RIP RAPP ARCHAEOLOGICAL GEOLOGY AWARD

Presented to Norman Herz

Norman Herz
Professor
University of Georgia

Citation by Scott Pike and Ervan Garrison

It would be wrong to say that this year's recipient of the Rip Rapp Award in Archaeological Geology has always wanted to be an archaeological geologist. Don't take this wrong, but who had? Even by the time he entered graduate school, no one had had the debate yet on whether "archaeology" should qualify "geology" or "geology" should qualify "archaeology." The two disciplines were worlds apart. Even in his first foray into the interdisciplinary world of archaeological geology in the 1950s, our awardee had no idea that his work with the renowned late archaeologist W.K. Pritchett was going to be a major watershed event towards the integration of the natural sciences into classical archaeology. This is not to say our awardee did not have vision or direction. He certainly did. Just as it took Odysseus twenty years to return to his home, it took our wayward traveler nearly two decades to return to academia, leaving the world of hard rock geology at the USGS to take on the Chair of the Department of Geology at University of Georgia.

It was at Georgia that our friend, mentor and today's honoree, Norman Herz, established himself as a preeminent visionary in the nascent field of archaeological geology. Looking to discriminate between the many sources of ancient white marble in the Mediterranean, Norm worked to find an analytical technique that was at one end objective and at another end required very little sample. Norm found that technique by delving into the measurement of carbon and oxygen stable isotopes. From the late 1970s through the 1980s, Norm went on "arduous" expeditions to collect multiple samples from the important ancient marble quarries in Turkey, Greece and Italy. Working alongside archaeologists and art historians, Norm was able to show that many quarries had unique stable isotope signatures. Norm was able to assign provenance to many marble artifacts and address important questions regarding the use, trade and quarrying of this important ancient resource. Norm has consulted on numerous projects including studying the marble sources of various temples and monuments at sites such as ancient Olympia, Bassai, the Athenian Agora, and Delos. He has worked closely on collections from the British Museum in London, the Ny Carlsberg Glyptotek in Copenhagen, The National Gallery in Washington DC and the Metropolitan Museum of Art in New York. Norm's work has been published in over 200 articles. Norm's exhaustive work and his willingness to share his data has resulted in his stable isotope database for Mediterranean white marbles being referenced by researchers throughout the world.

In December, 1986, a Penrose Conference, the first devoted to archaeological geology, was held on St. Simons Island, Georgia. It was organized by Charles Vitaliano, of Indiana University and, our awardee, Norman Herz. The official conference title was "Archaeological Geology: Environmental Siting and Material Use." Fifty-four invited participants, including the namesake of our award, George "Rip" Rapp, were in attendance. The presentations and discussions at this landmark conference, led to the shaping of the discipline we call archaeological geology today. It is a tribute to Norm's vision, and credit, that he was a key arbitrar in the modern definition of our field.

Later, in 1988 Norm spearheaded the organization of the Association for the Study of Marbles and Other Stones used in Antiquity (ASMOSIA). Along with his colleague Marc Waelkens, Norm convened a NATO-sponsored Advanced Research Workshop (ARW) in Tuscany, Italy. This was the first ARW devoted to the Archaeological Sciences in the International Scientific Programmes of NATO. At this first meeting, Norm was elected President. There have now been eight international ASMOSIA conferences bringing together a truly interdisciplinary group of scholars including geochemists, geologists, chemists, physicists, statisticians, archaeologists, museum curators, art historians and others who share research interests and perspectives on ancient stone. By maintaining a single session format the ASMOSIA meetings promote a true interdisciplinary exchange of ideas and research between scholars from diverse academic backgrounds. Since that first meeting of 53 participants, ASMOSIA's membership has grown to over 300 from over 23 countries. The continued success of the biennial ASMOSIA conferences is an excellent testament to Norm's vision and leadership in fostering interdisciplinary research. Norm saw the need for true collaboration across academic fields long before multidisciplinary and interdisciplinary became the buzzwords they are today. The proceedings of each conference have been published and can now be found in archaeology and classics library collections around the world. Norm was re-elected President several times and in 2000 he was elected Honorary President.

Norm's dedication and service to classical archaeology is well renowned. In 1985, the *American Journal of Archaeology* celebrated its one hundredth anniversary. In a review of the stewardship of Ashton Sanborn as editor, only two articles were cited as "significant events". One was the aforementioned paper by Herz and Pritchett in 1953 which "raised issues that have continued to be of interest to scholars in many specialties, and only recently have sophisticated laboratory techniques begun to answer some of the vexed questions of marble identification." Four years later, in the January-February special issue of *Archaeology* dedicated to "Archaeology in the 21st Century," George F. Bass, then president of Archaeological Institute of America, further recognized that Norm was the "first to apply his geologic knowledge to archaeological problems." Norm's international reputation was further enhanced where, in 1988, he was invited to be the keynote speaker at the 18th International Symposium of the International Association of Engineering Geology where the focus of the conference was on the engineering geology of ancient works, monuments and historical sites. In 1995 the classical archaeology community recognized Norm's contributions to archaeology by awarding him the prestigious Pomerance Award for

Scientific Contributions to Archaeology of the Archaeological Institute of America.

The recognition of Norm's achievements just don't come from the archaeological community. During his tenure with the USGS, Norm spent six years in Brazil as a research scientist studying the country's mineral deposits. Not only did he learn the Portuguese language, he made a significant impact within the Brazilian scientific community. This is reflected by his election in 1981 as a Foreign Associate of the Sao Paolo State Academy of Science followed by his election in 1991 as a Foreign Member of the Brazilian Academy of Sciences.

Norm's great success is further mirrored by his ability to win funding for what was once considered non-traditional research. Organizations that have valued and supported Norm's research include the National Endowment for the Humanities, the National Geographic Society, the National Science Foundation, the Samuel H. Kress Foundation, the American Philosophical Society, the NATO Science Committee and the National Research Council/National Academy of Sciences.

Norm's true nature as a Renaissance man is further exemplified by his recently published historical book *Operation Alacrity: The Azores and the War in the Atlantic.* The book recounts the top secret operation that led to the construction of an Allied airfield in the Portuguese-controlled and therefore neutral Azores island chain that may well have changed the course of World War II. Norm took part in the operation, but until his research he was unaware of the stakes of his mission. The book has won awards including the 2005 Book of the Year by the *Portuguese Tribune*.

Despite the accolades that are due him, perhaps Norm's greatest strength is his humility and willingness to share. He has a biting sense of humor and is respected by colleagues throughout the world. Erv Garrison, his co-author on his 1998 Oxford University Press textbook, entitled "Geological Methods for Archaeology", and contributor to this citation, recalls how easy it was to work with Norm on something as difficult as a co-authored textbook. They say if a marriage can survive building a house, then, by analogy, the same should be said of friendships and writing textbooks. Norm and Erv remain the best of friends and present-day colleagues at UGA.

Personally, I give Norm the credit or is it blame for my own professional trajectory. I remember vividly during my first year in graduate school walking down the sidewalk in front of the UGA Law School and running in to Norm. The conversation went something like this: "Hi Scott. I was wondering. I have a project for you if you're interested. Do you want to go to Greece?" Despite all his achievements Norm is generous and modest. He seeks to involve new scholars and averts seeking credit and accolades for himself. In fact, I was a bit nervous nominating him for this award as he would have to sit through this hazing ceremony. And even though I have only given you a small excerpt of his accomplishments you get the idea that this award is almost overkill so I will stop talking and give Norm his chance for rebuttal.

Response by Norman Herz

On July 19, 1788 Thomas Jefferson representing our new nation in Paris, then in an intellectual ferment with startling new scientific concepts such as the origin of volcanoes, the principles of crystallography and the origin of the solar system wrote to the Reverend James Madison back in Virginia: "As you seem willing to accept the crumbs of science on which we are subsisting here, it is with pleasure I continue to hand them on to you …"

I was very fortunate to have worked with some great archaeologists and geologists who handed down enough 'crumbs' to enlighten and inspire me throughout my career. Thanks to them I am here today and so in their names I am proud to accept this great honor, the Rip Rapp award in Archaeological Geology.

With the end of World War II which effectively cut short a career as an Air Force 2nd lieutenant I entered the Johns Hopkins University. There I fell under the influence of Professor Ernst Cloos, one of the great structural geologists of the past century. His good friend Professor Homer Thompson of the Princeton Institute for Advanced Study was director of the excavations of the Agora in Athens where, he felt, a geologist was needed to work along with the archaeologists. Thompson despaired of finding anyone, having been rejected by geologists and geology departments at Princeton and elsewhere who could see no possible geological good to come out of such a project. Thompson proposed the idea to Cloos, adding that only a *'rara avis'* would accept the assignment. Cloos decided that I qualified as a rare bird and so in 1951 off I went with a Fulbright to Greece to see if a geologist really belonged on a dig.

In Athens I worked on different projects, many designed to show archeologists how a geological approach might help answer some of their most difficult problems. I was fortunate to work also with Professor William "Ken" Pritchett a great classicist then also at the Institute for Advanced Study and later head of the Classics Department at Berkeley. Together we wrote a paper promoting geological applications to archaeology and published it in 1953 in the American Journal of Archaeology. It turned out to be a landmark publication, cited in the AJA when in 1985, it celebrated its hundredth anniversary. In a review of the stewardship of Ashton Sanborn as editor, only two articles were cited as "significant events". One was our 1953 paper *"which raised issues that have continued to be of interest to scholars in many specialties, and only recently have sophisticated laboratory techniques begun to answer some of the vexed questions of marble identification"*.

This exciting start in classical archaeogeology was quickly cut short, followed by 18 years with the USGS as a hard rock research geologist, 8 of which were spent in Brazil. Then in 1970 I accepted a position as department head at the University of Georgia, and settled in to a new life in academia. Several years later came the siren's call from Pritchett to return to Greece now that I was free of governmental obligations and resume a career in archaeogeology. He posed an interesting problem: many fragments of ancient Greek inscriptions on marble he felt had been joined incorrectly following epigraphical rules—according to the joiner—and not paying attention to the physical features of the stone. Could I propose a physical test to check the association of the pieces using a method which needed only milligram-size samples?

Stable isotopic ratio analysis was tried and worked beautifully. The results appeared in an article co-authored with Dave Wenner in Science in 1978, "Assembly of Greek Marble Inscriptions by Isotopic Methods" which proved to be another landmark publication; it was translated and published in the French Encyclopedia Universalis. I was now convinced that much could be done working with archaeologists, that geochemical methods especially stable isotope analysis might help resolve the most intransigent problems of provenance and authenticity of stone and metal artifacts. Today such analyses have become routine, databases have been accumulated, analytical equipment has been perfected and is widely available, and numerous researchers and laboratories are actively using isotope geochemistry to help solve archaeological problems.

I have also had a large measure of success disseminating "the crumbs of science" encouraging cooperation between scientists and archaeology. Among my proudest achievements are establishing a flourishing program in Geoarchaeology at the University of Georgia, organizing the Center for Archaeological Sciences which brought together members of the UGA departments of Geology, Geography, Anthropology, Classics, and Art History, and helping to start ASMOSIA, the Association for the Study of Marble and Other Stones in Antiquity, an international society of archaeologists, museum people, scientists, and others working together cooperatively.

Again I thank the GSA for this great honor, as well as my mentors for pointing out the way. I cannot conclude without acknowledging a great debt of gratitude to my colleagues and students for their encouragement and assistance which made the way both much easier and more enjoyable.

GILBERT H. CADY AWARD

Presented to Andrew C. Scott

Andrew C. Scott
Professor
Royal Holloway, University of London

Citation by John C. Crelling

This year's recipient of the Gilbert H. Cady Award is Professor Andrew C. Scott of Royal Holloway College of the University of London, England. Andrew has been conducting research in coal geology for almost thirty-five years during which he has published over 180 papers including five books. His research creatively combines aspects of paleontology, especially paleobotany, coal petrology and geochemistry in answering important questions in coal geology. He has made major research contributions in the understanding of ancient terrestrial ecosystems including the role of fire in the fossil record, the ecology and evolution of Carboniferous vegetation, the taxonomy and evolution of lycopsid megaspores, plant-arthropod interactions in the fossil record, the taphonomy and preservation of plant fossils, the formation of fossil fuels, including studies of oil source rocks, and he has developed and applied a range of microscopical techniques to the study of fossil plants, including the use of scanning acoustic and scanning laser microscopy.

His research has shown that the plants found in rocks overlying coal seams were often different from the plants that formed the coal seams themselves. His research on fossil plants, especially on paleoecology and taphonomy, including studies on the origin of coal balls, has improved our understanding of the evolution of coal-forming vegetation through time. His most significant contribution is that he has settled the long-standing questions on the origin of fusain and inertinite macerals. He has shown that fusain is really fossil charcoal and that its reflectance is a function of the temperature of its formation. He has also used this relationship to provide data for volcanologists on the temperature of the deposits from pyroclastic flows. Professor Scott's work crosses the traditional boundaries of Geology, Botany, Chemistry, History and Art. Recently he has published a catalogue of 17th century geological drawings from the Royal Collection, the volume of which was launched by Prince Charles at Windsor Castle. This was the work of Federico Cesi and members of the Accademeia dei Lincei and concerned the origin of fossil plants and lignites.

Professor Scott has been an invited speaker at a number of international symposia and conferences. First at Chelsea College of the University of London and then at Royal Holloway he has taught courses in stratigraphy, paleontology, sedimentology, terrestrial paleoecology, and coal geology. He has been the principal research advisor to twelve Ph. D students and numerous undergraduate students and post-doctoral assistants and fellows.

His service includes organizing numerous research conferences including successful international coal conferences as well as editing important volumes of invited contributions. His editorial work also includes serving on the editorial boards of the *International Journal of Coal Geology* and *Palaeogeography, Palaeoclimatology, Palaeoecology* and previously on the *Journal of Petroleum Geology*. He also has communicated coal science to the general public with regular public lectures, radio broadcasts on BBC and in the production of an Open University video for television on his work as a coal geologist. Perhaps more significant is his efforts in the creation and participation in the "Science and the Media" program (now called "Science Communication") at Royal Holloway where students are taught and given practical instruction about communicating science to the public and colleagues.

In summary, Professor Andrew C. Scott has made outstanding significant contributions in the field of coal geology and he is clearly worthy of recognition with the Gilbert H. Cady Award.

Response by Andrew C. Scott

Firstly, I would like to thank Jack Crelling for his kind words and secondly the Coal Section of the Geological Society of America for the honour of presenting me with the Gilbert H. Cady Award. I feel particularly proud to be the first Briton and only the second non-North American to receive the award. I am also pleased as Cady spent some time at Yale University where I have just spent a sabbatical year as visiting Professor.

I think that coal geology must be in my blood as many past generations of my family worked in the coal mines of Scotland. While undertaking a coal project for the Royal Scottish Museum in the Douglas coalfield near Coalburn, I spent some time researching my family history in the nearby village of Lesmahagow in Lanarkshire. My family had lived there from at least the mid 17th century until my father left at the start of World War 2. I discovered that my great- great grandfather, great grandfather and grandfather had all worked the coal in the exact area I was researching and that the family home of 1841 was on the edge of the opencast mine. I was thrilled by this connection and published some of my work on the coals in 1999. Who says that coal does not run in the genes?!

I was introduced to geology by a family friend at the age of nine and was encouraged by my uncle Robert Fraser, a coal miner himself. As a schoolboy I was enthused to study geology at London University by Ted Rose, and he not only became my teacher but later a colleague at Royal Holloway. Bill Chaloner introduced me as an undergraduate to fossil plants and I followed on as a PhD student under his guidance. I am pleased that he is now emeritus Professor in the Geology Department at Royal Holloway. There are many that I would like to thank: those with whom I have worked and of course my many research students. I would like especially to mention a few: Margaret Collinson, who has been a friend and co-researcher since we were research students together and who is now a colleague of mine at Royal Holloway; Jean Galtier, who collaborated with me on many papers; John Calder, who gave me the chance to work at Joggins and who has always supported my multi- and inter-disciplinary approach to coal geology; Jon Gibbins who introduced me to the industrial aspects of coal and Ian Glasspool who has been my PhD student, post-doctoral research assistant and now collaborator for the last few years. I also thank my wife Anne and my family for their long-suffering support, enabling me to indulge my various geological passions!

My interest in coal geology, palaeobotany and charcoal from wildfire was kindled in my first month as a PhD student, working on charcoalified plants from the Carboniferous Coal Measures of Yorkshire. I was fortunate to discover the earliest conifer and only after a year of my studies had a paper published in Nature. I should have realized that publishing in Nature is not that easy, as it has taken 33 years for me to have another one published recently, on the Cobham lignite, which spans the Paleocene-Eocene boundary!

My combined interest in coal and palaeobotany was to have another unexpected benefit. I was invited by a member of the Royal Household to come to Windsor Castle to examine some early 17th century drawings of 'lignites' from the Queen's Royal Collection. I was asked to write a catalogue of nearly 200 drawings made by Prince Federico Cesi, the Duke of Acquasparta and founder of the Accademia dei Lincei. When I initially saw the drawings, mainly of fossil woods, it was not possible to identify much. However, in the collection there were also the oldest known field sketches of the fossil localities. Over the next seven years I managed to relocate the sites in Italy and re-collect fossils. This enabled me to make sense of the drawings made for this ancient study to understand the nature of fossils. This project indulged my interest in geology, history and art all at the same time! Some of the sketches showed plumes of smoke rising from the ground and in contemporary correspondence it became clear that these were from underground coal fires! I was honoured that Prince Charles launched the book at Windsor Castle in 2001.

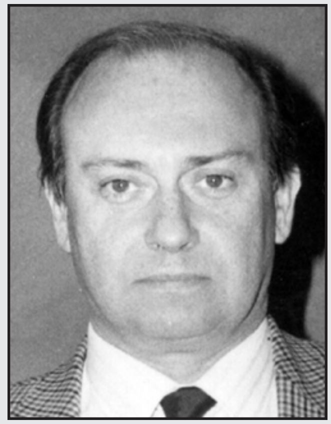
Marie Stopes, one of my heroines, was the only other lecturer at London University to be interested in palaeobotany and coal. Like her, I worked initially in palaeobotany. Like her, I became interested in and published on the origin of coal balls. Like her, I then became interested in coal and in coal petrology. However, Marie Stopes is probably best known in Britain for her work in setting up birth-control clinics, which still today carry her name. I can assure you that I do not plan to follow in that line of work!

I am a passionate believer in a holistic approach to the study of coal and coal geology, integrating petrology, sedimentology, palaeontology and geochemistry and I am pleased that this aspect of my work has been recognised by this award.

Again I thank you for this honour that you have paid me.

E.B. BURWELL, JR., AWARD

Presented to
Fred G. Bell and Laurance J. Donnelly



Fred G. Bell
British Geological Survey
Keyworth, Nottingham,
United Kingdom

Laurance J. Donnelly
Chartered Engineering &
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Halcrow Group Limited
Handforth, Cheshire,
United Kingdom

Citation by Allen W. Hatheway

To date, 35 years into the Environmental Era, there has been no comprehensive, single-source summarization of the systematic nature of the geologically-based environmental impacts of mining. This book is long overdue and Bell and Donnelly, with their obvious qualifications, have built their assessment by explaining the physical processes of mining as they affect the environment of the host ground and of the ground upon the mineral process wastes are disposed. They accomplish this in ten chapters, each of which offers the reader a description of the situation and information related to appropriate environmental response. The authors complement one another in nature and breadth of experience. Bell is known for his outstanding command of the literature and of the properties of earth materials, while Donnelly, has had a rigorous career of practice in geology applied to mining, and so adds the dimension of environmental awareness upon the mining industry. The book is well illustrated with images of relevance to the text and with useful maps, vertical sections and drawings, along with appropriate references at the end of each chapter. The reader will be well served who makes use of the text to identify physical and chemical parameters and geologic influences that may be present for individual projects. A special benefit of the book will be to help identify and tabulate special considerations for presentation in competitive consulting-project proposals, so that the reader will be able to show a special understanding to conduct geological planning or remediation in connection with mining.

Mining and its Impact on the Environment, 2006: Taylor & Francis Group, London and New York City, by Fred G. Bell and Laurance J. Donnelly, 547 p., hardbound ISBN 0-415-28644-1

Response by
Fred G. Bell and Laurance J. Donnelly

We were somewhat surprised and obviously highly honoured to receive the E.B. Burwell Jr. Award for 2007. As such, we would like to thank both the Awards Committee and the Engineering Geology Division of the Geological Society of America for conferring this Award on us. In addition, we would like to thank Allen Hatheway for his citation and efforts on our behalf.

Both of us have been professionally involved with mining problems and hazards for many years. Consequently, it was felt that a book on mining and its impact on the environment was needed, firstly, because of the diversity of the different hazards associated with mining throughout the world, and secondly, as far as the authors are aware, there is no book available today that covers this wide range of problems. In other words, no book provides a survey, in particular, of various aspects of subsidence, of waste disposal, pollution, contamination and dereliction as caused by different types of mining, together with their investigation and treatment. In addition, topics such as spontaneous combustion, fault reactivation, mine closures, mine effluents, acid mine drainage, heap leaching, gases, induced seismicity and landslides associated with subsidence also are included within the text. Furthermore, it is felt that many civil engineers, mining engineers, geotechnical engineers, engineering geologists, mining geologists, environmental scientists and managers, hydrologists, hydrogeologists, utilities engineers, builders, mineral surveyors, conveyance lawyers, insurance officers, land owners, and planners are not necessarily familiar with the wide range of ground problems and hazards that arise from or are associated with mining.

Many urban and industrial areas owe their location to the presence of mineral deposits, especially to that of coal that provided the energy and/or acted as raw material. Moreover, many of these areas are undergoing re-development and so those involved with re-development are likely to face some of these mining problems. But mining problems are not just associated with some urban and industrial areas, they can occur in rural areas where minerals are being or have been worked.

Most individuals today are more conscious of their environment than in the past and they are interested especially in those factors that degrade the environment. Mining is one of those factors. Mining refers to the process of extraction or abstraction of mineral deposits from the Earth. In this context, it also involves the abstraction of oil, gas, water and brine from the ground. Furthermore, mining represents one of man's earliest activities reaching back into palaeolithic times and accordingly it has played an important role in the development of civilization. As technology has developed, so mining has had an increasing impact on the environment. What is more, mining, although obviously highly localized, is an activity that has and is going on more or less worldwide. With time, the use of minerals has increased in both volume and variety in order to meet a greater range of purposes and demand by society. Hence, present day society is more dependent on the minerals industry than in the past. In fact, it can be claimed that every material thing in society is either directly derived from a mineral product or is produced with the aid of mineral derivatives such as steel, energy or fertilizers. Indeed, the exploitation of minerals is fundamental to society now and will continue to be in the future. In other words, the mining of minerals contributes to the sustained economic progress of developed nations, and helps to alleviate poverty and improve the quality of life of people in developing countries.

It is the working and processing of mineral deposits that gives rise to environmental damage. This can mean that land is disturbed, that the topography is changed and that the hydrogeological conditions are affected adversely. However, the degree of impact that mining has on the environment varies depending on the mineral worked, the method of working, and the location and size of the working.

In the past the mining industry frequently showed a lack of concern for the environment. This does not necessarily imply that society was not aware of the environmental problems that could be associated with mining. For instance, Agricola (1556) referred to environmental problems created by mining such as the devastation of fields and the pollution of streams. Today, however, the greater awareness of the importance of the environment has led to tighter legislation being imposed by many countries to lessen the impact of mining. This is especially the case in the developed, more affluent nations. Unfortunately, many poorer countries, in which the primary minerals industry is proportionately of greater economic importance, are reluctant to impose non-essential restrictions on their principal earners of wealth and foreign exchange. What is more, the concept of reclamation of a site after mining operations have ceased, has become entrenched in law in the developed countries. An environmental impact assessment is necessary prior to the development of any new mine and an environmental management programme has to be produced to show how the mine will operate. Plans for reclamation of the mine site have to be made. Although the adverse impacts on the environment should be minimized, some environmental degradation due to mining is inescapable. Land that has become derelict or blighted by past mining activity can be reclaimed. Mining therefore can be looked upon as one of the stages in the sequential use of land.

Mineral deposits represent a finite resource, when they become exhausted or uneconomic to work, then the associated mines close. Hence, mining also can have social impacts on the environment in that communities grow up around mines and can suffer, and even may die, when the mines close. Nonetheless, land that has become spoiled by mining activity generally can be rehabilitated but at a cost. This cost may be recovered indirectly by the benefit that a more attractive environment brings to the area so affected.

Consequently, the primary objective for writing this book was to provide an overview of various aspects of mining and how they affect the surrounding environment, and, just as importantly, how they can be investigated and subsequently dealt with. As such, it is hoped that it will be of value to those who are involved with the development or redevelopment of mining areas throughout the world.

Finally, we would once again like to express our sincere appreciation to the Geological Society of America and the Engineering Division for this prestigious E.B. Burwell Jr., Award.

GEORGE P. WOOLLARD AWARD

Presented to Alan Levandar

Alan Levandar
Professor
Rice University

Citation by Eugene D. Humphreys

Alan brings to the investigation of the Earth a combination of an industry-based technical perspective and a science-based desire to discover the undiscovered, find the fundamental and seek questions not previously asked. His accomplishments are derived from an effort to make real progress in Earth science and this runs through all of his efforts, whether they involve developing new ways of analyzing data, imaging the Earth, defining new directions for science, or serving a leadership position.

Much of Alan's scientific research is aimed at revealing structural aspects of the Earth. Representative works include: imaging crust and mantle structure of many orogenic settings (e.g., Alaska, California, Venezuela, Rocky Mountains); imaging environmental sites; developing the wave propagation code now widely used; developing stochastic methods of scattering imaging, and developing migration methods for teleseismic waves to image the upper mantle. More than just a list, what is seen throughout this work is a motivation to image physical structures authentically and address the underlying processes from which the structures originated.

Alan pursues the goals of resolving Earth structure with vigor and rigor. If progress requires organizing the larger community, he directs his abundant energy toward this. For instance, reflected in his publications one will find: early (perhaps initial) large off-shore on-shore investigations; organization of the Deep Probe investigation of the U.S. and Canadian Rocky Mountains (longest refraction experiment in recent history); pioneering efforts in applying industry techniques to crustal imaging; and he is now involved in developing imaging methods that integrate diverse seismic data types into a self-consistent image. This latter effort includes bringing people together, as in various collaborations and workshops, or as in the long effort toward developing a facility to image continental crust at a continental scale; among other things, USArray, and hence its outgrowth EarthScope, trace their roots back directly to these efforts. I can say with certainty that it was Alan's confidence and persistence that kept the idea of USArray alive for years until NSF finally picked up the idea. All this illustrates a persistence, patience and eventual success of a single individual that I've not seen elsewhere. His overall influence is such that it is difficult to imagine the state of lithospheric imaging or understanding of continental processes if one were to remove Alan's influence on the field over the last 15 years; his influence in many realms has brought our science forward, oftentimes in fundamental ways.

On a more personal note, I add that I've seen many people in our field who have made strong and important contributions in a wide variety of ways. Among them, Alan's ambition for accomplishment, joy of collaborative effort and a pleasure in taking, sharing and reflecting credit stand out for the breadth of success fostered and resulting significance to our field and those of us within it.

For these reasons, I am proud and happy to see Alan Levander receive the George Woollard Award.

Response by Alan Levander

First I'd like to thank Gene Humphreys for his generous words about my career, and I'd also like to thank the GSA and particularly the Geophysics Division for the George P. Woollard Award. Geophysics is a small part of a very large discipline, yet we have an unusual level of influence on the Earth Sciences if not on the GSA as an organization: Where would Earth Science be without geophysics for subsurface illumination, and equally important, where would geophysics be without geologists to keep us honest?

I'm honored, and of course pleased, to receive this award. To a large measure the pleasure comes from knowing most of the people who have received the Woollard Award in previous years. The first recipient of the Woollard Award was George Thompson, who was on my dissertation committee. The second, Manik Talwani, is a long time colleague at Rice, and last year's recipient, Ken Kodama, was a fellow student in graduate school. Among other Woollard recipients are five people I have collaborated with, some I've served on committees with, and all but two I've met at various times. I've explored Alaska with Walter Mooney, traversed most of the Rockies with Randy Keller and Ron Clowes, and I've surfed in La Jolla with Dave Sandwell. It's both gratifying, but also humbling to be included in the company of such an exceptional group of scientists and people.

Someone I never met was George Woollard, although I roughly knew his contributions from references in my introductory geophysics texts. From web research I learned that he taught at Princeton, and moved to the University of Wisconsin at Madison in 1949. The UW-Madison Geology and Geophysics webpage gives him given credit for founding the geophysics program there. In 1963, he moved to Hawaii, where he became the first director of the Hawaii Institute for Geophysics. Among other things, Woollard established a standardized international gravity network, and an Antarctic geophysics program. He received a Guggenheim fellowship in 1941, and has a mountain named for him in Antarctica, Mt. Woollard. In 1943, he published a paper in the *GSA Bulletin* entitled: *Transcontinental Gravitational and Magnetic Profile of North America and Its Relation to Geologic Structure.*

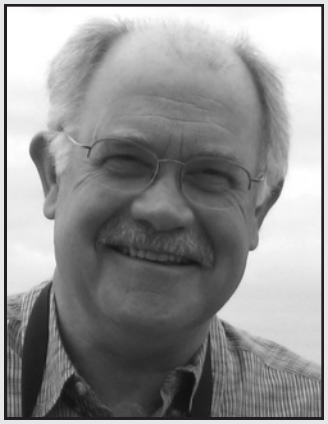
Imagine doing a transcontinental geophysical survey in 1943! Even a trip across the country was a major undertaking then, much less with delicate geophysical equipment. This contribution might be considered the potential fields forerunner to EarthScope.

My wife Caroline, who is an English professor, thinks that Earth scientists as a group are very nice people. Despite the fun of field work, I think that there is something both challenging and humbling about having to gather your basic data by traveling around on the surface of the Earth, even with today's transportation and communication systems. I think that the difficulties associated with field work make Earth scientists a bit unusual in the academy. The weather can be miserable, the mountains are steep, the wildlife and indeed the natives can be unfriendly, the equipment fails, vehicles break and crash, and one can just lose heart at times. I think that all of this makes Earth scientists both more pragmatic and more appreciative of their colleagues' efforts than one might find in other fields. Now that we are engaged in the EarthScope endeavor, I'm confident that we have the community élan to fully realize its potential.

As a group I'd like to thank you for this honor and the pleasure of working in Earth science. I'd again like to thank my long-time friend Gene Humphreys. In closing I'd especially like to thank my wife Caroline, who didn't quite know the boundary conditions associated with marrying an Earth scientist, but has shown remarkable patience and understanding along the way, and has always been an inspiration to me.

MARY C. RABBITT HISTORY OF GEOLOGY AWARD

Presented to Kenneth L. Taylor



Kenneth L. Taylor
Professor
University of Oklahoma

Citation by Kennard B. Bork

It is a distinct personal pleasure to recognize Dr. Kenneth L. Taylor as the 2007 recipient of the Mary C. Rabbitt History of Geology Award. As Oklahoman Will Rogers might say, "Better a Sooner than later."

Although associated with the University of Oklahoma throughout his professional career, Ken was born in Los Angeles -- hence the laid-back demeanor. He was educated at Harvard for all three degrees (bachelors, masters, and Ph.D.). Of course, you can always tell a Harvard man -- but you can't tell him much. His doctoral advisers were I. Bernard Cohen and Everett Mendelsohn, giants in the discipline of history of science. Ken's dissertation focused on Nicolas Desmarest (1725–1815) and his impact on French geoscience and technology.

The discipline of history of geology was in its American infancy in 1969 when elements of that dissertation were published in Cecil Schneer's seminal book Toward a History of Geology. "Geology in 1776" was the title of another valuable Taylor paper, incorporated into Schneer's Two Hundred Years of Geology in America (1979). Unlike some reprobates (yours truly is a case in point), Prof. Taylor stuck to his early research topics of Desmarest and French geoscience in the 18th century. The result has been a strong and coherent body of work, published in premier journals and in the Dictionary of Scientific Biography, and presented at conferences around the world. Ken's work has illuminated a people and a period. His 1985 paper on "Early geoscience mapping, 1700–1830" represents a pivotal statement on that important topic. Recently, he has worked with his Ph. D. student, Kerry Magruder, as they analyzed theories of the earth and the evolution of geology from 1450 to 1789. As Prof. Claudine Cohen, of the École des Hautes Études in Paris has noted, Ken Taylor's world-class work has helped us understand a 'crucial and complex moment when speculative Theories of the Earth gave birth to scientific geology.' As of 2007, a collection of Ken's pivotal papers is now part of the Ashgate Variorum series.

Trained as an historian, Ken is also a Fellow of the Geological Society of America. Many of you will remember when he co-chaired the well-received 1994 Penrose Conference on "From the Inside and the Outside," which looked at how historians and scientists can work to bridge the chasm between their disciplines. In 1999, Ken chaired GSA's History of Geology Division. Over the years he has served us well in his various capacities within the History of Science Society (HSS), the History of Earth Sciences Society (HESS), and the International Commission on the History of Geological Sciences (INHIGEO). In the early 1980s, Ken was Treasurer of HESS and I was Secretary; in the late '90s he chaired the GSA Division and I was President of HESS, as we worked together to make HESS an Associated Society with GSA; and currently Ken is the INHIGEO Vice-President for North America, while I am the Secretary-General. Thus, our careers have overlapped to an interesting degree—and I can report that working with Ken is an absolute pleasure.

When speaking of working with institutions and people, we must not forget that Prof. Taylor chaired the Department of History of Science at the University of Oklahoma, from 1979 through 1992. That Ken successfully pursued research and service-to-the-discipline chores while heading Oklahoma's stellar program is significant. A noteworthy encomium was given by a colleague, who said that, "he wore authority well." Innumerable students profited from his undergraduate teaching and Ken also mentored about a dozen doctoral students. A colleague reports that despite his wide reputation as a scholar, Ken never neglected the department or students at Oklahoma. The University of Oklahoma has recognized his gifts with teaching awards and a Torchmark Presidential Professorship. Beyond Oklahoma, Ken's hard work and abilities have been recognized in a variety of ways. He was a Dibner Visiting Historian of Science (1990–91) and he received the Sue Tyler Friedman Award of the Geological Society (London) in 1998.

Aside from the scholarly productivity and awards received, a key component of Ken's persona is that working with him is so pleasant. Betty Bellis, who typed his Ph. D. dissertation back in 1968, recently made the point that he was then, and is now, a fine individual and a joy with whom to work. Kerry Magruder shared the 18-page file of verbal applause heaped upon Ken at his retirement ceremony in May 2006. Recurring themes are integrity, wonderful mentoring, and responsiveness. When a student says that you are "one of the most civilized people I know," it is evident that a positive impact has been made. In our voluminous contacts over almost four decades, I would concur with all of those assessments. Given the data presented above, I suggest that the empirical evidence is in—nice guys can finish first.

It is a pleasure to recognize Kenneth L. Taylor as GSA's winner of the Mary C. Rabbitt Award for 2007.

Response by Kenneth L. Taylor

I am very proud to receive the Mary C. Rabbitt Award. I thank the GSA, the History of Geology Division, the Division's officers and the members of the award panel. I am honored, and delighted, to have my name added to the list of distinguished contributors to scholarly work in the history of geology who have won this award since it was inaugurated 25 years ago.

My own path into investigation of geology's past was a bit indirect. Something I learned in college was to put aside my juvenile prejudice to the effect that the only truly respectable fields of knowledge are the natural sciences and mathematics. I think I must have been looking for ways to link the methodological rigor and spirit of discovery characteristic of the sciences, with the concern for big questions about human values and choices attended to in the humanities and social sciences. So I was happy when I found out that Harvard's History of Science department offered a program allowing students to fuse together science and history in a bachelor's degree package, without too much discernible concern about how the parts fit together. To the surprise of nearly everyone, including myself, I was allowed to continue this experiment in multi-disciplinary education in the department's graduate program.

Although I have only a dim memory of how I decided to pursue research in the history of geology, I am quite sure about two personal motivations lying behind this choice. One was that since childhood I had always been fascinated by maps and geography, by the realization that terrain can be represented and interpreted. The other lay in the fact that, although I lacked formal geological training, I had an inordinate fondness for exposed rock masses like my home state's Sierra Nevada, and the Alps, and had picked up some bits of knowledge about mountain ranges. This arose through my experience in mountaineering, to which I was passionately if quite amateurishly dedicated. In any case, I admired what I knew about the perspectives afforded by geological science, and was keen to find out more about how these perspectives had been formed.

I owe a lot to the facts that the Harvard graduate program in History of Science was a flexible one, and that my teachers there—especially my undergraduate tutor George Basalla, and professors Bernard Cohen and Everett Mendelsohn—chose to have confidence in me notwithstanding plenty of reasons for doubts. It did not matter that Cohen and Mendelsohn worked mainly in the history of physics and biology; I could pursue geology's past if I wanted, and was encouraged to do so. Perhaps the most telling example of the doctoral program's flexibility in my case is the abrupt change of direction I was permitted to take in my third year, shortly after general exams. It had been understood that the sphere of my interest was to be the United States. My undergraduate honors thesis had been on American scientific exploration overseas in the mid-19th century, and most of my History Department course and seminar work had been in American history. As I look back on it, my mentors ought to have been alarmed, or even indignant, when I told them I thought it would be more interesting instead to work on this 18th-century French character, Nicolas Desmarest. Perhaps they were, but mild and possibly diverted surprise was the most they showed to me. They just said, well, okay, to do that you'll need to go to France. So they arranged a one-year traveling fellowship in Paris. The more time passes, the more remarkable I think it is that they were so accommodating.

For 39 years until my retirement a year ago I taught the history of science at the University of Oklahoma. This meant teaching comprehensively, as regards both subject matter and level of instruction. History of geology as such actually occupied only a modest place in my teaching experience. On the whole this was fine with me since I always preferred to consider myself a historian of science of a generalist sort, although dedicated in most of my research to early geology. It has been very satisfying to teach, and therefore continually to learn more about, the historical development of the full range of natural sciences in Western civilization across three millennia, from the ancient near east to the present day. Over the years, probably about three-quarters of my teaching time was at the undergraduate level, with students drawn broadly from major fields in over half a dozen of the university's colleges. Even as a director of graduate research in the history of science, I was allowed—or sometimes maybe I simply assumed—a certain breadth. Of the eleven doctoral students I supervised or co-supervised to completion, only three did dissertations that are recognizably about the history of geological science. It is entirely likely that my self-conception as a generalist contributed to my modest rate of productivity in published history-of-geology research; but I think it has both widened and deepened my understanding on all fronts, including that of the history of geology.

Let me say a few things about what I perceive as general patterns and consistencies in the approaches I have taken in my scholarly work. Certainly one consistency is my ongoing interest in Desmarest, on whom I expect to continue working for at least a few years more. My first research on this 18th-century French figure did nothing to call into question his significance as a geological innovator. His reputation as a pioneering field observer was, and is, richly deserved. His proposals for chronological interpretation of volcanic landscapes were indeed novel and influential. However, I did learn some unexpected things, and drew some modestly revisionist conclusions, some of which had historically interesting consequences. The breadth of Desmarest's geological interests surprised me a little. Perhaps my most intriguing discovery was that Desmarest's volcanological investigations never brought him to embrace a comprehensively 'vulcanist' doctrine, indeed he was in certain ways of a resolutely 'neptunist' persuasion. This observation contradicted parts of the standard story-line, in which advocates of those two views were supposed to be clearly differentiated. It also emerged that the seeds of Desmarest's geological career had an even more distant resemblance to modern sorts of geological experience than I had been led to suppose, whereas he had unexpectedly strong affinities with antiquarian scholars. It became apparent that I would need to learn much more about the broader scientific culture in which Desmarest lived, and the community of savants with whom he interacted. My effort to understand the world and work of Desmarest—who, incidentally, was also an important figure in technological and industrial developments of his period—widened into an inquiry into the ideas and circumstances guiding the early growth of geological thought and investigation during his lifetime.

A second persistent element in my work has been my conviction that it is worthwhile trying to examine basic elements of the conceptual worlds of my subjects, the historical characters whose ideas and deeds helped establish the new geological science near the close of the 18th century. This conviction is expressed beautifully in the opening lines of L. P. Hartley's novel The Go-Between: "The past is a foreign country: they do things differently there." As a teacher for almost four decades, I have urged this idea on my students. As a student myself, I have made this idea one of my main historical axioms. Thus, without advocating neglect of historical continuities, I admit to seeing historical differences and discontinuities as particularly important.

It has never been difficult to see my subjects as foreign. They are—geographically, chronologically, and intellectually. To figure out how these foreigners operate it is important (and, usually, fun!) to try to identify the beliefs and rules underlying their conduct. Of course, you have to expect that these characters seldom speak directly about the beliefs and rules guiding their thought. The relevant precepts frequently lurk partly or perhaps wholly beneath the horizon of their consciousness. It is the historian's job to bring them to light. This involves both detective work and exercise of the imagination, and when successful it yields one of the historian's greatest pleasures: getting partway into the mind of a distant figure, making the past a little bit more intelligible. Thus, one of my own rules: Cherchez l'opinion préconçue—seek out the hidden preconceptions standing behind what is puzzling or obscure about the ways your subjects think.

A third point, and the one with which I will close these remarks, is an observation about how—notwithstanding my professional training and identity in history of science as distinct from science itself—I seem to have done a lot of my scholarly work in a milieu that mixes together historians and scientists. My view is that this cross-disciplinary miscegenation is on the whole quite healthy. For one thing, in a thinly-populated field like history of geology, it helps create the critical mass of individuals needed to maintain a lively interchange. Probably more importantly, in my experience historians and scientists who share interests in the past of geological science have much to gain by talking and listening to one another. There is mutual advantage in it; each side has understanding valuable to the other; this serves the advancement of our understanding of geology's past.

The GSA's History of Geology Division is of course one of the leading institutional arenas for, and promoters of, the kind of mutual interchange I am talking about. I am personally indebted to a good many of its members for the help, encouragement, criticism, and advice I have so much needed on so many occasions. I will continue to count on more of the same for, I hope, a long time to come.

Thank you very much for the honor you do me, with the Mary C. Rabbitt Award.

O.E. MEINZER AWARD

Presented to Shaun K. Frape

Shaun K. Frape
Professor
University of Waterloo

Citation by F. Edwin Harvey

It is an honor for me to present Dr. Shaun Keith Frape, of the University of Waterloo's Earth Sciences Department to receive the 2007 O.E. Meinzer Award. For over twenty-five years, Shaun's research has focused on understanding the hydrogeology and hydrogeochemistry of deep crystalline shield rocks and brines and has included the use of major ions, trace metals, stable isotopes and gas chemistry to characterize and trace brine formation and migration. Shaun is a hydrogeochemist, who like numerous other Meinzer Award winning hydrogeochemists such as William Back, Bruce Hanshaw, John Hem, Neil Plummer, and Fred Phillips, applies innovative geochemical tools to understand and characterize complex hydrogeological problems in what can only be described as unique aquifer systems. Cited in support of this award are three of Shaun's seminal contributions related to the hydrogeochemistry of crystalline rocks:

(1) *Water-rock interaction and chemistry of groundwaters from the Canadian Shield,* 1984, Frape, S.K., P. Fritz, and R.H. McNutt, Geochimica et Cosmochimica Acta, 48(8), 1617-1627—which describes his original work related to groundwater-rock interactions within the fractured crystalline aquifers of the Canadian Shield. In this paper, Shaun used a combination of major ion chemistry along with stable oxygen and strontium isotopes to differentiate groundwaters of various origins across the shield and to delineate ion sources during their hydrogeochemical evolution. The paper discusses a number of evolutions histories responsible for the shift of shield brines toward a Ca-Cl end member chemistry, and sets the stage for subsequent research and debate related to brine chemistry and origin that continues today.

(2) *Geochemical trends for groundwaters from the Canadian Shield,* 1987, S.K. Frape and P. Fritz, p. 19-38, in Saline Water and Gases in Crystalline Rocks, P. Fritz and S.K. Frape editors, Geological Association of Canada, Special Paper 33, 259 p.—is part of a classic and highly cited collection of papers edited by Shaun and his colleague Dr. Peter Fritz, describes geochemical trends for groundwaters from the Canadian Shield. This work, documented the stark differences of shield brines from those found in sedimentary basins or hydrothermal environments, and noted a different origin for groundwater and dissolved solutes. Contrary to accepted sedimentary basin brine emplacement theories of the day, the paper suggests an autochthonous salt source and stresses the importance of water-rock interaction in the formation of brine chemistry as evidenced by a lack of non-equilibrium mixing or dilution, and

(3) *The Sr^{87}/Sr^{86} values of Canadian shield brines and fracture minerals with applications to groundwater mixing, fracture history, and geochronology,* 1990, McNutt, R.H., S.K. Frape, P. Fritz, M.G. Jones, and I.M. MacDonald, Geochimica et Cosmochimica Acta 54(1), 205-215—demonstrates the use of $^{87}Sr/^{86}Sr$ ratios to study groundwater in crystalline rocks. This paper presented ratios indicative of water-rock interaction with feldspars, and mixing of brines having different origins as well as mixing with meteoric waters. Subsequent to this paper, this method has become a standard for identifying solute sources and mixing in not only brine studies, but also in studies investigating the origin of salts in regional freshwater aquifers such as the Great Plains (Dakota) and High Plains (Ogallala) aquifers, for example.

Shaun's lifetime dedication to his research has made Shaun one of the world's leading authorities on the hydrogeology and hydrogeochemistry of crystalline rocks. Shaun's dedication and loyalty to his students and colleagues has made him a trusted and valued friend who is routinely sought after for his experience and expertise. Shaun's extensive body of work has unquestionably impacted his chosen field and the direction of research within it. So, these contributions to the hydrogeological community and his research related to the hydrogeology and hydrogeochemistry of crystalline rocks as demonstrated in, and represented by the cited publications that have unquestionably impacted and altered the way scientists study groundwater flow in crystalline rock environments, it is my distinct pleasure to present to you my good friend, this years GSA Hydrogeology Division O.E. Meinzer Award recipient, Dr. Shaun K. Frape.

Response by Shaun K. Frape

I would sincerely like to thank the members of the award committee and my many friends and colleagues within our division and discipline. As Ed Harvey has so nicely put in his nomination, I have a long standing and ongoing interest in flow systems within deep saline crystalline rock. This extends to sedimentary basinal systems and the impacts of salinity and saline intrusions into shallow and surface groundwater systems.

Many individuals have had an impact on my research and scientific training. My supervisors at Queen's University, Kingston, Dr. Alan Gorman and Dr. Ronald Patterson taught me that studying hydrogeochemical and hydrogeological problems was also a key element of the geological sciences. I came to Waterloo for one year in 1979 to study isotopes with Dr. Peter Fritz. I am still at Waterloo and still learning. Peter taught me that persistence and good thinking would usually come out ahead of vast amounts of funding thrown at a problem. He also taught me that funding sure helps the thinking part. Peter is still a great friend to this day. Dr. Fritz and several early colleagues at Waterloo offered me another unique opportunity. This was to stay at Waterloo in a hydrogeology rich environment with many exciting professors and to meet two of my best friends, Bob Drimmie and Ed Sudicky. Bob has taught me and my graduate students more about isotopes than anyone else I know. Ed and I are academically on the opposite ends of the hydrogeology spectrum, but we write together, supervise students together and enjoy sharing and expanding the thinking realm of "what if you could do that".

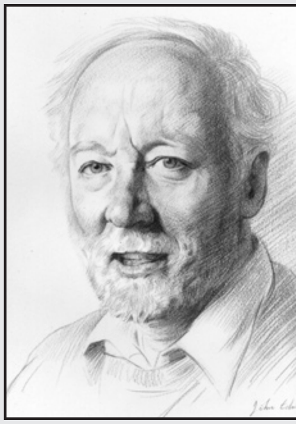
External to Waterloo, Dr. Fritz, in the early 1980's, introduced me to a group in Restin, Virginia that has a profound impact on my research interests. The U.S. Geological Survey Hydrogeology Division contains some of the most dynamic and interesting people in our field of research. Dr. Blair Jones, Dr. Warren Wood, Dr. Neil Plummer and Dr. Kirk

Nordstrom have all had major influences on how I think about saline fluids in the earth's crust. I would recommend to any young researcher in the audience that if you can strike up friendships with the U.S.G.S. it can be a great collaboration. I would also thank my friends and collaborators of the Finnish Geological Survey, particularly Dr. Runar Blomqvist and Dr. Timo Ruskeeniemi for friendship and research stimulation over the last 22 years.

To my graduate students, I would say thank you for the friendship, the hard work and the faith in trying to make often intuitive ideas that appeared to be scientific challenges succeed in working. To those that supported my nomination, Ed Harvey, Ed Sudicky, Don Siegel, Blair Jones, Kirk Nordstrom, and Warren Wood, thank you; you are a fine group of colleagues and friends. Ed Harvey is one of best friends that I could have ever wished for. He continues to be one of my closest ex-students and pays me the supreme compliment of still wanting to work on projects together. Thank you Ed, for all the hard work. And finally, to my family, my wife Nori and my children Liam and Erin, I hope the positive side of being part of my research efforts, knowing my colleagues and friends and the graduate students, has been more fun than problems. Again, thank you to the Meinzer Committee, the nominators, particularly Ed Harvey, and the Hydro Division of GSA.

INTERNATIONAL DIVISION DISTINGUISHED CAREER AWARD

Presented to Alan G. Smith



Drawn by John Edwards, reproduced by permission of The Master and Fellows of St John's College, Cambridge.

Alan G. Smith
Professor
Cambridge University

Citation by Eldridge Moores

I'd like to introduce my long-time friend, Dr. Alan Gilbert Smith of Cambridge University, winner of the GSA International Division's 2007 Distinguished Career Award. I have known Alan since we matriculated simultaneously as geology graduate students at Princeton University in 1959 (48 years ago last month). One year, we roomed together in Princeton's pseudo-Gothic Graduate College. I have many fond memories of good times, about which we have agreed to remain mostly silent. However, I will say that his witty, understated sense of humor became more robust at times, and included hilarious impersonations of assorted professors. We have remained friends and in touch though the decades.

As graduate students, we experienced the traditional criticism of continental drift, then Harry Hess's doubts about the reigning paradigm because of new evidence from the oceans, followed by Hess's conversion and distribution of his famous preprint on sea floor spreading. Princeton became a very exciting place to be, as the implications of Hess's hypothesis were immediately obvious.

Alan was a pioneer computer geek, working hard to develop skills and computer programs to apply to geological problems on the single available vacuum tube-equipped computer at Princeton. This computer involved stacks of paper cards and invariably late night sessions—the only time the computer was available for a lowly graduate student.

Alan did his Ph.D. in NW Montana on an area of overthrusting of the Mesoproterozoic Belt Supergroup. His work forms part of the foundation for our knowledge of the stratigraphy in the northern Rocky Mountains of this important sedimentary sequence.

After finishing his Ph.D., Alan returned to Cambridge as a research assistant to E.C. Bullard and J. A. Miller, setting up an age-dating program for South American and African rocks. Other things intervened, however, and Alan became involved with the effort to produce a quantitative fit of continents around the Atlantic. This work was eventually published as the classic Bullard, Everett and Smith (1965) paper on the fit of continents around the Atlantic. As luck would have it, I was present in Cambridge the day that he converted his computer numbers to a paper map. What emerged was the first quantitative map of the northern Atlantic fit and—the "scales fell from our eyes". It is hard to overemphasize the importance of that paper, as it essentially put to rest any lingering doubts about the fit of continents about the Atlantic Ocean, originally suggested by Alfred Wegener in 1912.

Alan's published two papers in the early 1970's, that stand out in my mind. His 1970 Nature paper with Tony Hallam, entitled "Fit of Southern Continents" was first quantitative attempt to re-assemble the Gondwana continents. His 1971 *GSA Bulletin* paper, entitled "Alpine deformation and the oceanic areas of the Tethys, Mediterranean and Atlantic" was the first paper to correlate spreading history in the Atlantic and Indian Oceans with Alpine-Mediterranean tectonics. It marked a major breakthrough in our views of the relationship between sea floor spreading, the then-new plate tectonics, and orogeny.

In 1965, Alan turned his attention to problems of the geology of Greece. His pioneering work during the latter part of the 20th century focused on detailed studies of problems of Greek geology, especially the Othris Mountains of central Greece. His many publications and those of his students on the geology of Greece and surrounding were major contributions to our understanding of that complex area.

Alan generalized his work in Greece into many publications on the general issue of Mediterranean ophiolites and tectonics. Although I occasionally have disagreed with him on some points (I've forgotten which), I have to salute him for major contributions to our understanding of these important sequences, their significance, and and to the general tectonics of the eastern Mediterranean region..

Smith's several books with co-authors on the fit of continents throughout the Mesozoic and Phanerozoic have proved useful for workers in many fields. The books have been translated into German and probably also into Chinese.

Over the years, Alan applied paleomagnetism to various geologic problems. His work on the geological time scale includes several fundamental contributions to global geology.

For his seminal geological work, Alan Smith has received several awards, including the Sedgwick Prize of the University of Cambridge, and the Bigsby medal of the Geological Society of London. He has also served as a member of several international boards and committees including a working group of the International Commission on the Lithosphere, the Commission on Structural Geology of the International Union of Geological Sciences, and a special group of the International Association of Geodesy focusing on long-term variations of the Earth's rotation.

Without a doubt Alan Gilbert Smith's contributions to our understanding of orogeny, the geologic time scale, tectonics of the Eastern Mediterranean, and variations in the Earth's rotation make him a giant of his generation in geology. There is no question in my mind that he merits the GSA International Division's Career Achievement Award.

Response by Alan G. Smith

I am delighted and deeply honoured to receive this award from the International Division and the GSA Council. I believe it is customary for one's nominator, in my case Yildirim Dilek, to make the citation, but after consulting him I asked Eldridge Moores if he was willing to undertake this, because Eldridge and I have been good friends for nearly half a century. I thank them both for their generous remarks.

When I was an undergraduate in Cambridge I had little idea what an academic career involved. The first tentative steps were taken as a result of a handwritten letter from Harry Hess, who had the ability to put himself into one's own position and explain why, after four years of strenuous courses, another year or two of coursework was basically a good idea. As a result, I embarked on a Ph.D. in the Whitefish Range in Montana under the supervision of John Maxwell, with Al Fischer and Franklyn Van Houten as other members of my Committee.

By today's standards writing a thesis in the early 60s was primitive. In my case it involved using a portable typewriter and cutting stencils, with corrections made by pasting over any errors with liquid wax. Fortunately, my wife, Judy, whom I met at Princeton, did all this for me, as well as teaching me how to write. Without her constant help and companionship over the past forty-five years I would not be here today.

I was also lucky to have a research assistantship with Bill Bonini through which I began to learn computing, something that has always been invaluable. The Faculty at Princeton were outstanding, not only for their open-door policy, which allowed one to simply walk into an office and discuss any scientific problem at almost any time, but particularly through Harry Hess, for fending off the administration, who wanted us to take still more courses. Harry wanted to give us as much time as possible to think. It is not clear that this led to any new theories, but it did lead to an unexpected result hatched one evening by the shores of Lake Carnegie in which all of us there decided we would not become geologists: we would become writers; explorers; drive a Land Rover from Europe to India, that sort of thing. However, all of my class, except one, became geologists along with other fellow graduate students that included Ron Oxburgh, Noel Hinners, and Creighton Burk.

While at Princeton I listened politely to Hess's ideas about ocean-floor spreading, not believing a word of it, because I had been strongly influenced in Cambridge by Harold Jeffreys' great book, *The Earth*. On returning to Cambridge I found myself working with Teddy Bullard, Jack Miller and Jim Everett. Bullard did not mind how one worked so long as one "brought home the bacon". It was from working with him and with Jim Everett that I began my continuing fascination with global reconstructions, the commercial interest in which has supported a small software company for the past 20 years or so. Shortly afterwards I became a so-called demonstrator (a job description I used to put in my passport), which started a collaboration with Brian Harland, leading to my continuing interest in improving the geological time-scale.

Fortunately, Eldridge Moores used to stay with us on his way home from his fieldwork on the Vourinos complex in Greece. His infectious enthusiasm convinced me that wandering around the Greek mountains was a much more interesting summer pastime than abstracting time-scale data. Thus began yet another abiding interest, this time in regional tectonics, particularly of Greece and of Mediterranean ophiolites.

Geology has become a science in that much of what we see on the Earth can now be accounted for by physical, chemical and biological models. It has been my good fortune to be in the same department as Dan McKenzie, whose physical models embody enough of reality to make them interesting and plausible: they also always lead to new avenues of research. They have stimulated some of my research on basins, most of it unfortunately unpublished. Despite this quantification, the essence of geology is easily understood by school children and by the public at large. One is acutely aware about how lucky one has been to be paid out of the public purse for something that is a consuming interest. In academia, we respond to this largesse by serving on worthy committees, by training research students, and by giving talks to schools, college and societies on some of the many questions that people have about the Earth, such as its age, earthquakes, tsunamis, dinosaurs, evolution—the list goes on.

However, I would like to finish with a few words on a more fundamental issue—terraforming. Terraforming is the process of changing the environment of other planets so that they will permit comfortable and free human habitation. In this sense it is still science fiction, but here on Earth mankind now has enough terraforming machines (including cars), to change the Earth itself. Geologists are directly involved in terraforming inasmuch as they decide where and how many oil platforms are built; how much coal or ore is taken out of this mine or that quarry; geological engineers are involved in deciding where to build dams, or place waste disposal sites or route roads through virgin territory. On a local scale the public would like to know the answers to questions such as: will this project increase or decrease the risk of flooding or of forest fires where I live, and so on. But on the planetary scale we have to ask ourselves whether these activities are making the Earth more habitable or less habitable. This is not a new question and there are many people working on it, but in today's world a correct answer is more urgent. If the answer is less, then what can we, as geologists, do about it?

I am sorry that geography has prevented me from serving the Geological Society of America as much as the Geological Society of London, but I am absolutely delighted to receive this award. I regard my mentors, colleagues, and students, as sharing it because they have all greatly helped me along the way.

Thank you.

G.K. GILBERT AWARD

Presented to Maria T. Zuber

Maria T. Zuber
Professor
Massachusetts Institute of Technology

Citation by Sean C. Solomon

More than any other individual in planetary science, Maria Zuber has pioneered the measurement and interpretation of the shapes of the surfaces of the inner planets, small bodies, and satellites and what those shapes mean for internal structure and dynamics, thermal and magmatic history, and surface-atmosphere interactions. What stand her apart are her combination of important theoretical contributions and expertise in the development of spacecraft experiments as well as the analysis of the derived data sets. Through her space mission leadership, she has advanced substantially our understanding of the internal structure and evolution of the Moon, Mars, and asteroids.

Maria's earliest work was in planetary tectonics, notably her development of the idea that many tectonic features arise from instabilities in the lithosphere induced by in-plane or basal shear stress and that the mechanical properties of the lithosphere may be inferred from the characteristics (particularly the wavelengths) of these instabilities. Together with colleagues and students she developed a suite of mathematical models to explore this hypothesis, and she persuasively applied the models to problems as diverse as extension in the Basin and Range Province, lithospheric shortening in the central Indian Ocean basin, rift systems on Earth and Venus, and the formation of wrinkle ridges on Mars and ridge belts on Venus. More recent work by Maria and her group has included numerical and laboratory analogue models of fault development that combine failure criteria, models of stress and strain, and observations of fault distributions and geometry in a variety of planetary settings. This body of work sets on a firm quantitative basis the interpretation of many classes of tectonic features on the terrestrial planets.

Maria led the data reduction and analysis efforts of the laser ranging experiment team on the Clementine mission that produced the first global topographic map of the Moon. From that work, in combination with a newly determined lunar gravity field, she produced the first global model of lunar crustal structure. It is difficult to overstate the importance of that work. The new models changed our understanding of the extent of isostatic compensation in the early history of the Moon, particularly during the formation and later modification of large impact basins. More importantly, they elucidated for the first time the strongly aspherical nature of internal temperature and melt production in the lunar mantle. Before Maria's work, the preferential location of lunar mare basalt deposits on the nearside of the Moon was attributed to a crust on the farside that was sufficiently thick that mare basalt magmas could not rise buoyantly to the surface. The Clementine altimetry and crustal thickness model, to the contrary, showed that the crust beneath the farside South Pole-Aitken basin is thinner than beneath much of the nearside, yet the basin is comparatively free of mare basalt deposits. The origin of this nearside-farside difference in lunar evolution remains a very active research issue.

As Deputy Principal Investigator for the Mars Orbital Laser Altimeter (MOLA) on the Mars Global Surveyor (MGS) spacecraft, Maria shares much of the credit (along with Principal Investigator David Smith) for the superb topographic data that have been returned by that instrument. As a result of MOLA observations, we now know the topography of Mars better than we do for any other planet (including Earth). More importantly, the data have stimulated a new understanding of a host of phenomena that affect the Martian surface, from cratering and deformation, to volcanism and atmospheric circulation, to the erosional and depositional action of water and ice. Maria led the combined interpretation of MOLA topography and the MGS-derived gravity field to produce the first high-resolution global determination of crustal thickness on Mars. Her crustal thickness models showed that Mars can be divided into two approximately hemispherical provinces, a southern province dominated by a progressive thinning of the crust from south to north, and a northern province of approximately uniform crustal thickness. These results constitute key constraints on the formation and modification of the Martian crust and are fueling a bevy of follow-on studies by the planetary geology and geophysics community.

As the leader of the Laser Rangefinder experiment on the Near Earth Asteroid Rendezvous (NEAR) Shoemaker mission, Maria produced the first detailed three-dimensional view of the shape of an asteroid (433 Eros). From the volume and mass of the asteroid has come the first precise estimate of mean density (2.67 ± 0.03 Mg/m^3). From the ordinary chondritic composition inferred from visible–near-infrared and X-ray spectral information, a mean porosity of 10-30% has been inferred. The laser rangefinding results also resolved an offset between centers of figure and mass, evidence for a competent substrate from regional-scale relief and slope, and small-scale ridges and grooves thought to be the result of fracturing during impacts.

More recently Maria has employed MOLA data to understand seasonal and interannual climate change on Mars. In a major tour de force she extracted from altimetry data the extremely small (meter to sub-meter) changes in the latitude-dependent elevation of polar regions and showed how those changes correlated with seasonal variations in the planet's gravitational oblateness and the changes expected from atmospheric circulation and CO_2 exchange models.

Beyond her towering research accomplishments, Maria's many contributions to the planetary science community include service as President of the American Geophysical Union's Planetary Sciences Section from 1998 to 2000 and membership on the 2004 President's Commission on Implementation of U.S. Space Exploration Policy. She is currently the Deputy PI on the Lunar Orbiter Laser Altimeter on the Lunar Reconnaissance Orbiter, the Team Leader for the Radio Science Gravity Investigation on the Mars Reconnaissance Orbiter, and the Chair of the Geophysics Discipline Group for the MESSENGER mission to Mercury.

On the basis of her seminal studies of the internal structure of the Moon, Mars, and Eros; her broadly influential theoretical work on the interpretation of planetary tectonic features; and her myriad contributions to the planetary science community, Maria Zuber is an exceptionally worthy recipient of the

Planetary Geology Division's Grove Karl Gilbert Award for 2007.

Response by Maria T. Zuber

I would like to thank the Planetary Geology Division of GSA for presenting me with the G.K. Gilbert Award, and also my nominators and letter writers for investing their precious time on my behalf. I am greatly honored and more than a little humbled. Most people undergo treatment for their addictions, and I am being rewarded for mine.

Occasions like this provide a time for reflection, about how one reaches the point where one finds oneself. In my case there was little doubt that I would pursue a career in space science. From as early as I can remember I was fascinated by space, reading every book in sight, and spending hours upon hours observing the night sky. People would ask how I got interested in this field and I concluded after some time that the answer is: genetics.

My first inspiration was my grandfather, George Stoffa, with whom I spent much of my time growing up building and using telescopes. I used to wonder whether he was really interested in astronomy or just did it to help me. But I eventually learned the truth. He quit school in eighth grade to work in the mines to support his family, but with the little money that he was allowed to keep he saved and bought a telescope. For much of his life he spent his days inside the Earth but his nights in space. I've concluded there is a recessive gene in my family that programs the holder to explore the universe. Sometimes I think about what hasn't been discovered yet because my grandfather never had the educational opportunities that I did.

In my more formal education I have been truly blessed to have mentors and colleagues who bent over backwards to provide me with great opportunities coupled with high expectations that drove me to achieve things beyond what could rationally be imagined. Marc Parmentier taught me problem solving and critical analysis and remains a trusted colleague and collaborator. Dave Smith gave me the opportunity to work on my first mission and we have gone on to map much of the inner solar system; he deserves credit for transforming planetary cartography into a precise geodetic science that has made myriads of discoveries possible. He, Greg Neumann, Frank Lemoine and others produced such remarkable data sets that it has been possible to advance the state of the art by leaps and bounds. Sean Solomon gets most of the credit for pushing me to think in terms of the big picture, and along with Roger Phillips, Jim Head and many other scientific collaborators on the various missions on which I have worked helped me to tackle the right problems from every conceivable angle.

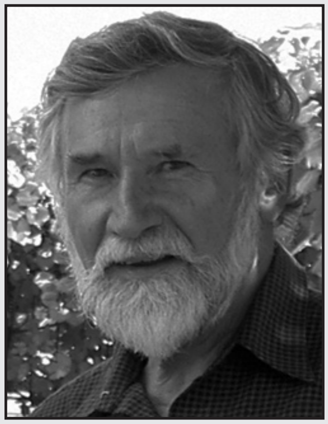
I also owe a great deal of thanks to my students and post docs, who usually wind up teaching me as much as I have taught them. That so many of them are on the path to having spectacularly successful careers of their own is my proudest professional achievement. I also express my gratitude to the many engineers with whom that I have worked. Their brilliance and attention to detail has turned dreams into reality.

Finally, I would like to thank my family. Neither of my parents attended college and they couldn't understand why anyone would want to stay in school as long as I did. But they have helped and supported me every step of the way and deserve much of the credit for any success that has come to me. I could not have accomplished even a fraction of what I have without my husband, Jack Mizerak; he has been a dedicated partner and father while building a successful career of his own, and he has taught me the importance of balance. My boys, Jack and Jordan, have helped me keep life in perspective. Every time I would come home and report that I'd won another instrument proposal they would cheer about another trip to Disney World. There's nothing better in life than to be in a situation where everybody wins.

KIRK BRYAN AWARD FOR RESEARCH EXCELLENCE

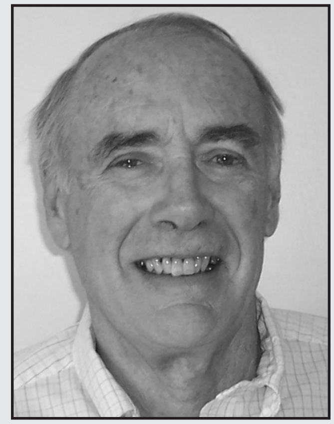
Presented to
Marith Cady Reheis, Andrei M. Sarna-Wojcicki, Richard L. Reynolds, Charles A. Repenning, Martin D. Mifflin

Marith Cady Reheis
USGS



Andrei M. Sarna-Wojcicki
USGS

Richard L. Reynolds
USGS



Martin D. Mifflin
Mifflin and Associates

Not Pictured: Charles A. Repenning, *USGS (deceased)*

Citation by Fred M. Phillips

It is my great pleasure today to introduce Marith Reheis and her coauthors Andrei Sarna-Wojcicki, Rich Reynolds, Chuck Repenning, and Marty Mifflin as the recipients of the 2007 Kirk Bryan Award for Research Excellence. The award recognizes their contribution to Quaternary geology through the publication of the paper "Pliocene to middle Pleistocene lakes in the western Great Basin—Ages and connections", which appeared in 2002 in the monograph "Smithsonian Contributions to Earth Sciences Number 33".

The dramatic evidence of huge lakes in a now-desert environment attracted the attention of the first geologists to visit the Great Basin. The earliest major studies of Quaternary geology in the Great Basin, in the 1870s and 1880s by Russell and Gilbert, focused on the evidence for these lakes and its interpretation. These were the seminal works that provided the key to understanding the late Quaternary paleoclimatic and geomorphic histories of the Great Basin.

One curious fact that these early investigators established was that there was clear geomorphic evidence for only one major lake cycle—i.e., that there is a single highstand shoreline of relatively young age, and little or no evidence of older shorelines. Both Russell and Gilbert inferred, based on stratigraphic evidence, that there had been at least one earlier lake cycle, but this still left open a tantalizing question: why was the most recent pluvial episode the greatest of all time?

This conundrum was further complicated by aquatic biogeography studies pioneered by Carl Hubbs and Robert Miller in the mid-20th century. They and subsequent investigators showed that the hydrographic interconnections provided by the Last Glacial Maximum highstand were not capable of explaining the observed distribution of fish species in the Great Basin.

A key piece in solving these puzzles has now been provided by Marith Reheis and her coauthors in the paper cited above. A few previous workers had noted very scanty evidence of shorelines higher than the LGM highstand. These were mostly dismissed as "anomalous". Marith, however, seized on these hints and examined numerous targeted localities across the western Great Basin. At many of these she did indeed find evidence of very old, very high lake stands. At many sites this evidence consists of wave-rounded pebbles on geomorphic benches, but at others it was corroborated by detailed stratigraphic work. Although such evidence at a single site might be considered equivocal, the overwhelming mass and consistency of the data presented in this paper is persuasive.

The result of all this work is a completely convincing demonstration of a new lacustrine history that has literally lain under our feet, ignored, for 150 years. The LGM highstand was certainly not the maximum pluvial of the western Great Basin (Lahontan); it was merely the largest highstand in the past several hundred thousand years. There have been at least five higher pluvial episodes in the past million years. The highest of these (during OIS 16) was ~70 m higher than at the LGM. This lake covered much of western Nevada and connected many basins that were previously thought to have been permanently isolated.

I think it is fair to say that the quantitative understanding of the pluvial history of the western Great Basin that is presented in this paper constitutes the greatest single advance since the original work of Gilbert and Russell. The work is remarkable not only for its carefulness, attention to detail, and massive data support, but also for its scope and implications. It will provide the foundation for an entire new generation of work on the Quaternary of the Great Basin. As such, it is fully worthy of the Kirk Bryan Award.

Marith and her coauthors have all had distinguished careers in Quaternary geology. Marith has published over sixty reviewed journal articles and major USGS publications and maps and is generally acknowledged to be among the foremost authorities on the Quaternary geology of the western Great Basin. She is well known for her expertise in soil geomorphology, in dust generation, dispersal, and composition, and in the neotectonics of the western U.S. I do not have time to recount the contributions of her coauthors, but they have equally distinguished careers. I will, however, express my deep regret that Chuck Repenning's tragic death prevents his acceptance of this award.

"Pliocene to middle Pleistocene lakes in the western Great Basin—Ages and connections" is a monumental contribution to the Quaternary history of western North America and I congratulate its authors on this well-deserved recognition of its significance.

Response by Marith C. Reheis, Andrei M. Sarna-Wojcicki, Richard L. Reynolds, Martin D. Mifflin, and Charles M. Repenning (deceased)

Thank you, Fred, for your kind words and for your key role in nominating our paper, and our sincere thanks to the Quaternary Geology and Geomorphology Division for this great recognition. Our paper is a summary of the last project to be funded by a late great program within the U.S. Geological Survey, the Gilbert Fellowships, which supported curiosity-driven research and ended in 1995. Intended to be a one-year field-based project, this study yielded such exciting and interesting results that I managed to extend it for several more years on a part-time basis, and to interest several friends and colleagues in helping out—thus, this multi-author summary paper was born. Andrei and the Tephrochronology Lab analyzed, at last count, 117 tephra samples collected from lake sediments and associated deposits (only the first 50 or less with any funding from the project!). Rich, who wanted to help without coauthorship, stepped in to help interpret the paleomagnetic data. Marty was the *eminence grise*, dredging up memories from studies done 20 years before of places to look for possible shorelines higher than those of late Pleistocene age. And Chuck, despite his dismay at the lack of microtine rodent fossils in the lakebeds, put aside his distaste for clumsy large fossil bones from horses, camels, and sloths to provide critical age control. We also benefited from valuable advice and observations passed on from such Lahontan experts as Ken Adams, Roger Morrison, and Jonathan Davis, for whom one of our paleolakes in central Nevada is now named Lake Jonathan.

Our study is a very good example of field-based scientific methods, augmented and confirmed by modern laboratory studies. I set out to test an initial hypothesis, based on one proposed by Marty Mifflin in 1984: A few remnants of high old shorelines in the southern parts of the Lahontan basin and internally drained basins to the south and east had been identified in southern part of the basins but were apparently absent in their northern parts. This discrepancy might be explained by regional northward tilting such that older nearshore sediments were buried by younger ones to the north—possibly as a result of the passage of the Yellowstone Hot Spot. However, during the first year of field work we found old shoreline deposits everywhere around these basins, not just at their southern ends. Even more surprising, there were stairsteps of progressively older shorelines with increasing altitude, and there were many more basins with such older shorelines than previously identified. The whole story became increasingly complex and swelled to encompass the entire western Great Basin…more than an entire career's worth of potential studies! These results led us to seek out other researchers to tackle problems on these basins and shorelines. We are proud that this project has, to date, seeded four completed M.S. theses and one in progress, as well as a successful NSF proposal.

We would also like to note that this Kirk Bryan award is historic, though Eileen Hemphill-Haley blazed the path with co-author Brian Atwater in 2000. In its 50-year history, this is the first awarded paper with a female first author—and also the first time that there have been more than three co-authors of a paper. This is more than a happy coincidence. On a personal note, I would not be standing here today if not for the love and encouragement of my parents, who never expressed doubt about my chosen career path, for the challenges from my older brothers, for the tolerance and support of my husband and children, and for the stimulation and companionship of my geologic professors, mentors, and friends of the soil circle. Finally, we observe that this paper fundamentally resulted from going to the field and making observations of deposits and landforms that mostly had never been seen or recorded before, despite generations of preceding studies of pluvial lakes back to Israel C. Russell in 1885. There are still surprising, undiscovered geologic puzzles to be found in these landscapes for the curious and energetic.

Andrei would like to add: Although the lion's share (or should I say, the lioness' share) for this report belongs to Marith, I am very honored to be a co-recipient of the award. I am particularly happy to be in the distinguished company of my four coauthors, and of two of my mentors, the recently deceased Richard Hay and Clyde Wahrhaftig, who were previous recipients of the KBA. The latter two inspired my interest in Quaternary geology and gave direction to my research career many years ago at the University of California in Berkeley. I would like to thank the support staff of the Tephrochronology Project and Laboratory in Menlo Park, Calif.—the technicians, analysts, and computer specialists, who have provided critical support to this activity over the last 35 years.

I think that our study demonstrates the usefulness of broad and intensive field investigations combined with modern laboratory studies, and underscores the need to maintain these capabilities in our earth science institutions. The practical benefits to society of curiosity-driven science can seldom be predicted but are realized with predictably high frequency, and justify its support.

Marty credits Margaret (Peg) Wheat with planting the seed 44 years ago that grew into this study. Peg had assisted Roger Morrison in the Carson Desert—Lahontan studies for years, and she believed there was more to the Lake Lahontan shoreline story. Marty suspects Peg was just waiting for someone to come along who was interested, and he was an easy target. What began as a casual weekend review of a few localities evolved into a fifteen-year study of all of the late Quaternary shorelines in Nevada (with a few looks beyond the borders). In the process, evidence for even more complex earlier lake histories were noted in some areas. Peg, with no formal training in the earth sciences, anthropology, or archaeology, interjected herself as a volunteer in field studies after raising a large family in Fallon, Nevada. She became a close friend and capable coauthor for both Roger Morrison and Marty, and was later the recipient of an honorary doctorate degree from the University of Nevada, Reno for her anthropological work and scientific book on the traditional culture of the Northern Paiute Indians.

LAURENCE L. SLOSS AWARD

Presented to Michael A. Arthur

Michael A. Arthur
Professor
Pennsylvania State University

Citation by Bradley B. Sageman

As the result of a recommendation from my post doctoral advisor to be, Mike Arthur, I was invited to interview at Northwestern in 1991. Mike was well known to the department as a result of his long and productive collaboration with Northwestern faculty member Sy Schlanger, and failing in their effort to hire Mike as a replacement for Sy (Mike had already agreed to fill the department head position at Penn State), they asked him to suggest alternatives. I was thoroughly astounded when, out of the blue, they called me for an interview, and I was very grateful that Mike had recommended me. During that interview I remember Larry Sloss, the quintessential crusty emeritus, saying right before my talk that Mike was a great scientist and a good friend, and I therefore damn well better put on a good show. Larry always knew exactly how to set a person at ease.

Having had the privilege of working with Mike over the years, and of occupying an office directly across from Larry between 1992 and his death in late 1996, I know a little bit about these two great geologists. The Sloss Award was created in memory of Larry's profound contributions to sedimentary geology and his dedicated service to GSA, and it provides us the opportunity to honor others who have made similar contributions through their careers. I can say with utter confidence that Mike Arthur is a fitting recipient of the Sloss award. His lifetime achievements in sedimentary geology uncannily exemplify Larry's career, in terms of scientific contributions and service to GSA, but also as regards the nature and quality of his professional character.

Larry was an incisive yet broad thinker who brought vision and creativity to a field that was largely descriptive when he started working in it. He animated sedimentary geology by infusing the study of facies and stratal packages with his insightful analysis of the physical processes that produce them. He dared to think outside the box of his regional subsurface studies in Montana and extrapolate to a cratonic scale. And then he influenced a cadre of young Northwestern students who went on careers at Exxon and, well the rest is history.

Mike's contributions have a similar flavor—he is an extremely broad geological thinker who has expanded our understanding of Earth History by animating stratigraphic and sedimentologic sections with creative analysis of the biogeochemical processes recorded in their elemental and isotopic signatures. He was one of the first geoscientists to apply stable isotopic techniques to paleoceanographic and paleoclimatic problems, and I can think of a long list of geochemical proxies that were discovered or illuminated in one Arthur manuscript or another. He is one of the most creative and empirically rigorous practitioners of the multiproxy approach for deep time paleoenvironmental analysis and he has made significant contributions to our understanding of the controls on organic carbon burial and the global carbon cycle, the expression of orbital forcing of climate in sedimentary systems, the biogeochemical cycles of sulfur, iron, nitrogen, and phosphorus, and their relationship to the redox state of the oceans and atmosphere, and many others.

Mike's scientific contributions span the geological record from the Precambrian to the Holocene, and he is equally at home on an outcrop, a research vessel at sea, in the lab, or behind a computer, modeling geochemical processes. He has authored or co-authored over 160 peer-reviewed publications, and contributed to a series of reports for the Ocean Drilling Program. Many of the co-authors of those publications, with names like Zachos, Glenn, Pagani, and Hurtgen, attest to his skill as an advisor, and others like Dean, Scholle, Schlanger, Kump, and Bralower, speak to his strong collaborative spirit.

Mike has been equally dedicated to teaching and service—he has long offered one of the largest introductory undergraduate courses in his department, and he is teaching four sections of it this year alone! He has served his institution as department head, the scientific community as editor or co-editor of many publications, and the GSA as a councilor and a member of many committees. He has been honored by Penn State with the Wilson Award for research, and again for service to the university, and by the Society for Sedimentary Geology with the Shepard Medal. In addition, he was recently elected Fellow of the American Geophysical Union.

Like Larry Sloss, Mike has been a pioneer in many of his efforts. And like Larry, Mike has also managed to achieve without ignoring the really important things in life…. like his family, his farm, his students, his colleagues, a good bottle of wine, a quiet dinner with an old friend, or strumming a fine guitar on the back porch. He has a big heart and has always been willing to give a chance to those who might not otherwise have had the opportunities he made possible. In this sense, both his career and his character remind me of Larry.

After my interview talk was over Larry paid me a great compliment, saying "at least you didn't embarrass yourself, Sageman," delivered with that wry grin of his. If he were here tonight I am sure his message to Mike would carry a good deal more praise. … something like "damn good show, Arthur" … and then he might say … "now give us a nice short speech so we can all go eat."

Mike - on behalf of the GSA, your students, colleagues, and friends, let me offer hearty congratulations for this well-deserved recognition of your diverse contributions to sedimentary geology.

Response by Michael A. Arthur

I am deeply honored to receive the Laurence L. Sloss Award. I humbly thank the Sedimentary Geology Division of GSA and the various committees that undoubtedly had to make some difficult decisions this year. It is also with great affection that I thank Brad Sageman for his friendship, scientific collaboration and for his well-spun tale and citation.

In his 1980 Twenhofel Medal acceptance speech, Larry argued that success "… for me, at least, … was another case of being with the right people in the right place at the right time and that, I must presume, is why I stand here today." I can wholeheartedly echo his sentiments there. In my view, I stand before you today because of the friends, mentors, colleagues and students that I have been so fortunate to have. And, it was not always through science alone that these folk had their major impact on me. The intrigue of black shales and pelagic carbonates for me was promoted and nurtured by my mentors Seymour O. Schlanger and Alfred G. Fischer. I also learned of the benefits and pleasures of wine and exotic foods during field excursions with both of these fine gentlemen. Al Fischer inspired a “holistic” view to my research early in my career that I have always valued. I must also acknowledge Peter A. Scholle for encouraging my fledgling efforts to apply stable isotopes to stratigraphic and paleoceanographic problems, and Erle G. Kauffman for introducing me to the wonders of epicontinental seas. And where would I be without the excellent collaboration of Walter E. Dean in all things cyclic and geochemical?

My first awareness of Larry Sloss was through my undergraduate sed/strat course, taught by Sy Schlanger, which used the venerable text by Krumbein and Sloss (1963) “Stratigraphy and Sedimentation.” Much later, I had the privilege of knowing Larry, and we even published together—alas, this was a memorial for Sy Schlanger. Sloss was, as noted, a pioneer of sequence stratigraphy. His classic paper on “Sequences in the Cratonic Interior of North America” was published in the highly respected - in 1963. For those of you concerned with evaluating a colleague’s impact through quantitative means, note that Professor Sloss’ citation index is quite modest, but that one influential paper has been cited at least 375 times to date. Few papers in the geosciences have reached that level. His work led to concepts of the interplay of sea level and sedimentation that were promoted by his students, among others, and though sometimes controversial, provided vitality to sedimentary geology and garnered much interest from the hydrocarbon industry in the late 1970s and 80s. My research was certainly profoundly influenced by the resulting emphasis on variations in sea level and “global cycle charts.” Who didn’t need a global sea level curve to which everything could be correlated?

Larry’s more interpretive and controversial work, however, came later in his life, and received much less attention. The inimitable Professor Sloss, unlike many of us whom he termed “Neo-Neptunists,” was not convinced that changes in eustatic sea level produced such globally correlative sequences. In papers published just two or three years before his death at 80 years old, Sloss continued to argue that strong synchroneity of uplift or subsidence in widely separated cratonic basins as the result of changes in mantle processes was a plausible mechanism for the origin of cratonic sequences. I suspect that he would have appreciated some of the later work on numerical modeling of dynamic

topography that seems to lend support to his ideas. I think that there is much more to be done in this regard. I admire the fact that Larry Sloss was still captivated by sedimentary geology and publishing thoughtful papers in his retirement as well as serving the profession he loved. Indeed, it is still, for me, fun to go to work every day, and, although I have found many other quite enjoyable things to do, when retirement comes, I cannot envision totally giving up the excitement of working on fascinating geological problems and collaborating with really great people. For my own part, I hope that, late in my career, I too am able to see through some self-created geobabble to provide more incisive analyses of the causes and consequences of oceanic anoxia or the global environmental effects of large igneous provinces.

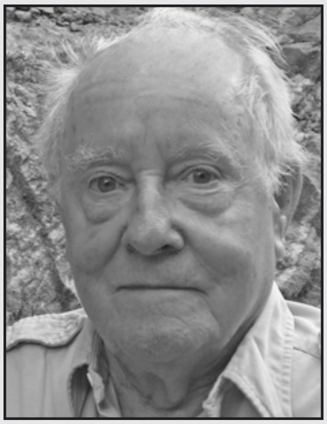
Like Larry, I do not believe that our field is moribund. To be sure, the field of sedimentary geology is quite robust today. The application of quantitative methods to modeling sedimentary processes is in its prime. One only needs to note the ongoing development of a “community sediment model” within the NSF Margins Program as an example. Ultimately, using such physical models, we should be able to more effectively examine the linkages between uplift, climate, erosion and sediment yield for comparison to patterns observed in the stratigraphic record. We might even eventually firm up the elusive connection between eustacy and stratigraphic sequences that Larry Sloss eschewed. Likewise, the availability of geochemical proxies for quantifying environmental parameters has burgeoned over the past several decades, as has our ability to use them in high-resolution studies of global change. Our temporal resolution of events and trends has improved significantly as well, in part because of orbitally induced cyclicity and its recognition and documentation in the record.

Well-trained sedimentary geologists are, and will continue to be, in demand in applied fields, and this will fuel hiring in academia as well. In particular, sedimentary geologists will be called upon to significantly improve predictions of subsurface sedimentary characteristics for exploration and efficient extraction of oil, gas, coal and water, and even for carbon dioxide sequestration. Let us not forget, however, that most of us were lured to geology by an opportunity (we thought) to work outdoors and pushed in that direction by our curiosity regarding what stories the rocks could tell. I know I was, although I have spent far more time behind a computer or in the lab than I ever anticipated, and it is continuing curiosity about how the Earth works that keeps me involved at this stage in my career. It is my fervent hope that curiosity-based science will still garner substantial funding even while we strive to serve society through relevant research. Applied science alone cannot entrain legions of enthusiastic young scientists into our field.

Oh how I envy the wordsmithing abilities and unabashed nature of some of my geological forebearers. So, with apologies, because try as I might I could not improve on it, I will end my acceptance speech with the following words from Larry Sloss’ Twenhofel Medal acceptance which are apt today. “I wish I could leave you with some pithy aphorism, some trenchant maxim, that would make me seem a more worthy role model for rising young geologists; instead, all that runs through the mind is that a lack of virtue does not necessarily lead to a lack of rewards, that procrastination saves time (the problem may go away) and that there is, indeed, a free lunch and I just had one.” Just one thing more—help GSA serve our profession and have fun out there! Thank you for your kind attention.

STRUCTURAL GEOLOGY & TECTONICS DIVISION CAREER CONTRIBUTION AWARD

Presented to Warren Bell Hamilton



Warren Bell Hamilton
Professor
Colorado School of Mines

Citation by Keith Howard

Warren Hamilton's powerful and innovative contributions to the development of tectonic concepts have had major influence on the directions of our science, consistently breaking new ground and undermining entrenched old dogmas.

Warren's prolific career has time after time presented us lucid and perceptive syntheses setting forth new and long-lasting concepts in global and crustal-scale views of tectonic and magmatic processes. Warren's current debunking of deep-seated plumes ("they don't exist"), his proposals for a weak, plateless Archean crust, and his drastic reinterpretation of Venus as a low-heat-flow planet that preserves its early crust and impact basins pose only the latest of many bold challenges he has offered the structure and tectonics community. And he doesn't go into these topics lightly, but carefully critiques, questions old paradigms, and integrates cosmic and mantle geochemistry, seismic tomography, and reams of geologic observation into his syntheses.

In 1966, the 100 percent Cenozoic extension that he and Brad Myers proposed for the Basin and Range faced a skeptical reception from stabilists, but it spurred the community to test it, and find it near the mark. On a similar note, I watched many California experts inititally deride his late-1960s integration of Mesozoic California geology into subduction models. Yet it paved new paths for the structure and tectonics community to integrate plate-tectonic concepts and on-land geology.

His 1979 synthesis of Indonesian tectonics remains a standard of comparison for countless newer studies of subduction belts worldwide. His Indonesian knowledge led to his elegant analysis that subduction drives plate tectonics, and that top-down cooling of oceanic lithosphere produces the density inversions that drive subduction. Other contributions provided tectonic syntheses of regions as diverse as Antarctica, the Gulf of California, Laramide uplifts and the Colorado Plateau, Cordilleran metamorphic core complexes, and the Urals and a broad range of topical studies. Insights into magmatic processes in relation to tectonics arose from field relations in island arcs, western American batholiths, exposures of the deep crust, and much more. He comprehensively integrated crust-building magmatic processes and their variations with depth into tectonic models. His global view has brought us concepts of sill-like batholiths, extension in volcanic arcs as a natural consequence of subduction, and a proposed new framework for understanding tectonism and magmatic heat loss in an Archean world lacking rigid plates and subduction.

Warren's ability to synthesize sweeping new general insights rests ultimately on his appreciation of, and perceptive contributions in, detailed field geology. His long-time collaborator Brad Myers once remarked to me proudly about Warren's mapping of the Big Maria Mountains that the maps were "full of squiggly lines—and Warren isn't a squiggly-line person!" The highly detailed mapping in the Big Maria area prompted Warren's notions of extensional faulting, ductile Cordilleran thrusting, and stunnning 100:1 tectonic attenuation of the Grand Canyon's Paleozoic formations—concepts as usual ahead of their time.

Warren's communication skills—on field trips, informal contacts, hundreds of lectures, and many visiting professorships and distinguished lectureships—have stimulated and influenced large numbers of students. He has served as a visiting scientist in many countries, and he has been charismatic mentor, guide, and friend to countless colleagues and students. Colleagues come to him as a sounding board on subjects ranging from giant Precambrian impact structures to environmental policy. Though he is never one to coddle or mince words at work with which he disagrees, Warren is outgoing, generous with his time, and a helpful tutor to those with whom he comes in contact. His crisp, power-packed collegial letters enjoy their own celebrated reputation.

You would think that five decades of huge contributions, membership in the National Academy of Sciences, and a Penrose Medal would be more than enough for any career, but Warren shows no signs of slowing down. Three meaty and eloquent papers by him due to be published this month forcefully argue for top-down cooling of slabs as the driver of plate motions and of upper-mantle convection, for a lack of plate tectonics in Earth's first two billion years, and for a plume-free planet Venus. Like many of his other works, these diverse iconoclasms are directly at odds with accepted paradigms. Pay close attention. Warren's intellectual ability to grasp the simple picture from a mass of details has been stunningly perceptive.

This man has been enormously influential on tectonic concepts, and on geologists. It is a high honor to present to you Warren Hamilton as the 2007 Career Contribution Awardee of the Structure and Tectonics Division.

Response by Warren Bell Hamilton

Thank you, Keith, for that generous account. For 60 years, I have been having a marvelous time seeing as much as possible of our planet and trying to figure out how it works. Being honored for the products of that exciting activity, and being placed with the eminent prior awardees, is a huge bonus.

I have always learned from people who knew more than I did about many things. From Keith, for example, I learned much about the nature of large-offset extensional faulting, and about the behavior of sedimentary rocks depressed into anatectic regimes. My longtime colleague Brad Myers was the best reader of geologic maps I have known. I have swapped and developed ideas with hundreds of colleagues, often in the field, and could not have worked without the reports generated by thousands of other scientists.

I was repeatedly fortunate to be in the right place at the right time. My first Antarctic season, 1958, changed me from a silent to an active continental drifter, at a time when the overwhelming American view was that no lateral motion of part of Earth's outer shell was possible. I was a visiting prof at Scripps when plate tectonics was brand new, and students including Tanya Atwater and Dan Karig brought me up to speed before most landlocked geologists knew anything was up. My early plate syntheses of continental geology led to the opportunity to integrate and learn from the onshore geology and offshore geophysics of spectacularly complex Indonesia and surrounding regions. This and much more was made possible by my USGS position (although some of my synthesis was unfunded, and even time for it was bootlegged). Fast forward, and I have been for seven years in a mind-opening multidisciplinary e-mail round table with Don Anderson, Gill Foulger, Jerry Winterer, Jim Natland, and others.

We now know that Earth accreted rapidly, violently, and hot. Nevertheless, popular geodynamic theories are descended from 1950s conjecture that Earth has fractionated only very slowly and incompletely. 1960s geochemists hardened this speculation into dogma that was accepted by newborn geodynamicists, who built whole-mantle convection, bottom-up drives, plumes, and deep subduction from it. Powerful evidence contradicts all components of these chemical and dynamic conjectures, yet they are now parts of the belief systems of most geoscientists. Alternatives are little considered. The balance worsens as specialties become more myopic, expensive, and inbred, and as broad approaches wither for lack of financial support.

Enter peer review. Recycled popular dogma breezes through, but new concepts displease challenged experts. It is difficult to publish, or get a grant for, work contrary to conventional wisdom because many reviewers, editors, and managers obstruct anything that conflicts with their beliefs. My own descriptive work sailed through, but the innovation for which you honor me often did not, and some of my best work was wholly blocked. Keith mentioned my three current major contrarian papers. These are appearing in books with supportive editors because I am now unwilling to probe successive journals for possible chinks in their conventional-wisdom armor. Two of these three multidisciplinary manuscripts were attacked viciously, on personal as well as contextual grounds, by turf-defending specialist reviewers. Other geoscientists whose work I most admire report similar personal and topical obstruction of contrarian papers which ultimately proved to be broadly correct.

So I appeal to all of you, as judges at all levels, from what you and others write to whom you support or hire or promote, to recognize that consensus may not define truth. Changes as profound as plate tectonics, and as unanticipated by the majority, likely lie ahead. This awareness should generate both positive and negative attitudes. On the one hand, innovative work should be evaluated on its own terms. Do the new concepts provide a viable explanation for the relevant evidence? What sorts of evidence are cited in support of each, and what does each misfit or overlook? What is required, and what is merely permitted, by independent data from different disciplines? What are the explicit and implicit assumptions behind new and old interpretations? On the other hand, any work that reaches a traditional conclusion should be viewed with skepticism. Are there flaws or gaps in the logic claimed to support the conclusion that was determined before the work was done, and could that conclusion be merely a popular assumption? A red flag for failed conjecture is special pleading to excuse each misfit of data to predictions, such as now characterizes advocacy of deep mantle plumes.

Science functions best when we can override our hard-wired inclination to blindly defend our clan. The mythology of science says that multiple working hypotheses lead to efficient incorporation of improved concepts. The reality is that ruling conjectures have great inertia, and that much that is patently false is widely accepted as true. Many current dynamic and petrologic invocations of plate interactions, 40 years on, are of misconceived cartoon systems that resemble nothing on Earth. Chemical and isotopic numerology has largely displaced igneous petrology, and impossible magmagenesis is widely postulated. Dick Armstrong showed decades ago that isotopic data do not require the common assumption that the upper mantle has fractionated unidirectionally, but only recently have a few geochemists begun to recognize that he was correct. And so on.

The schedule of a roving geologist produces hardships for young families. Alicita, my wife for those 60 years, nevertheless raised three wonderful children, and not until they were all in or beyond college was she able to widely share in the perks.

Thank you much. It has been a great trip.