ABOUT AGU

Zoback Receives 2008 Walter H. Bucher Medal

Mark D. Zoback was awarded the 2008 Walter H. Bucher Medal at the AGU Fall Meeting Honors Ceremony, held 17 December 2008 in San Francisco, Calif. The medal is for "original contributions to the basic knowledge of the Earth's crust."

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Citation

Mark Zoback is an outstanding geophysicist who has made fundamental contributions to the study of the global stress field, fault zone properties, crustal mechanics, and carbon sequestration. His work is consistently creative and original and has led to highly cited publications that address long-standing scientific questions.

Mark was a leader in establishing the scientific basis for the famous World Stress Map. The development of this map, led by his wife, Mary Lou, built on 15 years of collaborative efforts. He and Mary Lou were the first to show that stress orientations are regionally consistent and permit the definition of broad-scale regional stress patterns of tectonic significance. The scientific implications of global and regional stress patterns are profound and continue to stimulate new research. Observations of stress from deep wells and boreholes, using techniques pioneered by Mark and his colleagues, form the backbone of the World Stress Map and account for about two thirds of the database.

Mark is well known for his coleadership of the San Andreas Fault Observatory at Depth (SAFOD) project to drill into, sample, and monitor the San Andreas fault zone and for his role in establishing the International Continental Scientific Drilling Program (ICDP). Mark and his colleagues were able to uncover revolutionary empirical evidence that supports specific mechanical models of earthquake nucleation and propagation. In addition, Mark's team collected intact fluid and rock samples along an active portion of the San Andreas fault. The analysis of these samples, which has revealed the presence of highly compacted, cohesionless rock that has undergone extensive cataclasis, provides a vivid snapshot of the dynamic history of the fault.

Mark's work relating the state of stress in the brittle crust to fluid flow through critically stressed faults and fractures has led to exciting and unanticipated discoveries applicable at crustal and reservoir scale. *Reservoir Geomechanics*, his recently published seminal work, is an essential resource for reservoir geologists and engineers and others attempting to obtain knowledge of stress and mechanical processes at depth.

During the past decade, Mark has used his expertise in geomechanics and reservoir simulation to investigate CO_2 injection into deep saline aquifers, depleted oil and gas formations, and unmineable coal seams. Mark's analysis of the geomechanical implications of carbon sequestration lays important groundwork for assessing both the environmental and seismic risks and benefits of CO_2 injection.

Mark has been a true scientific leader, providing direction to numerous prominent organizations, international programs, and advisory bodies. He is an excellent teacher, one who demands a lot from his students but who also constantly encourages. At Stanford for the past 24 years, he has maintained a lively interaction with his outstanding colleagues there and at the nearby U.S. Geological Survey.

In summary, Mark Zoback has made important contributions to our understanding of how processes related to plate tectonics, earthquakes, and CO_2 sequestration are affected by various forces within the Earth's crust. Through his initiative, large scientific operations such as ICDP and SAFOD have become extremely successful in advancing our fundamental understanding of the Earth's crust, both in plate interiors and at active fault margins.

These accomplishments, and his success at solving complex and challenging problems, make him a very deserving recipient of the AGU Walter H. Bucher Medal.

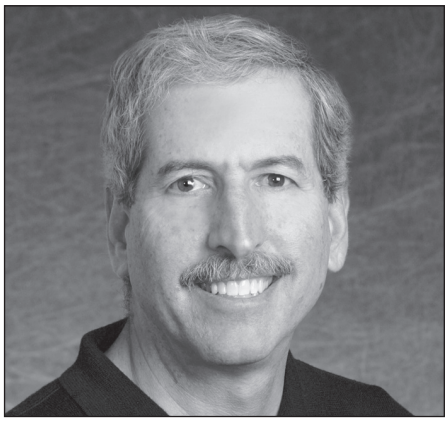
—WALTER D. MOONEY, U.S. Geological Survey, Menlo Park, Calif.

Response

I accept this honor from AGU with humility, especially in light of how much I admire previous winners. I would especially like to thank two scientists I also admire greatly, Walter Mooney and Richard Gordon, for nominating me and for their generous comments.

For most of my career I've had the great fortune to be associated with two remarkable organizations, the U.S. Geological Survey (USGS) and Stanford University. At both institutions, I had the privilege of having inspiring mentors and teachers early in my career and later the opportunity to work with outstanding colleagues and students, from whom I've learned most of what I know.

Somewhere near the end of my graduate student days I became curious about whether the ways we subject rocks to pressure and stress in the laboratory actually represent conditions in the brittle crust. I decided to apply for a postdoc at the USGS with the intention of spending a year working in the field, directly measuring the stresses acting at depth, and then returning to lab work with renewed confidence.



Mark D. Zoback

My plan was fine, but I seem to be about 33 years behind schedule.

Indeed, for much of these past 33 years, many of the research projects I've worked on have been related to characterizing stress orientation and magnitude in the brittle crust. The goal was to test, through direct measurements, a number of basic principles about the mechanical behavior of the brittle crust. It's been a challenging endeavor, often more challenging than one would hope, but I've had the good fortune to be able to carry out such studies at a variety of scales and in many different geologic environments.

It is especially important for me to recognize the support my colleagues and I have received from the USGS, the National Science Foundation, and private industry as well as multinational scientific programs such as the International Continental Scientific Drilling Program. It is especially important to note the National Science Foundation's EarthScope program. Along with the highly successful USArray and Plate Boundary Observatory components, SAFOD has provided the international scientific community with unprecedented new data. SAFOD has given us our first glimpse of an active plate bounding fault at seismogenic depth and provided the ability to conduct laboratory experiments on actual fault zone materials from depth and the ability to monitor earthquake nucleation in the near field. SAFOD would not have been a success without the enormous contributions of my co–principal investigators, Steve Hickman and Bill Ellsworth of the USGS.

Finally, and most important, I want to recognize how important Mary Lou Zoback has been to me during these past 35 years, both personally and professionally. We started to develop the principles for mapping crustal stress orientation and relative magnitude almost exactly 30 years ago. Following publication of our first papers on this topic, we decided to test whether we could handle some real stress in our lives and started our family. Somehow, despite frequent and sometimes prolonged absences, it all worked out. Eli and Megan are now remarkable adults, and Mary Lou and I continue sharing incredible adventures, usually involving stress, in one form or another.

—MARK D. ZOBACK, Stanford University, Stanford, Calif.