Geoinformatics: Transforming data to knowledge for geosciences

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SCIENCE ARTICLE

4 Geoinformatics: Transforming data to knowledge for geosciences
A. Krishna Sinha, Zaki Malik, Abdelmounaam Rezgui, Calvin G. Barnes, Kai Lin, Grant Heiken, William A. Thomas, Linda C. Gundersen, Robert Raskin, Ian Jackson, Peter Fox, Deborah McGuinness, Dogan Seber, and Herman Zimmerman

Cover: Earth image courtesy NASA. See “Geoinformatics: Transforming data to knowledge for geosciences”, p. 4–10.
Geoinformatics: Transforming data to knowledge for geosciences

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ABSTRACT

An integrative view of Earth as a system, based on multidisciplinary data, has become one of the most compelling reasons for research and education in the geosciences. It is now necessary to establish a modern infrastructure that can support the transformation of data to knowledge. Such an information infrastructure for geosciences is contained within the emerging science of geoinformatics, which seeks to promote the utilization and integration of complex, multidisciplinary data in seeking solutions to geoscience-based societal challenges.

INTRODUCTION

Over the centuries that humankind has been studying Earth, oceans, and sky, data were gathered toward explaining the physical phenomena of our surroundings. Understanding such events as eclipses, tides, volcanism, and earthquakes was challenging because of the difficulty of organizing observations within scientific frameworks that could provide an integrative understanding of these phenomena. Pioneers of the earth sciences, such as geologists Lyell (1797–1875) and Hutton (1726–1797), made multidisciplinary observations in stratigraphy, paleontology, and petrology, stored their observations in logbooks, and visualized them through interpretive products, such as maps and cross sections. We continue to conduct our science in similar ways. We make observations on the ground and through remote sensing techniques and store the information in computers, but we still find it difficult to achieve an integrative understanding of complex natural phenomena. The ability to find, access, integrate, and properly interpret data sets has been hampered by the expanding volumes and heterogeneity of the data. With the help of computer scientists, transformative advances in the geosciences are now possible through innovative approaches to interoperability, analysis, modeling, and integration of heterogeneous databases. This geoinformatics effort would require Web-based availability of data and applications, thereby removing geographic or political boundaries. Geoinformatics will give us the ability to encompass a variety of temporal and spatial scales, integrate heterogeneous data, and visualize data and analytical results.

WHAT IS GEOINFORMATICS?

Geoinformatics is an informatics framework for the discovery of new knowledge through integration and analysis of earth-science data and applications. Fostered by support from both national and international agencies, geoinformatics has emerged to address the growing recognition that problems with significant societal implications require integrative and innovative approaches for analysis, modeling, managing, and archiving of extensive and diverse data sets. In the United States, geoinformatics emerged as an initiative within the National Science Foundation (NSF) Division of Earth Sciences and other federal agencies, such as the U.S. Geological Survey (USGS) and the National Aeronautics and Space Administration (NASA). The impetus was the wide consensus that existing information management infrastructures were inadequate to cope with the complexities of earth processes.

Foundation technologies constitute the base infrastructure required to facilitate geoinformatics. These technologies include resources for communication, storage, and computation. Consequently, geoscientists are now better equipped (e.g., high-performance computing) to efficiently address complex questions. However, the true potential of these technologies can only be realized by enhancing our data- and application-management capabilities (shown as the geoinformatics components in Fig. 1). For instance, standards are needed for the exchange and understanding of data (e.g., shared data models, markup languages, ontologies, etc.), visualization, and computation. Data analysis

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WHY DO WE NEED GEOINFORMATICS?

Communities of scientists around the world are working toward the goal of discovering new knowledge through a better understanding of the fundamental principles that underlie complex and heterogeneous data—a foundation for why the data values are what they are or an indication as to how the data would change over time through physical, chemical, and biological processes. Geoinformatics will support the next generation of knowledge discovery, markedly broaden our understanding of science and engineering, and allow us to solve challenging and complex problems previously unimagined.

There is common consensus that access to and integration of data are prerequisites for creating an information infrastructure. In addition, we argue that in order to fully exploit data in the pursuit of knowledge discovery and transformative science, new semantic models are needed to integrate scientific processes and methods within such an infrastructure. The semantic stages scientists follow on the pathway from data to knowledge and beyond involve seeking information as it relates to description, definition, or perspective (what, when, where) followed by derivation of knowledge, which comprises strategy, practice, method, or approach (how). These stages lead to new insight into fundamental principles (why).

The lack of a robust informatics infrastructure for sharing data and knowledge across all scientific disciplines has become a major hindrance to productivity, especially in multidisciplinary research (Atkins et al., 2003). Community-specific knowledge creation requires intra- and inter-community integrative capabilities. However, integrating and using data acquired by different investigators can be difficult. This is primarily because each data set uses heterogeneous schema and semantics. Such heterogeneities can be divided into three categories: syntactic, structural, and semantic (Sheth, 1998).

Syntactic and structural transformation (e.g., database mediation) can be used to handle the first two kinds of heterogeneities but are not adequate for resolving semantic differences. The use of ontologies is considered a possible solution for the semantic heterogeneity problem (McGuinness, 2003).

We present two examples that demonstrate the current use of semantics for access and integration of an array of geologic data types and formats. Our purpose is to highlight the advantages of what may be considered elaborate semantics-based approaches to provide solutions for complex problems.

1. OneGeology (www.onegeology.org) is an international collaboration working to develop and serve a Web-accessible, worldwide geological map data set at a scale of 1:1,000,000. Its objective is to utilize community-endorsed standards for syntactic interoperability that enhance the use of existing data. To achieve this goal, the program has developed a data exchange model called GeoSciML (Commission for the Management and Application of Geoscience Information, 2008) that provides a controlled vocabulary within a common conceptual model. Such a model allows common description of geologic features leading to interoperability through a markup language for data interchange for the discovery and utilization of globally distributed geoscience data and information. GeoSciML is a critical first step in the use of informatics-based technologies (Simons et al., 2006).

2. Ontology-Enabled Map Integrator (OMI), developed at the San Diego Supercomputer Center (Lin and Ludäscher, 2003), utilizes ontologies for registering geologic data sets to assist in integrating and querying heterogeneous data. Although this system was implemented for integration of data associated with geologic maps, it is a geoscience breakthrough in regard to the use of ontologic capabilities for discovery and integration. Each data set is registered (“mapped”) to an ontology-based association before it becomes available in a Web environment. The process of data registration semi-automatically generates mapping from data sets to existing ontologies; these mappings are then available to software applications that may be used to explore and extract information from diverse data arrays.

GEOSCIENCE-BASED SOCIETAL AND RESEARCH CHALLENGES

An Example of Cities at Risk and Volcanic Hazards

Sixty-three cities worldwide are situated near potentially active volcanoes and have populations of more than 100,000,
including two mega-cities with a combined population of more than 50 million. Thus, there is a great need to understand volcanic processes through pattern recognition and epidemiological forecasting. The need for informatics in hazard mitigation is evident in the data sets generated by disciplines represented at the International Association of Volcanology and Chemistry of the Earth’s Interior’s (IAVCEI) biannual conferences (“Cities on Volcanoes”). An informatics-based solution makes the integrative process across geoscience disciplines (and others) efficient, accurate, and cost-effective, thus making possible the discovery of new critical knowledge not accessible via manual analysis of data. For instance, (1) epidemiological data models enable comparisons with similar recorded events in real time, and (2) volcano visualizations and mining of data associated with volcano product characterizations facilitate efficient hypothesis formation and evaluation.

The example of cities at risk illustrates the need for integrative, multidisciplinary access to research-based data products. A host of other societally significant initiatives has similar needs; two examples are the joint USGS and Chinese Qingdao Institute for Marine Geology project on management of delta ecosystems (Delta Research and Global Observation Network) and the UK’s Environment and Urban Regeneration Program for development of 3- and 4-dimensional (4-D), high-resolution shallow (first 200 m) subsurface models to aid assessment of urban risks associated with natural and anthropogenic ground instability, pollution, and flooding.

Basic research in geoscience also benefits from semantics-based geoinformatics. For example, construction of a 4-D, kinematically balanced, palinspastic restoration of a continental margin orogenic belt and foreland also requires geoinformatics-based solutions to gain a more robust understanding of geologic processes. The necessary first step in interdisciplinary integrative research is data discovery. The current method of Web-based data discovery (mainly through search engines) requires sifting through a large number of Web pages. Also, because human interaction is required, integration normally results in the “layering of data” through a GIS system to retrieve new information (e.g., Takarada et al., 2007). Alternatively, the user must create a data integration layer to capture the location, format, and structure of the underlying data leading to a logical view. This activity requires the adoption of a common data model (e.g., North American Data Model [Boisvert et al., 2003]). Such techniques are effective but laborious and not the most rational and efficient way to analyze complex information (Doan and Halevy, 2005).

The main impediment to data discovery and integration is the lack of semantics to enable machines to “understand” and “automatically” process the data that they now merely display (Cardoso and Sheth, 2006). Figure 2 shows the different types and levels of interoperability leading to integration through semantics-based techniques. For example, taxonomy can classify information hierarchically without defining the nature of connections, while a thesaurus contains associations with semantic constraints. Both levels of semantic models are for standard classification schemes in a single discipline (e.g., rock classification [one-dimensional]) and are unable to represent and interoperate across multiple dimensions and/or varied conceptual models (Obrst, 2003; McGuinness, 2003). The more expressive semantics, in the form of ontologies, are underpinned by logical theories and provide increased capabilities for deductions and inferences based on known associations and rules (Baader et al., 2004; Sinha et al., 2006). Enabling software tools and languages, such as XML (W3C, 2003), RDF (W3C, 2004a), and OWL (W3C, 2004b; McGuinness and Harmelen, 2004), allow interoperability at increasing levels of semantics (i.e., from weak to strong), resulting in a transition from data to knowledge. We endorse the definition of knowledge discovery as a nontrivial extraction of implicit, previously unknown, and potentially useful information from data (Frawley et al., 1992).

To enable strong semantic interoperability, current research emphasizes ontology-based data registration, discovery, and integration (Obrst, 2003; Noy, 2004; Raskin, 2006; Malik et al., 2007a; Fox et al., 2008). The primary purpose of ontologies (e.g., Noy and McGuinness, 2001) is to provide an organizational structure for automated data discovery and automated inferencing capabilities (Baader et al., 2004). For example, a relationship between the occurrence of ignimbrites and hazardous volcanic eruptions can be inferred by an automated reasoning system even though this fact is not contained in the database, but only if the ontologic framework effectively captures such a relationship (Fig. 3). The conceptual relationships are based on the ontologic relationships: (1) ignimbrite is a pyroclastic rock is a volcanic rock is a rock; (2) a hazardous eruption is an explosive eruption is an eruption; and (3) an explosive eruption has material pyroclastic rocks; therefore, ignimbrites are a product of hazardous volcanic eruptions.

Recognizing the significance of semantics, we see the future as a virtual environment that allows science communities to go beyond data discovery toward modeling and understanding processes through shared data and services. We recognize the need to establish a tripartite semantic infrastructure for automated discovery, analysis, utilization, and understanding of data (through both inverse and forward modeling capabilities), leading to new knowledge. This infrastructure will consist of

Figure 2. Multiple levels of semantics and associated interoperability capabilities (from Obrst, 2003). Increasing interoperability services requires increasing community agreement on conceptual relationships across participating geoscience disciplines. Strong semantics allow inferences from dataset contents. Terms defined in Appendix A.
and natural language processing. For example, a geoscience ontology being developed as a mid-level ontology (Malik et al., 2007a) could eventually contain all possible geoscience terms and their associations, similar to the well-developed semantic capabilities in bioinformatics (Stevens et al., 2004).

The use of existing ontologies (e.g., SWEET ontology library [Raskin and Pan, 2005], which contains numeric, time, and units ontologies) will accelerate the development of additional subject-specific ontologies in the geosciences (e.g., Ramachandran et al., 2006; Sinha et al., 2007; Tripathi and Babaie, 2008). Thus, we envision community-supported ontologies that would enable automated discovery, analysis, utilization, and understanding of data through both induction and deduction along the pathway from data to knowledge and ultimately to insight of scientific principles. We emphasize that through technologies such as ontology mappings (Fensel, 2004) it is possible to share ontologic frameworks within and across scientific communities, regardless of consensus level. For example, rock classification schemes used by the British Geological Survey and the Geological Survey of Canada are dissimilar, but a user can still map the concepts of one to the other based on either classification scheme.

The semantic interoperability problems of data discovery and integration are similar to those associated with the use of geoscientific services (e.g., visualization or modeling codes), which have experienced limited re-use because of differences in operating systems, formats, etc. The Web Services Initiative undertaken by the World Wide Web Consortium (W3C) is a step toward resolving the problem of service-sharing across computing environments (Alonso et al., 2003). A Web service user need not be concerned with the operating systems, development language environments, or component models used to create or access the service. Therefore, tools and services developed by geoscientists can be wrapped as Web services registered to a service and process ontologies and made accessible to the scientific community at large.

Figure 4 shows a software system architecture for organizing geoscientific data and tools through ontologies. Registration to ontologies of these data and tools as Web services would facilitate discovery, analysis, utilization, and understanding of data through both induction and deduction along the pathway from data to knowledge and ultimately to insight of scientific principles. We emphasize that through technologies such as ontology mappings (Fensel, 2004) it is possible to share ontologic frameworks within and across scientific communities, regardless of consensus level. For example, rock classification schemes used by the British Geological Survey and the Geological Survey of Canada are dissimilar, but a user can still map the concepts of one to the other based on either classification scheme.
enable them to be automatically selected to answer geoscience queries. For example, the problem of integrating heterogeneous volcanic and atmospheric chemical-compound data used to assess the atmospheric effects of volcanic eruptions can be accomplished through semantically enabled registration and integration engines (Malik et al., 2007b; Rezgui et al., 2007; Fox et al., 2008). A simple query, such as “Find A-type plutons in Virginia and identify the correlation between these plutons and their gravity properties,” requires Web-based access to distributed data resources (geochemical, gravity, and map databases, as well as computational and visualization tools) (Rezgui et al., 2007). Clearly, continued participation by geoscientists in ontology development and engineering and registration of data and tools will enable the community to move ahead into the emerging world of the Semantic Web.

THE FUTURE: THE SEMANTIC WEB AND DATA WITH NO BORDERS

The emerging Semantic Web is an extension of the existing Web, in which all information is given a well-defined meaning (Berners-Lee et al., 2001). The ultimate goal of the Semantic Web is to transform the present-day Web into a medium through which data and applications can be automatically understood and processed without geographical or organizational boundaries. The Semantic Web allows understanding, sharing, and invocation of data and services by automated tools associated with ontologies (Alonso-Jiménez et al., 2006), and it is already in use within the corporate world (Oracle, 2010; W3C, 2009a, 2009b). Other advantages of Semantic Web technologies for the geosciences include (1) facilitated knowledge management (capturing, extracting, processing, and storing knowledge) (Alonso et al., 2003); (2) integration across heterogeneous domains through ontologies (Fox et al., 2008); (3) the ability to handle non-text items, such as images and multimedia (Schreiber et al., 2001); (4) efficient information filtering (sending selective data to the right clients); (5) machine understanding (the ability to take humans out of the “integration loop”); (6) the formation of virtual communities (Reitsma and Albrecht, 2005); (7) legacy capture for long-term archiving; (8) serendipity (finding unexpected collaborators); and (9) Web-based education (Ramamurthy, 2006).

Capabilities based on semantic integration of data, services, and processes will become the new paradigm in scientific endeavors and will provide a significant boost to the visibility of geoscience research and education in a competitive world. Significant industry and government funding will be necessary for geoinformatics to grow to the level enjoyed by its sister program in bioinformatics (e.g., Mohan-Ram, 2000; Tracor Systems Technologies, 1998). We also support the establishment of a consortium to provide an organizational platform for promoting long-term management of data and resources. Researchers in bioinformatics have already recognized the need to establish economically viable models for the long-term survival of public data on the Web (Ellis and Kalumbi, 1998); geoscientists can utilize the voice of the consortium to provide stability for existing data, because those data represent the fundamental infrastructure for future geoscience research and its applications.

SUMMARY

Earth has a complex record of the dynamic interaction among plates, materials, and life that provides clues to the physical and chemical evolution of continents, oceans, atmosphere, and life forms. Extremely heterogeneous data from rocks that preserve ~4.5 billion years of history have been meticulously gathered through observations over the centuries, and this highlights the integration problems associated with studies of biodiversity, climate change, planetary processes, and natural hazards and resources. The vision of geoinformatics is to create a fully integrated geosciences information network with free access to earth-science data, tools, and services. Research in all categories of geoinformatics will support the emerging challenges posed by the building of knowledge societies:

First, to narrow the digital divide that accentuates disparities in development, excluding entire groups and countries from the benefits of information and knowledge; second, to guarantee the free flow of, and equitable access to, data, information, best practices and knowledge in the information society; and third to build international consensus on newly required norms and principles.

(UNESCO, 2003, preface)

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REFERENCES CITED


rules of inference and logic for some particular topic (Gru-ber, 1993).

OWL—Web Ontology Language is a family of knowledge rep-resentation languages for authoring ontologies endorsed by the W3C (2004b).

Portal—Web site considered to be an entry point for discovery and access of multiple resources and other Web sites.

Provenance—tracking the source of data and services.

Registration—adding new descriptions to a repository.

Relational model for database—based on first-order predic-ate logic.

Schema—structure and organization of databases, including information on the type of content and relationship within the structure (also XML and RDF schemas).

Service registry—a network-accessible directory that contains information about the available services.

Standards—defined by the International Organization of Standardization (ISO) as “documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose” (BioBasics, 2007).

Semantic—the implied meaning of data. Used to define what entities mean with respect to their roles in a system (Sedris Technologies, 2007).

Semantic interoperability—refers specifically to the meanings that are embedded in this exchanged information and to the effective and consistent interpretation of these meanings.

Semantic Web—an evolving extension of the World Wide Web in which Web content can be expressed not only in natural lan-guage but also in a form that can be understood, interpreted, and used by software agents, thus permitting them to find, share, and integrate information more easily (W3C, 2009c).

Structural interoperability—incompatibilities between hard-ware, operating systems, etc.

Syntactic interoperability—form of interoperability con-cerned with the technical issues and standards involved in the effective communication, transport, storage, and representation of metadata and other types of information (UKOLN, 2006).

Taxonomy—classification scheme for terms, structured col-lection of terms, generally hierarchical, that is used for both classification and navigation.

UML—Unified Modeling Language is the industry-standard language for the specification, visualization, construction, and documentation of the components of software systems. UML helps to simplify the process of software design, making a model for construction with a number of different views (Object Management Group, 2010).

Web service—defined by a set of technologies that provide platform-independent protocols and standards used for exchanging data between applications. Web services are fre-quently just Web application programming interfaces (APIs) that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.

XTM—provides a model and grammar for representing the structure of information resources used to define topics, and the associations (relationships) between topics (TopicMaps .Org Authoring Group, 2001).
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Our theme captures this diversity—Archean to Anthropocene; the past is the key to the future stresses the broad research and education agenda of the GSA community as a whole, as well as the applications of our work to society.
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And now—Check out our poster! We are pleased and excited to offer you yet another in a series of posters that go back to the 2005 North-Central Section meeting in Minneapolis. How many seconds will it take before you see something in that poster that you have never noticed before?

Brace yourselves—The Minneapolis meeting is going to be great. And now, folks: Get ready, get set… let’s start proposing sessions!

Harvey Thorleifson,
2011 Local Committee Chair, thorleif@umn.edu

The Details

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Topical sessions promote the exchange of timely, state-of-the-art information with respect to a focused topic and allow scheduling of interdisciplinary talks that bear on that topic. Organizers (also called advocates) may invite up to three specific papers or poster presentations to ensure a successful session and are also encouraged to solicit volunteered abstracts. Once topical sessions are approved, articles in GSA Today will also be used to solicit volunteered abstracts. Topical sessions must receive a minimum of 12 abstracts to be part of the technical program, and all session proposals are reviewed by the Joint Technical Program Committee.

Do you have an idea for a digital poster session? Perhaps your modeling poster would be better viewed digitally? Submit a Digital Poster Topical Session proposal. An extra abstract submittal fee will apply for the use of a digital board in the poster hall area.

Pardee Keynote Symposia (made possible by a grant from the Joseph T. Pardee Memorial Fund) are special events of broad interest to the geoscience community that represent leading-edge work in a scientific discipline or a vital area of public policy. The GSA Annual Program Committee (APC) takes a proactive role in selecting topics and soliciting conveners for Pardee Keynote Symposia in order to enhance the range and significance of science at the annual meeting and to highlight topics of particular relevance to the Minneapolis meeting location. However, ideas for symposia will not be limited to those of the APC. All interested parties are encouraged to pool their resources and submit ideas related to new breakthroughs and transformative science within their geoscience subdisciplines. GSA also encourages members to work with GSA Divisions and Associated Societies to come up with suggestions for Pardee Keynote Symposia. Symposia may follow a classic format, but organizers also have the flexibility to reformat a session in a manner that works best for the topic at hand.

Minneapolis 2011 Dates & Deadlines

1 Dec. 2010: Field Trip proposals due.
1 Feb. 2011: Short Course proposals due (also via www.geosociety.org/meetings/2011/).
26 July 2011: Abstracts due by 11:59 p.m. PST.
13 Aug. 2011: Technical program schedule finalized. Accepted abstracts with links to speakers and titles will be posted at www.geosociety.org in mid-August.

2011 Meeting Organizers

Chair: Harvey Thorleifson, Minnesota Geological Survey, thorleif@umn.edu
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GSA Division: Coal Geology

GILBERT H. CADY AWARD

Nominations due 28 February 2011

Submit three copies of the following to Jack C. Pashin, Energy Investigations Program, Geological Survey of Alabama, P.O. Box 869999, Tuscaloosa, AL 35486-6999, USA; jpashin@gsa.state.al.us: (1) name, office or title, and affiliation of the nominee; (2) date and place of birth; (3) education, degree(s), and honors and awards; (4) major events in his or her professional career; and (5) a brief bibliography noting outstanding achievements and accomplishments that warrant nomination.

The 2011 Gilbert H. Cady Award is given for outstanding contributions in the field of coal geology. The first award, established by the Division in honor of Gilbert H. Cady, was presented in 1973. The award recognizes contributions that advance the field of coal geology within and outside North America and will be presented at the Coal Geology Division Business Meeting at the 2011 GSA Annual Meeting in Minneapolis. Nominations will be evaluated by the Gilbert H. Cady Award Panel. Monies for the award are derived from the annual interest income of the Gilbert H. Cady Memorial Fund, administered by the GSA Foundation.

GSA Division: Geophysics

GEORGE P. WOOLLARD AWARD

Nominations due 15 February 2011

Submit online via link at www.gsageop.org. Nominations should include a description of the nominee’s specific contributions and their scientific impact.

The George P. Woollard Award recognizes outstanding contributions to geology through the application of the principles and techniques of geophysics. The award is presented at each annual GSA meeting in conjunction with the Geophysics Division and the Structural Geology and Tectonics Division business meetings. A highlight of the presentation is the honorary George P. Woollard Technical Lecture by the recipient before the award ceremony. Award funds are administered by the GSA Foundation.

GSA Division: Geoscience Education

BIGGS AWARD FOR EXCELLENCE IN EARTH SCIENCE TEACHING

Nominations due 1 February 2011

Submit nominations to http://gsaged.org/biggsaward/award2010.htm. Any supplemental materials should be sent to Dean Moosavi, smoosavi@umassd.edu.

The Biggs Award recognizes innovative and effective teaching in college-level earth science. Earth-science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full-time for 10 years or fewer are eligible (part-time teaching is not counted in this requirement). Both peer- and self-nominations will be accepted.

This award, administered by the GSA Foundation, is made possible by support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA’s Education and Outreach Program. An additional travel reimbursement is also available to the recipient to enable him or her to attend the award presentation at the GSA Annual Meeting.
GSA Division: Quaternary Geology and Geomorphology

FAROUK EL-BAZ AWARD
FOR DESERT RESEARCH

Nominations due 2 April 2011

Submit nominations, including (1) a statement of the significance of the nominee’s research, (2) a curriculum vitae, (3) letters of support, and (4) copies of no more than five of the nominee’s most significant publications related to desert research to Sara Rathburn, Dept. of Geosciences, Colorado State University, Fort Collins, CO, 80523-1482, USA; rathburn@cnr.colostate.edu. Please submit electronically unless hard-copy previously approved.

The Farouk El-Baz Award for Desert Research rewards excellence in desert geomorphology research worldwide. It is intended to stimulate research in desert environments by recognizing an individual whose research has significantly advanced the understanding of the Quaternary geology and geomorphology of deserts. Although the award primarily recognizes achievement in desert research, the funds that accompany it may be used for further research. The award is normally given to one person but may be shared by two people if the recognized research was the result of a coequal partnership. Any scientist from any country may be nominated. Because the award recognizes research excellence, self-nomination is not permitted. Neither nominators nor nominees need be GSA Members. Monies for the award are derived from the annual interest income of the Farouk El-Baz Fund, administered by the GSA Foundation.

GSA Division: History of Geology

MARY C. RABBITT HISTORY OF GEOLOGY AWARD

Nominations due 1 February 2011

Submit nominations to Jane P. Davidson, University of Nevada, Reno, NV 89557-0001, USA; +1-775-747-2252; jdhexen@unr.edu.

The Mary C. Rabbitt History of Geology Award is presented annually to recognize an individual for exceptional scholarly contributions of fundamental importance to our understanding of the history of the geological sciences. Achievements deserving of the award include, but may not be limited to, publication of papers or books that contribute new and profound insights into the history of geology based on original research or a synthesis of existing knowledge. The award was established by the History of Geology Division in 1981 and renamed in memory of Mary C. Rabbitt in 2005. For more information, please see http://gsahist.org/HoGaward/awards.htm. Neither the nominator nor the nominee need be a member of the Division or of GSA. Monies for the award are administered by the GSA Foundation.
GSA needs your assistance and expertise in making nominations for the wide range of geoscience awards outside of the GSA awards arena. GSA is looking to promote national visibility and recognition for the earth sciences by making credible nominations for national awards. Examples of such awards are the William T. Pecora Award, the Vannevar Bush Award, the National Medal of Science, and the Alan T. Waterman Award. The GSA External Awards Committee also selects nominees for AGI Awards, including the Ian Campbell Medal, the William B. Heroy, Jr., Award, and the Marcus Milling Legendary Geoscientist Award. For details, see the “Call for Nominations for National Awards” in the October GSA Today (p. 15).

Please send your complete nominations by 1 Feb. 2011 to GSA Grants, Awards & Recognition, P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301-9140, USA, awards@geosociety.org. Nominations will be forwarded to the GSA External Awards Committee. This committee consists of 12 voting members, including GSA’s past presidents, the Penrose and Day Medal Award Committee Chairs, and eight Division representatives. The committee is charged with generating, receiving, and evaluating candidates for all nominations submitted by either the GSA membership at large or by committee members themselves. After reviewing all nominations, the committee will present their recommendations to GSA Council for approval and will then forward the final nominee information to the sponsoring organizations for their consideration.

Our GSA membership has a wealth of knowledge and expertise, so please join us in making a nomination of an award that you are passionate about!

* Find the October issue online at www.geosociety.org/gsatoday/archive/20/10/.

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GSA Mentor Programs

STUDENTS
Interested in a Career in the Applied Geosciences?
Plan now to attend a Roy J. Shlemon Mentor Program in Applied Geoscience and/or a John Mann Mentors in Applied Hydrogeology Program at your 2011 Section Meeting to chat one-on-one with practicing geoscientists. These volunteers will answer your questions and share insights on how to get a job after graduation.

PROFESSIONALS
Interested in Mentoring Students about Applied Geoscience Careers?
Being a mentor is a rewarding experience. If you would like to serve as a mentor at one of the GSA Section Meetings, or need more information, please contact Jennifer Nocerino, jnocerino@geosociety.org.

www.geosociety.org/mentors/

GSA Section Meeting Schedule

NORTHEASTERN/ NORTH-CENTRAL
Joint Section Meeting
Pittsburgh, Pennsylvania, USA
20–22 March 2011
Abstract deadline:
14 December 2010

SOUTHEASTERN
Section Meeting
Wilmington, North Carolina, USA
23–25 March 2011
Abstract deadline:
14 December 2010

SOUTH-CENTRAL
Section Meeting
New Orleans, Louisiana, USA
27–29 March 2011
Abstract deadline:
18 January 2011

ROCKY MOUNTAIN/ CORDILLERAN
Joint Section Meeting
Logan, Utah, USA
18–20 May 2011
Abstract deadline:
15 February 2011
The Sierra Nevada is an important natural laboratory for understanding a disparate array of geologic processes, including plate tectonics and associated range uplift, volcanic activity, changes in regional climate, and the assembly of plutons and batholiths. Data derived from these seemingly disparate research areas are wholly interrelated. For example, the paleodepths of pluton intrusion or roof pendant metamorphism inform estimates of the magnitude of Cenozoic range uplift, as do the timing and composition of Miocene and Pliocene volcanic rocks. Similarly, paleoclimate models are important for understanding rates of downcutting of the modern canyons that cross the Sierra Nevada. Successful models of uplift, climate change, downcutting history, and regional volcanism must explain or be consistent with geophysical observations of the crust and lithosphere as well as the age and composition of the basement rocks.

This Penrose Conference brought together researchers with a wide range of interests, including geophysics, active tectonics, structural geology, volcanism, geochemistry, batholith emplacement, stratigraphy and sedimentology, paleobotany, geomorphology, geochronology, and thermochronology, with the goal of defining clearer paths of research and potential avenues of collaboration. Much of the discussion focused on the Sierra Nevada, including (1) the nature and origin of bedrock geology; (2) geophysical observations of the crust and lithosphere; (3) geomorphologic, paleontologic, and isotopic data and theoretical models related to range uplift; and (4) volcanism and potential links to tectonic events. However, a large part of the discussion dealt with a much broader context, starting with the entire western United States and Mexico and its Pacific plate margin, and narrowing to the Great Basin and, in particular, transtensional rifting in the Walker Lane belt (Eastern California shear zone) and the Gulf of California. After all, the origin and uplift of the Sierra Nevada cannot be evaluated without debating models, for example, of (1) Laramide flat-slab–Shatsky conjugate subduction and the existence/nature of the “Nevadaplano”; (2) Paleo–gene slab rollback, ignimbrite flare-up, and burning of the lithospheric landbridge across what is now the Great Basin; and (3) the relative importance of edge-driven (San Andreas) versus bottom-driven (mantle flow) controls on extension, transtension, and vertical motions.

The importance of the Sierra Nevada–Walker Lane region cannot be overemphasized for understanding the processes involved in the rupturing of continental lithosphere. This is a classic plate tectonic region, from which many important concepts have developed and been exported to other parts of the world. Furthermore, the region is important for geothermal and mineral resources and has a population living on active faults (e.g., Reno–Carson City population corridor, as well as newly discovered faults in the very popular North Tahoe basin).

For all of these reasons and as a result of this conference, we are soliciting papers for a special Geosphere issue titled “Origin of the Sierra Nevada and Walker Lane” (to be guest edited by Keith Putirka and Cathy Busby; manuscript deadline: 15 Jan. 2011). To the extent that work in adjacent regions is relevant, we further welcome papers related to the evolution of Baja California, the Basin and Range, and the southern Cascades across a range of disciplines, including, but not limited to, field studies, geophysics, paleobotany, petrology, and geochemistry.

Conference Details

This Penrose Conference took place 15–20 August 2010 in Bridgeport, California (population 856, elevation 6,468 ft), USA, about 25 miles north of Mono Lake. The conference kicked off with posters and a welcome party on Sunday, included two days of field trips, and ended at 1 p.m. on Friday, in time for an optional, informal post-meeting field trip.

Nine of the 31 speakers were women, and 20 out of the 68 participants were “youngsters” (under the age of 40 years), including 12 students and four postdoctoral researchers. Conveners Keith Putirka compiled an abstract volume, which he distributed to the participants both digitally and in print. The captive audience was never a thirsty one, thanks to the organizing efforts of student participant Chad Carlson, under the mentorship of John Wakabayshi, and this facilitated many hours of spirited debates over posters, extending until midnight on most evenings. The 37 poster presenters each gave a 3-minute “pitch” to the group (with summary slide) on the first day, and we scheduled 15 minutes of discussion for every 25-minute talk, as well as interspersed group discussion sessions. These group discussions mainly focused on (1) regional and Sierran geophysics, Sierran tectonics, and regional magmatism; (2) the Walker Lane–Eastern California Shear Zone-Northern Basin and Range: Future work with GeoPRISMS

CONVENERS

Cathy J. Busby, Dept. of Earth Science, University of California, Santa Barbara, California 93106, USA

Keith Putirka, Dept. of Earth and Environmental Sciences, California State University, 2345 E. San Ramon Ave., MS/MH24, Fresno, California, 93720, USA

Penrose Conference Report

Origin and Uplift of the Sierra Nevada, California, USA

Bridgeport, California, USA
15–20 August 2010

DECEMBER 2010, GSA TODAY
and (3) erosion, the sedimentary record, active tectonics, and landscape evolution.

Field Trips
Convener Cathy Busby compiled and edited a 68-page informal field guide, using text, figures, and references made by the following trip leaders: Graham Andrews, Cathy Busby, Chad Carlson, Jeanette Hagan, Christopher Henry, Angela Jayko, David John, Bruce Pauly, Christopher Pluhar, Keith Putirka, and David Wagner.

On Tuesday, the group hiked the Sierra Nevada crest at Sonora Pass, examining the ca. 10.5 Ma landslide and “andesite flood lava” fill of the newly recognized Sierra Crest graben (Busby, Hagan, Wagner, and Andrews), and the group was introduced to the magnetostratigraphy and chemistry of these distinctive lava flows (Pluhar and Putirka). In the early afternoon, Henry led us to a Sierran paleochannel filled with oligocene ignimbrites erupted in central Nevada for discussions of paleolandscapes and the nature of the “Nevadaplano.” At the end of the day, we examined Sierran range-front faults and discussed their controls on ca. 11–9 Ma high-K arc volcanism within a pullapart basin that shows paleomagnetic evidence for dextral vertical axis rotations (Busby, Putirka, Pluhar, and Hagan). This indicates that transtensional rifting was in full swing in this region by 11 Ma.

On Thursday, Pluhar and Carlson showed us the distinctive eruptive products of the Little Walker caldera and demonstrated further paleomagnetic evidence of dextral block rotations of these widespread strata within the Walker Lane belt. Most of the afternoon, led by John, was spent in the large, long-lived Miocene magmatic center of the famous Bodie and Aurora gold and silver mining district. The day ended with views and discussions of the Mono Basin–Long Valley areas, including volcanism, structure, landscapes, and climate change (Jayko and Pauly).

Presentations
Space does not permit a summary of all of the talks and posters, and we expect that many of the results presented at the meeting will appear in the special issue of *Geosphere*. Instead, we highlight some of the controversies and questions raised.

The legacy of subduction was debated on the big-picture scale, including the fate of the purported subducted Shatsky Rise conjugate (now below the eastern seaboard, or under Wyoming?) and the nature of the upper plate damage zone left in its wake. The nature, thickness, and evolution of the crust under the Sierra Nevada, Great Valley, and Great Basin were also debated at length. New geophysical imaging of the Cretaceous Sierra Nevada batholith suggests that a mafic residue remains only under the western foothills, and a “delamination Moho” extends as far north as Lake Tahoe (meaning that the crust rests on asthenosphere); does this indicate root removal under the entire eastern Sierra, similar to that proposed for the southern Sierra-Isabella anomaly, or did it never exist there, as suggested by xenolith studies on Cenozoic volcanic rocks? When and how did delamination (or lithosphere thinning) occur in the central and northern Sierra Nevada? Petrologic and geologic arguments were made for a wide variety of controls on Cenozoic magmatism, including “Ancestral Cascades arc” subduction, the onset of transtensional rifting, the migration of the Mendocino triple junction, and lithosphere degradation through root removal versus extension.

A series of presentations focused on the importance of Sierra Nevada microplate as a natural laboratory for collecting “real-time” data on an active rift, including GPS coverage, earthquake data, microseismicity and strain field analysis, and heat flow data. Advances in studies of active tectonics were also highlighted, including LiDAR imaging and surface dating, combined with detailed mapping and
trenching of active faults; furthermore, the rich Quaternary stratigraphic and structural record of the lacustrine rift basins was demonstrated by geophysical imaging from boats and compared with the marine record in the Gulf of California. All attendees agreed on the importance of gaining a better time-integrated view of tectonic processes along the “future plate boundary” through studies of the stratigraphic and structural architecture of Neogene basins. These basins are poorly known, perhaps in part due to inadequate funding for field-based studies relative to instrumentation-based studies, but also due to the fact that volcanic stratigraphy is a relatively new and rapidly evolving field. Knowledge of volcanic stratigraphy and structure is also important for geothermal exploration, and the role of fluids and volatiles in the development of the rift was identified as a topic deserving further investigation.

Concluding Remarks

We were very pleased with the commitment all the participants showed by arriving at the very beginning of the conference and staying until the very last hour, especially because this was a conference nearly everyone drove to, so “playing hooky” would have been easy. We felt the discussions were very lively and highly inclusive; we believe that a spirit of collaboration was fostered by the meeting. Everyone agreed that the time is ripe to mount a large, multi-investigator collaboration across a wide range of disciplines in order to understand this developing plate margin and its larger context. Several of us are now involved in exploring this possibility under the umbrella of the U.S. National Science Foundation MARGINS/GeoPRISMS Rift Initiation and Evolution initiative.

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SOUTH-CENTRAL
45th Annual Meeting
New Orleans, Louisiana, USA
27–29 March 2011

CALL FOR PAPERS
Abstract Deadline: 18 January 2011
Please submit your abstract online at www.geosociety.org/sections/sc/2011mtg. An abstract submission fee of US$10 for students and US$15 for all others will be charged. If you cannot submit the abstract online, please contact Nancy Wright, +1-303-357-1061, nwright@geosociety.org.

Symposia
S1. The Deepwater Horizon/Macondo Well Oil Spill One Year Later: What Has Been Learned?
Three sessions will involve research about the Deepwater Horizon Oil Spill. We seek abstracts addressing initial research into the fate of oil spilled into the Gulf of Mexico along three different fronts: the marine environment (session S1A), coastal environments (session S1B), and the biosphere (session S1C).

S1A. Deepwater Horizon Oil Spill: The Fate of Oil in Gulf of Mexico Waters and Beyond.

S1B. Deepwater Horizon Oil Spill: Tracing the Landed Oil and Its Effects on the Gulf Coast.

S1C. Deepwater Horizon Oil Spill: Biotic Responses to the Oil Spill Incident—Microbes to Macrobiota.

This session highlights research into dynamic coastal processes, including controls on deposition and erosion (session S2A), geologic records of change (session S2B), and societal response to change and threats (session S2C).

John B. Anderson, Rice Univ.; Antonio B. Rodriguez, Univ. of North Carolina.

Alex Braun, The Univ. of Texas at Dallas; Craig Glennie, Univ. of Houston; John Barras, USGS.

S2C. Our Dynamic Coasts: Delta Plain Management—What Are We Learning From the Geological Record?
Zhixiong Shen, Tulane Univ.; Juan L. Gonzalez, The Univ. of Texas–Pan American.

Theme Sessions
T1. Lithospheric Evolution of Southern Laurentia and the Gulf of Mexico.
Elizabeth Anthony, The Univ. of Texas at El Paso; Jay Pulliam, Baylor Univ.

Janok Bhattacharya, Univ. of Houston; M. Royhan Gani, Univ. of New Orleans.

T3. More than Meets the Eye: Geology and Geochemistry of Dark Shales of the Southern Midcontinent.
Anna Cruse, Oklahoma State Univ.; James O. Puckette, Oklahoma State Univ.

T4. Wetland Interfaces.
Gregg R. Davidson, Univ. of Mississippi; Zoe J. Hughes, Boston Univ.

T5. Quaternary Faulting along the Northern Gulf of Mexico Margin.
Nance H. Dawers, Tulane Univ.; Nicole M. Gasparini, Tulane Univ.

Rebecca L. Freeman, Tulane Univ.; Ronald L. Parsley, Tulane Univ.

Ioannis Georgiou, Univ. of New Orleans; Mead Allison, The Univ. of Texas at Austin.

Jeffrey S. Hanor, Louisiana State Univ.; Stephanie E. Welch, Southeastern Louisiana Univ.

Farzam Javadpour, Jackson School of Geosciences, The Univ. of Texas at Austin.
T10. **Creating Geoscience Opportunities for High School Students.** Diane F. Maygarden, Univ. of New Orleans; Ivan P. Gill, Univ. of New Orleans; Jeff Agnew, Tulane Univ.

T11. **Vertebrate Paleontology and Paleoecology of the Central Gulf Coast.** Judith A. Schiebout, Louisiana State Univ.–Baton Rouge; Michael J. Williams, URS Corporation.

T12. **Undergraduate Geoscience Education: Strategies Old and New.** Jay Simms, Univ. of Arkansas at Little Rock; Dean Moosavi, Univ. of Minnesota; Jeffrey Sigler, Tulane Univ.


T14. **Undergraduate Research (Posters).**

**LOCATION & HOUSING**
A block of rooms has been reserved at the meeting venue, the Chateau Bourbon Hotel, 800 Iberville Street, New Orleans, Louisiana, USA; www.chateaubourbonneworleans.com. This Wyndham Historic Hotel is in the French Quarter adjacent to Bourbon Street, 16 miles from Louis Armstrong New Orleans International Airport. Reservations can be made by calling +1-888-404-6875 and referencing “GSA SC Section.” Room rates are US$109 plus 13% tax and a US$1 occupancy tax.

**FIELD TRIPS**
We are planning a field trip to examine the impacts of Hurricane Katrina, plus other trips around the delta plain. Anyone interested in proposing a trip should contact field trip chair Alex Kolker, akolker@lumcon.edu.

**CONTACT INFORMATION**
Detailed information for this meeting is online at www.geosociety.org/Sections/sc/2011mtg/. If you have special requests or requirements, please contact the meeting chairs: Local Committee chair Mark Kulp, mkulp@uno.edu; Technical Program co-chairs Mike Miner, mminer@uno.edu, and Brad Rosenheim, brosenhe@tulane.edu.

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Kristin Frederick, hydrologist at Great Sand Dunes National Park and Preserve, 2009.
JOINT MEETING
46th Annual Meeting,
Northeastern Section, GSA
45th Annual Meeting,
North-Central Section, GSA
Pittsburgh, Pennsylvania, USA
20–22 March 2011

REGISTRATION FEES (all fees are in U.S. dollars)

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ACCOMMODATIONS
Hotel registration deadline: 20 February 2011
A block of rooms has been reserved at the historic Omni William Penn Hotel, 530 William Penn Place, Pittsburgh, PA 15219, USA, at US$149/night plus US$10 each for third and fourth occupants. Call +1-800-843-6664 and request a reservation under “The Geological Society of America.”

SYMPOSIA
2. CO2 Sequestration. William Harbert, Univ. of Pittsburgh, harbert@pitt.edu.
3. Applied Geology: Environmental, Engineering, and Hydrogeologic Applications. Cosponsored by GSA Engineering Geology Division. Terry West, Purdue, trwest@purdue.edu.
4. Devonian Climate and Paleoecology—Insight from Stratigraphic Studies. Dave Brezinski, Carnegie Museum of Natural History, dbrezinski@dnr.state.md.us; Gordon Baird, SUNY Fredonia, gordon.baird@fredonia.edu; Jeff Over, SUNY Geneseo, over@geneseo.edu.

THEME SESSIONS
Structure/Tectonics/Petrology
14. The Effect of Late Paleozoic Tectonics on the Devonian Shales. Cosponsored by Eastern Section, SEPM. Mark Evans, Central Connecticut State Univ., evansmaa@ccsu.edu.
30. Syncrystallization Evolution of Granitic Magma in Orogenic Belts. Tathagata Dasgupta, Kent State, tdasgupt@syri.edu; Scott Samson, Syracuse Univ., sdsamson@syri.edu.

REGISTRATION
Early registration deadline: 15 February 2011
Cancellation deadline: 22 February 2011
Please register online at www.geosociety.org/sectdiv/NE-NC/11mtg/. For further information, or if you have special requirements, please contact the local committee chairs: Daniel Holm (NC), dholm@kent.edu; Patrick Burk hart (NE), patrick.burkhart@sr.edu. Also check the Web site for meeting details.

From Shield to Sea
Pittsburgh is a thriving city with a vibrant community, great restaurants, and many museums, and the meeting area offers a variety of geologically interesting venues: excellent examples of the Allegheny Front separating the Valley and Ridge and Appalachian Plateaus Provinces, including terminal Laurentide moraines, as well as oil, gas, coal, aggregates and a wealth of additional natural resources, overprinted with myriad geotechnical hazards.
32. Structural Geology and Natural Resources in the Central and Northeastern United States. W. Ashley Griffith, Univ. of Akron, wag8@uakron.edu; John C. Lewis, Indiana Univ. of Pennsylvania, jclewis@iup.edu.

33. Advances in Defining Links between Deformation and Metamorphism. Gregory Dumond, Univ. of Arkansas, gdumond@uark.edu.

40. Advances in Defining Links between Deformation and Metamorphism. Gregory Dumond, Univ. of Arkansas, gdumond@uark.edu.

41. Devonian Orogenesis in the Appalachian-Caledonian Mountain Belt—Where, When, and What Caused It? Sandra M. Barr, Acadia Univ., sandra.barr@acadiau.ca; Paul Karabinos, Williams College, paul.m.karabinos@williams.edu; Cees R. van Staal, Geol. Survey of Canada, cees.vanstaal@nrcan-rncan.gc.ca; Robert P. Wintsch, Indiana Univ., wintsch@indiana.edu; David P. West Jr., Middletown College, dwest@middletown.edu.

42. Geophysics in the Central and Northeastern United States. Cosponsored by GSA Geophysics Division. Kevin Mickus, Missouri State Univ., kevinmickus@missouristate.edu.

Stratigraphy/Sedimentology


26. The Origin of the Dunkard Group, the Youngest Paleozoic Strata in the Central Appalachian Basin. Viktoras Skema, Pennsylvania Geol. Survey (retired), skema@verizon.net; Blaine Cecil, cecilblaine@gmail.com; William DiMichele, dimichel@si.edu.


Paleontology

2. Mesozoic/Cenozoic Vertebrate Paleontology. Cosponsored by Eastern Section, SEPM. Michael Ryan, Cleveland Museum of Natural History, mryan@cmnh.org; Matt Lamanna, Carnegie Museum of Natural History, lamannam@carnegiemnh.org.

3. Advances in Arthropod Paleobiology. Cosponsored by the Pander Society. Carrie Schweitzer, cschweitz@kent.edu; Rod Feldmann, rfeldman@kent.edu, Kent State.

4. Paleozoic Vertebrate Paleontology. Chuck Ciampaglio, Wright State Univ.—Lake Campus, chuck.ciampaglio@wright.edu.

43. Life’s Footprint: New Frontiers in Field and Experimental Trace Fossil Research. Cosponsored by Eastern Section, SEPM. Ilya Buynevich, Temple Univ., coast@temple.edu; Stephen Hasiotis, Univ. of Kansas; Jacob Benner, Tufts Univ.

Climate Change/Quaternary Studies

7. Theory and Application in Quaternary Paleoclimate Studies. Joe Ortiz, Kent State, jortiz@kent.edu.

8. Into the Woods: Ecohydrology and Groundwater-Surface Water Interaction in Forested Eastern North America. Alison Smith, Kent State, alisonjs@kent.edu; Don Palmer, dpalmer@kent.edu, Kent State.

13. Quaternary History of the Great Lakes. Cosponsored by Eastern Section, SEPM. Timothy G. Fisher, Univ. of Toledo, timothy.fisher@utoledo.edu.

23. Lakes and Environmental Change. Mark Abbott, Univ. of Pittsburgh, mabbott1@pitt.edu.

Applied Geology

6. Engineering Geology/Slope Stability/Mine Subsidence. Cosponsored by GSA Engineering Geology Division. Abdul Shakoor, Kent State, ashakoor@kent.edu; James Kilburn, Shaw Environmental, james.kilburn@shawgrp.com; Brian Greene, U.S. Army Corps of Engineers (retired).

18. Marcellus—Production and Disposal of Produced Water. Roman Kyshakevych, Allegheny GeoQuest, roman@gk@gmail.com.

20. Coal Ash Placement—Potential Impacts upon Surface- and Groundwater Quality. Henry Prellwitz, slagman1@verizon.net.

22. Urban Geochemistry. Daniel Bain, dbain@pitt.edu; Emily Elliot, eelliot@pitt.edu, Univ. of Pittsburgh.

Geological Education


FIELD TRIPS

Pre-Meeting

2. Analysis of the Hinterland (Structural Geology) and Proximal (Stratigraphy) Portion of the Marcellus Basin, Appalachian Valley and Ridge. Two-day trip. Fri.–Sat., 18–19 March. Departs 7 a.m. Fri.; returns 6 p.m. Sat. Cost: US$245. Max.: 40. Terry Engelder; Rudy Slingerland; Dan Kohl; Mike Arthur, Penn State.


During the Meeting

Post-Meeting

WORKSHOPS
1. **Geology of National Parks Modules in the “Spreadsheets across the Curriculum” Library.** 1–5 p.m., Sat., 19 March. US$15. Max.: 24. Len Vacher, vacher@usf.edu; Judy McIlrath, jmclrath@usf.edu; Tom Juster, juster@usf.edu, Univ. of South Florida.
2. **Creating Original Geoscience Content in Google Earth.** 8 a.m.–5 p.m., Sat., 19 March, US$45 (does not include lunch). Max.: 24. Steve Whitmeyer, James Madison Univ., whitmesj@jmu.edu; Declan De Paor, Old Dominion Univ., ddepaor@odu.edu.
3. **Classroom Strategies that Improve Learning and Engage Students.** 1–5 p.m., Sat., 19 March. US$25. Max.: 25. David Steer, Univ. of Akron, steer@uakron.edu.
5. **Near-Surface Geophysics for Non-Geophysicists.** 9 a.m.–5 p.m., Sat., 19 March. US$45 (does not include lunch). Max.: 35. Gregory Baker, Univ. of Tennessee, gbaker@tennessee.edu.

OPPORTUNITIES FOR STUDENTS

Mentor Programs
Cosponsored by the GSA Foundation. Learn more at www.geosociety.org/mentors/.

Roy J. Shlemon Mentor Program in Applied Geoscience
Sun., 20 March, noon–1:30 p.m. or Mon., 21 March, noon–1:30 p.m. FREE lunch and discussion of career opportunities & challenges with professionals from multiple disciplines.

John Mann Mentors in Applied Hydrogeology Program
Tues., 22 March, noon–1:30 p.m. FREE lunch and discussion of career opportunities in applied hydrogeology or hydrology with working professionals.

Travel Grants
**Deadline to apply:** 15 February 2011
GSA student members enrolled in Northeastern or North-Central Section schools who are presenting oral or poster papers can apply for a travel grant after registering for the meeting. Check your Section Web site for more information.

Volunteering
The Joint Sections offer free registration in return for ~7 hours of work at the meeting. Contact volunteer coordinator Tamra Schiappa, tamra.schiappa@sru.edu, for more information.

**CALL FOR APPLICATIONS**

**2011–2012 GSA-USGS Congressional Science Fellowship**

Bring your science and technology expertise to Capitol Hill to work directly with national leaders at the interface between geoscience and public policy.

**Deadline for application:** 1 February 2011

This GSA-USGS Congressional Science Fellowship provides a rare opportunity for a unique individual. Prospective candidates are GSA Members with a broad geoscience background and excellent written and oral communication skills. The fellowship is open only to U.S. citizens or permanent U.S. residents, with a minimum requirement of a master’s degree with at least five years professional experience or a Ph.D. at the time of appointment.

Learn more at [www.geosociety.org/csf/](http://www.geosociety.org/csf/) or contact Ginger Williams, +1-303-357-1040, gwilliams@geosociety.org.

Put your professional and academic background, experience applying scientific knowledge to societal challenges, and passion for shaping the future of the geosciences to work in this coveted arena:

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GeoCorps America™ — Geoscientists Working for Public Land Management and Protection

A Geological Society of America Education & Outreach Program

GSA places all levels of geoscientists—university students, professionals & retirees—in short-term positions working on U.S. National Parks, National Forests, and Bureau of Land Management (BLM) lands through the GeoCorps™ America Program. National Park, Forest, and BLM managers select projects in research, resource management, resource protection, education, and interpretation that require geoscience expertise. GSA then actively recruits applicants for these positions through the Society’s 22,000+ members and helps to place the most qualified applicants where needed. Selected participants receive a US$2,750 stipend and housing (or a housing allowance), paid through GSA.

Who Benefits?

The need for geoscience expertise on America’s public lands is great. Geoscience is often not adequately addressed in visitor education, resource management, site protection, geologic hazards mitigation, and research. For example, the National Park Service manages 80.7 million acres of land but only permanently employs 25 geologists. The National Park Service has over 1,000 interpreters on staff in the park system; however, only a handful of these interpreters have a background in geology. The U.S. Forest Service manages 192 million acres of land and only has 175 geoscientists on staff nationwide.

Since GSA’s GeoCorps program began in 1997, more than 600 GeoCorps participants have been put to work supporting 113 National Parks, National Monuments, National Forests, and BLM lands with their geoscience know-how.

GeoCorps participants also greatly benefit by being provided a “real life” on-the-ground work or research experience to help enhance their careers. Participants work side-by-side with Park Service, Forest Service, and BLM field staff and receive invaluable training and work experience on active public land projects.

GeoCorps Project Examples

- Excavating and preparing fossil specimens
- Developing and presenting geology educational tours to Park visitors
- Stream and erosion surveys for watershed assessments
- Glacial movement monitoring
- Paleontology research and database development
- Glacial lakes water quality monitoring
- Mapping soil and groundwater contamination

Make a Difference…

You can help make this an even greater success by supporting the GeoCorps™ America fund. For more information, go to http://rock.geosociety.org/g_corps/ or contact Donna Russell, +1-303-357-1054, drussell@geosociety.com. Donate directly via the dropdown menu at www.gsafweb.org/makeadonation.html.

Most memorable early geologic experience:

An overnight hike to the Phantom Ranch in the Grand Canyon with major Professor Stanley Beus of Northern Arizona University.

—Paul M. Crosby
Positions Open

GEOSCIENCE EDUCATION OPPORTUNITY
The Dept. of Geosciences anticipates hiring for a tenure-track faculty member at the Assistant Professor level pending final approval by the graduate and undergraduate department in the area of geoscience education. The area of research in geoscience education is open. We seek a colleague who will develop a vigorous research program in an area of geoscience education research and extramural support and will develop a strong record of teaching excellence in geoscience education complementing ongoing departmental research and instruction activities. Ph.D. in relevant discipline required. Further information about the Geosciences Dept. can be read at www.cs.ge.edu/geosciences/index.html. To ensure full consideration, applicants need to send by 15 Jan. 2011 an application stating their geoscience education research and instructional interests and goals, CV, and the names of at least three references. Send this information to Dr. Dwayne Elmore, Dept. of Geosciences, Georgia State University, Atlanta, GA 30302-4105. Start fall 2011. This position is open until filled. An offer of employment will be conditional upon background verification. Georgia State University is an Equal Opportunity/Equal Access/Affirmative Action employer fully committed to the employment and advancement of women and minorities.

NON-TENURE TRACK FULL-TIME LECTURER GEORGIA STATE UNIVERSITY
The Dept. of Geosciences anticipates hiring non-tenure track full-time lecturer position beginning August 2011 to teach Introduction to Geology (Geol 2020) and to those course offerings with appropriate teaching experience and staff preparation. Send application letter, CV, transcripts, and character reference letter (with description of instructional interests) to Dr. Craig E. Westmoreland, Dept. of Geosciences, Georgia State University, P.O. Box 3031, Atlanta, GA 30302-3031. Application deadline: 15 Jan. 2011. Review of applications will begin immediately and continue until the positions are filled. An offer of employment will be conditional upon background verification. Georgia State University is a Research University System of Georgia and is an EEO/AA employer.

FACULTY POSITION IN PLANETARY SCIENCES PURDUE UNIVERSITY
Purdue University is building a strong new effort in Planetary Sciences. Jay Melosh has joined the Purdue Faculty and, together with Andy Dress, directs a new “Planetary Geodynamics and Geobiology” NSF EPSCoR initiative. The department has 13 faculty members, whose research interests are in the broad area of stable isotope geochemistry. We expect the successful applicant to establish a vigorous and innovatively externally funded research program that integrates with one or more of our existing strengths in geochemistry, environmental geology, mineralogy/petrology, paleoecology, geomicrobiology, and structural geology. The position will be a joint appointment with the Geodynamics Program in the School of Geology and the Department of Geological Sciences, which includes research on the geodynamics of Earth and the Mars system, and will be expected to develop a research program related to terrestrial and extraterrestrial environments. A Ph.D. in geology, geomicrobiology, or related field is required. The appointment will begin Aug. 2011. We seek an individual whose research interests are in the area of stable isotope geochemistry. The successful candidate will have experience in applications to both the graduate and undergraduate levels. We seek someone who will complement our existing strengths in modeling and isotopic cosmochemistry. In harmony with Purdue’s traditional emphasis on science, mathematicians and engineers we seek a quality focused individual with an interest in planetary surface processes. The Dept. of Earth and Atmospheric Sciences presently has outstanding programs in geodynamics, isotope geochemistry, terrestrial climate and extreme weather systems.

Applicants must have a Ph.D. in in a field related to Planetary Science, Salary and benefits are highly competitive. The appointment will begin Aug. 2011. Candidates are expected to develop a vigorous research program that integrates with one or more of our existing strengths in geoscience education, and academic and extramural support. Interested candidates should submit their curriculum vitae, a statement of teaching and research interests, and list of at least three references (with names and contact information) to: Dr. Dwight G. Beck, Dept. of Geology and Environmental Geosciences, Northern Illinois University, DeKalb, IL 60115. Please submit CV, letter of application, statement of teaching and research interests, and the names of at least three references. The position will remain open until filled. An offer of employment will be conditional upon background verification. Georgia State University is an Equal Opportunity/Equal Access/Affirmative Action employer fully committed to the employment and advancement of women and minorities.

POST DOCTORAL POSITION IN HYDROGEOLOGY, NORTHERN ILLINOIS UNIVERSITY
The Dept. of Geology and Environmental Geosciences at Northern Illinois University invites applications for an anticipated tenure-track position of Assistant Professor to begin Aug. 2011. We seek a candidate with research and teaching interests in applied physical geology, including ground water modeling and field methods to characterize aquifers and flow systems. Possible areas of research include numerical modeling of subsurface flow, flow in fractured media and karst, groundwater/surface-water interactions, contaminant transport, aquifer studies, and field work. An important part of the position is to establish a strong externally funded research program, to supervise student research at undergraduate, M.S., and Ph.D. levels, and to participate in the summer environmental field methods camp. Departmental facilities include a truck-mounted GeoprobeSM 6600, field hydrogeological equipment, surface and borehole geo-physical systems, and extensive geochemical/analytical facilities. The department currently has 13 faculty members whose broad research interests are described on our website, www.niu.edu/geology; potential for collaboration exists with areas including role of fluids in formation of ore deposits and hydrocarbon accumulations, energy resources, hydro-geophysics, groundwater geochemistry and geomicrobiology, climate change and hydrology, and glacial environments. The candidate will be expected to establish a strong externally funded research program, to supervise student research at undergraduate, M.S., and Ph.D. levels, and to participate in the summer environmental field methods camp. Departmental facilities include a truck-mounted GeoProbeSM 6600, field hydrogeological equipment, surface and borehole geo-physical systems, and extensive geochemical/analytical facilities. 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The Dept. of Geological Sciences seeks candidates for five new permanent research geologist positions. This hiring initiative inaugurates a team approach to geologic research in Alaska. The five positions together make five new permanent research geologist positions. This hiring initiative inaugurates a team approach to geologic research in Alaska. The five positions together make

**VISITING ASSISTANT PROFESSOR OF GEOLOGY, ROCKY MOUNTAIN COLLEGE**

The Geology Program at Rocky Mountain College invites applications for a one or two year visiting teaching faculty position at the Visiting Assistant Professor level to begin Aug. 2011. It is possible that this position may become a permanent tenure track position. Classes taught will include introductory (physical) geology, earth’s materials (mineralogy), geomorphology, and a course in the successful candidate’s choosing. Successful preference will be given to candidates with a desire to teach field-based courses and demonstrated excellence as an instructor. A Ph.D. in geoscience is preferred for this position. The successful candidate is expected to teach an average course load of 12 credits each semester. If interested, there would be a possibility to teach introductory physics courses.

The Geology Program at Rocky Mountain College is dynamic and growing. Current faculty have active and expanding research programs and opportunities for students and researchers. Information about Rocky Mountain College is available at www.rocky.edu. Billings is a growing community of about 125,000 people that serves as the center of culture, commerce and health care for a multi-state region.

Questions should be directed to Dr. Thomas Kalakay, 406-657-1101 or kalakayt@rocky.edu. Review of applications will begin 1 Jan. 2011. Applications will be accepted until the position is filled.

To apply, submit letter of interest, curriculum vitae, 3 letters of recommendation addressing the candidate’s interest in and commitment to excellent teaching, a statement of teaching philosophy and the Rocky Mountain College application (go to www.rocky.edu and click on faculty & staff then employment opportunities) via email at jobs@rocky.edu or mail to Human Resources, Rocky Mountain College, 1511 Poly Drive, Billings, MT 59102. AA/EOE.

**FACULTY OPENING, GEOSCIENCES RESEARCH ASSISTANT PROFESSOR UNIVERSITY OF NEVADA, RENO**

The Nevada Bureau of Mines and Geology (NBMG), University of Nevada, Reno, seeks applicants for a tenure-track, Research Assistant Professor faculty position beginning Aug. 2011, with appointments either at the assistant professor level or as an instructor. The position is filled.

To apply, submit letter of interest, curriculum vitae, 3 letters of recommendation addressing the candidate’s interest in and commitment to excellent teaching, a statement of teaching philosophy and the Rocky Mountain College application (go to www.rocky.edu and click on faculty & staff then employment opportunities) via email at jobs@rocky.edu or mail to Human Resources, Rocky Mountain College, 1511 Poly Drive, Billings, MT 59102. AA/EOE.

**ASSISTANT PROFESSOR, GEOMICROBIOLOGY STATE UNIVERSITY OF NEW YORK, BINGHAMTON**

Binghamton University seeks applications for a tenure-track assistant professor in the area of geomicrobiology. We seek exceptional candidates whose research is focused on microbial influences on the Earth’s biosphere, atmosphere, hydrosphere and solid Earth, past and present. Areas of interest include microbial contributions to sedimentary, evaporite, soil, and mineral deposits; and detailed geologic mapping in support of fundamental understanding of the role of microbial processes affecting cycling of elements (carbon, sulfur); long-term preservation of biomaterials and biostructures; origin and evolution of life on Earth, and extreme environments on Earth and beyond.

The successful candidate must develop and sustain an internationally recognized, externally funded research program in geomicrobiology. We also expect the candidate to develop a strong record of teaching and mentoring students and teach undergraduate and graduate courses in geology and other topics outside of this area.
in his/her area of expertise. We are seeking candidates who will strengthen existing research programs in geochemistry and Earth surface processes with the potential to interact with geologists, biologists and environmental scientists on the Binghamton University campus. Candidates must have a Ph.D. with a focus in geomicrobiology, or a related field, at the time of appointment, and should send a letter of application, curriculum vitae, statements of research and teaching interests, and names and contact information of at least three references by email to csavets@binghamton.edu, or by mail to Search Committee, Dept. of Geological Sciences and Environmental Studies, State University of New York at Binghamton, Binghamton, NY 13902. For further information, visit the Geological Sciences and Environmental Studies website, www.geology.binghamton.edu, or contact Professor Tim Lowenstein by email: lowenst@binghamton.edu.

Women and minorities are encouraged to apply. Binghamton University is an equal opportunity/affirmative action employer. Applications will be considered until the position is filled, but priority will be given to those received by 15 Jan. 2011.

ASSISTANT PROFESSOR OF GEOGRAPHY
REMOTE SENSING, EASTERN KENTUCKY UNIV.
The Dept. of Geography & Geology at Eastern Kentucky University invites applications for a tenure-track faculty position at the Assistant Professor level, beginning 15 Aug. 2011. We are seeking candidates with expertise in remote sensing and the applied use of remote sensing and GIS techniques. The new hire would be expected to teach courses in remote sensing and advanced remote sensing, to teach applied geotechniques courses based on her or his specialty, to participate in our general education program, share in service activities, and conduct research that might involve undergraduates. Applicants must have a strong commitment to excellence in undergraduate teaching including willingness to participate in online teaching, mentoring, and to develop an active program of scholarship that encourages student involvement. Eastern Kentucky University is committed to the promotion of regional stewardship and student engagement. Candidates must have a Ph.D. in geography or a related discipline at the time of appointment. To apply, candidates must submit a letter of interest, names and e-mail addresses of three professional contacts, curriculum vitae, statements of teaching and research interests, and any unofficial transcripts via the EKU online employment website, jobs.eku.edu. The requisition number for this position is 0608540. Review of applications will begin on 3 Jan. 2011.

ASSISTANT PROFESSOR
UNIVERSITY OF WISCONSIN–FOX VALLEY
The University of Wisconsin Colleges Dept. of Geography and Geology seeks a broadly-trained geologist as a tenure-track Assistant Professor at the University of Wisconsin–Fox Valley (www.uwfox.uwc.edu), to begin Aug. 2011. UW-Fox is located in Menasha, WI, and is one of 13 campuses of the UW Colleges (www.uwc.edu). The UW Colleges provide a liberal arts education and allow students to participate in research in a variety of formats. Teaching responsibilities will include introductory courses in physical geology, environmental geology, and soil and water resources. Doctoral degree in geology or geosciences required within one year of appointment. For more information about the position and application: www.uwc.edu/jobs/faculty/FOX-GEO-Oct10.cfm. To be assured consideration applications must be received by 7 Jan. 2011. The UW Colleges is an affirmative action/equal opportunity employer.

DEPARTMENT HEAD AND PROFESSOR
GEOLOGY AND GEOLOGICAL ENGINEERING
SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY
The Dept. of Geology and Geological Engineering at the South Dakota School of Mines invites applications for a 12-month position as Department Head at the Professor level. The successful applicant should have a background in Geology or Geological Engineering, a proven record of academic or industrial leadership, and a history of successful research in a field that complements existing departmental strengths. The department head will foster growth in the areas of enrollment, research, and fundraising, strengthen industry relations, and lead faculty, staff, and the academic programs. Some teaching is expected. The department offers two undergraduate and three graduate degree programs in Geology, Geological Engineering, and Paleontology, with 11 faculty, ~90 undergraduate students and 45 graduate students. A Ph.D. in Geology, Geological Engineering, or a closely related field is required.
The School of Mines is a public state university offering baccalaureate, masters, and doctoral degrees in science and engineering with a student population of approximately 2,400 traditional and non-traditional learners representing 40 states and 27 countries. The university is located at the foot of the beautiful Black Hills in Rapid City, South Dakota's second-largest city. Twenty-five miles from Mount Rushmore, Rapid City has a relatively mild climate and the Black Hills offer numerous opportunities for summer and winter outdoor experiences. For more information, go to http://visitrapidcity.com/ and www.sdsmt.edu.

The School of Mines is committed to recruiting and retaining a diverse workforce. Individuals interested in this position must apply online at http://sdmines.sdsmt.edu/sdsmt/employment/. Human Resources can provide accommodation to the on-line application process and can be reached at 605-394-1203. Review of applications will begin on 4 Jan. 2011, and will continue until the position is filled. Employment is contingent upon completion of a satisfactory background investigation.

ASSISTANT PROFESSOR, GEOPHYSICS
SYRACUSE UNIVERSITY

The Dept. of Earth Sciences at Syracuse University seeks applicants for a tenure-track position in geophysics. The successful candidate will balance an active research program with both graduate and undergraduate teaching responsibilities (General/Applied Geophysics, as well as introductory courses in Earth Sciences).

We seek a geophysicist willing to collaborate within the Dept. of Earth Sciences and across campus (e.g., L.C. Smith College of Engineering, SUNY College of Environmental Science and Forestry), and participate in emerging University-wide initiatives in Water Resources, Energy and/or Forensic Sciences. Current department resources include a LINUX computing network for processing and interpreting seismic reflection data (PROMAX, SEISWORKS software), and marine seismic imaging instruments. More information is available at http://earthsciences.syr.edu.

Applicants must attach their curriculum vitae, statement of teaching and research interests, and the names and contact information for three referees to https://www.sujobopps.com. The search will remain open until the position is filled. Review of applications will begin 1 Dec. 2010. Syracuse University is an equal opportunity employer. Minorities and women are encouraged to apply.

ASSISTANT PROFESSOR, PALEOClimatology
SYRACUSE UNIVERSITY

The Dept. of Earth Sciences at Syracuse University seeks applicants for a tenure-track position in paleoclimatology. The successful candidate will balance an active research program with both graduate and undergraduate teaching responsibilities (e.g., Climate Change, Paleoecology/Paleoceanography, Isotope Geochemistry). We seek a physical scientist willing to collaborate within the Dept. of Earth Sciences and across campus (e.g., SUNY College of Environmental Science and Forestry), and participate in an emerging University-wide initiative in Clean Water. Potential fields of study might include, but are not limited to, recovering, analyzing, and integrating records of paleotemperature, ocean/atmosphere chemistry, or biogeochemical cycles. Current department resources include extensive geochemical, sedimentological, and paleobiological analytical facilities, as well as sediment sampling equipment and portable research vessels. More information is available at http://earthsciences.syr.edu.

Applicants must attach their curriculum vitae, statement of teaching and research interests, and the names and contact information for three referees to https://www.sujobopps.com. The search will remain open until the position is filled. Review of applications will begin 1 Dec. 2010. Syracuse University is an equal opportunity employer. Minorities and women are encouraged to apply.

ASSISTANT/ASSOCIATE PROFESSOR
NATURAL RESOURCE MANAGEMENT
NEW MEXICO HIGHLANDS UNIVERSITY

New Mexico Highlands University (NMHU) invites applicants for a tenure-track appointment in the Natural Resource Management Dept. We seek a dynamic teacher and broadly trained researcher with a commitment to undergraduate and graduate education. NMHU,
**ASSISTANT PROFESSOR/FACULTY POSITIONS IN GEOSCIENCES**

**UNIVERSIDAD DE LOS ANDES, BOGOTA**

The Faculty of Sciences at the Universidad de los Andes is seeking applications for one or more open faculty positions in Geosciences. Research interests may be in any field of the geosciences including, but not limited to, geology, geochemistry, structural geology, geochronology, stratigraphy, mineralogy, mathematical geosciences, climatology, oceanography, etc. The successful applicant will join an earth sciences research cluster at Uniandes and become part of the Geosciences Program (Undergraduate) and future Geosciences Dept. He/She will be expected to develop and maintain an active and independent program of research and to contribute to the education and training of undergraduates and graduate students in the Geosciences Program and related departments.

A Ph.D. and commitment to excellence in independent teaching and research are required. Postdoctoral experience is preferred. Interested applicants should send a curriculum vitae, a description of research and teaching interests, and arrange to have two recommendation letters sent to Germán A. Priele, Chairman Geosciences Program. E-mail: gprele@uniandes.edu.co, Universidad de los Andes, Depto. de Física A.A. 4976, Bogotá DC, Colombia. Phone (57) 1 332 4500 Fax (57) 1 332 4516.

**STABLE ISOTOTO GEOCHEMISTRY AND MASS SPECTROMETRY, UNIVERSITY OF PITTSBURGH**


The Dept. of Geology and Planetary Science at the University of Pittsburgh (www.geology.pitt.edu) invites applications for a tenure-track faculty position in stable isotope geochemistry at the advanced assistant or associate professor level. The position would begin with the fall term 2011, subject to budgetary approval. We seek an outstanding individual whose research program includes a strong field component, and who has expertise in stable isotope research using mass spectrometry. A Ph.D. is required at the time of appointment.

The successful candidate will be expected to develop and maintain an active, externally funded research program, including supervision of M.S. and Ph.D. students and undergraduate research projects. Teaching duties will include undergraduate courses in stable isotope geochemistry and related fields. We seek someone who would complement one or more of our existing programs in environmental geology, geophysics and geochemistry, hydrology, paleoclimatology, soil science, and volcanology.

Applications must submit to the Stable Isotope Geochemistry Mass Spectrometry Search Committee, Dept. of Geology and Planetary Science, 200 SRC, University of Pittsburgh, Pittsburgh, PA 15260, the following materials: CV, statement of research and teaching interests, copies of relevant publications; names and addresses of at least four references.

Application deadline: 15 Jan. 2011. The University of Pittsburgh is an equal opportunity/affirmative action employer. Applications from women and members of minority groups are especially encouraged.

**STRUCTURAL GEOLOGIST**

**UNIVERSITY OF FLORIDA**


The Dept. of Geology and Planetary Science (www.geology.pitt.edu) at the University of Pittsburgh invites applications for a tenure-track faculty position in structural geology/tectonics at the assistant professor level. The position would begin with the fall term 2011, subject to budgetary approval. We seek an outstanding individual whose research program includes a strong field component, laboratory component, and/or modeling components, with a particular emphasis in one or more of the following areas: structural analysis, plate tectonic interactions, planetary geodynamics, and/or volcano-tectonics. A Ph.D. is required at the time of appointment.

The successful candidate will be expected to have and/or develop an active, externally funded research program, including the supervision of M.S. and Ph.D. students and undergraduate research projects. Teaching duties will include undergraduate and graduate courses in structural geology and topics related to the individual’s expertise. We seek dynamic individual who would complement one or more of our existing programs in geophysics/paleomagnetism, tectonics, planetary science, regional tectonics, volcanology, and remote sensing. Further information can be found on the department’s website at www.geology.pitt.edu.

Applications must submit to the Structural Geology Search Committee, Dept. of Geology and Planetary Science, 200 SRC, University of Pittsburgh, Pittsburgh, PA 15260, the following materials: CV (including past and current grant support); statements of research and teaching interests; copies of relevant publications; names and addresses of at least four references.

Application deadline: 15 Jan. 2011. The University of Florida, P.O. Box 112120, Gainesville, FL 32611-2120, jbmartin@ufl.edu. Review of applications will begin 14 Dec. 2010 and continue until the position is filled. To ensure full consideration please apply online at http://jobs.ufl.edu (requisition # 0806180). For full consideration, the application should include: (1) cover letter;...
The Florida Museum of Natural History, University of Florida, invites applications for the Thompson Chair of Invertebrate Paleontology to be hired at the level of Associate or Full Curator (equivalent to Associate or Full Professor) with tenure. The successful candidate will be expected to conduct a dynamic research program and develop the museum’s extensive collection of primarily Cenozoic invertebrate fossils that includes five million specimens. The collection is assigned two full-time staff responsible for its operations. A substantial endowment is associated with this position.

This position requires a strong commitment to university education, field work, museum-based research, and outreach. Interactions with allied academic departments include affiliate professorship status with responsibility for supervision of graduate students and teaching two formal courses per year. Minimum qualifications: Strong externally funded research, collections experience, and tenure or at least seven years of post-Ph.D. professional experience (i.e., in academic, research, or tenure or at least seven years of post-Ph.D. professional experience). Strong externally funded research, collections experience, and tenure or at least seven years of post-Ph.D. professional experience.

If an accommodation due to a disability is needed to apply for this position, please call 352-392-2477 or the Florida Relay System at 800-955-8771 (TDD). The selection process will be conducted under the provisions of Florida’s “Government in the Sunshine” and Public Records laws.

The University of Florida is an Equal Opportunity/Affirmative Action Employer. If an accommodation due to a disability is needed to apply for this position, please call 352-392-2477 or the Florida Relay System at 800-955-8771 (TDD). The selection process will be conducted under the provisions of Florida’s “Government in the Sunshine” and Public Records laws.

**DIRECTOR OF PALEONTOLOGY**

**JOHN D. COOPER ARCHAEOLOGY AND PALEONTOLOGY CURATION CENTER**

**CALIFORNIA STATE UNIVERSITY, FULLERTON**

California State University, Fullerton, invites applications for the Director of Paleontology for the newly established John D. Cooper Archaeology and Paleontology Curation Center. The successful candidate will also hold a tenure-track appointment in the Dept. of Geological Sciences. We are searching for a person with extensive experience managing and curating vertebrate fossil collections, and will make an appointment at a level commensurate with the experience of the candidate. The successful candidate’s primary responsibility will be the management of the paleontology portion of the Orange County Archaeology and Paleontology Collection at the Senior Paleontology Technician, interns and volunteers. The Collection contains fossils in various stages of curation, from large jacked specimens to fully curated fossils. The bulk of the specimens at the Cooper Center are Miocene marine animals, including numerous previously unrecognized marine mammals. The successful candidate is expected to develop an externally-funded research program focusing on specimens curated at the Cooper Center and resulting in peer-reviewed publications. A Ph.D. in Paleontology, with emphasis in Vertebrate Paleontology, may include some of the following: physical geology, historical geology, paleontology, and upper-division and graduate courses in the needed areas of expertise. The successful candidate will have the following credentials and capabilities: (1) a Ph.D. in Geology or a related field with emphasis in Vertebrate Paleontology; (2) experience in fossil curation and museum operations related to the accession, management and display of fossils; (3) a vigorous, research-oriented vertebrate paleontology that can involve undergraduate and graduate students; (4) a strong interest in teaching and achieving excellence in teaching; and (5) interest and ability to interact effectively with an ethnically and culturally diverse campus community. To apply, please submit a letter of application that explains how you meet the qualifications outlined above and specifically addressing your qualifications as Director of Paleontology for the Cooper Center, including a record of your past external funding; a statement of your future research plans and goals as they relate to the collections in the Cooper Center; a statement about teaching including a list of courses you would feel comfortable teaching and a statement of your teaching philosophy; and (6) three letters of recommendation from at least three references familiar with your research, curration, and teaching experience. Reference letters should be directed to the search committee chair Dr. Bruce MacFadden, Thompson Chair Search Committee, Florida Museum of Natural History, University of Florida, P.O. Box 117800, Gainesville, FL 32611-7800, bmacfadd@fmnh.ufl.edu.

The Florida Museum of Natural History, University of Florida, is an Equal Opportunity/Affirmative Action Employer. View Classified and GeoMart ads online at www.geosociety.org/advertising.htm.
The University of Utah is fully committed to affirmative action and equal opportunity in all programs, activities, and employment. Employment decisions are made without regard to race, color, national origin, sex, age, status as a person with a disability, religion, sexual orientation, gender identity or expression, and status as a protected veteran. Inquiries and applications for equal opportunity should be submitted to the Office of Equal Opportunity and Affirmative Action, 801-581-5365 (V/TTY).

The University of Utah values candidates who have demonstrated a commitment to improving access to higher education for historically underrepresented students.

Opportunities for Students

UCLA Ion Microprobe Student Workshop (22-25 Feb. 2011). The UCLA SIMS laboratory hosts a four-day workshop on ion microprobe applications in earth sciences. The workshop emphasizes microanalytical geochronology and Stable Isotopes at the geochronology laboratory with large radius magnetic sector SIMS. Arrival and departure dates are 21 and 26 Feb., respectively. NSF’s Instrumentation for Innovation Program (NSF I/UC3) will sponsor travel, accommodation costs, and course materials for domestic participants. Graduate students and advanced undergraduate students are invited to apply. A letter (with an academic supervisor) can apply via http://sims.ess.ucla.edu/STUDENTWORKSHOP.php. Applications will be accepted until 01/14/11.

MS in Geological Sciences, Central Washington University. The Geology program at the Cascades, has an MS program that focuses on solid Earth dynamics, environmental geology, and geologic hazards. Exciting projects are in geochronology, seismology, geology, geomorphology, hydrogeology, environmental geochemistry, climate variability, volcanology, paleontology, stratigraphy, and geomicrobiology. The program is well-equipped with computational and geochronometry laboratories. Teaching and research assistantships are available. Application deadline: 2/1/2011. See http://www.cwu.edu or e-mail grad@geology.cwu.edu for more information. CWU is an AA/EOE/Title IX Institution. TDD 509-963-2143.

Graduate Student Opportunities at Case Western Reserve University. Students with backgrounds in geology, physics, chemistry, biology, engineering and related fields are encouraged to apply for our Ph.D. and M.S. programs in Earth, environment, and planetary sciences. Areas of active research in the department include surface processes, sediment transport, carbon sequestration, atmospheric science, planetary geology and geophysics, and high-pressure mineral physics and geochemistry. For more information, see http://geology.cwru.edu/STUDENTSHOP.php. Financial assistance is available. Application deadline: 15 Jan. 2011.

Fellowship Opportunities

TURNER POSTDOCTORAL FELLOWSHIP UNIVERSITY OF MICHIGAN

The Dept. of Geology and Geophysics at the University of Michigan invites applications for the Turner Postdoctoral Fellowship, a highly competitive fellowship in any field of earth science. The fellowship is intended for innova-
tive research proposals that can be pursued in collabora-
tion with a faculty member. Applications are encouraged to contact prospective hosts in advance. We are interested in areas of common interest (http://www.iss.umich.edu/geo/ people/faculty).

The Turner postdoc is a two-year position with an annual salary of $55,000, discretionary research funds totaling $10,000, and a generous benefits package.

Contact Information

Applications received will be reviewed on a continuing basis. Review of applications will begin 1 Jan. 2011 and continue until the position is filled.
Marine Geoscience Leadership Symposium

As global headlines focus on climate change, ocean acidification, and tsunamis, marine geoscientists stand well positioned to serve the needs of society while pushing the frontiers of scientific research. To solve these challenges and forge the necessary links between science and society, marine geoscientists must reach beyond their individual laboratories, form interdisciplinary collaborations, and communicate their discoveries to the public and policymakers. The Marine Geoscience Leadership Symposium introduces these skills to early career marine geoscientists. Participants will engage in small group discussions, participate in proposal workshops, and meet with funding agencies, media representatives, and policymakers. The symposium will provide leadership and communications training and begin the process of forming interdisciplinary research collaborations.

Applicants may be from any subfield of marine geology or geophysics and have completed their Ph.D. between December 1, 2007 and December 31, 2010. Selected participants will receive full participation support. The deadline to apply is December 31, 2010.

For more information, visit www.oceanleadership.org/mgls.

Take your career to new heights with Northeastern University

Northeastern’s College of Professional Studies has three innovative graduate programs that offer the hands-on training, knowledge, and skills necessary for a career in geospatial technology and remote sensing. Programs include:

- Master of Professional Studies in GIS
- Graduate Certificate in GIS
- Graduate Certificate in Remote Sensing

These programs feature 7 entry points per year and a flexible online format, allowing students to maintain work and life commitments while attending school.

For more information, or to apply, call 1.877.668.7727 or visit www.northeastern.edu/cps
The tradition of Rocky Mountain geology remains strong at all scales, spatially and temporally. This volume fosters that tradition with its collection of peer-reviewed papers associated with the 2010 GSA Annual Meeting in Denver, Colorado. Spatially, this volume discusses theories of continental mountain building events in tandem with microscopic observations and parts per billion trace element concentrations. Temporally, the volume covers geologic history from the Precambrian to modern issues of climate change and energy, groundwater contamination, geologic hazards, and landscape evolution. Many of the trips propose new interpretations of famous geologic ideas and environs such as Laramide deformation, the Colorado Mineral Belt, the Lewis and Clark Line, the Chalk Cliffs, and Garden of the Gods.

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