

Kentucky *Cross Section*

Earth Resources—Our Common Wealth

Winter 2015

Geohazards workshop focuses on landslide mitigation design and construction

A geohazards workshop for geotechnical engineers, geologists, and other geohazards professionals was held February 17 in Lexington. The day-long workshop focused on landslide mitigation and repair. Across the country, many landslides affect critical infrastructure such as highways, pipelines,

and transmission lines, costing state and local governments millions of dollars. The February workshop was the first of three sponsored by several geotechnical companies.

KGS landslide researcher Matt Crawford was the keynote speaker for the event. Crawford emphasized the importance of geology, and rock and soil properties,

when making decisions about the built environment. He talked about the activities and research involved with landslides in Kentucky and highlighted numerous KGS resources and publications that can benefit the engineering community.

A major winter snowstorm struck the region the day before the workshop, but about 15 hardy souls attended

the event at a Lexington hotel conference center. The three other speakers on the agenda explained design methods for landslide mitigation techniques and proper construction for various solutions.

“This event was specifically tailored to introduce the newest technologies, materials, design software, and

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May 15 annual seminar to focus on KGS research in the public interest

The 55th KGS annual seminar is scheduled for Friday, May 15, at the Survey’s Well Sample and Core Library. The seminar has typically been the largest gathering of industry, academic, and research geologists in Kentucky each year.

The seminar’s theme will be KGS Research in the Public Interest. The theme was chosen to underscore the impact on society of geo-

logic research and other activities. Research and data compilation done by KGS staff are well known for improving the understanding of the state’s geologic hazards, water resources, and energy reserves. But new collaborations with departments at the University of Kentucky and other partners are also having an impact on studies of human health, development of possible new pharmaceuticals derived

from molecules found in deep formations, and new technologies such as hydraulic fracturing to recover natural gas and oil. Speakers will address these developments during the seminar.

The agenda has not been finalized, but the morning will include a poster session for KGS staff and students to display their research work. The state’s two professional geology societies, the Geological Society of

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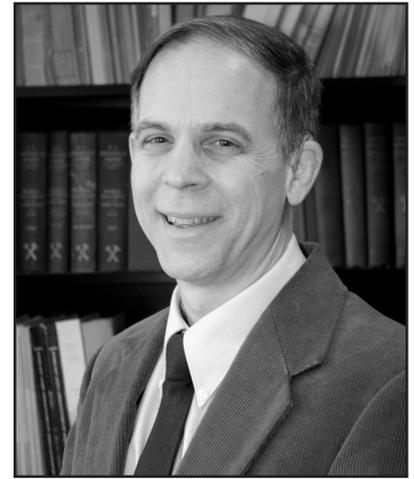
Director's Desk

There's been a lot in the news lately about the practice of hydraulic fracturing, also known as fracking, associated activities related to oil and gas development, and potential effects on water quality and seismicity. When a geoscience story of this type becomes front-page news, we get very busy with requests for information from the media and general public. Although responding to these requests can be challenging, we're very fortunate to be considered an unbiased source of information at a time when there are a lot of strong advocates attempting to influence the story. The antidote to bias is ample and high-quality data, and unfortunately, there is a shortage of it to inform these issues. As a result, KGS is undertaking installation of two monitoring networks to begin collecting relevant baseline data related to seismicity and water resources.

The first installation is an expansion of the Kentucky Seismic and Strong-Motion Network to focus on small-magnitude, potentially induced seismicity. The existing seismic network contains widely spaced stations that are designed to detect earthquakes larger than these and is focused on the western Kentucky region near the New Madrid Fault Zone. The

existing network is not optimized to record low-level seismicity like that typically associated with fracking and wastewater injection. To increase sensitivity of the network, stations need to be more closely spaced. KGS plans to add as many new stations as funds allow in eastern Kentucky overlying the Rome Trough, where wastewater injection has occurred and increased fracking is anticipated. We also hope to partner with private industry to double the number of stations and share expertise to interpret the data. A temporary network of this design will give the commonwealth the capability to detect microseismic events and much needed data to evaluate the effects of these activities. Making these data available to the public in real time will increase trust among all stakeholders.

The second installation is for monitoring groundwater levels and quality at strategic locations around the state. Although Kentucky depends heavily on surface water, groundwater is increasingly important for communities, agriculture, and industry. The U.S. Geological Survey monitors surface-water flow with gaging stations, and other agencies measure groundwater quality in focus areas, but there is not a permanent groundwater monitoring network for both water levels (quantity)



Jerry Weisenfluh

and quality. KGS plans to construct such a network with an initial set of strategically located stations. Some of these stations will use existing wells, and others will require drilling of new wells. As with the seismic network, we will depend on attracting partners in the public and private sectors to fully realize this ambitious undertaking. Ancillary to the network will be a renewed focus on characterizing the many and complex aquifers throughout the state. Water is an essential resource to sustain the livelihoods of Kentuckians and to support agricultural and industrial development, and we hope this new network will provide sound science data for policy-makers well into the future.

Look for updates on the KGS website for more information about these developing monitoring projects. ❖

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construction approaches to those that deal with landslides and other soil-related geohazards across Kentucky," says Colby Barrett, president of GeoStabilization International, one of the organizers of the workshop. "By having the

most up-to-date technologies in their toolbox, they can better characterize, model, and mitigate those hazards in the most cost-effective and timely manner possible." GeoStabilization and the other sponsors scheduled two other similar

workshops in Asheville, N.C., and Blacksburg, Va.

"Geostabilization International has set up a very good model for this type of workshop," Crawford says. "The information presented focused on theory, meth-

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Landslide project results and methodologies explained in new publication

Matt Crawford, of the Geologic Hazards Section, spent more than a year monitoring a landslide that forced a family to abandon its home in Boyd County in 2011. By monitoring rainfall, groundwater levels, and slope movement, and using electrical resistivity to characterize the subsurface, Crawford hoped to learn as much about the landslide as possible. Early this year, he and two other KGS researchers involved in the work published a report on the project, “Geologic, Geotechnical, and Geophysical Investigation of a Shallow Landslide, Eastern Kentucky” (Report of Investigations 29). The technical publication was intended to make his findings publicly available and document the methods he used to study the landslide.

“We were able to correlate pulses in rainfall and rises in groundwater levels to accelerated movement,” Crawford says. “That’s something that’s expected, but we were able to document and observe it in an area where groundwater dynamics are com-

plex.” It’s important to understand this information in order to apply it to other rainfall-triggered landslides. He called the project a “baby step” toward using geologic and geophysical methods to characterize a landslide. Few such comprehensive landslide studies have been done in the eastern United States, he adds.

Crawford was surprised by the success of the electrical-resistivity measurements, performed by Junfeng Zhu, of the Water Resources Section. Crawford says, “We learned that electrical resistivity is useful in imaging these landslides. It was able to give us some dimensions, depth to failure plane, and lithologic contrasts in the subsurface.”

The consulting engineering firm Terracon drilled boreholes for instruments on the slope and provided an inclinometer to track slope movement. Co-author Steve Webb, of the Water Resources Section, assisted with field work and setting instruments up for the project. Crawford hopes to use the lessons learned from Boyd County



A work crew prepares to drill holes for instruments at the site of the Boyd County landslide that Matt Crawford studied for a year.

on one or more other sites in Kentucky.

He conservatively estimates that landslides cause an average of about \$10 million in damage in Kentucky each year, based on information from State agencies and other sources. He has developed a database of Kentucky landslide information and a map service providing known landslide locations and information, available at <http://goo.gl/d6Bp5s>.

Crawford has written a more concise version of the Boyd County report that has been accepted for publication by *Environmental & Engineering Geoscience*, the journal of the Association of Environmental & Engineering Geologists and the Geological Society of America. ❖

New KGS web page and map provide locations and detailed information on arches

If you’ve wanted to find some of Kentucky’s arches and natural bridges, a new KGS web page and interactive map provide help locating dozens of them, along with information about and photos of these natural wonders. Steve Martin, of the KGS Geologic Mapping Section, has been studying Kentucky’s arches and natu-

ral bridges for five years, taking measurements, collecting data on fracture orientations and joints, and archiving photos. With help from Liz Adams, of the Geoscience Information Management Section, the new web page makes much of his documentation publicly available.

“I wanted to create an online system where the public and arch hunters could access arch location data,” Martin says. “So, the page we have now focuses on doing just that.”

Forty arches are shown on the website, available at kgs.uky.edu/arches. Clicking on an arch

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Lexington to host 2016 Eastern Section AAPG annual meeting

The annual gathering of the Eastern Section of the American Association of Petroleum Geologists will come to Lexington again next year, hosted by the Geological Society of Kentucky. The meeting is scheduled for September 25–27, 2016, at the Lexington Convention Center and Hyatt Regency Hotel. Energy and Minerals Section Head Dave Harris and section geologist Rick Bowersox are serving as co-chairs of the event.

Initial planning for the event began in January with a kick-off meeting, and will continue in earnest after the 2015 Eastern Section AAPG meeting this fall in Indianapolis. Companies interested in helping to sponsor the meeting or reserve exhibit space should contact Harris or Bowersox.

The last time GSK hosted the event, in September 2007, 540 people registered. Participants at that meeting had a variety of technical sessions, workshops, and exhibits to choose from. Organizers also scheduled field trips for canoeing the Kentucky River, visiting the Eastern Kentucky Coal Field, and exploring the Mammoth Cave area. ❖



Participants in the 2007 ES-AAPG meeting in Lexington browse displays at Lexington Center, where the 2016 meeting will also be held.

UC geology professor and Darwin lecturer donates fossils to KGS collection

Retired University of Cincinnati geology professor David Meyer donated more than a dozen trays of fossils found in the Lake Cumberland area to KGS on February 12. As he brought the fossils to the Survey, Meyer quipped that he was “repatriating” them to their native state. They had been collected during Meyer’s career, with the help of other UC faculty and geology students. KGS Energy and Minerals Section geologist Steve Greb plans to add the fossils, all Mississippian Fort Payne Formation crinoids, to the KGS collection and display some of them in the KGS building. Meyer’s career interest in crinoids has

taken him to the Caribbean, the western Pacific, and the Australian Great Barrier Reef.

The previous evening, he had given the 2015 Darwin Lecture, “A Sea Without Fish: Life in the Ordovician Sea of the Cincinnati Region.” Meyer and Richard Davis wrote a book on the same topic in 2009, published by Indiana University Press. An audience of about 90 people attended his lecture at UK’s Memorial Hall. Meyer, a New York native, joined



Retired University of Cincinnati Professor Dave Meyer brings his fossil donation to KGS with the help of his wife Kani, and KGS geologist Steve Greb.

the faculty at the UC Department of Geology in 1975. He continues to teach and conduct research part-time since his retirement. ❖

Arches website—continued from p. 3

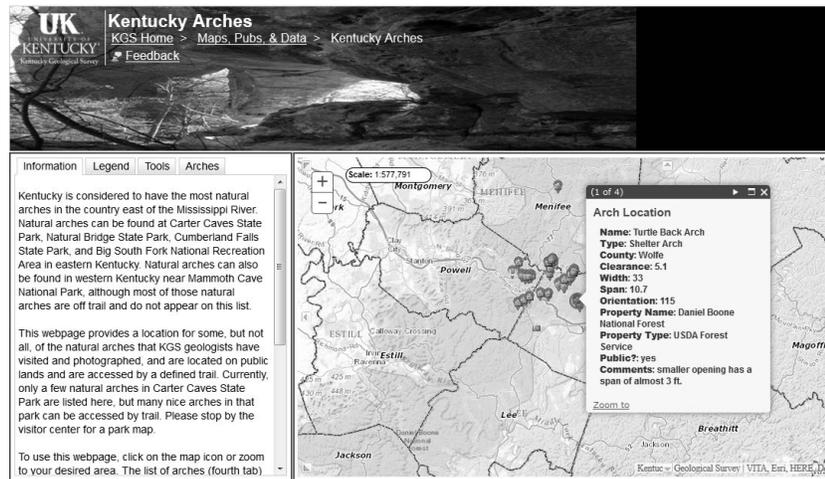
location on the map will bring up information for the feature, including its name and type, the county where it's located, size, and other information. Several photos of each arch or bridge are also available, linked from the KGS photo database. "These are arches that are on public lands, such as state parks, national forests, and national recreation areas, and they all have easy access," Martin says. "Each location has a trail leading to the arch, so people don't need to get off a trail to find it."

"Arches are more common than people think in this part of the country, although I don't think a lot of people know they exist here," Adams says. "We wanted to educate people about them and share their beauty with as many people as we can through the

Web." Users can simply click on the mapped arch icons to learn more about them and explore the pictures. For more information, they can click on "Detailed

Image Info" or the image itself for an enlarged view. Navigation between available images and arches is accomplished by arrows icons at the top of each pop-up window.

Those who are more familiar with the state's arches can search a list of arches visible in the current map view under the "Arches" tab.



Users can select a desired arch and click on "Zoom To" to go to that specific feature. This list is a live data set, and will update every time a user zooms in or out on the map. A collection of different base maps for the service also allows users to choose the base map that fits their needs. ❖

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odologies, and case studies regarding landslide mitigation and slope stability. Sharing detailed technical information and providing lessons learned is beneficial for a variety of attendees and potential stakeholders." ❖



Nathan Beard, of GeoStabilization International, leads a session at the geohazards workshop.

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Kentucky and the Kentucky Section of the American Institute of Professional Geologists, will also present their annual awards during the seminar.

The event, including lunch, is free and open to all interested participants. Advance registration helps us determine how many chairs to set up and how much

food to order for the lunch. For registration or questions about the seminar, contact Mike Lynch at mike.lynych@uky.edu or (859) 323-0561. ❖

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Terracon Consulting Engineers and Scientists presented KGS with a \$2,500 check in January to help buy equipment and hydrologic monitoring sensors for landslide studies. Terracon was a partner in the Boyd County landslide project that Matt Crawford, of the Geologic Hazards Section, conducted (see story, page 3). Pictured at the check presentation are Crawford, Ben Taylor and Robert Schenck, of Terracon, KGS Interim Director Jerry Weisenfluh, Geologic Hazards Section Head Zhenming Wang, and Ryan Ortiz of Terracon.