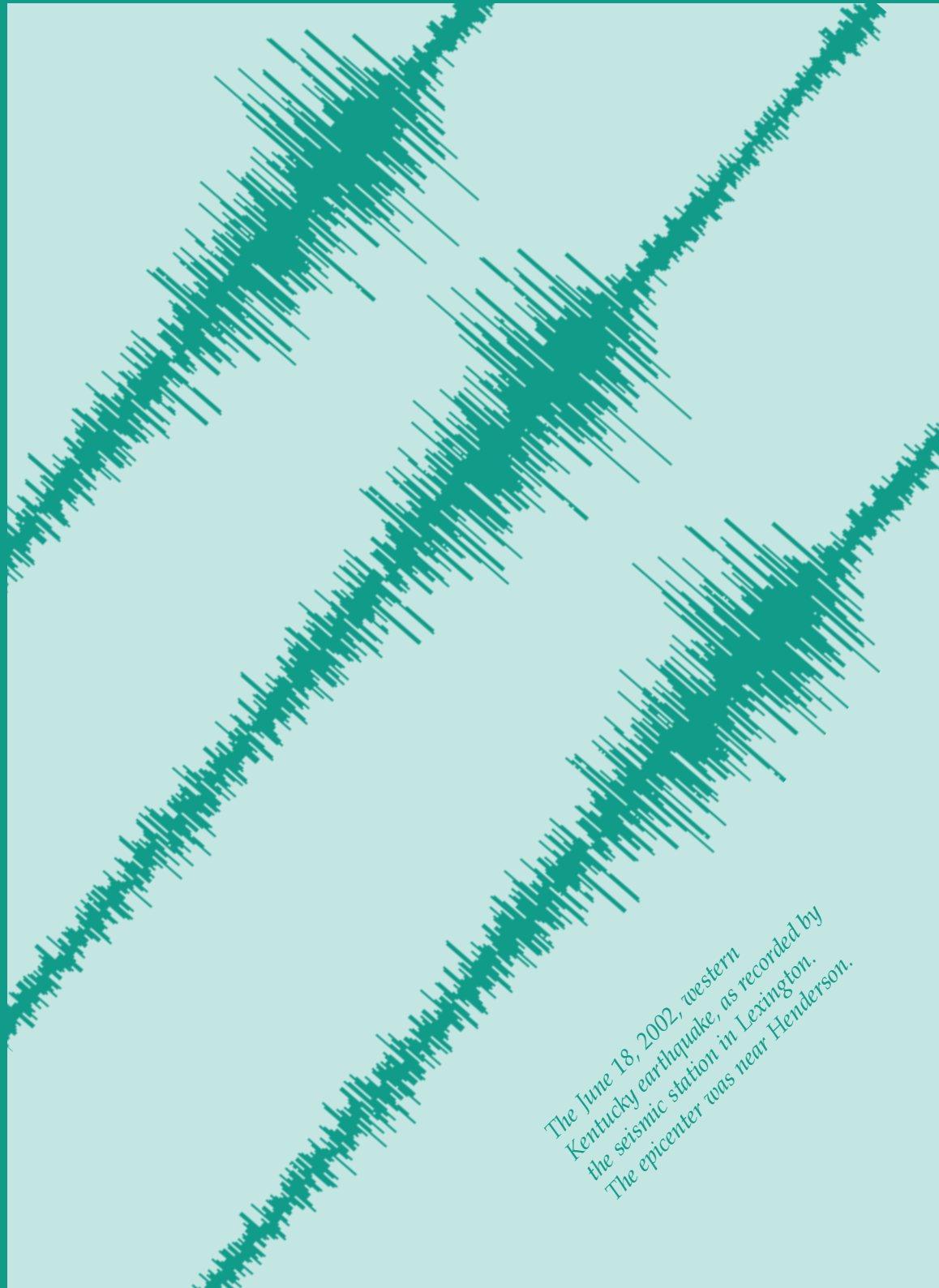


Kentucky Geological Survey Annual Report 2001–02

Our mission is to increase knowledge and understanding of the mineral, energy, and water resources, geologic hazards, and geology of Kentucky for the benefit of the Commonwealth and Nation.

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*The June 18, 2002, western
Kentucky earthquake, as recorded by
the seismic station in Lexington.
The epicenter was near Henderson.*

Director's Letter

It is my pleasure to present the Kentucky Geological Survey's annual report for fiscal year 2001-02. This report highlights our achievements in research, public service, and educational outreach. It is vital that we help citizens understand the role that geology plays in our state in environmental protection, energy production, planning, and hazard mitigation. We have made considerable strides in public communication and outreach in our efforts to help citizens in all walks of life understand and appreciate the important role that geology plays in our lives and economy.

Although the focus of our research is on Kentucky, it has broader implications at the international, national, and regional level. The strength of our research program is evident in the \$1.6 million in new external research grants, 24 active research projects, 31 new publications, 166 professional presentations, and numerous awards received by our staff. Our achievements in public service are reflected in enhancements to our online data delivery system, and the more than 13,000 questions or requests for technical information that our staff responded to in the past fiscal year.

The range of issues we investigate is broad. We are studying traditional subjects, such as exploration and recovery of coal, oil, and natural gas; water quality and supply; and geologic hazards. We are also researching relatively new subjects, such as carbon sequestration, and the long-term dynamics of changes in plant vegetation during periods of major shifts in climate. We are creating innovative products, such as a new Map and Chart series that explains geology for planning, karst groundwater basin maps, and remediation strategies for nitrate contamination of groundwater.

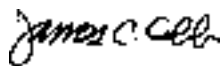
A major priority has been online delivery of data and maps. We now have oil and gas well records, water well records, coal borehole and production records, and real-time seismic recordings for Kentucky available on our Web site. The utility of these records has been greatly enhanced by user-friendly search tools and the ability to view these records on topographic maps using an Internet map server.

Our new online system, which enables oil and gas operators to view, download on their own computers, and print scanned images of more than 1 million oil and gas well records, is revolutionizing the way exploration and production is conducted in our state. The response from the petroleum industry has been enthusiastic.

Another compelling illustration of the value of our online data services was provided in June 2002, when people across the Nation were able to view real-time seismic recordings of an earthquake whose epicenter was in southwestern Indiana and northwestern Kentucky. This was possible because of the presence of our Kentucky Seismic and Strong-Motion Network and technology that enables us to provide online access to real-time seismic records from the network.

My vision of creating a statewide geographic information system for geologic data for Kentucky is being realized. In our project to digitize all 707 geologic quadrangle maps (GQ's) for our state, we have 70 percent of the GQ's digitized and are nearing the completion of this ambitious goal.

I am very proud of our achievements. As we remain committed to excellence in research and public service, I am confident about our ability to continue to expand and enhance the quality of geologic data, online data and map delivery services, and geologic expertise for the benefit of citizens and communities across Kentucky.




State Geologist and Director



Geology for Environmental Protection

Intercontinental comparison of tropical vegetation during the early part of an ice age

The extinction of some forms of tropical plants and the evolution of others, a process referred to as “paleofloral turnover,” is being studied by **Cortland Eble** and other scholars. They are comparing plant fossils found in surface outcrops and mines in North America with fossils from Europe to determine which changes in vegetation were simultaneous and which were more subtle or delayed, as well as the geographical extent of the changes. The study focuses on the central Appalachian Basin in the United States (Kentucky and West Virginia); the Ostrava-Karvina Basin in the Czech Republic, which is continuous with the Upper Silesian Basin in Poland; and the Lublin Basin in southern Poland. This research will contribute to a better understanding of the long-term response of ecosystems to climate change.

Eble and five American colleagues are collaborating with two Czech and five Polish researchers to develop a standard model for interpreting the long-term dynamics of changes in plant vegetation during periods of major shifts in temperature. This project is funded by the National Science Foundation. 

Assessing the potential for carbon sequestration in the Midcontinent region.

Hydrocarbons (oil, natural gas, and coal) are expected to be the primary source of energy for the United States well into this century. Increasing concentrations of carbon dioxide (CO₂) in the atmosphere, released when hydrocarbons are burned, may be having an impact on global climate change. Storing CO₂ in subsurface reservoirs, a process referred to as “carbon sequestration,” may become necessary. In anticipation, the Illinois, Indiana, Kansas, Kentucky, and Ohio geological surveys, with funding from the National Energy Technology Laboratory of the U.S. Department of Energy, are collaborating to build an integrated database of information that decision-makers can use to evaluate the potential for carbon sequestration in these states.

The Midcontinent Interactive Digital Carbon Atlas and Relational DataBase (MIDCARB) allows users to estimate the amount of CO₂ emitted by a source (such as power plants and refineries) and how close these sources are to reservoirs that can provide safe and secure, long-term storage. Producing and depleted oil and gas fields, unconventional oil and gas reservoirs, uneconomic coal seams, and saline aquifers are being evaluated as potential targets for sequestration. Injecting CO₂ into reservoirs may have the additional benefit of enhancing the recovery of oil and gas, as well as coalbed methane. The economic impact of this enhanced recovery is also being evaluated.

Cortland Eble is one of six Americans collaborating with Czech and Polish researchers to study the fossil record of tropical plants from the early part of an ice age 320 million years ago.

By providing seamless access to common sets of high-quality data in a consistent manner on the Web and making them available for real-time delivery, the advanced MIDCARB data delivery system will be a valuable tool for decision-makers. This is the first system of its kind in the United States.

The MIDCARB Web site (www.midcarb.org) provides a single portal through which data maintained in each state can be queried, accessed, analyzed, and displayed on the desktop of a user. Data about sources, potential “sinks” for sequestration, and transportation from the source to the sink are linked together for all five states in a single online database and geographic information system (GIS).

In a related study, funded by a \$533,000 grant from the U.S. Department of Energy, **Brandon Nuttall, Jim Drahovzal, and Cortland Eble** are trying to determine whether injecting CO₂ into the deep, organic-rich shales of eastern Kentucky (called the “black shale”) can displace natural gas stored in the shale. They will also evaluate the feasibility of long-term storage of CO₂ in the black shale.

During the first year of the study, drill cuttings and cores from the KGS Well Sample and Core Library will be analyzed to determine the CO₂ storage potential and identify units with the most potential. During the second year, new drill cuttings and core samples will be acquired to investigate specific black shales, their uptake of methane, and the resulting displacement by CO₂. Nuttall, Drahovzal, and Eble will also evaluate the efficiency of the stimulated production of natural gas displaced by CO₂. If the shale works as a storage site, CO₂ could be removed from emission sources before it enters the atmosphere, and injected into subsurface reservoirs, where it will also enhance production of natural gas for use as a fuel. ↻

Arsenic in groundwater rarely exceeds Federal regulatory limit

Arsenic, a naturally occurring element found in low concentrations in rocks, soils, water, plants, and animals, is used as a wood preservative and in paints, dyes, metals, drugs, soaps, semiconductors, animal feed additives, and herbicides. Long-term exposure to arsenic in drinking water has been linked to various types of cancer, as well as damage to the cardiovascular, pulmonary, immunological, neurological, and endocrine systems. Because of these health effects, the U.S. Environmental Protection Agency (EPA) began regulating arsenic levels in groundwater in 1974. In 2001, the regulations were revised to lower the EPA’s maximum contaminant level (MCL) to 10 parts per billion from the previous MCL of 50 parts per billion. Water-supply systems

must meet this new MCL by January 2006.

A new report by **Steve Fisher**, “Groundwater Quality in Kentucky: Arsenic,” concludes that arsenic in Kentucky groundwater generally does not exceed the MCL. The report summarizes more than 4,400 measurements of arsenic concentrations in groundwater at 930 sites across the state, compares values in each of the eight major physiographic regions of Kentucky, and includes a map showing concentration ranges at sampled sites. Although no widespread occurrence of high arsenic concentrations in groundwater are indicated, some regions of the state are more likely than others to have elevated concentrations. These findings will be of interest to water-resource planners and citizens who use groundwater

for domestic purposes (for example, drinking water and water supply for livestock).

Fisher’s research was conducted as part of the **Kentucky Inter-agency Groundwater Monitoring Network**, which was established by the General Assembly in 1998. The goals of the network are to provide baseline data on groundwater resources, characterize groundwater resources, and distribute information collected and created by the network. Two similar studies on nitrate and fluoride concentrations in groundwater were previously published. All three studies are available at www.uky.edu/KGS/pubs/lop.htm. Future studies will focus on the occurrence of pesticides, nutrients, and metals in groundwater. ↻

Solving the mystery of nitrate in groundwater

Between 1989 and 1991, a statewide water-quality survey indicated that nitrate was a major groundwater contaminant at several locations in the Western Kentucky Coal Field. Elevated nitrate presents health risks for humans and livestock, and is particularly significant for infants and possibly pregnant women. At one location in **Henderson County**, a farmer's domestic water supply consistently contained nitrate concentrations greater than 40 milligrams per liter, much higher than the EPA maximum contaminant level of 10 milligrams per liter. Research by **Glynn Beck, Shawnetta Compton, and Jim Dinger**, in collaboration with researchers from the UK Department of Agronomy and Department of Biosystems and Agricultural Engineering, has solved the mystery. Organic matter associated with an abandoned dairy feeding/holding lot, which had been out of operation for approximately 25 years, was the culprit.

A semi-impervious, compacted soil layer forms in active feeding/holding lots as a result of the animal traffic. The soil compaction, combined with the swelling wet manure, usually prevents vertical movement of contaminants such as nitrate. But after the lot is abandoned, over a period of years the manure and soil dehydrate and become cracked. Once surface cracks form, precipitation can move vertically through the soil and transport nitrate to the water table.

Beck and his colleagues have designed a remediation plan to remove the source of nitrate at the Henderson County farm.

The organic-rich soil associated with the abandoned dairy feeding/holding lot was removed and spread on a nearby pasture. The excavated area was back-filled with native soil and leveled to the original surface grade. Over the next 3 years, monitoring wells will be sampled and soil cores collected to determine if the nitrate concentrations begin to decrease in the soil column and shallow groundwater system (less than 100 feet below the surface). Efforts are being made, with the assistance of the UK Cooperative Extension Service, to locate additional abandoned animal feeding/holding lots that are associated with elevated nitrate concentrations in groundwater. The remediation plan can also be implemented at any additional lots.

Elevated nitrate concentrations occur in other parts of Kentucky as well. A greater proportion of rural domestic wells in the **Jackson Purchase Region** yield groundwater with nitrate exceeding the EPA's maximum contaminant level than wells in other parts of Kentucky. This is significant, because groundwater is used by more than 75 percent of the residents in the Jackson Purchase Region, and approximately 60 public water utilities provide groundwater from wells or well fields to residents, businesses, schools, and industry. To respond to this problem,

Glynn Beck's study is an important new area of research. Little work had been done previously to assess the impact of abandoned animal feeding/holding lots on shallow groundwater resources. The ultimate goal is to remediate other abandoned sites to determine the most effective and cost-efficient method to improve and maintain rural water sources in the Commonwealth.

Glynn Beck, together with researchers from the UK Department of Agronomy and the Department of Biosystems and Agricultural Engineering, is developing methods to assess and protect shallow groundwater from nitrate contamination.

Ninety-six domestic wells in **Hickman County** have been sampled, in order to better delineate the sources of elevated nitrate in shallow groundwater. To determine the possible sources of these elevated concentrations, detailed land-use and well-construction surveys have been completed for most of these wells. Tests have been performed on 4- and 24-inch-diameter domestic wells to determine construction integrity. Samples have been collected to better determine the source or sources of elevated nitrate.

The results indicate that the possible sources of nitrate in shallow groundwater in the Jackson Purchase are chemical fertilizers, leaky septic tanks, and active and abandoned animal feedlots, in possible combination with leaky wells. ❧

Assessing the quality of water at Kentucky Army National Guard training sites

In a multiyear study that began in May 1998, **Carlos Galcerán** is assessing the quality of water resources at three training sites operated by the Kentucky Army National Guard: the Wendell H. Ford Center in **Muhlenberg County**, the Artemus site in **Knox County**, and the eastern Kentucky site in **Powell County**. The goals of this project, funded by the Kentucky Department of Military Affairs, are to assess the impact of current activities on surface water at the three sites, as well as water exiting from the sites, and to examine groundwater quality at the Wendell H. Ford Center.

In October 2000, baseline measurements for water quality were established for the three sites. The quality of groundwater at the Ford Center, and the quality of surface water at all three sites, is being monitored and compared with the baseline measurements. This will allow the National Guard to determine how well it is protecting the land and water resources. The monitoring and water-quality assessment will indicate what precautions must be taken to minimize deterioration of the water resources, and provide the scientific basis to guide future use of the sites.

The quality of water is being assessed at approximately 80 surface-water sampling sites and 10 monitoring wells. The quality of surface water is also being assessed by inventorying aquatic life (such as stoneflies and crustaceans) and analyzing tissues from fish in ponds at the Ford Center.

Future work will include analysis of groundwater quality and flow, study of the relationship between groundwater and surface-water resources, and analysis of sediments in streams to assess the cumulative impact of land use on surface-water quality at the Ford Center. More information about this project is available at www.uky.edu/KGS/water/research/bwarmy.html. ↗

New water well maps are especially useful to environmental scientists who need to locate wells that could be affected by problems such as chemical spills or leaks from underground petroleum storage tanks. Homeowners can also use the maps to locate water wells or springs near their property in order to find possible groundwater supplies.

New water well maps are ideal for environmental scientists

Six new maps compiled by **Bart Davidson** showing the distribution of water wells and springs for the **Beaver Dam, Bowling Green, Campbellsville, Harrodsburg, Lexington, and Somerset** 30 x 60 minute quadrangles were published at a scale of 1:100,000 in the spring of 2002. Each map, which covers an area of approximately 31 by 54 miles, displays the locations of springs and four types of water wells (domestic or private, industrial, public, and monitoring). Detailed information about the wells and springs identified on the maps is available from the **Kentucky Groundwater Data Repository**, maintained by the Kentucky Geological Survey. Each map is available as a PDF file at www.uky.edu/KGS/pubs/lop.htm, or can be purchased from the KGS Publication Sales office. More of these maps will be released in the near future. ↗

Geology for Energy Production

Analyzing the natural gas potential of Trenton–Black River carbonates

Central Kentucky dolomites are direct analogs for natural gas reservoirs in carbonate rocks in the Trenton and Black River formations from the Finger Lakes region of New York. **Dave Harris** and **Jim Drahovzal** are characterizing the geology and geochemistry of these central Kentucky dolomites. KGS will collaborate with a gas exploration company, Triana Energy of Charleston, W.Va., to core two shallow boreholes so that the dolomites can be sampled. The sampling will provide a unique glimpse of fault-controlled dolomitization, a process that has resulted in the formation of prolific oil and gas reservoirs elsewhere in the Appalachian Basin in Kentucky, Michigan, New York, Ohio, and Ontario, Canada. The New York State Energy Research and Development Authority, Triana Energy, the U.S. Department of Energy, and KGS jointly funded the \$169,000, 2-year project. ↻

Rome Trough Consortium evaluates natural gas potential

The Rome Trough is a deep Cambrian sedimentary basin that produces natural gas from several fields. **Dave Harris** and **John Hickman** collaborated with colleagues from the state geological surveys of Ohio and West Virginia, and Columbia Natural Resources, Equitable Resources, North Coast Energy, Century Offshore Management, and Belden and Blake Corp., to evaluate the potential for natural gas discoveries in the Rome Trough. Industry participants contributed data and financial support, and the National Energy Technology Laboratory of the U.S. Department of Energy provided additional funding.

The stratigraphy for more than 700 wells in Kentucky, Ohio, and West Virginia was interpreted, and digital well logs were used to construct a regional cross-sectional framework. Cores from 19 wells were examined to interpret the depositional environments and evaluate reservoir quality. The project included a detailed study of the Homer Field in **Elliott County, Ky.** Well log data were used to model lithologies in the Cambrian section, and to map trends of potential reservoir rocks in the trough. Geochemical work by the U.S. Geological Survey (USGS) indicated the presence of Cambrian source rocks in the trough, and provided additional confidence that commercial gas fields remain to be found.

The research results will help focus future exploration in the Rome Trough where potential for natural gas is greatest. The final report was issued August 1, 2002. The results of the research will remain confidential to the consortium members for 2 years, after which time KGS will publish the results. ↻

Roadcuts in eastern Kentucky provide analog to guide offshore petroleum exploration in Hibernia, Newfoundland

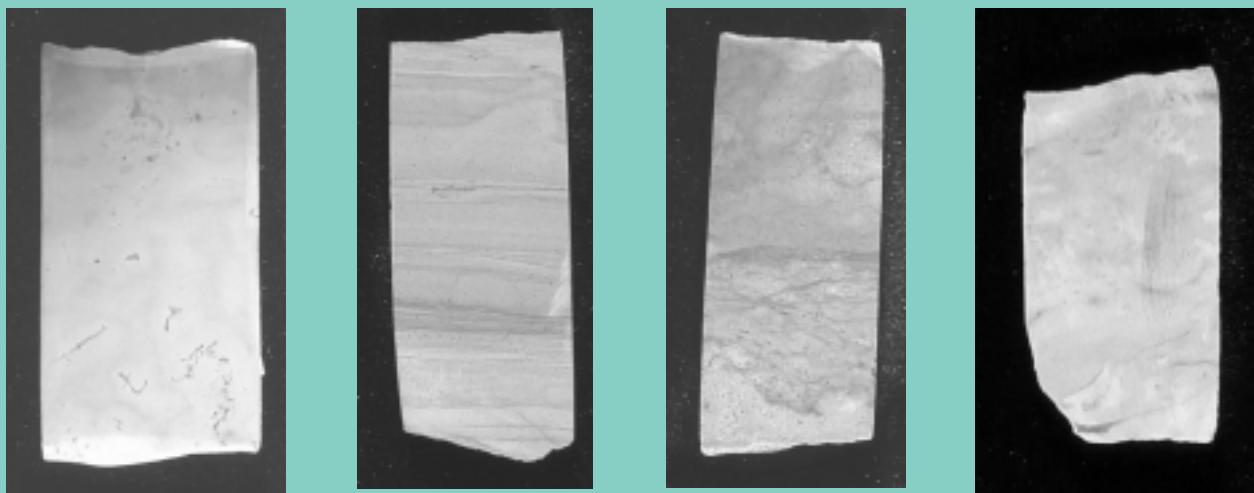
Outcrops in the **Prestonsburg** quadrangle of eastern Kentucky are possible analogs of Newfoundland's offshore petroleum reservoirs. **Steve Greb** described these outcrops for the Hibernia Management and Development Company. Students in the KGS 2001 summer internship program (pictured below) helped Greb with the project. The interns measured new roadcuts on U.S. 23, north of Prestonsburg. Outcrops on Old U.S. 23 (now Ky. 321), which had been previously studied, have since been partly covered by vegetation; their descriptions were updated for this project. The descriptions will be used to create a virtual geologic roadlog on the KGS Web site that will enable researchers and travelers to pick locations along the highway and view color photographs of roadcuts, measured sections, cross sections, and in some cases, photomosaics of significant or characteristic facies. ↻



Future availability of coal resources in western Kentucky

“Coal Availability in Western Kentucky,” by KGS geologists **Jerry Weisenfluh, Drew Andrews, and Robert Andrews**, and **John Hiatt** of the Kentucky Department of Mines and Minerals, has information about the distribution of coal resources in western Kentucky, historical mining in the region, and factors that impede the development of remaining resources. Weisenfluh and his coauthors estimated the remaining tons of resources in the region, and included detailed studies for selected areas. This report will be of interest to the coal industry, government agencies, and Area Development Districts. It is available at www.uky.edu/KGS/pubs/lop.htm.

Research for the report was conducted as part of the USGS coal availability program, an effort mandated by Congress. The program, which started in 1988, has resulted in numerous reports and products published by KGS, including a digital coal atlas for Kentucky; the atlas consists of 12 maps and charts showing original and remaining coal resources for six historically important coals. More information about the atlas is available at www.uky.edu/KGS/coal/webcoal/pages/coal/nca_refs.htm. ↻



Well cores provide vital clues for resource exploration and scientific research

Well cores—bored out of rock and sediment by hollow drill bits—are standard reference tools that geologists use to search for oil and natural gas, coal, and minerals. They are also used to assess geologic hazards and study groundwater. Valuable core is often discarded by companies for different reasons (for example, they may no longer have a commercial interest in the core, they may have new corporate owners, or they may no longer be able to afford warehouse storage space). When cores are discarded, the wealth of information they contain is lost and unavailable to support future exploration and research. The cost of drilling new core can be prohibitively expensive. For these reasons, the American Geological Institute and other organizations are spearheading a national initiative to preserve well cores.

Kentucky is fortunate to have the fifth largest public collection of well samples and cores in the Nation.

The well cores and samples housed at the 48,000-square-foot **Well Sample and Core Library** have been collected since the 1920's from exploratory drilling for oil and natural gas, black shale, coal, lignite, tar sand, lead, zinc, fluor spar, and limestone. This huge collection represents more than 20 million feet of drilling at 25,000 locations across the state. In the spring of 2002, more than 65,000 feet of core from western Kentucky, enough to fill three flatbed trucks, was donated to the library. Two companies exploring for lead and zinc acquired this core at a cost exceeding \$1 million. ↻

Geology in Planning

Understanding karst

Fifty-five percent of the landscape in Kentucky is characterized by karst, yet the term “karst” is unfamiliar to many people outside of the geoscientific community. Karst refers to a type of topography formed in limestone, gypsum, and other rocks, primarily by dissolution; it is characterized by sinkholes, caves, and underground drainage. In Kentucky, limestone and dolostone rock units are susceptible to developing karst topography. Over hundreds of thousands of years, this dissolution can create different karst hazards, such as sudden cover collapse, which caused this highway near Bowling Green to cave in. Other




hazards include sinkhole flooding, collapse of waste lagoons (resulting in spills), and infiltra-

tion of radon gas. The economic losses of karst hazards are largely hidden, because although they occur frequently, each incident typically affects only a small number of people.

Jim Currens is building a database of information about cover-collapse sinkholes. A form for reporting their occurrence is available on the KGS Web site at www.uky.edu/KGS/water/research/kasinkreport.html. Currens will use the data to develop maps showing the probability of sinkholes forming in a unit area within a specified period (for example, two sinkholes a year per square mile). Although it is unlikely that enough data will become available to identify the exact location of future cover-collapse sinkholes, areas with a probability for sinkholes can be identified.

Springs are an important source of water in rural areas, especially during droughts. A large percentage of livestock, and many people, in central Kentucky get their drinking water from springs or wells. In response to the increasing demand for water and concern about environmental protection of groundwater, **Jim Currens** and **Randy Paylor** of

KGS, and **Joe Ray** of the Kentucky Division of Water, are mapping the sources of springs in the **Inner Bluegrass Region**. They use dye traces to determine the flow paths of the groundwater, and the area that drains to a spring.

Dye traces are also used to construct karst groundwater basin maps, which are valuable to agricultural producers, property owners, researchers, and emergency-services personnel responding to chemical spills. In April 2002, Currens, Paylor, and Ray updated the map for the **Lexington** quadrangle, which includes **Ander-son, Bourbon, Clark, Fayette, Franklin, Harrison, Scott, and Woodford Counties**. Currens and Ray previously mapped the **Beaver Dam, Bowling Green, Campbellsville, Harrodsburg, and Somerset** quadrangles. These 30 x 60 minute, 1:100,000-scale maps depict springs, swallow holes, groundwater basin boundaries, and inferred groundwater flow routes. Arrows on each map indicate the direction of groundwater flow. These maps can be used to evaluate major springs for their potential as water supplies. They can be downloaded as PDF files at www.uky.edu/KGS/pubs/lop.htm, or they can be purchased from the KGS Publication Sales office. 


Developing water and wastewater treatment infrastructure

Governor Paul Patton has announced a goal of providing access to safe, reliable water supplies and wastewater treatment, at a reasonable cost, to all Kentuckians by the year 2020. **Dan Carey** has been providing technical assistance to the Kentucky Infrastructure Author-

ity (KIA) to help them achieve this goal. During the year, KIA and Carey worked with Area Development Districts (ADD's) and agencies of the Kentucky Division of Water to develop regional and state planning guidelines, and to expand the

Water Resource Information System (WRIS).

The WRIS is a Web-based tool for decision-makers. It is a collaborative effort of the KIA, Kentucky's 15 ADD's, the Natural Resources and Environmental Protection Cabinet, the

Public Service Commission, the Kentucky Rural Water Association, KGS, and water and wastewater treatment service providers across the Commonwealth. Located at wris.state.ky.us/wris, it contains information about water and sewer infrastructure, surface and groundwater supplies, protecting water resources, and risks to water supply. The WRIS is also a clearinghouse for water data and includes links to other sites with data related to water quality, streamflow, groundwater resources, climate, soils, geology, land use, utility systems management and training, and water-related State and Federal legislation. A wealth of information can be found on the WRIS, including online reports (such as water-supply plans and the governor's strategic water plans), GIS data (including water and wastewater treatment infrastructure, topographic and geologic maps, and aerial photos), and data on public water systems, public wastewater treatment systems, and sources of potential pollutants. During the year, the GIS section of the WRIS was expanded (wris.state.ky.us/kia/mapgis/gis.htm) to support the KIA's planning activities. 

Tapping water supplies from underground coal mines in eastern Kentucky

Water from underground coal mines could provide an inexpensive, reliable source of water to unserved or underserved communities in eastern Kentucky.

Abandoned underground mines in the Eastern Kentucky Coal Field have the potential to serve as municipal water supplies. With funding from the Kentucky Infrastructure Authority, Dennis Cumbie is assessing this potential. He has completed detailed analysis at three sites near Whitesburg in Letcher County, one site near Manchester in Clay County, and two sites in Perry County. Cumbie's research has also helped the cities of Evarts in Harlan County and Fleming-Neon in Letcher County, which already use mines for their water supplies. Long-term monitoring of mines in Perry County is still in progress, but results from Letcher County show that deep-mine water levels, and thus storage capacity, vary seasonally. The water quality varies little over time in an individual mine, but can differ substantially between mines, even if the mines are in the same coal seam.

An advantage of water from deep abandoned coal mines is that it is not vulnerable to contaminants from the surface, such as crude and refined oils, pesticides, industrial solvents, and human pathogens (for example, E. coli). Municipal water systems currently using underground mines as primary water supplies have had few problems with quantity, and use conventional treatment methods.

More information is available at www.uky.edu/KGS/water/research/bwmines.html. 

Locating wells with high water yields in eastern Kentucky

Robert Andrews is using geologic and remote-sensing technologies to identify sites that could yield large amounts of groundwater in areas of eastern Kentucky where municipal sources of water are limited. Wells producing significant amounts of water (more than 30 gallons per minute) are usually near fractures or faults, which may be expressed on aerial photographs, satellite imagery, and topographic maps as linear features. Andrews is using satellite imagery and low-altitude radar to locate linear features.

Over the course of the project, wells have been drilled at eight sites (four in **Breathitt County** and one each in **Carter, Clay, Knott, and Letcher Counties**). Five sites have wells that yield more water than 95 percent of the wells recorded for their respective counties. Four of the sites have wells that yield more water than 95 percent of the wells recorded for the entire Eastern Kentucky Coal Field; these wells were located by drilling at an angle, in order to intersect more fractures than would be possible by traditional vertical drilling. In October 2001, the Knott County well was pumped for 30 days to test its long-term viability. Local governments in both Breathitt and Knott Counties have expressed interest in using the wells drilled for this project as water supplies.

More information is available at www.uky.edu/KGS/water/research/bwhyield.html.

Land-use planning and geologic maps

Continued growth in Kentucky requires a better understanding of the physical environment. Taxpayers bear the cost of poor development decisions that result from inadequate technical input. Many problems can be avoided or minimized if geologic input is provided early in the planning and development process. To provide this geologic information, KGS is cooperating with the U.S. Department of Agriculture–Natural Resources Conservation Service to produce maps based on geologic and environmental analyses. These maps will be produced for select counties (1:48,000 scale) and 7.5-minute quadrangles (1:24,000 scale). The maps, prepared by **Dan Carey**, contain information on how the underlying rock in an area affects excavation and foundations, on-site wastewater-treatment systems, residential and industrial developments, highway and street development, and pond and reservoir construction. Photographs of sites in the area illustrate the geology.

The map for **Fayette County** has been published, and preliminary maps have been completed for the **Berea** 7.5-minute quadrangle and **Jessamine, Scott, and Woodford Counties**. ↗

Land-use planning and geology maps provide an interpretation of the local geology in nontechnical language, and can be used by planners, developers, and homeowners.



Digital geologic maps for Kentucky

Geologic quadrangle maps have been used for decades to address issues associated with mineral and energy resources, landslides, flooding, subsidence, groundwater supply and protection, waste disposal, and septic systems. Since 1996, KGS has undertaken an ambitious project to convert all 707 published geologic quadrangle maps for Kentucky into digital data sets. The digital format enhances the value of the maps by enabling users to combine geologic information with other data in a GIS. Seventy percent of the digital conversion of the geologic quadrangle maps for Kentucky has been completed for this project, managed by **Warren Anderson**. Funding from the USGS makes the project possible. The current status of the digital mapping program is available at www.uky.edu/KGS/statusmap. ↗

Using digital geologic maps to plan the Interstate 66 corridor

Jerry Weisenfluh and **Drew Andrews** are preparing geologic information to assist in the preliminary planning of Interstate 66. Three segments of the Kentucky portion of the Interstate are currently being studied – **Pike County, London to Somerset**, and **Glasgow to Bowling Green**. The Bowling Green route crosses an environmentally sensitive karst region next to **Mammoth Cave National Park**. KGS geologists are preparing geologic maps and illustrations about the region to inform the public and transportation planners about issues that will have an impact on road construction in this area. Geologic data are being combined with karst groundwater basin information in a GIS to identify potential corridor locations that will minimize environmental impacts. ↗

The Harrodsburg and Lexington 30 x 60 minute quadrangle maps are the first in a new series of digital geologic quadrangle maps to be published for the entire state of Kentucky.

New geologic maps provide valuable insight into the regional geology of central Kentucky

Two new 1:100,000-scale maps for the **Harrodsburg** and **Lexington** 30 x 60 minute quadrangles were published during the past year. Each map was digitally compiled from 32 separate 7.5-minute quadrangle maps (scale 1:24,000), and covers an area of approximately 31 x 54 miles. As a result, each map displays a valuable regional perspective, while at the same time providing an exceptionally high level of accuracy and detail. The digital data sets that were used to create the maps are available on CD-ROM for use in GIS and other computer software.

The Harrodsburg and Lexington quadrangle maps and accompanying digital data sets will be of interest to geologists and persons involved with engineering, agriculture, urban and rural planning, and environmental protection. Citizens, private companies, and government agencies will no longer have to digitize parts of the printed map for use in their own reports or assessments. Instead, they can use the KGS digital data sets. ↻

Kentucky is one of fewer than six states to create an Internet map server of this type on the Web.

Serving maps and data on the Web

The Commonwealth of Kentucky is making maps and related data available on the Web to enhance the public's appreciation and understanding of the unique geography of the state. To achieve this, the Governor's Office for Technology, Kentucky Natural Resources and Environmental Protection Cabinet, Kentucky Infrastructure Authority/Water Resource Information System, Office for Geographic Information, and KGS have collaborated to develop a dynamic Web site, the **Kentucky Geography Network (KYGN)**, available at kygeonet.state.ky.us. **Dan Carey** has helped develop this Web site.

A collection of static map images, mapping applications, and downloadable data for use with GIS software can be accessed through the site. Users can search for maps and information by entering a city, county, or place name, or by using a tool to draw an area of interest on a map of Kentucky. Water, oil and gas, and coal information from KGS data repositories can be accessed and displayed on topographic maps and aerial photos using the tools available on KYGN. The site also provides access to KGS well records and logs, published maps, and GIS data. GIS professionals, oil and gas professionals, environmental consultants, engineers, teachers, students, and citizens interested in maps and information that can be displayed on maps will find this site a valuable resource. ↻

Ecoregions map of Kentucky

Drew Andrews worked with State and Federal agencies to develop an ecoregions map of Kentucky. Personnel from the U.S. Environmental Protection Agency coordinated the effort. Project participants used various data sources to examine the natural landscape across many parts of the state, and Andrews provided the geologic and physiographic background for the project. He also led a field trip to verify the data on the map. The map, published by the U.S. Geological Survey and available for purchase from the KGS Publication Sales office, provides a common framework for State agencies to manage the diverse ecosystems found in Kentucky. It will be of interest to biologists, archeologists, and land-use planners. ↻


Geology to Mitigate Natural Hazards

Kentucky Seismic and Strong-Motion Network

The Kentucky Seismic and Strong-Motion Network, jointly operated by KGS and the UK Department of Geological Sciences, consists of 12 seismic stations and 10 strong-motion stations. The network is capable of monitoring any earthquake occurring in Kentucky with a magnitude greater than 2.0, as well as major earthquakes in the central United States. The strong-motion network is designed to record ground motion from strong earthquakes in the New Madrid Seismic Zone.

A new seismic station, installed February 11-12, 2002, in **New Harmony, Ind.**, to monitor earthquake activity in the Wabash Valley Seismic Zone, has been added to the network. The station is a collaborative effort between the U.S. Geological Survey, the Center for Earthquake Research and Information at the University of Memphis, the Rapp Granary-Owen Foundation, and the Illinois Basin Consortium (composed of the Illinois State Geological Survey, Indiana Geological Survey, and Kentucky Geological Survey). The Wabash Valley Seismic Zone is located in the lower Wabash River Valley in the Kentucky-Indiana-Illinois tristate area. It is the second most active seismic zone in the central United States, after the New Madrid Seismic Zone. Several strong earthquakes of magnitude 5 to 6 have occurred in the Wabash Valley Seismic Zone since 1891. New Harmony is located in the center of the zone. The seismic signals from the station are continuously recorded and stored on a standard personal computer.

Funding was secured to install a new vertical strong-motion array in **Fulton County, Ky.** The array is designed to capture soil responses to earthquakes from the New Madrid Seismic Zone. Together with other vertical arrays in the network, it will allow KGS to characterize three-dimensional soil response to earthquakes from this seismic zone. The 110 records acquired by the network in the past 12 years are being processed, and will be incorporated into a national database through the Consortium of Organizations for Strong-Motion Observation Systems.

Major hardware and software upgrades were made to the network to give users unprecedented data-management and processing capabilities. Beginning in March 2002, real-time seismic records for 10 stations across the state were displayed on the KGS Web site (www.uky.edu/KGS/geologichazards/eqaffect.html#KSSMN). The local and national value of this state-of-the-art system became apparent when both scientists and the public were able to view online the seismic recordings of a magnitude 5.0 earthquake that occurred on June 18, 2002, at 1:37 P.M. EDT. The epicenter of the earthquake was in the **Evansville, Ind.-Henderson, Ky.**, area. Although the effects of the earthquake were felt in offices and homes in central and western Kentucky, Indiana, and northwestern Tennessee, no one was hurt and only minor damage occurred. The earthquake and the public access to the real-time recordings caught the public's interest and brought media attention to KGS's research expertise in seismology. 

The Kentucky strong-motion network is the largest in the United States outside of California.

Seismic hazard mapping in the Louisville metropolitan area

The newly defined region of **Louisville–Jefferson County**, located in north-central Kentucky, is the largest metropolitan area in the state and the 16th largest in the Nation. It is also an area that is subject to seismic hazards. For instance, Louisville experienced strong ground shaking during the 1811–12 earthquakes in **New Madrid, Mo.**

The metropolitan area is underlain by thick, soft soils along the Ohio River that are prone to amplification and liquefaction, which could result in great property damage in the event of an earthquake. Even if the ground motion is not strong, the amplification and liquefaction could be devastating. An example of this devastation was the 1985 earthquake in Mexico City, in which soft lake deposits underneath the city amplified the ground motion of an earthquake whose epicenter was 300 kilometers away.

To help prevent a similar tragedy in Kentucky, **Zhenming Wang** and **Ed Woolery** are studying the soil properties and groundwater table in Louisville–Jefferson County to assess the risk of amplification and liquefaction. They will then prepare seismic hazard maps that emergency managers, planners, and the general public can use to take steps to mitigate the risks. The maps will also be used with HAZUS99, a software package for seismic-risk evaluation developed by the Federal Emergency Management Agency, to assess the seismic risk for the Louisville metropolitan area. ↻



Seismic hazard maps for the design of highway bridges

Zhenming Wang, **Ed Woolery**, and **Baoping Shi** are working with **Issam Harik** of the Kentucky Transportation Center at the University of Kentucky to develop seismic

hazard maps and design parameters for highway bridges in Kentucky. Because new seismic guidelines have been recently established by the Association of State Highway and Transportation Officials, the seismic vulnerability of all bridges in Kentucky will need to be reevaluated; this research will be helpful in that effort. ↻

Helping Kentucky adopt a new seismic design standard for residential buildings

A key question in designing building codes and considering seismic risk is “What level of risk is acceptable, and at what cost, in building design?” Building codes take into consideration factors related to the geology/seismology, engineering, economics, and safety of an area.

The 2002 Kentucky Residential Code (KRC) was to have taken effect on September 7, 2001, and enforced on a mandatory basis beginning January 1, 2002. The 2002 KRC was derived from the 2000 International Residential Code (IRC), with a significant amendment to the seismic design provision. But enforcement of 2002 KRC was delayed because of concerns expressed by the Structural Engineers Association of Kentucky about the amendment to the seismic design provision. The amendment was based on a ground-motion hazard with a 2 percent probability of being exceeded in the next 50 years. This resulted in parts of western Kentucky being assigned an extremely high seismic risk, greater than the risk for southern California. An ad hoc committee was formed by the Kentucky Department of Housing, Buildings, and Construction to review this issue and make a recommendation. **Zhenming Wang** served on the committee.

Wang presented KGS’s recommendations, developed by a group of experts from KGS, the Department of Geological Sciences, and the Department of Civil Engineering at the University of Kentucky, to the committee. One of the recommendations was to develop seismic design categories based on a ground-

motion hazard with a 5 percent probability of being exceeded within the next 50 years, which resulted in a much lower seismic risk being assigned to western Kentucky. The committee accepted the recommendation and revised 2002 KRC accordingly. On February 14, 2002, the Board of Housing, Buildings, and Construction adopted the new seismic design standard. ↻

Seismic loads and hazardous-waste landfill

The northern boundary of the New Madrid Seismic Zone is not well defined. **Ed Woolery** and **Zhenming Wang** are trying to determine whether the seismic zone extends as far north as **Paducah** in western Kentucky. This research will have important economic implications for Kentucky in general, and for Paducah in particular in defining building codes.

Woolery and Wang are working with the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Kentucky Division of Waste Management to evaluate the integrity of any new waste cells that may be constructed at the Paducah Gaseous Diffusion Plant landfill. They will determine the seismic load that the waste cells must be designed to withstand (a seismic load is analogous to a snow load on a roof, or a hurricane force on the side of a building). The potential ground motion at the site and the appropriateness of the seismic design value proposed by the U.S. Department of Energy will be evaluated. ↻

Modeling the subsurface of the earth

Researchers in the seismology and geophysics research program at KGS and the UK Department of Geological Sciences will be able to model subsurface geologic behavior from seismic images generated for petroleum exploration, groundwater investigations, and other research, thanks to a gift of software from Seismic Micro-Technology in Houston, Tex. **Ed Woolery** and **Jim Drahovzal** were instrumental in obtaining the software, valued at \$216,000. ↻

A gift of sophisticated computer software for seismology and geophysics research will provide the University of Kentucky with a research capability that is unique among universities in the central United States.

Understanding the Fluorspar Area Fault Complex in western Kentucky

The Fluorspar Area Fault Complex, which trends northeast-southwest, is exposed in parts of southern Illinois. The fault complex is believed to continue southwest beneath the soil cover of the northern Mississippi Embayment, where it appears to form the northwestern margin of the Reelfoot Rift in western Kentucky. Strands of the fault complex in **McCracken** and **Ballard Counties** also coincide with two diffuse zones of seismicity. **Ed Woolery** and **Zhenming Wang** are conducting seismic surveys to gain a better understanding of the fault complex and evaluate the potential seismic risk for major structures in the area, such as bridges and dams. ↻

Assessing landslides in northern Kentucky

In a study prepared for Congress, the U.S. Geological Survey reported that northern Kentucky and Cincinnati have the highest per capita loss due to landslides in the Nation. With funding from USGS, **Jim Cobb** and **John Kiefer** are working with **John Rockaway**, chair of the geology program at Northern Kentucky University, to inventory landslide damage in **northern Kentucky**. This study will obtain more accurate estimates of landslide damage and develop techniques for landslide characterization. A map designating known landslides in northern Kentucky is being developed using a GIS. The study is being undertaken as part of the Congressional mandate to USGS to develop a national landslide mitigation program. ↻

Public Service and Educational Outreach

The online access to well records promises to revolutionize the way companies explore for oil and gas reserves in Kentucky.

Enhanced online access to KGS data

The Kentucky Geological Survey is responsible for maintaining several repositories of oil, natural gas, coal, and water data. Traditionally, the public gained access to these data through direct contact with KGS personnel (telephone, fax, e-mail, or personal contact), which limited the public's access to normal business hours. This year, KGS completed a comprehensive Web-based system to make oil and gas well records (including geophysical logs), water well records, coal borehole and thickness information, and coal production data available online in a searchable format. The system is accessible at www.uky.edu/KGS/pubs/lop.htm.

Online tutorials show users how to access the data. The system features interactive map services and text-based forms that enable users to locate data from KGS data repositories by query or map searches, perform spatial analysis, print maps, download data, and link to related data sources. Throughout the design process, emphasis was placed on providing user-friendly public access and presenting geologic data and information in a format that was readily understood and accessible by the general public.

In the summer of 2002, KGS launched the Nation's first statewide, Web-accessible database of oil and gas well records. The new system provides free access to 1.3 million digital images of well records.

Included in the database is information on more than 150,000 oil and gas wells drilled in Kentucky. It also contains images of the highly valued geophysical logs. These logs are long documents (up to 110 feet in length) that are similar to medical EKG's; they record critical rock properties and indicate what was found at different depths in the wells. The records have information on the well location, the character of the rocks drilled, and any oil and gas encountered.

Searches can be performed by selecting a county or 7.5-minute quadrangle, or by entering a Carter coordinate location. A page displaying the results of the search has pertinent descriptive information for each well (farm and owner name, completion date, and penetrated formations), along with a link to the scanned geophysical log, which can be viewed online by downloading a free browser plug-in.


Each well location can also be viewed on an interactive topographic map. When the interactive map link is clicked, another browser window opens, and the selected well location can be viewed, together with the well locations in the surrounding area. A user can zoom in and out, and pan across the map, to view all the oil and gas well locations in Kentucky.

Three databases with information about Kentucky coal resources are now available on the Web at www.uky.edu/KGS/pubs/lop.htm.

The first contains the locations and descriptive information about coal boreholes drilled for exploration. Well locations, along with surface elevation, depth, and stratigraphic interval, can be viewed or downloaded for specified geographic areas. Detailed records of lithology and thickness must be purchased from KGS, but these data will be available on the Web in the near future. The excellent photographic core-logging manual, "Cored Rocks of the Southern Appalachian Coal Fields," is also available online.

The second database contains measurements of coal thickness and elevation from outcrop exposures, coal mines, and some drill holes.

The third database contains information collected by the Kentucky Department of Mines and Minerals about annual coal production.

The **Kentucky Groundwater Data Repository** maintained by KGS has data for more than 56,000 water wells in Kentucky. KGS staff respond to about 100 requests for groundwater data per month and provide location information on requested wells. This popular service was made available online in the spring of 2002 at www.uky.edu/KGS/pubs/lop.htm. Users have the option of searching for data based on county, quadrangle, and a specified radius around a given latitude/longitude point. The search generates descriptive information about a well (total depth, depth to bedrock, primary use, etc.) and location information. Lithology and casing information for each well can be viewed and downloaded. Users may also view well locations on an interactive map. The requested water well data can be downloaded for plotting on a map, either manually or by using GIS software. Scanned images of water well and spring records will be available online by January 2003. 

***The KGS
online
geologic data
services
provide
efficient
access 24
hours a day, 7
days a week,
from the
convenience
of a user's
office, home,
public library,
school, or any
place with
access to the
Web.***

KGS cohosts North-Central-Southeastern Section meeting of the Geological Society of America

A record number of approximately 1,200 people attended the combined meeting of the Southeastern and North-Central Sections of the Geological Society of America (GSA) in **Lexington**, April 3-5, 2002. In addition to KGS, the meeting was hosted by the Department of Geological Sciences at the University of Kentucky and the Department of Geology at the University of Cincinnati. It featured 586 papers in eight concurrent oral sessions and five poster sessions, six workshops, 10 field trips, 14 special events, and 40 exhibitors. KGS geologists presented 26 papers, presided over five symposia, hosted one workshop, and led three field trips. The technical sessions included topics on hydrogeology and environmental geoscience, digital geologic mapping, economic geology, geoscience education, geologic hazards, geology and public policy, GIS and remote sensing, geology and history, and geology and public health. ↗

Technology transfer for the petroleum industry

On May 16, 2002, **Brandon Nuttall** conducted a 1-day workshop, "Integrating GPS and GIS for the Petroleum Industry." The workshop, designed for oil and gas professionals and field personnel, explained how to integrate global positioning system (GPS) data and GIS mapping applications for exploration and development of energy resources and related facilities management. On June 4, 2002, **Dave Harris** conducted a 1-day core workshop and field trip, "Outcrop Analogs for Trenton/Black River Fractured Dolomite Reservoirs." Energy industry geologists and geophysicists working in Ordovician hydrocarbon plays in the Appalachian, Michigan, and Illinois Basins attended the workshop and field trip. Both workshops were sponsored by the Appalachian Region of the Petroleum Technology Transfer Council, and held in **Lexington**.

On June 18, 2002, **Brandon Nuttall** presented a workshop, "Oil and Gas Data on the Web," in **Lexington**. The workshop, held in conjunction with the annual meeting of the Kentucky Oil and Gas Association, explained how to use online oil and gas well records for Kentucky and integrate the well data with map coverages available on the KGS Web site. ↗

Improving water-quality monitoring and assessment

Steve Fisher served as a panelist at a workshop titled "Building Capacity for State and Regional Councils" at the Third National Monitoring Conference of the National Water Quality Monitoring Council, May 20-23, 2002, in **Madison, Wis.** The workshop was part of the council's effort to coordinate consistent and scientifically defensible methods and strategies for improving water-quality monitoring, assessment, and reporting. At the half-day workshop, Fisher and the other panelists described their experiences with collaborative, interagency monitoring networks. A summary of the workshop can be viewed at www.uky.edu/KGS/water/presentations/Capacity.ppt. Fisher and **Pete Goodmann**, of the Kentucky Division of Water, also presented a poster and contributed an article to the conference proceedings. ↗

Training professional geologists

Drew Andrews and **Ed Woolery** taught a short course, "Review of Practical Geology," for the Kentucky Society of Professional Geologists on August 11, 2001, and February 9, 2002, at the Well Sample and Core Library in **Lexington**. The course helps geologists prepare for national-level exams for professional registration. ↗

Preventing nonpoint-source pollution in karst aquifers

Jim Currens and **Randy Paylor** conducted two workshops on the hydrogeology of karst aquifers in the **Inner Bluegrass Region** and the use of KGS karst groundwater basin maps to prevent nonpoint-source pollution. Precipitation rapidly recharges a karst aquifer, either by infiltrating through surface cracks, or by entering directly through swallow holes. Often there is essentially no filtration, so karst aquifers are highly vulnerable to pollution. The workshops, held in February 2002 in **Versailles** and **Stanford**, were designed to inform county officials, regional planners, and water consultants about ways to prevent pollution of karst aquifers. ↗

Earthquake awareness

John Kiefer and **Steve Cordiviola** taught a 1-day workshop on earthquake awareness, the geologic nature of earthquake hazards, and use of geologic maps to assess risk. The workshop was attended by disaster and emergency-services personnel and public officials from Kentucky, Indiana, and Illinois. The workshop, sponsored by the Central United States Earthquake Consortium's State Geologists, was held in **Owensboro** in conjunction with the Governor's Earthquake Task Force on April 22, 2002. Kiefer is vice chair of the task force. **Norm Hester**, retired State Geologist of Indiana, and **Robert Bauer** of the Illinois State Geological Survey, taught at the workshop, and **Mike Griffin** of ABS-EQE Engineering and **Randy Shackleford** of Simpson Strong-Tie Co., Inc., made presentations on structural and nonstructural methods of mitigating earthquake damage. ↗

Continued popularity of KGS internship program

Following the tremendous success of the internship program for geology students in the summer of 2000, KGS offered the program again in 2001, with additional funding from the National Science Foundation and the Association of American State Geologists. Interns **Laura DeMott** (Western Kentucky University), **Derek Stakelin** (Morehead State University), and **Rob Hoppenjans** (Northern Kentucky University) collected latitude, longitude, and elevation data using GPS equipment to verify the accuracy of data on new digital geologic quadrangle maps. They helped conduct dye tracing to determine the paths of subsurface groundwater in the Inner Bluegrass Region for pollution control and water-quality protection. They took field trips to the Ghent coal-fired electric power plant and to Jephtha Knob (the site of an ancient impact of a meteorite in **Shelby County**). Students working at KGS also participated in the activities organized for the interns. **Matt Crawford**, an intern in the 2000 program now working at KGS, helped organize the 2001 program. ↗

Rocks and hearts

Patrick Gooding, Ray Daniel, and Mark Eversole taught small groups of adults with disabilities about earth science on January 30, February 6, and March 6, 2002. The workshops were sponsored by the Christian Appalachian Project, which provides a 1-week respite for parents and guardians, by offering programs such as these for adults with disabilities. The KGS program began with the participants gathering rocks and geodes from outcrops in **Estill County**. Their samples were brought to the **Well Sample and Core Library**, where Gooding, Daniel, and Eversole identified the rocks. The participants were then taught how to cut and polish the rocks. Gooding, the manager of the library, showed the participants fossils and minerals and presented a slide show to explain interesting facts about geology. The response from the participants was enthusiastic and positive. It was a heartwarming experience for everyone involved. 🌿

Susan Landon honored as first annual Donald C. Haney Distinguished Lecturer

Susan Landon, an independent petroleum geologist and consultant affiliated with Thomasson Partner Associates in Denver, Colo., presented the first annual **Donald C. Haney Distinguished Lecture** on April 24, 2002. Haney was the State Geologist and Director of KGS from 1978 to 1999.

In her lecture titled “Opportunities and Challenges for the U.S. Petroleum Industry: The Next 50 Years,” Landon gave an insightful overview of historic demand and supply trends, changing patterns of resource use, environmental issues such as global warming and Federal clean air regulations, and geopolitical developments, to provide the context for her analysis of future issues that will confront the petroleum industry. She concluded that the Nation would not face a shortage of oil and gas in the future. The Nation’s oil supplies are well insulated from potential oil embargoes because the United States has diversified its imports, and the countries that now export to the United States are much more dependent on U.S. petroleum revenue to support their economies than they were during the 1970’s. She was optimistic that there will be a smooth transition to alternative fuels, and predicted that vehicles will be powered by hydrogen gas or other alternative fuels by mid-century. She was also confident about the ability of the U.S. petroleum industry to develop its resources in an environmentally appropriate manner. 🌿



Susan Landon, the 2002 Donald C. Haney Distinguished Lecturer, pictured with the namesake of the lecture, State Geologist Emeritus Donald C. Haney (left) and State Geologist Jim Cobb (right).

Awards and Appointments


National

Jim Cobb, director of the Kentucky Geological Survey, was appointed to the Committee on Earth Resources for the National Research Council. The committee investigates resource and environmental issues for Federal government agencies.

John Kiefer, Assistant State Geologist, was appointed to the Central United States Committee for the USGS Advanced National Seismic System. He was also elected chair-elect of the Southeastern Section of the Geological Society of America. His term as chair will be for the 2003–04 fiscal year. Kiefer will continue to serve as chair of the Southeastern Section GSA Committee on Geology and Public Policy. In addition, he is a member of the Geology and Public Policy Committee of the national GSA, and a member of the Joint Technical Program Committee for GSA.


Jerry Weisenfluh, head of the Geospatial Analysis Section, was appointed in September 2001 to the North American Data Model Technical Advisory Committee. Formed by the Association of American State Geologists (AASG), the committee advises AASG about the USGS program to create a national geologic map database system. The committee has prepared recommendations about technical and administrative activities necessary to implement such a system.

Randy Paylor, hydrogeologist in the Water Resources Section, received a fellow award from the National Speleological Society (NSS) at its annual convention, held in **Mt. Vernon, Ky.**, on July 27, 2001. This prestigious award is given in recognition of consistent effort in promoting the goals of the NSS and exemplary achievements in speleology (the exploration and scientific study of caves). Only about 20 members receive these awards each year out of a membership of more than 12,000.

Steve Greb, **Cortland Eble**, and **Don Chesnut** received the best paper award in the Coal Geology Division of the Geological Society of America for “Spatial and Temporal Trends of Lower and Middle Pennsylvanian Coals, Central Appalachian Basin, U.S.A.,” presented at the 2001 national meeting in Boston, Mass. 

Regional

Jim Drahovzal, head of the Energy and Minerals Section, received the 2001 Levorsen Memorial Best Paper Award from the Eastern Section of the American Association of Petroleum Geologists for “Mid-continent Interactive Digital Carbon Atlas and Relational DataBase (MIDCARB).” Drahovzal’s coauthors were **Larry Wickstrom**, Ohio Geological Survey; **Timothy Carr**, Kansas Geological Survey; **John Rupp**, Indiana Geological Survey; **Beverly Seyler**, Illinois State Geological Survey; and **Scott White**, Kansas Geological Survey. Drahovzal also received this award in 1996.

John Kiefer chairs the Geohazard Data Base Committee of the Appalachian States Coalition for Geological Hazards in Transportation. He also represents the University of Kentucky on the Board of Directors of the Ohio River Basin Consortium for Research and Education. 


State

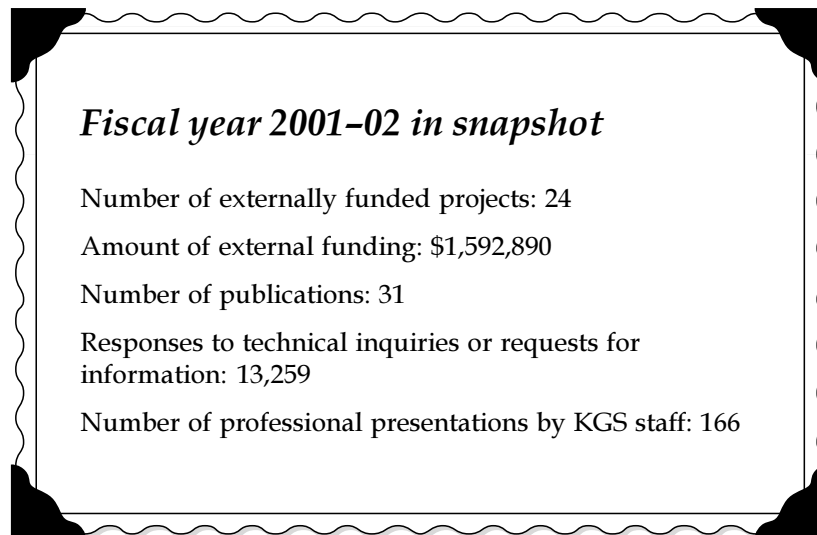
John Kiefer is cochair of the Governor’s Committee for Earthquake Hazard Mitigation.

Jerry Weisenfluh was appointed in January 2002 to the Kentucky Mine Map Database Technical Design Team. This group will design and implement an underground mine map database system for agency and public use in Kentucky.

Dave Williams, manager of the KGS field office in **Henderson**, received the Kentucky Geologist of the Year Award at the Kentucky Section of the American Institute of Professional Geologists' spring banquet on May 11, 2002.

Jim Dinger, head of the Water Resources Section, was appointed to the Lexington-Fayette Urban County Government Greenspace Commission. His term will extend from July 1, 2002, to June 30, 2005.

Terry Hounshell, chief cartographic illustrator in the Geoscience Information Section, received the Outstanding Achievement Award from KGS Director Jim Cobb on April 26, 2002, at the Survey's annual seminar in **Lexington**. The award was presented in recognition of Hounshell's leadership in the advancement of digital cartography at KGS. It was the first time such an award has been granted to a Survey employee. 



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www.uky.edu/KGS

Earth Science Education Network

www.uky.edu/KGS/education/education.html

KGS Online List of Publications

www.uky.edu/KGS/pubs/lop.htm

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