RIP RAPP ARCHAEOLOGICAL GEOLOGY AWARD

Presented to Paul Goldberg

Paul Goldberg

Citation by Rolfe D. Mandel and Vance T. Holliday

It is a great pleasure and honor to introduce our friend and colleague, Paul Goldberg, for the presentation of the 2002 GSA Rip Rapp Award. Few merit such recognition, and Paul is one of them.

Paul's involvement in geoarchaeology spans more than 35 years. Throughout his academic career, Paul has practiced and promoted geoarchaeology on a full-time basis; it is not a secondary interest to him. He has been a key player in the discipline and undoubtedly will continue to have a strong influence on its direction.

Paul's most significant contribution to geoarchaeology, indeed to the broader field of archaeology, is his work on soil micromorphology as a tool in archaeological research. Paul is one of the world's leading experts on the subject, and he is certainly the most prolific and best-known practitioners in micromorphology. An example of this work is the book *Soils and Micromorphology in Archaeology*, which Paul co-authored with his long-time collaborators Marie-Agnes Courty and Richard MacPhail. This book is the standard reference for the topic and will soon appear in a long-awaited second edition. Paul also published dozens of articles dealing with this topic, ranging from very focused, site-specific studies to review articles. He published papers in several of the proceedings volumes of the International Working Meeting on Soil Micromorphology, but more importantly (for the archaeological community), he published various overviews in volumes aimed at the archaeological audience, such as the 1995 volume on *Archaeological Sediments and Soils*. Hence, Paul has made a strong effort to develop a technological bridge between the geoscience and archaeological communities.

Paul is also one of the leading practitioners of geoarchaeology at the macromorphological level more familiar to most of us.. He is widely known for his work on the stratigraphy and paleoenvironments of the Middle East at both site-specific and regional levels. He has been a principal figure in the investigation of some of the most important Pleistocene cave and rockshelter sites in the region, beginning with his work at Tabun and more recently with his involvement at Kebara and Hayonim. For example, his contributions to the dating and history of site formation processes at Kebara helped to establish the site as one of the most significant Upper Pleistocene localities in the Old World. His broader papers on regional paleoenvironments in the Middle East also establish him as one of the leading authorities on the subject.

Although many of Paul's publications focus on micromorphology and/or paleoenvironments, he has also been involved in works that are broad in scope. For example, he was the driving force behind the recently co-edited *book Earth Sciences and Archaeology*, a comprehensive volume that presents a wide array of subjects that are relevant to geoarchaeology. It is also noteworthy that Paul is currently writing a book (with R.I. MacPhail) entitled *Practical and Theoretical Geoarchaeology*. As indicated by the title, this book will transcend descriptive geoarchaeology, an approach that is sorely needed.

One of the more remarkable aspects of Paul's work is his global perspective. He has enthusiastically applied his methods and talents throughout the world, working on most continents. His research at major sites in North America, including Hell Gap, Meadowcroft, Wilson-Leonard, and many others, has helped expand the application of geoarchaeology and broaden the appreciation of the earth sciences among the archaeological community. And his current research at Zhoukoudian, China, is shedding new light on one of the most famous and significant archaeological and hominid sites in the world.

Paul has also gained great respect for his remarkable teaching skills and, moreover, his willingness to train others who are interested in applications of micromorphology. Despite his teaching and research load and many other commitments, Paul often devotes considerable time to students and professionals who travel to Boston University for the opportunity to sit down with him at the microscope. Few people are as generous with their time and effort as Paul!

Beyond his contributions in the realm of research, publication, and teaching, Paul performed a significant service to the geoarchaeological community during his tenure as Chair of the AG Division (2001), and as Editor-in-Chief *of Geoarchaeology: An International Journal.* In our view and that of many colleagues, he did an outstanding job of transforming *Geoarchaeology* by aggressively bringing in a more substantive and a broader topical and geographic array of papers. Paul is currently Co-Editor of *Geoarchaeology,* and he continues to play an important role in promoting the journal.

In sum, Paul Goldberg is an international scholar of the highest caliber known throughout the world's geoarchaeological community and much of its archaeological community for his considerable energy, talents, and contributions. We believe his efforts reflect the spirit and the standards of the award he is receiving, and that both the Geological Society of America and past award recipients should be proud to recognize him in this way.

Response by Paul Goldberg

It is a great honor to be chosen for this year's award, and I am sincerely appreciative to be chosen by the Society. As 60s product , I tend to take a holistic view of things, and inasmuch it is I who is receiving the award, I cannot admit to having earned it by myself. The knowledge or insights I have obtained during the 30+ years of doing archaeological geology has been possible only through interactions with archaeologists and geologists, some good, some bad. I would like to thank some of the good collaborators, although because of space limitations, I cannot thank them all.

One of the most influential persons during my graduate studies was Henry Wright at Michigan. In a reading course he pointed out that it would be wonderful if we could find the means to recognize individual surfaces in archaeological deposits and infer specific activities associated with them. This comment would plant the seeds for my enthusiasm for micromorphology that I would develop later.

I took a more geomorphological view of archaeological geology when I moved to the Institute of Archaeology, Hebrew University in the early 1970s. It is there that I was immersed in and surrounded by archaeology, geology, and a bunch of smart prehistorians. I spent many days in the field with Na'ama Goren, Nigel Goring-Morris, Anna Belfer-Cohen, Uri Baruch, and Tom Levy, and I came to appreciate the variety of sites, how they articulated with past landscapes and environments, and how my comrades thought about and excavated them. At this time fuzzy notions of micromorphology from graduate school were fleshed out, and I realized how important were microstratigraphy and micromorphology in figuring out how archaeological sites form.

In the mid 1980s my target began to shift from landscape to micromorphology, specifically aiming at Kebara Cave. There I got to work with French colleagues who not only elevated the level of my Franco-babble but who exposed me to different ways of thinking about and doing prehistory. Collaboration with the late geologist, Henri Laville was both inspiring and fun, and interaction with prehistorian Liliane Meignen has often forced me think more clearly. The same is true of more than a decade's interaction with Steve Weiner (Weizmann Institute). His rigorous approach has forced me to raise my geoarchaeological bar.

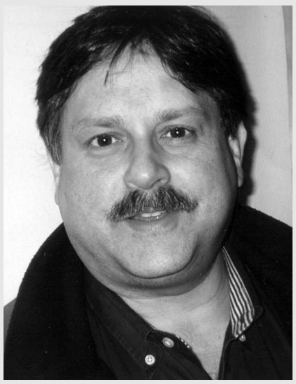
Back in the United States, I spent the 90s developing micromorphology with Marie-Agnès Courty and Rich Macphail who squeeze out palaeoclimates and human activities from stones and sediments. At the same time I expanded my interaction and horizons with North American sites and colleagues, and they exposed me to different kinds of geoarchaeological approaches. Vance Holliday, Rolfe Mandel, Reid Ferring, Boyce Driskell, and Mike Collins would all admit that I have some weird viewpoints about how I approach things and I admire them for their tolerance, especially to my *Geoarchaeology* co-editor.

Finally, my colleague, pal and solid source of inspiration for thirty years has been my "older brother," Joe O'Brien, a.k.a., Ofer Bar-Yosef. From the time I arrived as a green Post-Doc at Hebrew University, to the ad hoc visits at Harvard, it's been energizing to hang out and, especially, to mumble and kvetch in Hebrew.

To all these (and uncited) friends and colleagues I am really grateful for your help in getting me here today, and I thank you.

GILBERT H. CADY AWARD

Presented to
Ronald W. Stanton



Ronald W. Stanton

Citation by Brenda S. Pierce

The Gilbert H. Cady Award is presented, posthumously, this year to Ronald W. Stanton in recognition of his many outstanding achievements in the field of coal geology. Ron contributed significantly to our practical knowledge of coal composition, the nature of coal macerals, and the formation of coal. Ron shaped many aspects of current coal petrologic research and created innovative approaches to coal characterization. Although Ron's best-known contributions were in the fields of coal petrology and petrography, he also developed new techniques for prediction of coal quality characteristics, coalbed methane occurrence, and carbon sequestration potential. His interest and research touched on all aspects of coal geology, from a coal's inception in the peat mire, through diagenesis and coalification, to mining, utilization, and combustion.

Ron's work on coals and other organic materials from all over the world and of all different ranks allowed him to compare and contrast components from a wide variety of host materials. Ron was one of the first to petrographically study low rank western U.S. coals (Powder River Basin, Big George, Wind River, and others), already having extensive experience with Appalachian Basin coals. As his experience expanded, he was often asked to study coals, carbonaceous shales, and petroleum source rocks from many different deposits around the world. This wide breadth of experience allowed Ron to create standardized methods that are now current practice, such as coal pellet etching, vitrinite reflectance methodologies, and coal bed sampling techniques. Ron and colleagues were able to identify and characterize new crypto-macerals as a direct result of the etching research. Ron correlated certain crypto-maceral occurrences with higher levels of coalbed methane occurrence in specific coals. His broad focus on global coals of all ranks, as well as the characterization of new macerals, allowed Ron to correlate many of the petrographic components to other coal characteristics, such as quality parameters.

Ron also had vast experience in the entire spectrum of basic and applied research. Throughout his career, he took basic research on coal origin, components, and characterization and applied it in the real world of coal mining and utilization. He worked with geologists and engineers at coal mines, power plants, cleaning laboratories, other research facilities, universities, and state geological surveys to ensure that his research results were valid and usable. One of Ron's basic research concepts that had immediate applicable results was the concept of coal bed facies, which basically changed the way in which many coal scientists study a coal bed. Coal bed facies are vertically distinct, laterally continuous subunits within the coal. By studying the facies, rather than the bed as a whole, coal quality, washability characteristics, and chemistry are more quantifiable and in many instances predictable.

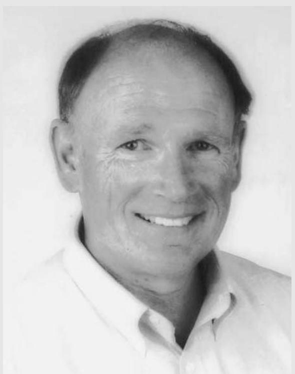
Ron analyzed coal components throughout his career and his observations led to significant modifications of coal petrographic classifications that are recognized by other coal geologists throughout the world and by the American Society for Testing and Materials. In addition to the coal petrographic standardization, Ron had started to create standards and unified methods to measure the volume of coalbed gas and conduct coal resource assessments for ASTM. One of Ron's last research projects involved coalbed methane desorption and carbon dioxide absorption in low rank coals. This innovative research led to a whole new mind set on the ability of low rank coals to act as sequesters of carbon dioxide. Ron's research showed that some low rank coals can absorb 7 to 10 times the amount of CO_2 previously thought able by bituminous coals.

Ron's advice was sought after by a whole cadre of organic scientists because of his multidisciplinary approach to coal science. His broad, yet in-depth, understanding of so many facets of coal geology made him an invaluable resource to co-workers at many different research institutions. In addition to his scientific contributions, Ron mentored a whole generation of coal geologists, who now work at research institutions all over the world. Collectively, this group has defined current coal petrographic standards.

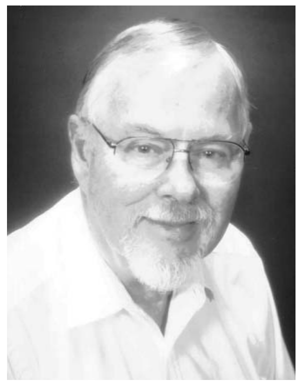
Ron was certainly an individual who made outstanding contributions to many facets of the field of coal geology. Ron contributed to coal geochemistry, mineralogy, quality, formation and origin, coalification, and of course coal characterization, as well as helped create an environment that fostered multidisciplinary coal research as a mentor, teacher, and manager of coal research at many different research organizations. Ron Stanton is certainly an outstanding recipient of the Gilbert H. Cady Award.

E.B. BURWELL, JR., AWARD

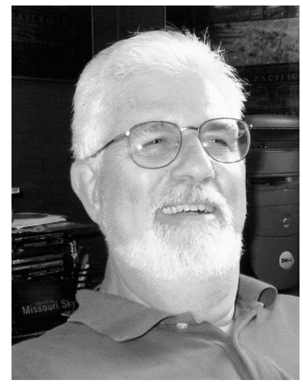
Presented to Tom Eastler, Paul Fisher, and Don Percious



Tom Eastler



Paul Fisher



Don Percious

Citation by Judy Ehlen

I am truly honored to be the citationist for the 2002 Burwell Award. I have known Tom and Paul for about 30 years, and Don for almost 10, and I am well aware of their commitment to military geology and to our nation. As geologists, Tom, Paul, and Don have different backgrounds and specialities, which makes their combined expertise as exhibited by their paper unique. This combination has enabled them to develop a characterization methodology to predict the geotechnical properties of remote underground facilities that are of crucial concern to our nation's well being. This expertise was gained as a result of careers in the military and as civil servants. For Don and Paul work is continuing into retirement, and I'm sure Tom will follow in their footsteps. No award could possibly be more timely with respect to the current military activities in Afghanistan, which have made very clear the critical need to understand the geology of tunnels and other underground facilities, be they natural or man made. The way the conduct of war has changed since the early 1990s suggests that future military endeavors will be carried out on a local, rather than regional or continental, basis, and that those involved, although using weapons of the most modern technology, will use the subsurface for camouflage, protection; supply, weapon, and ammunition storage; and subsistence to the maximum extent possible. Application of the methodologies described in their *Role of Geology in Assessing Vulnerability of Underground Fortification to Conventional Weapons Attack* is thus essential to our national well being. It thus gives me the greatest pleasure to present the 2002 Burwell Award to Tom Eastler, Don Percious, and Paul Fisher.

Response by Tom Eastler

Youth and brevity are not strange bedfellows. As the youngest, and occasionally the most brief, of the three of us, I find myself drafted by my colleagues to give one short acceptance speech on behalf of us all.

We accept the 2002 E. B. Burwell, Jr. Award with gratitude and humility. It is truly an honor to receive this award for excellence in engineering geology in the name of the first Chief Geologist for the Corps of Engineers and one of the greatest engineering geologists of our time.

We come from varied backgrounds in the geology profession but we share a passion for and a history of involvement in military geology that dates back many, many years. Paul, our elder statesman and former Chief Geologist with the Corp of Engineers, with his extensive background in military design and construction, Don with his longstanding work in the Military Geology branch of the U.S. Geological Survey, and I, with my life's work of detecting and documenting underground facilities (UGFs) and educating the military about their significance worldwide, naturally gravitated toward a most rewarding professional association when we synergistically combined our knowledge and experience in attacking the problem of determining the vulnerability of UGFs to conventional weapons attack.

It occurred to us that the only way to exploit potential vulnerabilities of underground facilities was to know the geotechnical characteristics of the terrain encompassing such facilities. In the early 1990's we all found ourselves working for several Department of Defense (DoD) agencies involved in the detection and characterization of UGFs. Paul and Don were performing geotechnical characterization studies for a great many UGFs worldwide. I was involved in the detection and characterization of enemy facilities, the design and testing of analog facilities, and the education of various DoD elements on the importance of geology in targeting and defeating such facilities.

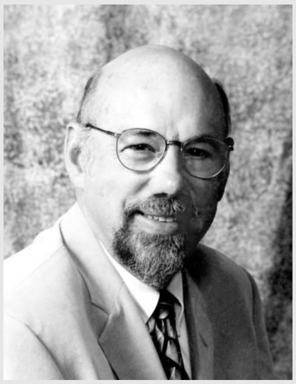
At this time the construction of UGFs for military purposes was proliferating, and a number of potentially hostile countries were constructing UGFs, which could be used for many purposes including the manufacture and storage of weapons of mass destruction. With some very effective unconventional attack options no longer available to us since the end of the cold war, hostile UGFs would have to be held at risk primarily with conventional weapons, not a trivial task. Geotechnical characterization was now to become the key to developing the best attack options since the brute force approach was no longer a player.

Although the results of our research efforts in UGF characterization have been disseminated in classified documents going back as far as 1977, we felt that it was time to share our joint endeavors in an unclassified mode, hence the publication of our paper. The threat to our Nation's security arising from the use of UGFs in potentially hostile countries is very real. We hope that our contributions have helped to reduce that threat.

We never expected to be the recipients of such a prestigious award for our work. We are very gratified for having been chosen, however, and we are pleased to have been able to share our work with our engineering geology colleagues.

GEORGE P. WOOLLARD AWARD

Presented to G. Randy Keller Jr.



G. Randy Keller Jr.

Citation by Alan Levander

The George P. Woollard Award is given to an individual who has contributed in an outstanding manner to geology through the application of principals and techniques of geophysics.

It's a pleasure to be asked to deliver the citation for this year's recipient G. Randy Keller, as Randy and I have collaborated for the past 7 years on a number of seismic investigations in the Western U.S.

Randy particularly integrates geologic and geophysical data in studies of large scale tectonic systems. Randy has spent a significant fraction of his career studying the crust and upper mantle of continental rifts in Africa, first in Kenya and now in Ethiopia, in Asia at Lake Baikal, and in North America, in the mid-continent and in the Rio Grande rift, where he lives. Randy was one of the U.S. principal investigators of the KRISP experiment in the east African rift, which provided the first modern seismic images of the crustal and upper mantle structure of a continental rift. These images have changed the way we think about how rifting processes are distributed through the crust and upper mantle.

From the backyard of Randy's house, which is sited on a mountainside, you can look out westward across the Rio Grand rift. In the early morning the peaks in the distance look remarkably like islands at sea. The comparison between the sea and desert has been made many times before, of course, but here it is apt also on a personal level. The famous oceanographer Maurice Ewing believed in geophysical exploration. He kept the Lamont research ship at sea and kept its geophysical instruments constantly in operation . Similarly Randy keeps his instruments, his students, and his staff in the desert collecting all types of geophysical data that are used to address questions related to the tectonics of the Rio Grande rift, the evolution of the North American continent, and El Paso regional groundwater resources and waste disposal issues.

Randy makes use of all available geologic and geophysical data when approaching a tectonic problem. For decades Randy has been industriously investigating his own backyard, if by that description you include not only the Rio Grande Rift but also the Colorado Plateau, the Southern Rocky Mountains, much of the Western U. S., Texas, and Oklahoma. At this stage of his career, without having lost interest in North America, he is involved in a variety of experiments in Eastern Europe.

Although the Woollard Award makes no mention of professional service, it would be difficult to give a citation for Randy that didn't include his work for the community.

When the active source seismology community needed a new lightweight portable instrument, Randy put together a coalition of Texas universities, secured Texas State money and developed the instrument. Four hundred of these now reside at UTEP, with another four hundred at IRIS. These instruments are known in the community as the Texans; which is both an honorific and ironic, as the Texan instruments are diminutive, being about a tenth the size and weight of the instruments we had been using.

For a significant part of his career, 17 years, Randy chaired the Department of Geological Sciences at the University of Texas at El Paso. As chairman he was the overseer of a building reconstruction and a building addition; UTEP has a beautiful Earth Science facility. While chair Randy set an absolute standard for modern hiring practices in Geoscience Departments. He has also directed more than 20 Ph.D. and 50 M.S. thesis projects, and published some 200 papers.

Congratulations Randy!

Response by G. Randy Keller Jr.

To say the least, I am extremely pleased to be this year's recipient of the George P. Woollard Award. I am particularly gratified to see my name added to a list of awardees that includes many distinguished geophysicists, and I am fortunate that many of them have been valued colleagues and mentors. Above all, it is nice to receive this award at a joint gathering of the Structure and Tectonics and Geophysics Divisions in the presence of many friends and colleagues who have often served as geologic tutors.

As the years have passed, I have found myself more and more motivated by the search for answers to important geologic questions of all scales. Although it is at bit daunting to work simultaneously on the lithospheric evolution of the Rocky Mountains and the magmatic processes at work in the East African rift while helping select a site for a brine disposal well linked to a major desalinization plant, it is also invigorating and challenging. Thus, receiving an award, whose purpose is to "recognize outstanding contributions to geology through the application of the principals and techniques of geophysics," means a great deal to me.

The establishment of this award almost twenty years ago was a forward looking step, because in recent years, we have seen an evolution of our science with an ever increasing emphasis on integrated studies. This trend is primarily due to our joint recognition that the questions we are seeking to answer, in both the basic and applied science domains, require us to collaborate and use every tool available. The many collaborative tectonic research efforts represented at this meeting attest to this development. It has been both my pleasure and privilege to participate in several such studies, and my students and I have learned a great deal from our colleagues and experiences during these endeavors.

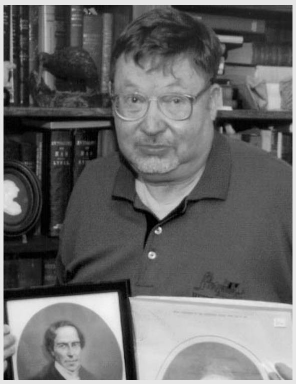
It is, of course, important to use an opportunity such as this to thank those who have made it possible for me to be standing here accepting this award. I have been around long enough that this is indeed a long list, and I am happy to say that it includes many of my students and international colleagues. I only have time to say that I particularly appreciate the openness, cooperation, and support of the individuals, organizations, and institutions working and located in the Rio Grande rift / southern Rocky Mountain region. From the first day I arrived in El Paso, I have felt welcome and part of a group that understands the importance of cooperation and collaboration to achieve important scientific goals.

It was essentially by accident that I was introduced to the geosciences, but I want to say that I consider myself very lucky to be a geoscientist today. It is a privilege to be involved in such an interesting and challenging endeavor and to work with so many excellent students. Peer review and collegial support have given me a chance to do things that I never dreamed possible, and I am very thankful of this and for this award.

Thank You All.

HISTORY OF GEOLOGY AWARD

Presented to Dennis Dean



Dennis Dean

Citation by R.H. Dott Jr.

I first met our awardee in 1965 when a Ph.D. candidate in English literature named Dennis Dean showed up in the first class that I taught on the history of geology. I may well have gained more from our classroom experiences than he, for Dennis introduced me to a wealth of 19th Century literary allusions to geology. One example that particularly delighted me, and which he later published, was how Edward Hitchcock's celebrated Connecticut Valley trackways inspired Henry Wadsworth Longfellow's famous passage "Footprints on the sands of time" from the *Psalm of Life* (published in 1838). Dennis' Master's thesis at Stanford had been about *Emerson and Geology*, and when he joined my class, he was working on his Ph.D. dissertation about *Geology and the British Romantic Poets*. After graduate school, Dennis joined the humanities faculty of the University of Wisconsin at Parkside, where he taught for 25 years. He gradually expanded his duality of interests, which has made him unique among historians of geology.

Over the years, Dennis has researched and written increasingly about the history of geology, and his work has gained much authority. His efforts have culminated with outstanding scientific biographies of James Hutton published in 1992 and Gideon Mantell published in 1999, which are now the definitive references for these two important figures. Dennis made a coup in his serendipitous discovery of a rich store of Mantell resources in New Zealand, where one of Gideon's sons had emigrated, but I leave it for him to tell that story.

Those two books alone would justify our award for Dennis Dean, but he also has published important articles about the history of geology in such journals as *Isis, Annals of Science*, *Modern Geology*, and the *Journal of Geological (*now *Geoscience) Education* . These have concerned not only Hutton and Mantell, but also Erasmus Darwin, Playfair, Lyell, Hitchcock, Mallet, Benjamin Franklin, and William MacLure. He has published important essays about Sir Walter Scott and the neptunist-vulcanist dispute; Tennyson and geology; the controversy between Muir and Whitney about the origin of Yosemite Valley; the age of the earth controversy; and the San Francisco Earthquake of 1906. He has contributed to symposium volumes and encyclopedias, notably 14 entries for the new *Dictionary of National Biography*. For the 1997 Hutton-Lyell bicentenary, Dennis edited an augmented reprint edition of James Hutton's v. III of *Theory of the Earth* - the long lost volume, which was first published in 1899. He is presently the General Editor for a History of Earth Sciences reprint series and frequently participates in both national and international conferences on the history of geology.

In all of his work, Dennis Dean is one of the most thorough and rigorous scholars active in the history of geology. He single-mindedly pursues relevant source materials, and has made a number of important factual discoveries in the process. Dennis subjects his material to the strictest scrutiny before he draws his often novel conclusions. With his unique background, he is able to analyze subtleties of linguistic expression and to see interdisciplinary relationships between science and the humanities that would go unnoticed by most of us. I am honored to present Dennis Dean for the History Division's 2002 Award.

Response by Dennis Dean

Thank you, Bob, my friend and mentor, for nominating me to receive the same History of Geology Award that has in the past been presented to so many worthy scholars. If any among us still doubts the appropriateness of its going to a humanist like myself, I hope that he or she will ready my books.

Though reading has always been one of my greatest pleasures in life, I began to collect rocks even earlier, before I could read. In 1941, when my family was living in northern Illinois (not far from where I live now), my mother and two of her sisters took my older brother and me on a lengthy car trip through Canada and New England. We stopped at a place called the desert of Maine, at which colorful sands were exposed. While there my aunt Bea saw how fascinated I was with some of the pegmatite minerals on sale in the gift shop and bought a few specimens for me, on of which I still have. My rock collection began on that date and has continued ever since—for more than sixty years.

Having started at age three, I had plenty of time to expand my original interest in rocks to include fossils, artifacts, and geological and cultural history. I discovered the history of science as a graduate student at Stanford, but only through private reading (in March 1961). A book called *The History of Science and the New Humanism*, by George Sarton, showed me how I could put the scientific and humanistic sides of my mind together. I began to write literary term papers emphasizing the cultural influence of science, and later did a Master's thesis on Emerson and geology (1962), explaining that writer's numerous allusions to earth science.

Following two years in the army, I returned to graduate school at Wisconsin, where I was the first ever to pair a doctoral program in English with a minor in the history of science. As part of that unique curriculum, I undertook three credits of work with Bob Dott, who was then the same "peach of a fellow" (as someone assured me) that he still is today. My dissertation topic, as he mentioned, was "Geology and the British Romantic Poets"—in other words, the literary contemporaries of Hutton, Playfair, and the early Lyell.

In 1977, while on my way home from a Senior Fulbright lectureship in Korea, I stopped off in Wellington, New Zealand, to see four letters by Mary Shelley, wife of the poet and the author of *Frankenstein*; I knew two of the letters to be unpublished. All four were to Gideon Mantell, of whom I had heard by reason of my work on Emerson and the *American Journal of Science*. But I was entirely unprepared for the previously unknown riches of the Alexander Turnbull Library's superb Mantell collection. Revising my schedule of the spot, I spent four days—as much time as I could spare—researching two essays, one on Mary Shelley and Gideon Mantell, the other on the Mantell collection itself. Someone, I was convinced, really ought to write a biography of the fascinating and greatly underrated British discoverer of dinosaurs. It took me several months to figure out who that someone had to be. Eventually, I returned to New Zealand for a more extended stay of nine weeks, funded by the National Science Foundation—this with a doctorate in English literature—and the book itself (my third) took twenty-two years in all. My current book-length project has to do with Charles Lyell and won't, I hope, take as long.

Thank you very much.

O.E. MEINZER AWARD

Presented to Thomas C. Winter

Thomas C. Winter

Citation by Donald I. Siegel

This year's O.E. Meinzer Award is presented to Tom Winter of the U.S. Geological Survey. The Meinzer award was established in 1965 to recognize significant contributions that an individual has made in hydrogeology or some closely related field during the past five years. To this end, I am simply delighted to be asked by Tom to be his citationist. I first met Tom in 1972 when I enrolled at the University of Minnesota. Tom, then the Assistant District Chief of the USGS in St. Paul, was in the throws of completing his own Ph.D. dissertation under the same advisor, Olaf Pfannkuch. Tom's bibliography now is a profound record of achievement spanning decades of focused research to try and understand the complexities of surface-water and groundwater interaction in literally every hydrogeologic setting, from humid to dry climates, granular to fracture driven flow systems, from tiny potholes to large swamps. Tom was doing multidisciplinary research decades before it became fashionable. Indeed, Tom is known to many as the "father of lake-groundwater interaction," not because of his age (and I can say this because I am a gray beard too!), but because of his profound influence to the science.

Tom's winning the Meinzer Award has not been his first recognition. He received the Dept. of Interior Superior Service Award in 1981, the American Water Resources Association Boggess Award for Best Paper in 1981, three USGS special achievement awards, and Dept. Interior Meritorious Service Award and Distinguished Service Awards. He won the National Ground Water Association's M. King Hubbert Science Award in 1999, and the Society of Wetland Scientist's Lifetime Achievement Award this year, 2002. Tom is on a well-earned roll.

Specifically, why did Tom win the Meinzer Award? The Meinzer Committee cited several of Tom's recent papers out of his large body of work. Two of these papers, *"Groundwater and Surface water—a single resource,"* by Winter, J.W. Harvey, O.L. Franke, and W. M Alley, published as USGS Circular 1139, and Winter, *"Relation of streams, lakes and wetlands to groundwater flow systems*," published in the Hydrogeology Journal, include outstanding syntheses of his theoretical modeling experiments and subsequent field studies to test the model results. More than 30,000 copies of the Circular have been distributed to date. Tom—why, oh why, didn't you publish it with Elsevier? Just think of the royalties!

Both these paper directly descend from Tom's first, and arguably seminal, contribution to modern lake hydrogeology: "*Numerical Simulation of the Interaction of Lakes and Ground Water,"* published in 1976 as *USGS Professional Paper 1001.* The results in this paper and Tom's subsequent 3-D, non-steady state, and unsaturated/saturated flow models provide the intellectual foundation for modern multidisciplinary research on physical, geochemical, and biogeochemical processes at the ground water-surface water interface. Prior to these models, hydrologists, ecologist, and geologists oversimplified descriptions of lake groundwater interaction in ways that often led to scientific and regulatory misinterpretations and errors.

The second two papers cited by the committee are Winter's, "The vulnerability of wetlands to climate change: A hydrologic landscape perspective," published in the *Journal of the American Water Resources Association*, and Winter's "The concept of hydrologic landscapes," published in 2002 in the *Journal of the American Water Resources Association*. These contributions stem from Tom's recent interest in how wetlands and lakes evolve and fit into climatic and geomorphic landscapes. Wetlands and lakes occur in their many variations and forms because of changes and differences in regional and local geomorphology and climate. This fundamental concept somehow got lost in many regulatory schemes for wetland and lake classifications, which usually center on derivative ecological or descriptive factors. The two cited papers have received a great deal of press and discussion throughout both the academic and regulatory wetland hydrology and ecology communities. I predict that the elegance of the papers will lead to much better regulatory understanding of how hydrology controls wetland and lakes, and perhaps even a simpler and more scientifically robust formalization of wetland classifications used in regulatory and legal practice.

Finally, I would like to comment to one other paper that Tom wrote that changed paradigm. Calculating water balances is routinely done in hydrology. These calculations are essential to evaluate water and geochemical cycling in lakes and wetlands. In 1981, Winter showed in his review article, "*Uncertainties in estimating the water* *balance of lakes"* published in the *Water Resources Bulletin,* that errors in many measured components of lake water balances are often profound and, consequently, estimating a component of a water budget by residual often has little meaning. Tom's paper was particularly significant because lake management projects greatly depend upon accurate water budgets. If water budget errors are neglected, management projects can be doomed to failure. This paper won Tom the W.R. Boggess Award and he tells me that he's sent out over 2,000 reprints of the paper.

Tom has stayed throughout his career with the USGS, where in the National Research Program he conceived, organized, promoted and received long-term funding for his lake and wetlands research. As part of this program, Tom linked with academic, state, and other researchers in one of the most successful long-term collaborations around. Tom's success, beyond his intellect, stems from his being one of the most generous, self-effacing, and congenial scientists I know. Working with him simply is a pleasure. I can say this with some assurance. In the mid-1970's I was the USGS district hydrologist who organized most of the field work at Williams Lake (MN), where Tom field tested the results of his initial theoretical numerical modeling experiments on lake-groundwater interaction. There, under my astute supervision, a driller planted 100+ feet of drill stem, stabilizer and bit forever into the ground. When Tom heard about it, he laughed, and told me a story how he, in another aborted drilling operation, wound up glaciating an important Minnesota highway with continual ice a winter, much to the consternation of locals, the State, and the USGS which had to foot the bill to fix the problem. They kept him anyway, which has been to all our benefit.

Tom, my hearty congratulations on winning the Meinzer Award!

Response by Thomas C. Winter

I thank my GSA colleagues for this great honor. I have a photo of Meinzer and his USGS colleagues, taken in 1932, in my office. That photo is a continuing inspiration to live up to the standards that he set. Many individuals who followed Meinzer influenced me during my career, but in this limited space I can name only a few individuals who were either great thinkers, selfless colleagues, or both.

When I was a student in the late 1950s, a USGS hydrologist told me that if I became a ground-water hydrologist, I would spend the rest of my life running pumping tests to determine transmissibility and storage values, and plotting time-drawdown and distance-drawdown curves to predict aquifer performance. I thought 'there has to be more to this hydrology business than that'. And, in fact, there was, because in the early 1960s, Joe Tóth (Alberta Research Council) published his papers on ground-water flow systems. To me, ground-water flow systems were the link that held the hydrologic world together. Through ground-water flow systems, one could make sense of the distribution of chemical constituents in ground water, movement of contaminants, and the role of ground water in affecting the physical and chemical characteristics of surface water. The concept of ground-water flow systems was the framework upon which I set up my research project on the hydrology of lakes and wetlands.

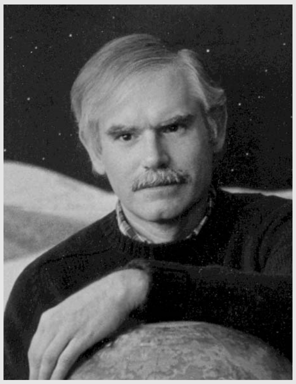
Following several years of numerical modeling of the interaction of ground water with lakes, I established field sites in different parts of the U.S. to see if the real world agreed with theory. After several years of field activity at those sites, it was clear that there was more to understanding the interaction of ground water and surface water than knowing only the big picture of the interaction of surface water with ground-water flow systems. And, in fact, there was, because with the help of Dick Cooley (USGS) in the early 1980s, I ran numerical experiments of variably-saturated flow, which indicated that wells needed to be placed very near surface water in order to fully understand the interaction of ground water and surface water. This insight led to a massive redesign of our field installations. To this day we continue to learn of the intertwined roles of landform, geology, and climate on the interaction of ground water and surface water.

With respect to the data record itself, it is impossible to obtain a continuous record at four field sites over a 25-year period without help. And for that help I thank Don Rosenberry, Jim LaBaugh, Don Buso, Dennis Merk, Dallas Hudson, and personnel of the Northern Prairie Wildlife Research Center.

A few others that must be acknowledged are; Herb Wright and Olaf Pfannkuch (my academic mentors), Gene Likens and George Swanson (who invited me to work at their field sites), Bob Maclay (an unusually selfless project chief), and managers of the USGS National Research Program (Joe Upson, John Bredehoeft, Roger Wolff, and Mary Jo Baedecker), who provided the atmosphere and funding for me to pursue my research.

G.K. GILBERT AWARD

Presented to James W. Head III



James W. Head III

Citation by Sean C. Solomon

The G. K. Gilbert Award is presented annually for outstanding contributions to the solution of fundamental problems in planetary geology. There have been few, if any, whose professional work exemplifies this description in greater breadth than this year's awardee. Jim Head is the recipient of the 2002 G. K. Gilbert Award for his many scientific publications addressing a wide range of geological problems on the planets and satellites of our solar system, for his sustained efforts in undergraduate education and graduate research supervision in planetary geology, and for his leadership role in fostering international communication on planetary exploration.

Jim Head is the author or coauthor of approximately 300 papers in books and refereed journals. A scientist of prodigious energy and sweeping curiosity, his publications treat most of the large solar system objects with solid surfaces. His principal source of inspiration has been the regular stream of new data from planetary missions, and his personal involvement in those missions has been enormously varied and characteristically intense. In the early 1970s, while on the staff at Bellcomm, Jim played a key role in the study of potential Apollo landing sites, the geological training of the Apollo astronauts, and the planning of their traverses while on the lunar surface, contributing enormously to maximizing the scientific return from the Apollo missions. In the three decades that he has been on the faculty of Brown University, Jim has been a guest investigator or a member of a science or instrument team on at least 10 missions that collectively have orbited (or will orbit) every planet from Mercury to Jupiter.

Trained in stratigraphy as a graduate student focused on Appalachian geology, Jim followed in the scientific footsteps of G. K. Gilbert. The first extraterrestrial body to which Jim applied his classical training was the Moon, where his earliest emphasis was on the nature of lunar craters and impact basins and on the styles and history of lunar volcanism. It was because he was a leading authority on the structure and evolution of lunar mare basins that he and I began a collaboration, about 25 years ago, on the history of volcanism in and lithospheric loading by mascon maria. In an early conversation in Jim's office on mare basin dimensions, we discovered that his dimensions were systematically twice those of mine. We quickly realized that we were approaching this simple question from complementary perspectives. For Jim — whose perceptions are based strongly on sensory input — the size metric was basin diameter, whereas for me the immediate application of mathematical models led me to think in terms of basin radius. An appreciation of our distinct approaches has helped to sustain our collaboration through more than 30 papers.

Another, even more prolific collaboration has produced some of Jim's most widely cited work. With Lionel Wilson of Lancaster University, Head developed quantitative models for the ascent, eruption, and fate of magma, and he applied those models systematically to a wide range of volcanic features on the planets. From the conditions favoring explosive volcanism to those favoring plutonism, from the formation of domes to that of rilles, from an assessment of time-dependent volcanic flux to an explanation for chemical variations among lunar volcanic samples, Jim and Lionel have matched theory and observation to gain insight into volcanic landforms on every terrestrial planet and several of the Galilean satellites. In explaining succinctly one of the reasons for the success of their highly productive collaboration, Wilson writes that Jim "is a powerhouse of constructive ideas."

The planet about which Jim has written more papers than any other is Venus, and the largest source of fuel for his creative Cytherean fires was the Magellan mission. Even more than a decade prior to Magellan's arrival at Venus, Jim made the most of the data from the Pioneer Venus Orbiter, the images from the Venera landers and orbiters, and Earth-based radar images of ever-improving resolution to develop and test hypotheses for Venus's geological workings. During the heady days when the stream of new data from Magellan gushed the strongest, Jim led the analysis of mission observations of volcanic landforms. His interests were much broader in scope, however, and his stratigraphic roots gave him the tools to synthesize observations and hone his ideas for how the Venus surface evolved on both regional and planetary scales. The global geological history that Jim and several colleagues have developed is not without controversy, but it is the most clearly espoused and most broadly developed among competing scenarios, and it is the benchmark against which all others are measured.

In the last five years, the Mars Global Surveyor (MGS) mission and particularly the Mars Orbiting Laser Altimeter (MOLA) experiment have given Jim a phenomenally rich source of information. Like the proverbial kid in the candy store, Jim has seen clues in the MOLA data that touch on the full spectrum of geological processes that shape planetary surfaces. From volcanic eruption mechanisms to large-scale deformation patterns, from glacial processes to polar cap evolution, from fluvial and hydrological processes to testing ideas for ancient Martian oceans, Jim and his students have wrung new geological insights from the latest data wherever they've looked.

Whereas most of us are usually hard pressed to keep up with the new findings from a single spacecraft mission, throughout the operation of MGS Jim has been in the thick of mission operations and data analysis for the Galileo mission to Jupiter and its geologically fascinating satellites. Jim and his students and colleagues have developed novel tectonic models for the origin of surface features of Europa and Ganymede and have tested ideas for magmatic and volcanic processes on Io. They have weighed in strongly on the nature of the icy lithosphere of Europa, its thickness, and the possibility of an underlying ocean, arguing on the basis of photogeology, chemical remote sensing, and physical models that convection within a thick ice layer can account for most of Europa's surface features.

In the area of planetary geological education, Jim Head's contributions are without equal. At the undergraduate level, Jim's introductory "Geo 5" class (currently titled Mars, Moon, and the Earth) each fall draws enthusiastic enrollments that have averaged 200 students per year. Extending back to the mid-1970s, this class now has as many as 5000 alumni. To put this astounding number into some perspective, Jim Head has single-handedly introduced planetary geological thinking to more than 20% of the graduates of Brown University over the past quarter century.

At the graduate level, Jim has supervised more than three dozen master's theses and two dozen Ph.D. theses. Rumor has it that Jim can be a challenging taskmaster. Nonetheless, he provides his students with countless avenues for fieldwork, involvement in spacecraft missions, and interaction with the larger scientific community, and I have watched with appreciation as he encourages his students to make the most of those opportunities. More important than mere numbers has been that an overwhelming majority of Jim's students have gone on to productive careers in planetary science. Many are now in positions of leadership where they are helping to chart the future directions of our field.

On the international level, Jim has done probably more than any other individual to promote scientific communication and collaboration between the planetary geology communities in Russia and the west. At the height of the Cold War era, when there were no ties between NASA and the Soviet space agency, Jim guided the establishment of a formal agreement between Brown University and the Vernadsky Institute of Geochemistry and Analytical Chemistry in Moscow. The Brown-Vernadsky microsymposia, held twice per year since 1985, have provided a forum for Russian, American, and European scientists to hold discussions and interact on collaborative research efforts. The continuation of these meetings after the break-up of the Soviet Union has permitted Russian planetary scientists to travel and carry out research in the west at a time when the levels of government support for science in Russia have been far from generous.

Jim's international diplomatic efforts also facilitated an exchange of mission scientific data that benefited the planetary geological communities in both the west and the east. Jim brought some of the first data to the west from Venera lander missions. As a guest investigator on the Venera 15/16 orbital missions, which obtained the first high-resolution radar images of much of the northern hemisphere of Venus, Jim played an important role in making these images available to western scientists. It is perhaps under-appreciated that it was the arrival of Venera 15/16 data in the U.S. that provided key arguments to persuade NASA to improve the radar image resolution planned for the Magellan mission that would fly 6 years later.

G. K. Gilbert, were he alive today, would be fascinated with Jim Head's scientific contributions and would soundly applaud Jim's achievements in education and international scientific cooperation. It is my honor and great pleasure to introduce the recipient of this year's G. K. Gilbert Award.

Response by James W. Head III

Thank you Sean for your very complimentary citation. It is a tremendous honor to have my name associated with that of G. K. Gilbert and with the many outstanding previous Gilbert Award winners. We are very very definitely shaped by the times in which we live, the settings in which we work, and the people that our personal trajectories intersect. This was of course true for G. K. Gilbert himself, who was born in 1843. The 75 years of his lifetime span the Heroic Age of American Geology. Names like James Hall, James Dwight Dana, John Wesley Powell, T. C. Chamberlin, William Morris Davis, and of course, G. K. Gilbert himself. Gilbert contributed a much more quantitative approach to the interpretation of geology than his contemporaries, who were largely naturalists. His treatises on the Henry Mountains of Utah and the shorelines of Lake Bonneville are testimonials to careful observations and application of quantitative approaches to understanding geological and geodynamical processes.

A mere 40 years after the death of G. K. Gilbert, a revolution occurred that completely changed the context for geosciences. This of course was the space age. You often hear terms like the "dawn" of an age, but for most of us in America, the space age arrived much more like a lightning bolt. The launch of Sputnik in 1957 by the Soviet Union was that lightning bolt. It was instantaneous, it was very bright to the point of being blinding, it got everyone's attention, and it reset virtually all circuits in our society. It literally galvanized America. A mere 12 years after the Soviet Union placed the first artificial satellite in Earth orbit, humans were walking on the Moon. Twelve years! In my own personal life, this event and its aftermath were pivotal. I was in the right place, at the right time!

I remember exactly where I was when I heard about Sputnik. I then listened to Radio Moscow on my short-wave radio to get details, and learned that I could send them my address and get the times Sputnik would pass over my home and the frequency on which it broadcast. I remember the day I got the letter from the Soviet Union. I came home from school, found the letter from Moscow covered with amazing Soviet space stamps, and my Aunt standing next to the table giving me a death ray stare! This was also the day that I learned that my Aunt didn't really work for the "State Department" at all, but actually worked for the CIA!

Following high school I went on to Washington and Lee University. I had to take a science course freshman year and I took geology because it had labs "outside". I quickly fell under the spell of Ed Spencer and his interest in Appalachian structural geology. Through Ed, I spent the summer of my freshman year in Montana as a field assistant to a young PhD student, Sam Kozak, mapping the Precambrian geology of the Madison Mountains. Ed said I would come back from that summer in Montana either loving Geology or hating it. I loved it! In Montana, Sam taught me the rigors of field observations and mapping and how to avoid rattlesnakes. Totally enamored with the field, and with the power of geological mapping in solving important problems, I spent the next three summers mapping in the Appalachians and trying to decipher the tectonic code. These were incredible times for me; at Washington and Lee, a small liberal arts institution, I was treated as much as a colleague pondering important scientific problems, as I was as a student learning the basics.

One day I remember hearing a rustling noise out in the hall, and this usually meant that some new maps or posters had arrived in the mail, and that Ed Spencer was busy tacking them up on the wall. So I rushed out to help him, and hopefully to see a geologic map of a new part of the world that I hadn't thought about before. I pushed the map to the wall while Ed finished putting the tacks in and with my nose to the wall, it slowly dawned on me that this was not a normal geological map. It was Shoemaker and Hackman's engineering geological map of the Moon. The seeds were sown! Ed Spencer and Sam Kozak, who was now teaching at Washington and Lee, encouraged me to apply to graduate school. I got accepted at several schools, including Brown University, where Sam Kozak had gotten his Master's degree. With their encouragement, I accepted the offer from Brown. It was a good decision.

Unbeknownst to me, the massive infusion of NSF funding that resulted from Sputnik was drastically changing graduate education. Brown had hired a lot of new young faculty. I got to work with Bill Chapple, Dave Harkrider, Bruno Giletti, Dick Yund, John Imbrie, and Rob Matthews. I worked with Tim Mutch and Leo Laporte on Appalachian shallow marine sedimentary environments. We used an understanding of recent sedimentary environments as a clue to paleoenvironmental stratigraphy and as keys to depositional basin evolution.

Interacting with Leo Laporte was like a spacecraft flyby gravity assist. An encounter with Leo altered your trajectory in powerful but subtle ways. I can remember coming into his office, babbling to him excitedly about something that I thought that I had just figured out, and having him join in my excitement and offering me encouragement to follow up on this new idea. Only some time later did it dawn on me that what I had reported to him as a new insight that week, was in fact pretty much what he had been trying to explain to me the week before, but that I hadn't understood at the time. Leo patiently taught me how to think, while letting me think that I had discovered how to do it myself.

Tim Mutch was different: an explorer, a dreamer, a teacher. Tim was a very tall, lanky guy; some said he literally always had his head in the clouds. In retrospect, I believe that his height actually meant that he could see the horizon much better than everyone else. For example, three of us graduate students took an Advanced Stratigraphy Seminar from Tim just before graduation: In the middle of a lecture, Tim went silent, wandered over to the window, gazed out the window for a few long minutes, and then turned around and said, "You know, there are just no fundamental problems left in Earth stratigraphy." Here we were, just a year before finishing graduate school, and our advisor tells us there are no fundamental problems left in the field!

Well, of course we soon learned that what he meant was that the real intellectual challenges were in extraterrestrial stratigraphy and in deciphering and defining the geologic history of the Moon and planets. Needless to say, Tim Mutch went on to a distinguished career in that field, really helping to define it with his books on the Moon and Mars. And indeed, two of the three people in that class, myself and Steve Saunders, also went on to careers in that field. Thanks Tim, for a definite mid-course modification of my trajectory.

But it wasn't immediately obvious to me that I was on this new trajectory. During my last year at Brown, Tim went off on sabbatical to Flagstaff to work with Gene Shoemaker, and I was left to ponder what to do after graduate school. Interviews with oil companies, small colleges, and so on were on the agenda. But one day I picked up a book called "The College Placement Annual", which listed employment opportunities in various fields for that year, 1967. I looked up geology in the index, and began to turn to the appropriate pages. The first one was a full-page ad with only a picture of the Moon with the words superposed "Our Job is to Think our way to the Moon and Back" and in small print at the bottom, "For more information, call this number." How could you NOT call that number! Well, I did, and it turned out to be the Apollo Program at NASA Headquarters.

The good news? I got the job! The bad news? I had no idea what I was doing! And indeed, that was the way it was. There was a job to be done, we were sending humans to the Moon and returning them safely. No one had any direct experience in doing it, and we made it up as we went along. I spent five wonderful years at NASA Headquarters (Bellcomm) during the Apollo Program. There was landing site selection: Learning planetary geologic mapping from the amazing people at the USGS: Gene Shoemaker, Don Wilhelms, Mike Carr, Jack McCauley, and many others. Working with Farouk El Baz and Noel Hinners. Trying to optimize multiple and often competing scientific goals and objectives. Working with a diversity of people from many different disciplines; cosmic ray physicists like Bob Walker, geochronologists like Jerry Wasserburg, petrologists and geochemists like John Wood and Paul Gast, engineers like Jack Sevier, flight controllers like Chris Craft and Gene Kranz, managers like Bob Gilruth, Rocco Petrone and George Low. Astronaut crew training: The amazing hours in the field, labs and briefing rooms working with highly motivated astronauts; thanks to Dave Scott, John Young and Jack Schmitt in particular, for taking us along for the ride and sharing their experiences with us. Mission operations while the astronauts were on the Moon: I owe special thanks to Gordon Swann and Bill Muehlberger for letting me play a role in the Apollo Lunar Field Geology Team. It was an incredible time! The United States was going to the Moon, and my mentors had steered me to the right place at the right time, so that I could become involved.

Following the Apollo Program, Tim Mutch helped to bring me back to Brown as an Assistant Professor Research, where I have more or less remained since that time. Tim's confidence in me and the tolerance and tutelage from my former professors are greatly appreciated. Tim, ever the explorer, went on to Viking and Mars, then to be NASA Associate Administrator for Space Science, and sadly to perish in a climbing accident in his beloved Himalayas. My major goal became to continue Tim's legacy of teaching and research at the university-college that is Brown.

In the last 25 years the field of planetary geoscience has enjoyed a host of successful missions and we all have been lucky to reap the rewards from this data acquisition and data analysis. These data have made comparative planetology a reality and have resulted in stunning new insights into planetary history and themes of evolution. During this time I had the opportunity to interact with many individuals who also altered my professional trajectory.

Tom McGetchin, who was then a professor at MIT, taught me the power of the spherical cow; the application of simple equations to seemingly complex geological processes to gain insight, and to reveal further questions that could be tested with new field observations. From time to time in Tom's slide presentations would appear the obligatory picture of the outcrop evidence, but instead of the hammer or lens cap for scale, Tom had inserted a slide rule. One day Tom and I pondered about what our students would do if they were witness to an impact event. Tom envisioned MIT students backing away from the impact point while busily mentally calculating ballistic trajectories of individual ejecta blocks, and moving from side to side to avoid them. I envisioned Brown students as knowing that most impact ejecta deposits obey a -3 ejecta thickness decay law, then turning 180 degrees from the impact point, and running as fast as they could!

Lionel Wilson, a physicist by training, taught me the importance of the physical continuum of natural processes. As geologists, we tend to classify and pigeonhole rocks and features so that we can bring order out of chaos. But sometimes these schemes become ends in themselves, and to paraphrase Doris Lessing, they form prisons we choose to live within. But in working with Lionel, I learned that distinctive eruption styles such as strombolian, hawaiian, plinian, and vulcanian, were not unique, but were points along a physical continuum. Furthermore, there was as much to learn about what you don't see in nature along this physical continuum, as there is from what you do see. For example, basaltic plinian eruptions sound like an oxymoron to many geologists on Earth, but this style is likely to dominate on Mars. My collaboration with Lionel was considerably helped early on when Lionel presented me with a copy of the "British-American Dictionary": it is real and it is thick! And in one of the most intellectually stimulating aspects of my life, Lionel and I spend at least as much time pondering how our different backgrounds bring us to the conclusions we ultimately reach, as we do thinking about the conclusions themselves.

Sean Solomon taught me how to apply key geological observations to test geophysical models and paradigms, and the scientific synergism that can result from the combination of geological and geophysical perspectives. At a recent workshop, a geophysicist colleague of ours was describing approaches to modelling the lithospheric structure and evolution of Australia. The geophysicist started by saying: "OK, the first thing I did was to subtract off all the geological noise." The geologists in the audience responded with a howl! "Hey, that's us!" But Sean has taught me not to take this as a grievous personal insult! It is easy to get lost in the geological "noise". It is important to have simplified geophysical models. But Sean's path is one of true scientific synergism. What are the most relevant and critical geological observations? How do they challenge geophysical models? How can we reconstruct a combined geological and geophysical model that makes predictions that can be tested further with new data? Thanks Sean for your tolerance of my simple geophysical questions and thanks for your laser-like geological queries that have consistently served to sharpen my thinking.

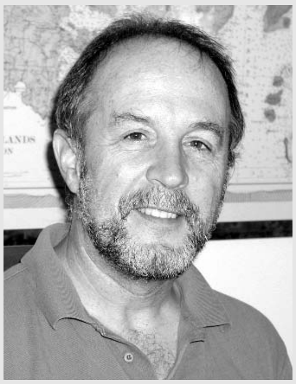
Alexander (Sasha) Basilevsky introduced me to the world of the Soviet Union and Russia, paved the way for me to participate in Soviet planetary missions, and together we have been able to explore the wonders of the geological history of Venus. Sasha and his colleagues have considerably enhanced my appreciation of culture and history and, ironically, through their intelligent and penetrating questions, have taught me that American culture is not an oxymoron.

I want to acknowledge the very important role my family has played in my life. Thanks to Liz and our two daughters, Melissa and Carol. Melissa and Carol tolerated my incessant attempts to introduce them to the natural world and to the power of listening and observations. They also tolerated the complete inability of their Dad, a rocket scientist, to answer many of the simplest of their queries. I remember Carol asking "Dad, how do you hear what you say in your head?" To which I could only answer: "Beats the heck out of me! I don't even know how you say what you hear in your head!" Needless to say, if the Gilbert award was given for providing coherent answers to questions from girls under 12 years of age, you wouldn't be seeing me up here today.

And finally, one of my most important mid-course corrections, meeting Anne Cote. Anne is an artist and her creativity and artistic perspective on both life and the natural world have opened whole new universes, which we explore together. Thanks Anne, thanks Sean, and thanks to my students and colleagues who have made this G. K. Gilbert award possible.

KIRK BRYAN AWARD

Presented to Mark T. Brandon and Frank J. Pazzaglia



Mark T. Brandon

Citation by Peter L.K. Knuepfer

It is a great pleasure to introduce the paper and authors voted the Kirk Bryan Award winners, Frank J. Pazzaglia of Lehigh University and Mark T. Brandon of Yale University for their paper, A fluvial record of long-term steady-state uplift and erosion across the Cascadia forearc high, western Washington State, published in 2001 in the American Journal of Science, v. 301, p. 385-431. This paper provides a veritable "how-to" for careful study and use of river terraces as a tool in understanding orogenic evolution, topics very close to my own interests. Before I discuss the paper and its authors, however, I'd like to place the work in a broader context.

Tectonic geomorphology can be viewed as a marriage between the disciplines of tectonics and geomorphology. Tectonic geomorphologists seek to understand the response of landscapes—rivers, hillslopes, mountains—to tectonic deformation while also examining the dynamic and tectonic response of the earth to surface processes, especially loading and unloading due to erosion and deposition. The field covers a broad range of scales and scientific problems, some of which have been recognized by prior awards from both this division and the Structural Geology and Tectonics Division. For example, aspects of paleoseismology—the study of prehistoric earthquakes—have been recognized in the 2000 Kirk Bryan Award to Brian Atwater and Eileen Hemphill-Haley for their work on recurrence intervals for great Cascadia earthquakes from detailed stratigraphic analysis of buried marsh deposits in Washington and in the 1994 Best Paper Award of the SGT Division to Rolando Armijo, Paul Tapponnier, and Han Tonglin for their study of Late Cenozoic right-lateral strike-slip faulting in southern Tibet. The link between tectonism and landscape evolution has been highlighted in the 1967 Kirk Bryan Award to Clyde Wahrhaftig for his work on the stepped topography in the southern Sierra Nevada and the 1997 Best Paper Award from SGT to Peter Molnar, Philip England, and Joseph Martinod for their analysis of the relationship between uplift of the Tibetan Plateau and the Indian Monsoon. The connection between rivers and tectonism was part of the message in John Hack's paper on longitudinal stream profiles in Virginia and Maryland.

This year's Kirk Bryan Award honors a paper that is a direct collaboration between a geomorphologist and a tectonicist/structural geologist. Frank Pazzaglia is a geomorphologist who has ranged beyond the traditional bounds of modern geomorphology in his studies of rivers and landscape evolution, as shown in his earlier studies of the Cenozoic evolution of the Appalachians by combining study of rivers and terraces—essentially the erosional record—with the offshore depositional record to reconstruct Appalachian denudation. Mark Brandon is a structural geologist who concentrates on the study of ancient and modern convergent orogens, but has broadened the scope of structural geology to include use of fission tracks and helium analysis to examine denudation, not only in the Olympics but also in the Alps and more recently New Zealand and Kamchatka. His comfort with geomorphologists extends beyond the collaboration honored in this award; he has also lent his statistical expertise to Bill Bull in analyzing lichen dating of earthquake-generated rockfall events.

It is not surprising, therefore, that two such broadly based earth scientists would work together to evaluate the record of uplift and denudation in the Olympic Mountains of Washington. Their collaboration began when Frank joined Mark at Yale as a post-doc after finishing his Ph.D. at Penn State in 1993. This initial collaboration led to some papers presented at national meetings. Frank then joined the faculty at the University of New Mexico (a tie to Kirk Bryan!), where he and his students continued studies of river terraces in the western Olympics. Meanwhile, Mark continued work on geochronology in the Olympics with his students and other colleagues. Their collaboration has continued to the present, with the paper honored here and other papers in press or planned.

As I've already indicated, the paper by Pazzaglia and Brandon that we honor tonight marks a major contribution to combining geomorphic and tectonic studies into a coherent whole. The authors summarize the geomorphic and stratigraphic relationships that have allowed them to correlate river terraces along the Clearwater River in western Washington and to tie terrace development and preservation into eustatically controlled base level changes and compare the resulting geomorphically inferred incision rates to denudation rates inferred from fission-track studies. This is careful and thorough work, though in itself it is no more innovative than many other studies of terrace sequences on rivers, even studies that correctly recognize the interplay of tectonics and climate in river-terrace development, as these authors have done.

There are, however, three aspects of the paper that are particularly innovative, and thus make the paper deserving of the Kirk Bryan Award. Two of these deal with how Frank and Mark consider the response of the landscape to tectonic shortening (and thus how to interpret the spatial distribution of fluvial and marine terraces). They are the first authors (in my experience) to account for the lateral translation of a river terrace surface that occurs in an orogen when the rocks and land surface are being moved horizontally by compression. Previous workers have used terrace elevations above a river in a 1D sense to estimate vertical incision rates, and generally they assume that vertical incision rates equal uplift rates. Pazzaglia and Brandon correctly recognize that if the mountains/rocks of the Olympic Peninsula are actually moving westward relative to the Pacific Ocean coastline, vertical incision of the Clearwater River will result in abandoning a terrace long profile that is moving horizontally toward the west. Thus terrace incision is a 2D problem, as elevation of the terrace above the river is not exclusively a matter of vertical uplift and incision but of that combined horizontal and vertical translation of the land surface due to tectonic shortening. They provide a simple yet elegant means of calculating the expected results of shortening on apparent river incision (if shortening rates are known).

The second point is related. They recognize that if a marine terrace and its original shoreline are being translated horizontally, then subsequent coastal erosion during sea-level highstands will produce a landward translation of the edge of the marine terrace (even as the original shoreline morphology has been translated toward the ocean by tectonically driven horizontal movement of the landscape). This can result in an apparent uplift of the marine terrace, as the shoreline that was present at the time of terrace formation has migrated oceanward and been eroded away, leaving the cover-bed stratigraphy that was originally inland (and deposited above sea level) now at the coast. Again, they provide a far more elegant explanation than I have here.

The third aspect of the paper deserving of special mention is the effort the authors make to compare the uplift rates they infer from (corrected) incision rates with the uplift/denudation profile obtained previously from fission-track dating. They use the similarity of rates between these two techniques to conclude that the orogen has reached a steady state between influx from tectonic accretion and outflux from erosion. While this conclusion is consistent with the data, it is not required, as the uncertainties in denudation rates are large. Nonetheless, this melding of geomorphology and geochronology has been attempted elsewhere, but never combined as successfully as here.

Comments from others about the paper include that it integrates a remarkable range of geomorphic and tectonic research, with the use of geomorphic features to investigate the 2D nature of the orogen as an original and creative approach consistent with the stature of the Kirk Bryan award. Another reader emphasizes how well the authors have integrated the centerpiece of a river-terrace study with neotectonics, glacial geology, geochronology, and sea-level change, coupling all of this with innovative modeling and an exceptionally well written and profusely illustrated text.

In summary, Pazzaglia and Brandon have written a clear, well reasoned paper that comprehensively documents the tectonic signal that can be obtained from a careful study of river and marine terraces. They have corrected most of the errors that are commonly made in this kind of study—particularly the assumption that vertical incision equals uplift rate—and have provided a template for future studies of river response to rapid tectonic uplift and shortening. This paper will be a key reference not only in the field of tectonic geomorphology, but also among those geoscientists interested in mountain-building and the evolution of mountain landscapes in tectonically active regions.

Response by Mark T. Brandon

I am honored to receive the Kirk Bryan Award. It gives me even greater pleasure to share this award with Frank Pazzaglia, who taught me what rivers can tell us about the evolution of tectonically active landscapes. In the fall of 1991, I attended a GSA field trip in the Transverse Range, lead by Ed Keller and Bob Yeats, to learn how geomorphology might be used to measure uplift in the Olympic Mountains. On that trip, I immediately hit it off with a young geomorphologist who was finishing his Ph.D. on fluvial incision and uplift in the northern Appalachians. Frank joined us that summer for a backpacking trip in the Olympics to collected samples for fission-track dating. We spent the whole time in long conversations about all things tectonic and geomorphic. Frank was also quick to realize that the Clearwater drainage would be ideal for a study of strath incision, given that it was the only major drainage that had not been affected by late Pleistocene glaciation.

In the fall, Frank submitted a proposal to NSF, and was awarded a two-year Earth Sciences Postdoctoral Research Fellowship. He was also offered a faculty position at University of New Mexico, but arranged a delay so that he could spend at least one year at Yale. In the summers of 1993 and 1994, Frank produced the first detailed maps of the straths and terrace fill sequences in the Clearwater. His year at Yale was intense. We spent most of the time trying to reconcile our very different experiences with deformation, uplift, fluvial incision, and terrace formation. We also spent considerable time discussing the interplay between tectonics, climate, and erosion at the regional scale. That laid the ground work for a paper on uplift and erosion of the Appalachians, published in 1996.

Frank's student Tony Garcia mapped fluvial stratigraphy in the Dosewallips drainage in the eastern Olympics, but the record there was much shorter and more complicated because of recent glaciation. Frank's student Karl Wegmann refined the fluvial stratigraphy in the Clearwater during the summers of 1997 and 1998. Karl's very nice work on the Holocene fluvial history of the Clearwater just came out in *GSA Bulletin*.

Frank and I would agree that writing our Clearwater paper was both an exciting and a miserable experience. We knew that at its core, the strath incision record in the Clearwater would provide a fundamental control on long-term uplift across the Olympics. We also knew that the pattern of uplift was very different from that indicated by modern geodetic studies. The reason was simple. Geodetic measurements record both the preseismic elastic deformation, plus the long-term permanent deformation. The strath incision rates were averaging uplift over a much longer time scale, so the elastic deformation associated with the earthquake cycle was averaged out. We struggled for a very long time to figure out how to estimate the ages of strath formation. The ultimate breakthrough came when we figured out how the outwash stratigraphy at the mouth of the river was tied to eustatic sea level. This result provided good age control for the upstream fluvial stratigraphy, which was used to constrain the ages of the underlying straths.

With rates we learned that the incision rates along the river were relatively steady over the last 150 k.y., and also matched the long-term erosion rates indicated by fission-track and He apatite dating. Mary Roden-Tice, John Garver and I had already proposed that the Olympics sector of the Cascadia wedge has been in a flux steady state since about 14 Ma, but to see steadiness on the 100 k.y. time scale was very surprising.

Discussions with Sean Willett started us to think about the implications of horizontal displacements on our geomorphic results. We gradually came to realize that the entire landscape was "surfing" into the west coast. Horizontal motion is fastest at the coast, but decelerates farther inland. The deceleration is due to horizontal shortening, in the direction of convergence, and accounts for the landward increase in uplift rates across the western Olympics. Work on thermal-kinematic modeling with Geoff Batt, Mary Roden-Tice, and Ken Farley also provided important support for this conclusion.

Differences in our backgrounds caused Frank and me to spend a lot of time debating the reliability of using strath incision as a measure of rock uplift in the Clearwater. Thus the broad scope of the paper reflects our need to come to terms with some of the core ideas in tectonic geomorphology. We are thankful to *American Journal of Science* for providing the space needed to dip deeply into these issues.

I have been lucky to work with a great group of people in the Olympics over the years. To all, including the many individuals not mentioned above, I thank you very much for your collaboration and friendship. I am grateful to my colleagues at Yale. I have profited greatly from the fine intellectual environment there. The long history of accomplishments in the department, both in research and in undergraduate and graduate education, have driven me to make more of my talents, as they are. Even with this award, I was surprised to learn that Kirk Bryan got his Ph.D. from our department in 1920.

I am very lucky to have a wonderful family, with my wife Susan Monsen and my son Alec. Their love and support have long helped to moderate the ups and downs that come with an academic life.

I would like to finish with a comment. Several years ago, the NSF Earth Science Postdoctoral Research Fellowship program was quietly discontinued. I was surprised because it provided a unique opportunity for newly minted Ph.D. students to chart their own direction for postdoctoral research. Those who succeeded got personal recognition for their talents, initiative, and research ideas. I know that Frank profited greatly from his fellowship experience. I hope that the Division of Earth Sciences at NSF will consider reinstating this program.

Frank J. Pazzaglia

Response by Frank J. Pazzaglia

There are not words to describe my surprise when I learned that the Clearwater terrace paper was nominated, let alone awarded the Kirk Bryan Award. It means a great deal to me to have this paper recognized by this division. I have come to call most of you colleagues and a large number of you friends; it is a fine gesture of mutual respect we have for one another in nominating and making this award every year. It helps us maintain a link with the long list of outstanding geomorphologists upon which the foundation of our science is built. The award carries special meaning for me because I have always felt a certain connection to Kirk Bryan and his work. Kirk Bryan was the second graduate from the Department of Geology at the University of New Mexico. I have had the honor and privilege of studying geomorphology in that department as both a student and as an assistant professor. There is no finer place and no finer group of faculty colleagues for a young geomorphologist to learn how to become a scientist. I consider myself lucky to call Charles Stearns a friend. Charlie was one of Kirk Bryan's last students working in New Mexico, and inspired by him, I continue to work with my New Mexican colleagues on the Tuerto Gravels and geology in the Hagan Basin, both long-time research projects of Kirk Bryan. It is a great thrill to see that the broader community of Quaternary Geologist and Geomorphologists recognize the now maturing field of tectonic geomorphology. And in selecting a paper co-authored by someone traditionally trained as a geomorphologist and another traditionally trained as a structural geologist, I think it speaks well to the good things that can happen when the walls between disciplines are kept low.

The paper that you have chosen to honor tonight reflects the work and consideration of many of you who are not listed as authors, but nevertheless, deserve recognition. So it is fitting and proper to use this opportunity to recognize the efforts of that broader community. First and foremost, I'd like to thank my co-author Mark Brandon. This paper was such a complete team effort that it is only through his grace and character that my name appears first. Mark has been my closest professional colleague and a good friend for over ten years. I do not assume full responsibility for when Mark starts speaking like a geomorphologist, but our collaboration has certainly forced me to rethink my traditional training! The geomorphic foundation of what Mark and I tried to accomplish in the Olympics is an outgrowth of that training that I received from Steve Wells, Les McFadden, and Tom Gardner, three of the finest process geomorphologists and citizens in our discipline.

I have been blessed to have mentored 11 outstanding graduate students, two in the Olympics who were among the finest young men any professor could have ever hoped to advise. Tony Garcia worked on the eastern side of the peninsula, and Karl Wegmann worked in the Clearwater basin itself. Karl's remapping of my initial work was instrumental in getting the fluvial stratigraphy correct for the Clearwater drainage. Along with these students, I have had a long-standing relationship with Glenn Thackray who at that time was completing his Ph.D. at the University of Washington and is now an associate professor at Idaho State. Glenn and I spent several summers together and it is his glacial stratigraphy and descriptions of the coastal exposures that anchors much of what we know about the Clearwater terrace ages. Likewise, I am thankful for the cooperation and numerous field discussions with members of the State of Washington DNR, namely Wendy Gerstel and Bill Lingley. And I would like to acknowledge the support and cooperation of the National Park Service, the Quinault Nation, and Rayonier Inc.

The paper benefited greatly from extensive reviews spanning several years as Mark and I wrote, rewrote, revised, rewrote, and rewrote again. I am so thankful that length of time between the first draft and final publication was not a criteria in the award selection process. I'd like to recognize Harvey Kelsey, Brian Atwater, Kelin Whipple, Bill Bull, and most important, Peter Knuepfer, who graciously provided the final advice and push that made the manuscript publishable. Financial support over the years was provided by the National Science Foundation and I'd like to thank the Tectonics Program and the unknown reviewers of my proposal to work in the Olympics for their support. My research continues in the Olympics with the support of my current department at Lehigh University and new collaborators including Eric McDonald and John Gosse as we attack the very complicated world of soils and cosmogenic exposure ages in the temperate rain forest setting.

Last, in selecting this paper for the Kirk Bryan Award, you have, in a very direct way, recognized the efforts of individuals whose names never makes it to the list of authors. I'm speaking specifically of my wife Kristen, who for many consecutive summers was home in Albuquerque, with three very young children, alone and with no support while I was enjoying myself grandly in the Olympics being a field geologist. Rarely is there recognition and almost never are there awards for those at home that give us field geologists the freedom and opportunity to do what we do. This award recognizes the support and sacrifice of my wife and I sincerely thank you on her behalf for that.

This concludes my comments, thank you again very much for your recognition of this paper.

LAURENCE L. SLOSS AWARD

Presented to
Allison R. "Pete" Palmer

Allison R. "Pete" Palmer

Citation by Paul Karl Link

Pete Palmer's lifetime contribution to Geoscience, and to GSA is extraordinary. His career is now in its 6th decade and Pete is as full of energy, ideas, and optimism as he was when he began the Decade of North American Geology project, over 20 years ago. At that point, in 1980, Pete had finished a full-length geological career already, with 15 years with the USGS and 14 years at SUNY Stony Brook.

Pete got his B.S. at Penn State in 1946, which is before many of us were born, and before most of our students' *parents* were born!

His Ph.D. is from Charlie Bell and the University of Minnesota in 1950, where he began a life-long fascination with trilobites, and with the Cambrian. Pete's publications on Cambrian paleontology are classics, and form the basis for much of what we know about the Cambrian of the Great Basin. Pete's concepts of Cambrian facies belts, trilobite evolution and the significance of extinction events in Cambrian history, and his persistent advocacy of the importance of paleontology to stratigraphy have benefited sedimentary geology in fundamental ways; in particular, the analysis of problems related to international stratigraphic correlation and paleogeography, and to the Laurentian subdivisions of the Cambrian System.

Pete's colleagues span the geographic extent of the globe, and his genuine enthusiasm for people allow him to count among his friends scores of international geologists.

Beyond the Cambrian, Pete's most well-known and most lasting contribution has been the shepherding of the DNAG volumes, which represent thousands of pages of collaborative summaries of the geology of North America, and which are the most ambitious publishing endeavor ever undertaken by the Geological Society of America.

With incredible patience, persistence and energy, Pete tracked each volume and sometimes each paper in each volume, established personal contact with hundreds of authors, and faithfully and tirelessly 'herded cats', not just during the 1980's which was to be 'the decade', but through the 1990's and even into the 21st century. The final geologic map compilation of North America is on display at this meeting. Reminiscent of the EverReady Bunny, Pete's energy was tireless. But more important were his undying faith in the final product, and the personal interest in and commitment to the co-authors. Further, Pete was instrumental in the fund-raising for the project, without which it would not have started.

In addition to his Institute for Cambrian Studies, which is a globally used resource, Pete has recently become involved with GSA initiatives in Geoscience Education and Geology and Public Policy. To take the time to deal with teachers, and the general public, and Creation Science advocates, is typical of Pete's lack of pretension and his respect for all people.

In the last few years Pete has helped organize symposia dealing with issues relating to Sustainability and Ecological Footprints. Many of us are reluctant to dive into these issues, since they embrace all the messiness of politics, morality, and economics. Pete's willingness to foster discussion of the future of human resource use grow from his dedicated, optimistic values and personality.

In terms of lifetime contributions that rise to those of the magnitude of Larry Sloss, Pete Palmer is among a select few. The publication numbers, documented by Nigel Hughes in his presentation of the Paleontology Society Medal to Pete in 1999, are over 137 refereed articles, including 9 major monographs, and over 2,200 printed pages. But, as Nigel pointed, out, there is a wonderful humanist looming behind those numbers.

I feel honored to have been inspired, early in my career, by Pete, who I first met in the Flinders Ranges in South Australia in 1976. I know that many people in the present audience feel exactly the same way about him. I am delighted to be able to present the L.L. Sloss Award to Allison R. "Pete" Palmer.

Response by Allison R. "Pete" Palmer

Mr. Chairman, members of the award Selection Committee, Ladies and Gentlemen. Mercifully for you, GSA has given me only 500 words for my response. Larry was a good friend and I hope he would be pleased with your selection. I know Charlie Bell would be pleased. My professional life has revolved around the Cambrian System, except for the 12-year diversion to help bring to fruition the DNAG Project for GSA. Even though I classify myself as a paleontologist, my work has largely been in the context of biostratigraphy and regional stratigraphic synthesis. The Cambrian is ideal for this sort of integration because its fossil record is dominated by trilobites and thus has the potential to be handled by a single individual.

My interest in the integration of biostratigraphy and lithostratigraphy was nurtured as a graduate student by Charlie, and then I had the ultimate perfect job as the Cambrian specialist for the USGS, under the leadership of Pres Cloud. This permitted me to get familiar with Cambrian rocks all over Laurentia during the years when mapping parties swarmed over the Appalachians, the Rocky Mountains and the Great Basin. I have also had the privilege of visiting most foreign Cambrian successions as a member of working groups of the Cambrian Subcommission of the International Stratigraphic Commission regarding stratotypes for the Precambrian/Cambrian Boundary and for international stages within the Cambrian System.

The Cambrian System is the key to unraveling much of the complex story of the dance of the continents during Phanerozoic time. The Cambrian world consisted of five clear continental or sub-continental entities, Gondwana, Baltica, Siberia, Avalonia and Laurentia. Each of these entities carried its own distinctive shallow-marine trilobite fauna and/or a distinctive lithostratigraphy. I've had fun contributing to recognition of that geography and the fate of many of its pieces, which involved establishment of the paleogeographic significance of particular biofacies and lithofacies. Fragments of Laurentia are now found in northwest Scotland and the Argentine Precordillera. Avalonia is split between eastern North America and western Europe. Gondwana is represented by all the southern continents and by numerous pieces, and possible peripheral peri-Gondwana terranes, throughout southern Eurasia. Western Alaska has un-American terranes with strong Siberian Cambrian affinities, and the Cambrian of Oaxaca in southern Mexico is also clearly un-American.

My interest in regional synthesis was partly responsible for my third career with the DNAG Project at GSA, beginning in 1980. Larry Sloss was President at that time and helped make the decision to hire me. Subsequently he was one of my editors for the volume on the Sedimentary Cover of the Craton in the U.S. He also created the Sauk Sequence, which made eminent sense for anyone working in the lower Paleozoic.

It's been a great life so far, thanks to Charlie Bell, Virgil Barnes, Pres Cloud, and the numerous field geologists here and abroad who were so generous with their mentoring and knowledge. It has been the right half-century to help resolve the Cambrian world. I thank you all for your acknowledgment of this with the honor of the Sloss Award. It will have a special place in the office of the Institute for Cambrian Studies.

STRUCTURAL GEOLOGY AND TECTONICS CAREER CONTRIBUTION AWARD

Presented to Robert E. Wallace

Robert E. Wallace

Citation by Robert Yeats

Prior to the 20th century, the study of earthquakes was done by geologists: Gilbert, Lawson, McKay, Koto. Then the seismograph was invented, and geologists fled the field! *Seismology* came to mean the study of earthquake waves using the seismograph, and the physics of the earthquake process. This state of affairs continued for nearly half a century.

Although Levi Noble labored in a lonely vineyard in his studies of the San Andreas fault, the first geologist to return to the study of earthquakes was Bob Wallace, who, in his CalTech thesis and GSA Bulletin article in the 1940's, began a long-term study of the San Andreas fault, particularly its 1857 trace. His work in the Carrizo Plains is most notable, where he combined structural geology and careful geomorphology to work out the meaning of the now-famous stream offsets across the fault. One locality became so associated with him that it is now officially named Wallace Creek. Wallace's love affair with the San Andreas fault culminated with the publication of a USGS Professional Paper on the San Andreas fault after his retirement from the USGS.

In the 1960's, Wallace began a project on the 1915 earthquake rupture in Pleasant Valley, Nevada, one of the largest known earthquakes known on a continental normal fault. (Previous work on this rupture had been done in the 1930's by a previous SGTD awardee, Ben Page.) Wallace pioneered the careful mapping of surface features followed by backhoe trenching, a project that continues today after the publication of his professional paper on the Pleasant Valley earthquake. Wallace recognized that the sequence of 20th century earthquakes left an unruptured segment of the Stillwater range-front fault between the 1954 Dixie Valley trace and the 1915 Pleasant Valley trace. This became known as the Stillwater seismic gap. Wallace also recognized that the high degree of activity in this century was unusual because recurrence intervals on earthquakes in this region was measured in thousands of years. This led to the concept of earthquake clustering.

In the 1980's, Wallace extended his work to the Yinchuan graben of north China, studying the normal fault that ruptured the Great Wall of China in 1739. This was part of his interest in collaboration between American scientists and those from elsewhere in the world, leading to a Penrose conference convened with Bill Bull in Winnemucca, Nevada, in 1983 (just before the Coalinga earthquake) and IGCP 206, Worldwide Comparison of Major Active Faults. Foreign collaboration was nothing new to Wallace; he had earlier worked on the North Anatolian fault because of its similarity to the San Andreas fault.

Once, when he visited OSU to give a talk, he pointed out that his major specialty was *paleoseismology*, a word at that time unfamiliar to me. Paleoseismology is the study of earthquakes based on their expression in the geologic record. This field, very much in vogue today, finally got geologists back into the study of earthquakes because 100 years of seismographic records are not enough to understand the earthquake process, particularly recurrence intervals, segment boundaries, and slip rates. (Does this make the geological study of earthquake ruptures accompanying a recent event like Landers *neoseismology?*)

Wallace used his administrative positions in the USGS as a bully pulpit to promote geological studies of earthquakes, both within and outside the USGS. The mission and goals of the present-day National Earthquake Hazards Reduction Program were laid out by Wallace in a paper in 1960. Wallace convened a symposium at AGU in 1983 entitled "Active Tectonics," an attempt to bring together structural geologists, geomorphologists, Quaternary geochronologists, and geophysicists (including geodesists) to see where we were in establishing earthquake geology as a viable subdiscipline. Wallace discarded the term *neotectonics* and adopted a new term, *active tectonics*, the title of a book he edited that was published by the National Academy Press in 1986. This book, which has had an enormous impact on earthquake geological studies worldwide, is commonly called the Wallace Volume because he saw it through from beginning to end. However, Wallace is not listed as the editor, and no paper in the book has him as an author! The paper written by him, "Overview and Recommendations," is anonymous, characteristic of his own modesty, yet it is the most important paper in the book because he shows why active tectonics is so important to society.

The term *active tectonics* would probably qualify as "strategic research," based on Wallace's analysis, yet, thanks to Wallace's marching orders, NEHRP has included much fundamental research on how the crust behaves, and on the geology of the earthquake process. To quote from the anonymous "Overview and Recommendations," active tectonics refers to "tectonic movements that are expected to occur within a future time span of concern to society." A congressman would understand this definition, and so would my next door neighbor.

A final comment about Wallace's qualifications regards his impact on the geophysical community. Geophysicists have a jaundiced view of geologists: we don't do so well in physics and math, and we are too qualitative in a field that demands numerical answers to questions such as how long until the next earthquake and how large will it be? Wallace's impact on the seismological community is marked by his being awarded the Medal of the Seismological Society of America in 1989. The citation points to his "leadership in geological research that have linked the disciplines of seismology and geology and have emphasized the simple truth that they are, indeed, one."

Selected Publications

R.E. Wallace, 1949, Structure of a portion of the San Andreas fault in southern California: Geol. Soc. America Bull. 60:781-806.

____, 1968, Notes on stream channels offset by the San Andreas fault, southern Coast Ranges, California, in Dickinson, W.R., and Grantz, A., eds., Proceedings of Conference on Geologic Problems of the San Andreas fault system: Stanford Univ. Pubs. Geol. Sci. 11:6-21.

____, 1968, Earthquake of August 19, 1966, Varto area, eastern Turkey: Seismol. Soc. America Bull. 58:47-102.

____, 1970, Earthquake recurrence intervals on the San Andreas fault: Geol. Soc. America Bull. 81:2875-2890.

____, 1976, The Talas-Fergana fault, Kirghiz and Kazakh S.S.R.: Earthquake Information Bull. 8:4-13.

____,1984, Fault scarps formed during the earthquakes of October 2, 1915, Pleasant Valley, Nevada, and their tectonic implications: U.S. Geol. Survey Prof. Paper 1274-A.

B. Zhang, Y. Liao, S. Gao, R.E. Wallace, R.C. Bucknam, and T.C. Hanks, 1986, Fault scarps related to 1739 earthquake and seismicity of the Yinchuan graben, Ningxia Huizu Zizhiqu, China: Seismol. Soc. America Bull. 76:1253-1287 (Wallace wrote this paper, but modestly refused to list himself as first author).

____, 1987, Grouping and migration of surface faulting and variations in slip rates on faults in the Great Basin province: Seismol. Soc. America Bull. 77:868-876.

____, (ed., anonymous), 1986, Active Tectonics: Washington, National Academy Press, 266 p.

____, (ed.), 1990, The San Andreas fault system, California: U.S. Geol. Survey Prof. Paper 1515, 283 p. (includes papers by Wallace entitled "General Features," "Geomorphic Expression," and "Supplement: Additional Reading and Source Material."

Response by Robert E. Wallace

I am honored and extremely pleased to accept this award. I am also embarrassed because carrying out the studies that led to this involved such exciting exploration, travel and adventure, indeed, so much fun, that I feel that I should in some way be paying back for my experiences.

The least I can do is to thank the U.S. Geological Survey, which was my professional home for almost fifty years. Those were halcyon years at the USGS during which exploring for new ideas was strongly encouraged. In contrast, some later managers, who were primarily administrators, apparently had no concept of how little we really know about the workings of the earth.

Without a strong focus on research we cannot design measures that will help protect society against the ravages of natural disasters such as earthquakes, floods, volcanic eruptions and landslides. Few fundamental ideas are available to help us cope with new and complex environmental problems. Finding resources of minerals and water for the nation's insatiable industrial and domestic needs continues to require entirely new approaches, concepts and technology.

Preston Cloud (Cloud, Preston, 1980, The Improbable Bureaucracy: The United States Geological Survey, 1879-1979; Proceedings of American Philosophical Society, Vol.124, no.3, 1980.) wrote a history of the USGS to celebrate its centennial in 1979. He referred to the USGS as "The Improbable Bureaucracy", and expressed the organization's long-term strength thus:

"What I would stress is the importance to USGS distinction of the nonadministrative leadership that welled up and continues to well-up under the traditional Survey policy of encouraging and rewarding individual initiative." What an important observation about the management of scientific research that was.

Those one hundred years were enormously productive years, and I am thankful to have been a part of the USGS during at least some of them. My wife, Trudy. provided constant moral support, and several times joined me in the adventures of exploration and discovery. In addition, thanks to The Geological Society of America and its Division of Structural Geology and Tectonics for granting today's award to me.