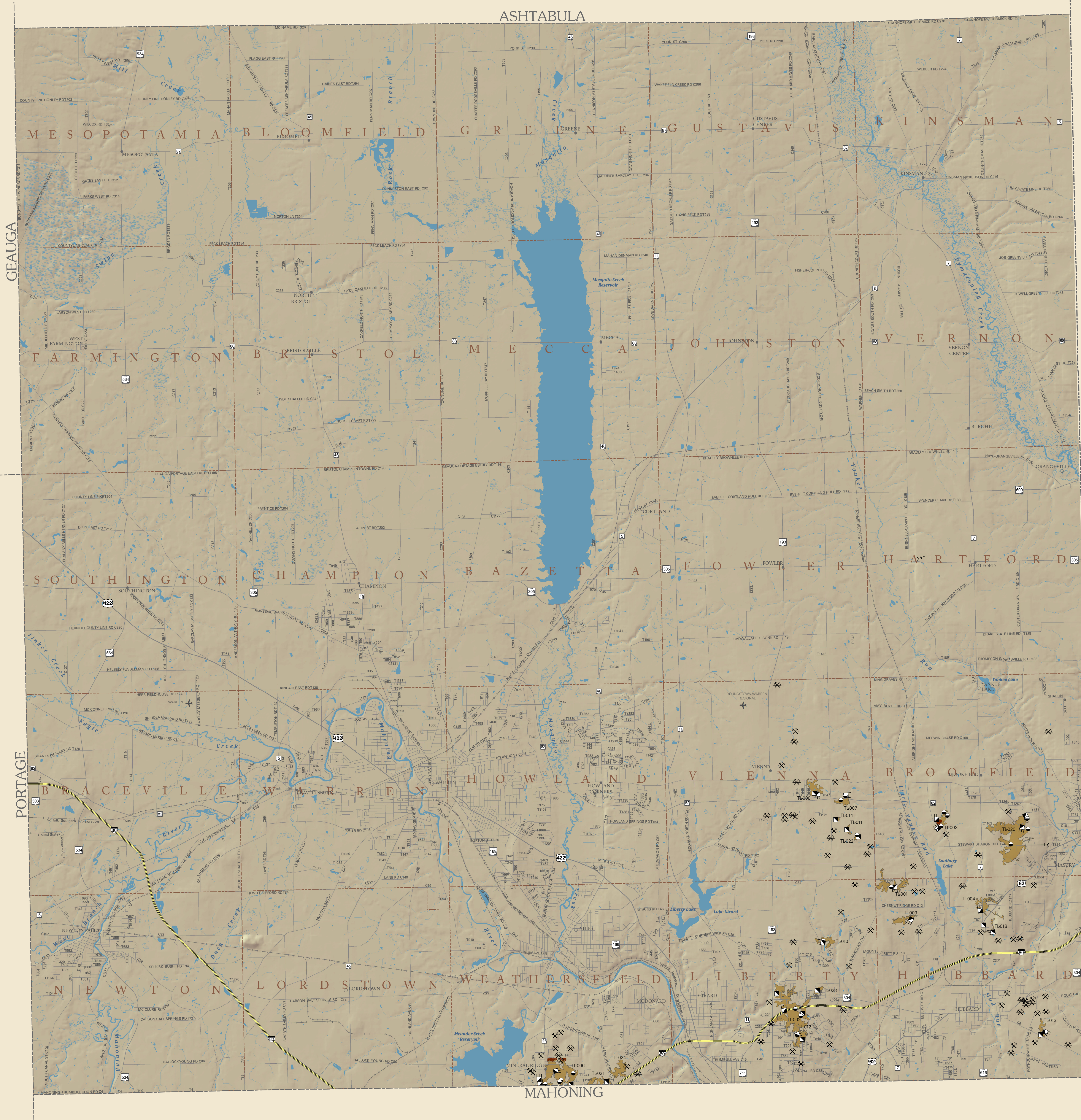


# ABANDONED UNDERGROUND MINES - TRUMBULL COUNTY

by  
Douglas L. Crowell, Richard M. DeLong, Charles E. Banks, Paul D. Hoeffler, Christopher P. Gordon,  
James McDonald, Joseph G. Wells, Donovan M. Powers, and Ernie R. Slucher  
cartography by Dean R. Martin



### PURPOSE OF THIS MAP

Underground mining of rock and mineral resources in the Ohio region began more than 200 years ago when the state was still a territory (Crowell, 1995a). Thousands of abandoned underground mines (AUMs) have resulted from this resource extraction and today pose a major geologic hazard, especially in the historic coal- and clay-mining districts of eastern and southeastern Ohio (Slucher and others, 2006). The locations of a large number of these mines are known; however, mining and geologic-resource professionals believe that several thousand additional small AUMs with unknown locations likely exist because a large number of mines were created before mine-reporting laws were enacted. This map provides information about the geographic distribution of known AUM areas (several are part of active underground mines), AUMs where the extent of mining is partially known, and the locations of entryways associated with AUMs of unknown size and area.

One of the most significant hazards associated with AUMs is *mine subsidence*, which occurs when subsurface bedrock or unconsolidated materials collapse into voids left by mining, causing the ground surface to lower. When mines abandoned, roof-support timbers and other mine structures can deteriorate over time and increase the risk of collapse. Even though deterioration takes place over a number of decades, mine roof collapse can occur in a short period of time without warning. A collapse can create hazardous conditions, such as small pits, openings, or broad depressions on the surface that result in damage to building foundations, underground utilities, and roadways (Crowell, 2001).

Abandoned underground mines have been located in 43 of Ohio's 88 counties. The EG-3B series of maps show the general distribution of AUMs within specific counties. The maps are designed to educate the public as to where underground mining has occurred in the past. A larger, poster-sized map (EG-3, 1:500,000-scale), maps based on U.S. Geological Survey 1:24,000-scale topographic maps (EG-3, 1:24,000-scale), and the online, interactive *Abandoned Underground Mine Locator* are designed to assist landowners and public officials in ascertaining whether a property overlies an AUM.

### OHIO'S MINING HISTORY

Most AUMs in Ohio were used for coal production, which has a long history in the state. The first reported commercial extraction of coal occurred in 1804, prior to statehood in 1803; by 1908, approximately 50,000 workers were operating more than 1,000 underground mines in the state (Crowell, 1995a). From 1800 to 2010, approximately 2.35 billion tons of coal was produced from underground mines located in northeastern, eastern, and southeastern Ohio. Much of early mining occurred near cultural centers or points of coal utilization that, over time, have been enveloped by urban expansion.

The advent of post-World War II mechanization technologies made large-scale surface mining feasible and reduced the number of mines using underground mining methods for coal extraction. Over the past two decades, however, as the availability of coal extractable by surface methods has declined, the volume of coal produced by underground methods has increased from approximately 35 percent to more than 67 percent of the yearly coal production in Ohio (Lopez, 1988; Wolfe, 2011). Consequently, AUMs have increased, and knowing the locations of AUMs is essential when planning new underground operations.

Underground mines also have been used in Ohio to produce industrial minerals—clay, limestone, salt, shale, gypsum, iron ore, and sandstone. In 2010, four industrial-mineral underground-mining operations were active; two operations produced salt and two produced limestone (Mark E. Wolfe, oral communication, 2012).

### UNDERGROUND MINING METHODS

Three types of underground mines are found in Ohio, each named for the type of opening workers use to gain access to the commodity being extracted (Fig. 1). A *drift mine* extends horizontally from the surface into the resource being extracted. Most abandoned underground mines and many industrial-mineral mines in Ohio are drift mines. A *shaft mine* has a vertical opening that extends downward from the surface, and a *slope mine* has an inclined shaft opening. Shaft and slope mines generally are used when surface mining is not economically feasible or where surface features, such as towns or rivers, make surface mining impractical. Shaft and slope mines in Ohio, particularly those developed to extract coal, typically extend no more than 500 feet below the surface. However, mines of greater depth have been excavated for production of industrial minerals. For example, the abandoned Pittsburgh Plate Glass limestone mine, near the city of Norton in Summit County, is a shaft mine that extends more than 2,200 feet below the surface.

After a geologic commodity has been reached through a drift, slope, or shaft opening, either the *room-and-pillar* or *longwall* mining method is used to extract the resource from the rocks. Since mining in Ohio began, the room-and-pillar method has been the primary underground-mining system used. In a room-and-pillar mine, large areas of a resource are extracted, creating openings (rooms), and intervening blocks (pillars) of the resource are left in place to serve as roof support for the mine (Fig. 2). In some instances, a large percentage of the remaining pillars are systematically removed during a final phase of mining, known as "pillaring" or "walling pillars" to maximize resource recovery. If pillars are not removed, only 50–70 percent of the resource is recoverable (Crowell, 2002).

In a longwall mine, large resource areas called *panels*, which can reach several thousands of feet in length and width, are mined in a continuous process (Fig. 3). As mining progresses through a panel, no roof-supporting pillars are left in the extraction areas; instead, the roof rock is allowed to collapse into the mined-out areas in a relatively controlled process. Up to 90 percent of a mineral resource can be recovered using the longwall mining system. Even though there are more room-and-pillar mines than longwall mines in Ohio, longwall mining currently is the predominant means of large-scale, underground coal extraction in Ohio (Wolfe, 2011).

Both room-and-pillar and longwall mining systems are subject to subsidence, which is discussed in detail in the "Purpose of this Map" section of this text. For specific details on mine subsidence, see Crowell (1995b; 2001), DeLong (1988), and Gordon (2009).

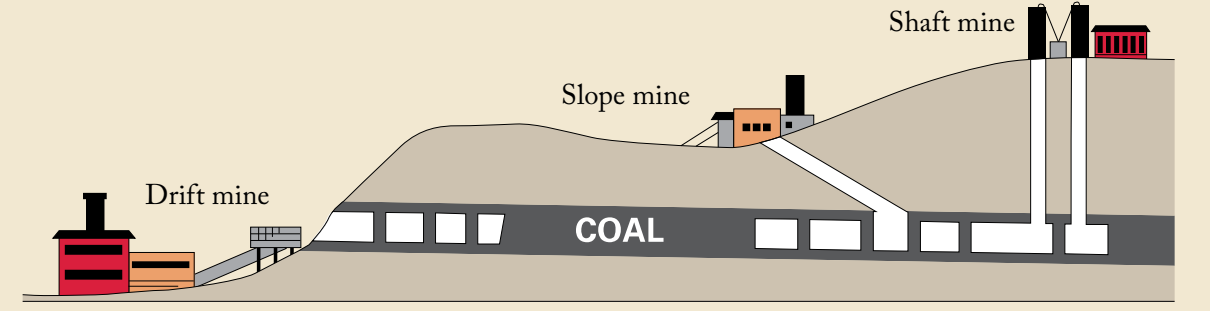


Figure 1—Types of underground mining methods used in Ohio (modified from Crowell, 2000).

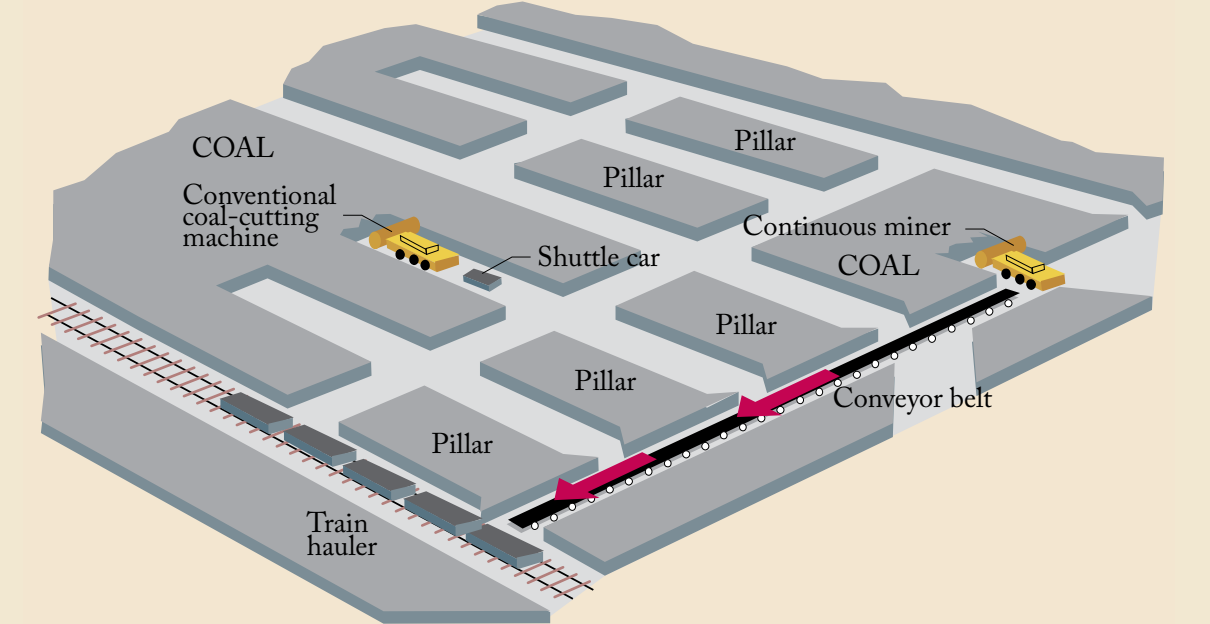


Figure 2—Room-and-pillar mining method. In most older mines, the rooms were created by blasting and excavating the coal into shuttle cars that hauled coal to the surface. Most modern room-and-pillar mines use continuous-miner machinery to cut and directly feed the coal to a conveyor system that transports it to the surface. (Graphic from *The Columbus Dispatch*, 2006, used with permission.)

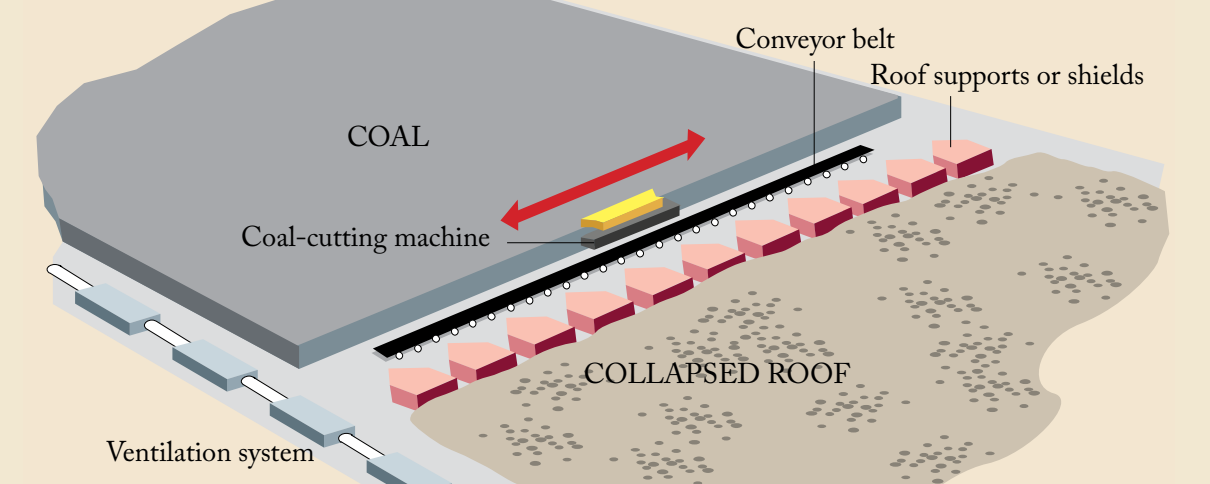


Figure 3—Longwall underground mining method. In a longwall mine, a cutting machine moves back and forth across a panel of coal that can be up to 1,100 feet in width and 7,000 feet in length. The cut coal falls onto a flexible conveyor or return airway. Hydraulic supports (shields) hold up the mine roof and cutting machinery as the coal is cut. The roof in the mined-out area falls as the shields advance. (Graphic from *The Columbus Dispatch*, 2006, used with permission.)

### EXPLANATION

- Underground Mine - Extent Partially Unknown
- Air Shaft
- Drift Entry
- Vertical Mine Shaft
- Inclined Mine Shaft
- Mine Location - Extent Unknown
- State mine number

### REFERENCES

Crowell, D.L., 1995a, History of the coal-mining industry in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Bulletin 72, 204 p.

Crowell, D.L., 1995b, The hazards of mine subsidence: Ohio Department of Natural Resources, Division of Geological Survey Ohio Geology, Fall issue, p. 1–6. <http://www.dnr.state.oh.us/Portals/0/pubs/ohio/ohio0209.pdf>.

Crowell, D.L., 2001, Mine Subsidence: Ohio Department of Natural Resources, Division of Geological Survey Geofacts no. 12. <http://www.dnr.state.oh.us/Portals/0/pubs/Geofacts/EG2001.pdf>. (Revised 2003)

Crowell, D.L., 2002, Coal mining and reclamation: Ohio Department of Natural Resources, Division of Geological Survey Geofacts no. 15. <http://www.dnr.state.oh.us/Portals/0/pubs/Geofacts/EG2002.pdf>.

DeLong, R.M., 1988, Coal mine subsidence in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Ohio Geology, Fall issue, p. 1–4. <http://www.dnr.state.oh.us/Portals/0/pubs/ohio/ohio0209.pdf>.

Gordon, C.P., 2009, Mine Subsidence—Mitigating that sinking feeling: Ohio Department of Natural Resources, Division of Geological Survey Ohio Geology, no. 1, p. 1–5. <http://www.dnr.state.oh.us/Portals/0/pubs/ohio/ohio0209.pdf>.

Lopez, S.W., 1988, 1987 Report on Ohio mineral industries: Ohio Department of Natural Resources, Division of Geological Survey, 113 p.

Slucher, E.R. (principal compiler), Swintford, E.M., Larson, C.E., Schuchter, G.A., Strick, D.L., Rice, C.L., Condit, M.R., and Ren, R.G., with GIS production and cartography by Powers, D.M., 2006, Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, scale 1:500,000.

Wolfe, M.E., 2011, 2010 Report on Ohio mineral industries—An annual summary of the state's economic geology with directories of reporting coal and industrial mineral operations: Ohio Department of Natural Resources, Division of Geological Survey, 111 p. <http://www.dnr.state.oh.us/Portals/0/pubs/ohio/ohio0209.pdf>.

<sup>1</sup>Visit [www.OhioGeology.com](http://www.OhioGeology.com) to access the Ohio Abandoned Underground Mines Locator.

This product of the Ohio Department of Natural Resources (ODNR), Division of Geological Survey is intended to provide general information only and should not be used for any other purpose. It is not intended for resale or to replace site-specific investigations. These data were compiled by the ODNR Division of Geological Survey, which reserves the publication rights in this material. If these data are used in the compilation of other data sets or maps for distribution or publication, this source must be referenced.

### Recommended bibliographic citation:

Crowell, D.L., DeLong, R.M., Banks, C.E., Hoeffler, P.D., Gordon, C.P., McDonald, James, Wells, J.G., Powers, D.M., and Slucher, E.R., with GIS production and cartography by Martin, D.R., 2013, Abandoned underground mines of Trumbull County, Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-3B Trumbull, scale 1:62,500.

The information contained herein may be updated or edited in the future. Future releases of this material, if altered, will display a revision date. Users should check to ensure they have the latest version and reference the appropriate revision date if it is being used in other works.

Neither the Ohio Department of Natural Resources, nor any agency thereof, nor any of its employees, contractors, or subcontractors, make any warranty, expressed or implied, nor assume any legal liability or responsibility for the accuracy, completeness, or usefulness of this product. Any use thereof for a purpose other than that for which said information or product was intended shall be solely at the risk of the user.

