AGU

Gurnis, McComas Receive Macelwane Medals

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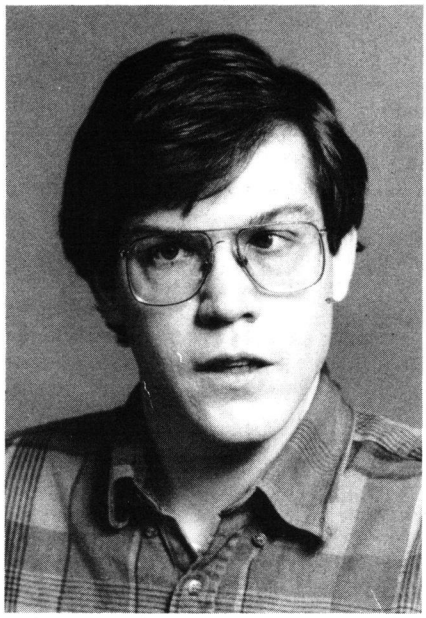
Michael Gurnis and David J. McComas were honored as recipients of James B. Macelwane Medals at the AGU 1993 Spring Meeting in Baltimore last May. The medal recognizes significant contributions to the geophysical sciences by a young scientist of outstanding ability. Richard O'Connell presented Gurnis' medal, and James L. Burch presented McComas' medal. Citations and responses are presented below.



Michael Gurnis

David J. McComas

Citation for Michael Gurnis

"I am most pleased to present the citation for Michael Gurnis for the James B. Macelwane Medal. Mike has distinguished himself by addressing some important problems dealing with the relation between the large-scale dynamics of the Earth's interior and geochemical and geological observations. He has made seminal contributions to understanding the role of mixing of heterogeneities in the Earth's mantle; the influence of lithospheric plates on mixing, flow and subduction in the mantle; and the role of mantle convection and plate tectonic processes in causing changes in sea level and epeirogenic uplift and subsidence.

"Mike grew up in Cohasset, Mass., a small town on the coast south of Boston. I recently moved to Cohasset myself, and after experiencing several winter storms that battered the coast, I too have come to appreciate Mike's interest in changes of sea level. Perhaps to distance himself from such changes, he attended the University of Arizona in Tucson, where he received a B.S. in geoscience in 1982. He also managed to add the first three papers to his bibliography while he was there, based on work interpreting the statistics of craters on Mars, Mercury, and Galilean satellites partly with Alex Woronow and Robert Strom.

"It appears that Mike had already acquired a reputation as one who spoke directly and did not hesitate to ask difficult questions, and he was encouraged to go to Washington University to work with Geoff Davies. Mike tells me that it was thought that their personalities would provide a good match. They must have, for they both went to Australian National University, where Mike completed his Ph.D. in 1987.

"His first paper at ANU was 'Simple parametric models of crustal growth,' written with Davies. This paper demonstrated Mike's ability to isolate the relevant parts of a complicated problem to construct a model that could be analyzed to illuminate the important aspects of the problem. In this paper, as well as in a later one, they showed that smooth growth models could lead to a bimodal crustal-age distribution if younger crust is preferentially recycled. This work was followed by a series of papers on the mixing of heterogeneities (such as recycled crustal material) in the mantle, which showed that a range of heterogeneities could be preserved in the convecting mantle with large scale flow. In these papers he really came to grips with reconciling and understanding the differences between his results and those of other workers. Neither he nor Geoff shy away from confronting discrepancies.

"After completing his Ph.D., Mike went to Caltech for a post-doctoral appointment where he collaborated with Brad Hager. I wish he had come to Harvard! There he extended his modeling the interaction of mantle convection with the lithosphere and showed how continents could be broken apart and reassembled by mantle convection. He also pursued work on the dynamics of subduction and extended his numerical repertoire to include the use of parallel processing computers.

"He went to the University of Michigan in 1988, and in that supportive environment continued his work, assessing the role of plates on mantle convection and using parallel computation to model mantle mixing. Most importantly, however, he really dug into the problem of effects of convection, the rearrangement of continents, and the location of subduction zones on sea level and continental flooding. This work represents an important advance, for it relates the fundamental geological processes of basin formation and sedimentation to the larger-scale dynamics of the interior. The study promises to bring together disciplines from sedimentary geologists to numerical convection modelers and illustrate the unity of geosciences in attacking fundamental problems, while showing the range of disciplines that is needed to do so. Mike Gurnis is the sort of scientist with the vision and ability to recognize both and the energy and perseverance to come to grips with the problem. He is a most deserving recipient of the Macelwane Medal."—*Richard O'Connell, Harvard University, Cambridge, Mass.*

Response

"I sincerely thank you Dr. Cicerone, Rick, and AGU for awarding me this Macelwane Medal. I was truly humbled when I read over the list of distinguished Earth scientists who have received the Macelwane in years past.

"When I was younger I was determined to do things myself, to make it on my own without the influence of others. I guess I still feel this way. But when I reviewed my career, I realized that reality has been very different. Indeed, to a large measure, the fact that I'm up here this evening is a tribute to others.

"As an undergraduate at Arizona I was lucky to be taken into the research group of Bob Strom, who was then on the Voyager imaging team. This was about the time of the first encounter with Saturn, which was very exciting. But what was more important for me is that I started working with Alex Woronow, who was part of Strom's team. Alex introduced me to the fine art of numerical modeling. I was very fortunate to be able to work so closely with a creative research scientist early in my career. I truly thank Alex for that opportunity.

"I was drawn to planetary science out of a long fascination I had with other solar system bodies, but things had started to go bad for NASA funding, and I decided to jump ship—figuring the opportunities with a career in terrestrial geophysics were far better. As I was figuring out what field to go into, I stumbled upon mantle convection. It may have been through the influence of Bill McKinnon, with whom I had endless scientific discussions. Randy Richardson, my official advisor, suggested I should go and work

for Geoff Davies. I was skeptical. But for some reason, Randy thought that if I worked with Davies only great things could come of it. I don't know why Randy felt so strongly about this, but perhaps it was because Geoff was a troublemaker and, apparently, so was I. My choice of a graduate advisor was not random, and I have Randy to thank for that.

"Off I went to St. Louis and before I knew it, Davies was to leave Washington University and return to his homeland, Australia. Well, Geoff invited me to transfer to the ANU and continue my graduate studies. I didn't know much about Australia, this was before Crocodile Dundee, but even I knew one couldn't go wrong with the ANU. This is one decision I have never regretted. The Research School of Earth Sciences at ANU is a most wonderful scientific institution. When I went there, I was a scatterbrain, but I had an advisor, Geoff Davies, who was dedicated at putting some semblance of logic into my thinking. He was a tough advisor, but also one of the most pleasant and humble persons I have known. He is a deeply creative scientist. In many respects, I believe that the ideas first sparked by Geoff have propelled me to this place this evening. From my time at RSES, I must acknowledge the influence of Ross Griffiths for sharing his deep understanding of fluid mechanics.

"Returning to the United States, I was lucky to have yet another fantastic opportunity—a post-doc at Caltech's Seismo Lab working with Brad Hager. Hager allowed me to pursue my own interests with complete freedom. Brad turned out to be a fierce devil's advocate, continuously forcing me to do better. Brad has incredible insight into how to make dynamic models useful for the rest of geophysics. I must also acknowledge the influence of Don Anderson—he spent long hours at Seismo Lab coffee forcing me to question everything Davies and Hager had taught me! Scott King and Arthur Raefsky also played influential roles in introducing me to the work of finite elements. I'm not sure where geodynamics would be without the influence of Raefsky.

"After a long stint in warm climes, I moved to the truly delightful geology department at the University of Michigan. It seems that the only thing wrong is that we are turning into a department of mass spectrometers instead of a department of geologists. I have many delightful and stimulating colleagues in Ann Arbor, including Kenji Satake, Larry Ruff, Bruce Wilkinson, Rob Van der Voo, Henry Pollack, and before he left Michigan, Thorne Lay. I thank them all and many others. I will end here by thanking an exceptional junior colleague with whom I have the opportunity of working: Shijie Zhong.

"Once again, thank you all."—*Michael Gurnis, University of Michigan, Ann Arbor*

Citation for David J. McComas

"I am pleased to be able to present the AGU Macelwane Medal to David J. McComas of Los Alamos National Laboratory. In looking back over the past Macelwane award winners, I am always struck by the high level of their subsequent accomplishments. Macelwane awardees, it seems, simply do not settle into patterns of moderate accomplishment. In fact, most of the medalists have redefined their fields of study and have continued to work at the absolute forefront throughout their careers. Following this tradition, Dave McComas is in the process of redefining his field of study, which encompasses the composition of solar system plasmas, their source regions, and their interactions with the various planetary obstacles that exist in the heliosphere. He is doing so with unique applications of existing spacecraft data and with the innovative design of startlingly new plasma instrumentation that will provide ion composition data with unprecedented sensitivity and mass resolution over the next decade. So significant are his contributions to his field that I wanted to nominate him 2 years ago but was dissuaded by his colleagues because he was still too young!

"Dave's work on spacecraft plasma instrumentation began after his arrival at Los Alamos from undergraduate school at MIT. This work, which soon led to published innovations, was interrupted by his Ph.D. studies at UCLA. Dave completed his Ph.D. in record time at UCLA, going from a B.S. to a Ph.D. in under 3 years, the previous record having been held by his advisor, Chris Russell, a Macelwane awardee himself. While still a graduate student, Dave began a series of studies of the interaction of the solar wind with comets and with both magnetized and unmagnetized planets. The work focused on the draping of magnetic field around the unmagnetized bodies and on the development of current sheets in the downstream magnetic tails of both types of obstacles. This research was especially notable for its comparative aspects, which have led to a better appreciation for the scaling laws that apply throughout the solar system.

"On his return to Los Alamos, Dave continued his investigations of the solar-wind interactions with obstacles to the flow and began to try to relate phenomena he observed in the solar wind back to the source regions on the Sun. Very little was known about the overall magnetic topology of interplanetary space or its relationship to processes in the solar atmosphere, even though such information is crucial to our eventual understanding of how solar phenomena affect interplanetary space and planetary environments. Working with the idea that reconnection in the solar atmosphere might lead to dropouts in the solar wind electron heat flux, Dave searched for and found such dropouts, and showed that they occur preferentially in the vicinity of the heliospheric current sheet where reconnection might be expected. Realizing that the U-shaped magnetic structures resulting from reconnection across the current sheet might be visible in coronagraph images of the solar corona, Dave examined data from the Solar Maximum Mission and discovered the structures he had predicted. As *GRL* editor-in-chief, I was privileged to publish his discovery of U-shaped magnetic structures in the solar corona in the January 1991 issue and to feature one of the figures from that paper on the journal's cover.

"In 1989 and 1990, I was a member of a large international consortium that proposed to provide the plasma science instrumentation for the Cassini Saturn Orbiter mission. At one of our later meetings, Dave McComas presented a new idea based on a very simple concept, which would, he claimed, lead to an instrument with characteristics exceeding our then current design. We were skeptical but agreed to defer our final decision on which instrument to propose for a few months while he backed up his claims. During this time Dave organized a small group of competent people and together they verified his idea with computer ray tracing and by building a laboratory prototype. We decided to adopt his design and we were selected to build the Cassini plasma instrument. As a direct result of Dave's creativity and tenacity, a primary plasma investigation for the next phase of exploration of the outer solar system will be based on his revolutionary design.

"At the same time he was involved with the design of the Cassini plasma instrument, Dave was also developing an approach to the global imaging of ions in the Earth's magnetosphere with energies down to 1 keV. A new NASA mission, known as the Inner Magnetosphere Imager, is scheduled for a new start in the next few years. The concept of IMI is based partly on a technique known as energetic neutral atom (ENA) imaging. This technique has been proven in a crude way for energetic ions with energies greater than 20 to 30 keV. But the most important plasma reservoir in the magnetosphere is the plasma sheet, which has ion energies of only a few keV. As far as I know, no viable technique for imaging these lower-energy ions had been proposed, and the strawman payload for IMI did not include such a measurement. Thanks to Dave, this important gap will now be filled since the instrument he defined is now part of the strawman payload.

"At Los Alamos, Dave was selected as section leader of the Space Plasma Section in 1991 even though he was its youngest scientist, and the section included three LANL fellows, two of whom were also AGU Fellows. He has since been appointed as group leader of the Space and Atmospheric Sciences Group at LANL. He also is principal investigator for more than ten plasma analyzers that are being flown on various DOE satellites. The leadership he provides for the Los Alamos group has greatly enhanced its already considerable prestige and involvement in forefront space missions. His leadership capabilities have also been recognized on the national scene. Not only does he serve as a member of the NASA IMI Study Team, he also serves on the National Research Council's Committee on Solar-Terrestrial Research and on its Committee on Space Science Technology Planning, of which he is by far the youngest member.

"It is difficult for an experimentalist in space research to achieve prominence at a very early age. This problem results from the long-term nature of the projects and the diffi-

culty in developing the resources to compete with established principal investigators. Theorists have neither of these difficulties, so it is not surprising that only two of the twelve Macelwane medalists from Space Physics and Aeronomy have been experimentalists. Dave McComas has shown that experimentalists can achieve early prominence with the right mix of talent, leadership, and hard work.

"Because of his intense loyalty, establishment of strong personal interactions at all levels, good sense of humor, skill at learning from others, and pride in doing things right and well, Dave's biggest fans are the members of his own group, which is a happy but all too rare circumstance. He is a fiercely committed family man who apparently wants his children to be as creative and independent as he is, if their names (Random, Koan, and Orion) are any indication. Dave is well known at LANL for never missing a hunting trip (or a shot), for his bruising demeanor on the basketball court as he dreams of slam-dunking, and for his devotion to his hot tub and the spectacular views of the Sangre de Cristo mountains that it affords.

"In summary, Dave McComas is an uncommonly talented and gifted young scientist who has made a number of innovative contributions to space plasma physics. He is full of good ideas both in the areas of instrument development and in the analysis and interpretation of data, and he knows how to implement his ideas while enlisting the enthusiastic support of both junior and senior scientists within and outside his own group. His impressive list of publications and the speed at which it is growing are testimony to his scientific creativity and productivity. Most importantly, Dave has an extremely strong sense of the significant. His instruments and his science always address important problems, and this ability to zero in on the most significant issues is perhaps what is most remarkable about a person as young as Dave. I believe that time will prove him to be the most outstanding space plasma experimentalist of his generation."—*James L. Burch, Southwest Research Institute, San Antonio, Tex.*

Response

"Thank you, Jim, for that very kind citation. It is indeed a great honor for me to accept this Macelwane Medal from my many friends and colleagues of AGU. I am particularly pleased because tonight, in addition to so many of my colleagues, both my parents, Harrold and Hazelyn McComas, and my wife, Richelle McComas, are here to celebrate this occasion. I could not even begin to thank these three individuals for all of the love and support that they have given me.

"I am struck, as I think back about my personal and professional development, by how critical my friendships have been; I feel fortunate to count essentially all of the colleagues that I have worked closely with also as my personal friends. These friendships, intertwined with the professional work, have made my career extremely enjoyable as well as exciting. I am also struck by my great fortune in having had the opportunity to work closely with so many truly outstanding individuals. In the interests of getting us on to the reception, I hope that you will forgive me for reflecting on only a fraction of the people who have helped shape me along the way.

"As an undergraduate, I met and began a life-long friendship with someone who profoundly influenced my entire future: Gian-Carlo Rota, professor of mathematics and philosophy at MIT. Gian-Carlo introduced me to phenomonology and existential philosophy (and by extension also to eastern philosophy). Even though I was earning a bachelors degree in physics, I chose to write my undergraduate thesis (an MIT requirement) on Heideggarian philosophy. This effort and my interactions with Gian-Carlo taught me the importance of philosophical thinking in my day-to-day life.

"After graduating from MIT, Richelle and I spent several months traveling around the country, camping out of our VW bus, and looking for the optimum place to live and work. Gian-Carlo, who has continued to help and guide me since MIT, had made me promise to visit Los Alamos before accepting an offer anywhere else. When we reached Los Alamos, we found both the intellectual and physical environments to be nearly ideal. At Los Alamos I have had the great privilege of working and developing close friendships with many truly exceptional people.

"The space physics program at Los Alamos provided me with a unique opportunity for developing space flight instrumentation, and therefore, also for developing my skills as an experimentalist. In particular, much of my space instrument experience was gained in what amounted to an apprenticeship under Sam Bame. Sam's broad hardware knowledge, gained the hard way through the design and implementation of numerous space experiments, and his ongoing Ulysses solar wind spectrometer development work in the early 1980s provided the foundation for my training. The combination of DOE and NASA space mission has lead to a synergistic program of space science at Los Alamos which has been highly responsive to both agencies; it has also allowed me to pursue a continuous program of instrument development and real flight experience.

"After 3 years at Los Alamos, I entered the geophysics and space physics graduate program at UCLA to work with Chris Russell, a 1977 Macelwane award winner. Chris showed me the value of intuition in understanding physical phenomena and helped me to improve my own intuition. My dissertation project centered around magnetotail current sheets, both intrinsic, such as the Earth's and draped, such as at Venus. Over my two exciting years at UCLA, I was exposed to the diverse ideas of many fellow students, including my good friend Harlan Spence, and the wisdom of a world-class academic and research staff.

"After returning to Los Alamos, I continued to develop space instrumentation and carried out analysis of the then new ICE data from the encounter with comet Giacobini-Zinner. A detailed examination of the draped cometary tail current sheet completed my dissertation. In this, and in many subsequent data analysis projects, Jack Gosling took me under his wing. Numerous insightful discussions with Jack and his copious comments on my various manuscripts (generally called 'Goslinating' a manuscript at Los Alamos) provided me with the blunt and honest feedback that is so critical both for honing new ideas and for developing critical thinking. Jack and Michelle Thomsen have also freely given me invaluable advice and provided me with excellent role models. Collaborations on various data analysis projects with Jack and Michelle as well as with John Phillips, Bill Feldman, Kurt Moore, Rick Elphic, and others at Los Alamos have been essential to my scientific development.

"I have also had the great privilege to work closely with another exceptional experimentalist at Los Alamos, Beth Nordholt. Together, Beth and I led the development of a unique high-sensitivity, high-resolution ion mass spectrometer for measuring the 3-dimensional distributions of space plasma ions. This design ultimately became the core of the winning proposal for the Cassini plasma investigation. The Cassini investigation, which includes two other sensors as well, is presently being carried out under adept leadership of Dave Young, from whom I have also learned much about space instrument development. Dave's move from Los Alamos to the Southwest Research Institute brought me into contact with Jim Burch, whose broad range of interests across space science and his strong community service, such as his editorship of *GRL*, has provided me with yet another excellent role model.

"Another hardware project, to develop instrumentation for imaging low-energy charge exchange neutrals, has only been possible because of the hard work of and close collaboration with Herb Funsten, Earl Scime, and others at Los Alamos. This project has also benefitted greatly from the input of colleagues at the Applied Physics Laboratory. Throughout all of my experimental work, laboratory support from my good friends Phil Barker, Bob Baldonado, Bruce Barraclough, and Kevin McCabe has been invaluable.

"On a final note, over the last several years I have also become involved in committee work both for NASA and the National Research Council. Don Williams and Marcia Neugebauer, chairs of the joint NRC committees on Solar-Terrestrial Research and Solar and Space Research, have shown me how powerful cooperation is in supporting a common future for my field.

"Throughout my career I have had the great fortune of being surrounded by and working with truly exceptional people. I find that to a very great extent, I have become what these interactions have made me; I am truly grateful to all of my friends and colleagues.

"Thank you very much."—*David J. McComas, Los Alamos National Laboratory, Los Alamos, N. Mex.*