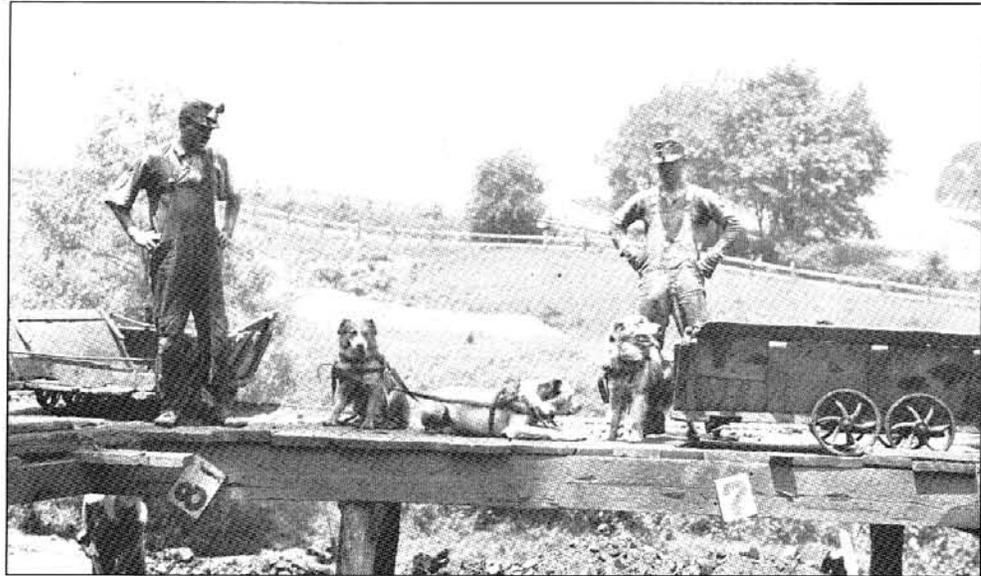


Ohio Geology

Division of Geological Survey

MINE DOGS *by Michael C. Hansen*

Three dogs hitched in tandem at a Middle Kittanning coal mine on the property of Lewis Fisher in Wayne Township, Muskingum County. Photo by Wilber Stout, 1917.



In the days before mechanization, hauling coal from the working face in an underground mine to the surface was a difficult proposition. In drift or slope mines, in which the mine entry was a horizontal or sloping tunnel, low, wheeled cars were used to transport coal to the surface on tracks made of iron or even wood. At the surface, the coal was trimmed and weighed and each miner credited with the tonnage he had produced.

Sometimes miners pushed and pulled the loaded mine cars to the surface with only their own muscle power, but more commonly a variety of livestock was used to haul the mine cars. Horses, mules, oxen, and even goats were widely used as beasts of burden in this task. Many people may be surprised to learn that "man's best friend," the dog, was also used to haul coal in some Ohio mines in the late 1800's and early 1900's.

Not only are dogs strong, loyal, intelligent, easily trained, and devoted to the task assigned by a human master, but they also have an additional attribute that made them particularly qualified for hauling coal from many mines—they are built low to the ground. Many small mines extracted coal from seams that were barely 3 feet thick. A miner could stoop over or even lie on his back to cut, load, and haul coal from the mine, but horses, oxen, and mules cannot be trained to perform such gyrations in order to haul a fully loaded coal car. Even large dogs, however, can work comfortably in a mine with a ceiling less than 4 feet above the floor.

Wilber Stout, who was State Geologist of Ohio from 1928 to 1946, noted in his 1918 bulletin on the geology of Muskingum County that dogs were used to haul coal

from a Middle Kittanning (No. 6) coal mine operated by William A. Werner on the property of Lewis Fisher in Wayne Township. This coal seam was about 3 feet thick. Stout took two photographs of dogs hauling coal from this mine and used one of them in the Muskingum County bulletin. Both photos are reproduced in this article.

Stout noted that dogs were used to haul coal from other mines in Wayne Township, Muskingum County. He further noted that dogs were used in many low-ceilinged mines in the Lower Kittanning and Middle Kittanning coals in the vicinity of Zanesville.

James W. Haughee, District Mine Inspector from Nelsonville, gave insight into the use of dogs to haul coal from Muskingum County mines in a brief paper presented to the Ohio Institute of Mining Engineers. This paper was printed in the *Ohio Mining Journal* in 1890.

Haughee noted that the dogs were easily trained to pull coal cars and could pull about half the load that a man could push. The Blue Rock mine in Muskingum County employed 18 miners and 30 dogs. Two dogs were used to pull the loaded coal car while one miner pushed.

The treatment of the dogs was deplored by Haughee, who observed that many of the animals appeared to be underfed and to have sore feet. A miner was charged 50 cents per week for the dog's board and Haughee indicated that he never saw the miners give extra food to the dogs. Haughee's sympathy for the mine dogs and their plight is suggested by the following:

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A MESSAGE FROM DIRECTOR SOMMER

The Division of Geological Survey represents the oldest program among all of our Divisions. We celebrated the 150th Anniversary of the Survey in 1987. In spite of its age and accomplishments, it is still one of the least known and understood of all DNR operations. The work of the Division is of great value to Ohio business and industry. Every citizen of this state is a recipient of the benefits derived through the programs of this Division, yet few are aware of its role.

During the five and one-half years that I have served as Director at ODNR, I believe we have been able to focus more attention on the Division and expand its activities. We were very fortunate to secure a Geologist of Tom Berg's stature to replace Horace Collins. I believe that Tom's broad experience and dedication have motivated the staff and advanced the Survey. Relations with the academic community have been substantially improved. The Ohio Survey is gaining positive recognition on a national level. Good relations with Ohio industry continue through open communication and timely response.

The creation of an Ohio Geology Advisory Council is a major accomplishment and should be of great benefit to the Division in the future.

If the Division is to continue to progress and provide the services necessary to meet the challenges of the 21st century, there must be an ongoing effort to educate not only the public in general, but especially the members of the Ohio General Assembly on the importance of its programs. Hopefully, through greater awareness they will be moved to provide the necessary funding that will be required in the future.

As I complete my tenure as Director of this Department, I take pride in the accomplishments that we have achieved in the Division of Geological Survey. This has only been possible through the strong support and cooperation of the many dedicated professionals who work in the Division. I believe we have set a course for progress and a standard of achievement that will not only be followed, but expanded by the new administration in the years ahead.



Joseph J. Sommer, Director
Department of Natural Resources

OHIO GEOLOGY

A newsletter published quarterly by the Ohio Department Natural Resources, Division of Geological Survey, 4383 Fountain Square Drive, Columbus, Ohio 43224-1362. Telephone (614) 265-6576 (Voice) or (614) 265-6994 (TDD).

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News items, notices of meetings, etc. should be addressed to the attention of the editor. Change of address and new subscriptions should be addressed to the attention of the secretary.

We have become a nation with an incredibly voracious energy appetite. Quite obviously, energy conservation and energy efficiency must be integral to a national energy strategy. U.S. Secretary of Energy James Watkins predicts that in about 50 years, nuclear fusion will be the primary new source of energy; it will be clean and unlimited. For the immediate future, however, fossil fuels will be the backbone of our energy economy. And—if we are also to become energy independent and invulnerable to political instability in petroleum-producing nations—part of our national energy strategy must include providing for investigations that identify the location, quantity, and quality of our vast coal resources. Furthermore, the strategy must give equal emphasis to clean-coal technologies that reduce carbon dioxide emissions along with sulfur dioxide and nitrogen oxide.

The Ohio Division of Geological Survey plays a pivotal role in the present and future development of the state's coal resources. Two of our sections devote a very large amount of time to coal investigations. The Regional Geology Section, directed by Dennis N. Hull, prepares geologic maps showing the outcrop lines and structure contours of the coals in eastern Ohio. The Regional Geology Section also maintains an extensive file of maps showing mined-out areas, along with voluminous files of stratigraphic information from measured sections and drill holes. The new state geologic map project, supported in part by the U.S. Geological Survey's COGEMAP Program, will provide maps showing the structure and distribution of all the coal-bearing formations. The Survey's drilling program, coordinated by Douglas L. Crowell, provides subsurface information and core samples that are used by staff geologists to map the coal seams and build the coal-quality database

FROM THE STATE GEOLOGIST . . . by Thomas M. Berg

NATIONAL ENERGY STRATEGY AND OHIO'S COAL GEOLOGY

In the Summer 1990 issue of *Ohio Geology*, I stressed the need for a national energy strategy that recognizes the important role of domestic oil and gas and the need for statewide geologic investigations to locate and characterize remaining hydrocarbon resources. I also emphasized the need for a strategy that enlarges our capability to utilize our rich coal deposits.

In developing a national energy strategy, we need to be bold enough to look as far into the future as possible. I have three beautiful granddaughters, and have other grandchildren on the way. I fully expect to live to see great-grandchildren, and I want to be a partner in giving them a

world at peace with an acceptable quality of life that is environmentally balanced. The United States must confront the issue of energy independence! Concurrently, we must seriously confront the issue of global warming. *Our nation pumps more carbon dioxide into the atmosphere than any other nation.* At the same time, we import nearly 9 million barrels of crude oil and petroleum products every day! Petroleum accounts for nearly 44 percent of our energy consumption, while coal accounts for nearly 23 percent. Natural gas provides about 22 percent of our energy, and hydroelectric and nuclear sources provide the remainder.

needed by industry.

The Mineral Resources and Geochemistry Section, managed by David A. Stith, has the responsibility of building and maintaining the Ohio portion of the National Coal Resources Data System (NCRDS) of the U.S. Geological Survey. Richard W. Carlton is the principal investigator for Ohio's coal database, and is also in charge of the Survey's coal reserve-base revision being prepared for the U.S. Department of Energy. The USGS-NCRDS project provides every participating state with the capability of quickly calculating coal resources. The system is in fact a geographic information system (GIS) that can generate a completely new series of maps showing coal thicknesses, overburden thicknesses, interburden characteristics, and trends for sulfur, heat value, ash content, trace elements, roof quality, and many other related properties.

Sherry W. Lopez, mineral statistician in the Mineral Resources and Geochemistry Section, prepares the annual *Report on Ohio Mineral Industries*, which contains

valuable information on coal production. Her report also provides statistics on all the industrial minerals of Ohio, including the carbonate rocks which will assuredly play an increasingly important role in the utilization of Ohio coal through the development of fluidized-bed technology.

The USGS Branch of Coal Geology, directed by Harold J. Gluskoter, has been working for several years on an ambitious project in the central Appalachians called "Coal Availability." The Coal Availability Program involves detailed investigations in coal-producing areas that provide our citizens and coal producers with far more realistic analyses of available coal resources than traditional methods. For a given area, the program assesses available coal resources, taking into consideration all of the demographic, geographic, economic, and environmental constraints and barriers to coal mining. The U.S. Congress has now appropriated sufficient funds to expand the program into the northern Appalachian Basin, including Ohio. We

look forward to working with the USGS on this project.

The Ohio Geological Survey is currently planning a comprehensive investigation of the state's abundant limestone and dolomite resources. The Survey plans to identify the location, quality, and quantity of these carbonate rocks, particularly in regard to acid-mitigation capability. If the State expects to utilize its high-sulfur coals, much more limestone and dolomite will be needed, and specifications will become tighter and tighter.

Your State Geological Survey has made a big commitment to coal, and expects to continue that commitment. Our programs of geologic mapping and resource investigation are now more sharply focused on the nonexclusive goals of energy independence and environmental improvement. The challenge is great, but our staff are anxious to meet the challenge. We hope that Ohio's citizens, policy-makers, and mineral producers are willing to make the fiscal commitment necessary to achieve these goals.

continued from page 1

... but if the pull gets a little hard, he will stop and bark or whine; in this case, when pulling a loaded car, they are badly used by the miner. The dog is tricky and will play off when an opportunity presents itself. When in front of the car where he cannot be seen by the man behind who is pushing, I have noticed the dog with his head down panting and pretending to pull very hard when his traces would be slack; of course their feet get very sore, and by this way of shirking they save themselves and suffer less pain, and you can't blame the dog.

Perhaps the most detailed account of the use of dogs to haul coal in Ohio was provided by Wallace H. Higgins through a series of interviews with former coal miner William H. "Daddy Bob" Baughman in the mid-1950's. Higgins summarized the information on the use of dogs in Ohio coal mines in a 1958 article entitled *Mine dogs and dog miners*, published by the Ross County Historical Society as part of the Ohio Valley Folklore Research Project.

"Daddy Bob" Baughman, who was born at Philo, Muskingum County, in 1861 and died in 1957, moved with his family to the town of McLuney in Harrison Township, Perry County, in 1873. In 1877, at the age of 16, he began work as a coal miner at the Tague Mine near McLuney. This was a drift mine in the Middle Kittanning coal, which ranged from 36 to 42 inches in thickness in this mine. According to Baughman, dogs were used to transport coal out of the mine in cars that ran on wooden tracks. The practice of using dogs as haul



Three dogs in tandem pulling a loaded coal car from a Middle Kittanning coal mine on the property of Lewis Fisher in Wayne Township, Muskingum County. There does not appear to be a miner assisting the dogs by pushing on the rear of the coal car. Photo by Wilber Stout, 1917.

animals continued at this mine until 1884.

Higgins summary of "Daddy Bob's" recollections of the use of dogs at the Tague Mine is given below.

Each miner had his own dog. The dog was hitched to the car and pulled it while the miner pushed from behind. The dog was attached to the car by a collar and harness with "tugs" of leather or chain hooked to a singletree. A good set of dog harness and collar cost about \$3.00. A pretty good singletree could be made out of a pick handle. A lazy dog could "back his rump up agin' the car and let the miner do all the

work." But many a good dog would take hold of roots and sticks with his teeth to help pull the steep places. A few of the strongest dogs could move a car by themselves.

While the miner was loading, the dog was unhitched and was free to roam. When the miner replaced the end board, the well-trained dog knew it was time to go to work and would come up, wagging his tail, and stand waiting to be "hitched up." Sometimes a man bound for the tippie with a load met another coming in empty. If the dogs were quarrelsome there would be a bit of free entertainment. Some breed of shepherd dog trained best in the



Unidentified mine near Zanesville, Muskingum County, circa 1900. From this photograph it appears that a single dog was used to haul a loaded coal car. The coal was then transferred from the coal car to a horse-drawn wagon for transport. Photo from the collection of Don Nunley, Glouster, Ohio, through the courtesy of the Ohio Historical Society.

mine. "Daddy Bob" remembered having two dogs. One was called "Shep" and another, which was part "bird dog," was called "Butch."

The life of a mine dog must certainly have been difficult, but perhaps no less so than that of a coal miner. It is apparent from Baughman's account that a miner and his dog shared more or less equally in the task of hauling coal out of the mine. The miner had the added tasks of cutting and loading the coal. The following narrative from "Daddy Bob" Baughman is indicative of the dangers and difficulties in the early days of underground coal mining.

One time I was workin' late; there was no one else in the mine, they havin' quit and gone home. The dog and I were wheelin' out the last car. I was pushin' hard with my shoulder when

the car jumped the track and the metal brace on the side jammed my head tight agin' the "rib" and held it there. Well sir, I hollered myself hoarse and the dog yelped and howled, but there wasn't anybody to hear us. Somehow I got loose, my head and face all streamin' with blood, unhitched the dog and we both got home. I don't rightly know to this day how it happened.

Baughman indicated that a mine car for hauling coal was 18 to 20 inches high, 6 feet or more in length, and had a capacity of 10 to 12 bushels of coal (about one-half ton). He noted that 40 bushels of coal dug and hauled to the tippel at the surface was considered a fair day's work, although some miners were capable of digging and hauling up to 100 bushels per day.

After the coal had been transported to the surface it was dumped and weighed

by the "weigh boss." Baughman related that the miner yelled to the weigh boss for the weight of his hard-won load of coal and usually "cussed the weighman for a damned thief when he got it." Miners were paid about 40 to 50 cents per ton (20 bushels of coal represents about one ton) for coal mined and transported to the surface.

Although Baughman's recollections indicate use of a single dog pulling, in conjunction with a miner pushing, it is apparent from existing photos of these "dog-mine operations" that up to three dogs were sometimes used in tandem. Most of these dogs in the photos appear to be large, stout-bodied, mixed breeds of shepherd or hound origin.

Human partnership with and affection for dogs is of ancient origin, perhaps nearly as old as either species. For a brief period in Ohio history this partnership was instrumental in producing coal from a number of mines in the state.

ACKNOWLEDGMENTS

We are indebted to Don Nunley of Glouster, Ohio, and Elizabeth Reeb of the Ohio Historical Society for one of the photos in this article. Horace R. Collins, former Chief of the Survey, provided the reference to the paper by Haughee.

The Division of Geological Survey would be interested in additional information, photographs, or accounts on the use of dogs or other animals in Ohio coal mines. Loaned photographs will be promptly copied and returned to the owner.

FURTHER READING

- Haughee, J. W., 1890, Dog mines of Muskingum County: Ohio Mining Journal, Whole No. 19, p. 93-95.
 Higgins, W. W., 1958, Mine dogs and dog miners: Ross County Historical Society, Ohio Valley Folklore Project, 6 p.

EARTH DAY MONUMENT DEDICATED

In commemoration of the 20th anniversary of Earth Day, the Survey erected a monument of Ohio building stones at the Ohio Department of Natural Resources Fountain Square complex. The intent of the monument is to emphasize the importance of geology and industrial minerals to Ohio's citizens and to promote wise use of these materials for the benefit of our society.

The monument was dedicated in ceremonies held on April 27, 1990, as part of ODNR's celebration of Earth Day. Before the capstone was placed on the monument, Ohio Governor Richard F. Celeste and ODNR Assistant Director Charles E.

Mauger placed a time capsule into the hollow core of the monument. The capsule contains more than 60 items contributed by each division of the Department of Natural Resources. These items include brochures, photographs, memorabilia such as patches and pins, audio and video tapes, and examples of both environmentally good and bad items such as a recyclable can and a styrofoam cup. The capsule is to be opened on Earth Day 2040.

A ginkgo tree was planted adjacent to the monument as part of the dedication ceremony. This species of tree, commonly called a "living fossil," was chosen because of its long geologic history. Ginkgoes first

appeared late in the Permian Period and flourished during the Mesozoic Era along with dinosaurs.

The monument was designed by Linda M. Gaertner and Dr. Garry D. McKenzie of The Ohio State University and Dennis N. Hull of the Survey. Ohio building stones were used in the construction and represent many of the principal geologic units quarried in the state. The monument was built by stonemason Ralph F. Styers of Columbus.

Nearly all materials and services for the monument were donated by Ohio industrial-mineral operators and contractors. Robert A. Wilkinson, Managing Director



Governor Richard F. Celeste (right) and Ohio Department of Natural Resources Assistant Director Charles E. Mauger (left) placing time capsule in the Earth Day monument on April 27, 1990. The capsule is to be opened on Earth Day, 2040.

of the Ohio Aggregates Association, coordinated construction activities and contributed in many other ways to the project. Dennis N. Hull, Head of the Regional Geology Section, and David A. Stith, Head of the Mineral Resources and Geochemistry Section, obtained the stone, assisted in the design, and coordinated most aspects of the monument.

At least some readers of *Ohio Geology* will be active in 2040. The Division of Geological Survey invites you to the opening of the time capsule in that year.

ODNR CALENDAR

The popular Ohio Department of Natural Resources calendar is now available for 1991. The 13-month calendar features color photographs of some of Ohio's scenic getaways, including Hocking Hills State Park and the Lake Erie shoreline. Also provided, on separate pages at the end of the calendar, are location maps and lists of state forests, nature preserves, parks, public boating areas, and public hunting and fishing areas. Each list includes the location of the area, available facilities, activities, and other pertinent information.

The 1991 ODNR calendar is available for \$4.00, which includes tax and mailing, from Publications Center, Ohio Department of Natural Resources, 4383 Fountain Square Drive, Columbus, OH 43224-1362.

OHIO GEOLOGY ADVISORY COUNCIL



Ohio Geology Advisory Council members at the Survey's Lake Erie office in Sandusky. Left to right, Michael Puskarich, Robert Wilkinson, Thomas Lewis, Arie Janssens, Scott Bair, Barry Maynard, and Thomas Berg, Chief of the Division of Geological Survey. Linda Aller was unavailable for the photo.

Governor Richard F. Celeste recently appointed a seven-member Ohio Geology Advisory Council to advise the Chief of the Division of Geological Survey. The Council will recommend policy and legislation with respect to geology, resource analysis, and management in order to promote the economic and industrial development of the state while minimizing threats to the natural environment.

The Council also will review and make recommendations on programs and plans for comprehensive, long-term geologic mapping in Ohio and promote cooperation among governmental agencies having an interest in Ohio geology in order to encourage wise use and management of the geology and mineral resources of the state.

Initially, three of the appointments are for a term of one year, three are for a term of two years, and one is for a term of three years. At the conclusion of these terms, appointments will be for a period of three years. Any member may be re-appointed. Not more than four members may be from the same political party. Members serve without compensation except for reimbursement of expenses incurred in the performance of their duties. The chairman of the Ohio Geology Advisory Council also serves as a member of

the Recreation and Resources Commission of the Ohio Department of Natural Resources.

The following individuals were appointed to the Council by Governor Celeste:

- Ms. Linda K. Aller, Geodyssey, Inc. — representing Environmental Geology
- Dr. E. Scott Bair, The Ohio State University — representing Hydrogeology
- Dr. Arie Janssens, Consulting Geologist — representing Oil and Gas
- Dr. Thomas L. Lewis, Cleveland State University — representing Higher Education
- Dr. J. Barry Maynard, University of Cincinnati — representing At-Large Citizens.
- Mr. Michael T. Puskarich, Cravat Coal Co. — representing Coal
- Mr. Robert A. Wilkinson, Ohio Aggregates Association — representing Industrial Minerals.

The first quarterly meeting of the Ohio Geology Advisory Council was held on September 12, 1990, at Fountain Square. Council members toured the Survey facilities, met staff, and were briefed on Survey history, goals, programs, and problems. Arie Janssens was elected chairman of the Council and Robert Wilkinson was elected vice chairman.

NEW PUBLICATIONS LIST AVAILABLE

The Division of Geological Survey has issued a new *List of publications and open file materials*. This list is comprehensive and includes both in-print and out-of-print Survey publications and an index to topographic map coverage of the state. Single copies of the *List of publications* are available at no charge from the Survey.

REPORT ON WARREN COUNTY DEEP CORE AVAILABLE

Information on the 5,370-foot-deep core completed by the Survey in 1989 in Warren County (see *Ohio Geology*, Summer 1989) has been published in Ohio Division of Geological Survey Information Circular No. 56, *Lithologic and geophysical description of a continuously cored hole in Warren County, Ohio, including description of the Middle Run Formation (Precam-*

brian?) and a seismic profile across the core site. The report was authored by Survey geologists Douglas L. Shrake, E. Mac Swinford, and Lawrence H. Wickstrom and Paul J. Wolfe and Benjamin H. Richard (Wright State University), Paul E. Potter (University of Cincinnati), and Gary W. Sitler (Stocker & Sitler, Inc.).

This 11-page report includes drilling information, description of seismic methods, and description of a new stratigraphic unit, the Middle Run Formation. Appendixes detail hydrocarbon shows and fluorescence and lithologic description of the core. Two plates show geophysical logs and a lithologic column for the core and unmigrated, migrated, and migrated and interpreted profiles of the seismic line run in the vicinity of the core.

This core hole has created interest among geologists because it is one of the deepest continuously cored holes in the eastern U.S., and because of the new sedimentary rock unit that was discovered below the Cambrian Mount Simon Sandstone. The Mount Simon traditionally has been thought to be the sedimentary unit that rests directly on Precambrian crystalline basement rock. The Middle Run Formation appears to be a sandstone that was deposited in a basin, possibly a rift basin, that formed in late Precambrian or early Cambrian time. This basin may have potential for hydrocarbons or could be used for subsurface storage. On the basis of this discovery, the Ohio Geological Survey has formed the Cincinnati Arch Consortium with the geological surveys of Indiana and Kentucky and interested petroleum companies to study the geology of this and similar features in the tristate area (see accompanying article).

Copies of Information Circular No. 56 are available from the Survey for \$10.21, including tax and mailing.

MATHER MEDAL AWARDED TO JANE L. FORSYTH

In ceremonies held at The Ohio State University Faculty Club on October 15, 1990, Dr. Jane L. Forsyth, Professor of Geology at Bowling Green State University, was awarded the Mather Medal of the Ohio Geological Survey. This award recognizes significant, lifelong contributions to the knowledge of the geology of Ohio and is named after Ohio's first State Geologist, William W. Mather (1837-1838).

The medal was presented by Division Chief and State Geologist Thomas M. Berg at a special dinner held in conjunction with the Bownocker Lectures, sponsored by the Department of Geology and Mineralogy of The Ohio State University.

Albert W. Bally of Rice University was the Bownocker Lecturer and an honored guest at the Mather Medal dinner.

The Mather Medalist is selected by the Mather Medal Committee of the Survey from nominations submitted by Survey staff. The 1990 Mather Medal Committee is composed of Michael C. Hansen, Chairman, C. Scott Brockman, Philip J. Celnar, Merrienne Hackathorn, and E. Mac Swinford. Previous recipients of the Mather Medal are Myron T. Sturgeon (1987), Richard P. Goldthwait (1989), and George W. White (1989).



Dr. Jane L. Forsyth receives Mather Medal from Thomas M. Berg, State Geologist of Ohio.

Dr. Jane L. Forsyth was awarded the Mather Medal for her significant contributions to the Pleistocene geology of Ohio during a career spanning more than 35 years. In addition, Dr. Forsyth was cited for her tireless efforts to share the excitement of Ohio geology with the public through numerous publications, lectures, and field trips.

Dr. Forsyth began her Ohio career in geology in 1943 when she enrolled in the graduate program at the University of Cincinnati after receiving a bachelor's degree from Smith College. In 1946 she received a master's degree after completing a thesis on Ordovician rocks in the Cincinnati area.

After several years in various parts of the United States, Dr. Forsyth returned to Ohio to begin work on a Ph.D. at The Ohio State University. Her dissertation, under the direction of Dr. Richard P. Goldthwait, was on the glacial geology of

Logan and Shelby Counties and was completed in 1956.

While completing her dissertation, Jane began a 10-year period of employment with the Division of Geological Survey researching and mapping Pleistocene geology. As she noted in her remarks after receiving the Mather Medal, a position researching Pleistocene geology was almost unique at that time and was referred to by some as "cow pasture" geology. However, as State Geologist Thomas M. Berg observed in his presentation of the Mather Medal, two-thirds of the surface of Ohio is covered by glacial sediments and perhaps 90 percent of the state's population live in this area. The importance of Pleistocene geology is reflected by the fact that Dr. Forsyth is the third-in-a-row Mather Medalist that has specialized in Pleistocene geology.

During her tenure at the Division of Geological Survey, Dr. Forsyth published reports on beach ridges, radiocarbon dating, and glacial maps of Knox, Licking, and Fairfield Counties and quadrangle maps in the area of the Bellefontaine outlier. She was also a co-author, with Mather Medalists Richard P. Goldthwait and George W. White, of the *Glacial map of Ohio*, published by the U.S. Geological Survey in 1961. Dr. Forsyth also has published numerous papers in scientific journals and a marvelous series of articles on Ohio geology in nontechnical publications.

In 1965 Dr. Forsyth left the Survey for a professorship at Bowling Green State University. During her long tenure at Bowling Green she has continued her research on the Pleistocene geology of Ohio and maintained an active program of lectures and field trips for nongeologists. For many years she has taught a course on the geology of Ohio. In addition, she has had numerous graduate students complete theses on Pleistocene problems in Ohio.

Dr. Forsyth also has been active in many geological and environmentally oriented organizations. From 1964 through 1973 she served as editor of the *Ohio Journal of Science*. While editor, she produced not only a quality publication but also authored a number of geological papers in the journal.

Jane L. Forsyth can be characterized as a well-rounded naturalist in the traditional sense. Her orientation towards field work and an interest in the relationships between geology and other disciplines has led her to studies of botany and soil science. Although her geological specialty is glacial geology, Dr. Forsyth has authored papers on various aspects of bedrock geol-

ogy pertaining to most of the geologic systems exposed in the state and on the development of the landscape.

The career efforts of Dr. Jane L. Forsyth have directly touched thousands of Ohioans and indirectly benefitted millions. She has been a driving force in many aspects of Ohio geology for more than three decades and an integral part of the development of Pleistocene geology in the state. She is affectionately and respectfully known to many of her colleagues as the "Queen of the Pleistocene," an appellation bestowed upon her for her dominance and leadership in this field of endeavor. The Division of Geological Survey is honored to have Dr. Jane L. Forsyth as a Mather Medalist.

—Michael C. Hansen

CARLTON RECEIVES AWARD



Dr. Richard W. Carlton receives Professional Recognition Award from ODNR Director Joseph J. Sommer and Division Chief Thomas M. Berg.

Dr. Richard W. Carlton, Senior Geologist in the Mineral Resources and Geochemistry Section, received the Professional Recognition Award at the Ohio Department of Natural Resources Director's Awards ceremony, held on October 11, 1990, at Fountain Square. Dick was introduced by Division Chief Thomas M. Berg and the award was presented by ODNR Director Joseph J. Sommer.

Dick began his career at the Survey in 1970 after receiving B.S. and M.S. degrees in geology from Washington State University and a Ph.D. in geology from Oregon State University. Dick's primary specialty is petrography and he has worked on a variety of projects including potential uses of Ohio clays, mineralogy of Devonian shales, and pyrite distribution in Ohio coals. Currently, Dick is working in cooperation with the U.S. Geological Survey on the Ohio sector of the National Coal Resources Data System.

Dick's professional expertise, dedication, and ambition are respected by his colleagues at the Survey. The award has special meaning to Dick because he was nominated and selected by his peers in the Department of Natural Resources.

CINCINNATI ARCH CONSORTIUM

The Ohio Geological Survey has entered into a cooperative agreement with the Indiana and Kentucky Geological Surveys to investigate the origin and dimensions of the pre-Mount Simon basin in the tristate area. The investigation is a joint industry-government effort known as the Cincinnati Arch Consortium (CAC). The consortium is an outgrowth of considerable interest from both the scientific community and industry in the Cincinnati Arch area. This intense interest is a result of the discovery of a thick (greater than 4,000 feet) sequence of sandstone below the Cambrian Mount Simon Sandstone in a 5,370-foot-deep core hole completed in 1989 by the Ohio Geological Survey in Warren County.

Arkla Exploration Co., BP Exploration, Inc., CNG Development Co., and Shell-Western Exploration and Production, Inc., have provided in-kind funding to the three geological surveys

to support this study. Amoco Production Co. is providing detailed analyses from a variety of tests on the core from this hole. Principal investigators for the project are Lawrence H. Wickstrom (Ohio Geological Survey), James Drahovzal (Kentucky Geological Survey), and Brian Keith (Indiana Geological Survey).

The project is scheduled for completion by July 31, 1991, and will examine all existing seismic and drill-hole data, prepare maps of Precambrian through Ordovician strata, and reinterpret gravity and magnetic surveys for the tristate area. Once the results of the initial study are evaluated, additional funding may be pursued in order to acquire new exploration surveys and, possibly, to drill additional test holes.

—Lawrence H. Wickstrom
Subsurface Stratigraphy and
Petroleum Geology Section

OHIO'S MINERAL INDUSTRIES TEACHERS WORKSHOP: GETTING SEASONED AND GETTING BETTER

Can we mine our economical mineral resources, reclaim the land, and have subsequent environmentally sound land use? That and many more questions on Ohio's mineral resources were answered during the fourth Ohio's Mineral Industries Teachers Workshop. The workshop was conducted by the Division of Geological Survey and the University of Akron July 9-13, 1990, at the ODNR Fountain Square complex in Columbus. Grants from the Ohio Aggregates Association, the Ohio Mining and Reclamation Association, the Ohio Oil and Gas Association, the Northern Ohio Geological Society, and the Ohio Chapter of Women in Mining paid for field-trip costs and educational materials.

The workshop familiarizes the teachers with Ohio geology, the importance of Ohio's fuel and nonfuel mineral industries, and how environmental protection can be compatible with mining economic mineral resources. Teachers deal daily with young people who will be in control of the future. These young people must be knowledgeable in subjects affecting the Earth, such as earth science and geology. By educating the teachers on these subjects, our future decision-makers are being educated.

This year 23 elementary through high school teachers earned two graduate credit hours for the workshop. Two days of presentations by experienced professionals from research, industry, and state and federal regulatory agencies provided a variety of information on the economics, regulations, uses, and geologic origin of Ohio's mineral resources. Three days of field trips gave the teachers a firsthand look at the operations of various mineral industries. The first field trip to central and southeastern Ohio included an overnight stay at Burr Oak State

Park Lodge in Morgan County. The teachers visited Waterloo Coal Co., Inc., in Jackson County, where they viewed coal strip mining, limestone and clay mining, and reclamation activities. Lunch was provided by Waterloo Coal Co., Inc. Afternoon activities included visiting the Ohio Historical Society's Buckeye Furnace State Memorial, a reconstructed charcoal-iron furnace that operated in the 1800's in Jackson County. Next, a stop at an abandoned coal-mine site clearly demonstrated the need for reclamation procedures. The last activity of the first day was a tour of American Electric Power's Southern Ohio Coal Co.'s coal-preparation plant in Meigs County—the largest coal-preparation plant in North America.

On the second day of the first field trip the teachers met with a geologist from W. E. Shrider



Teachers observing coal strip-mining operation at Waterloo Coal Co., Inc., Jackson County, during the 1990 Ohio's Mineral Industries Teachers Workshop.

Co., an oil and gas firm, at a working oil and gas pump and holding tanks in Perry County. The teachers learned the mechanics of drilling for oil and gas along with the economics of the industry and environmental concerns. The group then toured Central Silica Co.'s sandstone quarry, reclamation operation, site of their new quarry, and their glass-sand processing plant in Perry County. Lunch was provided by Central Silica Co. The day ended with a tour of the brick plant, shale pile, and brick artwork of the Bowerston Shale Co. in Licking County.

The second field trip was in central and southwestern Ohio. The teachers were scheduled to tour a limestone quarry and sand and gravel pit of American Aggregates Corp. and visit one of their reclaimed sites in Franklin County. However, heavy rains made the tour of the limestone quarry unique and wet, and forced the cancellation of the tour of the sand and gravel pit. Workshop participants also visited Anderson Concrete Corp.'s portland-cement concrete mixing plant in Franklin County, but again heavy rains cancelled the tour of Bituminous Concrete Corp.'s asphaltic-concrete mixing plant. The last stop of the day was at Caesar Creek State Park, in Warren County, where the teachers were given a presentation on earth science educational tools by the U.S. Army Corps of Engineers before they set their sights on collecting fossils. Not even the heavy rains could keep these dedicated

fossil collectors from crawling on their hands and knees in the mud to search for trilobites and various other Ordovician-age fossils.

The intent of the workshop is to open the eyes of the teachers, and therefore their students, to the economic need for Ohio's mineral resources and the responsible way these resources are being extracted in Ohio. All citizens rely on the science of geology and consume mineral resources daily. Mining is a necessary human activity. The land being mined can be reclaimed to be compatible with farming, grazing, commercial and residential development, or recreation. The overwhelming interest and enthusiasm expressed by the group during the week, along with the numerous thank-you letters, indicate that our efforts were successful. It was a very educational and enjoyable five days.

The Survey is grateful to all of the teachers that attended the workshop this year for their patience, interest, and good humor throughout the workshop and the wet field trips! The many excellent suggestions received during the week for future workshops are also appreciated. Details regarding the 1991 Ohio's Mineral Industries Teachers Workshop will be included in the winter issue of *Ohio Geology*.

—Sherry W. Lopez
Mineral Resources and
Geochemistry Section

QUARTERLY MINERAL SALES, APRIL—MAY—JUNE 1990

compiled by Sherry W. Lopez

Commodity	Tonnage sold this quarter ¹	Number of mines reporting sales ¹	Value of tonnage sold ¹ (dollars)
Coal	7,227,919	151	\$215,144,212
Limestone/dolomite ²	11,964,557	93 ³	44,980,215
Sand and gravel ²	10,266,957	196 ³	35,932,951
Salt	888,589	5 ⁴	8,173,841
Sandstone/conglomerate ²	425,352	21 ³	7,403,962
Clay ²	234,513	20 ³	832,529
Shale ²	298,825	17 ³	426,925
Gypsum ²	48,318	1	459,021
Peat	7,192	1	34,872

¹These figures are preliminary and subject to change.
²Tonnage sold and Value of tonnage sold include material used for captive purposes. Number of mines reporting sales includes mines producing material for captive use only.
³Includes some mines which are producing multiple commodities.
⁴Includes solution mining.

NEW STRATIGRAPHIC CHART AVAILABLE

The Survey recently released a revised *Generalized column of bedrock units in Ohio*. This 11-inch by 17-inch single-page chart portrays the major bedrock units in Ohio and is divided into four columns reflecting the four quadrants of the state. Dennis N. Hull, Head of the Regional Geology Section, was chief compiler of the chart. Single copies of this chart are available at no charge from the Survey.

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