Ohio Geology

A Quarterly Publication of the Ohio Department of Natural Resources, Division of Geological Survey 2001, No. 3

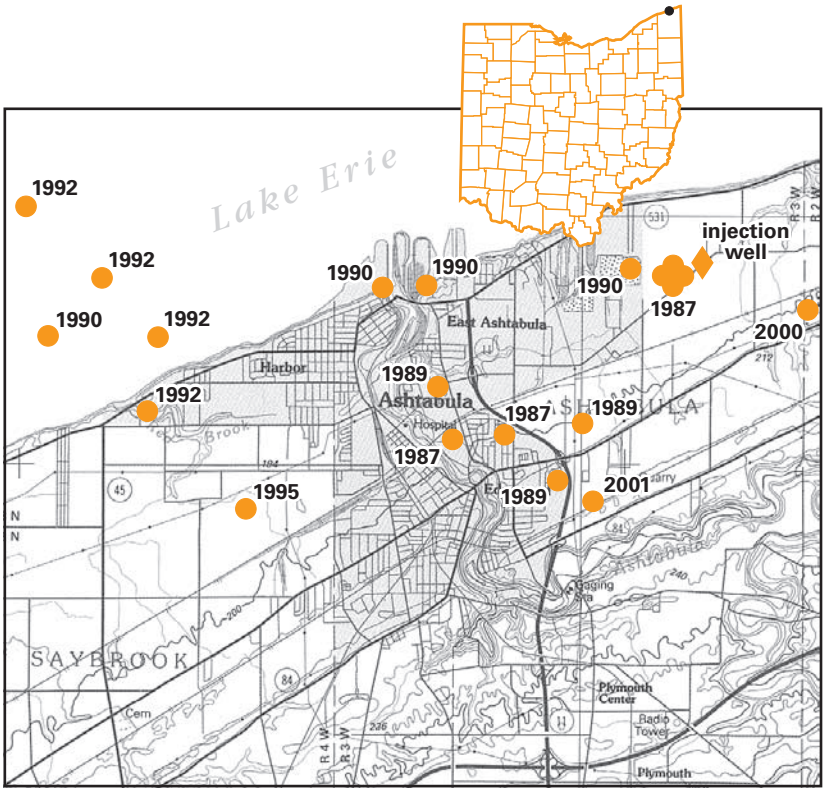
We, the employees of the ODNR Division of Geological Survey, express our heartfelt sympathy for all those people who suffered through the horrible events of September 11, 2001. The violence has affected us profoundly. We continue to work and pray for healing and peace.

SEISMIC SPOTLIGHT SHINES ON ASHTABULA

by Michael C. Hansen, Glenn E. Larsen, and E. Mac Swinford, Division of Geological Survey and Larry J. Ruff, University of Michigan

Although northeastern Ohio is the secondmost seismically active area of the state, historic earthquakes have been confined to the greater Cleveland area, particularly east of the city. Citizens of the City of Ashtabula and Ashtabula County had never experienced an earthquake centered in their area since arrival of the first permanent European settlers in 1803. However, in 1987, a series of small earthquakes beneath the city of nearly 21,000 people dramatically elevated the community into the seismic spotlight. On July 13, 1987, a 3.8-magnitude earthquake was felt in Ashtabula and surrounding areas, much to the astonishment of residents. This event was the first of a series of felt earthquakes that has continued to the present.

At 9:05 p.m. eastern standard time (EST) on January 19, 2001, a 2.6-magnitude earthquake was felt by many residents of Ashtabula and renewed the excitement created by the earlier series. Numerous felt reports from this event were collected by the Ashtabula County Emergency Management Agency, but no damage was reported. However, the January 19 quake was just a foreshock. At 10:03 p.m. EST on January 25, a 4.5-magnitude earthquake jolted the city and was felt in northeastern Ohio, northwestern Pennsylvania, and parts of Michigan and Ontario. In contrast to the previous events, which had caused no damage, this earthquake resulted in more than 50 damage reports to the Ashtabula County Emergency Management Agency, host and operator of OhioSeis station ACEO in Jefferson. Edward Somppi, director of this agency, and his staff were overwhelmed with phone calls and media interviews. Most of the reports indicated minor damage, such as cracks in plaster, but two gas lines ruptured, resulting in temporary evacuation of 40 local residents, and there were two reports of building walls that were bowed. A large organ pipe fell at a church, ceiling tiles and light fixtures fell, and pictures were knocked off walls. Many people in Ashtabula and surrounding areas reported a very sharp jolt from the earthquake. Modified Mercalli intensities reached a maximum of VI.



Epicentral locations for Ashtabula earthquakes greater than 2.0 magnitude. The 1987 and 2001 earthquakes are precisely located using multiple, nearby stations, whereas the events between 1987 and 2001 have greater margins of error in their locations because of seismic-station geometry and distance.

At least five aftershocks were recorded in the hours and days after the mainshock. Aftershocks that occurred in the first few hours after the mainshock, including one of 3.2 magnitude that was felt by some residents, were difficult to analyze on the Ohio Seismic Network, as seismic signals on network stations were dominated by surface waves from the massive and devastating earthquake in Gujarat, India. The first waves from this event arrived in Ohio about 30 minutes after the Ashtabula earthquake. More than 20,000 people were killed in the 7.7-magnitude earthquake in India.

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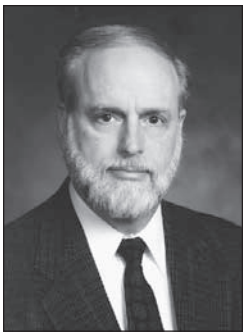

Thomas M. Berg, Division Chief and State Geologist

From The State Geologist...

Thomas M. Berg

ROBERT G. VAN HORN, ASSISTANT STATE GEOLOGIST

On a very hot and humid July 31, 2001, at about 6:00 p.m., Bob Van Horn and I shook hands in the Survey parking lot as he officially began his retirement from the Ohio Geological Survey. We had just carried the last two boxes of belongings from his office out to his car. Tired from the frenetic pace of packing and a bit apprehensive of the big change in his life, Bob drove away from the Division of Geological Survey where he had spent 29 years and 3 months serving the people of Ohio as a geologist and a Survey administrator. As I watched his car disappear around the corner, I felt a great loss and a feeling of anxiety knowing that Bob would not be with us any more to help run the Survey.

My sense of loss was generated not so much by knowing that Bob's work would now fall on others, including me, but by knowing that a very good friend would not be with me every day to ponder, discuss, commiserate, make decisions, laugh, and swap stories. The State Geologist's job is a colossal undertaking. But having an Assistant State Geologist like Bob Van Horn makes it doable. His fantastic sense of humor was a mollifying force in tense moments. His willingness to do almost anything for the Survey helped enormously as we slogged through all the paperwork involved in running a state agency. His excellent understanding of geology—particularly the geology of Ohio—enabled us to make good scientific judgments. He was particularly good at making geology understandable to the layperson.

Bob Van Horn started full-time work at the Division of Geological Survey in October 1972. He had obtained his bachelor's and master's degrees in geology at The Ohio State University. He had worked at the Ohio Survey as a summer assistant and had worked in the oil industry in Montana for a summer. Bob worked as a geologist in the Regional Geology Section of the Survey and was appointed Head of the Section in December 1976. He mapped sand and gravel and other glacial deposits, evaluated solid-waste-disposal sites, assessed environmental impact statements on power-site applications, worked on coal resources, and investigated carbonate rocks of Ohio as sulfur dioxide sorbents. Bob worked closely with former Assistant State Geologist Richard Struble to develop a methodology for mapping and characterizing sand and gravel resources. This work resulted in the publication of sand-and-gravel-resource reports for numerous counties in the state's most important sand and gravel producing districts. Bob developed an Ohio Survey approach to three-dimensional mapping of surficial materials that considered the lithologic, engineering, and hydrogeological properties of materials at depth as well as at the surface. Bob's report on *Surficial materials of Summit County, Ohio* (Report of Investigations 109) was the first Survey publication to use this new methodology. This report represented a significant change for the Survey, as previous surficial-geology mapping products focused primarily on depicting only the uppermost material units. Bob had a great interest in the development of derivative mapping products that could be used by nongeologists to serve the public interest. Most notably, he refined a methodology for mapping the land areas of counties according to their suitability for solid-waste disposal. His report on *Land areas in Summit County, Ohio—geologic suitability for solid-waste disposal* (Report of Investigations 98) was the first report by the Survey on this critical public issue.

Horace R. (Buzz) Collins, former State Geologist, appointed Bob as Deputy Chief of the Division in January 1982. In that position, he assisted the Chief in all kinds of administrative procedures, helping to make the Geological Survey run smoothly. He also continued some of his geological work and became involved with evaluation of Ohio as a site for the Superconducting Supercollider. Bob firmly believed that reliable bedrock-geology, surficial-geology, and mineral-resource mapping must be based on high-quality subsurface data. However, such information commonly is not available for many areas of the state. To address this deficiency, Bob worked closely with Buzz Collins to establish a drilling program to support the Division's mapping and mineral-resource-characterization programs. Bob also worked closely with Collins to establish and implement the Division's statewide geologic mapping program that was created in 1981 through an act of the Ohio General Assembly.

When I was appointed Division Chief in March 1989, Bob continued as Assistant State Geologist, providing invaluable assistance to me in a plethora of administrative duties. He was appointed to represent the Division on all committees and organizations dealing with ground water. Bob assisted me on many matters involving the Association of American State Geologists (AASG), including writing the annual report and the annual statistical summary. He participated in the compilation of the Survey's statewide map, *Quaternary geology of Ohio*, which was published in 1999. With expanded responsibilities and ever-burgeoning government paperwork, Dennis N. Hull was appointed as a second Deputy Chief and Assistant State Geologist in 1993. Bob continued to work on personnel actions and budget preparation and tracking. He oversaw the Lake Erie Geology Group, the Geologic Records Center, and the Cartography and Editing Group. He also helped plan the Survey's Horace R. Collins Laboratory and core repository at Alum Creek State Park north of Columbus. He represented the Ohio Geological Survey at many different kinds of meetings, including Eastern Cluster Meetings with the U.S. Geological Survey. He went to great efforts (along with many others) to make the 1994 AASG National Meeting at Maumee Bay an enormous success.

Although there are many, many more tasks that Bob undertook, it was always with great dedication to the Division and the Ohio Department of Natural Resources that he accepted assignments. He was even willing to get up in the middle of the night on one occasion to assist me in helping at a situation at one of Ohio's prisons. We spent a very long day mapping surficial materials around the prison and interpreting the geology for prison officials. In my 36½ years of state geological survey experience (Pennsylvania and Ohio), I have known few geologists who could match Bob Van Horn's talent, dedication, hard work, and willingness to perform as a public servant. We thank you for everything you did, Bob, and we wish you a happy retirement filled with success, satisfaction, and good humor.

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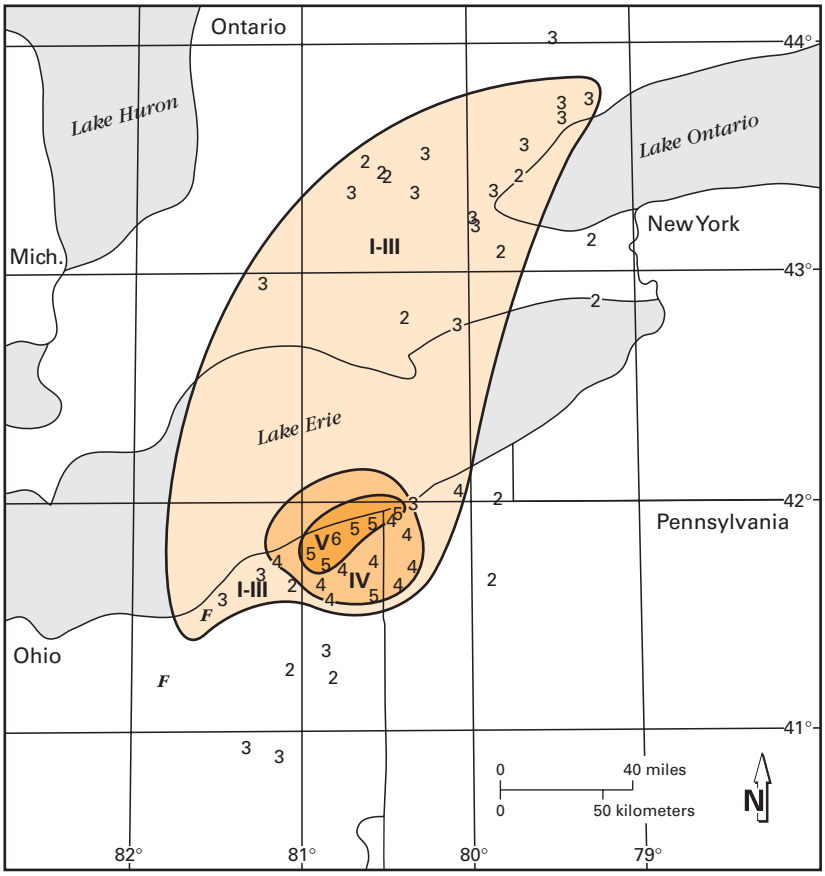
On June 3, 2001, a 3.2-magnitude earthquake struck the same area of Ashtabula at 6:36 p.m. eastern daylight time (EDT). The Ashtabula County Emergency Management Agency received approximately 90 felt reports from this event, although no damage was indicated. On June 5 at 4:27 a.m. EDT, a 2.3-magnitude aftershock was recorded, and one felt report was received from an individual living near the instrumental epicenter.

The June series was recorded in detail by four portable seismographs located very close to the epicenter. These instruments had been deployed on June 1 by Dr. John Armbruster of Lamont-Doherty Earth Observatory of Columbia University. Armbruster and Dr. Leonardo Seeber, also of Lamont-Doherty, had studied the earlier series of earthquakes in Ashtabula, beginning in 1987, and were eager to examine this new series. These instruments are still deployed in the Ashtabula area, and data are periodically downloaded and transferred to Lamont-Doherty by personnel of OhioSeis station ACEO. These portable instruments, located very close to the area of seismic activity, detect very small earthquakes (microearthquakes), too small to be felt, and allow precise location of the events and calculation of the depth, fault orientation, and sense of movement on the fault. Beginning with the June 3, 2001, earthquake, the Lamont-Doherty instruments had recorded 12 small earthquakes as of late August. It is worth noting that the epicenters calculated by the Ohio Seismic Network, on the basis of recordings of the events from OhioSeis stations throughout the state and data generously provided by the Geological Survey of Canada from stations in Ontario, were very close to the epicenters determined from data recorded on the Lamont-Doherty portable instruments.



Isoseismal map for the January 25, 2001, mainshock at Ashtabula. The map depicts areas of approximately equal Modified Mercalli intensities as reported by residents in the areas in which the earthquake was felt or caused damage. Maximum Modified Mercalli intensity was VI at some locations in Ashtabula. Note the elongation of the felt area northward into Ontario and the abrupt southward termination in northeastern Ohio and northwestern Pennsylvania. A similar phenomenon was evident on the felt-area map for the 1998 Pymatuning earthquake in northwestern Pennsylvania. Ohio Seismic Network stations have noted a north-south asymmetry of waveforms for lakeshore earthquakes. The cause of this phenomenon is unknown. Map prepared by Margaret Hopper of the U.S. Geological Survey. Canadian intensities courtesy of Sylvia Hayek of the Geological Survey of Canada.

PREVIOUS EARTHQUAKE ACTIVITY IN ASHTABULA

Soon after the 1987 series of earthquakes began in Ashtabula (see data table), John Armbruster and Leonardo Seeber initiated detailed studies of the events by deploying portable seismographs in the epicentral area. These researchers are experts on induced earthquakes and became interested in northeastern Ohio seismicity after the January 31, 1986, earthquake in southern Lake County (see *Ohio Geology*, Summer, 1986). Their interest in the Ashtabula events was piqued by the fact that the epicenter of the July 13, 1987, mainshock was very close to a deep Class I injection well, located on the east side of Ashtabula, that began pumping fluids into the Mount Simon Sandstone (Cambrian) in 1986.

The portable seismographs in the epicentral area recorded 36 precisely located microearthquakes in 1987 less than 1 km[1] from the injection well along an east-west-striking vertical fault. These microearthquakes were confined to an area about 1.5 km long by 0.25 km wide at a depth of about 2 km. Fluids were being injected into the Mount Simon Sandstone, the basal Paleozoic sedimentary unit that overlies crystalline Precambrian basement, at a depth of about 1.8 km. The sense of movement on this fault was left-lateral strike-slip.

These data led Seeber and Armbruster to conclude in published reports that the Ashtabula earthquake sequence had been triggered by fluids from the injection well. Armbruster has pointed out, however, that this was a pre-existing fault under strain—in essence, an earthquake waiting to happen—and the injection fluids simply triggered it earlier than would have been the case if only natural forces were involved. It is worth noting that no surface faults are visible in the area, no subsurface faults had been detected from data available prior to the earthquakes, and detailed searching of historical records by Armbruster did not reveal any events within 30 km of Ashtabula. It is also worth noting that deep Class I injection wells elsewhere in Ohio have operated for a num-

[1]Because seismic researchers use the metric system, metric measurements are used throughout this article. To convert kilometers to miles, multiply the number of kilometers by 0.62.

DATA[1] FOR EARTHQUAKES IN ASHTABULA AND VICINITY, 1987-2001

Year	Month	Day	Time (UTC)	Latitude (°N)	Longitude (°W)	Depth (km)	Magnitude (mbLg)	Comments/ Solution source
1987	07	13	05:49:17.4	41.896	80.767		3.8	mainshock (USGS)
1987	07	13	07:52:12.0	41.900	80.700		3.0	aftershock (USGS)
1987	07	13	13:05:00.0	41.900	80.800		2.9	aftershock (USGS)
1987	07	14	14:51:10.0	41.900	80.800		2.8	aftershock (USGS)
1987	07	16	04:49:40.0	41.900	80.800		2.7	aftershock (USGS)
2000	06	07	06:19:18.8	41.900	80.700		2.0	(GSC, OhioSeis)
2000	06	07	06:55:08.2	41.900	80.700		2.4	(GSC, OhioSeis)
2001	01	20	02:05:07.0	41.877	80.774		2.6	foreshock (OhioSeis)
2001	01	26	03:03:20.6	41.870	80.760	2.5	4.5	mainshock (OhioSeis)
2001	01	26	05:36:53.0	41.870	80.760		3.2	aftershock (OhioSeis)
2001	06	03	22:36:46.4	41.870	80.760	2.5	3.2	aftershock (OhioSeis)
2001	06	05	08:27:15.0	41.870	80.760		2.2	aftershock (OhioSeis)

[1]GSC, Geological Survey of Canada; USGS, U.S. Geological Survey; UTC, Universal Coordinated Time.

ber of years with no indication of nearby earthquakes. Ashtabula may represent a combination of factors that generate small-to-moderate earthquakes. It is therefore important to understand the geologic and seismic attributes of this area.

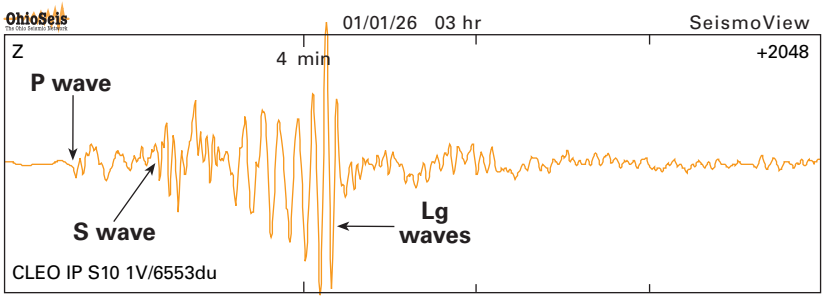
At least 13 additional earthquakes with magnitudes greater than 2.0 were recorded by the seismic network at John Carroll University in Cleveland (see *Ohio Geology*, Summer, 1993) from late 1987 through mid-1992, when this network ceased operations. A number of these earthquakes were felt by local residents. Two small earthquakes (2.0 and 2.4 magnitude) were recorded instrumentally in the area on June 7, 2000, but apparently were not felt at Ashtabula. Most of these events were poorly located because of the lack of nearby seismographs during this period.

THE 2001 SERIES OF EARTHQUAKES

Installation of the Ohio Seismic Network in 1999 allowed precise location of the 2001 Ashtabula earthquakes. These events had epicenters about 4.5 km south of the 1987 earthquakes, a location confirmed by the Lamont-Doherty portable instruments for the June 3 earthquake. Independent analyses of data from these latest earthquakes by Armbruster and Ohio Seismic Network personnel confirm a calculated depth for these events of about 2.1 to 2.5 km and the presence of an east-west-oriented strike-slip fault.

Detailed study of the Ashtabula earthquakes is still underway. Armbruster and Seeber propose that the 2001 sequence was initiated by migration of fluids from the injection well, which was plugged and abandoned in 1994. Other possible explanations of the 2001 earthquakes are that the seismic events that occurred between 1987 and 1995 created instability along other faults in the Ashtabula area, thus triggering the 2001 series, or that these are simply natural earthquakes.

Although the earthquakes in Ashtabula are some of the most studied and well-documented seismic events in Ohio, the lack of immediate and definitive answers points out how little we know about the rocks deep beneath the state. It is only through continued, detailed study of these rocks and the earthquakes generated by them that we will eventually gain an understanding of seismic risk in Ohio. The data gathered by the Ohio Seismic Network is making a significant contribution to this knowledge.



Filtered seismogram from OhioSeis station CLEO at the Cleveland Museum of Natural History for the mainshock on January 25, 2001. This station is approximately 85 km from the epicenter. Note that the event occurred at 10:03 p.m. local time on January 25, but at 03:03 Universal Coordinated Time (UTC) on January 26.

THE OHIO SEISMIC NETWORK

The Ohio Seismic Network, implemented in 1999, now consists of 22 volunteer stations at colleges, universities, high schools, and government institutions across Ohio. This distribution of stations allows detection and precise location of small earthquakes in the state. Although earthquakes have been instrumentally located in Ohio for many years, the distribution of stations generally has been inadequate for precision location of epicenters in many areas. The Ohio Seismic Network has been able to pinpoint events so that insight is gained on the location of faults deep beneath the surface. The Ohio Seismic Network is coordinated by the Division of Geological Survey and is partially funded by the Federal Emergency Management Agency through the Ohio Emergency Management Agency. Please visit the OhioSeis Web site, <www.dnr.state.oh.us/OhioSeis/>, for Ohio earthquake information, including data on recent earthquakes in the state.

ACKNOWLEDGMENTS

The documentation and study of earthquakes is always a shared activity—many people participate in and contribute to each event. We extend our thanks to Edward Somppi and his staff, particularly Dannette Ingersol, of the Ashtabula County Emergency Management Agency for gathering extensive felt and damage reports from the Ashtabula events. Sylvia Hayek of the Ottawa Observatory of the Geological Survey of Canada was particularly helpful in rapidly providing data from seismic stations in Ontario. Seismologists of the U.S. Geological Survey National Earthquake Information Center were, as always, very helpful in sharing data immediately after the events. Margaret Hopper of the U.S. Geological Survey graciously prepared the isoseismal map of the January 2001 mainshock. John Armbruster and Leonardo Seeber of Lamont-Doherty Earth Observatory have generously provided their data, expertise, and insight on Ashtabula seismicity to the Division of Geological Survey for the past 15 years. Executive Director Dale Shipley and Candice Sherry of the Ohio Emergency Management Agency have provided continuing encouragement and support of the Ohio Seismic Network.

FURTHER READING

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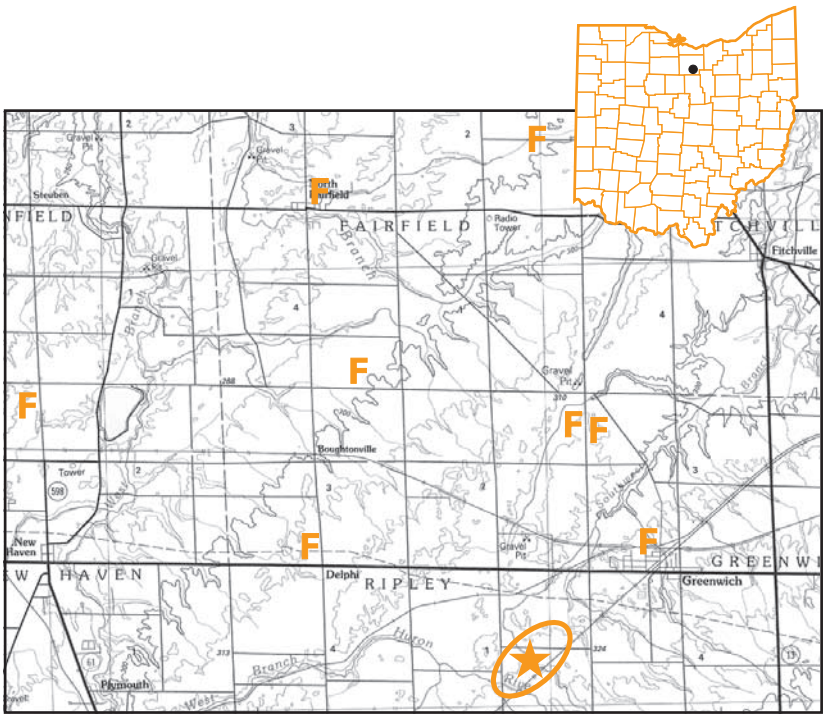
SMALL EARTHQUAKE STRIKES HURON COUNTY

Huron County, in north-central Ohio, has not traditionally been considered an area of seismic activity in the state. However, a 2.7-magnitude earthquake struck the southern part of the county at approximately 6:47 a.m. EDT on July 26, 2001. This small event was noticed on seismic records at the Ottawa Observatory of the Geological Survey of Canada and was recorded by numerous stations of the Ohio Seismic Network. No calls about the event were received by the Division of Geological Survey, and calls to emergency agencies in Huron and surrounding counties did not result in any felt reports. However, nearly a week after the event, the Ohio Seismic Network received an e-mail from Susan Leak, who lives near Greenwich in southern Huron County, inquiring if there had been an earthquake on the morning of July 26. Subsequent conversations with Mrs. Leak resulted in several more felt reports from Greenwich and North Fairfield and points between. The Ohio Seismic Network was able to precisely locate the event just southwest of Greenwich. It is probable that many other people in this rural area of southern Huron and northern Richland Counties felt the earthquake; however, events in this magnitude range are generally only a brief jolt that many may not recognize as an earthquake and they are therefore reluctant to report it.

The Geological Survey of Canada reported two additional earthquakes in this general area in 1998, before establishment of the Ohio Seismic Network. A 3.2-magnitude earthquake occurred on the evening of November 25, 1998, and was reported to emergency officials. It was felt in southern Huron, northern Richland, and eastern Crawford Counties. Individuals in Greenwich,



Location of epicenter and felt reports for the July 26, 2001, earthquake near Greenwich, Huron County. The star denotes the instrumentally computed epicenter and the ellipse represents the error margin for this location. "F" symbols represent felt reports from area residents. Few people initially recognized the brief shaking as an earthquake and did not report it to local authorities. Most reports were received only after publication of an article in the Norwalk Reflector. *The lack of reports south of the epicenter, into northern Richland County, may reflect distribution of newspaper subscribers more than the actual felt area. Maximum Modified Mercalli intensity is III, based on these reports.*

Fitchville, North Fairfield, Plymouth, Shelby, Tiro, and Willard felt the event. An article in the *Norwalk Reflector*, titled "Boom puzzles officials," provided documentation of the event but consternation concerning its origin. Another small earthquake was recorded in this area on December 25, 1998. This 2.8-magnitude event did not result in felt reports that reached the attention of the Division of Geological Survey.

Although these recent events would seem to imply a sudden onset of seismic activity in this area, there may have been activity in previous years. In 1927, a small earthquake was reported in Richland County, and a series of four small earthquakes was reported in the summer of 1940 in northern Ashland County. These events were not instrumentally located and are poorly documented. As with many preinstrumental, historical earthquakes, their assigned epicenters may be considerably in error.

Another factor in the documentation of earthquakes in the Huron County area may be either lack of recognition of the event as an earthquake or a reluctance to report the event to local officials or state agencies. The Ohio Seismic Network welcomes citizen reports of events thought to be small earthquakes and will check seismic records for confirmation. Please use the following contacts during specified hours:

- Business hours (8-5, Monday-Friday)—614-265-6576.
- After business hours and weekends/holidays—614-325-1051 (24-hour cell phone, seismologist on duty).
- Ohio Earthquake Information Center, Alum Creek State Park—staffed intermittently, but always after an earthquake—740-548-5979.
- E-mail—ohioseis@dnr.state.oh.us

—Michael C. Hansen, Ohio Seismic Network

Billie Long retires

Billie Long, Fiscal Specialist for the Division of Geological Survey, retired July 31, 2001. She came to the Survey in 1977 from the Ohio Board of Regents. Her cumulative state service was 34 years. Billie processed all publication orders received by the Survey and tracked payments through the State's intricate accounting system. She also maintained the inventory of Survey furniture, computers, and other office equipment. Billie frequently helped out in the Geologic Records Center—the Survey sales office—filling in for Center staff who were out of the office because of meetings, vacations, or illness. Although she normally worked "behind the scenes," Billie's work was essential for the day-to-day operation of the Survey. Her fellow employees recognized her contributions and chose her as the Survey Employee of the Year in 1997.

Billie is a native of Mississippi, and her retirement plans include an eventual move to Florida. Billie's duties at the Survey are now being performed by Jim Patterson, who transferred to the Survey from the Division of Forestry.

Dr. Myron T. Sturgeon, 1908-2001

Dr. Myron T. Sturgeon

It is with regret that we report the death of Dr. Myron T. Sturgeon, Professor Emeritus of Geology at Ohio University, at age 93, of heart failure on May 24, 2001. Dr. Sturgeon's long career was focused on Ohio geology, particularly Pennsylvanian rocks and fossils in eastern Ohio. He had a career-long association with the Survey and with the Ohio Department of Natural Resources and made significant contributions to both organizations.

Myron Sturgeon was born on April 27, 1908, in Salem, Columbiana County. Growing up among Pennsylvanian rocks in the heart of Ohio coal country perhaps fostered his interest in these subjects, but his undergraduate education in geology from Professor George F. Lamb at Mount Union College in Alliance provided the inspiration for Myron's life-long research on Pennsylvanian rocks and fossils. After graduation from Mount Union College in 1931, Sturgeon pursued graduate studies at The Ohio State University, earning M.A. (1933) and Ph.D. (1936) degrees. His thesis and dissertation were both on Pennsylvanian fossils under the direction of Dr. Grace A. Stewart. It was during these graduate-student years that Sturgeon became acquainted with the Ohio Survey and State Geologist Wilber Stout. In the summer of 1935, he did field work for the Survey and thus began a long association.

In 1937, Myron began teaching at Michigan State Normal College (now Eastern Michigan University), where he stayed until 1946, when he accepted a position with Ohio University. During his time in Michigan, he returned almost every summer to do field work on Pennsylvanian rocks and fossils in Ohio under the sponsorship of the Survey. Sturgeon spent the rest of his career at Ohio University, serving as chairman of the Department of Geology and Geography from 1954 until 1970. He assumed the position of Emeritus Professor in 1978 upon his mandatory retirement at age 70. After his retirement, which he reluctantly accepted, he maintained office space and continued his research on Pennsylvanian fossils. He continued field work and research until recent years, when short-term memory loss and a broken leg suffered during one of his daily walks forced eventual residence in a nursing facility. The untimely death of his wife, Carolyn, in 1990 had a significant impact on him.

Myron Sturgeon was from the old school of

practical geologists who believed that geology could only be studied in the field where rocks and fossils resided. Nearly every geology class that he taught included many Saturdays, and some whole weekends, in the field observing rocks and collecting fossils, particularly in Pennsylvanian rocks in eastern Ohio. Through these dedicated efforts that continued for many years, he amassed a collection of well-documented Pennsylvanian-age fossils that numbers more than 50,000 specimens. These specimens are in the collections of Orton Geological Museum in the Department of Geological Sciences at The Ohio State University.

Sturgeon's goal, however, was not only to amass one of the largest collections of Pennsylvanian-age fossils in the world, but to study, describe, and document them in a series of publications. To this end, he enlisted the assistance of fellow researcher Dr. Richard D. Hoare of Bowling Green State University, and later several other specialists, to compile a series of monographs describing these fossils. These monographs were published by the Ohio Division of Geological Survey. The first, Ohio Geological Survey Bulletin 63, *Pennsylvanian brachiopods of Ohio*, appeared in 1968, followed by Bulletin 67, *Pennsylvanian marine Bivalvia and Rostroconchia of Ohio*, in 1979, Report of Investigations 142, *Pennsylvanian trilobites of Ohio*, in 1989, and Bulletin 71, *Pennsylvanian cephalopods of Ohio*, in 1997. In addition to these monographic works, Sturgeon, Hoare, and other researchers published numerous papers on these fossils in scientific journals. Many of Sturgeon's students completed theses or dissertations that were based on his fossil collection. No other state has such comprehensive documentation of the fossils and their stratigraphic occurrences in Pennsylvanian rocks. It is improbable that anyone will ever again assemble such a large and well-documented collection from these rocks. The Sturgeon collection at Orton Geological Museum will provide fruitful research for decades to come.

In 1948, under sponsorship of the Survey, Sturgeon began field work in Athens County in order to assemble a bulletin on the geology of this area. As was typical of his approach to geology, and perhaps any task, he demanded thoroughness and attention to detail. He spent every summer for nearly the next decade measuring stratigraphic sections (detailed descriptions of vertical thicknesses of outcropping rocks) in Athens County and documenting other geologic features. In 1958, the Survey published Bulletin 57, *The geology and mineral resources of Athens County, Ohio*. This 600-page bulletin has been called the most comprehensive county geology report of any county in the country. The data in this report are still being used by a new generation of geologists to develop depositional models and interpretations of these coal-bearing rocks.

Myron Sturgeon was not only a dedicated teacher and researcher, he was also a member of many geological and conservation organizations. In 1955, he was appointed by Governor Frank Lausche to the Natural Resources Commission of the Ohio Department of Natural Resources. He served on this advisory council for 20 years, the last three (1972-1975) as chairman. In 1979, the Ohio Department of Natural Resources recognized Myron Sturgeon's contributions with a Conservation Achievement Award. Throughout this tenure, Sturgeon was a strong supporter of the Survey and its mission.

Myron Sturgeon's other contributions did not go unrecognized. In 1977, the Department of Geological Sciences at The Ohio State University presented him with the Orton Award, which recognizes outstanding alumni of the department. In 1987, at the Sesquicentennial celebration of the Ohio Geological Survey, he was presented with the first Mather Medal, named after Ohio's first State Geologist and in recognition of outstanding, career-long contributions to the knowledge of the geology of Ohio. His many students initiated the Myron T. Sturgeon Honor Fund in 1974 to provide modest funding for his continued research activities and to assist with student loans and scholarships and equipment purchases for the Department of Geological Sciences at Ohio University.

All of this dedicated work and service was accomplished despite the fact that Myron was an insulin-dependent diabetic since his days as a graduate student. He conscientiously controlled this condition and often remarked that his longevity was attributable to good genes (his father lived until his mid-90's), and that he should have a picture of a pig on his tombstone as a reminder of the source of the insulin that kept him alive and active for so many years.

Myron T. Sturgeon gave inspiration to many students and taught them fundamentals of geology and geologic field work. A large number of these students went on to successful geologic careers in industry, government, and academic research. He directed some of these students to positions at the Ohio Geological Survey. He was a mentor, friend, and unrelenting supporter of geology, conservation, the Division of Geological Survey, and the Ohio Department of Natural Resources.

Dr. Sturgeon is survived by daughters Lynn Sturgeon and Sharon DeMaria, two grandchildren, one sister, and two brothers. His many friends, colleagues, and students will remember him fondly for the rest of their days, and his contributions to the geology of Ohio will survive far longer.

—Michael C. Hansen

Our Web address has changed—but only slightly

To streamline our Web address, the "/odnr/" has been dropped. Our URL is now <www.dnr.state.oh.us/geo_survey/>. If you have us bookmarked, your Web browser should automatically direct you to the new address.

UPDATE ON SURVEY'S OIL- AND GAS-WELL DATABASE

The Division of Geological Survey's Petroleum Geology Group has completed Phase II of its oil- and gas-well data-conversion project by assigning API (American Petroleum Institute) standard well-permit numbers to every well in the state. Each well is now uniquely identified, making data retrieval and data matching easier for users of the data. All existing "regular" permit numbers have been assigned a 20,000-series number, and all "nonregular" permit numbers (or wells that did not have any type of permit number) have been assigned a 60,000-series number. The numbers have been assigned sequentially by county. In addition, all map-based records have been matched with the corresponding paper well records (completion cards) on file in the Survey's Geologic Records Center. This labeling process now ties all records—digital data files, digital maps, and paper records—together via the API number.

After API well numbers were assigned, location coordinates for all well files were expanded to include coordinates for the Ohio State Plane Coordinate System, North American Datum of 1983 (NAD83), in addition to NAD27 coordinates. NAD27 and NAD83 coordinates are now both stored in the associated data files.

The Phase II records have been merged with existing records in ODNR's version of the risk-based data-management system (RBDMS). Skeletal data on many historic wells and coordinates for all wells are available to users of this system.

The well-location data files are stored by county and can be downloaded from the Division of Geological Survey's Web site, <www.dnr.state.oh.us/geo_survey/>. Well-location records for the entire state may be purchased on CD-ROM for $25.00 plus applicable tax and handling by contacting the Geologic Records Center, 4383 Fountain Square Drive, 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. For more information on the database, contact Joe Wells at 614-265-1030 or e-mail him at joseph.wells@dnr.state.oh.us.

Phase III of the data-conversion project is underway. All historic well cards are being digitally imaged and the well information entered into the RBDMS system. When completed, users will be able to access all located well information and view the images of the original well cards from within RBDMS. This phase of the project will be done a county at a time, so the original file records will be unavailable while they are being scanned. As counties are completed, their records will become available digitally. It is anticipated that the entire state will be completed by early 2003. Questions concerning Phase III of this project should be directed to Larry Wickstrom at 614-265-6598, e-mail: larry.wickstrom@dnr.state.oh.us. For information concerning specific well-card availability during this project, please contact Garry Yates at 614-265-6581, or e-mail: gary.yates@dnr.state.oh.us (please note the "misspelling" of Garry's first name in the ODNR e-mail system).

—Lawrence H. Wickstrom

20th anniversary

The first issue of *Ohio Geology* was published in the summer of 1981. For the past 20 years, we have presented timely and timeless articles and information on a quarterly (mostly!) basis on topics ranging from fossils to mining to radon. It is a tribute, perhaps, to the wonderful diversity of Ohio geology that there never seems to be a dearth of topics for feature articles. (The time to research and write them is another story.) The series summarizing the geologic systems has been the most ambitious offering. Descriptions of the Precambrian through the Mississippian have been completed; descriptions of the Pennsylvanian, Permian, and Pleistocene are planned. We hope we have achieved our goal of educating Ohio's citizens on the importance of geology and geologic studies in an informative and entertaining fashion.

Ohio Geology

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