Ohio Geology
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GYPSUM IN OHIO

by Mark E. Wolfe

Gypsum is a very common sulfate mineral, hydrous calcium sulfate ($CaSO_4 \cdot 2H_2O$), that forms principally in sedimentary rocks of chemical origin. Gypsum has unique fire-retardant and soil-conditioning properties. These properties were known to the ancient Egyptians and Romans, who used gypsum as early as 2000 B.C. The name comes from the Greek word *gyphos*, meaning "plaster."

Gypsum may take several forms. A massive, pure-white form of gypsum is known as alabaster. Satin spar is a fibrous gypsum that has a pearly opalescence. Selenite is a clear, glasslike variety. According to Ohio Division of Geological Survey Bulletin 69, *Minerals of Ohio*, some of the finest selenite crystals in the world came from the banks of Meander Creek near Ellsworth in Mahoning County.

Gypsum also has been found in Pleistocene glacial lake deposits of northeastern Ohio. In northwestern Ohio, massive beds and nodules of gypsum are present in Silurian-age rocks of Ottawa, Erie, Sandusky, Lucas, Wood, and Wyandot Counties. Gypsum has been mined commercially in Ottawa and Erie Counties. Gypsum also occurs as veins, crystals, rosettes, and efflorescences in sandstones and shales of Devonian to Permian age in the eastern half of Ohio.

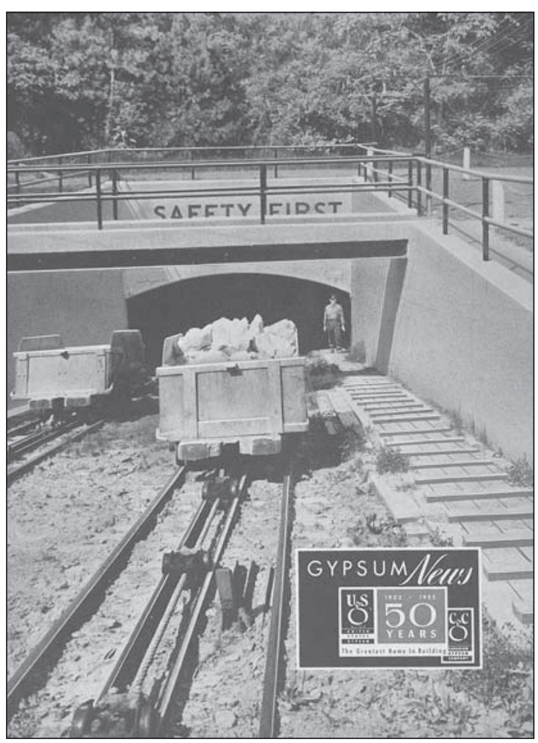
Plaster of paris is a powdered material made from gypsum. The term "plaster of paris" originates from the early exploitation of the vast gypsum deposits near Paris, France. To make plaster of paris, the gypsum is ground up and heated at 374º-392ºF until about three-fourths of the water evaporates. This process is called calcining. The resulting material is then powdered and packaged. When water is added to the plaster of paris, the gypsum molecules absorb the water and recrystallize, and the material hardens or "sets."

GEOLOGY OF GYPSUM

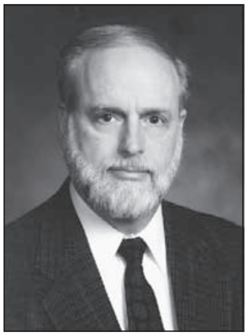
Gypsum is classified as an evaporite, a chemical sedimentary rock produced from saline solutions as a result of extensive or total evaporation of the solvent. Other common evaporite minerals are salt (halite) and anhydrite. Anhydrite is chemically similar to gypsum; it is calcium sulfate but lacks water. The name "anhydrite" means "without water."

In 1877, the Swedish geologist Ochsenius developed a concept of evaporite (gypsum-anhydrite-salt-potash) origin. He proposed that these deposits had been produced by the intense evaporation of normal seawater in an arid environment in a restricted lagoon that was separated from the open ocean by a bar. Periodic influx of seawater across the bar added more salts, and gradual subsidence of the lagoon allowed thick evaporites to accumulate. During Silurian time (about 420 million years ago), Ohio was covered by seas, the environment was arid, and extensive reefs developed. The water in restricted basins became very salty. These dense, hypersaline waters sank to the bottom of the basin as layers of brine, from which evaporite minerals such as salt, gypsum, and anhydrite precipitated.

Another explanation of the origin of gypsum is the sabkha model, which hypothesizes that the evaporite minerals were deposited on an extensive tidal flat that was periodically inundated by hypersaline waters from a restricted lagoon. *Sabkha* is an Arabic word meaning "shallow lagoon." The Persian Gulf is a present-day analog of this environment of deposition. The presence of shallow-water depositional features such as desiccation cracks, erosion surfaces, and flat-pebble conglomerates in Silurian rocks of Ohio have been cited as evidence for a sabkha environment.



Ore cars leaving the underground mine of United States Gypsum at Gypsum in Ottawa County, circa *1950. Photo first appeared on the cover of the November 1952 issue of* Gypsum News, *published by United States Gypsum.*



Thomas M. Berg, Division Chief and State Geologist

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Commercial gypsum production in Ohio is from the Silurian Salina Group, specifically the Salina F unit (see stratigraphic column). The gypsum occurs as nodules, lenses, and massive beds as much as 5½ feet thick.

Gypsum in northwestern Ohio may result from the hydration of anhydrite in the zone of weathering in which surface and ground water flow. The commercial deposits of northwestern Ohio are found near the surface. At depths below 120 feet, the amount of gypsum decreases until anhydrite predominates. Normally, no gypsum is present below 150 feet in depth. This situation suggests a gypsum-anhydrite cycle. One hypothesis is that after the anhydrite or gypsum was deposited in an arid coastal tidal flat or sabkha, a burial-uplift-erosion event took place. Burial pressures and temperatures forced the water out of the gypsum, converting it to anhydrite; later uplift and erosion allowed the anhydrite to absorb water and convert back to gypsum. Gypsum thus is found near the surface and anhydrite at depth.

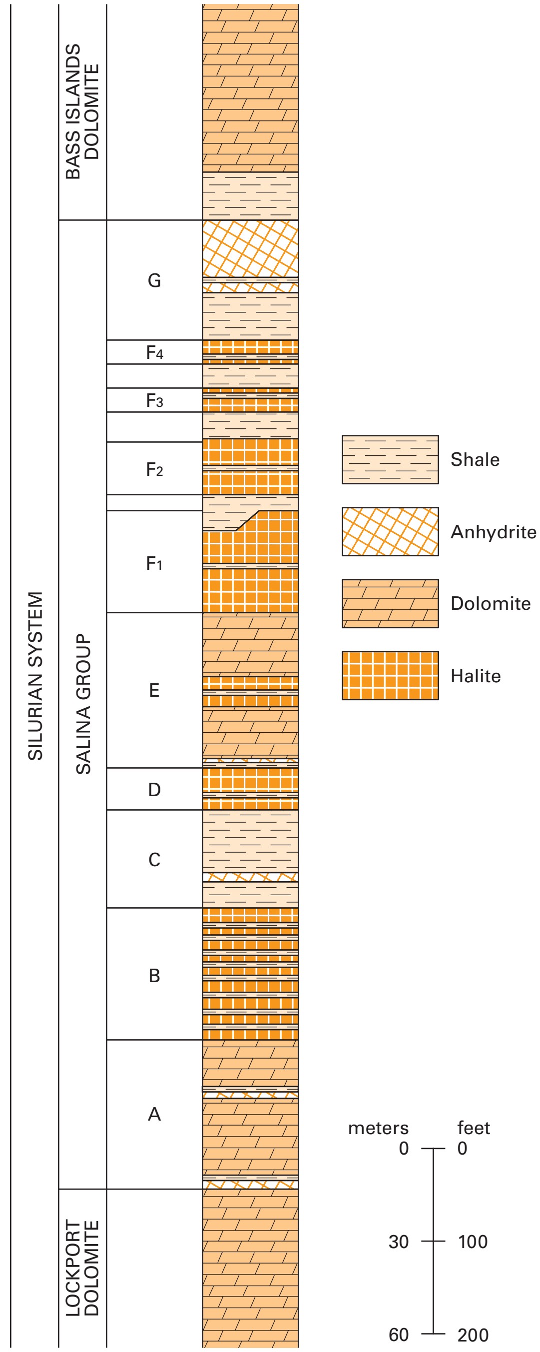
The localization of economic gypsum deposits in eastern Ottawa, eastern Sandusky, and western Erie Counties is further determined by unique geologic factors. The Salina Group rocks were tilted and in part truncated by erosion prior to Devonian time (prior to 410 million years ago) and again in Recent time. Hydration by ground water transformed anhydrite to gypsum, which is protected by overlying or enclosing shales.

The Salina B unit may contain economic gypsum deposits in east-central Ottawa and eastern Sandusky Counties. The B unit is protected by impermeable shale that has restricted the intake of ground water to the updip exposed edge. Two gypsum beds less than 5 feet thick are present in the Salina A unit in Antrim and Crane Townships, Wyandot County. In an 1873 Geological Survey report, G.K. Gilbert noted that two 3-foot-thick beds of gypsum crop out on West Sister Island (now a National Wildlife Refuge) approximately 18 miles northwest of the gypsum-producing area of Ottawa County.

USES OF GYPSUM

The major use of gypsum in the United States is in the manufacture of wallboard. Other uses include plaster (plaster of paris), caulking compounds, cement, additive to concrete to retard the setting rate, fertilizer/soil conditioner, filler in prescription medication, and a stiffening agent in bakery products such as frostings. In modern times, all of Ohio's gypsum production has been used for the manufacture of wallboard.

Gypsum is well suited for use in wallboard because of its fire-retardant property—the water that is part of the chemical composition serves as gypsum's own "sprinkler system." As the gypsum wallboard surface is heated to 212°F (the boiling point of water), the water is released from the gypsum crystal and dissipates the heat. After about 15 minutes of exposure to the intense heat of fire, the bound water in gypsum is released to a depth of ¼ inch.



Composite section of the Salina Group and associated rocks in Ohio. Modified from Hansen (1983).

HISTORY OF GYPSUM MINING IN OHIO

Gypsum was first recognized in Ohio in 1821 by two boatmen on Sandusky Bay, who noticed the white rock along the north shore of the bay in Ottawa County. Colonel Samuel M. Lockwood paid $10 for the white rock, then rushed to the U.S. Public Lands Office in Delaware, Ohio, and purchased 101 acres in Ottawa County at $0.25/acre. By early 1822, a gypsum quarry had been established and a combination mill and dock erected. The Portage Plaster Company, formed in 1825 by Col. Lockwood and William Townsend, continued to enlarge the original operations, even building its own fleet of steamers and scows to transport the gypsum. The town of Gypsum in Portage Township took its name from the quarries. The major early use of Ohio gypsum was as a fertilizer (soil conditioner) referred to as land-plaster.

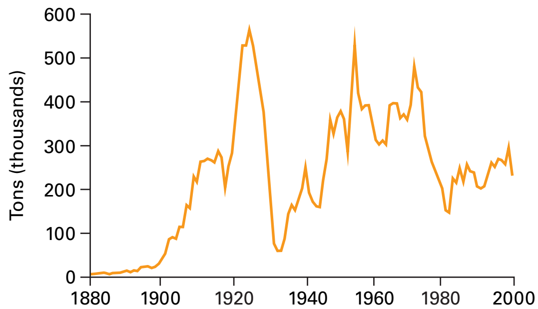
As the population of Ohio grew during the mid-1800's, the gypsum industry prospered. By 1856, B. F. Smith had taken charge of the former Portage Plaster Company. Smith was an innovator. Although his attempt at cutting the gypsum into building stone was a complete failure (gypsum weathers too easily), Smith began the successful manufacture of calcined plaster in 1860.

By 1881, a quarry operated by Marsh and Company at Gypsum was producing several thousand tons of unusually pure gypsum annually. The quarry produced both land-plaster and calcined plaster for use in the building industry. In 1885, the Pittsburgh Plate Glass Company of Pittsburgh, Pennsylvania, contracted with John W. Lockwood (one of Samuel's sons) to supply approximately 6,000 tons annually to be used in the manufacture of glass. The nearby Lake Shore and Michigan Southern Railway, as well as Lake Erie, provided easy access to distant markets. According to an 1888 report on gypsum by Edward Orton, the average price paid for land-plaster was $4.09 per ton, a significant amount for the late 1800's.

Marsh and Company opened the first of several underground gypsum mines in 1901 in Portage Township, Ottawa County. Room-and-pillar mines also were operated by the Granite Wall Plaster Company and the Consumers Gypsum Company. In 1902, Marsh and Company and the Granite Wall Plaster Company were sold to the United States Gypsum Company. Tremendous growth in the Ohio gypsum industry occurred in the early 20th century. Annual gypsum production increased from 112,202 tons in 1906 to 268,261 tons in 1913.

The Kelly Plaster Company operated an underground mine in Margaretta Township, Erie County, from 1912 until 1918. In the 1920's, the major gypsum producers in Ohio were the American Cement Plaster Division of the Beaver Products Company, Inc., the American Gypsum Company, and United States Gypsum. Gypsum production increased to greater than 500,000 tons by 1923 and reached an all-time peak of 562,928 tons in 1928. The Celotex Corporation purchased all land and plant facilities from American Gypsum in 1939 and in 1946 changed from underground mining to an open-pit operation. By the mid-1940's, consolidation in the U.S. gypsum industry had reduced the active operators in Ohio to United States Gypsum and Celotex.

After enduring some lean production years during the 1930's and early 1940's, annual gypsum production in Ohio rebounded to over 300,000 tons in 1948. Stable production of greater than 300,000 tons was the hallmark of the Ohio gypsum industry from the 1950's through the early 1970's (see graph). The 500,000-ton threshold was again surpassed in 1955 and was nearly



Annual production of gypsum in Ohio, 1881-2000.

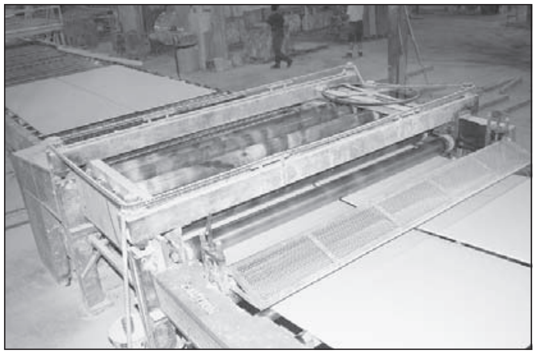
reached in 1972. United States Gypsum's underground mine flooded in the late 1970's and that operation ceased production. Since 1978, Celotex Corporation has been the sole company mining gypsum in Ohio. In 2000, the United Kingdom company BPB plc acquired Celotex's wallboard and ceiling-tile business. Annual production has been relatively steady at approximately 250,000 tons. Estimated cumulative gypsum production in Ohio through 2000 totals 27,900,000 tons. In August 2001, the BPB-Celotex gypsum mine and wallboard plant were shut down, thus ending 180 years of gypsum mining in Ohio.

GYPSUM PROCESSING

Although gypsum production has now ceased in Ohio, the process is still interesting, and the operation of the BPB-Celotex Ohio plant is described here. After the gypsum-bearing rock was mined, an in-pit crusher reduced the size of the rocks to 2-3 inches. A conveyor transported the rock to the plant, where the gypsum was separated from dolomite and shale by heavy-media separation. Gypsum has a specific gravity of 2.31 and floats on top of a liquid that has a specific gravity of 2.47, while the other constituents sink and are removed. Heavy-media separation improves the gypsum concentration from approximately 50 percent when mined to greater than 80 percent.

The purified gypsum was then ground to a very fine powder and heated in a large mill to approximately 350°F. The material changed chemically to $CaSO_4 \cdot \frac{1}{2}H_2O$, calcined gypsum plaster. Similar to plaster of paris, calcined gypsum sets into a hard rocklike substance when it is mixed with water.

The calcined gypsum produced at BPB-Celotex was used exclusively to make wallboard products. To manufacture wallboard, two rolls of paper were fed continuously onto a series of rollers. The edges of the bottom paper were folded to form a box. A slurry mixture of calcined gypsum, water, fibers, starches, and accelerators was continuously fed into the paper box, then the second sheet of paper covered the filled box. The two sheets of paper bonded to the core because the gypsum crystallized in long needles that grew into the paper. After the board was formed and set, it was cut to the required length and dried to remove excess water. The BPB-Celotex plant could produce approximately 120 board feet per minute of



Conveyor system for making wallboard at the BPB-Celotex operation in Ottawa County. Photo by Michael D. Williams.

wallboard, and the product was shipped to several states and Ontario, Canada.

CURRENT AND FUTURE TRENDS

The national gypsum industry is currently undergoing major changes. The acquisition of Celotex by BPB plc in 2000 continued a trend seen in other industrial minerals in which multinational companies are expanding through acquisition and consolidation. Several new large wallboard plants recently have been completed in Kentucky, Pennsylvania, and Indiana, substantially increasing capacity and competition in the eastern U.S. Many of the new plants use flue-gas-desulfurization (FGD) gypsum, which is a waste by-product of primarily coal-fired power-generating stations. The gypsum is produced when lime (calcium carbonate) is mixed with the sulfur dioxide in the stacks. Normally, FGD gypsum is taken to landfills; using FGD gypsum to manufacture wallboard is both low cost and environmentally friendly. Two disadvantages of FGD versus natural gypsum for the manufacture of wallboard are the presence of fly ash, an impurity found in FGD gypsum, and smaller crystal growth compared to natural gypsum. The increased use of FGD gypsum led to the closing of the BPB-Celotex operation in Ohio.

ACKNOWLEDGMENTS

I extend my sincere appreciation to Eugene Van Voorhis, curator of the Ottawa County Historical Museum, for helping me gain access to the excellent records concerning the early gypsum industry in Ottawa County. I also thank Charles Johnson, plant manager of BPB-Celotex in Port Clinton, for his review of this article and for providing invaluable information about gypsum and the process of making wallboard.

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Editor's note: this article is condensed from an article of the same title in the *2000 Report on Ohio mineral industries* (see p. 7).

James J. Schmidt and Alfred C. Walker 2001 Mather Medal recipients

The 2001 honorees for the Division of Geological Survey Mather Medal are James J. Schmidt and Alfred C. Walker, retired Division of Water hydrogeologists. 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 medal, named in honor of William W. Mather, the first State Geologist of Ohio (1837-1838), was first awarded as part of the Survey's sesquicentennial celebration in 1987. Mr. Schmidt and Mr. Walker are the 14th and 15th recipients. Mr. Schmidt received his award at a banquet in late October in Columbus. Because Mr. Walker was unable to attend the October banquet, his award was presented at a luncheon in Coshocton in late November.

Over their combined 77-year career, Al Walker and Jim Schmidt made exemplary contributions to the understanding of Ohio's ground-water resources. They are widely known for their expertise in the fields of hydrogeology and environmental ground-water geology. Their work has been invaluable to homeowners, industry, planners, ground-water consultants, public officials, and environmental regulators across the state.

Al Walker and Jim Schmidt were born within three months of each other, Al in January 1923 and Jim in March 1923. Al was born in Dennison, Ohio, but grew up in New Philadelphia, Ohio, where he presently makes his home on a 10-acre farm. Jim is a lifelong Columbus resident. Both men served in the armed forces during World War II. Jim was in the Army Engineers, where he became skilled in aerial photo-topography. Al was a bombardier in the Army Air Force. During a bombing run in 1943, Al's plane was shot down over Germany. He landed safely, but spent the last 20 months of WW II, including one of the coldest winters in Europe during the 20th century, as a POW at Stalag Luft 1 near Barth, Germany.

Jim's interest in geology began as a youth. He enjoyed fossil collecting during family outings and was fascinated by the stories his father would tell about the oil-drilling business—his father was a wildcatter during the early 1900's. Following WW II, Jim's interest in geology was rekindled and nurtured by a young OSU professor, J. Osborn Fuller (who ironically passed away the morning of the banquet; see p. 8). Jim's enthusiasm for geology grew through courses taught by OSU professors Richard P. Goldthwait, J. Ernest Carman, and George W. White. In 1951, while still a student at OSU, Jim began his career as a geologist with the Ohio Department of Natural Resources, Division of Water. He completed his B.S. degree in geology in 1953.

Al's interest in geology was a result of growing up in a part of Tuscarawas County that was heavily surface mined for coal and clay. He remembers being horrified at the environmental damage to the countryside caused by then-unregulated surface mining. Al started his college education at Denison College in Granville. After World War II, he resumed his college education at the University of Michigan, then transferred to Marietta College in Ohio, completing his B.S. degree in geology in 1948. Al started graduate work at the University of Kansas but left early to accept a position with the Kansas Geological Survey, where he cataloged fossils and became interested in hydrogeology and ground-water issues. Shortly thereafter, he took a position with the Virginia Geological Survey, where he worked in ground-water geology. In 1953, Al joined the Ohio Department of Natural Resources, Division of Water as Head of the Water Inventory Section.

Al Walker and Jim Schmidt were instrumental in the development of the knowledge base of ground-water resources in Ohio. During the 1950's. Jim and Al evaluated the water resources of Jackson, Pike, Ross, and Scioto Counties in response to the Atomic Energy Commission's desire to construct a gaseous diffusion plant in southern Ohio. In 1958, Jim published Water Bulletin 30, *Ground-water resources of Franklin County*. This highly regarded publication is still considered by many as among the best in a series of county water bulletins. Beginning in the 1960's, accelerated highway construction, including the interstate highway system, put Jim and Al to work determining ground-water availability along the Ohio Turnpike corridor and many roadside-rest areas along state and federal highways. In addition, they conducted numerous pumping tests and ground-water evaluations for many state parks, prisons and honor camps, and school districts in Ohio.

Left to right: Gregory A. Schumacher, chairman of the Mather Medal Committee; 2001 Mather Medalists James J. Schmidt and Alfred C. Walker; and Thomas M. Berg, Chief of the Division of Geological Survey.

Under Al's leadership, Ohio was one of the first states to map ground-water availability for the entire state. This program was completed in 1962. Jim and Al published a combined 74 drainage-basin ground-water-resource maps. Between 1978 and 1996, the Division of Water remapped the ground-water resources of the state on a county basis. Jim and Al published 51 of the 88 county ground-water resource maps.

Until the formation of the Ohio EPA in 1972, Al and Jim were responsible for conducting water-quality studies and advising on environmental issues that impacted ground water. In 1973, the Division of Water was split in two; part of the Division went to the Ohio EPA and the Water Inventory Section joined the Division of Geological Survey. The Water Inventory Section remained with the Division of Geological Survey until 1976, when the Division of Water was resurrected.

Jim Schmidt retired from Division of Water in June 1985, and Al Walker retired in January 1986. However, both Jim and Al continued to work part-time over an additional combined period of 16 years, completing a number of county ground-water resources and pollution-potential maps for the Division of Water. Together they authored 142 publications on the ground-water resources of Ohio. In addition, they were long-time members of the National Ground Water Association and the American Institute of Professional Geologists. Currently, they are enjoying their retirement and both reside near their boyhood homes.

Al and Jim were tireless employees of the Division of Water and the Division of Geological Survey, and many in the Department of Natural Resources as well as private industry have had the honor of working with them on collaborative studies. Jim and Al's contribution to the understanding of Ohio's ground-water resources and environmental impacts to ground water are exemplary and their accomplishments speak for themselves.

—Douglas L. Crowell and Merrianne Hackathorn

OHIO'S NATIONAL COAL RESOURCES DATA SYSTEM, 1989-2001

In 1989, the Ohio Department of Natural Resources (ODNR), Division of Geological Survey (DGS) began a series of cooperative agreements with the U.S. Geological Survey (USGS) to systematically transfer large amounts of geologic data into a USGS computer database, the National Coal Resources Data System (NCRDS). For more than 100 years, the DGS has collected coal data from a variety of sources, including field work by DGS geologists and by students, drillers' logs, and coal companies. These data consist of paper records filed by county. Extracting useful information from the paper files can be inefficient and difficult, and the files themselves are vulnerable to damage and loss. Thus, the benefits of having Ohio coal data in a digital file are many. In digital form the information is highly organized and easily manipulated, sorted, or searched; the data are available worldwide, either on compact disk or via the Internet, to practically anyone; and the likelihood that the information will be preserved indefinitely is increased.

Converting coal data into an ASCII format compatible with the NCRDS is fairly straightforward, but, as in any long-term project, our procedures and equipment have continuously improved and changed since 1989. The DGS had limited access to the NCRDS via telecommunications systems during much of the project period, partly because the NCRDS itself was undergoing radical changes in software and hardware. This situation necessitated the development of in-house databases in order to edit and rapidly access the encoded data before transfer to the NCRDS.

Between 1989 and 2000, a total of $236,000 was awarded to the DGS through the USGS NCRDS cooperative agreements. A major portion of these funds supported college interns who worked on Ohio's NCRDS under the supervision of Senior Geologist Richard W. Carlton. Since 1989, nearly 40 interns have worked part-time on NCRDS at the DGS, gaining valuable experience that has helped some to find jobs in their field. DGS personnel have encoded coal-location data for 25,491 points linked to 245,486 rows of associated stratigraphic information. These points, located in the coal-bearing region of eastern Ohio, represent stratigraphic descriptions for 33 named coals and many other stratigraphic descriptions containing no coals or unidentified coals.

Initially, DGS personnel selected measured-section data that had been described as part of a coal-sampling program in eastern Ohio between 1977 and 1983. Additional measured-section and drill-hole data entered in 1989 were selected on a random basis. In 1990, the DGS used a more systematic approach to selecting the data to be encoded, choosing blocks of 7.5-minute quadrangles and encoding all available measured-section and drill-hole data for these blocks. In 1993, in addition to the NCRDS agreement, the DGS began a series of cooperative agreements with the USGS under its Coal Availability (CA) program. Detailed information on coal resources available for mining were compiled for eight 7.5-minute quadrangles under the CA program. The NCRDS work and the CA studies were closely coordinated so that NCRDS data could be used in the CA studies, and the data collected for the CA studies could be incorporated into the NCRDS. In 1994, the NCRDS program began using the line data (structure-contour, crop-line, and isopach maps) from the CA studies because these line data were created on more sophisticated software than NCRDS line data. The NCRDS program in turn supported the CA program by digitizing coal crop lines and surface-mined areas, providing coal-point data, and helping in various other map-construction endeavors.

In 1996, the DGS was awarded $12,000 under the USGS National Coal Assessment Program (NCAP) to provide point and line data along with technical support for the Pittsburgh, Upper Freeport, and Middle Kittanning coal beds in Ohio. Between 1997 and 1999, an additional $44,000 was channeled through the NCRDS cooperative agreements to provide point and line data and technical support for the Lower Kittanning coal as well as the above-mentioned coals.

The methods used by DGS personnel to transfer coal information from the original paper data sheets to a computer database are briefly summarized below.

- *Data collection:* Data were collected, organized, and copied onto paper forms containing the database fields used in the NCRDS. Coal-location and stratigraphic data were collected from DGS measured-section and drill-hole files, from ODNR, Division of Mineral Resources Management (DMRM) permits, and from DGS abandoned-underground-mine maps.
- *Data input:* From 1989 to 1999, data were entered into a software program that stored the data in files with the correct USGS-specified format that could be sent directly to the USGS for entry into the NCRDS. However, the data stored in these files were easily corrupted, the files could not be very large, and editing the files was extremely difficult. In 1999, DGS personnel began using a Microsoft Access database. Before sending the data to the USGS, the Access database is exported to a text file, then imported into a computer-software program called Stratifact. A module in Stratifact converts the data to a format compatible with the NCRDS.
- *Data plotting:* Coal point locations were plotted on base maps of 246 7.5-minute topographic quadrangles. Most of the DGS measured-section and drill-hole points were copied from older 15-minute topographic maps and are only approximately located. If coal elevations were known for measured sections, the point was plotted at the correct coal elevation and as close to the known

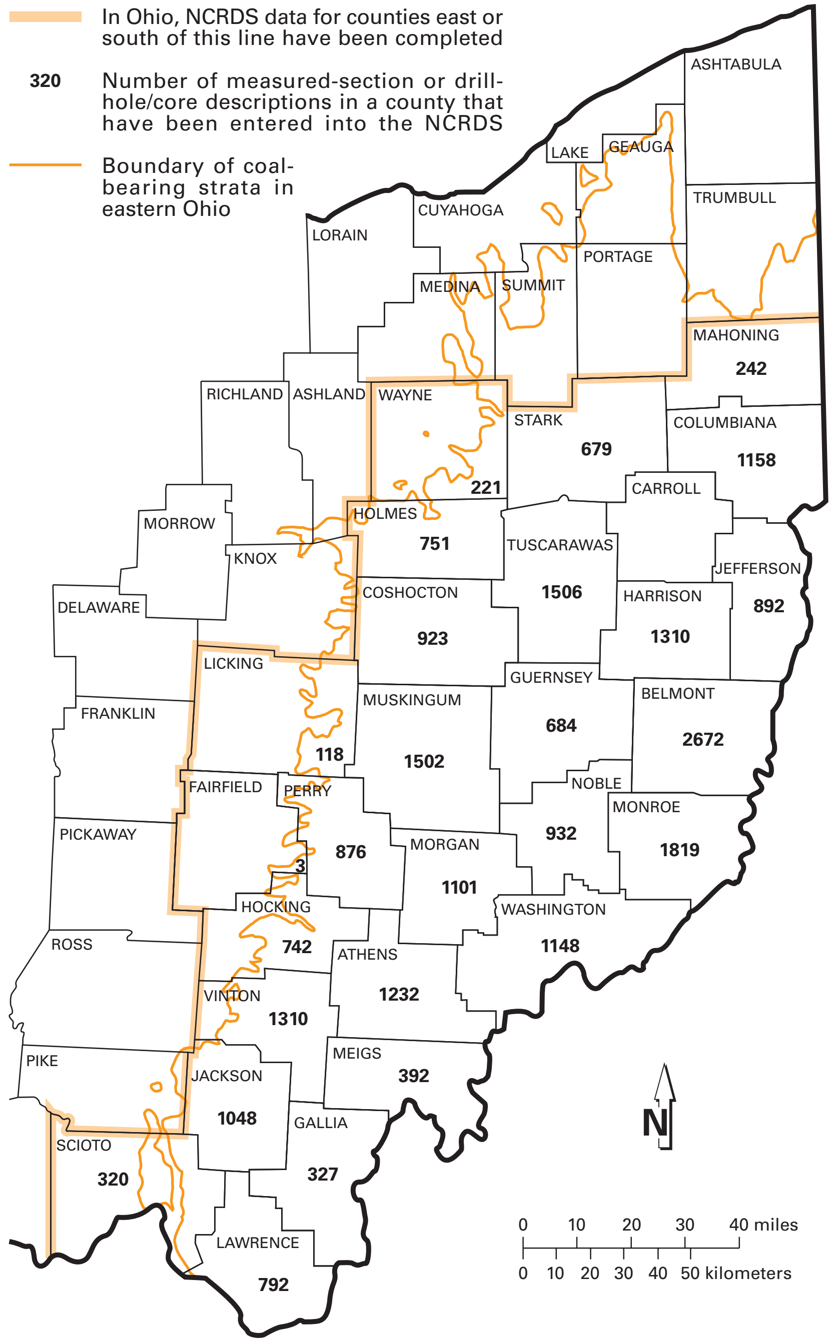
position as possible. DGS drill holes were plotted at the surface elevation. Points obtained from DMRM permits generally were copied from 7.5-minute topographic maps and locations are quite accurate for the most part. The few abandoned-underground-mine map points added to the NCRDS were plotted at mine mouths at the correct coal elevation in the case of drift entrances and at a point on the mine boundary for shaft and slope mines.

- *Coal-point digitization:* Each of the 25,491 coal points were digitized to create a computer file containing all the points arranged in their correct geographic location. Universal Transverse Mercator (UTM), latitude and longitude, or state plane coordinates for each point can be obtained indirectly from this file.
- *Data editing:* All coal data have been repeatedly checked for errors that may have been introduced when transferring the data to the paper forms or when typing the information into the computer database. Errors inherent in the original data, such as incorrect coal elevations or incorrect coal names, are difficult to detect. Such errors undoubtedly exist in the database.

As of March 2001, nearly 100 percent of all DGS measured-section and drill-hole data and about 75 percent of all easily available DMRM-permit coal data for 28 counties (see map) had been entered into the Access database. Eight additional counties on the margins of the primary coal-producing counties contain approximately 178 coal points that will be added to the database.

Although the Ohio NCRDS database can provide valuable information to the user, some weaknesses need to be addressed. The database contains a significant number of coals that have not been named or have been named incorrectly. Some measured sections have no coals or identifiable stratigraphic units and, therefore, cannot be placed in a stratigraphic framework. Original coal elevations on some measured sections are incorrect or none are given, and many of the locations are relatively inaccurate. Despite these flaws, the NCRDS database provides a tremendous amount of information on Ohio's coal resources. For more information on the Ohio NCRDS database, please contact Doug Crowell at 614-265-6594, e-mail: doug.crowell@dnr.state.oh.us.

—*Richard W. Carlton*



Distribution of NCRDS data points for Ohio, by county.

Editor's note: Doug Crowell is the contact person instead of Dick Carlton because Dick retired in March 2001.

2000 Report on Ohio mineral industries *now available*

The *2000 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. Visa and MasterCard are accepted. The *2000 Report on Ohio mineral industries* also can be viewed in pdf format on the Survey's Web site at <http://www.ohiodnr.com/geosurvey/ogcim/minstat/minstat1.htm>

J. Osborn Fuller, 1912-2001

On October 26, 2001, we were saddened to learn of the death of Dr. J. Osborn Fuller, Professor Emeritus of Geological Sciences at The Ohio State University, and former associate of the Ohio Geological Survey. Dr. Fuller was also the father of Jonathan (Nate) A. Fuller, a geologist with the Survey's Lake Erie Geology Group.

Oz, as he was known to friends and colleagues, was born on August 14, 1912, in Chaumont, New York. He received a bachelor's degree in geology from Lehigh University in 1934 and a Ph.D. in geology from Columbia University in 1941. In 1939, Oz came to Ohio to teach at Mount Union College in Alliance. In 1941 he joined the faculty of The Ohio State University. In 1943, he took a position with West Virginia University, and then with the U.S. Geological Survey. Oz returned to OSU in 1946, where he remained until 1967, serving as both Professor of Geology and in various administrative capacities, including Dean of the College of Arts and Sciences from 1957 to 1967. In 1967, he became president of Fairleigh Dickinson University in New Jersey. In 1974, Oz again returned to OSU, where he taught geology and served in temporary administrative positions until his retirement in 1983.

Oz began his association with the Survey soon after his initial arrival at OSU in 1941. During the summer of 1942, he and Myron T. Sturgeon (see *Ohio Geology*, 2001, No. 3) mapped coal deposits in northeastern Ohio. Oz continued working summers for the Survey until 1955. This field work kindled his interest in the geology of Lower Pennsylvanian rocks of this area, especially the Sharon sandstone. In 1955, Oz published an important paper on the source of the Sharon sandstone, which was reprinted as Survey Report of Investigations No. 23. In 1965, the Survey published his report and geologic map on the Garrettsville quadrangle (Report of Investigations No. 54) in Portage and Geauga Counties. This scenic area includes Nelson-Kennedy Ledges State Park.

Between 1947 and 1961, Oz oversaw 14 master's theses and eight Ph.D. dissertations on the geology of Ohio. Most of these projects were done in cooperation with the Survey and included mapping and description of the geology in many areas of eastern Ohio. This body of work remains a principal source of information on the geology of eastern Ohio. Many of his students went on to outstanding careers in geology.

Dr. J. Osborn Fuller made many contributions to the geology of Ohio. He specialized in economic geology and had great insight into geologic problems. He served as a consultant to a number of mineral companies in Ohio. After retirement from OSU, Oz became active with the International Center for Preservation of Wild Animals (The Wilds), which is located on reclaimed coal-strip-mined land in Muskingum County. He served as trustee and secretary/treasurer of this organization from 1984 until 2001. He is survived by his third wife, Patricia, and his children, Richard, Christine, Jonathan, and Teri.

—Michael C. Hansen

New leader for the Lake Erie Geology Group

Constance J. Livchak took over the helm of the Survey's Lake Erie Geology Group in September. She oversees the four-member staff in the Sandusky office. Ms. Livchak is a Certified Professional Geologist with the American Institute of Professional Geologists and a Certified Ground Water Professional with the National Ground Water Association. She earned her B.S. and M.S. degrees from Bowling Green State University and has more than 13 years of experience in managing major environmental geology projects in the private sector. Ms. Livchak can be reached at 419-626-4296, e-mail: constance.livchak@dnr.state.oh.us.

Ohio Geology

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