

## 2010 ANNUAL REPORT



*West Virginia*  
**WEST VIRGINIA**

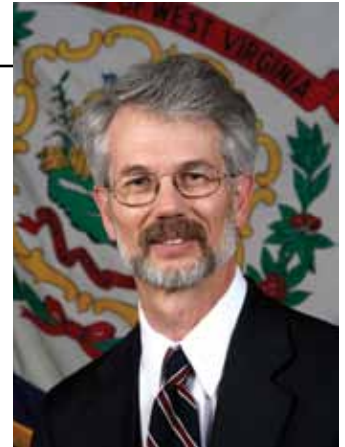
## MESSAGE FROM THE DIRECTOR

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Maps are a basic tool in the practice of geology and the distribution of geological knowledge. We are all familiar with maps on paper, and demand still exists for the paper map, from bedrock geologic maps to topographic maps. Today the move is toward virtual maps for display on the Internet or downloading.

### We have several active mapping projects for West Virginia:

- Mapping significant coal beds in the state, with about 68% of the area underlain by mineable coal now complete
- Geologic mapping of 7.5' quadrangles in the eastern mountains of the state, funded in part through the U.S. Geological Survey
- Geologic mapping of quadrangles in and around Elkins
- Geological and surficial mapping of 14 quadrangles covering the Gauley, Bluestone and New River Federal Recreation areas, a three-year effort that started in FY 2009 and funded largely by the National Park Service



### Maps available for download from our website include:

- Statewide map of bedrock geology
- Map of Marcellus Shale thickness, showing permitted and completed gas wells

These are static maps in the sense that the user downloads them and prints them, relying on our geologists to select the information displayed. We are currently experimenting with downloadable maps comprising several data layers that can be turned on and off by the user. We provide another option with interactive maps on our website with a wide variety of data layers that the user can select. In effect, the user can design a map by selecting the scale and area in addition to the information to be displayed. Examples of interactive maps on our website are:

- Marcellus Shale resources map
- An oil and gas well website that allows users to zoom in, select individual wells or groups of wells, display basic well information and view well locations on a map
- Tight gas formations in the state, with maps, digitized well logs, photographs of cores and access to basic well information.
- Maps for most of the state showing significant coal beds, with data layers that include coal bed thickness, elevation and mined-out areas.

With each new or enhanced web feature introduced, the number of page downloads from our website increases. In large measure, web resources are supplanting traditional ways of disseminating information such as publications and direct responses to inquiries from business, industry, schools, government agencies and the public. People increasingly expect to find information available online, just as they expect a serious business to have a web presence. Meanwhile, our conventional publications are still available, in many cases as scans of the original paper copies if the reader prefers.

A handwritten signature in blue ink, which appears to read 'Michael Ed. Hohn'.

Michael Ed. Hohn



## APPLIED COAL RESOURCES

### Coal Bed Mapping Project (CBMP)

Survey geologists continue to progress on the Statewide GIS (Geographic Information Service) based inventory of West Virginia's coal. GIS layers, by seam, include structural contours, outcrops, mined areas, isopachs, percent partings and coal quality. These products are regularly updated and can be viewed on the website. These data are provided to the West Virginia Tax Department where the information is used to generate state tax revenues for the counties. Taxes received by this information are used to fund many important parts of the state's infrastructure, notably, the education system.

### Elkins Mapping Project

Survey coal geologists are mapping five 7.5' quadrangles near Elkins in Randolph County: Junior, Elkins, Beverly West, Beverly East and the Sinks of Gandy. During this project, over 1,400 geologic data points have been collected and preliminary geologic contacts have been drawn and are currently under review. This project is producing 1:24,000 scale geologic maps in digital format for a part of the state that has received little attention since the early 1900s. Completed geologic maps will enhance ongoing efforts in nearby areas to update the State's geology. This project will be expanded into new areas next spring.



### Coal Quality

The Coal Program maintains a robust and growing computerized database of various chemical and physical characteristics of West Virginia coals. This valuable database has been very effective in aiding potential customers to identify specific West Virginia coals that meet their needs for power generation and to serve as chemical feedstock or as a source of coal-to-liquid applications.

### National Coal Resources Data System (NCRDS)

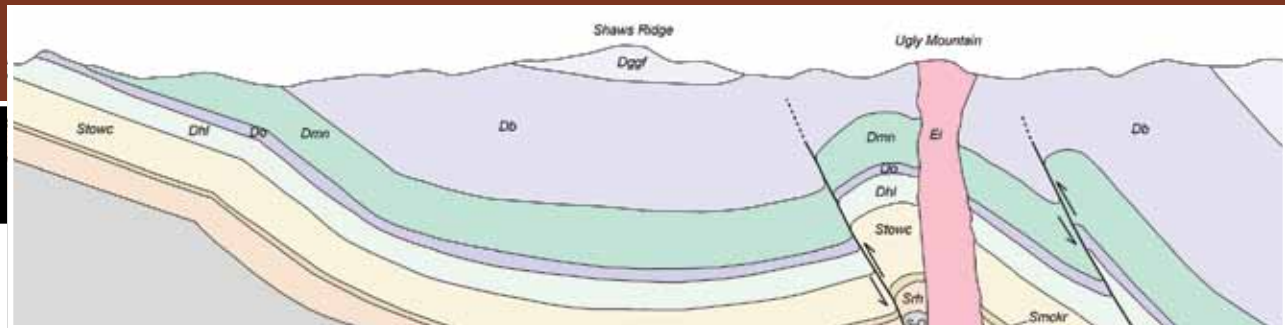
This long-running cooperative research initiative between the U.S. Geological Survey and the West Virginia Geological and Economic Survey (WVGES) Coal Program has enabled both partners to maintain and grow their respective coal databases. In addition to facilitating important research on various aspects of coal, coal mining and resource analyses, the cooperative effort has resulted in the collection of valuable data on the occurrence, distribution and quantities of various trace elements found in West Virginia's coal measures.

### Underground Mine Mapping Project

Coal Program geologists, in conjunction with West Virginia's Office of Miners' Health, Safety and Training (MHST), continue to expand the large collection of coal mine maps by obtaining previously unavailable historic maps from various repositories. The footprints of newly obtained mine maps are digitized and added to the Survey's coal bed GIS. Ancillary information is entered into WVGES stratigraphic database for use in the statewide coal bed GIS. Footprints of active mine areas are updated annually.

### Mine Information Database System

Work continues on updating and expanding the WVGES Mine Information Database System (MIDS) as new mine maps and information become available. The MIDS database contains information on mine maps, including bed mined, mine names, company names, location information and permit numbers. MIDS contains records of every mine map available at the WVGES, and is comprised of more than 44,000 documents depicting more than 71,000 mines. Submissions and comments from online users are requested to make the system more complete and user-friendly.



## GENERAL GEOSCIENCE PROGRAM

### Geologic Mapping

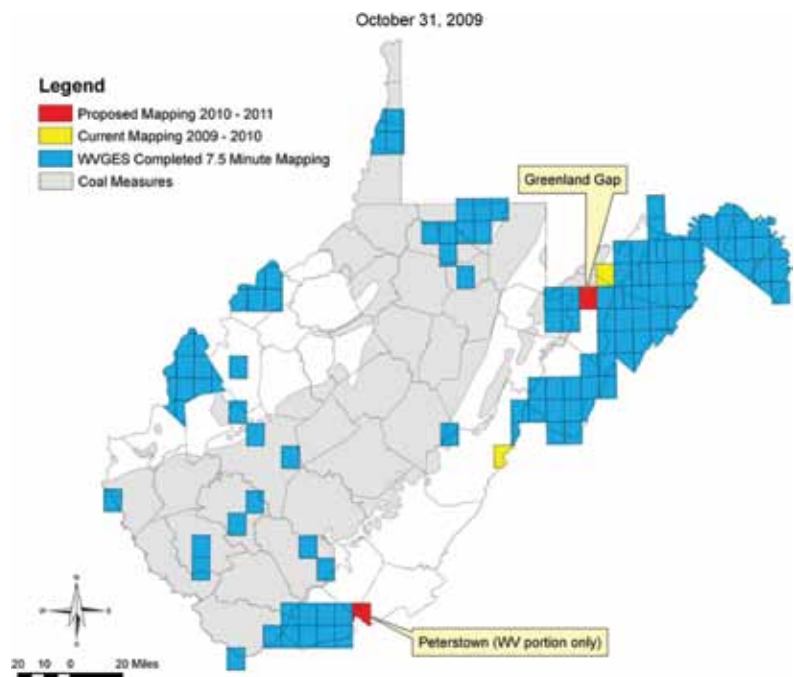
Geologic Mapping at WVGES consists of two major components: the direct acquisition of new geological information through field reconnaissance and the digital conversion of existing geological information from hard copy (paper, mylar, etc.).

- Acquisition of new geological data is carried out under the auspices of the STATEMAP program funded jointly by the U.S. Geological Survey and WVGES. In August 2009, the STATEMAP Advisory Committee, composed of individuals from industry, government and academia, met to assess and reprioritize mapping efforts for West Virginia. During the summer and fall of 2009, field work was conducted on three 7.5' topographic quadrangles in eastern West Virginia (Antioch, Paddy Knob and Mustoe). Published as WVGES Open File Reports, these data are currently available as paper maps; digital conversion of each map is either complete or in progress. Fieldwork on a new STATEMAP project (Greenland Gap) began in May 2010.
- In August 2009, WVGES submitted a successful proposal to the National Park Service to map the geology of three park units within the state of West Virginia. Over a three-year period, a consortium of geologists from WVGES, West Virginia University and Concord University will map the bedrock and surficial geology of the Fayetteville, Thurmond, Beckwith, Winona, Danese, Prince, Meadow Creek, Hinton, Meadow Bridge, Talcott, Anstead, Summersville Dam, Flat Top, and Pipestem quadrangles. These map areas cover park lands within the Gauley River National Recreation Area, the New River Gorge National River Area and the Bluestone National Scenic River Area. Fieldwork on this project began in spring of 2010 with WVGES mapping teams starting on the Anstead and Summersville Dam quads and Concord teams starting on the Flat Top and Pipestem quads.

- Digital conversion of existing and future map information is a high priority at WVGES. Digitizing and further processing of the six-quadrangle, Mercer County map project (Athens, Bluefield, Lerona, Matoaka, Oakvale and Princeton), which began in May 2008, has been completed and the map is being reviewed. During FY 2010, digital maps of the bedrock geology of the Paddy Knob, Mustoe, Antioch, Beckley, Shady Spring, Big Chimney and Sissonville quads were completed. In addition, digital maps of the surficial geology of the Antioch, Burlington, Headsville, Medley, Patterson Creek and Springfield quads were completed.

### Mine Pool Atlas Project

This two-year project, funded by the U.S. Environmental Protection Agency through the Division of Water and Waste Management (DWWM) of the Department of Environmental Protection (WVDEP), is evaluating abandoned coal mines as a source of stored ground water that could provide large volumes of water for various private, public and industrial uses in West Virginia.



## Mine Pool Atlas Project continued ...

To better understand the potential of this water source for development, WVGES is developing a dynamic, interactive GIS to portray mine pools, the structure contour of the base of each coal seam, and an isopach of each coal seam. GIS tools will be used to estimate mine pool volumes from available WVGES Coal Bed Mapping Program (CBMP) mining and coal seam data, and existing water quality data will be tied to appropriate mine water sources.

## Geothermal Resources

WVGES is participating in a three-year project, sponsored by the United States Department of Energy and the Association of American State Geologists, to increase the publicly available data on geothermal resources in all 50 states. Over the course of the project, WVGES will provide GIS-accessible versions of temperature logs, gravity and magnetic data. In addition, WVGES will be working with engineering researchers from West Virginia University to acquire and make available direct measurements of thermal conductivity taken from drill core and cuttings currently held by WVGES.

## Environmental Geoscience and Geochemistry

Environmental and geochemical work at WVGES deals primarily with the evaluation of geologic site characteristics for Underground Injection Control (UIC) permits for injection of fluids into subsurface rock formations, the assembly of a database of selected metals content of the state's rock formations, and answering inquiries regarding geology, surface water, groundwater, geologic hazards and bedrock chemistry.

- Under West Virginia State Code §22-11-11, the Director of WVGES furnishes consultation to the State's Department of Environmental Protection (WVDEP) concerning UIC draft permits. During FY 2010, WVGES provided input regarding geologic conditions at injection sites for 51 Class V UIC draft permits.
- Analyses of 40 geochemical samples collected during field reconnaissance were added to the existing geochemical database bringing the total number of analyses to more than 900. The database currently contains geochemical information on approximately 90% of the state's bedrock formations, exclusive of the coal-bearing strata.



## Outreach Activities

- Geoscience personnel organized the WVGES Colloquium series which hosted two talks during the FY 2010. Speakers included academic and industry professionals. Topics ranged from geomorphology to geostatistics.
- Geoscience personnel taught evening classes in Historical Geology at Fairmont State University.
- Geoscience personnel presented a poster entitled "Trace Fossils in the Tioga Ash Help Decipher Changing Paleoenvironmental Conditions in the Middle Devonian of West Virginia" at the joint Northeast-Southeast Section Meeting of the Geological Society of America held in Baltimore, Md., in March 2010.
- Geoscience personnel presented a poster entitled "Marcellus Shale Gas Wells in Karst Areas of West Virginia" at the joint Growing Communities on Karst 2010 Great Valley Water Resources Science Forum held in Shepherdstown, W.Va., April 2010.





## OIL AND GAS PROGRAM

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### The Marcellus Shale

The Marcellus Shale continues to draw significant attention from oil and gas operators as a source of natural gas for large markets in the northeastern United States. Though much of the production to date has come from the western part of the state, operators continue to expand the boundaries of the play.

Historically, this organic-rich shale had been regarded as an important source of gas, but it wasn't until recently that its economic potential as a production reservoir also was recognized. In that sense, it is regarded as an unconventional gas play. Today, technological approaches that were largely employed in the Gulf Coast such as horizontal drilling and hydraulic fracturing are common practices for exploration companies operating throughout the Appalachian Basin.

The WVGES created an Interactive Mapping Service (IMS), accessible via its website, specifically for the Marcellus, to give users the opportunity to directly search for information concerning characteristics of the Marcellus formation (e.g., presence and depth). This popular service is constantly being updated for the benefit of the public.

The WVGES has responded to hundreds of inquiries about the Marcellus from private citizens, government officials and industry professionals interested in a wide range of issues, including property leases and geologic characteristics of the formation. In addition to routine responses, WVGES geologists have made a number of presentations to various groups, including the Upper Monongahela River Association, the West Virginia Oil and Natural Gas Association Marcellus Shale Task Force, the Interstate Oil and Gas Compact Commission, West Virginia University Extension Service, National Association of Royalty Owners, West Virginia Division of Energy and West Virginia Division of Forestry. With the Petroleum Technology Transfer Council (PTTC), the WVGES also jointly hosted the "Organic Shales of West Virginia" Core Workshop and Field Trip. This 2.5-day event that focused on the Marcellus Shale served to familiarize participants with the complex stratigraphic and facies relationships of Devonian shales present in West Virginia.

## CARBON SEQUESTRATION

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Carbon sequestration is receiving considerable attention as a means for reducing the amount of carbon dioxide released to the atmosphere. The process of sequestration involves pumping carbon dioxide deep into underground reservoirs where it can be stored indefinitely.

Carbon dioxide is of particular interest since it is a natural byproduct from the combustion of fossil fuels, especially coal, an important economic resource for West Virginia. Carbon dioxide has been shown to be a significant greenhouse gas that contributes to the entrapment of heat from the sun within the earth's atmosphere. By capturing and sequestering carbon dioxide in deep underground reservoirs, coal can effectively be utilized as a carbon-neutral source of fuel.

In many ways, the sequestration of greenhouse gases is similar to but opposite of the production of oil and natural gas. Oil and natural gas are withdrawn from subsurface reservoir rocks, whereas sequestration involves the charging of underground reservoirs with gas. Both processes are dependent on low-permeability rock formations known as seals to cap the reservoirs and contain the gas or oil within them.

WVGES is an active participant in the Midwest Regional Carbon Sequestration Partnership (MRCSP), a group of industrial and government institutions dedicated to the selection and characterization of potential sequestration sites and demonstrating the viability of large-scale sequestration through field demonstration projects. The MRCSP is one of seven regional partnerships established by the U.S. Department of Energy.

The focus of the MRCSP Phase I research was identification of regional sources of carbon dioxide and storage opportunities. Phase II concentrated on further characterization of potential storage formations and small-scale field testing. The WVGES contributed significantly to several Phase II final characterization reports. Phase III work will involve further reservoir characterization and a large-scale geologic field test. The WVGES will build on the characterization of prospective reservoirs and seals in Phase III by further defining the structural and stratigraphic characteristics of key sequestration target formations.

**WVGES developed two Geology of the State Park Guides (\$5.95 each) to help visitors identify the visible rock units.**

Please visit WVGES's publications page ([www.wvgs.wvnet.edu/www/services/servpubc.htm](http://www.wvgs.wvnet.edu/www/services/servpubc.htm)) for a complete list of maps and other publications available to the public. Or call us at 304.594.2331 to order your copies.



## OFFICE OF GEOGRAPHIC INFORMATION SYSTEM COORDINATION

The office fostered efficient and effective use of the state's geospatial capabilities and made significant headway in a number of critical areas, including data sharing between agencies and providing technical assistance to state, local agencies and the public.

The office developed and prepared a new Executive Order and the 2010 GIS Statewide Strategic Plan, and presented both documents to the GIS Policy Council for approval and recommendation to the governor. The updated plan, a critical component of the GIS Program, articulates a strategic vision for the development and use of geospatial technology within state government and sharing of information with federal, local and private entities for the benefit of West Virginians. The Executive Order formally establishes the State Office of GIS Coordination and defines the coordinator's duties and responsibilities.

The Office of GIS Coordination was instrumental in obtaining and has oversight over a National Telecommunications and Information and Administration Broadband Mapping Grant totaling \$4.7 million. The program, funded by the American Recovery and Reinvestment Act, will increase broadband access and adoption through better data collection and broadband planning. The data will be displayed in NTIA's national broadband map, a tool that will inform policymakers' efforts and provide consumers with improved information on the broadband Internet services available to them.

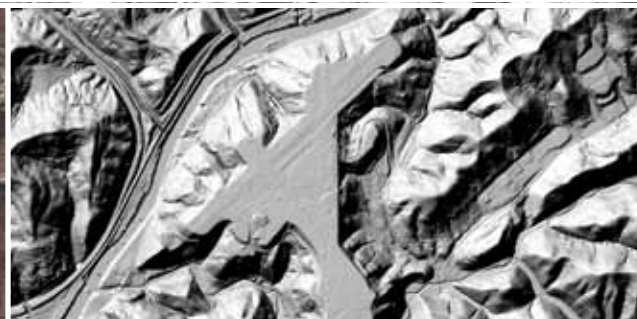
The coordinator provided general administrative oversight of the Mineral Lands Mapping Program (MLMP). In collaboration

with the Coal Bed Mapping Project and the Property Tax Division, new procedures suggested by the coordinator were implemented and significant results were achieved.

The office provided technical assistance and advice to the Water Development Authority (WDA), the National Guard, the West Virginia Intelligence Fusion Center, the Division of Homeland Security and Emergency Management's Hazard Mitigation Section, and other state and local agencies in their search of GIS contract services and/or GIS application development.

A series of cadastral GIS workshops, created in collaboration with the West Virginia GIS Technical Center, Rahall Transportation Institute, Property Tax Division, County Assessors and 911 directors the previous year continued to be popular among GIS professionals. These workshops were designed to inform, train and advise county and local government officials that have GIS programs in the latest technology, and at the same time to educate those officials that have not embraced GIS technology in their own organizations. The workshops emphasize interagency collaboration and are given at different locations throughout West Virginia.

The coordinator attended sessions and presentations at the annual and mid-year National States Geographic Information Council (NSGIC) conferences in Cleveland, Ohio, and Annapolis, Md. The coordinator participated in sessions of the WVGIS Policy Council, the West Virginia Information Technology Council, the GIS Steering Committee, E911 Council, Green Infrastructure Committee, and the Statewide Addressing and Mapping Board.





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## WEST VIRGINIA GEOLOGICAL AND ECONOMIC SURVEY

### Principal Staff Directory and Points of Contact January 2011

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Computing Services and Publications	<i>Mary C. Behling</i>
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**Hours:** 8:00 a.m. to 5:00 p.m. Monday through Friday (*closed holidays*)