The Incorporated Research Institutions for Seismology (IRIS) and the Seismological Society of America (SSA) are pleased to announce the selection of three experienced speakers from the Earth science research community for the third annual IRIS/SSA Distinguished Lectures Series. The lecturers will be presenting talks aimed at general audiences during 2006. The speakers and their topics are:

Dr. Seth Stein, Northwestern University
Giant Earthquakes: Why, Where, When and What We Can Do

Dr. Ed Garnero, Arizona State University
Vibrations From the Deep: Deciphering the Birth and Death of the Earth’s Surface

Dr. Mary Lou Zoback, U.S. Geological Survey
The 1906 Earthquake – Lessons Learned, Lessons Forgotten, and Future Directions

The Lecture Series is seeking museum, university, and other venues for this season’s lecturers. General arrangements, including publicity, will be coordinated between IRIS, SSA, and the sponsoring venue. The desired audience size is 250 or more. IRIS and SSA will provide speaker travel costs and may also provide accompanying seismology displays and other outreach materials.

For more information, please visit http://www.iris.edu/services/iris_ssa.htm

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On December 26, 2004 the world saw yet again the incredible power of giant earthquakes. An area of rock under the Indian Ocean, about the size of the state of California, shifted by 30 feet. This shift generated a massive sea wave that crossed the Indian Ocean in a few hours, wreaking destruction along seacoasts and causing at least 300,000 deaths. The energy released was far greater than the largest nuclear weapons.

December's earthquake was one of the largest earthquakes ever recorded. Such giant earthquakes have happened before: 100 years ago much of San Francisco was destroyed by an earthquake far smaller than the Indian Ocean one. They will happen again. Seismologists are working to understand the physics of such earthquakes and learn how to live with them.

In fact, we can't live without them.

This is because giant earthquakes are part of plate tectonics, the process that keeps our planet and us alive. They occur primarily at the boundaries between the great plates that make up earth's outer shell. Heat from inside the earth makes plates move - at about the speed fingernails grow - while their boundaries are locked. Every few hundred years, the motion on part of a boundary is released in a giant earthquake. This destruction is the price we pay for plate tectonics, which also keeps us alive. Plate tectonics also creates volcanoes, which replenish the atmosphere we breathe and keeps the earth warm enough for us to live on. The processes of plate tectonics provided the conditions needed for life to evolve and survive.

We haven't learned to predict when giant earthquakes will happen. Thus the best we can do is build our societies to minimize the damage from earthquakes. This can be done by earthquake resistant construction, systems to warn of imminent tsunami waves, and other measures. Deciding how to do this is a challenging and important task.
Dr Seth Stein, Professor
Northwestern University, Chicago, Illinois

Education
Ph.D., California Institute of Technology, Geophysics, 1978
S.B., Massachusetts Institute of Technology, Earth and Planetary Sciences, 1975

Positions Held
Professor, Northwestern University, 1987-
Associate Professor, Northwestern University, 1983-1987
Assistant Professor, Northwestern University, 1979-1983

Dr. Seth Stein's research interests are in earthquake seismology, plate tectonics, and space geodesy. Much of his research focuses on how plate tectonics works and how it causes earthquakes. He was one of the developers of a global model showing how fast plates move, which is crucial to understanding where and when large earthquakes occur. He has also been involved with testing such models using the Global Positioning System satellites, which can see motions in a few years rather than over millions of years. He and his wife have used seafloor and satellite data to study the heat coming from the earth that causes plate motions and thus earthquakes. Beyond purely scientific issues, he is interested in questions of formulating public policy to mitigate earthquake hazards and has worked extensively with news media to improve public understanding of earth science.

Professor Stein was one of the organizers of EarthScope, a new national initiative to dramatically advance our knowledge of the structure and evolution of North America. He served as Scientific Director of UNAVCO, the consortium of universities using GPS for earth science, and been Visiting Senior Scientist at NASA's Goddard Space Flight Center. He has also been active in earth science education. He is a coauthor of a widely used seismology textbook, started Northwestern's Environmental Science program, and published papers on teaching methods. He has advised many Ph.D. students, four of which have received outstanding paper awards from the American Geophysical Union.

He was awarded the James B. Macelwane Medal of American Geophysical Union, been elected a Fellow of the American Geophysical Union and Geological Society of America, and named to the Institute for Scientific Information Highly Cited Researchers list. He has also edited books about plate boundary zones, the Mesozoic Pacific, intraplate earthquakes, and authored more than 100 scientific publications.

Books
Stein, S., and J. Freymueller, (eds), Plate Boundary Zones, American Geophysical Union, 2002.


**Selected General Interest Publications**


**Selected Peer-Reviewed Publications**


Vibrations From the Deep: Deciphering the Birth and Death of Earth’s Surface
Dr. Ed Garnero, Arizona State University

While the most fundamental feature of interiors of large planetary bodies is layering/stratification, the creation and destruction of Earth’s outermost rigid shell at mid-ocean ridges and subduction zones, mountain building, earthquakes, and volcanic activity, all point to dynamical processes within the interior that must certainly go far beyond simple internal layering. However, Earth’s deep interior is predominantly inaccessible, since one can only drill several miles deep, and volcanic activity only very rarely involves material thought to originate from below a couple hundred miles or so. We are thus left with the question: how can the rest of the interior, nearly 4000 miles of material down to the center, be confidently interrogated? And furthermore, can we characterize deep structure and processes at a level that reveals the connection between the making of Earth’s surface and its interior?

Using seismic imaging techniques, we are now getting glimpses of exotic internal structures at a variety of spatial scale lengths: from several kilometers to 1000’s of km. While there is certainly so much that lies before us awaiting discovery, we are now seeing connections between hot spot volcanoes and partially molten material half way to Earth’s center at the base of the mantle. We are also detecting deep mantle seismic wave reflections (or “echoes”) off of former oceanic crust and lithospheric material, confirming the hypothesis that some tectonic plates submerge into the interior. Presently or in the near future, the National Science Foundation funded EarthScope USArray will have over 100 seismic motion detectors marching across your state. This program will continue the advancement of our understanding of the symbiotic relationship between Earth’s surface and interior, because there have not high numbers of recorders in a given area before. My presentation will show recent results from a variety of experiments, highlighting those that help to decipher Earth’s enigmatic and unreachable interior.
Dr. Ed Garnero, Associate Professor  
Arizona State University, Tempe

Education
Ph.D., California Institute of Technology, 1994  
A.B., University of California, Berkeley, 1986

Positions Held
Associate Professor, Arizona State University, Tempe, AZ, June 2005-Present  
Assistant Professor, Arizona State University, Tempe, AZ, Jan 1999-May 2005  
Assistant Researcher, University of California, Berkeley, July 1997-Dec 1998  
Postdoctoral Researcher, University of California, Santa Cruz, June 1996-July 1997  
NSF Postdoctoral Researcher, University of California, Santa Cruz, June 1994-June 1996  
Staff Seismologist, Woodward-Clyde Consultants, Oct 1989-Dec 1991

Dr. Ed Garnero is currently an Associate Professor in the Department of Geological Sciences at Arizona State University in Tempe, Arizona. His research interests have centered on understanding the relationship between the structure and dynamics of Earth’s deep interior and Earth’s surface, but include analyses of seismic wave propagation, and seismic interrogation of the birth and death of features that exchange mass and heat between the surface and the interior, such as hot plumes and cold descending oceanic lithosphere. The detailed nature of Earth’s interior, particularly up until recently, can be considered only poorly known. Thus seismic methods that provide information on dynamical processes in the interior help us better understand the forces and processes that shape the surface that we live upon.

Professor Garnero has devoted significant resources towards teaching geological sciences to entry level students, as well as the lay population. This has resulted in multiple “Favorite Professor” citations from campus-wide student polls at one of the nation’s largest public universities, as well as a Distinguished Faculty citation from ASU’s Department of Geological Sciences. In 2004, he was awarded a Last Lecturer Series citation, in which only 3 of ASU’s over 2100 professors are yearly selected by students to give what would be their last lecture ever. In the fall of 2005, Dr. Garnero was named an ASU Faculty Exemplar, in which the ASU President selects newly tenured faculty as exemplars of “the finest teacher-scholars” of the university. Dr. Garnero continues to receive the department’s highest teaching evaluations for their 230 student entry level geology 101 course, owing to a combination of his dynamic lecturing style, a multimedia approach in which all class resources are openly shared online with students, and dynamic class experiments/presentations which include performances on his electric bass with student compositions of “geology songs”. Garnero emphasizes the process of “discovery” in his teaching (and research); this enhances his conveyance of research excitement, whether in general public lectures or the classroom. Bringing discovery into the classroom was a focal point of his NSF Career Award, one of NSF’s most prestigious awards across all disciplines that support early career-development activities of teacher-scholars that
most effectively integrate research and teaching. His work has been highlighted in various lay magazines (e.g., Science News), as well as television (e.g., National Geographic’s Naked Science episode on The Earth’s Core).

**Some Recent Publications**


The 1906 Earthquake – lessons learned, lessons forgotten, and future directions
Mary Lou Zoback, U. S. Geological Survey, Menlo Park, CA

At the beginning of the 20th century, San Francisco was the “most cosmopolitan city outside of New York”. Overnight, everything changed when the city was violently shaken awake at 5:12 AM on April 18, 1906. The 1906 earthquake and resulting firestorm over the next 3 days left San Francisco devastated and significant damage throughout northern California. More than 3000 persons lost their lives and in San Francisco alone, 225,000 of the city’s 400,000 citizens were left homeless. The centennial of this major natural disaster affords an opportunity to commemorate the cultural and social response to this historic event and to highlight a century of progress in understanding earthquake hazards and reducing the risks they pose.

The 1906 magnitude 7.9 earthquake on the northern San Andreas Fault marked the birth of modern earthquake science. For the first time, the effects and impacts of a major seismic event were systematically investigated and documented in a detailed report published in 1908. These investigators not only carefully mapped the entire 200-mile-long onshore fault rupture, but they also followed and mapped the fault south to the Mexican border, documenting the San Andreas as a major through-going geologic structure for the first time. Their surveys of damage to structures concluded that destruction was closely related to building design and construction—a painful lesson oft repeated around the world.

Perhaps the most important scientific result to come out of the 1906 earthquake was the concept of an earthquake cycle, the “elastic rebound hypothesis”-- that earthquakes represent sudden release of elastic energy along a fault resulting from a cycle of slow strain accumulation produced by relative displacements of neighboring portions of the crust. This concept is still accepted today with minor modifications, even though the basis for large-scale horizontal displacements was not established until the plate tectonic revolution six decades later.

As earthquake science evolves, reanalysis of the 1906 earthquake data continues to yield new insights about that event and the behavior of large strike-slip faults in general. Looking to the future, a dense array of continuous GPS recorders in N. California, part of the National Science Foundation’s EarthScope’s Plate Boundary Observatory, can search for fault interactions and determine if an acceleration of strain rate precedes the next big earthquake as it may have prior to 1906.
Mary Lou Zoback, Senior Research Scientist, U.S. Geological Survey, Menlo Park

Education
Ph.D., Stanford University, Geophysics, 1978
B.S., Stanford University, Geophysics, 1974

Positions Held
Senior Research Scientist, USGS, 2002-
Chief Scientist, USGS, Western Hazards team, 1999-2002
Research Geophysicist, USGS, Earthquake Hazards Program, 1979-1999
National Research Council Postdoctoral Fellowship, USGS, 1978-1979

Mary Lou Zoback is a Senior Research Scientist with the United States Geological Survey, Menlo Park, CA and currently serves as the Regional Coordinator for the USGS Northern California Earthquake Hazard Program. She is a respected geophysicist recognized for her work on the relationship between earthquakes and state of stress in the Earth's crust. From 1986-1992 Dr. Zoback created and lead the World Stress Map project, an effort that actively involved 40 scientists from 30 different countries. This work demonstrated that broad regions of the earth's crust in the interior of tectonic plates are subjected to relatively uniform stresses that result from the same forces that cause plate motion. These results imply that earthquakes in the interior of continents result from the same causative forces as those occurring on plate boundaries, but are the result of much slower processes.

Dr. Zoback has served on numerous national committees and panels on topics ranging from continental dynamics, storage of high-level radioactive waste, the role of "inquiry" in the National Science Education Standards, and facilitating interdisciplinary research. She is currently a member of the executive committee for a National Research Council study on "Earth Science and Applications from Space" which is defining a scientific strategy and rationale for the next generation of earth observations from space in conjunction with land-based monitoring. She previously served on NASA's Solid Earth Sciences Working Group. Their report, "Living on a Restless Earth", developed a long-term vision with the goal of understanding natural and perturbed earth systems well enough to predict outcomes, consequences and impacts.

Dr. Zoback is active in several professional societies. She is a past-President of the Geological Society of America and formerly served as President of the Tectonophysics Section of the American Geophysical Union and as a member of the AGU Council. In 1987 Zoback was awarded the American Geophysical Union's Macelwane Award for "significant contributions to the geophysical sciences by a young scientist of outstanding ability". In 1995 she was elected into the National Academy of Sciences.
Selected Publications:


Committee on Development of an Addendum to the National Science Education Standards on Scientific Inquiry, 2000, Inquiry and the National Science Education Standards, National Academy Press, 202 p.
