Graduate Study in Geoscience at Saint Louis University
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To help you make an informed decision about graduate schools we are providing this description of our faculty, students, research, and facilities. We are proud of, and excited about, our programs and are confident that after reading this information you will seriously consider joining our group. If you still have questions regarding our program after reading this description, please do not hesitate to contact us. And regardless of where you choose to attend graduate school, we wish you the best of luck and we look forward to seeing you at professional meetings and conferences.

SLU Tradition

Saint Louis University has a long tradition in Geoscience education including fundamental contributions to observational and theoretical Geophysics. Our department was founded by Dr. James B. Macelwane, S. J., an exceptional scientist, influential president of the American Geophysical Union, and the namesake of a prestigious national geophysics award for outstanding young scientists. His successors, who were also outstanding scientists, include Dr. William Stauder, S. J., who made important studies of subduction-zone faulting processes during the development of plate tectonics, and Dr. Otto Nuttli, who made fundamental contributions to our understanding of intra-plate earthquakes including the great 1811-1812 New Madrid, Missouri earthquakes.

Our traditional research strength is in Seismology and Geophysics, and we have more than 50 alumni in the petroleum industry, government agencies, and academia. To address a broader range of inter- and multi-disciplinary research challenges we have expanded our research expertise and developed Master’s degree programs in the broader discipline of Geoscience. Our energetic faculty includes four recent hires with expertise in hard- and soft-rock geology, active tectonics and structure, geodynamics, geochronology, and sedimentary geology.

Our Faculty

The Geoscience Programs at SLU are part of the Department of Earth & Atmospheric Sciences which includes fourteen faculty. All of our faculty contribute to the research environment and support the infrastructure of our graduate programs. This brochure is focussed on the Geoscience Programs. We encourage you to visit our web site to obtain information on our activities in Meteorology. For your convenience we have summarized the interest of our Graduate Geoscience Faculty below and we provide more details in the section that follows.

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Electronic Address</th>
<th>Research Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charles Ammon</td>
<td><a href="mailto:ammon@eas.slu.edu">ammon@eas.slu.edu</a></td>
<td>Earth structure, large earthquake processes, intraplate earthquakes, tectonics.</td>
</tr>
<tr>
<td>David Crossley</td>
<td><a href="mailto:crossley@eas.slu.edu">crossley@eas.slu.edu</a></td>
<td>Temporal variations in gravity, physics of the Earth's core, geophysical fluid dynamics, normal modes, global seismology.</td>
</tr>
<tr>
<td>Joachim Dorsch</td>
<td><a href="mailto:dorsch@eas.slu.edu">dorsch@eas.slu.edu</a></td>
<td>Sedimentary geology, tectonics and sedimentation, environmental geology.</td>
</tr>
<tr>
<td>John Encarnación</td>
<td><a href="mailto:jpe@eas.slu.edu">jpe@eas.slu.edu</a></td>
<td>Igneous and metamorphic petrology, radiogenic isotope geochemistry, geochronology, regional geology, tectonics.</td>
</tr>
<tr>
<td>Robert Herrmann</td>
<td><a href="mailto:rbh@eas.slu.edu">rbh@eas.slu.edu</a></td>
<td>Strong ground motion, intraplate earthquake processes, computational techniques in seismology.</td>
</tr>
<tr>
<td>Martha House</td>
<td><a href="mailto:house@eas.slu.edu">house@eas.slu.edu</a></td>
<td>Thermochronology, metamorphic petrology, regional geology, tectonics.</td>
</tr>
<tr>
<td>David Kirschner</td>
<td><a href="mailto:dkirschn@eas.slu.edu">dkirschn@eas.slu.edu</a></td>
<td>Fluid-rock interaction, structural geology, geochemistry, and geochronology.</td>
</tr>
<tr>
<td>Brian Mitchell</td>
<td><a href="mailto:mitchell@eas.slu.edu">mitchell@eas.slu.edu</a></td>
<td>Earth structure and evolution, seismic wave propagation and attenuation, seismicity, tectonics.</td>
</tr>
</tbody>
</table>
Faculty Research Interests

Interesting, high quality research is of utmost importance in a graduate student’s education. To help you find out more about our individual research interests, each of us has written a brief summary of some of the details of our current research. Please contact us if you wish to discuss any of our work in more detail.

Dr. Charles J. Ammon (Associate Professor of Geophysics, Ph.D. Geophysics, Penn State)

Research: My research is focussed on earthquake seismology, using the information recorded in seismograms to study earthquake processes and Earth structure. I have worked on modeling moderate-size (magnitudes 4 to 5) earthquakes to estimate faulting parameters (such as strike, dip, rake, and moment) and depth in the eastern United States (in collaboration with Bob Herrmann) as well as regions with higher rates of seismic activity such as Tibet and the Tien Shan region of Eurasia. At the other end of the earthquake size spectrum are the large earthquakes (magnitudes larger than 7). These larger earthquakes are more complicated and in addition to estimating the depth, size, and faulting geometry we can study the character of the fault rupture (how large an area of the fault slipped? How fast and in what direction did the rupture travel? How much did the fault slip? etc.). In collaboration with researchers from several institutions I have investigated the rupture character of about ten major and great earthquakes which occurred during the last few years. Work is underway with one of our current students, Luca Malagnini, to study three recent large earthquake sequences that occurred in the subduction zone off the coast of Kamchatka.

In addition to earthquake studies, I am involved in studies of Earth structure including studies of surface-wave propagation across the North America plate (in collaboration with Harley Benz of the US Geological Survey) and across the Arabian plate (in collaboration with Bob Herrmann and Talal Mokhtar of Saudi Arabia). This work includes the analysis of surface-wave dispersion and the use of tomographic techniques to image lateral variations in the lithospheric structure. Juan-Pablo Ligorría and I have also completed a survey of the nature of the crust-mantle boundary beneath more than 100 sites in North America. We are correlating our results with geological history of each region trying to understand the interaction between crust and mantle during the evolution of the continent.

Research Collaborators: Current students: Juan-Pablo Ligorría, Brett Ketter and Rommel Villagómez. Recent collaborators from other institutions: George Zandt, University of Arizona; Aaron Velasco and George Randall, Los Alamos National Laboratory; Thorne Lay, University of California at Santa Cruz; Harley Benz, US Geological Survey; Sujoy Ghose and Michael Hamburger, University of Indiana.

Selected Publications


Dr. David J. Crossley (Professor of Geophysics, Ph.D. University of British Columbia, Earth & Atmospheric Sciences Department Chair)

Research: I am interested in all aspects of the Earth’s core and global Earth dynamics. The first topic includes fluid dynamics of the liquid core at all periods from seismology (10s of seconds) to time scales of the magnetic field generation (about 10^4 years) and the motions of the inner core at all possible periods, including the hard-to-detect Slichter triplet. With respect to the magnetic field I have worked on the problem of the reversal mechanism, but not the dynamo field generation mechanism that currently requires sophisticated numerical modeling on supercomputers. In the area of global dynamics of the Earth, I am interested in the seismic free oscillations of the Earth and in the wobble and nutation modes associated with the Earth’s rotation. At the present time I am heavily involved in the Global Geodynamics Project (GGP), which is a 6-year campaign to record and analyze the Earth’s global gravity field at all period ranges. While my ultimate goal is to use this data to search for core modes, as they affect gravity, there are many interesting problems that arise in modeling the gravity response to environmental effects such as atmospheric pressure and hydrology. I am willing and eager to supervise students in all of the above subjects.

Research Collaborators: I work most closely with Jacques Hinderer (Institut de Physique du Globe in Strasbourg) and other international colleagues connected with GGP. I have also collaborated recently with the NOAA group in Boulder on the treatment of the data from their superconducting gravimeter. Su Xu, a post-doctoral fellow, worked with me on some of the above problems from 1996-98.

Selected Publications


Dr. Joachim Dorsch (Assistant Professor of Geoscience, Ph.D. University of Tennessee)

Research: My research is concentrated in the field of sedimentary geology, its interaction with tectonics, and its application to address environmental problems. Specifically, clastic facies analysis, event stratigraphy and sequence stratigraphy are employed to discern the depositional dynamics and the competing influences of eustatic sealevel changes and tectonism on the stratigraphic architecture of foreland-basin deposits. Recent field work is being conducted within the southern and central Appalachians with focus on the Siluro-Ordovician Taconic molasse. A recently established research project is concentrated on possible impact structures in the midcontinental USA and the likely traces these catastrophic “events” left within the stratigraphic record.

Another ongoing research topic is the pore-space characterization of low-permeability sedimentary rocks (mudstone) and their weathering product (mudstone saprolite) using petrophysical measurement techniques. These low-permeability Earth materials are commonly used for the disposal of waste materials. Although hydrogeologists employ manifold modeling techniques, their knowledge of the most crucial parameter, effective porosity, is very often only rudimentary at best. This research is attempting the overcome this deficiency in knowledge. Sedimentary geology techniques are also applied to investigate the architecture and occurrence of possible flow barriers within clastic aquifers. Research initiated at the Tennessee Valley Authority up until now focused on the alluvial-fluvial depositional system.

Research Collaborators: Recent collaborators from other institutions: Richard K. Bambach, Virginia Polytechnic Institute & State University; RaNaye B. Dreier, Oak Ridge National Laboratory; Steven G. Driese, Uni-
Dr. John Encarnación (Assistant Professor of Geoscience, Ph.D. University of Michigan)

Research: My research is in the area of tectonics and geochemistry. I use geochronology and the chemistry of rocks to decipher the tectonic and magmatic history of an area. The results of such studies lead not only to a better account of the geologic history of an area, but reveal new insight to processes that have shaped the Earth. In one of my projects we are studying rocks in the Transantarctic Mountains to determine their age as well as their tectonic and geographic setting (in collaboration with Anne Grunow and Tim Paulsen, Ohio State University). This will allow us to evaluate Antarctica’s tectonic setting in the Precambrian and test if it was once connected to the ancient North America. It will also help us understand the timing and kinematics of the assembly of the Gondwana supercontinent. In another study we are establishing the timing and structural setting of flood basalts in Antarctica and South Africa (in collaboration with Michael Watkeys, University of Natal). This will hopefully shed light on the origin of flood basalts, their relationship to supercontinent (Gondwana) breakup, and even their significance for mass extinctions.

Research Collaborators: Recent collaborators from other institutions: Michael Watkeys, University of Natal, South Africa; Anne Grunow, Timothy Paulsen, and David Elliot, Byrd Polar Research Center, Ohio State University.

Selected Publications


Dr. Robert B. Herrmann (Professor of Geophysics, Ph.D. Saint Louis University)

Research: My recent research emphasis has been directed toward the application of seismology to seismic hazard reduction but I enjoy all aspects of quantitative seismology. Some specific interests include earthquake history, earthquake processes and seismic wave propagation. You might say that I have focussed my research on...
Earth’s outer shell, the lithosphere, for my earthquake and Earth structure studies. I have estimated earthquake source parameters using long-period surface-wave spectra and broad-band seismogram modeling using signals recorded at local and regional distances. Recently my students and I have used regional seismic network recordings to examine the propagation of high frequency S-waves in the 10-500 km distance range. I have supervised the operation of our short-period radio-telemetered seismic network and am now installing a 15-station broadband digital network that relies on the Internet for data transmission.

I have a strong interest in numerical computations and I am proud of Computer Programs in Seismology, a collection of tools for seismogram analysis and numerical modeling of wave propagation which are available for MS-DOS and UNIX systems. This compilation has extensive documentation and is the result of software-development and software-modification efforts of many of our graduates. The package provides students and researchers worldwide with the tools for doing modern seismological research. This is especially important because of the advances in data due to modern seismological instrumentation.

**Research Collaborators:** Current students: Luca Malagnini, Roberto Ortega and Monica Maceira. Postdoctoral Researcher: Aybige Akinci. Recent collaborators from other institutions: Glenn Rix, Georgia Institute of Technology; Paul Bodin, University of Memphis; Jaime Yamamoto, Universidad Nacional Autónoma de México.

**Selected Publications**


**Dr. Martha House (Assistant Professor of Geoscience, Ph.D. Massachusetts Institute of Technology)**

**Research:** My research interests center on understanding the tectonism in the upper crust from a thermochronologic perspective. Earth sciences have been evolving toward an understanding that observations we make in individual subdisciplines are the result of a combination of effects. Crustal processes and tectonics are a central part of this system, recording the historical interaction between deep-earth geodynamic forces and the surficial effects of erosion and climate. Because problems in earth sciences are rarely addressed by a single technique or piece of information, my goal is to apply a multidisciplinary approach to problem solving that incorporates structural geology and low-temperature geochronology with field observations.

In addition to my interests in the tectonothermal evolution of the North American Cordillera, most of my current research revolves around application and further development of the helium thermochronometer. Active studies in this area focus on the geomorphic evolution of the Sierra Nevada, California, and the thermal history of passive margins.

**Research Collaborators:** Recent collaborators from other institutions: Brian Wernicke, Ken Farley, California Institute of Technology; Kip Hodges, Sam Bowring, MIT; Nicholas Pinter, Southern Illinois University; Roger Phillips, Washington University; Ann Blythe, University of Southern California; Barry Kohn, LaTrobe University, Australia; Meinert Rahn, Albert-Ludwigs-Universität Freiburg, Germany.

**Selected Publications**


Dr. David L. Kirschner (Assistant Professor of Geoscience, Ph.D. University of Minnesota)

Research: My research is focussed on documenting and understanding the interaction of fluids and rocks during deformation of the Earth’s crust. I am working primarily on seismogenic strike-slip faults and in fold-thrust belts located along the margins of large mountain belts. To date I have worked on the San Andreas strike-slip fault (California) and on the fold-thrust belts of the Alice Springs Orogen (Australia), Alps (Switzerland), Pyrenees (Spain), Apennines (Italy), and Rocky Mountains (Canada). The research involves extensive fieldwork, structural analysis, sample collection, and laboratory analyses. These laboratory analyses are needed to document the mineralology, meso- and microstructures, and geochemistry (stable isotopes, radiogenic isotopes, elemental chemistry) of the deformed rocks. By combining the results of the structural and geochemical analyses, I hope to document the structural pathways fluids (water, oil, natural gas) use to move through the earth’s crust, the relative timing between fluid migration and deformation of the crust, the role fluids play in localizing deformation, and the role fluids play in initiating and facilitating earthquakes. In collaboration with Fred Chester (Texas A & M) I am currently mapping and analyzing the most deformed rocks in an exhumed strike-slip fault of the San Andreas Fault system. The results of this study are shedding new insights on the formation and deformation of seismogenic faults. In collaboration with researchers from several other institutions in Canada and Italy, I am investigating the structure and geochemistry of thrust faults in the Canadian Front Range, and of thrust and seismogenic normal faults in the central Apennines.

Research Collaborators: Current students: Fabrizio Agosta. Recent collaborators from other institutions: Fred Chester, Texas A & M; Lori Kennedy, University of British Columbia, Canada; Francesca Ghisetti, University of Catania, Sicily; Livio Vezzani, University of Torino, Italy; Johannes Hunziker and Mike Cosca, University of Lausanne, Switzerland.

Selected Publications


Dr. Brian Mitchell (Professor of Geophysics, Ph.D., Southern Methodist University, Reinert Chair in the Natural Sciences)

**Research:** My current research utilizes various seismic waves to study the structure and evolution of the Earth’s crust and upper mantle. I have measured the attenuation of both fundamental-mode and higher-mode seismic surface waves in various parts of the world and found that the attenuation rate of both types of waves with distance is proportional to the time that has elapsed since the most recent episode of major tectonic or orogenic activity in any region. I am currently developing methods by which regional variations of seismic wave attenuation can be determined on a much finer scale, so that individual fault zones, segments of plate boundaries, sub-surface structure of volcanoes, or other smaller structure can be studied.

I have also recently studied the velocity and attenuation structure of the New Madrid seismic zone. My research of two decades ago (with Cheng-chuan Cheng and Fr. William Stauder) showed that seismic wave velocities were considerably reduced beneath the active portion of the New Madrid seismic zone relative to regions at the same depth outside that zone. More recently Haydar Al-Shukri and I obtained a detailed tomographic velocity map of the New Madrid region and found that seismic velocities were lowest in regions of greatest seismic activity. Currently I am trying to map variations of seismic-wave attenuation there using the attenuative dispersion of seismic waves.

**Research Collaborators:** Current students: Alemayehu Jemberie, Behsara Sholy, and Jorge Mejía. Recent collaborators from other institutions: Andrzej Kijko, Council of Geosciences, South Africa; G.-Akis Iselentis, University of Patras, Greece; Antonio Correig, University of Barcelona, Spain; Zoltan Der, ENSCO Inc.

**Selected Publications**


**Visiting Scientists**

Dr. Aybige Akinci (Visiting Scientist, Ph.D., Dokuz Eylul University, Turkey)

**Research:** I have been working primarily on seismic-wave propagation and attenuation. My research has included studies of the single multiple scattering attenuation models using observations from Turkey and South-
ern Spain in collaboration with E. del Pezzo (Italy) and J. M. Ibanez (Spain) during my Ph.D. research. I am also involved in projects of regional and near site attenuation characteristics in Bursa, Northwestern Anatolia, Turkey using the acceleration records of microearthquakes (in collaboration with researchers from Istanbul Technical University, Turkey). I have also worked on seismic attenuation and crustal evolution of the Middle East with Brian Mitchell (USA) in collaboration with A. Correig (Spain), A. Hofstetter (Israel), and T. Mokhtar (Saudi Arabia). Most recently I have been working as a visiting scientist with Bob Herrmann on a project on probabilistic seismic hazard map and ground motion relations for the central United States.

Selected Publications


Contacting Our Current Graduate Students for Information

As faculty we can answer many of the questions you may have about graduate school, and we have tried to anticipate some of these by providing the information in this brochure. However, for some information about student life, the intellectual environment, and the quality of our education, you may want to seek the opinions of our students. Here is a list of our current students. Many of these students also maintain a web site with information on themselves and their research. Please feel free to contact them with any questions about our program.

<table>
<thead>
<tr>
<th>Name</th>
<th>Home</th>
<th>Electronic Address</th>
<th>Current Research Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luca Malagnini</td>
<td>Italy</td>
<td><a href="mailto:luca@eas.slu.edu">luca@eas.slu.edu</a></td>
<td>Strong-motion attenuation relationships for the central Apennines, Italy (with Herrmann)</td>
</tr>
<tr>
<td>Roberto Ortega Ruiz</td>
<td>Mexico</td>
<td><a href="mailto:ortega@eas.slu.edu">ortega@eas.slu.edu</a></td>
<td>Strong-motion attenuation relationships for Mexico City, Mexico (with Herrmann)</td>
</tr>
<tr>
<td>Alemeyahu Jemberie</td>
<td>Ethiopia</td>
<td><a href="mailto:jemberie@eas.slu.edu">jemberie@eas.slu.edu</a></td>
<td>Seismic attenuation in the east African Rift system (with Mitchell)</td>
</tr>
<tr>
<td>Rommel Villagómez</td>
<td>Ecuador</td>
<td><a href="mailto:rommel@eas.slu.edu">rommel@eas.slu.edu</a></td>
<td>Faulting characteristics of the 1995 fold-and-thrust belt earthquake, eastern Ecuador (with Ammon).</td>
</tr>
<tr>
<td>Brett Ketter</td>
<td>United States</td>
<td><a href="mailto:ketter@eas.slu.edu">ketter@eas.slu.edu</a></td>
<td>Seismic surface-wave propagation in central Asia (with Ammon)</td>
</tr>
<tr>
<td>Monica Maceira</td>
<td>Spain</td>
<td><a href="mailto:quintas@eas.slu.edu">quintas@eas.slu.edu</a></td>
<td>Faulting geometry of recent earthquakes in eastern North America (with Herrmann)</td>
</tr>
<tr>
<td>Jorge Mejía</td>
<td>Colombia</td>
<td><a href="mailto:mejia@eas.slu.edu">mejia@eas.slu.edu</a></td>
<td>First-year Ph.D. student</td>
</tr>
<tr>
<td>Fabrizio Agosta</td>
<td>Italy</td>
<td><a href="mailto:agostaf@eas.slu.edu">agostaf@eas.slu.edu</a></td>
<td>First-year M.S. student</td>
</tr>
</tbody>
</table>
Graduate Employment Information

Another way to gauge the success of a graduate program is to examine the positions secured by former graduates. You can find more information on our alumni on our web site but here we list some of their employers to give you an idea where our former students have established careers: Lamont-Doherty Earth Observatory, University of Arkansas, University of Kentucky, University of Barcelona, Ankara University, Shell, Mobil, CONOCO, British Petroleum, Geological Survey of Spain, Multimax Inc, Woodward-Clyde Consultants, Scientific Applications Incorporated, and the Air Force Technical Applications Center.

Research Facilities

Our department maintains a UNIX local area network with about 30+ Sun Microsystems workstations. These machines are equipped with software packages for scientific computing, map construction, and seismogram analysis, as well as tools for software development in Fortran, C, C++, and Java. We also maintain a set of Macintosh and Windows NT microcomputers designed for scientific computing and document/graphics preparation. We have state-of-the-art mineral separation facilities, which include a large jaw crusher and disc mill housed in a room with a dust-collection system; a Wilfley heavy mineral separation table, fume hood and glassware for heavy mineral separation with heavy liquids; Franz magnetic barrier separator; and research-grade petrographic and binocular microscopes. In addition, we have an oxygen isotope extraction line for carbonates. Our most recently hired faculty are in the process of developing research laboratories.

Saint Louis University has a long tradition of seismic observation including a seismogram collection dating back to the early part of the century and involvement in a number of seismic networks. Currently, we are involved in two regional seismometer networks: the BILLIKEN network and the Cooperative New Madrid Seismic Network. Together these regional networks contain about 20 seismometers distributed throughout the central conterminous United States. Data are collected and archived in-house, as part of the IRIS (Incorporated Institute for Seismology) global seismic network, or along with the US Geological Survey's National Seismic Network.

Financial Aid

Without a doubt you are wondering about the costs of a graduate education. In the Geoscience program we customarily provide financial support to those students in the research programs. At present, our research is supported by a number of external agencies including the U.S. Geological Survey, the U.S. National Science Foundation (Geophysics, Tectonics, Polar Research), the Department of Energy, the Defense Special Weapons Agency, and the Petroleum Research Fund. Additional funds from the University help us maintain the equipment necessary for research and support a number of students on teaching assistantships. All of our current full-time graduate students are supported by scholarships which include full-time tuition waivers and approximately $1000 per month plus medical coverage.

How To Contact Us

Please don't hesitate to contact us by email or phone if you have more specific questions about our research and opportunities for graduate study:

Attn: Geoscience Graduate Program Director
Department of Earth & Atmospheric Sciences
Saint Louis University
How To Apply

Formal applications materials are available from the Graduate School, Saint Louis University:

The Graduate School - Saint Louis University
Suite 100 of O'Donnell Hall
3663 Lindell Boulevard
St. Louis, MO 63108-3342
VOICE: (314) 977-2240 and FAX: (314) 977-3943

You can request an application using the World-Wide Web at:

http://www.slu.edu/colleges/gr/grad03.html