

Kentucky Cross Section

Earth Resources—Our Common Wealth

Summer 2015

Water Resources Section setting up groundwater monitoring network

Over the past few months the KGS Water Resources Section has begun work on a new groundwater observation network to enable accurate tracking of changes in groundwater levels in various parts of the state. Water-level data obtained from the new network will help KGS scientists and State water-resources managers to better assess groundwa-

ter availability, predict oncoming droughts, and evaluate the potential impacts of drought conditions on ground- and surface-water resources throughout Kentucky. Section Head Chuck Taylor hopes to establish long-term observation stations at a minimum of 14 existing or newly drilled well sites over the next year. Each of the wells will be selected to monitor naturally occurring changes in groundwater levels that are representative of the major aquifer present in that particular area of the state. All of the

wells included in the observation network will be equipped with pressure transducers and data loggers capable of recording changes in groundwater levels at 15- to 30-minute increments. Approximately seven of the wells will also be equipped with a telemetry system that will automatically transmit recorded groundwater-level data to the Survey each day, enabling more rapid tracking and evaluation



Steve Webb (left) and Section Head Chuck Taylor (right) check the operation of telemetry equipment they installed in a groundwater observation well at the Kentucky Horse Park. It was the first of 14 wells planned for the new groundwater network.

of current groundwater conditions. All groundwater data collected from the network's wells will

—Continued on p. 4

Kentucky Geological Survey
228 Mining & Mineral Resources Bldg.
University of Kentucky
Lexington, KY
40506-0107
859.257.5500
fax 859.257.1147
www.uky.edu/KGS
Jerry Weisenfluh,
Interim Director
Mike Lynch, Editor,
Kentucky Cross Section, mike.lynch@uky.edu
Meg Smath, Copy Editor

Will the Utica Shale be the next big natural gas producer?

A new report prepared by the Utica Shale Consortium was released in July, providing evidence that the unconventional reservoir in the northern Appalachian Basin is much larger than originally estimated. KGS is one of four state geological surveys that participated in the 2-year

research project, along with the U.S. Geological Survey and the U.S. Department of Energy's National Energy Technology Laboratory. The study was funded by 15 industry partners, and managed by the Appalachian Oil and Natural Gas Research Consortium at West Virginia Univer-

sity. The Utica Shale lies beneath West Virginia, Pennsylvania, Kentucky, Ohio, and New York. The consortium was formed in 2012 and focused on assessing the geologic characteristics of the Utica and other associated Upper Ordovician units, defining oil and gas fairways, and assess-

—Continued on p. 5

Director's Desk

Some of the most interesting and rewarding experiences of my career have involved research projects conducted at coal mines. The application of geologic models to the exploration and development of coal presents challenging problems and exposed me to a wonderful world of underground mining that provided three-dimensional perspectives of the geology of economic deposits. I was also fortunate to work with many talented company geologists and engineers who further enriched my experiences. Kentucky is blessed with an abundance of roadcuts in the Eastern Kentucky Coal Field that expose, in great detail, the same rocks that have an impact on the mining of coal from a continuity and safety perspective. Integrating these two sources of data was an ideal way to further the understanding of coal mine geology. I couldn't have chosen a better place to spend my career.

I learned early on the value of the data collected by coal companies to researchers. While still in

graduate school, I participated in development of field guides for rock-core description and continue to see the benefits of their use today. Many companies and agencies use this tool to facilitate standardized core descriptions. I also participated in development of computer systems to efficiently store and utilize the data from core drilling programs. Over the last 25 years, KGS has used these systems to construct a statewide database of coal exploration data contributed by companies that operate in the state. With information from more than 15,000 wells, it is one of the most comprehensive data sets of its kind and has been made available to interested users through the KGS website. This database has allowed us to prepare assessments of coal deposits that are of use to all stakeholders in the energy arena.

So, it is with chagrin that I've observed the downturn in the coal mining industry, simply because it's been such an integral part of my career. And I fear for the data



Jerry Weisenfluh

that are likely to be lost when operations close as a result of this downturn. We've seen downturns before, and I admit this one seems more lasting. But one thing I've learned over the years is not to attempt to predict the future of the energy markets. And because of that, I think it's important to preserve coal-mining data for future use. I hope that companies will consider donating drilling information to KGS when circumstances permit. You have my word that we'll be good custodians of the data for when they will next be needed. ❖

A thank you for recognition and acknowledgment of support from others

Retired Water Resources Section Head Jim Dinger received the Distinguished Service Award from the Geological Society of Kentucky in May. He retired in April 2012 after more than 30 years with KGS.

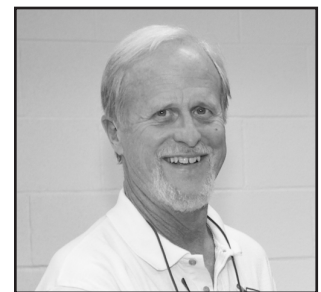
Take this opportunity to thank the Geological Society of Kentucky and the Kentucky Society of Professional Geologists for honoring me with the 2015 Distinguished Service Award. Like many of my colleagues, I have never had

any aspirations of receiving such an award. We did what we did out of our deep interest in science and education for the betterment of life in the commonwealth.

We sometimes involved ourselves in controversial issues because we had the expertise to do so, and in the process brought to light the facts concerning those issues, even if politically incorrect at the time. I want to recognize John Kiefer, Lyle Sendlein, and

the late Don Haney for sharing and supporting

my desires and insights into those issues concerning coal mining, petroleum production, agricultural practices, environmental health, and the establishment of a com-



Jim Dinger, Ph.D.

—Continued on p. 5

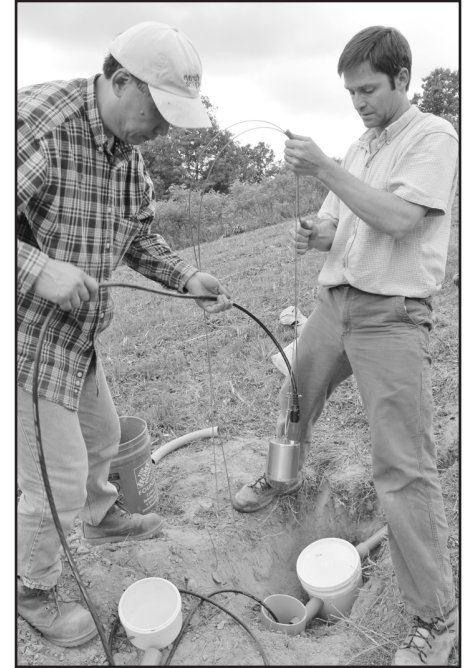
Sensitive instruments installed for new seismic network in eastern Kentucky

Seth Carpenter of the KGS Geologic Hazards Section has managed the installation of the first four highly sensitive seismic stations in eastern Kentucky, as part of a new network to monitor for low-level seismicity. Carpenter, Section Head Zhenming Wang, and student worker Andrew Holcomb installed the instruments on private property in relatively remote and quiet locations. These new instruments, along with as many as 11 others to be added to the network, will help monitor the background level of natural earthquakes too small for current instruments in the existing KGS seismic network to detect. Carpenter hopes to determine if current oil and gas activities in the region might also cause such microseismicity.

No earthquake activity related to oil and gas development

is known to have happened in Kentucky, but hydraulic fracturing (also called fracking) and deep wastewater injection related to oil and gas development in several other central U.S. states have been linked to cases of induced seismicity. The development of deep shale gas plays in eastern Kentucky, such as the Rogersville Shale, is expected to increase fracking and water-disposal activities.

The UK Department of Earth and Environmental Sciences is collaborating with KGS on the study, and a partner from private industry is loaning KGS instruments to increase the overall sensitivity of the temporary network. Real-time recordings from the stations that have been installed can be viewed by clicking one of the red triangles at <http://goo.gl/3oUs8i>. The first four stations



Zhenming Wang and Seth Carpenter lower a seismometer into the ground at a new site in rural Boyd County.

were installed in Boyd, Lawrence, and Johnson Counties. ❖

Earth Science Week, KGS open house scheduled for October

KGS plans to hold its annual Open house the evening of Oct. 14, during Earth Science Week. The week is organized nationally each year by the American Geosciences Institute, and AGI offers earth science resources at its website, www.earthsciweek.org, for teachers, students, the general public, and news media. The 2015 national theme for the week is “Visualizing Earth Systems,” exploring scientists’ use of a variety of technologies, ranging from on-site data collection to satellite-based remote sensing, to investigate Earth systems and present their findings.

During the KGS open house, students and their families and teachers are invited to tour displays and demonstrations at the Mining and Mineral Resources Building on the UK campus. KGS staff and other organizations typically set up exhibits on rocks, minerals, fossils, water resources, energy issues, meteorites, and more. Students in the UK Departments of Earth and Environmental Sciences and Mining Engineering set up displays and help with the event, and members of the Kentucky Paleontological Society and Bluegrass Gem and Mineral Club display specimens.

KGS also provides a limited number of Earth Science Week tool kits to central Kentucky teachers who request them. The kits include resources and class activities from AGI member organizations, including NASA, the National Park Service, and the Society for Mining, Metallurgy, and Exploration.

Recent open houses at KGS have attracted as many as 250 visitors from public, private, and home schools. More information about the Oct. 14 event will be posted on the KGS website. ❖

Energy staff members visit carbon-capture research site at coal-fired power plant

Several Energy and Minerals Section staff members traveled to the E.W. Brown generating station in Mercer County in July to tour a research project to capture carbon dioxide being conducted by the UK Center for Applied Energy Research. The project draws a small sample of the flue gases emitted by the coal-fired power plant, then processes the gas through a liquid solvent, removing most of the CO₂ by absorption. After processing, the flue gas contains less than 2 percent CO₂. It is then returned to the stack and emitted with the plant's flue gases.

The liquid solvent carrying the removed CO₂ goes into a process to remove the carbon dioxide and produce a concentrated stream of CO₂. The solvent is then recycled to treat more flue gas. In commercial applications, the concentrated CO₂ would be compressed and used for other purposes or stored underground. KGS has conducted two success-

ful State-funded projects to test the feasibility of injecting carbon dioxide captured by such processes into deep geologic formations for permanent storage. The KGS projects were conducted in Hancock and Carter Counties.

Heather Nikolic, a CAER research engineer who led the tour, said the power plant, operated by Kentucky Utilities, is capable of 750 megawatts of output, and the project is drawing off the equivalent of 2 Mw of flue gas for the research. The \$19.5-million research is funded by the U.S. Department of Energy, UK, the Kentucky Department of Energy Development and Independence, and the Carbon Management Research Group, a consortium of government agencies, electric utilities, and research organizations.

The E.W. Brown power plant project will improve the integration of carbon-capture technology with an existing industrial operation and develop a safer and more



KGS staff approach the CAER carbon capture pilot research project during their tour at the E.W. Brown generating station in Mercer County.

efficient capture process. CAER is also conducting research on the use of algae to capture CO₂, and has a demonstration in progress at Duke Energy's East Bend Station in Boone County. ❖

Groundwater monitoring network—continued from p. 1

eventually be posted to the KGS website and available for the public's use.

Water Resources staff have begun inspecting and testing existing but currently unused water wells in selected parts of the state where up-to-date information on groundwater conditions are particularly critical to the needs of public water suppliers and expanding agricultural and industrial operations. One observation station

with telemetry was established in August at an existing KGS-owned well at the Kentucky Horse Park. Another two wells are being inspected at Mammoth Cave National Park and we anticipate they will be included in the network by early September. In some areas, suitable existing wells are not available. For example, one older, unused irrigation well located at a Murray State University agricultural farm was inspected and

found to be unsuitable for monitoring. KGS and MSU have signed a memorandum of agreement, however, to establish a groundwater observation station consisting of three newly constructed observation wells that will each monitor a different aquifer zone at this location in the Jackson Purchase Region. KGS has allocated funding for up to five new wells to be drilled for the groundwater observation network this year, if needed. ❖

Theme chosen, planning work continues for 2016 ES-AAPG

The committee planning next year's meeting of the Eastern Section of the American Association of Petroleum Geologists has chosen a theme for the September 25–27, 2016, event, which will be hosted in Lexington by the Geological Society of Kentucky. "Basins to Barrels: Kentucky 2016" will be the theme, and several members of the planning committee will set up a display promoting the event during this year's ES-AAPG meeting in Indianapolis, September 20–22. A call for papers for the 2016 meeting will be released at that time.

Dave Harris and Rick Bowersox of the KGS Energy and Minerals Section serve as general chairs for the planning committee. Financial and program committees have been set up to coordinate tasks from publicity, registration, exhibits, and finance to field trips, guest programs, and the technical program.

The meeting is scheduled for the Lexington Convention Center and Hyatt Regency Hotel in downtown Lexington. More than 500 people attended the last ES-AAPG meeting, held in Lexington in September 2007. ❖

Web page offers links to leasing information for property owners

The development of oil and gas resources in the Berea Sandstone and the deep Rogersville Shale has drawn the attention of the public and the news media in recent months, but landowners approached about leasing their property for access to those resources in Kentucky may be unfamiliar with the leasing process. To help them learn more about it, KGS created a web page in June with a list of useful links to outside sources of information on leasing and related topics.

The links can be found at the KGS oil and natural gas page, www.uky.edu/KGS/emsweb. The links include leasing guides pro-

vided by universities and royalty owners' associations, examples of different types of leases, and guidance for negotiating an oil and gas lease. One of the linked sites, MineralWeb.com, has information for people who own mineral rights and are considering leasing them. Another site, Landmen.net, has generic clauses and language for leasing agreements. There are also links to the Kentucky Division of Oil and Gas and university websites with leasing information.

KGS does not endorse the providers of the content supplied on the linked websites nor take responsibility for the accuracy of statements made there. ❖

Jim Dinger—continued from p. 2

prehensive digital groundwater database. These issues could not have been addressed without the dedication of the some 40 hydrogeologists and engineers that worked with me in the Water Resources Section over the past 30 years, and those other-section employees such as Steve Cordivola who brought us into the computer age, sometimes kicking and screaming.

There were so many other Survey support groups that helped us with geologic interpretation, analysis, and publication tasks, and many State government cabinets and divisions that helped point the way and provided mechanisms to fund our work. I want to thank all of you for working with me. I trust that similar cooperation and progress will be made in the coming years. ❖

Utica Shale—continued from p. 1

ing the size of the resources in the Utica Shale play. The consortium concluded that the size and potential recoverable resources are comparable to the Marcellus play, the largest shale oil and gas play in the United States and the second largest in the world.

John Hickman and Cortland Eble of the Energy and Minerals Section and Laboratory Manager Jason Backus were actively involved in the study. Backus and Eble analyzed more than 1,000 sets of rock samples for total organic carbon content, organic petrology, or thermal maturity. Hickman was the lead on stratigraphic correlations and regional

—Continued on p. 6

University of Kentucky
Kentucky Geological Survey
228 Mining & Mineral Resources Bldg.
Lexington, KY 40506-0107

Address service requested

Nonprofit Organization U.S. Postage PAID Lexington, KY Permit No. 51
--

Utica Shale—continued from p. 5

mapping. He and Eble also hosted a core workshop and field trip for study participants.

An earlier study by the U.S. Geological Survey had estimated the recoverable resources in the Utica at 38 trillion cubic feet (Tcf) of gas and an additional 940 million barrels of oil (MMbo). The consortium’s study increased those estimates to 782 Tcf of gas and 1,960 MMbo. The majority of the Utica Shale play lies beneath the Marcellus Shale. The interval between the two ranges from 4,000 feet in Ohio to more than 6,500 feet in West Virginia. The

drilling depth of the Utica ranges from less than 4,000 feet in Ohio to more than 12,000 feet in West Virginia.

Among the other conclusions of the study:

- The play is actually neither “Utica” nor “shale.” Information from the study suggests an interbedded limestone and organic-rich shale interval in the underlying Point Pleasant Formation is the preferred drilling target.
- The most productive hydrocarbon source rocks tend to be the Point Pleasant Forma-

tion and the Logana Member of the Lexington/Trenton formations.

- The combination of a relatively shallow reservoir and the potential for liquids production make the Utica an attractive play for producers. The full report can be downloaded at www.wvgs.wvnet.edu/utica.

Some information for this story came from a news release prepared by the West Virginia Geological and Economic Survey, the principal investigating partner for the Utica Shale project. ❖