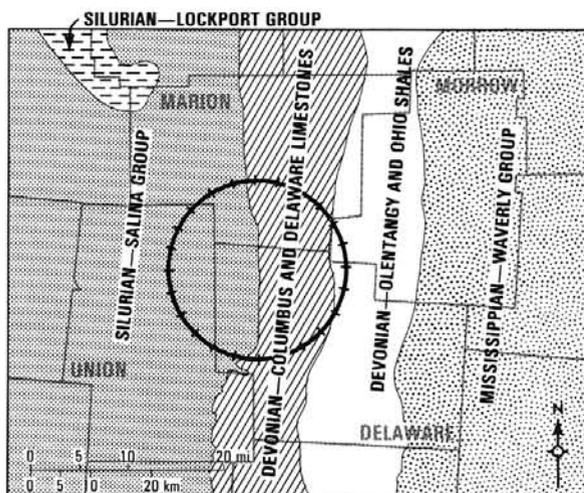


## OHIO MAKES BID FOR SSC

by Michael C. Hansen



Geologic map of the proposed SSC site area in north-central Ohio. The 53-mile circumference ring is depicted on the map for illustrative purposes. The actual shape of the ring may vary and its precise location within this area will be decided when geologic data now being gathered by Survey geologists and other information are analyzed.

The Division of Geological Survey is playing an integral role in Ohio's bid to land the U.S. Department of Energy's Superconducting Super Collider (SSC) project. The SSC proposed by the Department of Energy would be the largest, most powerful particle accelerator ever built and would enable physicists to shatter protons into their constituent subatomic particles in order to study the basic structure of the atom.

The proposed SSC would utilize a 10-foot diameter tunnel, with a circumference of 53 miles, located at a depth of approximately 150 feet beneath the ground surface. Supercooled electromagnets would guide protons at nearly the speed of light around the racetrack-like tunnel.

At least 20 states are expected to submit proposals to the U.S. Department of Energy by August, 1987 in an attempt to land the \$4.2 billion SSC project. Competition for the project is keen because the stakes are high. Estimates are that 3,000 construction jobs would be created during a six-year construction phase of the project; operation of the SSC would require between 3,000 and 6,000 high-tech employees; high-tech industries would be attracted to the area of the SSC site; direct taxes to the state on

salaries of SSC workers would total more than \$400 million throughout the 30-year life of the project and local governments and school districts would benefit from the increased tax base.

Certain requirements, such as locating the SSC near a major metropolitan area that offers housing, a major university, cultural, and other human needs and an international airport, are requirements that can be met by most states. Final selection of site may depend to a great degree on the local geology. Economical construction of the SSC tunnel which, for comparison, is approximately the same circumference as the outerbelt (Interstate 270) that surrounds Columbus, will require easily tunneled bedrock, few faults or other geologic structures, low earthquake potential, and minimal problems with ground water.

Preliminary geologic analysis in 1985 of potential sites for the SSC in Ohio by Survey geologists indicated that north-central Ohio, north of Columbus, offered nearly ideal geologic conditions and was the most geologically suitable site in the state near a major metropolitan area with an international airport. In addition, this largely agricultural area, encompassing parts of Delaware, Marion, Morrow, and Union Counties, has a relatively low population density. Although the SSC ring will have only minimal disruption of the land surface, and that only in areas where access shafts and main research facilities are located, it is desirable that the ring not pass beneath densely populated areas because of the complexities of acquisition of right-of-way.

With presidential approval of the SSC project in January 1987, the State of Ohio authorized spending



Division of Geological Survey's Mobile B-61 core-drilling rig drilling the first of 16 core holes for the SSC project. Perry Stone Co. quarry in the Columbus Limestone (Devonian) near Radnor, Delaware County.

continued on next page

As many of our newsletter readers probably know, the Division of Geological Survey also operates the Publications Center of the Ohio Department of Natural Resources. The Geological Survey "inherited" this function because we are the largest single distributor of publications and related materials in the Department. Approximately one half of all material distributed by the Department of Natural Resources consists of geologic records, reports, and maps.

The staff of the Publications Center handles 15,000 walk-in, 19,000 telephone, and 36,000 mail-in customers each year. The Center's staff of four are responsible for assisting these citizens and distributing more than 300,000 publications a year. The Publications Center staff must be familiar with more than 2,500 different maps, pamphlets, technical reports, and miscellaneous items available through the Department of Natural Resources. These include such diverse items as fishing, hunting, and boating licenses along with camping permits, T-shirts, and bronze trilobite paper weights.

Many citizens also need to be referred to one of the Department's seventeen operating Divisions or Offices for assistance with one or more of the Department of Natural Resources' many programs. Being familiar with the complexities of the Department is no small task in itself.

The Geological Survey is proud of the reputation it has developed through its Publications Center staff in handling citizens requests. Many requests are handled within 24 hours and numerous letters complimenting the efficiency of the staff are received each year.

If you need publications or information on the geology of Ohio or any of the other Department of Natural Resources' divisions or offices write or call the Publications Center at Fountain Square, Building B, Columbus, Ohio 43224 or 614-265-6508. You will be assisted by four knowledgeable and dedicated employees.

### MINERAL INDUSTRY WORKSHOP

A workshop designed to familiarize educators with the geology and economic mineral resources of Ohio will be held on June 22-27, 1987 in Columbus. The workshop is sponsored by the Survey and the University of Akron. For additional information, contact Dr. Jim Jackson, University of Akron, Oak Hill Center, 3505 Oak Hill Road, Peninsula, Ohio 44264 (Telephone: 216-657-2815). Deadline for registration is June 1, 1987.

### MORROW COUNTY PHOTOGRAPHS WANTED

The Ohio Geological Society is preparing, under the direction of William Shafer, a volume of collected papers on the oil and gas boom in Morrow County, Ohio, during the 1960's. Photographs or anecdotes pertaining to this unusual episode in the history of oil and gas exploration and production in Ohio would be welcome additions to this volume. Those wishing to donate or make available for copying such photos should contact Andy Maslowski, Ohio Geological Society, P.O. Box 14322, Columbus, Ohio 43214. Telephone: 614-890-7891.

### OHIO GEOLOGY

A newsletter published quarterly by the Ohio Department of Natural Resources, Division of Geological Survey, Fountain Square, Columbus, Ohio 43224. Telephone (614) 265-6605.

Editor: Michael C. Hansen  
Secretary: Donna M. Swartz  
Layout and design: Philip J. Celnar  
Phototypist: Jean M. Leshner

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.

*continued from page 1*

\$1.25 million in order to prepare a detailed proposal to bring the SSC project to Ohio. A significant portion of the proposal will consist of detailed geologic reports on the proposed site north of Columbus. The Division of Geological Survey has been given the responsibility to develop the detailed geologic data base and, accordingly, an intensive investigation of the site area has begun.

Primary geologic investigations are focused on characterization of the bedrock and glacial geology of the area. Survey geologists are mapping and describing surface exposures of bedrock and glacial deposits in the SSC area and preparing top-of-rock and drift-thickness maps. Perhaps the most intensive portion of the geologic investigation is the drilling of 16 core holes with the Survey's two core-drilling rigs. Each hole is approximately 250 feet in depth. A similar number of holes are being drilled through glacial sediments with the Survey's auger rig. Collectively, the data derived from these drilling activities will provide a detailed picture of the SSC site for both subsurface tunneling and surface construction of research facilities.

The proposed site in north-central Ohio is, geologically, extremely favorable for development of the SSC tunnel and other facilities required for the project. The area is underlain by Silurian and Devonian carbonate rocks that present, from an engineering perspective, relatively uniform and favorable rock types for tunneling. These rocks dip gently to the east and appear to be undisturbed by faulting. The area has low potential for substantial earthquakes.

Overlying the bedrock are glacial sediments of varying thicknesses. In no portion of the area are the glacial sediments extremely thick and the proposed site appears to be undisturbed by major buried valleys. Such valleys could create problems with ground water if the tunnel were to intersect them.

It is the objective of the investigation by the Division of Geological Survey to provide a detailed picture of the site geology by core drilling, surface mapping, and analysis of records from water wells and oil and gas wells. Such detail will enhance the potential of the Ohio site in the national selection process. The Ohio SSC site has to be considered one of the frontrunners not only because of favorable cultural features but also because the geology of the proposed site is nearly ideal. Final selection of the SSC site will be made in July 1988.

## SESSUICENTENNIAL BANQUET AND OPEN HOUSE

Nearly 300 friends, staff, and supporters of the Division of Geological Survey attended the Sesquicentennial Banquet celebrating the 150th anniversary of legislative authorization of the Survey in 1837. The date of the banquet, March 27th, is the actual day on which the legislation was signed. Resolutions from the Ohio Senate and House of Representatives and a proclamation from Governor Richard F. Celeste were issued in commemoration of the Survey's Sesquicentennial and displayed at the open house and banquet.

During the afternoon of March 27 an open house was held at the Survey. More than 200 people attended this event and had the opportunity to examine Survey facilities and discuss Survey projects with the staff. To a person, all staff members enthusiastically got everything in order and greeted the many guests that took the tour. Some geologists, in an effort to make the offices look "neat," discovered their desk surfaces for the first time in several years!



*Dallas L. Peck, Director of the U.S. Geological Survey, was the keynote speaker at the Division of Geological Survey's Sesquicentennial Banquet held on March 27, 1987. His address was titled "Earth science in the public service: 150 years of contributions from the Ohio Geological Survey".*

Banquet festivities featured opening remarks by Joseph J. Sommer, Director of the Ohio Department of Natural Resources, on the Survey's long history and continued service to Ohio; introduction of the Mather Medalist, Myron T. Sturgeon, by Michael C. Hansen, Survey geologist and former student of Sturgeon; presentation of the Mather Medal to Dr. Sturgeon by Horace R. Collins, Division Chief and State Geologist and also a former student of Sturgeon; response by Dr. Sturgeon; and keynote address by Dallas L. Peck, Director of the U.S. Geological Survey. Horace R. Collins served as Master of Ceremonies. Director Peck presented the Survey with a plaque commemorating the Survey's Sesquicentennial and long service to science. Chief Collins presented Director Peck with the Survey's flag.

Banquet attendees represented a wide cross section of the geologic and natural resources community in Ohio and adjacent areas. Each person who attended the banquet received a special Sesquicentennial commemorative lapel pin and a commemorative coffee mug that featured the Survey's Sesquicentennial logo and a portrait of W. W.

Mather, Ohio's first State Geologist. These mugs were coveted items at the banquet.

The Sesquicentennial Banquet presented a unique opportunity for Ohio's diverse geological community to gather



*Scenes from the Sesquicentennial Banquet.*

together to renew old friendships, make new ones, and to reflect on the century and a half of geological investigations in Ohio by the Survey. By all measures the banquet was a success. Indeed, another banquet is planned for the Bicentennial in 2037! To aid in that venture, the Sesquicentennial

Committee, consisting of Philip J. Celnar, Rene L. Fernandez, Merrienne Hackathorn, Michael C. Hansen, and Lawrence H. Wickstrom, are assembling a time capsule containing memorabilia from the Sesquicentennial and a message for the Bicentennial.



*Dignitaries at the Sesquicentennial Banquet. John J. Dragonetti, Assistant Director of the U.S. Geological Survey; Horace R. Collins, Chief of the Ohio Division of Geological Survey; Dallas L. Peck, Director of the U.S. Geological Survey; Joseph J. Sommer, Director of the Ohio Department of Natural Resources.*

#### STURGEON RECEIVES MATHER MEDAL

Dr. Myron T. Sturgeon, professor emeritus of geology at Ohio University, Athens, received the W. W. Mather Medal in ceremonies held at the Survey's Sesquicentennial Banquet on March 27, 1987, in Columbus. This award recognizes significant, lifelong contributions to the knowledge of the geology of Ohio and contributions to the mission of the Division of Geological Survey. It is named for and inspired by Ohio's first State Geologist, William Williams Mather.

Sturgeon, a native of Salem, Ohio, received a bachelor's degree from Mt. Union College, Alliance, in 1931 and M.S. and Ph.D. degrees from The Ohio State University in 1933 and 1936, respectively. His thesis and dissertation for these degrees dealt with the geology and paleontology of Pennsylvanian rocks of eastern Ohio, topics that have been lifelong interests of Dr. Sturgeon. He began his teaching career in 1937 at what is now Eastern Michigan University and in 1946 moved to Ohio University, where he continued teaching geology until his retirement in 1978. Dr. Sturgeon maintains office and research facilities in the Department of Geological Sciences at Ohio University and is still actively pursuing his research on Ohio geology.

Dr. Sturgeon has authored or coauthored more than 60 scholarly works on Ohio geology and paleontology, including two major monographs on Pennsylvanian invertebrate fossils. These two works were coauthored with Dr. Richard D. Hoare of Bowling Green State University and were published by the Division of Geological Survey. An additional volume in this series (on Pennsylvanian cephalopods) is currently being edited for publication by the Survey. Sturgeon's 600-page bulletin on the geology and mineral resources of Athens County, Ohio, published by the Survey in 1958, has been termed one of the most comprehensive county geologic reports on any county in the United States.

The collection of Pennsylvanian fossils from eastern Ohio,

systematically assembled by Sturgeon and his students during more than a half century of collecting, numbers more than 70,000 specimens from more than 500 collecting localities. This collection of fossils, one of the finest of its kind in the United States, has formed the basis for numerous papers by Sturgeon and his students and colleagues. The entire collection is to be eventually repositied in Orton Museum at The Ohio State University.



*Dr. Myron T. Sturgeon, professor emeritus of geology, Ohio University, receives the W. W. Mather Medal from State Geologist Horace R. Collins at the Sesquicentennial Banquet on March 27, 1987.*

Myron T. Sturgeon has been a research associate of the Division of Geological Survey since 1935 when, while still a student at The Ohio State University, he served as a part-time Survey assistant to State Geologist Wilber Stout. He has continued this research association under State Geologists George White, John Melvin, Ralph Bernhagen, and Horace Collins—in effect, half of the 10 State Geologists that have served Ohio since 1837. Dr. Sturgeon's areas of focus for the Survey have ranged from the Sharon sandstone and abandoned coal mines in northeastern Ohio to Pennsylvanian rocks and fossils in eastern Ohio. A direct benefit to the Survey of the continued work by Dr. Sturgeon and his students has been the contribution of numerous measured stratigraphic sections to the Survey files.

From 1955 to 1975 Dr. Sturgeon served on the Natural Resources Commission, an advisory board to the Ohio Department of Natural Resources, and was chairman of this group during the last three years of his term. In 1979 he was elected to the Ohio Conservation Hall of Fame for his numerous contributions to natural resources in Ohio. In 1977, Sturgeon received the Orton Award, honoring outstanding alumni, from the Department of Geology and Mineralogy of The Ohio State University.

This long list of achievements in Ohio geology by Dr. Myron T. Sturgeon is ample testimony to his qualifications for selection as the first recipient of the Mather Medal. His persistence and dedication to deciphering the geology of his native state has left a legacy of knowledge for future generations of geologists. As an example of Dr. Sturgeon's modesty and humor, during his acceptance speech for the Mather Medal he indicated that many previous investigators of Ohio geology, including John Newberry, Edward Orton, John Bownocker, and Wilber Stout, had contributed more than he had; however, he has one advantage over them—he is still alive!

—Michael C. Hansen

## HIGH WATER CREATES PROBLEMS ON LAKE ERIE SHORE

Record-high lake levels on Lake Erie are again creating havoc on the Ohio shoreline. The actual stillwater high-lake levels have by themselves created problems for shoreline property owners. The flooding of docks, farm land, and low building sites has caused some hardship. Reduction of clearance under bridges has been a problem for some marinas. The level of wetted material on the bluffs has increased, slightly increasing the potential for erosion of the shore, and protective beaches have been partly submerged.

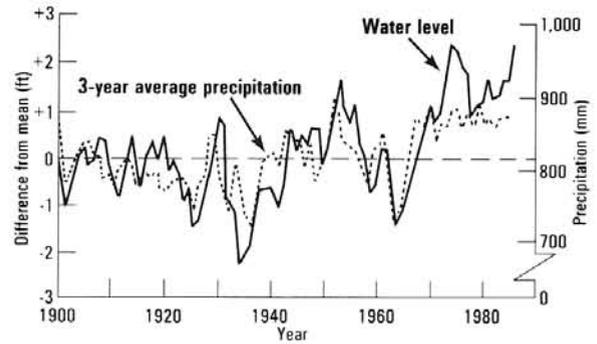
The continuing high lake levels have also been a source of both aggravation and fear for some shoreline residents. Sand bags wrapped in sheets of plastic, installed in desperate attempts to control flooding, are becoming a way of life for a number of property owners in Lake Erie's western basin. Installation of expensive shore-protection structures or relocating houses have become the only alternatives for a number of property owners along the remainder of the shore.



Damage from waves and flooding in Rye Beach, Huron County, after the storm of December 1, 1986.

Little comfort can be gained from the knowledge that the Great Lakes' levels are controlled by natural variations in climate and weather and by the hydraulics of the lakes and connecting channels. Human activities can slightly influence these factors in the Great Lakes system, but we are far from being able to control them. Even on the two Great Lakes with "limited regulation" (Superior and Ontario), the ability to successfully keep them within their target range of levels is thwarted by natural occurrences.

Fluctuations in lake levels can be grouped into three categories: long term, annual, and short term. Long-term levels are controlled primarily by the climate over the Great Lakes Basin. On Lake Erie, the range of the long-term variations during the 127 years of continuous records is slightly more than 5 feet, when considering annual averages. Annual levels are related to the yearly variations in precipitation, runoff, evaporation, temperature, etc. The Lake Erie monthly averages have an annual range of about 1.6 feet from the late winter low to the early summer high. Short-term water-level changes are the only ones that do not represent a change in the volume of water in the lake. These changes are caused by meteorological events. The storms which cause the largest variations in water levels have winds which come from the southwest or northeast and continue blowing for a number of hours along the axis of the lake. Storm-induced differences in water levels (wind setup) between the two ends of Lake Erie as great as 16 feet have been

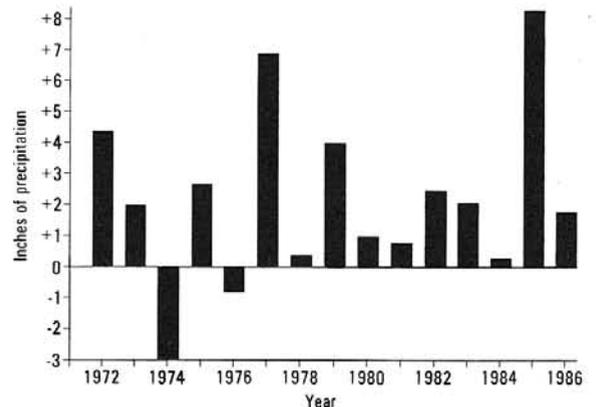


Annual Lake Erie water levels, 1900-1979, and average precipitation. (National Oceanic and Atmospheric Administration).

recorded.

Water-volume changes in a lake occur when the inflow and outflow are not balanced. Because lakes are large and outlets are relatively small, the high and low lake levels caused by volume changes linger for a long time following the event which caused them. For the present high-lake-level situation, if water supplies return to "normal," it would still take six to ten years for Lake Erie to return to the long-term average levels.

The greatest danger in the long-term high lake levels is that the critical levels for erosion and flooding can be reached more easily by smaller, less intense (and more frequent) storms. Damage at a time of higher lake levels can occur from storm surges which would be harmless during lower levels. Also, deeper water, close to shore, allows larger waves to break nearer to shore, in turn allowing even more energy to reach the shore. Accelerated erosion and increased damage due to flooding have been the calling card of the high water. The situation is not expected to improve in 1987; higher (by a couple of inches) summer levels than last year have been predicted.



Precipitation, compared to normal (0) in the Great Lakes Basin for the period 1972 through 1986. (U.S. Army Corps of Engineers).

The cause of the high levels is primarily continued above-normal precipitation in the Great Lakes drainage basin. Average precipitation for the upper Great Lakes over the last 10 years has been 5 to 10 percent above the long-term average, with precipitation in individual years for individual lakes running as high as 36 percent above normal. The above-average precipitation, when coupled with below-normal temperatures (the 1956-1985 average temperature was 1.5°F lower than the previous 25 years), has reduced evapotranspir-

ation of moisture by vegetation, increased runoff, and, therefore, also increased the net basin water supply.

Understanding how lake levels are measured may help to understand the confusing array of numbers which commonly accompany discussions of lake levels. The level of Lake Erie is measured as the difference between the stillwater level (without waves) and some standard elevation (datum). One of the two commonly used datums for the lake is the International Great Lakes Datum (IGLD), which is mean sea level at Father Point, Quebec, as measured in 1955. Using this datum, Great Lakes levels are reported in feet above IGLD (1955) and range from 568 to 574 feet. The other common datum is low water datum (LWD), which is an arbitrary level, set for Lake Erie at 568.6 feet above IGLD (1955). Using this datum, levels are measured in feet or inches from this plane in space. Low water datum is commonly used because it lets people work with small positive numbers. It is also called "chart datum" on the navigation charts used by boaters. The level of a storm surge is commonly reported in feet above or below a reference level. Common reference levels are: (1) "recent levels" which were not affected by the storm, (2) long-term or historic levels, or (3) low water datum.

Lake Erie shoreline property owners should be prepared for continued high water (summer highs of 4.5 to 5.0 feet above LWD). At these high lake levels even storm surges caused by the frequent small storms can do damage to lakeshore property. When and if we return to "average conditions" of temperature and rainfall, the high-water situation will continue for a few years until a new equilibrium of net basin supply can be reached.

—Jonathan A. Fuller  
Lake Erie Section

**1986 EMPLOYEE OF THE YEAR**



Merrienne Hackathorn, Survey geologist and editor, receives the Division's "Employee of the year" award from Division Chief Horace R. Collins.

Merrienne Hackathorn, geologist and editor in the Technical Publications Section, was the recipient of the Survey's 1986 "Employee of the Year" award in ceremonies held at the Division's annual employee Christmas gathering. This award recognizes superior efforts and contributions by an employee and carries particular significance because honorees are selected from nominations submitted by fellow employees.

Merrienne began her career with the Survey in 1973 as an assistant editor after receiving a B.S. degree in biology and an

M.S. degree in geology from Bowling Green State University. She has the enormous task of editing all Survey reports and maps for style and accuracy and seeing all publications through the production process to final camera-ready copy. Her geologic knowledge has been a tremendous asset to insure that Survey authors employ proper terminology and meet the level of excellence that has come to be expected from Survey publications. At one time or another, Merrienne's editorial skills have saved most Survey authors from major errors or inconsistencies. Merrienne also has the uncanny knack to spot typographical and other small errors that commonly escape the notice of most of us.

In addition to such exemplary professional skills Merrienne commonly volunteers for committee and special project work. She frequently organizes retirement, "going away," and other Survey employee social gatherings.

Merrienne is originally from Norwalk and now resides in the Columbus suburb of Worthington with her husband.

**HIGH-CALCIUM LIMESTONE AND NATURAL GAS IN SOUTHWESTERN OHIO**

A new Division of Geological Survey publication, *Supplemental core investigations for high-calcium limestones in western Ohio and discussion of natural gas and stratigraphic relationships in the Middle to Upper Ordovician rocks of southwestern Ohio*, Report of Investigations No. 132, by David A. Stith, Head of the Survey's Geochemistry Section, provides additional data on the occurrence of high-calcium limestones in western Ohio. Four cores drilled by one of the Survey's core-drilling rigs indicated the presence of substantial resources of high-calcium (greater than 95% CaCO<sub>3</sub>) and high-carbonate (greater than 95% CaCO<sub>3</sub> plus MgCO<sub>3</sub>) limestone.

A core in Defiance County, in northwestern Ohio, indicated a 22-foot thickness of high-calcium limestone in the Dundee Limestone (Devonian). The Carntown unit of the Black River Group (Ordovician) yielded 68 feet of high-carbonate stone from a core in Butler County and a 59-foot



thickness of high-carbonate stone from two cores in Clermont County.

A surprising discovery made during the course of drilling these cores was the presence of natural gas at all three sites in southwestern Ohio. Although the gas, from Upper Ordovician rocks in the shallow subsurface, was low pressure in two core holes, the third one, in Franklin Township, Clermont County, encountered strong gas pressure in marker bed  $\Delta$  and in the Oregon correlative in the Black River Group. Gas pressure in this hole was sufficient to blow a gas and water plume 60 feet into the air for a period of several days.

Report of Investigations No. 132 is available for \$3.00 plus tax and mailing (\$3.92 total). Please order from: ODNR, Division of Geological Survey, Fountain Square, Building B, Columbus, Ohio 43224.

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### AAPG MEETING TO BE HELD IN COLUMBUS

The Eastern Section of the American Association of Petroleum Geologists will hold their annual meeting at the Marriott North in Columbus on October 7-10, 1987. The Ohio Geological Society will host the meeting. According to William M. Rike, general chairman of the meeting, technical sessions will focus on the geology and mineral exploration of the Cambrian and Ordovician rocks in the eastern basins and on coal. Two short courses, one on principles of seismic exploration and a second on computer-aided analysis of geologic data, will precede the technical sessions.

Two field trips will be held on Saturday, October 10, 1987. One trip will cover the stratigraphy and depositional environments of the Cincinnati Group (Ordovician) in southwestern Ohio, and will be led by Gregory A. Schumacher, E. Mac Swinford, and Douglas L. Shrake of the Survey. The other trip will be on the geology and depositional environments of the Cuyahoga and Logan Formations (Mississippian) of central and eastern Licking County, and will be led by Kennard B. Bork and Robert J. Malcuit of Denison University. For more information on the meeting or for registration forms for non-AAPG members, please contact William M. Rike, P.O. Box 763, Worthington, OH 43085. Telephone: 614-888-6745.

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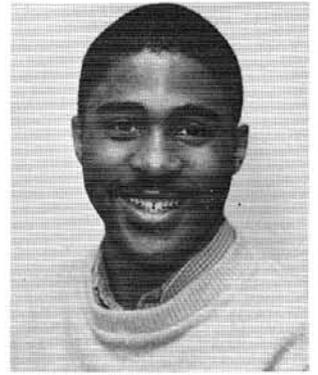
### TWO NEW SAND AND GRAVEL REPORTS RELEASED BY SURVEY

The Division of Geological Survey recently released maps and reports on the sand and gravel resources of Butler and Columbiana Counties. These publications are part of the continuing series of county maps in the statewide county mapping program of the Survey. The maps depict the distribution of sand and gravel deposits on a topographic base map at a scale of 1:62,500. Each map is accompanied by a text that describes the origin and distribution of the sand and gravel deposits. Tables giving resource estimates by township, size analyses, and pebble counts from selected samples also are included. Columnar representations of the materials encountered by water wells and from measured sections in surface exposures of sand and gravel are also depicted on the sheet.

*Sand and gravel resources of Butler County, Ohio, Report*



Gregory A. Schumacher



Michael R. Lester

Greg Schumacher is a geologist in the Regional Geology Section and is involved in the Survey's statewide county geologic mapping program. Recently, he completed bedrock mapping of Clermont County and is now mapping in Brown County. Greg came to the Survey in 1984 after completing a B.S. degree in geology at Wright State University and an M.S. degree in geology at the University of Cincinnati.

Greg is an expert on Ordovician rocks and he has been deeply involved in stratigraphic revisions. He is also a specialist on Ordovician and Silurian echinoderms. Greg particularly enjoys the challenge of solving complex stratigraphic problems.

Originally from Kettering, Ohio, Greg now lives in Westerville and is soon to be married. He enjoys outdoor sports, such as camping and bicycling, and woodworking.

Mike Lester is a cartographer in the Technical Publications Section. He came to the Survey in 1984 after receiving a B.A. degree in visual communications technology from Bowling Green State University and working for a graphic design company. Mike has worked on a variety of Survey maps and publications and particularly enjoys the challenge presented by many of the cartographic projects undertaken by the Survey.

Mike lives in Columbus with his wife and daughter. His hobbies include basketball and tennis and he has an avid interest in cars and motorcycles.

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of Investigations No. 130, is authored by Richard A. Struble. Butler County is the third leading county in Ohio in the production of sand and gravel with an annual production of about 3 million tons per year from a resource estimated to be about 6.9 billion tons. Most of the production is from glacial outwash along the Great Miami River and its tributaries.

*Sand and gravel resources of Columbiana County, Ohio, Report of Investigations No. 131, is authored by Michele L. Risser. Only about 0.1 percent of the estimated 2.3 billion tons of sand and gravel in Columbiana County has been extracted. Although the tonnage of sand and gravel resources in the county is about equally divided in the county between outwash and kame deposits, most of the mining has taken place in the kames.*

Reports of Investigations Nos. 130 and 131 are available for \$11.00 each plus \$2.86 for tax and handling (\$13.86 total per report). Please order from: ODNR, Division of Geological Survey, Fountain Square, Building B, Columbus, Ohio 43224.

**1986 OHIO MINERAL SALES<sup>1</sup>**

compiled by Sherry L. Weisgarber

Commodity	Tonnage sold in 1986 <sup>2</sup>	Number of mines reporting sales <sup>2</sup>	Value of tonnage sold <sup>2</sup> (dollars)	Percent change of tonnage sold from 1985 <sup>2</sup>
Coal	34,897,394	314	1,100,976,112	-1
Limestone/dolomite <sup>3</sup>	40,668,316	115 <sup>4</sup>	148,207,832	+6
Sand and gravel <sup>3</sup>	33,955,033	257 <sup>4</sup>	106,097,061	+8
Salt	3,885,824	5 <sup>5</sup>	40,890,030	-10
Sandstone/conglomerate <sup>3</sup>	1,717,792	25 <sup>4</sup>	24,544,585	-17
Clay <sup>3</sup>	1,090,920	33 <sup>4</sup>	6,242,387	+13
Shale <sup>3</sup>	1,311,594	23 <sup>4</sup>	1,921,831	-1
Gypsum <sup>3</sup>	213,972	1	2,032,736	-14
Peat	17,184	3	101,544	-42

<sup>1</sup>The sums of previously reported quarterly totals may not necessarily equal the annual totals reported here owing to the receipt of additional information or corrections to previously reported figures.

<sup>2</sup>These figures are preliminary and subject to change.

<sup>3</sup>Tonnage 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.

<sup>4</sup>Includes some mines which are producing multiple commodities.

<sup>5</sup>Includes solution mining.

**QUARTERLY MINERAL SALES,  
OCTOBER—NOVEMBER—DECEMBER 1986**

compiled by Sherry L. Weisgarber

Commodity	Tonnage sold this quarter <sup>1</sup>	Number of mines reporting sales <sup>1</sup>	Value of tonnage sold <sup>1</sup> (dollars)
Coal	8,683,321	217	274,926,085
Limestone/dolomite <sup>2</sup>	9,412,569	92 <sup>3</sup>	34,333,318
Sand and gravel <sup>2</sup>	7,648,649	203 <sup>3</sup>	22,693,491
Salt	962,295	5 <sup>4</sup>	10,002,248
Sandstone/conglomerate <sup>2</sup>	349,072	21 <sup>3</sup>	5,492,259
Clay <sup>2</sup>	253,438	25 <sup>3</sup>	1,094,535
Shale <sup>2</sup>	278,955	20 <sup>3</sup>	538,013
Gypsum <sup>2</sup>	71,051	1	674,985
Peat	4,735	3	25,076

<sup>1</sup>These figures are preliminary and subject to change.

<sup>2</sup>Tonnage 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.

<sup>3</sup>Includes some mines which are producing multiple commodities.

<sup>4</sup>Includes solution mining.

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