STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
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ABANDONED UNDERGROUND MINES - LUCAS COUNTY

by
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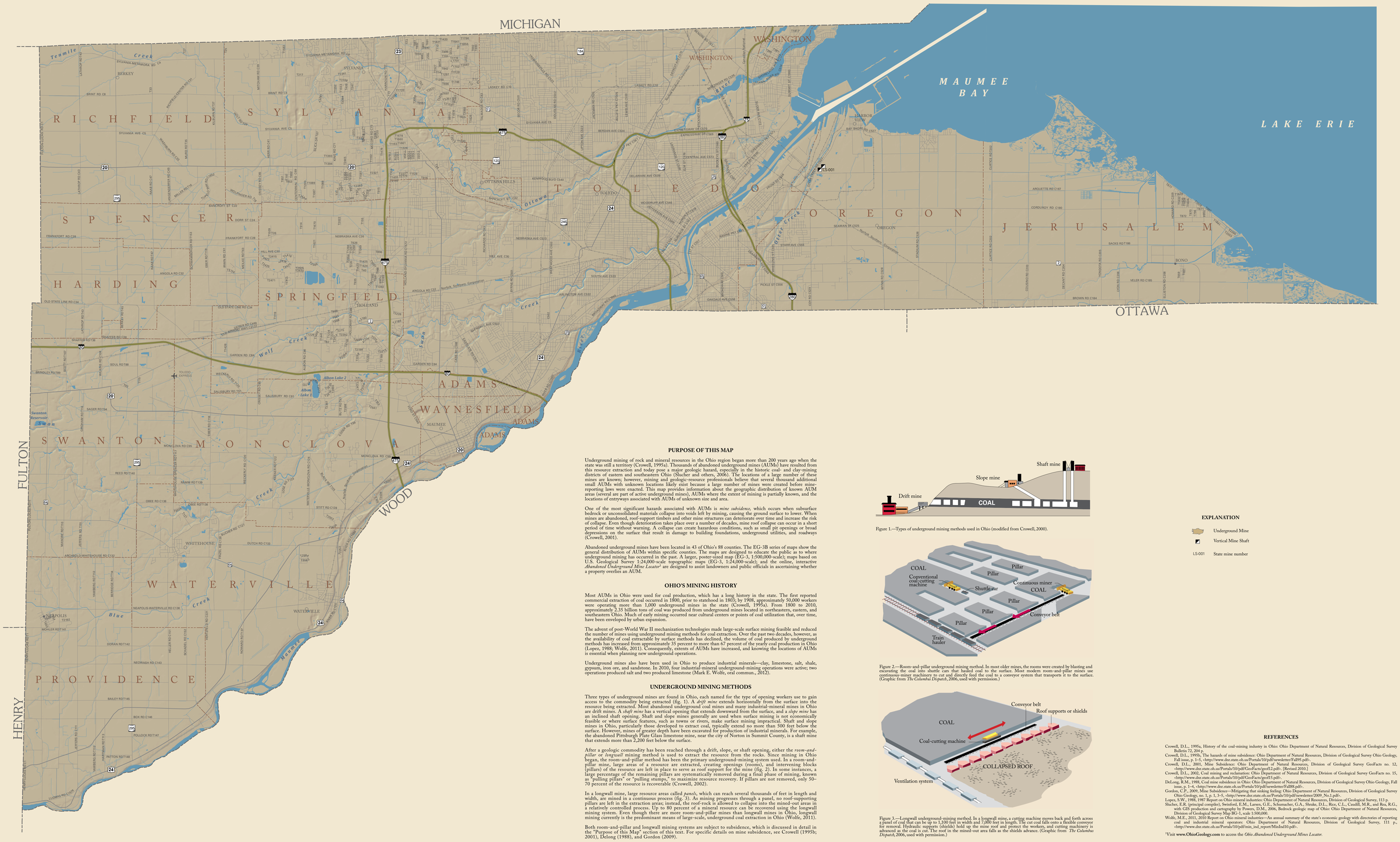
MAP EG-3B LUCAS
ABANDONED UNDERGROUND MINES
OF LUCAS COUNTY
6/2013



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 are 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 pit 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*[1] 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 1800, 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, extents of 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 commun., 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 coal 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 "pulling pillars" or "pulling stumps," 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 80 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 underground 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 for removal. Hydraulic supports (shields) hold up the mine roof and protect the workers, and cutting machinery is advanced 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
- Vertical Mine Shaft
- LS-001 State mine number

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[1]Visit **www.OhioGeology.com** to access the *Ohio Abandoned Underground Mines Locator*.

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www.OhioGeology.com

Index map

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W E
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1 0.5 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

Scale 1:62 500

Base map derived from Ohio Department of Transportation data sets.
Projection of data is Ohio coordinate system, south zone, North American Datum, 1983.