided me in the study of coupled African uplift and erosion on land and deep-water deposition offshore. The idea that Africa's present topography is related to shallow mantle convection rather than to the underlying Large Low Shear Wave Velocity province at the core mantle boundary led me, with Trond Torsvik, to discover that although Africa's topography is very young the underlying deep structure has been unchanged for at least 300 My.

The second half of my life spent in America has given me opportunities of working with an exceptional and diverse group of the world's leading Earth scientists. I have received the best collaboration in research. Nowhere outside the United States could I have had my kind of career and I have deeply appreciated the opportunities. Finding out about the Earth has been its own reward and because I deal in ideas rather than real work I have told myself that recognition was not to be expected. Nevertheless recognition—all the sweeter for being unexpected—is special and I am most grateful to the Society and to all who have helped me.

ARTHUR L. DAY MEDAL

Presented to Mary Lou Zoback

Mary Lou Zoback
Vice President for
Earthquake Risk Applications
Risk Management Solutions

Citation by Richard G. Gordon

Mary Lou Zoback has been exemplary in contributing to geologic knowledge through the creative application of physics to the solution of geologic problems. She is a rare individual who is at home both mapping in the field (notably in the Basin and Range province) and in understanding and elucidating the subtle relationships between buoyancy and the state of stress of the lithosphere.

Mary Lou's early work on rifting in the Basin and Range province is widely recognized and highly cited, as is her ensuing work on the structure and evolution of the Colorado Plateau (Zoback & Thompson, 1978, 1979; Zoback et al., 1981). An important contribution of that early work was the recognition that the Pliocene and younger orientation (principal extensional incremental strain) of Basin and Range extensional deformation is rotated clockwise from the mid-Miocene orientation.

While this work was still in progress, she began the work that firmly established her international stature in geoscience, that of elucidating the state of stress first of the conterminous U.S. (Zoback & M.D. Zoback, 1980, 1981; M.D. Zoback et al., 1987; Zoback 1989) and eventually of the world (Zoback et al. 1989, Zoback 1992, Muller et al. 1992). Mary Lou Zoback has been the leader, a vital intellectual force, and the effective driving force behind the development of the world stress map. It is an exaggeration—but not that great of one—to claim that Mary Lou and colleagues developed an essential observational data set, the world stress field, which did not exist before they began their work. Reproductions of maps from that work now populate more textbooks than I can begin to count. It is impossible to go to a geoscience meeting without seeing talks that draw from it. The papers listed above have certainly not gone unnoticed by the community. The least cited of them has more than 90 citations, and the most cited are classics with many hundreds of citations.

There are many contributions made through Mary Lou's U.S. and world stress maps including the following. First, she and colleagues showed that different types of indicators of stress orientation were consistent where they overlapped spatially and temporally, thus allowing many types of data to be combined in defining the world stress field. Second, they showed that stress orientations were regionally consistent, which permitted the definition of broad-scale regional stress patterns. Third, they showed that first-order midplate stress fields are largely the result of compressional forces (ridge push and continental collision) applied at plate boundaries, and that there is no evidence of the lateral stress gradients that would be expected if plates were driven or resisted significantly from below. Fourth, they showed that regions of deviatoric tensional stress are generally associated with high topography, as in the western U.S. Cordillera, the Andes, and the Tibetan plateau, and thus related to buoyancy.

Yet another profound contribution comes from a landmark paper that grew from the work in which her husband Mark is first author and she second-author (M.D. Zoback et al. 1989). In that paper, the Zobacks and colleagues showed that the principal compressive stress is nearly orthogonal to the San Andreas fault, with the implication that the fault is much weaker than widely supposed. This remarkable and surprising result has stimulated an enormous amount of thought and observation that still continues.

Mary Lou's latest installment on understanding the pattern of world stress uses the USGS global data base of crustal structure determinations as well as surface heat-flow measurements to infer the thickness of the mantle lid. She infers thick roots beneath cratons and shows that they lead to strongly negative gravitational potential energy relative to surrounding regions. As a result, compressive stresses are superimposed on those from plate boundary forces, which in turn may explain the dominance of reverse-faulting earthquakes in cratons.

Other recent work has focused on the role of step-overs as the source and origin of the 1906 San Francisco earthquake. She has expanded this work to other earthquakes as well.

Mary Lou Zoback is a geoscientist who uses the tools of physics to delineate the forces that drive and deform the lithospheric plates. She is a scientist of international stature. She has made many profound, widely appreciated, and influential contributions. Please join me in congratulating her as the 2007 recipient of the Arthur L. Day Medal of the Geological Society of America.

Response by Mary Lou Zoback

Thank you Richard for that generous citation and for nominating me, along with your silent partner, Ken Kodama of Lehigh University, for the Day Medal. Ken, Richard, and I were graduate students together in the Geophysics Department at Stanford—an environment in which the students learned more from fellow students than they did from their professors, according to their advisor Alan Cox. It certainly was a rich and stimulating environment from which to launch.

It is truly an honor, and very humbling one, to receive this recognition in Arthur L. Day's name from the Geological Society of America. I gave my first scientific talk at a GSA meeting in Denver, more years ago than I am willing to admit. I want to begin by thanking GSA for providing a friendly home to geophysicists such as myself, seeking to understand the physical forces driving very real geologic processes. It is a distinct pleasure and honor to share this podium with two giants of tectonics on whose shoulders I, and myriad of others have stood, Kevin Burke and Celal Sengor. Their bold thinking on regional, global, and even extra-terrestrial tectonics always challenged and inspired us to think creatively, beyond conventional wisdom.

Receiving a recognition like the Day Medal invokes many emotions: joy, embarrassment, as well as suspicion that the committee or someone at headquarters made a mistake in sending the email announcement. But most of all, I feel tremendous pride in this recognition of a number of wonderfully productive, and personally rewarding, collaborations throughout my career.

The first such collaboration, and an enduring one, was with my advisor and mentor, George Thompson at Stanford University. George's guidance and inspiration provided me with a strong field geologic grounding and opened my eyes to the power of applying simple physical principles, such as force and mass balance, to constrain large-scale geologic processes. His gentle nudging and thought-provoking questions, not to mention his able service as "field assistant extraordinaire," set me on the wonderful path of exploring the evolution of the active tectonic provinces of the Western U.S in the context of broader plate tectonic interactions.

As Richard indicated, this interest in active tectonics and changes in the state of stress in the Basin and Range expanded to a broader captivation with understanding the present day state of stress within the earth's crust. Special thanks to Barry Raleigh, then a USGS branch chief, who first introduced me (as an undergrad technician) to the possibility of mapping the tectonic stress field.

The body of work on defining the state of stress in the earth's crust resulted from the collaboration of which I am most proud, both in life and in my career—that with my husband Mark. Together we developed and tested a broad range of geologic and geophysical techniques to infer the present-day stress field. A major step came in quantifying quality criteria that would allow for comparison of the results of different techniques. This was truly a joint effort, often involving many late night, heated discussions, after the kids went to bed.

Applying our stress mapping techniques globally was the brainchild of Karl Fuchs, then President of the International Lithosphere Program and now Professor Emeritus at Karlsruhe University. Karl's vision created the World Stress Map project, a collaboration of 40 eager and dedicated scientists in 30 different countries that I had the pleasure to lead. Each of these scientists made critical contributions to this global effort. Looking back, I am amazed at what we accomplished in a widely dispersed collaboration--all prior to the days of email. That the understanding we developed of global stress patterns has stood the test of time and has provided valuable constraints in many diverse areas of geology and geophysics is extremely gratifying. I am forever indebted each of those 40 scientists, especially Birgit Mueller, of Karlsruhe University, who was invaluable in the data compilation effort and whose good humor helped keep me sane. Special thanks too to Randy Richardson, for the knowledge and insights he shared in our collaborations quantifying relationships between forces and stress.

Finally, I want to acknowledge my amazing good fortune to have been able to spend much of my career at U.S. Geological Survey, the finest earth science agency in the world. The USGS remains a special and unique environment, consisting of a cadre of remarkably dedicated, world-class research scientists who always have time for discussion of ideas, regardless how crazy, and who willingly drop their own research to help out with a sticky problem. We understood the power, value and rewards of collaborative research long before "teamwork" became a management fad. I dare not mention these colleagues by name because it might begin to sound like a filibuster. I do want thank John Filson for many years of inspired leadership of the USGS earthquake program; his hands off leadership style allowed program scientists to pursue research directions we deemed important and productive. Special thanks to Bill Ellsworth for making it easy for me to establish a part-time schedule for much of my career.

I gratefully thank the GSA Council and Day Medal Committee for honoring me with this award which I accept on behalf of all those scientists I have had the privilege of working with. They stand beside me in receiving this honor. My heartfelt thanks to Mark, my collaborator in both life, and science, and to our children Eli and Megan—a continual source of joy, pride, and wonder.

YOUNG SCIENTIST AWARD (DONATH MEDAL)

Presented to Carmala N. Garzione

Carmala N. Garzione
Associate Professor,
University of Rochester

Citation by Matthew J. Kohn

The Donath Medal was established to honor a young scientist whose original research marks a major advance in the earth sciences. I can think of no more worthy recipient than Carmala Garzione, largely for her pioneering work in paleoaltimetry.

Carmie first attended the University of Maryland, where she received a B.S. in geology, then the University of Arizona, where she received a M.S. and Ph.D. in tectonics, sedimentology, and geochemistry. She was subsequently hired by the University of Rochester, where she is currently an associate professor.

I should mention that I have no particular affiliation with Carmie or her respective institutions. Rather what led me to support her for this award, and ultimately what has guaranteed her place among great geologists, are her contributions in tectonics and paleoaltimetry. Carmie's talents extend through many fields, including stratigraphy and sedimentology, stable and radiogenic isotope geochemistry, and (what links all these interests) geodynamics and tectonics. She's also a fearless and talented field geologist. But her innovative research in paleoaltimetry simultaneously framed the isotopic methods by which we now investigate paleoelevations and changed our paradigms of how Earth's major plateaus have formed.

To provide a bit of background, paleoelevations sensitively monitor bulk lithospheric properties and distinguish geodynamic models of continental deformation. Developing a local paleoelevation history is, however, analytically intensive and requires close attention to geologic detail. Yet, paleoaltimetry offers insight into truly big-picture tectonic processes unavailable to other endeavors.

Carmie recognized the power of paleoaltimetry while still a graduate student. At Arizona, she decided that, rather than working on a "safe" project characterizing sediment source terranes in the Himalaya, she would work on the Thakkhola Graben, an extensional basin that featured heavily in tectonic models of the development of the Tibetan Plateau, but that no one had studied in any detail. Now, there's a good reason no one had studied Thakkhola. Her Ph.D. advisor, Pete DeCelles, has described it as "one of the harshest places in the Himalaya, situated in officially restricted terrain along the Tibetan border; a windy, cold, [roadless], topographically rugged, oxygen-deficient high desert." And of course they had zero funding. Not good prospects for a Ph.D. project! Regardless, Carmie wrote several proposals, landed a $20,000 fellowship from the National Security Education Program, and took off for Nepal—for seven months. She spent three strenuous field seasons there and in the process learned to speak Nepali.

I tell this story for two reasons. First, it ultimately led to two landmark papers in tectonics and paleoaltimetry. One showed that the southern margin of the Tibetan Plateau must have been elevated and extending by 10–11 Ma, several million years prior to when the reigning paradigm said it "should" have occurred. This forever changed our view of the geodynamics of the Indo-Asian collision. The second paper documented the elevation dependence of the stable isotope compositions of local waters in the Himalaya and set the standard by which we now evaluate other datasets and models. Other paleoaltimetry contributions notwithstanding, I view Carmie's Himalayan work as having sparked this research field. It illustrated the power of elevation histories in geodynamics as no previous study had and laid the groundwork for all future paleoelevation studies incorporating stable isotopes. The second reason I tell this story is that it illustrates Carmie's perseverance and willingness to take risks. These qualities are evident in all her endeavors, not least in the field when scampering across steep and treacherous exposures. Lots of people are smart, but perseverance and risk taking are, I believe, requisite for the finest science.

Up until a couple of years ago, I would have offered Carmie's Himalayan papers as paleoaltimetry's exemplar. Now, however, she has surpassed them with a series of articles on the elevation and geodynamic history of the Altiplano plateau in Bolivia. In part employing a novel stable isotope technique, she has shown that the Altiplano rose several kilometers within a few million years, likely the result of abrupt loss of lithospheric mantle. If, as I argue, Carmie's Himalayan studies forged stable isotopic methods in paleoaltimetry, then her Altiplano work tempered them to superb fineness.

To wrap up, I have to explain that when Carmie first asked me to present the citation here, I threatened her with the fact that I've sometimes given introductions in verse, and that I had recently been reading a book on limericks. But I told her not worry because I couldn't think of a rhyme for "Carmala," God forbid "Garzione." Whereupon Carmie demanded a limerick that included her last name. So, with due apologies to, well, everyone …

There was a geologist named Garzione
Whose work in Tibet took her far along.
For the altimetry game
Soon gave her great fame
And now she's entitled to party-on.

Anyway, I hope I've managed to convey some of Carmie's unique contributions and qualities, and I'm privileged to present to you, as this year's recipient of the Donath Medal, an outstanding young scientist, Carmala Garzione.

Response by Carmala N. Garzione

Thank you, Matt, for the kind words and for the humorous (and hopefully not immortal) limerick. I am impressed that you met that challenge and could not resist the opportunity to write a response limerick:

There once was a geologist named Kohn
Who entitled me to party-on.
I invite him here
To grab his own beer
And join in the celebrati-on

On a more serious note, I would first like to thank the Geological Society of America and the Donath family for establishing this award. I feel honored to accept the Donath

Medal this year, and yet I feel humbled by the knowledge of some of the amazing work being done by my peers. I insist that a number of other young scientists could be standing up here tonight, and I wish I could share this honor with them.

Looking back to the beginning of my geology career as an undergraduate at the University of Maryland, I have to thank Rich Walker and Eirik Krogstad for turning me on to the apparently limitless applications of geochemistry to address regional geologic problems. My experiences at Maryland, working in their lab on a senior thesis project, inspired me to go to graduate school. While I was a Master's student at the University of Arizona, my advisor, Jon Patchett, helped me learn to think independently and communicate my ideas. I considered stopping at the end of my Master's to teach high school, and I am grateful to Jon for encouraging me to stay in graduate school. My Ph.D. mentors at Arizona, Peter DeCelles, Jay Quade, David Dettman, and Bob Butler, were role models that I looked to for inspiration. They view regional tectonic questions with a flexibility of mind that enables them to adapt and develop new approaches to answering questions. I thank my mentors and the Geosciences department for cultivating the freedom for students to develop their own Ph.D. projects. I took complete advantage of this and found that the professors and their labs were always available if I was bold enough to ask.

Over the past 7 years since I completed my Ph.D., I have benefited from the support of the University of Rochester and my colleagues and students in Earth and Environmental Sciences. In particular, our department chair, John Tarduno, was encouraging and supportive. Gautam Mitra has helped to keep the student alive in me. I've sat in on most of his classes, as he has sat in on mine, and I continue to learn from Gautam. I thank Rochester for offering a stimulating environment in which to both teach and learn. As I'm sure that many of you feel, while students learn from us, they also help strengthen our knowledge and inspire new insights. Last year, I took on my first postdoc at Rochester, Greg Hoke, who has helped to integrate the regional geomorphology with our view of the Andes elevation history. Our collaborative efforts have broadened my view of surface processes and have provided a new source of ideas that I hope will forward our understanding of the Andes.

Matt describes me as fearless and willing to take risks. The truth is that my biggest fear was the risk of squandering my PhD years not doing something that was fun and inspiring. Working in remote central Nepal and southern Tibet on an intriguing question, despite the challenges, ensured that I would enjoy that part of my life. Like many discoveries, I did not set out with the intention of developing a paleoelevation technique, but instead planned to establish a climate record from southern Tibet that could be compared to the Himalayan foreland basin record. However, when I analyzed the first paleosol samples and saw how anomalous their O isotopes were compared to the low-lying foreland, I immediately realized that the Thakkhola graben recorded an elevation signal. I planned my next field season around calibrating the paleoaltimeter by systematically sampling surface waters in the Himalaya, south of the Thakkhola graben. Our more recent work in the Andes was an obvious target for paleoelevation research because I was aware that controversial paleoelevation estimates from fossil leaves suggested the Andean plateau resided at half its height only 10 m.y. ago. The Andes provide a surface uplift history that is tractable, allowing us to better constrain the geodynamic processes that raise mountains.

I thank numerous colleagues, including Matt Kohn, who came up to talk with me about my work in Thakkhola after my very first AGU talk. Matt's and others' interest ignited my desire to keep plugging away during my Ph.D. work. I want to thank Peter Molnar, who hosted me as a CIRES fellow at the University of Colorado. Peter's ability to view the Earth system through the physical interactions between atmosphere, oceans, lithosphere, and asthenosphere has encouraged me to think broadly. I also want to thank David Rowley and Page Chamberlain who have been simultaneously working to establish quantitative stable isotope-based paleoaltimetry techniques. Our lively interactions, both agreements and debates, have stimulated widespread interest in paleoelevation studies.

Lastly, I want to thank my family and friends. Although I was the first in my family to obtain a college degree, my parents always instilled in me the value of education. I am grateful to Damian for love and support early in my career. I am fortunate to have my family, my daughter, Fiona, and my partner, Doug, to celebrate this honor with. My 4 year old daughter tells me that I have a fun job because I get to spend a lot of time outside. I agree with her. I am grateful for the privilege to be able to contribute to our understanding of how the earth works.

GSA PUBLIC SERVICE AWARD

Presented to Mary Lou Zoback

Mary Lou Zoback
Vice President for Earthquake Risk Applications
Risk Management Solutions

Citation by J. David Applegate

Recognizing Dr. Mary Lou Zoback as both the Day medalist and Public Service awardee at the same ceremony could not be more appropriate. For while independent nominating processes produced the same result, it is only in the combination of these honors that we begin to capture the phenomenon that is Mary Lou.

Throughout her distinguished career, Mary Lou has consistently dedicated her talents to bringing the best science to bear on the solution to societal problems. Her instincts have always been collaborative, whether in her scientific achievements or in the application of science in the public interest. Her tireless efforts to educate the public on earthquake hazards in the San Francisco Bay region culminated in her leadership of a wide-ranging alliance to turn the commemoration of the 100th anniversary of the devastating 1906 San Francisco earthquake into an unprecedented campaign to build public awareness and improve earthquake preparedness. As just one part of that campaign, Mary Lou led development of "Putting Down Roots in the Bay Area," an earthquake preparedness pamphlet that was distributed to millions of people in northern California and has been translated into multiple languages.

Mary Lou recently retired from the U.S. Geological Survey after a long career of public service. In addition to her research activities, which earned her election to the National Academy of Sciences, Mary Lou served as the chief scientist of the Earthquake Hazards Team and northern California coordinator for the Earthquake Hazards Program. In those roles, she was a principal spokesperson for the Survey on earthquake-related topics, participating in countless media interviews, press conferences, documentaries, public lectures, and policymaker briefings.

Through her service on National Research Council boards and committees, Mary Lou has made important contributions to the application of geoscience to public policy decision making, reviewing policy topics that range from high-level radioactive waste disposal to the National Science Education Standards and the future of earth observation systems. Most recently, she served on the National Academies' Committee for Science and Public Policy, which addresses broad policy questions at the highest level. She is only the third geoscientist in a century and a half to serve on the National Academies' Governing Council. Indeed, Mary Lou has often been the lone geoscientist on such high-level bodies, and we all owe her a debt of gratitude for being our ambassador.

Mary Lou has a long history of distinguished service to GSA as a member of Council and the Executive Committee, as Cordilleran Section president and culminating in her term as GSA president in 2000. She used her GSA presidential address to lay out grand challenges for the earth and environmental sciences in the coming decades, focusing on those areas of improved understanding that would be needed to tackle environmental problems and, just as important, analyze the impact of proposed remedies. She recognized that this was not an undertaking for the geosciences or even physical and biological sciences in isolation, but rather these sciences must work together with the social sciences in order to develop workable and societally acceptable solutions. All the more appropriate than that in her new incarnation as vice president for Earthquake Risk Applications at Risk Management Solutions, Mary Lou has turned her talents to a new sector and a new challenge taking her well beyond the scientific quantification of hazard to the societal factors that encompass vulnerability and risk.

Throughout her career, Mary Lou has been unstinting in her willingness to nurture, advise, and otherwise help younger scientists. She has been actively involved in science education in her local schools and also participates in a national program, Expanding Your Horizons, which encourages girls in middle school toward careers in mathematics and the sciences. That means she is already helping us with a particularly difficult task that we in the geoscience community face: cloning Mary Lou. For we need a future supply of scientific leaders whose impeccable credentials grant access to the highest councils, whose curiosity impels them toward the application of their science to societal issues, and whose dedication and resolve drive positive change. We must find ways to encourage the best and the brightest in our science toward public service, creating viable career paths so that others may follow where she has led.

In recognition of her many accomplishments, her infectious enthusiasm, her genuine concern and what has been described as her irresistible leadership, Mary Lou Zoback is a most deserving recipient of the GSA Public Service Award. Now I wonder what comes next.

Response by Mary Lou Zoback

Thank you Dave, that citation means a great deal to me, coming from you, whom I've always looked up to as the epitome of selfless public service, as was recognized when you received this award two years ago.

Colin Powell, in his Lessons for Leaders, stated that "Perpetual optimism is a force multiplier." I feel the same way about public service—in serving, the rewards you reap far exceed what you give.

I'm also going to admit two secrets. The first will not be a big surprise—I have a hard time saying no. The second is that much of my service has been for selfish reasons—my criteria for saying yes is always whether I feel I am going to learn something new. I have never been disappointed. I have learned about other scientific disciplines and different approaches to science, and also have been greatly enriched by interactions with many bright and inspiring individuals.

As scientists, we are extremely privileged to be able to pursue our passions and curiosity as a career. With that privilege comes some responsibility, I believe. We are at a rare moment of crisis and opportunity. Finally the public, both in the United States and in much of the world, has accepted the idea of global change and many are beginning to understand the potentially dramatic consequences resulting from this grand experiment we are unwittingly conducting

on our planet. As Earth scientists, we have a special obligation to educate the public and our business and policy leaders about both the short term and long term impacts of our present course of action.

Having served on advisory committees for the USGS, NSF, NASA, NOAA, DOE, and the National Academy, I have often witnessed big, bold thinking commensurate with the scale of the problems we are facing. What we are missing is leadership in creating an Earth Science agenda for the nation. Rather than constantly fighting to protect turf, we should forge an alliance and raise the profile of Earth Science on the national scientific scene. There are many competing interests and needs for the nation's resources, but what Earth Sciences can offer can literally change our future. I urge each of you to contribute in your own way to help make this happen.

On a more personal note, I would like to end with a few words about the 1906 earthquake centennial, a major scientific, cultural, and historical event that captured local, national, and international media attention. This was, in part, due to several years of concerted planning and community building by the 1906 Earthquake Centennial Alliance, which I was privileged to lead. The Alliance consisted of over 250 member groups that put on more than 120 activities and events. My biggest thrill was seeing this major scientific event interpreted through the eyes of historians, ballet dancers, fire fighters, composers, photographers, story tellers, and even nuns.

I want to particularly acknowledge the scientific and public information contributions to the Centennial by scientists, web and GIS gurus, and publications staff of the USGS. This amazing group produced a 3d fault and block model of all of northern California and turned it into a 3d velocity model. Five different groups used this model to recreate the intensity and duration of 1906 shaking through ground motions simulations based on a reanalysis of the surveying data and constrained by a reanalysis of 1906 shaking and damage reports. A virtual helicopter tour allowed the public to view the Hayward fault from above, and they were able to see the fault below ground in a public trench exhibit. A century of geologic mapping in the San Francisco Bay Area was synthesized in a new uniform, digital geologic map accompanied by new regional maps of Quaternary faults, surficial deposits and liquefaction susceptibility. A century of progress in understanding earthquakes and their effects was highlighted in a student guide to earthquake science, field guides for the public, and a Google Earth virtual field trip of the 1906 earthquake. Putting Down Roots in Earthquake Country, a public earthquake information and preparedness guide was produced with a number of public agencies and the Red Cross. Over two million copies were distributed. Heartfelt thanks to everyone involved for their cheerful hard work and creative energy. This was the most amazing, selfless scientific collaboration I have ever been a part of.

I gratefully thank the USGS for allowing me the time and encouraging my participation in many of these activities and the award committee and the GSA Council in honoring me.

GSA DISTINGUISHED SERVICE AWARD

Presented to Nancy Carlson-Wright, Yildirim Dilek, Robert C. Thomas

Nancy Carlson-Wright
Technical Program Manager, GSA

Yildirim Dilek
Professor, Miami University

Robert C. Thomas
Professor, University of Montana-Western

Citation by Robert S. Young

I have been technical program chair (TPC) for the annual meeting twice and have served for many years on the Annual Program Committee. Nancy Carlson has been the constant guide to all involved in meeting planning and management. During my two years as TPC, I was amazed and gratified by Nancy's work ethic and dedication to GSA. As we assembled the meeting, I would get e-mails from Nancy at all hours of the night. She was never off the clock during crunch time. We would talk at home and on weekends. I can't imagine that the GSA leadership has a true appreciation for how many hours Nancy puts in outside of the business day to get the technical program assembled. Replacing her would be impossible. I sure hope that I retire before she does.

Additionally, working with the various members of GSA divisions, the Associated Societies, and the Joint Technical Program Committee (JTPC) is difficult work. Nancy is the consummate diplomat. She is always polite and professional. She is a supremely gracious representative for GSA headquarters and GSA in general.

Finally, she is that rare individual who is able to provide leadership and new ideas where they are needed, but who is also willing to serve and carry out requests when asked (and from the TPC when he is in a bind). My work with her has been truly a pleasure. I cannot think of another individual who is more deserving of this award. Nancy Carlson's service to GSA has been distinguished and exemplary.

Citation by Paul T. Robinson

Yildirim Dilek is a highly productive geoscientist, well known for his many outstanding scientific and editorial contributions to the geological community. Scientifically, he is one of the leading experts on ophiolites and oceanic crust, and he has greatly advanced our knowledge of the tectonic evolution of ophiolites and orogenic belts through his original and innovative work. His contributions to the GSA include editorial work, committee assignments, division presidency, and organization of many successful meetings and symposia.

A Fellow of GSA, Yildirim served as editor of the *GSA Bulletin* for four years, helping to raise its international profile, scientific rigour, and impact factor. He also served as president of the International Division and on a number of important GSA committees, including the Publications and Penrose Conferences Committees. As many of you know, Yildirim excels at organizing conferences, symposia and technical sessions at national and international meetings that collectively serve as international forums for scientific exchange. Equally important, he successfully edits the volumes resulting from these meetings that disseminate current data and new ideas on hot topics to the scientific community; some of these books are among the GSA's bestsellers. His ability to focus on important problems and to involve different divisions of the GSA is a great strength and has served the membership of our society well.

Yildirim has devoted immense effort and time to supporting the GSA and advancing its goals internationally, and his accomplishments

Citation by George C. Sharp

It is with great pleasure that I introduce Rob Thomas as recipient of the GSA's 2007 Distinguished Service Award. Rob is being recognized for initiating a GeoVenture and GeoHostel program in southwest Montana and for organizing and leading 10 trips in Montana and surrounding areas since 1995. His GeoTrips have included overviews of the Pioneer Range and Dillon areas, Glacier Park, the Beartooths, the Yellowstone region, the Grand Tetons, tracing the geology of the Lewis and Clark Expedition through parts of Montana, Idaho and Washington, the Wind River Range, and the Crazy Mountains-Bridger Range.

Rob has a unique ability to communicate his extensive knowledge of geology and field techniques in a manner understandable to both geologists and non-geologists. His style is to teach rather than preach and to make people feel valued for their comments and observations. His technical gifts are matched by his pleasing personality and good humor—even while being tested by all the things that can (and do) go wrong while shepherding 35 people with varying degrees of geologic knowledge in vans on back roads for a week. A testimony of his leadership and teaching skills is that all of his 10 trips have sold out, many within days of their announcement.

Rob was not alone in organizing these 10 GeoVentures; his co-leader, Shelia Roberts, joined Rob in 1997, and Edna Collis, now retired from GSA, provided logistic support.

We hope, Rob, that you continue to expose others to high-quality field geology

Carlson-Wright citation *(continued)*

Response by Nancy Carlson-Wright

Thank you. It's great working at the Society with all of the volunteers and it's really an honor to receive this award. Thank you.

Dilek citation *(continued)*

are widely recognized. In addition to his many contributions to the Society and to the scientific community at large, he has maintained a dynamic and successful research program, has excelled at both graduate and undergraduate teaching, and has served his own university in many capacities. Yildirim richly deserves to be recognized for his contributions, and we are pleased to award him the 2007 GSA Distinguished Service Award.

Response by Yildirim Dilek

I am deeply honored to receive the GSA Distinguished Service Award. I thank my nominators, friends and colleagues for their support and the Geological Society for providing me with opportunities to serve the international geoscience community. I have been fortunate to have many role models as my mentors and colleagues, who are leaders in their fields and who have served the Society in many capacities. It has been most inspiring for me to see the great scientific, professional, and public contributions of these people and many others reach every corner of the world through GSA and its multi-faceted activities.

I have this passionate love for our profession, which remains a source of constant and immense joy for me. My involvement with GSA has taught me a lot and has brought wonderful international connections and deep friendships. Throughout my tenure as the *Bulletin* Editor and as the Divisional officer I have made every effort to ensure that GSA reach out to the international community to promote international science and endeavors, and to become an international leader in our profession well beyond the confines of North America. It is my sincere hope and desire that the GSA shall be there soon, if not already.

I would not have been here today to receive this award had I not had the distinct privilege and fortune of working with many wonderful colleagues, fellow editors, and staff members in the GSA headquarters, who have made my job much easier with their diligent work, profound care, and great sense of humor; I am grateful for all they have done. I thank my colleagues and students at Miami University for providing me with ample time and causes to serve our profession and society. Finally, I would like to thank my family for their unconditional support and encouragement throughout my education and career. I share this award with all of these people around me. Let me thank GSA again for this recognition.

Thomas citation *(continued)*

at a time when such opportunities are becoming rare.

Response by Robert C. Thomas

I am pleased to accept this award on behalf of the GeoVenture team of Sheila Roberts, Edna Collis, Sherrie Landon and myself. Together, we had the pleasure of sharing the geology of the northern Rocky Mountains with people who I now consider to be family. Public outreach is my passion in geology and so I am very pleased that it is rewarded by the Society. Thanks …

GSA PRESIDENT'S MEDAL

Presented to

Phil and Amy Mickelson

Phil and Amy Mickelson

Citation by Stephen G. Wells

Professional golfer Phil Mickelson recently publicized the serious need for improvement of teaching of physical science and math in elementary schools in order to attract more students into those fields. To address that need, Phil and his wife Amy have teamed up with ExxonMobil to establish the Mickelson ExxonMobil Teachers Academy, a week-long workshop to help third- through fifth-grade teachers gain the skills to excite their students about science and math. The teachers, selected from school districts around the country in teams of as many as ten from a district, work in the academy with established experts in the teaching of science and math. "Amy and I are thrilled to be a part of this program," said Phil Mickelson in the June 2005 issue of Geotimes. "We see it as an opportunity to really make a difference. We hope that we can be instrumental in bringing awareness to the plight of science in America today."

Phil and Amy support the program financially, and they also join the teachers on the last day of the academy, spending time with each teacher. Three public service announcements (2006's "Peanut" and "Kids scientists," and 2005's "What if") about the Teachers Academy ran during the Masters Tournament in 2005 and 2006. These announcements are particularly powerful messages delivered to a national television audience. The delivery of these messages about the importance of science education to so many people so effectively is another example of how the Mickelsons are providing outstanding support of both the sciences, including the geosciences.

For individuals who have reached the highest level of their own profession to offer their public support for science education deserves the gratitude, encouragement, and recognition by the Geological Society of America through the GSA President's Medal.

Response by Phil and Amy Mickelson

Video transcription — Hi, I am Phil Mickelson. My wife Amy and I are very sorry we cannot join you this evening in Denver. Currently we are on a flight to Singapore and to China. We are bringing our family with us. As I compete in these two events, I also want to take advantage of this opportunity to show our kids what wonderful things China and Singapore have to offer.

But more importantly I want to thank you for recognizing the passion that my wife Amy and I have for developing and inspiring young children in the sciences. Weíve developed some educational programs for the elementary school teachers in math and sciences. Through our partnership with ExxonMobil we created the Mickelson ExxonMobil Math and Science Teachers Academy where we were able to bring in teachers from across the country and show them new innovative ways to inspire their students.

Our country has long been a leader in the geosciences and for us to maintain that leadership position we must continue to inspire our young students in these areas. Scientists have an opportunity to help slow or reverse global warming. Scientists lead us in new directions for energy. Scientists also help us predict natural disasters which save many many lives. And, the GSA is at the forefront of this research. So we are so humbled to be able to be recognized for such a wonderful award.

I also want you to know that in my world a silver medal is usually awarded for the runner up. But the Geological Society of America Presidentís medal feels like an atomic weight 79 to me. Thank you very much for having us and for honoring us with this wonderful award. And we will continue our work and appreciate all that you have done to help recognize that.

Thank you very much.

SUBARU OUTSTANDING WOMAN IN SCIENCE AWARD

Presented to Tanja Bosak

Tanja Bosak
Assistant Professor
Massachusetts Institute of Technology

Response by Tanja Bosak

I am delighted to receive the Subaru Outstanding Woman in Science Award. I am also grateful for this opportunity to thank some of the people who have supported me and encouraged me at Caltech and Harvard: Joe Kirschvink, John Grotzinger, Andy Knoll, Ann Pearson and Rich Losick. I hope to be as good a mentor and colleague to others as these people have been to me. But probably the most important person I need to thank is my Ph.D. advisor at Caltech, Dianne Newman.

When I came to Caltech from Croatia, I thought I would be a planetary scientist and I started working on atmospheric models of Jupiter. But I was quickly enticed by geobiology although I had had virtually no experience in this area. I decide that one of my Ph.D. qualifying exam projects would be a study of microbial mats.

However, I soon discovered that the project would never work as conceived. As I was describing this revelation during the exam, I was nervous that I would fail, but Dianne started laughing in approval. Not only did I pass, Dianne also wanted me to work with her in spite of my background in physics! From then on I have been fortunate to have Dianne as a terrific mentor and role model. This experience taught me to keep an eye out for people with a non-traditional approach to questions about life and the environment, in keeping both with the vision of the GSA and with the spirit this award.

AGI MEDAL IN MEMORY OF IAN CAMPBELL

Presented to Arthur A. Socolow

Arthur A. Socolow
Retired
Pennsylvania Geological Survey

Citation by Walter A. Anderson

The American Geological Institute (AGI) representing the Geological Society of America (GSA), the Mineralogical Society of America (MSA), the Association of American State Geologists (AASG), and other AGI member societies, select with gratitude Arthur A. Socolow as recipient of AGI's prestigious award, the 2007 Medal in memory of Ian Campbell.

Socolow was born in New York City in 1921 and grew up on a farm in Toms River, New Jersey. He attended Rutgers University, where he received his B.S. degree in geology in 1942. After six months with the U.S. Geological Survey, he served in the U.S. Air Force from 1942 to 1946, with stations in India, Burma, and the Philippines. His geological education strengthened his military duties as a photogrammetrist and air photo interpreter, which benefited his subsequent geological career.

After his military service, Socolow rejoined the U.S. Geological Survey until he entered Columbia University, where he received his M.S. and Ph.D. degrees with a strong background in structural and economic geology, mentored by such distinguished geologists as Walter Bucher and Charles Behre. He served as a professor of geology from 1948 to 1957 successively at Southern Methodist University, Boston University, and the University of Massachusetts. During those teaching years, he also served as a consultant to numerous mining and oil companies in the United States, Canada, and Mexico, as well as four months in Alaska for the U.S. Geological Survey on the Defense Minerals Exploration program.

In 1957, Socolow accepted an appointment as geologist to head up the mineral resources program of the Pennsylvania Bureau of Topographic and Geologic Survey under the well-known State Geologist Carlisle Grey. In 1961, Socolow was named director and state geologist of the Pennsylvania Survey. It was during his early tenure as state geologist that he met Ian Campbell, whom he admired and respected as an outstanding professional geologist, leader, and gentleman. During their long professional relationship, Campbell, as a mentor, influenced Socolow's philosophy and style as demonstrated by his proven public service, broad regional and national contributions, leadership, administrative, and scientific successes.

At the Pennsylvania Topographic and Geologic Survey, Socolow developed and advanced major programs in topographic and geologic mapping, oil and gas research, and environmental studies. His topographic mapping program met great success with the completion in 1973of the 7.5 minute series for Pennsylvania, one of the first states to have such complete coverage. Intensive geologic mapping was done under Socolow's supervision, resulting in a new state geological map compilation that comprehensively presents the complex geology of Pennsylvania to geologists and non-geologists alike. Socolow was always pushing the envelope for new and better ways of producing geological products and providing services to the user community. Under his directorship, the Pennsylvania Survey was a leader in applying natural resource information to environmental concerns when it was not particularly popular among more traditional survey programs. Art knew, however, that with the emergence of environmental concerns and regulations, a new group of user material needed to have understandable natural resource data in order to make better and more reasonable decisions. As Ian Campbell was a strong advocate for environmental education, the Pennsylvania Survey was one of the first to develop public education and outreach programs oriented to land-use, economic, and environmental needs. Socolow's efforts on public education were a natural when one considers the years of service that he gave to the American Association for the Advancement of Science (AAAS), and the American Association of Geology Teachers (AAGT) who gave him the Ralph Digman Award for contributions to the academic community, intercollegiate-public geological field trips, and other forms of outreach.

Socolow has authored over 100 papers and publications and is an active member of some 14 professional societies. Most notably, he served as councilor of GSA, president of AASG, chairman of the North American Commission on Stratigraphic Nomenclature, and president of the Geology Section of AAAS.

As for the AASG, Art Socolow's leadership skills and his persuasive yet genial approach to his work brought him to the helm of the organization in 1977. During that time period he instituted the important Liaison Committee with the purpose of meeting regularly with the leadership of federal agencies and directly with members of the Congress to ensure that appropriate geologic information was used in the development of sound national policy. The nation as a whole has benefited from this effort. The AASG is currently a sponsored member of AAAS because of the diligent efforts of Art Socolow.

Socolow is strongly devoted to, and mutually supported by, his talented family: Edith, his wife of 58 years and a recognized artist, and sons Carl, Roy, and Jeff, who are established professionals in photography, hydrology, and medical research, respectively.

Art's life-long dedication, achievements, and consistency to the geologic profession through his public service are fitting for recognition with the prestigious Ian Campbell award.

Response by Arthur A. Socolow

I thank my good friend Walter Anderson for preparing the comprehensive and gracious Citation. Walter is responsible for much attention given to New England geology. I accept the Ian Campbell Award established in recognition of his scientific contributions and his unique ability to relate geology to the interests and needs of the public.

I chose geology as a profession in recognition of its historic role in influencing the activities of mankind starting with the Stone Age, then the expansion of man's geography, development of resources, establishment of trade routes, colonization, and sadly, strife among nations.

I met Ian Campbell at a number of meetings. I was impressed with his breadth

of knowledge and especially his ability to communicate with professionals and the public. An outstanding scientist, he was also the consummate gentleman. I am truly honored to receive his namesake award.

I thank the selection committee for choosing me and I am especially proud to join the 26 member list of distinguished geologists who previously received the Campbell award.

It is most appropriate for AGI to sponsor the Campbell award in view of AGI's historic role in expounding and coordinating America's geologic activities. I recall an AGI sponsored meeting decades ago in Duluth where we prepared a volume to assist in the teaching of geology.

I must thank my wife and my three sons for supporting my interests and especially for putting up with my frequent absences from home when I was attending another (and yet another !) meeting.