

## THE OHIO MINERAL INDUSTRIES IN 1999

by Mark E. Wolfe

Data compiled by the Ohio Department of Natural Resources, Division of Geological Survey for the *1999 Report on Ohio mineral industries* indicate that Ohio's mineral industries remained strong overall in 1999, although coal production experienced a significant decline. The total value of coal, industrial minerals, and oil and gas sold in Ohio in 1999 was nearly \$1.8 billion, a 3 percent decrease from 1998. The value of nonfuel minerals continued to increase steadily, recording a 90 percent increase since 1991. Nonfuel minerals were produced from 491 operations, and coal was produced from 116 mines. A total of 48 mines produced multiple mineral commodities (for example, coal and clay). There were 437 new wells completed for oil and gas in 1999, of which 352 were productive and 85 were dry. Nearly 9,000 people were directly employed by the mineral industries (excluding oil and gas) in Ohio during 1999.

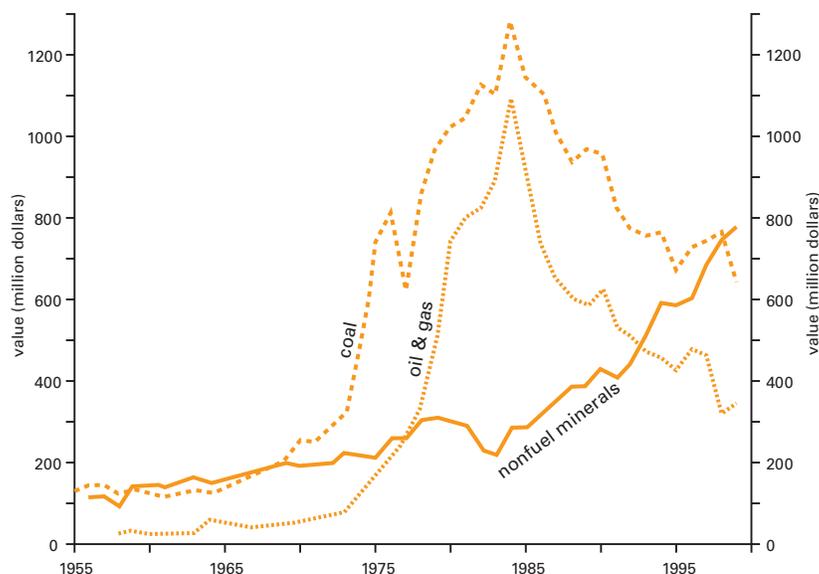
### COAL

Coal was produced by 48 companies at 116 mines in 22 Ohio counties in 1999. Production totaled 22.5 million tons, a decrease of 19 percent from 1998. (NOTE: all tonnages are in short tons.) In 1999, 11.6 million tons were produced from 8 underground mines, and 10.9 million tons were produced from 108 surface mines.

Belmont County again led the state in coal production in 1999, reporting 5.5 million tons. Vinton, Harrison, Gallia, Jackson, and Meigs Counties each produced more than 1 million tons. Athens County reported coal production in 1999, for the first time since 1991. Buckingham Coal Co., Inc., mined the Upper Freeport (No. 7) coal while developing a box-cut access pit for a new 1-million-ton/year underground mine that opened in 2000.

The companies with the largest coal production in 1999 were Southern Ohio Coal Co., a subsidiary of American Electric Power (4.5 million tons); Ohio Valley Coal Co. (4.4 million tons); Oxford Mining Co., Inc. (1.6 million tons); Waterloo Coal Co., Inc. (1.5 million tons); and Harrison Mining Corp. (1.5 million tons). During April 1999, Quarto Mining Co., a subsidiary of Consolidation Coal Co., closed its 3-million-ton/year Powhatan #4 underground mine in Monroe County.

The Pittsburgh (No. 8) coal was the most heavily mined seam, followed by the Clarion (No. 4A), Meigs Creek (No. 9), Middle Kittanning (No. 6), and Lower Freeport (No. 6A) coals. All of these



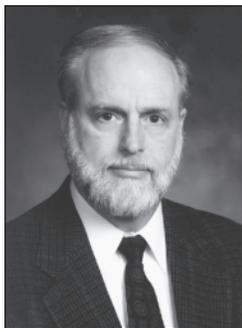
Value of coal, nonfuel minerals, and oil and gas in Ohio.

coals are Pennsylvanian in age. Because of high sulfur content, approximately 13.1 million tons of Ohio coal was washed prior to delivery to electric-generating power plants. The average price paid for Ohio coal in 1999 was \$27.61 per ton; the total value of coal sold in Ohio in 1999 was \$643 million. Ohio coal mines and associated facilities directly employed 3,063 persons in 1999.

### LIMESTONE AND DOLOMITE

Limestone and dolomite were sold or produced by 72 companies at 124 operations in 50 Ohio counties in 1999. Production totaled 82.2 million tons, an all-time record and a 1 percent increase from the previous record set in 1998. This increase continues an upward trend that began in 1982, when less than 28 million tons of limestone and dolomite were sold in Ohio.

The counties having the largest sales of limestone and dolomite in 1999 were Erie (8.3 million tons), Delaware (6.3 million tons), Ottawa (6.2 million tons), Wyandot (5.6 million tons), and Franklin (5.3 million tons). The leading companies include National Lime & Stone Co. (13.1 million tons), Martin Marietta Aggregates (9.4 million tons), Rogers Group, Inc./Sandusky Crushed Stone Co. (4.8 million tons), Stoneco, Inc. (4.7 million tons), and LaFarge Corp. (4.1 million tons). Five individual mines produced in



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## Ohio Geology

A quarterly publication of the

Ohio Department of Natural Resources  
Division of Geological Survey  
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Columbus, Ohio 43224-1362

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World Wide Web: [http://  
www.dnr.state.oh.us/odnr/geo\\_survey/](http://www.dnr.state.oh.us/odnr/geo_survey/)

Ohio Geology is a free publication. To  
become a subscriber please contact the  
Division of Geological Survey at the above  
address, phone numbers, or e-mail.

Editor: Michael C. Hansen  
Layout/Design: Lisa Van Doren

Administration/State Geologist  
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# From The State Geologist...

Thomas M. Berg

## GROUND WATER AND THE FUTURE OF THE GREAT LAKES

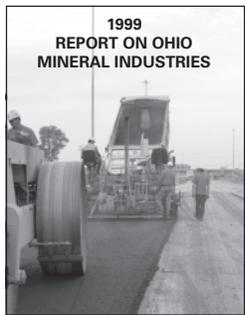
The State of Ohio and the Ohio Department of Natural Resources are deeply concerned about the future of Lake Erie and all the Great Lakes in general. These lakes are the largest fresh-water system in the world. Water quality in Lake Erie has been a long-standing public concern. Even though there have been quality improvements in the past couple of decades, there are still concerns—as were confirmed last summer when health advisories were posted at some beaches. Water quantity was a huge problem last year as lake levels dropped and boat channels became precipitously shallow. In addition, overseas nations are eyeing the Great Lakes as a source of fresh drinking water.

Ohio's concern about Lake Erie goes beyond the lake itself. Proper management of the lake also includes proper management of the watershed areas that feed into the lake. Although about 85 percent of the water flowing into Lake Erie comes from the upper Great Lakes via the Detroit River, about 15 percent (and in periods of high precipitation, up to 20 percent) of the water flowing into the lake comes from the Lake Erie Basin itself. Both surface water and ground water make an important contribution that significantly affects the quantity and quality of water in Lake Erie and the other Great Lakes. Surface water and ground water need to be seen as a single resource. (Recommended reading: U.S. Geological Survey Circular 1139.)

In a region like Ohio where the majority of the land is covered by unconsolidated glacial sediments (in places up to several hundred feet thick), ground water makes a significant contribution (greater than 50 percent in some cases) to the flow of rivers and streams. In glaciated areas dominated by sand and gravel, ground water can contribute more than 90 percent of the base flow of streams. Accordingly, proper management of ground water in the watersheds is an essential component of managing the Great Lakes themselves. And we cannot manage the ground water unless we understand the geologic framework of the glacial deposits.

Locating, characterizing, developing, and protecting glacial aquifers was the most important of many reasons for forming the Central Great Lakes Geologic Mapping Coalition, which comprises the state geological surveys of Ohio, Indiana, Illinois, and Michigan and the U.S. Geological Survey. Working together, the five surveys will have the ability to map the glacial and related surficial deposits of all four states in three dimensions and deliver that 3-D information to geographic information systems that will be used to manage the Great Lakes and their watersheds. The effects of long-term withdrawal of ground water on Lake Erie cannot be properly assessed without a 3-D geologic framework. Effects on ground water by continued application of agricultural chemicals cannot be realistically evaluated without a 3-D geologic framework. The movement of contaminants from point and nonpoint sources cannot be correctly determined without a 3-D geologic framework. (Remember the case described by Jonathan Harr in *A Civil Action*.) The biogeochemical reactions (beneficial or deleterious) that take place within ground water in unconsolidated deposits cannot be accurately established without a 3-D geologic framework. The mapping to be done by the Central Great Lakes Geologic Mapping Coalition will require a significant investment of time and money. But the future of Lake Erie and the other Great Lakes deserves such an investment.

## 1999 Report on Ohio mineral industries now available



The *1999 Report on Ohio mineral industries* contains production and employment information and operator directories for minerals produced in Ohio as well as information on oil and gas wells drilled in the state. The report includes a *Mineral industries map of Ohio* (black and white, scale approximately 1:750,000, or 1 inch equals about 12 miles). The report is \$10.00 plus tax and shipping and can be ordered from the Ohio Division of Geological Survey, 4383 Fountain Square Drive, B-2, Columbus, OH 43224-1362; telephone 614-265-6576; fax: 614-447-1918; e-mail: [geo.survey@dnr.state.oh.us](mailto:geo.survey@dnr.state.oh.us). Visa and MasterCard are accepted. The *1999 Report on Ohio mineral industries* also can be viewed in PDF format on the Survey's Web site at [http://www.dnr.state.oh.us/odnr/geo\\_survey/ogcim/minstat/minstat1.htm](http://www.dnr.state.oh.us/odnr/geo_survey/ogcim/minstat/minstat1.htm)

continued from page 1

excess of 3 million tons each.

The total value of limestone and dolomite sold in Ohio during 1999 was \$361.3 million. Average price per ton was \$4.55. Ohio limestone and dolomite quarries directly employed 2,345 persons in 1999. Crushed stone for road construction was the primary use for Ohio limestone and dolomite in 1999. Ohio ranks 4th nationally in the production of lime and 7th in the production of crushed stone.

#### SAND AND GRAVEL

Sand and gravel were sold or produced by 223 companies at 305 operations in 60 Ohio counties plus Lake Erie in 1999. Sales totaled 59.8 million tons, a slight increase (0.6 percent) compared to a very strong 1998. Sand accounted for 31.1 million tons sold, and gravel accounted for 28.7 million tons. Ohio ranks 4th nationally in the production of construction sand and gravel and 9th in the production of industrial sand and gravel.

Five counties, located primarily in the state's metropolitan areas, had sales of more than 4 million tons each in 1999: Hamilton (6.4 million tons), Butler (6.3 million tons), Franklin (5.3 million tons), Portage (4.6 million tons), and Stark (4.6 million tons). Four companies sold more than 2 million tons of sand and gravel in 1999: Martin Marietta Aggregates (11.4 million tons), Shelly Materials, Inc. (4.0 million tons), Olen Corp. (3.7 million tons), and Watson Gravel, Inc. (2.4 million tons). Most Ohio sand and gravel operations are small to medium size, although seven pits produced more than 1 million tons each, led by Olen Corp.'s Columbus Plant #3 (3.1 million tons).

The total value of sand and gravel sold in Ohio during 1999 was \$264.4 million. Average price per ton was \$4.42. Ohio sand and gravel operations directly employed 1,973 persons in 1999. Aggregate for the building industry was the primary use of Ohio sand and gravel in 1999.

#### SALT

Salt was produced by three companies at five operations in five Ohio counties during 1999. Rock-salt sales from two large underground rock-salt mines in Cuyahoga and Lake Counties were 3.7 million tons, and three salt solution-mining operations sold 0.8 million tons, for a total of 4.5 million tons, a 15 percent increase from 1998. Cargill, Inc., and Morton International, Inc., are the dominant Ohio salt producers. Morton merged with specialty chemicals company Rohm and Haas in June 1999 in a deal valued at \$4.9 billion. Total value of salt sold in Ohio in 1999 was \$92.7 million. Average price per ton was \$20.27. The Ohio salt industry directly employed 452 persons in 1999. Ohio ranks 4th nationally in salt production.

#### SANDSTONE AND CONGLOMERATE

Sandstone and conglomerate were sold or produced by 20 companies at 28 operations in 18



*Limestone quarry in Union County operated by Shelly Materials, Inc.*

Ohio counties during 1999. Sales totaled 2.8 million tons, a 51 percent decrease from 1998. The large decrease is related to the near-completion of a landfill and wetlands system at American Electric Power's Gavin coal-fired power plant in Gallia County; this operation used large amounts of sandstone in 1998. Five counties accounted for 91 percent of the total sales of sandstone and conglomerate: Geauga (935,000 tons), Gallia (694,000 tons), Perry (554,000 tons), Knox (176,000 tons), and Pike (160,000 tons). Sales of crushed sandstone and conglomerate totaled 2.7 million tons. Dimension-sandstone production increased 8 percent to 45,000 tons. Ohio ranks 3rd nationally in the production of sandstone dimension stone. Best Sand Corp. (891,000 tons) and Beaver Excavating, Inc. (694,000 tons) led in sandstone and conglomerate sales.

The total value of sandstone and conglomerate sold in Ohio during 1999 was \$41.5 million. Average price per ton was \$14.05 for crushed stone and \$76.59 for dimension stone. The mining of sandstone and conglomerate in Ohio directly employed 283 persons during 1999. Ohio's crushed sandstone and conglomerate were used primarily for glassmaking and construction; the majority of the sandstone dimension stone was used for rough construction.



*Road construction is the major use for Ohio sand and gravel and crushed stone.*

## CLAY

Clay was produced by 48 companies at 57 operations in 28 Ohio counties during 1999. Clay sales (including material for captive use within the company) totaled 3.1 million tons, a 44 percent increase over 1999. Tuscarawas (550,000 tons), Wayne (421,000 tons), Hamilton (366,000 tons), Perry (327,000 tons), and Ottawa (227,000 tons) Counties accounted for 61 percent of the total clay sales in Ohio during 1999. Mt. Eaton Reclamation (410,000 tons), Rumpke Mountain Mining Co. (366,000 tons), Suburban South Recycling and Disposal Facility (289,000 tons), and Belden Brick Co. (256,000 tons) led in clay sales. Ohio ranks 5th in the nation in the production of clay and shale.

The total value of clay sold in Ohio (including material for captive use) during 1999 was \$12.9 million. Average price per ton was \$4.16. The mining of Ohio clay directly employed 176 people in 1999. The major uses of Ohio clay and shale in 1999 were as landfill liners and in the manufacture of common clay products such as bricks.

## SHALE

Shale was produced by 19 companies at 26 operations in 15 Ohio counties during 1999. Shale sales (including material for captive use within the company) totaled 4.1 million tons, a 3 percent increase over 1999. Hamilton (2.0 million tons), Stark (665,000 tons), Tuscarawas (552,000 tons), Cuyahoga (323,000 tons), and Marion (209,000 tons) Counties accounted for more than 93 percent of the total shale sold in Ohio during 1999. Rumpke Mountain Mining Co. (2.0 million tons), American Landfill, Inc. (665,000 tons), Hydraulic Press Brick Co. (323,000 tons), and Kimble Clay & Limestone Co. (263,000 tons) led in shale sales.

The total value of shale sold in Ohio (including material for captive use) during 1999 was \$10.6 million. Average price per ton was \$2.60. The mining of Ohio shale directly employed 101 people in 1999. The major uses of Ohio shale in 1999 were as landfill liners, in the manufacture of common clay products, and for lightweight aggregate.

## GYPSUM

Gypsum was produced by one company (Celotex Corp.) at one operation in Ottawa County. Production and sales totaled 295,000 tons, a 15 percent increase from 1998. All material was for captive use in Celotex's wallboard-production plant. The mining of gypsum employed 7 people in 1999. Celotex installed a new separating drum in the float department and more efficient screening to increase gypsum recovery. The total value of gypsum sold in 1999 was more than \$2.7 million. Average price per ton was \$9.00.

## PEAT

Peat was produced by four companies at four operations in three Ohio counties during 1999. Sales totaled 9,200 tons and had a value of \$73,000. Average price per ton was \$7.92. No employment information is available. Peat in Ohio is used primarily for mulch and soil mixture.

## OIL AND GAS

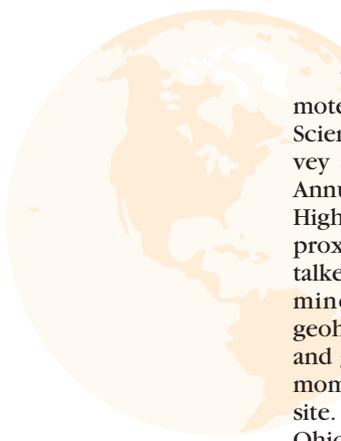
Oil and gas wells were drilled in 38 Ohio counties in 1999. The Division of Mineral Resources Management estimates 499 wells were actually drilled in 1999, a decrease of 18 wells from 1998; 437 well completions were reported. The top five counties in number of new wells completed in 1999 were Ashtabula (50 wells), Washington (48 wells), Stark (33 wells), Muskingum (32 wells), and Wayne (24 wells). The Silurian "Clinton" sandstone (176 wells) and the Cambrian-Ordovician Rose Run sandstone (88 wells) and "Trempealeau" dolomite (54 wells) were the most actively drilled geologic horizons in 1999.

The total reported crude oil production in Ohio in 1999 was 6.0 million barrels, a 9 percent decrease from 1998. The value of crude oil produced in Ohio in 1998 was \$96.7 million, an increase of 26 percent.

Natural gas production in Ohio in 1999 was 103.5 billion cubic feet, a 5 percent decrease from 1998. The value of gas produced in Ohio in 1999 was \$249.1 million, an increase of 2.5 percent from 1998.

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## Earth Science Week 2000 a success

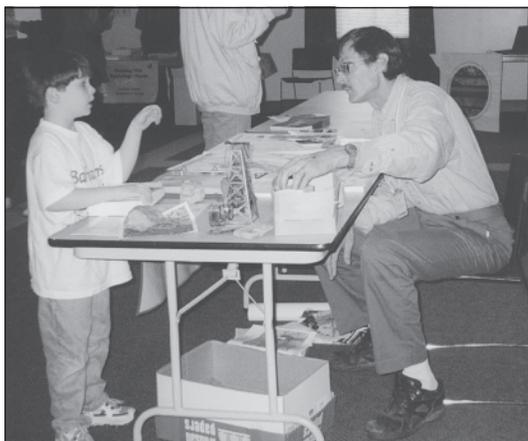


The Ohio Division of Geological Survey promoted a number of events in celebration of Earth Science Week 2000, October 8-14. Geological Survey staff members were on hand for the Third Annual Earth Sciences Expo on October 8 at Highbanks Metropark in Delaware County. Approximately 350 park visitors viewed displays and talked to staff geologists on such topics as Ohio minerals, Ohio fossils, economic geology, geohazards, topographic maps, and the bedrock and glacial geology of Ohio. An operational seismometer from the OhioSeis network also was on site. Representatives from other divisions of the Ohio Department of Natural Resources, the U.S.

Geological Survey, the Ohio Section of the American Institute of Professional Geologists, the Orton Geological Museum at The Ohio State University, the Delaware and Franklin Soil & Water Conservation Districts, as well as Metroparks staff members also participated in the Earth Sciences Expo.

Survey geologists made two evening presentations on Ohio geology at the Highbanks Metropark Nature Center. Mac Swinford spoke on "The bedrock and glacial geology of Ohio" and Mike Hansen spoke on "Earthquakes in Ohio."

The Ohio Section of the American Institute of Professional Geologists organized three one-hour walking tours to explore the rocks used for build-



Survey geologist Mark Baranowski explains oil and gas production to a young visitor at the Earth Sciences Expo.



Participants on the Cincinnati building stones tour check grain size of the wall in Fountain Square with the guidance of R.A. Davis (standing left).

ing stones in three Ohio cities. The field trips were based on the series of guidebooks published in the early 1990's by the Survey, and the Survey provided descriptive brochures for the three trips. The tours were:

- "Building stones in the vicinity of Capitol Square, Columbus, Ohio," led by Garry D. McKenzie and Dale Gnidovec of The Ohio State University;
- "Building stones in the vicinity of Public Square,

Cleveland, Ohio," led by Joe Hannibal of the Cleveland Museum of Natural History; and

- "Building stones in the vicinity of Fountain Square, Cincinnati, Ohio," led by R. A. Davis of the College of Mount St. Joseph.

The brochures prepared for the field trips are available in PDF format on the Survey's Web site: <[http://www.dnr.state.oh.us/odnr/geo\\_survey/new/esciweek.htm](http://www.dnr.state.oh.us/odnr/geo_survey/new/esciweek.htm)>

## **Benjamin H. Richard receives Mather Medal**

Dr. Benjamin H. Richard, Emeritus Professor of Geology in the Department of Geological Sciences at Wright State University, is the most recent recipient of the Mather Medal Award of the Ohio Geological Survey. On October 20, 2000, more than 40 colleagues gathered in Columbus for the award ceremony and banquet. The Mather Medal is awarded periodically by the Division of Geological Survey in recognition of lifelong contributions to the knowledge of the geology of Ohio. The award is named in honor of William W. Mather, the first State Geologist of Ohio (1837-1838). The medal was first awarded as part of the Survey's sesquicentennial celebration in 1987. Dr. Richard is the 13th recipient.

Over his 37-year teaching career, Ben Richard has trained of hundreds of geologists and made exemplary contributions to the understanding of Ohio's geology. Dr. Richard is widely known for his expertise in the fields of geophysics, hydrogeology, and environmental geology. He has served in a consulting or advisory role for dozens of private and public companies, government agencies, and citizen groups.

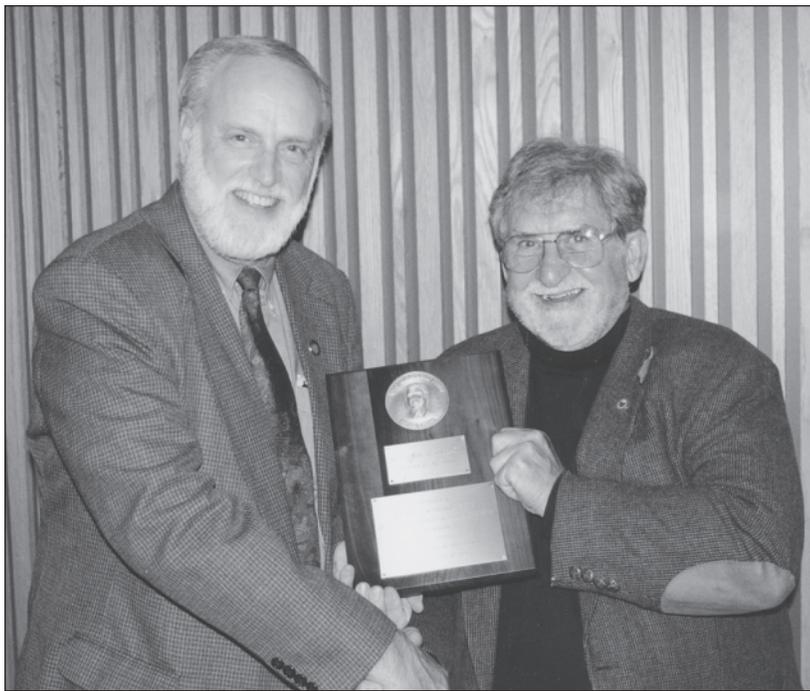
Ben Richard was born in Phoenixville, Pennsylvania, about 20 miles northwest of Philadelphia, in the shadow of Valley Forge National Historical Park. He grew up in a pre-Revolutionary War house in the picturesque community of Schwenksville, Pennsylvania, north of Philadelphia. Ben's love for music led him to join the marching band while attending Muhlenberg College, in Allentown, Penn-

sylvania. Ben and his Muhlenberg marching-band colleagues were selected to play in President Harry S Truman's inaugural parade in January 1949.

Ben Richard's teaching career began as he served his country during the Korean War. He was stationed at Fort Leonard Wood Army Base, Missouri, and trained enlisted men in the finer points of driving military trucks. After the war, Ben enrolled in Virginia Polytechnic Institute, graduating with a Bachelor of Science degree in 1958. He returned to the Midwest and attended Indiana University for his graduate studies, completing a Master of Science degree in 1961 and a doctoral degree in 1966. His multidisciplinary approach to solving geologic problems was highlighted in his dissertation, which described the geologic history of the intermontane basins of the Jefferson Island quadrangle in Montana.

Ben Richard's professional career began when he joined the faculty of Wittenberg University in 1962. He quickly perfected a dynamic teaching style that emphasized geology as a frontier science that has boundless opportunities for discovery. To challenge his students, he frequently departed from his prepared lecture notes to emphasize what geologists don't know, pointing out areas for additional thought and future research. His passion for geology and the science's limitless opportunities influenced countless students to consider and later become geology majors and professionals.

Dr. Richard's career at Wittenberg ended in



*Benjamin H. Richard accepts the Mather Medal Award from Division Chief Thomas M. Berg.*

1966 as he followed one of those limitless opportunities he so often spoke about. That opportunity was the birth of Wright State University in Fairborn, Ohio. He was one of the founding fathers that developed a geology department distinctly different from the many established geology departments throughout Ohio. His goal was to develop an applied geology program focusing on geophysics and hydrogeology that prepared students to enter the workforce and immediately become productive employees. Realizing that students also needed to look at rocks in the field in order to understand the many nuances of geology, he was instrumental in establishing one of the few geology field camps east of the Mississippi River.

Over the years, Ben and his colleagues built the Wright State University Geology Program into a nationally recognized program for excellence. Graduates are employed throughout the nation and world in industry, government, and education.

Dr. Richard's research career exemplifies his beliefs that geology is a science of endless possi-

bilities. His research interests span the geologic column, ranging from the Precambrian rift systems of Ohio to mapping of the buried preglacial Teays River System. He has studied the Knox unconformity in Morrow County, researched the geophysics of Pennsylvanian coal seams in eastern Ohio, and conducted geologic and geophysical studies of Cedar Bog State Memorial in Champaign County.

However, Ben never lost sight of the primary objective of educating the students of Wright State. He truly enjoyed being with the students, making sure to be personally involved with their education and research. The freedom he gave students to learn from their mistakes occasionally had a down side. Ben will never forget that phone call in the middle of the night concerning Cedar Bog State Memorial. The caller informed Ben that the bog had just blown up! When Ben arrived on the scene, he discovered a truck-size crater. As the story goes, some students, who will remain nameless, were using dynamite as an energy source for the geophysical investigation of the Mad River buried valley. The procedure called for about 1/2 a stick of dynamite per hole. It was getting late, the students were tired and hungry, and the storage magazine was just too far away. Three sticks down the hole might make a slightly larger hole but who would know? Well, when the commotion died down, everyone within earshot knew!! Fortunately, some skillful diplomacy by Ben defused a tense situation, and two loads of gravel healed the scar.

Ben stepped down from full-time teaching at Wright State in 1999. He remains active in the department and continues with his geological and geophysical consulting in the Dayton area. In his spare time, he continues his long-time passion for snow skiing by working as a member of the ski patrol and ski instructor at Mad River Mountain ski area.

Ben has been a good friend of the Survey, and many staff members have had the honor of working with him on collaborative studies. Ben's contribution to the understanding of Ohio's geology is exemplary, and his accomplishments speak for themselves. Ohio's geology has an active ambassador in Ben Richard, the 2000 Mather Medal recipient.

*—Gregory A. Schumacher and  
Merrienne Hackathorn*

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## Ohio Journal of Science celebrates its centennial

The December 2000 issue of The Ohio Journal of Science marked 100 years of publication for the journal. Volume 1, no. 1, was published in November 1900. The journal was originally called the O.S.U. Naturalist. The title became The Ohio Naturalist in 1901, The Ohio Naturalist and Journal of Science in 1914, and The Ohio Journal of Science in 1915. The Journal's publisher, The Ohio Academy of Science, was founded in 1891. Prior to the establishment of its own journal, members of the Academy were encouraged to publish articles in the Bulletin of the Ohio Agricultural Experiment

Station and the Journal of the Cincinnati Society of Natural History.

The geology of Ohio has been an important topic for the Academy and the Journal from the beginning. Edward Orton, who was State Geologist from 1882 to 1899, was president of the Academy in 1893. In its Proceedings for 1893, the Academy published a report of the Boulder Committee, submitted by Committee chairman G. F. Wright. The purpose of this committee was to attempt systematic collection and determination of the origin of glacial erratics. J. A. Bownocker,

who was State Geologist from 1906 to 1928, was on the first advisory board for the Journal and published an article on the Corning oil and gas field in volume 1 (no. 4). The June/September 2000 issue of the Ohio Journal of Science was a special issue on fractures in glacial tills.

The history of the Journal is detailed in "A centennial history of *The Ohio Journal of Science*," by William R. Burk, in the December 2000 issue. According to Burk, "The Journal has developed from an Ohio natural history serial to an interdis-

iplinary science journal of international use and respect. Copies are sent to 1900 individuals and organizations, including 37 foreign countries."

The 110th Annual Meeting of the Ohio Academy of Science will be held March 30-April 1, 2001, at Mount Union College in Alliance. For more information contact the Ohio Academy of Science, 1500 West Third Avenue, Suite 223, Columbus OH 43212-2817; phone or fax: 614-488-2228 (outside 614 toll free: 800-OHIOSCI); e-mail: oas@iwaynet.net; Web site: <<http://www.OHIOSCI.org>>.



## Madge Fitak Survey Employee of the Year for 2000

Madge R. Fitak, Office Assistant in the Geologic Records Center, received the Employee of the Year award for 2000. Division Chief Thomas M. Berg presented Madge with a plaque recognizing her achievement at the Division's annual Christmas luncheon and awards ceremony. Madge was chosen as the 2000 recipient by a special committee selected to review nominations submitted by fellow staff members.

Madge's positive attitude, professionalism, and exemplary customer service are often noted in the numerous customer comments received by the Division. Madge extends these qualities when dealing with other Division staff members and is always willing to assist when needed. Because of this attitude, she has accepted various additional assignments, including "permanent volunteer" as the Division's representative for Operation Feed, an annual ODNR food drive for area food banks. Madge has a very extensive knowledge of all the records that she deals with, such as oil and gas well cards, geophysical logs, abandoned underground-coal-mine maps and data, Division publications, and topographic maps.

Madge is originally from Erie, Pennsylvania, and began working for the Division in 1973 after graduating from Mount Union College in Alliance, Ohio, with a B.S. degree in Geology. Madge was Head of the Public Service Section and supervisor of the Department's Publication Center when she left state service in 1986. Madge returned to the Division in 1994, working part-time in the Geologic Records Center, and accepted a full-time



*Madge Fitak receives Employee of the Year award from Division Chief Thomas M. Berg.*

position in the Geologic Records Center in 1995.

Madge is married, has three children, and resides in Westerville. When not working at the Division, Madge enjoys being involved with her children's school and sports activities and singing in her church choir. She also enjoys collecting music boxes and cooking—staff members gladly enjoy the results of the latter activity.

—Garry E. Yates



## Resources of the Middle Kittanning (No. 6) coal

The Middle Kittanning coal bed, known commercially in Ohio as the No. 6, is one of the most extensively mined coals in the state, both historically and spatially. Surface and deep mining during 1999 produced over 2.3 million short tons of Middle Kittanning coal, ranking it 4th of the 17 coals reported mined. Moreover, cumulative production from 1946 to 1998 totaled more than 360 million tons, ranking it second behind the Pittsburgh coal in overall statewide production. However, despite the importance of this coal, the most recent compre-

hensive resource assessment for the Middle Kittanning was performed almost 50 years ago.

Recently, the Division of Geological Survey entered into a cooperative agreement with the U.S. Geological Survey to evaluate, on a statewide basis, the coal resources for the Middle Kittanning coal as part of the federal Coal Availability program. This investigation focused on calculating how much Middle Kittanning coal remains for future development. Numerous variables were considered, including thickness and spatial distri-

bution of the Middle Kittanning coal, current mining practices and constraints, the extent of previous mining, types of cultural land use, and technological restrictions that affect coal recovery. Extensive core drilling by the Division of Geological Survey over the past 25 years has greatly expanded the subsurface database on deep coal beds in Ohio. These and other newly acquired data permitted a more accurate resource assessment for the Middle Kittanning, particularly in areas where previous investigations lacked data.

The Middle Kittanning coal-resource investigation used ArcView, a Geographic Information System (GIS) designed by ESRI (Environmental System Research Institute) for personal-computer systems. This technology permitted efficient management of data and rapid completion of the various maps and data queries necessary to complete a coal-resource investigation of this magnitude. The Middle Kittanning investigation is the first coal-resource assessment to use ArcView and only the second GIS-based coal-resource investigation conducted by the Division.

Results of this new assessment indicate Ohio had an original coal-resource base of 21.2 billion short tons of Middle Kittanning coal. This figure is 119 percent greater than the previous resource estimate conducted by the Division of Geological Survey. Surface and deep mining through the years has removed approximately 8 percent of the original resource base, leaving slightly more than 19.6 billion short tons of coal. Land-use and technological restrictions, such as major federal and state highways, population centers, railroads, parks, and coal considered too deep for mining, further reduced the remaining resource base by approximately 29 percent. Thus, on the basis of the established parameters of this resource assessment, Ohio has slightly more than 13.9 billion short tons of Middle Kittanning coal remaining for future development.

Of the 13.9 billion short tons of remaining coal, only 3.2 billion short tons, or about 23 percent, are within 200 feet of the surface. Future exploitation of the Middle Kittanning coal has the greatest potential where the coal is 200 to

1,000 feet below the surface; approximately 10.7 billion short tons of coal remain statewide in these regions.

Summaries of the resource calculations as well as structure-contour and isopach maps of the Middle Kittanning coal produced for this assessment are on open file at the Division of Geological Survey. These items may be purchased by contacting the Division's Geologic Records Center at 614-265-6576. For more information on the Coal Availability project, contact Ernie Slucher at 614-265-6627, e mail: [ernie.slucher@dnr.state.oh.us](mailto:ernie.slucher@dnr.state.oh.us).

—E. R. Slucher

#### FURTHER READING

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## Ohio Geology

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