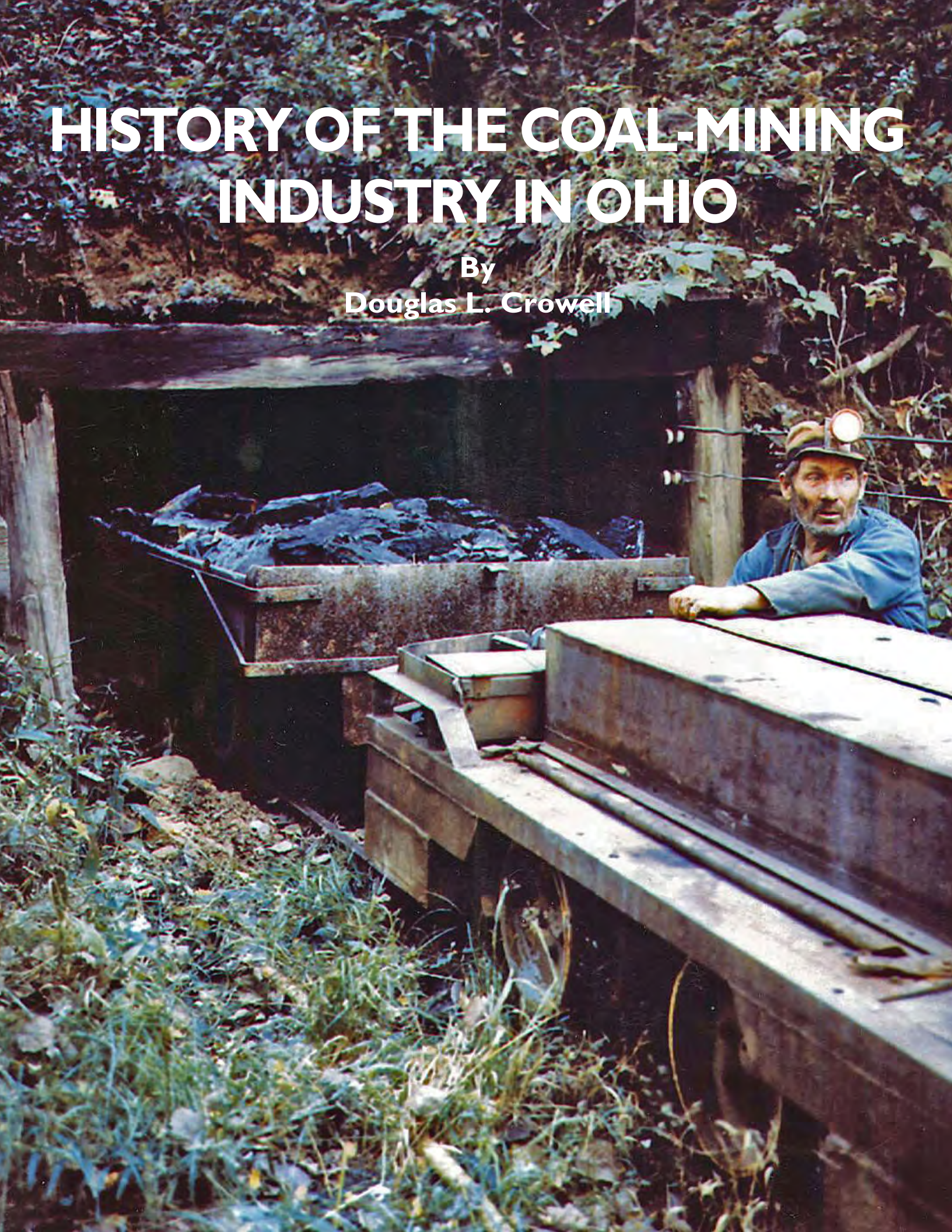
HISTORY OF THE COAL-MINING INDUSTRY IN OHIO

By
Douglas L. Crowell



DIVISION OF GEOLOGICAL SURVEY
4383 FOUNTAIN SQUARE DRIVE
COLUMBUS, OHIO 43224-1362
(614) 265-6576
(614) 447-1918 (FAX)

OHIO GEOLOGY ADVISORY COUNCIL

Dr. E. Scott Bair, *representing Hydrogeology*
Dr. J. Barry Maynard, *representing At-Large Citizens*
Mr. Michael T. Puskarich, *representing Coal*
Mr. Ronald M. Tipton, *representing Industrial Minerals*
Mr. Mark R. Rowland, *representing Environmental Geology*
Dr. Samuel I. Root, *representing Higher Education*
Mr. William M. Rike, *representing Oil and Gas*

SCIENTIFIC AND TECHNICAL STAFF OF THE DIVISION OF GEOLOGICAL SURVEY

ADMINISTRATION (614) 265-6988

Thomas M. Berg, MS, *State Geologist and Division Chief*
Robert G. Van Horn, MS, *Assistant State Geologist and Deputy Division Chief*
Dennis N. Hull, MS, *Assistant State Geologist and Deputy Division Chief*
Michael C. Hansen, PhD, *Senior Geologist, Ohio Geology Editor, and Geohazards Officer*
James M. Miller, BA, *Fiscal Officer*
Billie Long, *Fiscal Assistant*
Sharon L. Stone, AD, *Executive Secretary*

BEDROCK GEOLOGY MAPPING GROUP (614) 265-6473

Edward Mac Swinford, MS, *Geologist Supervisor*
Glenn E. Larsen, MS, *Geologist*
Gregory A. Schumacher, MS, *Geologist*
Douglas L. Shrake, MS, *Geologist*
Ernie R. Slucher, MS, *Geologist*

ENVIRONMENTAL & SURFICIAL GEOLOGY GROUP (614) 265-6599

Richard R. Pavey, MS, *Geologist Supervisor*
C. Scott Brockman, MS, *Geologist*
Kim E. Vorbau, BS, *Geologist*

LAKE ERIE GEOLOGY GROUP (419) 626-4296, (419) 626-8767 (FAX)

Scudder D. Mackey, PhD, *Geologist Supervisor*
Danielle A. Foye, BS, *Geology Technician*
Jonathan A. Fuller, MS, *Geologist*
Donald E. Guy, Jr., MS, *Senior Geologist*
Dale L. Liebenthal, *Operations Officer & &search Vessel Operator*

COAL GEOLOGY GROUP (614) 265-6594

Douglas L. Crowell, MS, *Geologist Supervisor*
Allan G. Axon, PhD, *Geologist*
Richard W. Carlton, PhD, *Senior Geologist*

CARTOGRAPHY & EDITING GROUP (614) 265-6593

Edward V. Kuehnle, BA, *Cartographer Supervisor*
Merrianne Hackathorn, MS, *Geologist and Editor-*
Ray 0. Klingbeil, AD, *Cartographer*
Michael R. Lester, BS, *Cartographer*
Robert L. Stewart, *Cartographer*
Lisa Van Doren, BA, *Cartographer*

PETROLEUM & COMPUTER GEOLOGY GROUP (614) 265-6583

Ronald G. Rea, MS, *Geologist Supervisor*
Mark T. Baranoski, MS, *Geologist*
James McDonald, MS, *Geologist*
Ronald A. Riley, MS, *Geologist*
Lawrence H. Wickstrom, MS, *Senior Geologist and Computer Coordinator*

INDUSTRIAL MINERALS GROUP (614) 265-6602

David A. Stith, MS, *Geologist Supervisor*
Norman F. Knapp, PhD, *Chemical Laboratory Coordinator*
Sherry L. Weisgarber, MS, *Geologist and Mineral Statistician*

GEOLOGIC RECORDS CENTER (614) 265-6585

Garry E. Yates, NZCS, *Supervisor*
Angelena M. Bailey, *Public Inquiries Assistant*
Madge R. Fitak, BS, *Natural Resources Aide*

An Equal Opportunity Employer - M/F/H
recycled paper

STATE OF OHIO
George V. Voinovich, Governor
DEPARTMENT OF NATURAL RESOURCES
Donald C. Anderson, Director
DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

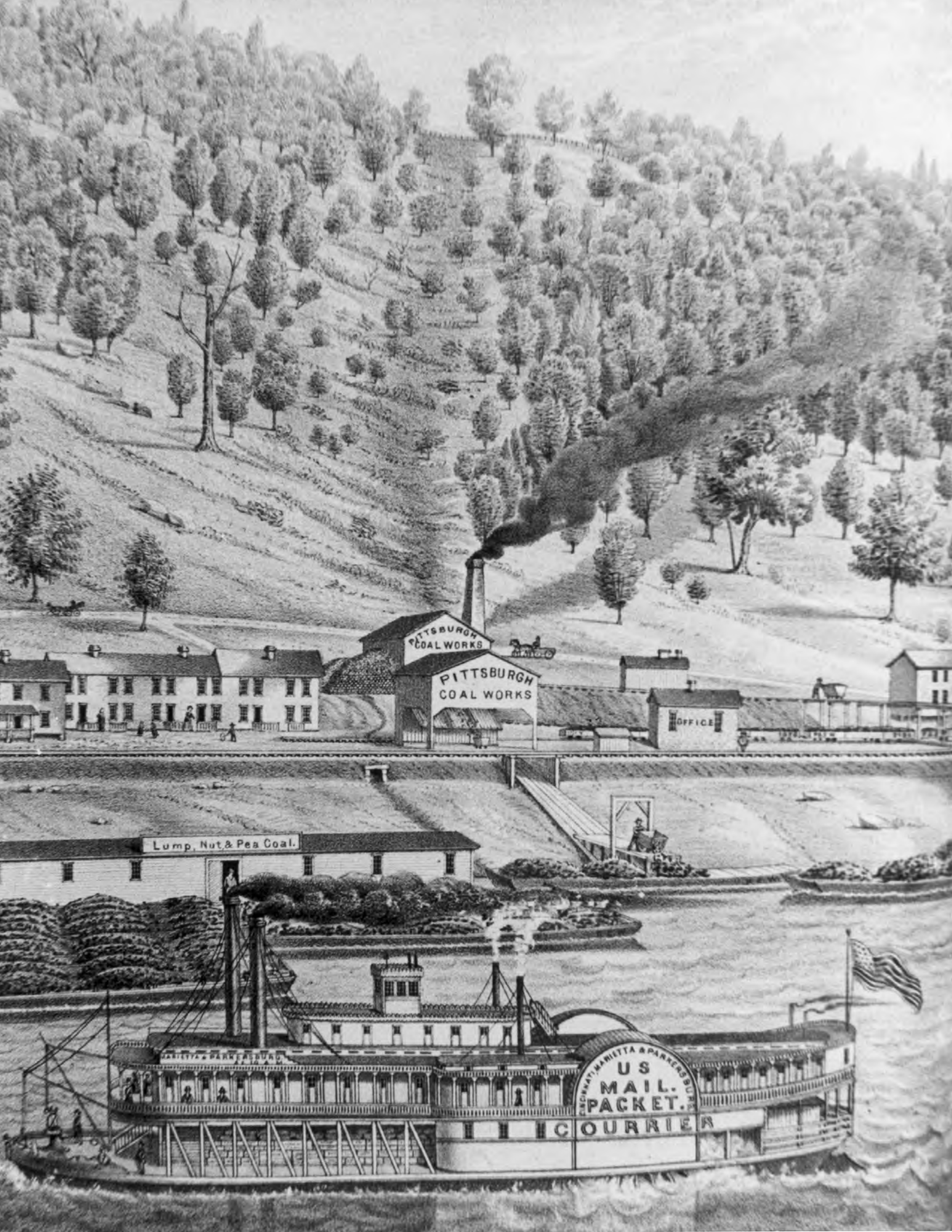
BULLETIN 72

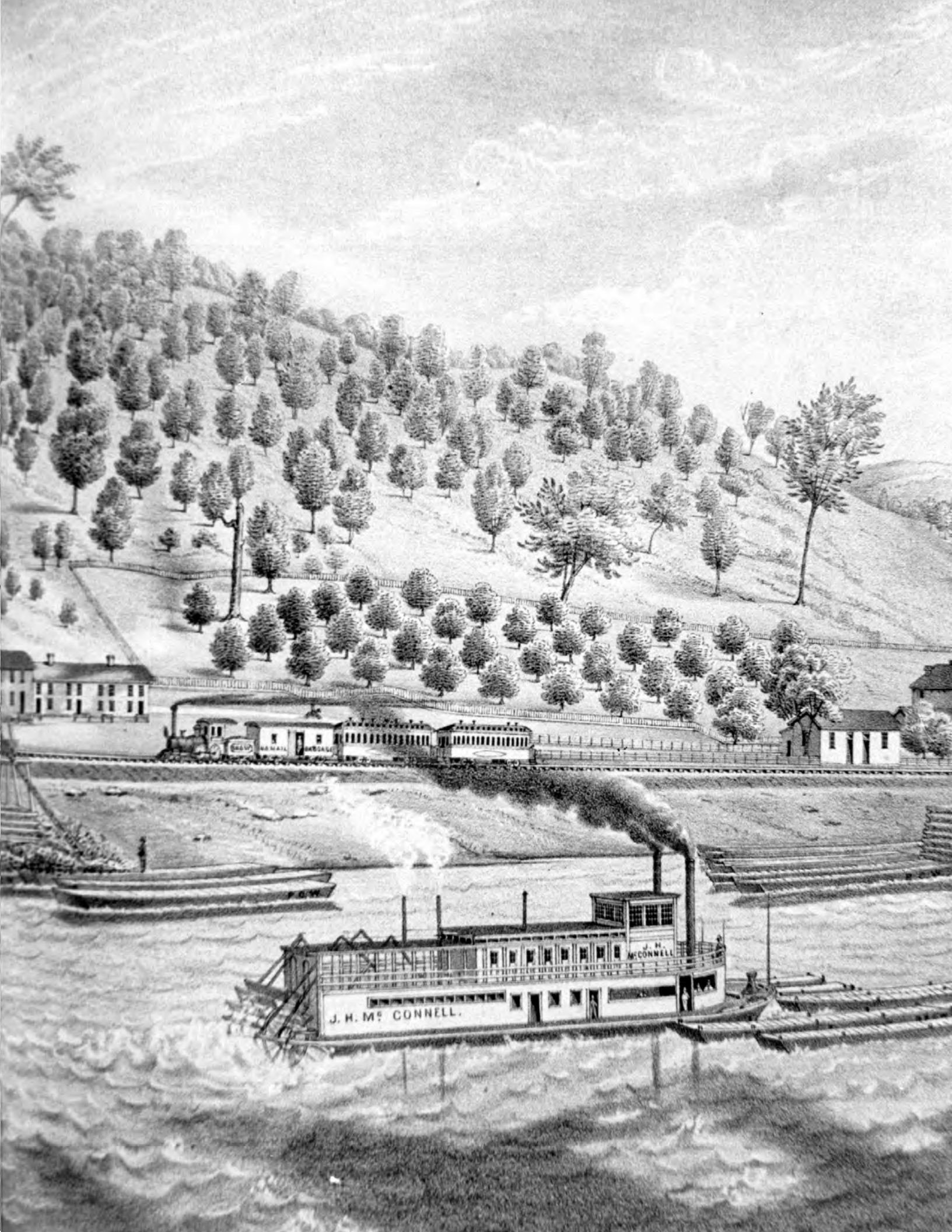
HISTORY OF THE COAL-MINING INDUSTRY IN OHIO

by

Douglas L. Crowell

Columbus
1995


PITTSBURGH
COAL WORKS
PITTSBURGH
COAL WORKS
OFFICE
Lump, Nut & Pea Coal.
US
MAIL.
PACKET.
COURRIER


J. H. Mc CONNELL.
J. H. McCONNELL

Typesetting and layout: Graphic Directions

Frontispiece: Coal being shipped on the Ohio River from Bellaire, Belmont County, *circa* 1840's. Illustration from Caldwell (1880, p. 80a, 80b).

Cover illustration: Ray Stahl hauling a load of coal from his tiny Tuscarawas County mine, the only one-man operation listed in 1978 by the Ohio Division of Mines. According to Stahl, his mine, is just a *short ways out of Port Washington in southern Tuscarawas County. It's across the* [Tuscarawas] *river, 'round the bend to the right and a short ways up the first valley* (The Columbus Dispatch Sunday Magazine, January 28, 1979, p. 6). Stahl opened his mine, located in Salem Township, in 1958, mining into a 36-inch-thick seam of Middle Kittanning (No. 6) coal. He abandoned the mine in 1982 (Jim Bouscher, 1994, personal communication). As is common of small "dog-hole" or family-operated mines in Ohio, no map is available which shows the workings of Stahl's mine. Photo by Fred Shannon, from the cover of The Columbus Dispatch Sunday Magazine, January 28, 1979. Reprinted with permission from The Columbus Dispatch. (See also figure 38.)

To Ohio coal miners—

for working tirelessly with great ingenuity
to make a better way of life.

To Sherry, Daniel, Scott, Andrew, Matthew, and Christopher—

for never losing patience
or minimizing the importance of the past.

[Blank Page]

FOREWORD

As we approach the next millennium, it is important that we evaluate and understand our history as a state and as a nation. Only with this perspective can we make wise plans for our future. World energy resources will be a major concern well into the coming millennium. At some point during the next few hundred years, humanity will probably identify a pure and nearly inexhaustible source of energy to maintain a balanced society. However, in light of diminishing public investment in scientific research and development, it appears that our society will continue to depend on fossil fuels for its energy needs for the immediate future.

As responsible members of the world community, present and future legislators and public policy-makers will have to make farsighted and conscientious decisions about our domestic energy resources and how their use affects our natural environment. Conservation of energy clearly must be a major planning factor for the future. But the need for an increased energy supply will be a natural consequence of an expanding population and an advancing quality of life. There is no way to produce more fossil energy without having some effect on the environment, but it must be possible to strike a reasonable balance between providing adequate energy supplies and achieving environmental security.

The history of coal mining in Ohio presented in this Survey bulletin shows how this abundant energy and raw material resource has played a pivotal role in the growth of our state as an important leader in the industrial development of the United States. It was critical to the outcome of both World Wars. The present decline of the Ohio coal industry is distressing and formidable, because this carbon-based energy resource will be needed as a bridge to the future. With a dismantled industry, it will be very expensive to rebuild the mining infrastructure once clean-coal technologies are finally implemented.

The Ohio Department of Natural Resources, Division of Geological Survey has played an important role in the development of the state's coal industry. For more than 150 years, it has provided critically important information about the location, quantity, and quality of Ohio's coal seams. Presently, the Survey cooperates with the U.S. Geological Survey (USGS) in building the National Coal Resources Data System (NCRDS), a computerized, public-domain database that shows the areal distribution of individual coal seams and identifies coal quality and quantity. The Survey also cooperates with the USGS in developing maps and reports describing the present availability of Ohio's coals as a function of geologic, demographic, and environmental constraints. With partial funding from the USGS, Ohio Survey geologists are mapping the distribution of coal-bearing formations in all of eastern and southeastern Ohio, much of which has never been mapped by modern geologic standards. Limestone and dolomite resources that are crucial to clean-coal technologies are currently being assessed in cooperation with the Ohio Valley Mineral Consortium. The Division remains committed to providing quality service for the state's coal miners and producers so that future Ohioans will be energy secure.

This publication authored by Douglas L. Crowell will serve as an outstanding documentation of one of Ohio's most important natural-resource industries. It will also serve as an inspiration for the future. Ohio's coal miners and their families are the archetypes of true-grit Americans who can succeed against almost all odds. The coal miner's spirit of determination and courage in the face of challenge and great danger is the spirit that will be needed to make the wise decisions about our nation's energy future. The Division of Geological Survey hopes you will enjoy—and learn from—this bulletin.

Thomas M. Berg
State Geologist & Chief

[Blank Page]

CONTENTS

FIGURES

Page

TABLES

[Blank Page]

Chapter I

INTRODUCTION

Coal is entitled to be considered as the mainspring of our civilization. By the power developed in its combustion, all the wheels of industry are kept in motion, commerce is carried with rapidity and certainty over all portions of the earth's surface, the useful metals are brought from the deep caves in which they have hidden themselves, and are purified and wrought to serve the purposes of man. By coal, night is in one sense converted into day, winter into summer, and the life of man, measured by its fruits, greatly prolonged. Wealth, with all the comforts, the luxuries and the triumphs it brings, is its gift. Though black, sooty and often repulsive in its aspects, it is the embodiment of a power more potent than that attributed to the genii in oriental tales. Its possession is, therefore, the highest material boon that can be craved by a community or nation. Coal is also not without its poetry. It has been formed under the stimulus of the sunshine of long past ages, and the light and power it holds are nothing else than such sunshine stored in this black casket, to wait the coming and serve the purposes of man. In the process of formation it composed the tissues of those strange trees that lifted their scaled trunks and waved their feathery foliage over the marshy shores of the carboniferous continent, where not only no man was, but gigantic salamanders and mail-clad fishes were the monarchs of the animated world.

(Newberry, 1871, p. 33)

I am coal.
I keep the home fires burning.
I fire the furnaces of great apartments.
I make the hoe and plow possible.
I make the farm modern
I play a leading part in food production.
I help make iron.
I help make steel.
I keep railroad locomotives moving.
I send the great ships to sea.
I made the automobile possible.
I maintain modern factories.
I keep the laboring man working.

I am coal.
I warm the humblest home.
I warm the rich man's castle.
I warm the picture show.
I warm the opera house.
I warm the schools where children learn.
I warm the high school.
I warm the college.
I warm the university.
I warm the store and office.
I warm the state house.
I warm the nation's capitol.
I warm the church in which men worship.
I am not unkind to the criminal.
I warm the prison.
I help establish justice.
I work for domestic tranquility.
I promote the general welfare.
I am stored up sunshine.
I am coal.

(Watkins, 1937, p. 32)

FIGURE 1.—Inspirational cartoons and editorials in support of the coal-mining industry were routinely published during World War II. From Hanna Coal News (December 1942, front cover).

One ton of bituminous coal is needed to produce enough steel to make one 2,000-pound aerial bomb, or twenty 100-pound aerial bombs, or nine 3-inch trench mortars, or nine 20-mm antiaircraft cannons, or sixteen 5-inch shells, or twenty-one 4-inch shells.

Is Coal Important?

Bituminous coal serves the war effort in more ways than turning out the steel for guns, ships, tanks and planes. Many of the basic ingredients of explosives, plastics, dye and dye-stuffs, pharmaceuticals, photographic chemicals, industrial solvents and other important war materials are derived from coal by way of the by-products [of the] coke industry. The total of their contribution to the war is enormous. Bituminous coal also drives nine out of every ten railroad locomotives, creates 55% of all electric power used in this

country, heats four out of every seven homes, and has 60,000,000 customers.

(Hanna Coal News, October 1943, p. 1, 2)

Coal is something most of us take for granted and its not until we are deprived of its energy-making qualities that we fully realize its importance to our national economy.

(Omar Bradley, quoted *in* Hanna Coal News, January 1958, p. 12)

The lyrical prose on coal by John Strong Newberry, second state geologist of Ohio (1869-1882), the poem on coal by Damon Watkins, the political cartoon (fig. 1) and editorial from Hanna Coal News, and the quote by General Omar Bradley serve well as an introduction to this history of the coal-mining industry of Ohio.

The earliest known record of the occurrence of coal in the United States is from the accounts of the expedition of Louis Joliet and Père Marquette, who traveled down the Wisconsin and Mississippi Rivers to the mouth of the Arkansas River and back to Green Bay by way of the Illinois River in 1673-74. Joliet mentioned "charbon de terre" in northern Illinois and showed it on his map of the area (Eavenson, 1942, p. 16).

Joliet's documentation of the occurrence of coal in the United States was closely followed in 1682 by an account of Father Louis Hennepin, a chaplain who traveled with the French explorer and fur trader Robert Cavalier, Sieur de La Salle into the upper Mississippi Valley. Hennepin's map shows the word "cole mine" on the Illinois River above Fort Crevecoeur (Peoria, Illinois). The accounts of Joliet and Father Hennepin precede the discovery of coal in Ohio by about 75 years.

The first record of coal mining in the United States is for Virginia in 1702 (Humphrey, 1959, p. 5). The next state to report coal production is Pennsylvania, from its bituminous coal fields in 1760. By 1775, coal was being mined in Maryland and North Carolina. In the following year, coal mining began in the anthracite fields of Pennsylvania. By 1790, coal mining had started in Kentucky.

The existence of coal in Ohio was first noted by frontiersmen and travelers as early as 1748. The earliest map record of coal in Ohio is on an undated, untitled, and unsigned manuscript map in the Library of Congress. This map was reproduced in C. A. Hanna's *Wilderness Trail,* where it is called a "Traders Map of the Ohio Country before 1753" (Eavenson, 1942, p. 7, 20). Eavenson attributed the origin of this map to John Pattin, an Indian trader, and believed Pattin made the map in the fall of 1752. The next recorded occurrence of coal in Ohio is from "A Map of the Middle British Colonies in America," published in 1755 by Lewis Evans (Eavenson, 1942, p. 7, 21). Evans noted on his map the word "coals" along the "Hockhocking River" (present-day Hocking River), in the approximate location of Athens County, and along the Muskingum River at the mouth of "Lamanshikola Creek" (present-day Sandy Creek), in the vicinity of Bolivar, Tuscarawas County. An edition of Evans' map was reproduced in 1776 by Thomas Pownall, a close associate of Evans. The Pownall edition of Evans' map is reproduced as figure 2. The Evans map of 1755 was accompanied by a pamphlet entitled, "Geographical, Historical, Political, Philosophical and Mechanical Essays: The first, containing an Analysis of the General Map of the Middle British Colonies in America" (Smith, 1977, p. 14). In his analysis, Evans reported that *there was a coal mine on fire in 1748 at Lamanshikola Creek, on the head of the Muskingum River, the information having been given him by Indian traders* (quoted in Eavenson, 1942, p. 19). A separate account of this same (?) mine fire was reported by Gilbert Imlay (1797, quoted in Stoddard, 1929, p. 222), who stated that *a coal mine, opposite Lamenchicola mouth, took fire in 1748, and kept burning about a twelvemonth, where great quantities are still left.*

In commenting on the burning coal mine cited in Evans' "Analysis," Colonel Charles Whittlesey, geologist and topographer with the first Geological Survey of Ohio (1837-1838), wrote (1883, p. 15) that

the outcrop is located on the side of the river, apparently ten miles north of the Big Sandy at Bolivar; probably on the hills between the river and Sugar Creek. Mention is made of a burning coal bed, which would naturally attract the attention of the red man, and of the white traders who traversed that country along the main trail from the Ohio River, to Sandusky Bay and Detroit. Further north on the waters of Chippeway Creek, a few miles northwest of Clinton, in Summit County, I have seen where such a fire has occurred, a very long time ago; probably as early as 1755.

It is doubtful that the accounts of Evans and Imlay were of an actual coal mine on fire, but more likely an outcrop of coal that had caught fire. There are several reasons for this belief:

1. 1748 was one year before the formation of the first Ohio Company, one of the first organized efforts to acquire land in Ohio for settlement (this attempt ended in failure), and 40 years before the founding of the first permanent settlement in Ohio at Campus Martius (present-day Marietta). Also, organized settlement north of the Ohio River was prohibited until the Passage of the Ordinance of 1787, which created the Northwest Territory and allowed the selling of land in Ohio for settlement.

2. Colonel Whittlesey reported (1872, p. 1),

   As early as 1755, mineral coal had been discovered near Bolivar, in Tuscarawas County, by its being seen on fire, smoking and slowly burning in the ground, but I am not aware that it was dug or mined for use as fuel, in this part of the State, prior to 1810.

3. Trees were abundant and very important to the pioneers and early settlers, who judged the desirability of land by the number of trees it contained because of their potential as a source of building materials and as a fuel. As of 1800, Ohio, which covers an area of 26 million acres, possessed an abundance of forested land estimated at 25 million acres (Noble and Korsok, 1975, p. 42). In fact,

   Although the early settlers were fully aware of these deposits of coal, they, from force of circumstance, did not for some years give much attention to them. The clearing of the land furnished an abundance of fuel, and hence they did not need the coal. But as the forests disappeared, its importance was realized more, and its extent more fully developed (Stoddard, 1929, p. 225, quoting N. N. Hill, Jr.).

Although mining of coal in Ohio prior to 1800 is very unlikely, a pamphlet published in French in 1788 by Manasseh Cutler for agents of the Scioto Company mentioned coal in an effort to promote the sale of their lands in Ohio. Of the Hocking River, the pamphlet said (Cutler, 1788, p. 34),

The Hockhocking is somewhat like the Muskingum, but not as large. It is navigable for a large vessel for about seventy miles, and much further for small ones. On the banks of

FIGURE 2.—A portion of a map of the Middle British Colonies published by Lewis Evans and reproduced by Thomas Pownall in 1776. Map modified from Smith (1977, p. 41). Evans noted the word "coals" along the Hockhocking [Hocking] a nd Muskingum Rivers. This reference is among the earliest documentations of coal in Ohio.

the much frequented river are inexhaustible quarries of building stone, great beds of iron ore . . . . We also find frequently in the neighborhood of this river coal mines and salt springs, which abound in the Western country.

In regard to the Muskingum River, the pamphlet (Cutler, 1788, p. 61) stated

All the voyagers and hunters have spoken with admiration of the fertility of the hills and valleys watered by the Muskingum, as well as the excellent springs, the salt wells, and the mines of coal, particularly that of Lamenchicola.

The occurrence of coal in the Tuscarawas Valley was known by the Moravians before they made their settlement at Schoenbrunn in 1772 (Stout, 1944a, p. 1). By 1797 the availability of coal in Ohio was being advertised by newspaper. The August 12, 1797, Pittsburgh Gazette carried the following advertisement for coal at Steubenville:

Sale of lots. In the new country town of Fort Steuben [present-day Steubenville], *in the new county called Jefferson, on the bank of the river Ohio. There is a sawmill close to town and the abundance of Pitt* [Pittsburgh (No. 8)] *coal will render fuel a very cheap article forever. Bazaleel Wells, 8/1/1797* (quoted in Eavenson, 1942, p. 265).

Chapter 2

COAL PRODUCTION

Although the date when coal in Ohio was first mined will probably never be known, the first reported production of coal was in 1800, three years prior to Ohio's entrance as the 17th state of the Union. This first reported production amounted to 100 tons of coal mined from Jefferson County (Eavenson, 1942, p. 512). The next county to report coal production was Columbiana in 1803. Coal mining was reported near Silver Run and Coalport, located between Middle Port and Pomeroy, Meigs County, in 1806 (Stout, 1940, p. 4).

Coal mining began in Springfield Township, Summit County in 1808 and continued until after 1842, from the same opening, the only one in the township. The coal was hauled away in wagons (Perrin, 1881, p. 549). *Coal was discovered and worked by stripping, in a ravine one mile west of the Center of Tallmadge, Summit County, as early as 1810* (Whittlesey, 1883, p. 16).

Coal production was reported from 10 eastern Ohio counties by 1820, from 20 counties by 1840, and from 30 counties by 1871. Coal production by year by county is given in the Appendix to this bulletin. Table 1 lists those counties in Ohio which have reported coal production since 1800, and the cumulative coal production by county. Not included in table 1 are Geauga County, where coal was mined underground to a very minor extent from Burton Township (1885 to about 1903) and Troy Township (Sturgeon, 1945, p. 255), and Knox County (Jefferson Township) (Read, 1878a, p. 336) and Ashland County (Hanover Township) (Read 1878b, p. 524), where minor amounts of Sharon coal were drift mined for local use.

Belmont County is the all-time leader in coal production in Ohio. From 1816 to 1993, over 757.3 million tons have been mined from this county. The second- and third-highest coal-producing counties historically are Harrison and Jefferson, followed by Perry, Athens, Tuscarawas,

TABLE 1.—CUMULATIVE OHIO COAL PRODUCTION (SHORT TONS) BY COUNTY AND METHOD, 1800-1993

County	First year of reported production	1993 production		Cumulative production (1800-1993)
		Underground	Surface	
Athens	1820	-	-	200,508,978
Belmont	1816	3,968,101	1,936,078	757,360,433
Carroll	1853	-	107,572	40,697,570
Columbiana	1803	490,772	640,275	96,455,533
Coshocton	1864	-	1,347,597	96,054,728
Gallia	1840	-	-	21,255,873
Guernsey	1835	-	402,250	143,829,117
Harrison	1830	1,175,173	1,271,922	386,821,903
Hocking	1840	-	-	85,341,841
Holmes	1840	-	153,635	16,080,606
Jackson	1820	-	1,250,717	93,243,692
Jefferson	1800	261,792	1,411,655	386,077,192
Lawrence	1844	-	9,611	23,433,351
Licking	1976	-	-	107,089
Mahoning	1840	-	4,837	35,525,407
Medina	1871	-	-	4,754,780
Meigs	1806	2,895,853	-	113,803,955
Monroe	1840	827,377	-	49,521,600
Morgan	1869	-	46,549	43,211,104
Muskingum	1810	-	2,350,330	129,408,418
Noble	1845	-	1,065,855	104,997,322
Perry	1816	-	395,321	218,954,437
Pike	1978	-	-	40,799
Portage	1870	-	-	6,847,996
Scioto	1870	-	-	319,567
Stark	1833	-	230,340	73,395,548
Summit	1810	-	-	10,363,130
Trumbull	1835	-	-	12,990,355
Tuscarawas	1810	-	2,388,339	170,880,817
Vinton	1851	853,258	2,097,197	61,527,570
Washington	1867	-	-	7,125,603
Wayne	1840	-	3,169	9,135,458
TOTAL		10,472,326	17,113,249	3,400,071,772

FIGURE 3.—Scene typical of eastern Ohio coal-mining operations during the 1890's. Wooden-side railroad cars are waiting to be loaded at a coal tipple. Note the loaded mine cars on the trestle (top left) en route to the tipple. Location unknown. Photo courtesy of Ohio Historical Society.

Guernsey, Muskingum, Meigs, and Noble Counties (table 1 and Appendix).

From its modest beginning in 1800, Ohio's coal production increased steadily but very slowly until the mid-1800's, never exceeding 1 million tons annually until 1853 (table 2). During the first half of the 19th century, Ohio's early coal miners, primarily of English, Scottish, and Welsh descent, cut and loaded coal entirely by hand and moved the coal to market by means of wagons, carts, flatboats, dogs, mules, or goats, where it was sold at prices ranging from 75 cents to $13.63 per ton. Gradually coal replaced wood as a fuel for boilers for salt production, blast furnaces, steam mills, sawmills, some oil and gas drilling rigs, steamboats on the Great Lakes and the Ohio River, and domestic purposes.

During the mid-1800's Ohio experienced a transformation from an agricultural to an industrial economy. This change provided great impetus to the development of Ohio's coal industry, making Ohio one of the largest coal-producing and coal-consuming states in the nation. Ohio's industrialism was triggered by the manufacture of equipment for railroads, machinery for increased farm mechanization, and supplies for the Civil War (Noble and Korsok, 1975, p. 5), and by the recognition of coal as an abundant, accessible, and inexpensive fuel, especially for the generation of steam power.

From Civil War times to the Great Depression of the 1930's, Ohio's coal production steadily and rapidly increased because of improved methods of transportation and mining. Between 1850 and 1880, Ohio's railroad system grew at a tremendous rate, facilitating the movement of coal to market (fig. 3) as well as becoming a major consumer of coal for steam-generated locomotion. By the late 1800's, mechanized mining equipment had been successfully introduced into many of Ohio's underground coal mines (figs. 4, 5). From 1800 to about World War I, most of Ohio's coal was mined by underground mining methods (fig. 6). During the World War I years, Ohio's coal industry realized production levels which would not again be equalled until the late 1960's. Because of the war effort and increased mechanization, in 1918 the ranks of Ohio's coal work force swelled to its greatest levels of more than 50,000 individuals, more than 12 times its 1993 level of 4,116 employees.

Ohio's coal production slumped and remained essentially stagnant during the interwar period in the late 1920's and the 1930's, but in the years following World War II production increased steadily until 1970. This increase in production occurred in spite of a major decrease in the number of operating coal mines after World War II. Between 1950 and 1970, the number of underground mines (figs. 7-9) decreased by 90 percent. The increase in coal production during this period also occurred in spite of a 83 percent

FIGURE 4.—Coal being loaded into a mine car by conveyor of a gathering/loading machine. Evidence of a roof-support system is lacking in the portion of the mine shown in this photograph. Ohio's current mine law specifies roof-support procedures, including the use of roof bolts and timbers. These procedures also limit the mining activity beyond an unsupported roof. Date and location unknown. Photo courtesy of U.S. Bureau of Mines.

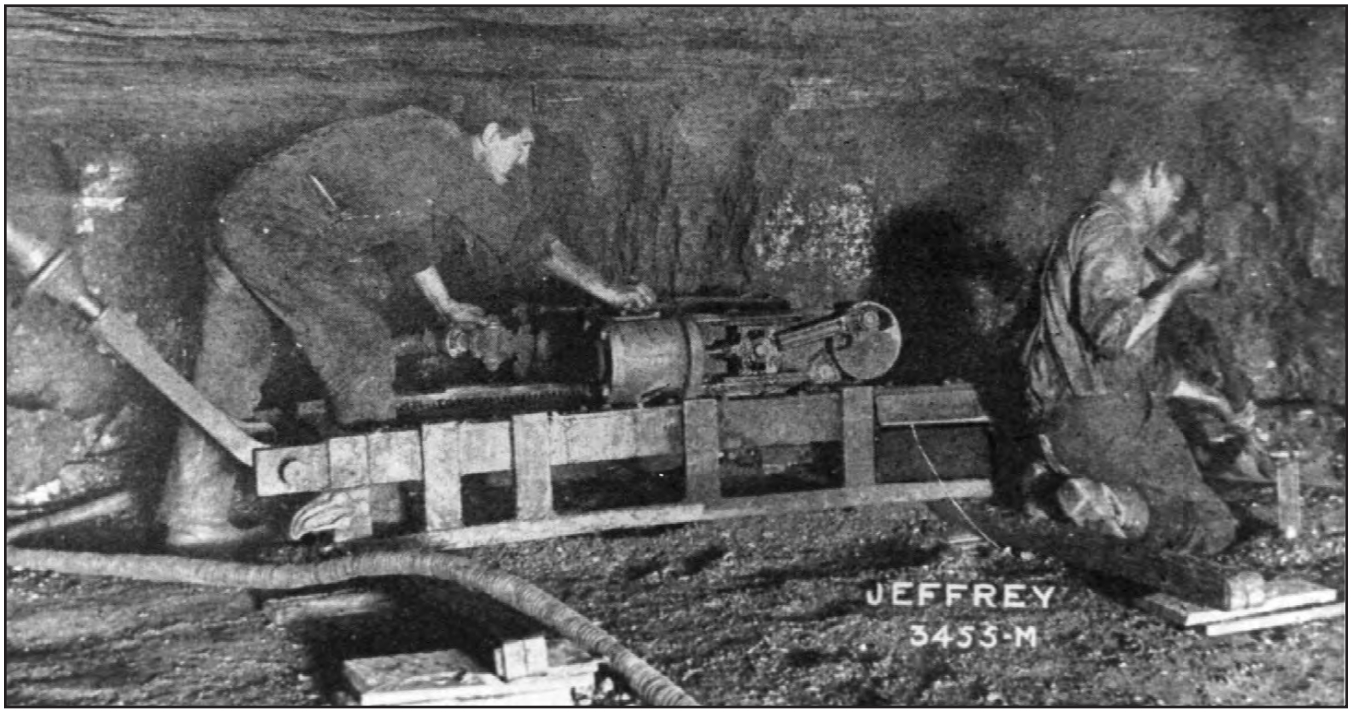


FIGURE 5.—A compressed-air-powered coal-cutting machine built by the Jeffrey Mining Equipment Company in use in one of the mines of the Massillon Coal Company in Tuscarawas Township, Stark County. From State Inspector of Mines Report (1909, plate VI).

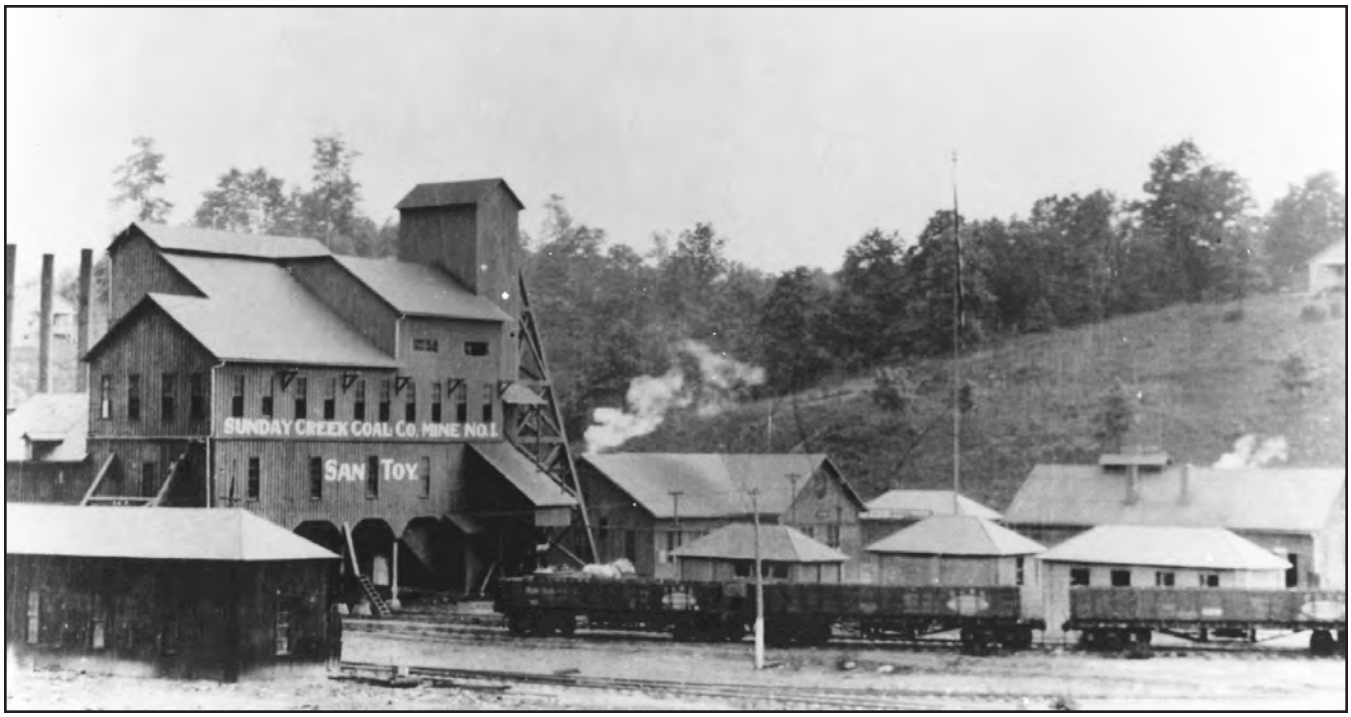


FIGURE 6.—Hoisting-shaft headframe, tipple, and company buildings of the Sunday Creek Coal Company San Toy mine No. 1 (Ohio Division of Mines abandoned-mine-map file number Py-63; see footnote 1 on p. 29 for explanation). This underground mine, located in San Toy, Monroe Township, Perry County, was opened by the New England Coal Company in 1902 to mine the Middle Kittanning (No. 6) coal. In 1915, Sunday Creek Coal Company took over the operation. This mine operated until 1927, when it was abandoned. The hoisting shaft was 195 feet deep and 26 feet by 13 feet wide. Date unknown. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

FIGURE 7.—Hoisting-shaft headframe, tipple, and company buildings of Gem Coal Company mine No. 255 (As-191 and As-132) on Baily Run about 2 miles southwest of Jacksonville in Dover Township, Athens County. Mine No. 255 had a 135-foot-deep shaft to the Middle Kittanning (No. 6) coal. This mine was opened in 1903 by the Continental Coal Company and was operated by the Sunday Creek Coal Company from about 1907 to 1918, the Drydock Coal Company from 1918 to 1955, and the Gem Coal Company from 1955 until its abandonment in 1963. This mine used horses until about 1906, when electric locomotives were installed for coal haulage. A new tipple, replacing the one shown here, was built in 1945. Date unknown. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

FIGURE 8.—Loaded mine cars en route to the coal tipple of Murray Coal Company mine No. 5 (As-168, As-175, and Hg-161) near Murray City in Ward Township, Hocking County, and Trimble Township, Athens County. This drift mine in the Middle Kittanning (No. 6) coal was operated by the Sunday Creek Coal Company until 1938, then under a variety of leases until it was abandoned in 1952. Date unknown. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

FIGURE 9.—Hoisting-shaft headframe, tipple, and powerhouse of New York Coal Company mine No. 25 (As-157) at Chauncey in Dover Township, Athens County. This mine, formerly known as mine No. 275 and operated by the Sunday Creek Coal Company, had a 125-foot-deep shaft, mined Middle Kittanning (No. 6) coal, and was abandoned in 1952. Date unknown. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

decrease in the size Ohio's coal-mine labor force between World War I and 1970. The number of operating coal mines and coal miners in Ohio decreased when surface mining became the principal method by which Ohio coal was produced. Surface mining made a dramatic rise after World War II because the development of very large and efficient earth-moving equipment such as the *Mountaineer* (fig. 10) and the *Big Muskie* (fig. 11) enabled the near-surface coal to be mined more easily, more quickly, more inexpensively, and with fewer people than underground mines. Although from World War I to 1969 coal was a cheap source of fuel (the price per ton of coal was low and relatively static, never rising above $4 per ton), coal's dominant hold on the fuels market was repeatedly challenged and somewhat eroded by petroleum in the form of diesel power. However, as utility companies became major consumers of coal for the steam generation of electricity, Ohio's coal industry survived these challenges in the competitive fuel market, and Ohio's coal production soared, peaking at 55 million tons in 1970.

Since 1970, however, Ohio's annual coal production has declined nearly 53 percent to the 1993 level of 27.6 million tons, the lowest level of coal production in Ohio since 1941, the year the United States entered World War II. This drop in production is due in part to the increasing regulation and enforcement of surface-mine activity, health and safety issues, increased transportation costs, and the escalating cost of union contracts, but primarily to the impact of the Federal Clean Air Act of 1970, which placed stringent controls on the emissions, particularly SO_2 emissions, from

FIGURE 10.—The power shovel *Mountaineer* excavating overburden to expose an underlying seam of coal. This scene was typical for the *Mountaineer,* which was operated by the Hanna Coal Company, Division of Pittsburgh Consolidation Coal Company, in surface mines of southern Harrison and northern Belmont Counties from 1956 to 1979. The Hanna Coal Company was formed in 1900 as Wheeling and Lake Erie Coal Company. In 1931 the name was formally changed to Hanna Coal Company. During World War II, the Hanna Coal Company was informally referred to as the United States Coal Company. In June 1946, Hanna Coal Company became a Division of Pittsburgh Consolidation Coal Company. In 1958, the corporate name was shortened to Consolidation Coal Company, more commonly known as Consol. *Circa* 1970's. Photo courtesy of Dale Davis.

FIGURE 11.—The *Big Muskie*, built by Bucyrus-Erie, is the world's largest walking dragline machine. This dragline has a 220-cubic-yard capacity bucket and was operated from 1969 to 1991 by the Central Ohio Coal Company at the Muskingum mine (Ne-41), located near Coal Hill, Meigs Township, Muskingum County. The *Big Muskie* has been idle since 1991. Photo taken by Doug Crowell in 1984. (For other photos of this mine see figs. 13 and 200.)

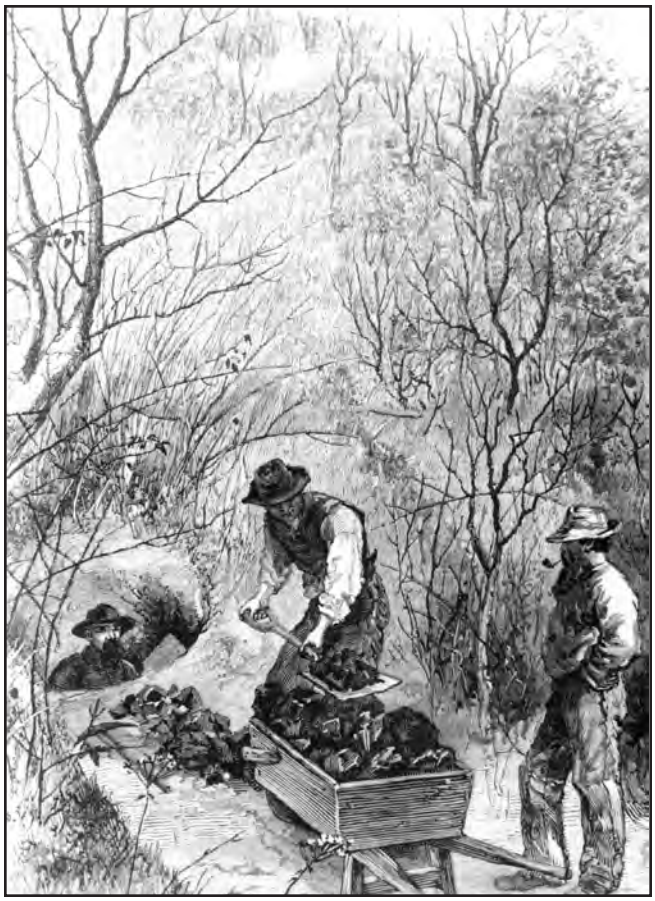


FIGURE 12.—Miners shoveling coal from an underground mine in the Hocking Valley region in 1884 (from Harper's Weekly, v. 29, January 3, 1885, p. 4).

burned coal (see Chapter 8). Late in 1990, the Clean Air Act was amended to give coal-fired power plants of greater than 100-megawatt generating capacity a deadline of 1995 to comply with strict emission standards. As a result of this legislation there is concern that the utility rates of many Ohioans may increase substantially because of the expense of retro-fitting of aging power plants with expensive sulfur-emission-control systems such as scrubbers, or the high cost of importing low-sulfur coal from outside Ohio. Another expensive option for utilities is to fuel switch from coal to petroleum or natural gas. A concern shared by many is that the amended Clean Air Act will cause a continued decline in Ohio's production of coal.

From its pioneer beginnings, Ohio's coal industry has evolved from a stage where coal was mined and shipped by hand (fig. 12) for domestic and early industrial consumption to a highly regulated, mechanized, and automated industry (fig. 13) employing thousands of people and providing a much-valued fuel to help meet Ohio's energy needs. The total cumulative coal production in Ohio by underground, surface, and auger mining methods from 1800 to 1993 is 3,400,071,772 tons (table 2). The quantity of recoverable coal reserves remaining in the ground in Ohio is estimated at 11.8 billion tons (Energy Information Administration, 1993, table C3).

FIGURE 13.—Central Ohio Coal Company's Muskingum Electric Railroad, the first totally electric, fully automated railroad in North America, moves coal from the mine's loading area to its coal preparation plant 15 miles away. The Meigs Creek (No. 9) coal is mined from Central Ohio Coal Company's Muskingum mine (Ne-41) and used at Ohio Power Company's Muskingum River electric-generating station. *Circa* 1988. Photo courtesy of American Electric Power Service Corporation. (For other photos of this mine see figs. 11 and 200.)

TABLE 2.—COAL PRODUCTION, NUMBER OF MINES, EMPLOYMENT, NUMBER OF FATALITIES, AND VALUE IN OHIO, 1800-1993

Year	Total production (short tons)	Underground production (short tons)	Strip production (short tons)	Auger production (short tons)	Total mines	Number of underground mines	Number of surface mines	Average employment	Number of fatalities	Value per ton
1800	100	100	-	-	NA	NA	NA	NA	NA	NA
1801	100	100	-	-	NA	NA	NA	NA	NA	NA
1802	100	100	-	-	NA	NA	NA	NA	NA	NA
1803	200	200	-	-	NA	NA	NA	NA	NA	NA
1804	200	200	-	-	NA	NA	NA	NA	NA	NA
1805	200	200	-	-	NA	NA	NA	NA	NA	NA
1806	350	350	-	-	NA	NA	NA	NA	NA	NA
1807	450	450	-	-	NA	NA	NA	NA	NA	NA
1808	450	450	-	-	NA	NA	NA	NA	NA	NA
1809	450	450	-	-	NA	NA	NA	NA	NA	NA
1810	1,000	1,000	-	-	NA	NA	NA	NA	NA	NA
1811	1,200	1,200	-	-	NA	NA	NA	NA	NA	NA
1812	1,600	1,600	-	-	NA	NA	NA	NA	NA	NA
1813	2,250	2,250	-	-	NA	NA	NA	NA	NA	NA
1814	2,850	2,850	-	-	NA	NA	NA	NA	NA	NA
1815	3,450	3,450	-	-	NA	NA	NA	NA	NA	NA
1816	4,600	4,600	-	-	NA	NA	NA	NA	NA	NA
1817	5,400	5,400	-	-	NA	NA	NA	NA	NA	NA
1818	6,000	6,000	-	-	NA	NA	NA	NA	NA	NA
1819	6,850	6,850	-	-	NA	NA	NA	NA	NA	NA
1820	9,900	9,900	-	-	NA	NA	NA	NA	NA	NA
1821	11,100	11,100	-	-	NA	NA	NA	NA	NA	NA
1822	13,200	13,200	-	-	NA	NA	NA	NA	NA	NA
1823	16,700	16,700	-	-	NA	NA	NA	NA	NA	NA
1824	18,100	18,100	-	-	NA	NA	NA	NA	NA	NA
1825	19,500	19,500	-	-	NA	NA	NA	NA	NA	NA
1826	18,100	18,100	-	-	NA	NA	NA	NA	NA	NA
1827	19,500	19,500	-	-	NA	NA	NA	NA	NA	NA
1828	21,100	21,100	-	-	NA	NA	NA	NA	NA	NA
1829	22,900	22,900	-	-	NA	NA	NA	NA	NA	NA
1830	25,300	25,300	-	-	NA	NA	NA	NA	NA	NA
1831	28,000	28,000	-	-	NA	NA	NA	NA	NA	NA
1832	31,100	31,100	-	-	NA	NA	NA	NA	NA	NA
1833	36,819	36,819	-	-	NA	NA	NA	NA	NA	NA
1834	44,347	44,347	-	-	NA	NA	NA	NA	NA	NA
1835	53,376	53,376	-	-	NA	NA	NA	NA	NA	NA
1836	60,844	60,844	-	-	NA	NA	NA	NA	NA	NA
1837	69,921	69,921	-	-	NA	NA	NA	NA	NA	NA
1838	77,624	77,624	-	-	NA	NA	NA	NA	NA	NA
1839	89,500	89,500	-	-	NA	NA	NA	NA	NA	NA
1840	103,664	103,664	-	-	NA	NA	NA	NA	NA	NA
1841	114,884	114,884	-	-	NA	NA	NA	NA	NA	NA
1842	123,734	123,734	-	-	NA	NA	NA	NA	NA	NA
1843	135,332	135,332	-	-	NA	NA	NA	NA	NA	NA
1844	183,620	183,620	-	-	NA	NA	NA	NA	NA	NA
1845	218,300	218,300	-	-	NA	NA	NA	NA	NA	NA
1846	230,979	230,979	-	-	NA	NA	NA	NA	NA	NA
1847	281,924	281,924	-	-	NA	NA	NA	NA	NA	NA
1848	355,703	355,703	-	-	NA	NA	NA	NA	NA	NA
1849	464,805	464,805	-	-	NA	NA	NA	NA	NA	NA
1850	616,846	616,846	-	-	NA	NA	NA	NA	NA	NA
1851	778,900	778,900	-	-	NA	NA	NA	NA	NA	NA
1852	957,084	957,084	-	-	NA	NA	NA	NA	NA	NA
1853	1,265,421	1,265,421	-	-	NA	NA	NA	NA	NA	NA
1854	1,922,289	1,922,289	-	-	NA	NA	NA	NA	NA	NA

Year	Total production (short tons)	Underground production (short tons)	Strip production (short tons)	Auger production (short tons)	Total mines	Number of underground mines	Number of surface mines	Average employment	Number of fatalities	Value per ton
1855	1,943,804	1,943,804	-	-	NA	NA	NA	NA	NA	NA
1856	1,998,560	1,998,560	-	-	NA	NA	NA	NA	NA	NA
1857	2,167,909	2,167,909	-	-	NA	NA	NA	NA	NA	NA
1858	1,983,478	1,983,478	-	-	NA	NA	NA	NA	NA	NA
1859	1,914,466	1,914,466	-	-	NA	NA	NA	NA	NA	NA
1860	1,849,586	1,849,586	-	-	NA	NA	NA	NA	NA	NA
1861	1,855,300	1,855,300	-	-	NA	NA	NA	NA	NA	NA
1862	1,890,400	1,890,400	-	-	NA	NA	NA	NA	NA	NA
1863	1,923,500	1,923,500	-	-	NA	NA	NA	NA	NA	NA
1864	1,952,500	1,952,500	-	-	NA	NA	NA	NA	NA	NA
1865	1,891,288	1,891,288	-	-	NA	NA	NA	NA	NA	NA
1866	1,847,249	1,847,249	-	-	NA	NA	NA	NA	NA	NA
1867	2,005,883	2,005,883	-	-	NA	NA	NA	NA	NA	NA
1868	2,483,702	2,483,702	-	-	NA	NA	NA	NA	NA	NA
1869	2,646,100	2,646,100	-	-	NA	NA	NA	NA	NA	NA
1870	2,959,421	2,959,421	-	-	NA	NA	NA	NA	NA	NA
1871	3,023,756	3,023,756	-	-	NA	NA	NA	NA	NA	NA
1872	5,315,294	5,315,294	-	-	NA	NA	NA	NA	NA	NA
1873	5,405,028	5,405,028	-	-	NA	NA	NA	NA	NA	NA
1874	4,304,975	4,304,975	-	-	NA	NA	NA	NA	20	NA
1875	5,356,212	5,356,212	-	-	NA	NA	NA	NA	23	NA
1876	4,210,182	4,210,182	-	-	NA	NA	NA	NA	13	NA
1877	4,580,048	4,580,048	-	-	NA	NA	NA	NA	30	NA
1878	4,911,116	4,911,116	-	-	NA	NA	NA	NA	20	NA
1879	5,404,980	5,404,980	-	-	NA	NA	NA	NA	-	NA
1880	7,956,995	7,957,795	-	-	NA	NA	NA	NA	22	NA
1881	8,225,000	8,225,000	-	-	NA	NA	NA	NA	29	NA
1882	9,450,000	9,450,000	-	-	NA	NA	NA	NA	25	NA
1883	8,229,429	8,229,429	-	-	NA	NA	NA	NA	26	NA
1884	7,650,062	7,650,062	-	-	503	503	-	20,101	26	NA
1885	7,816,179	7,816,179	-	-	558	558	-	19,704	51	NA
1886	8,435,211	8,435,211	-	-	705	705	-	20,437	43	NA
1887	10,301,708	10,301,708	-	-	661	661	-	22,237	36	NA
1888	10,910,946	10,910,946	-	-	729	729	-	21,801	29	NA
1889	10,907,385	10,907,385	-	-	683	683	-	23,295	33	NA
1890	11,788,859	11,788,859	-	-	724	724	-	22,192	42	NA
1891	13,050,187	13,050,187	-	-	802	802	-	23,977	44	NA
1892	14,599,908	14,599,908	-	-	832	832	-	26,972	42	NA
1893	14,828,097	14,828,097	-	-	957	957	-	28,810	32	NA
1894	11,910,219	11,910,219	-	-	1,096	1,096	-	31,493	45	NA
1895	13,683,879	13,683,879	-	-	1,097	1,097	-	28,998	52	NA
1896	12,912,608	12,912,608	-	-	1,113	1,113	-	28,446	41	NA
1897	12,448,822	12,448,822	-	-	1,126	1,126	-	28,785	40	NA
1898	14,058,155	14,058,155	-	-	1,155	1,155	-	28,365	52	NA
1899	15,908,934	15,908,934	-	-	1,055	1,055	-	28,028	59	NA
1900	19,426,649	19,426,649	-	-	1,001	1,001	-	31,702	68	NA
1901	20,321,290	20,321,290	-	-	947	947	-	33,505	72	NA
1902	23,929,267	23,929,267	-	-	906	906	-	37,421	81	NA
1903	24,573,266	24,573,266	-	-	912	912	-	41,396	114	NA
1904	24,583,815	24,583,815	-	-	959	959	-	45,834	118	NA
1905	25,834,657	25,834,657	-	-	881	881	-	44,193	79	NA
1906	27,213,495	27,213,495	-	-	1,003	1,003	-	46,501	80	NA
1907	32,365,949	32,365,949	-	-	980	980	-	47,876	97	NA
1908	26,287,800	26,287,800	-	-	1,051	1,051	-	50,267	72	NA
1909	27,755,032	27,755,032	-	-	1,034	1,034	-	47,019	70	NA

Year	Total production (short tons)	Underground production (short tons)	Strip production (short tons)	Auger production (short tons)	Total mines	Number of underground mines	Number of surface mines	Average employment	Number of fatalities	Value per ton
1910	34,424,951	34,424,951	-	-	983	983	-	48,830	104	NA
1911	30,342,039	30,342,039	-	-	948	948	-	48,407	91	NA
1912	34,444,291	34,444,291	-	-	951	951	-	47,234	100	NA
1913	36,285,468	36,285,468	-	-	944	944	-	48,420	91	NA
1914	18,736,407	18,594,961	141,446	-	936	936	-	24,063	45	NA
1915	22,627,046	22,335,312	291,734	-	827	NA	NA	29,116	36	NA
1916	34,526,552	33,993,399	533,153	-	938	NA	NA	45,669	68	NA
1917	41,677,986	40,452,019	1,225,967	-	1,296	NA	NA	45,669	67	NA
1918	47,919,192	45,180,268	2,738,924	-	1,427	NA	NA	50,078	98	NA
1919	35,225,908	33,377,463	1,848,445	-	1,230	NA	NA	41,339	77	NA
1920	45,227,077	41,568,304	3,658,773	-	1,411	NA	NA	49,096	80	NA
1921	32,242,857	30,782,765	1,460,092	-	1,104	NA	NA	42,376	108	NA
1922	27,526,555	24,405,382	3,121,173	-	1,515	NA	NA	34,268	96	NA
1923	40,904,275	37,959,589	2,944,686	-	1,301	NA	NA	46,008	131	$2.44
1924	30,096,893	27,688,958	2,407,935	-	1,082	NA	NA	32,056	99	2.02
1925	27,564,760	24,963,381	2,601,379	-	955	NA	NA	27,977	93	1.93
1926	28,039,109	25,573,801	2,465,308	-	935	NA	NA	27,444	80	1.92
1927	15,762,369	13,375,490	2,386,879	-	906	NA	NA	15,096	61	1.92
1928	15,067,020	13,030,021	2,036,999	-	752	NA	NA	13,061	70	1.66
1929	23,128,649	21,349,502	1,779,147	-	729	NA	NA	20,916	78	1.51
1930	22,035,674	20,880,735	1,154,939	-	717	NA	NA	21,945	153	1.40
1931	20,422,980	19,473,235	949,745	-	876	NA	NA	22,499	61	1.25
1932	13,969,414	13,133,675	835,739	-	880	NA	NA	14,734	33	1.10
1933	19,615,564	18,606,965	1,008,599	-	1,031	NA	NA	21,731	52	1.20
1934	20,340,974	19,199,521	1,141,453	-	1,119	NA	NA	26,142	50	1.67
1935	21,076,226	19,021,445	2,054,781	-	1,220	NA	NA	26,837	47	1.66
1936	23,462,032	21,120,032	2,342,000	-	1,178	NA	NA	25,139	49	1.61
1937	24,509,192	22,272,702	2,236,490	-	1,122	NA	NA	26,829	70	1.71
1938	18,302,626	15,903,236	2,399,390	-	1,163	NA	NA	21,169	42	1.69
1939	20,035,239	16,177,126	3,858,113	-	1,254	NA	NA	17,601	40	1.63
1940	22,470,054	17,760,268	4,709,786	-	1,128	NA	NA	17,805	145	1.66
1941	28,850,924	21,862,684	6,988,240	-	1,200	NA	NA	19,924	48	1.92
1942	31,491,420	22,888,829	8,602,591	-	907	NA	NA	20,150	69	2.07
1943	31,009,023	22,122,111	8,886,912	-	842	NA	NA	18,271	47	2.32
1944	31,646,588	21,594,668	10,051,920	-	688	NA	NA	16,825	113	2.55
1945	31,518,055	18,582,542	12,935,513	-	710	NA	NA	16,142	31	2.71
1946	30,785,021	17,730,142	13,054,879	-	705	NA	NA	16,390	26	2.95
1947	37,068,655	20,032,116	17,036,539	-	758	NA	NA	18,313	37	3.45
1948	38,314,357	18,232,155	20,082,202	-	904	NA	NA	20,528	41	3.93
1949	30,777,212	12,841,741	17,935,471	-	846	NA	NA	17,185	22	3.78
1950	36,977,932	14,584,297	22,393,635	-	840	526	314	16,922	23	3.70
1951	37,816,708	16,205,975	21,610,733	-	808	491	317	16,006	30	3.76
1952	35,487,231	13,803,344	21,683,887	-	691	402	289	13,950	16	3.72
1953	34,112,748	12,831,798	21,280,950	-	660	370	290	12,122	17	3.70
1954	31,472,066	10,772,268	19,761,155	938,643	634	375	259	10,411	6	3.68
1955	37,034,321	12,586,019	23,217,346	1,230,956	658	333	325	10,455	12	3.52
1956	38,808,577	13,385,272	24,065,843	1,357,462	534	267	267	10,725	17	3.74
1957	37,493,450	12,248,642	24,146,687	1,098,121	527	235	292	10,446	6	3.92
1958	32,106,390	9,235,923	21,880,388	990,079	593	258	335	8,956	8	3.83
1959	35,322,289	9,593,804	24,776,291	952,194	557	237	320	8,656	3	3.83
1960	33,896,497	9,172,040	23,909,186	815,271	524	211	313	8,284	7	3.81
1961	31,733,741	8,498,906	22,255,564	979,271	476	178	298	7,482	9	3.78
1962	34,010,824	9,326,393	23,424,345	1,260,086	514	192	322	7,371	12	3.67
1963	36,916,741	10,524,210	24,469,449	1,923,082	464	163	301	7,390	7	3.63
1964	37,390,478	10,828,753	24,754,215	1,807,510	455	145	310	7,373	6	3.43

Year	Total production (short tons)	Underground production (short tons)	Strip production (short tons)	Auger production (short tons)	Total mines	Number of underground mines	Number of surface mines	Average employment	Number of fatalities	Value per ton
1965	39,331,560	11,287,745	26,247,566	1,796,249	466	133	333	7,276	8	3.61
1966	43,068,447	13,106,713	28,238,583	1,723,151	483	131	352	7,350	12	3.78
1967	45,891,615	15,176,943	29,103,851	1,610,821	422	93	329	7,538	4	3.86
1968	48,286,873	16,334,122	30,486,026	1,466,725	378	70	308	7,518	12	3.95
1969	51,193,028	18,618,334	30,792,280	1,782,414	328	61	267	7,842	14	4.15
1970	55,136,699	18,107,487	35,754,384	1,274,828	326	52	274	8,466	8	4.66
1971	49,016,773	12,786,663	35,180,794	1,049,316	353	42	311	9,477	3	5.16
1972	50,571,568	16,301,798	33,196,456	1,073,314	339	33	306	10,361	9	5.91
1973	45,666,487	16,209,436	28,371,431	1,085,620	263	28	235	10,475	4	7.21
1974	45,351,602	14,415,464	30,175,669	760,469	280	28	252	11,766	5	10.96
1975	46,341,004	15,469,291	30,062,586	809,127	267	34	333	14,258	6	15.76
1976	45,868,411	16,707,554	28,479,261	681,596	384	32	352	15,319	6	17.28
1977	46,157,872	14,004,157	31,777,850	375,865	344	30	314	15,202	5	12.31
1978	39,519,844	11,389,206	27,768,441	362,197	471	31	440	15,356	4	20.95
1979	42,820,429	14,545,857	27,695,485	579,087	440	24	416	15,555	3	22.12
1980	40,445,427	14,573,076	25,508,524	363,827	327	24	303	13,004	12	24.77
1981	37,341,959	12,100,258	24,753,107	488,594	328	19	309	12,358	4	28.08
1982	38,882,611	14,019,292	24,382,384	480,935	294	17	277	11,499	3	28.77
1983	33,216,630	10,821,891	21,828,070	566,669	313	14	299	9,545	5	32.64
1984	38,824,002	14,171,647	23,822,085	830,270	292	15	277	10,223	9	32.54
1985	35,465,374	13,660,013	20,787,443	1,017,918	299	14	285	9,052	3	38.97
1986	34,733,410	14,256,143	19,756,554	720,713	310	16	294	8,587	7	31.55
1987	33,152,316	11,431,871	20,851,219	869,226	294	17	278	7,587	3	30.14
1988	31,164,003	11,169,005	19,182,936	812,062	285	12	273	6,697	5	29.72
1989	31,431,757	10,832,825	19,671,476	927,456	255	13	242	6,522	4	30.62
1990	33,127,567	12,899,852	19,179,568	1,048,147	217	12	205	6,161	4	29.09
1991	29,357,683	12,224,506	16,084,288	1,048,889	198	10	188	5,475	5	27.77
1992	29,403,063	11,990,407	16,438,033	974,623	191	10	181	4,632	0	26.85
1993	27,585,575	10,472,326	16,082,765	1,030,484	194	9	183	4,116	0	27.44
Total	3,400,071,772	2,103,912,374	1,255,196,131	40,963,267					4,921	

NA = not available.

Sources: Collins (1976), State Inspector of Mines (1875-1915), The Industrial Commission of Ohio (1915-1919), Ohio Division of Labor Statistics (1919-1950), Ohio Division of Mines (1944, 1951-1981), Ohio Division of Geological Survey (1983-1994).

Chapter 3

NUMBER OF MINES AND METHODS OF MINING

The number of operating coal mines in Ohio has fluctuated considerably since record-keeping began in 1884. The largest number of operating coal mines in Ohio was 1,515, in 1922 (table 2). From about the time of World War I, the number of coal mines operating annually, particularly underground mines, has decreased dramatically owing to advances in surface-mine technology and the higher cost of producing coal underground. In 1950 there were 314 surface mines and 526 underground mines operating in Ohio, compared to 183 surface mines and 9 underground mines operating in 1993. Coal currently is mined in Ohio by surface and underground methods as well as by auger, which in Ohio is a combination of surface and underground methods.

SURFACE MINING

The first account of surface mining in Ohio was reported by the Akron Beacon Journal (June 24, 1857, p. 3) and Whittlesey (1872, p. 25) for an area 1 mile west of Tallmadge, Summit County, as early as 1810. There are several accounts of surface mining during the 19th century. These reports include: Milton Township, Jackson County (Morrow, 1956, p. 49, 50); Marion Township, Monroe County (Andrews, 1873a, p. 301); Jackson Township, Noble County, and Center Township, Monroe County (Andrews, 1874, p. 512, 581); and Tuscarawas County (Newberry, 1878a, p. 67). By 1906, the Pomeroy, or Redstone (No. 8A), coal had been extensively surface mined in Bedford and Salisbury Townships, Meigs County (Bownocker and Condit, 1908, p. 183). The identifying numbers assigned to this coal and some others are a carry-over from the very early days of Ohio geological investigations when the commercially mineable coals were assigned numbers; the No. 1 (Sharon) was the stratigraphically lowest (oldest) coal, and the No. 12 (Washington) was the highest (youngest) coal. This system of numeration, though formally abandoned, is still commonly used in the coal industry. The numbers apply only to Ohio coals and do not relate to numbers assigned to coals in other states.

Prior to 1948 most Ohio coal was mined by underground mining methods. During World War II, surface mining began to increase at a very rapid rate. New high-strength steels developed during World War II allowed even larger surface-mining equipment to be built. In addition, World War II was a great concern for operators of underground coal mines. Because more than 10 percent of Ohio's experienced and skilled coal miners working underground joined the armed forces, Ohio's coal companies, in effort to maintain production levels, had to replace the experienced miners with inexperienced individuals. This corporate decision resulted in an increase in production costs as well as an increase in fatalities in underground mining. Thus, by 1948, surface mining accounted for more than half of Ohio's annual coal production. In only a relatively few years, surface mining became the dominant method of mining coal in Ohio. Of the 840 operating mines in 1950, 314 were surface mines; in comparison, of the 194 reporting coal mines in Ohio in 1993, 183 were surface mines (table 2).

The amount of coal produced in Ohio by surface mining was first officially reported in 1914. Reported cumulative production of surface-mined coal in Ohio since 1914 is 1,255,196,131 tons (table 2). Surface-mining production reached an annual peak of about 35.7 million tons in 1970. In 1993, the 183 surface mines produced 16,082,765 tons of coal.

Early surface mining in Ohio consisted of digging coal that cropped out along hillsides, using picks and shovels (figs. 14, 15) and in some cases horse-drawn scrapers. The coal and cover material were excavated back into the hillside, perhaps 10 feet or more, until removal of the cover was too impractical or too difficult. At this point, coal mining continued using underground methods. Although evidence is now nearly obliterated, there are some areas in southeastern Ohio, such as Lawrence County, where remnants of terraces or pits from early surface mining can still be seen. Mechanized surface mining in Ohio probably did not occur until the 1880's, during the construction of the railroads.

The first steam shovel (fig. 16) in the United States was developed in 1835 by William Smith Otis (Anderson, 1980, p. 11). However, only 20 of these machines were built. The first use of a steam shovel, an Otis shovel, for coal mining was at Pittsburg, Kansas, in 1877. The surface-mine work at Pittsburg was based on experience gained from steam shovels used in railroad construction work in Ohio (Stoek, 1917a, p. 43). By 1880 demand was increasing for excavating machinery for railroad construction and a variety of public works projects. In 1882, the Ohio Central Railroad ordered its first Bucyrus steam shovel, called the Thompson (fig. 17) (Anderson, 1980, p. 16). This order was followed by numerous orders for such machines during the late 1880's. These early steam shovels were built on rail wheels and required track to be laid as it advanced (figs. 18, 19).

Prior to and during construction of the Panama Canal (1905-1914), giant strides had been made in the development of surface excavating machinery. Because of the success of these steam shovels, a number of Bucyrus 95-ton and 70-ton steam shovels were brought to Ohio, following the completion of the Panama Canal, and put to work in the coal fields (fig. 20) (Dale Davis, personal communication, 1992). In 1913, the United Electric Coal Company began surface mining the Pittsburgh (No. 8) coal, using two electric-power shovels, near Rush Run, in Wells Township, Jefferson County (Ohio Division of Geological Survey measured section no. 1147). By 1915, seven power shovels were in operation in Ohio, and by 1916 the number of power shovels had risen to 18 (Burroughs, 1919, p. 3). In 1917, six surface mines were operating in the Pittsburgh (No. 8) coal of Harrison and Jefferson Counties (fig. 21), and one surface mine was operating in the Lower Kittanning (No. 5) coal along the border of Stark and Tuscarawas Counties (Stoek, 1917b, p. 31). In a short period of time, technology

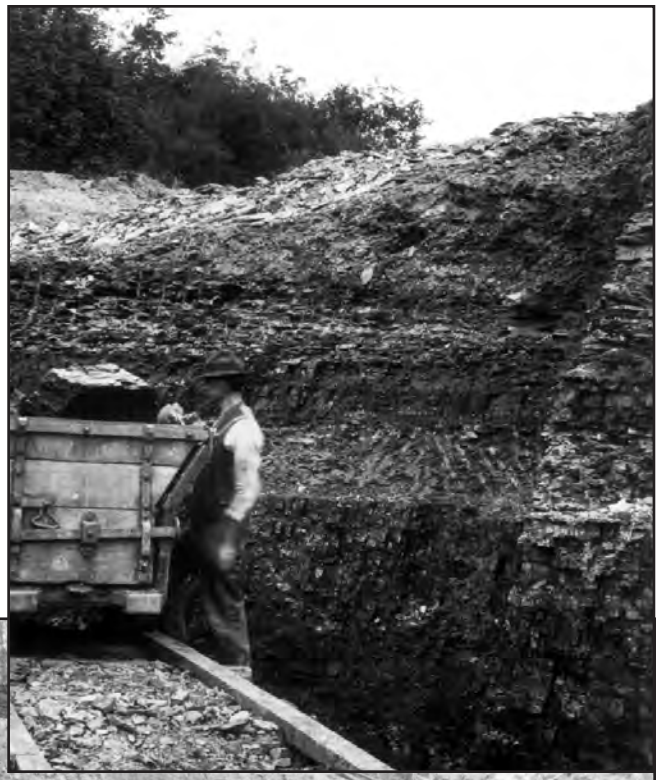


FIGURE 15.—Surface mining the Meigs Creek (No. 9) coal along Long Run, about 3 miles southwest of Bethesda, in Goshen Township, Belmont County. Note the wooden track for the mine car. *Circa* 1915. Photo appeared in Condit (1923, plate IIIA). Photo courtesy of U.S. Geological Survey, D. Dale Condit (#124) collection.

FIGURE 14.—Hand loading a coal car at the Blue Bell mine near Strasburg, Tuscarawas County. Date unknown. From Collins (1987, p. 3). Photo courtesy of Ohio Historical Society.

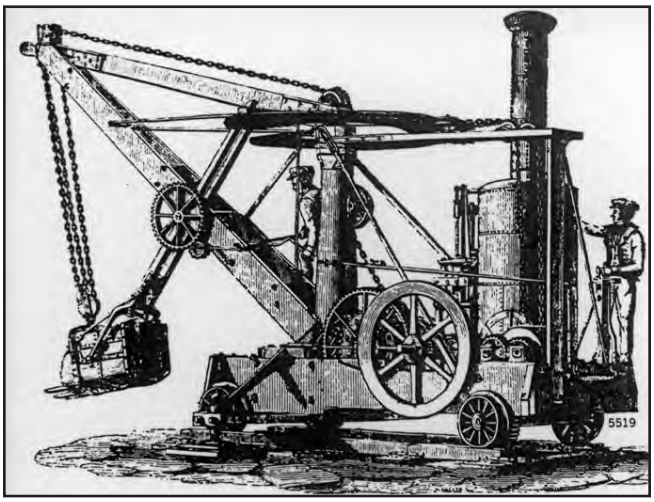


FIGURE 16.—*The first excavating machine was invented in 1838* [patented in 1835] *by William S. Otis, of Philadelphia. First used on the Western Railroad in Massachusetts, then extensively for other excavation work. The machine is recorded as doing the work of 150 men . . . loading 26 wagons (of 2 1/2 yards) within an hour*. Illustration and quote from an advertisement for CF&I Steel Corporation in Coal Age (1967, v. 72, no. 6, p. 110). Reprinted with permission from COAL.

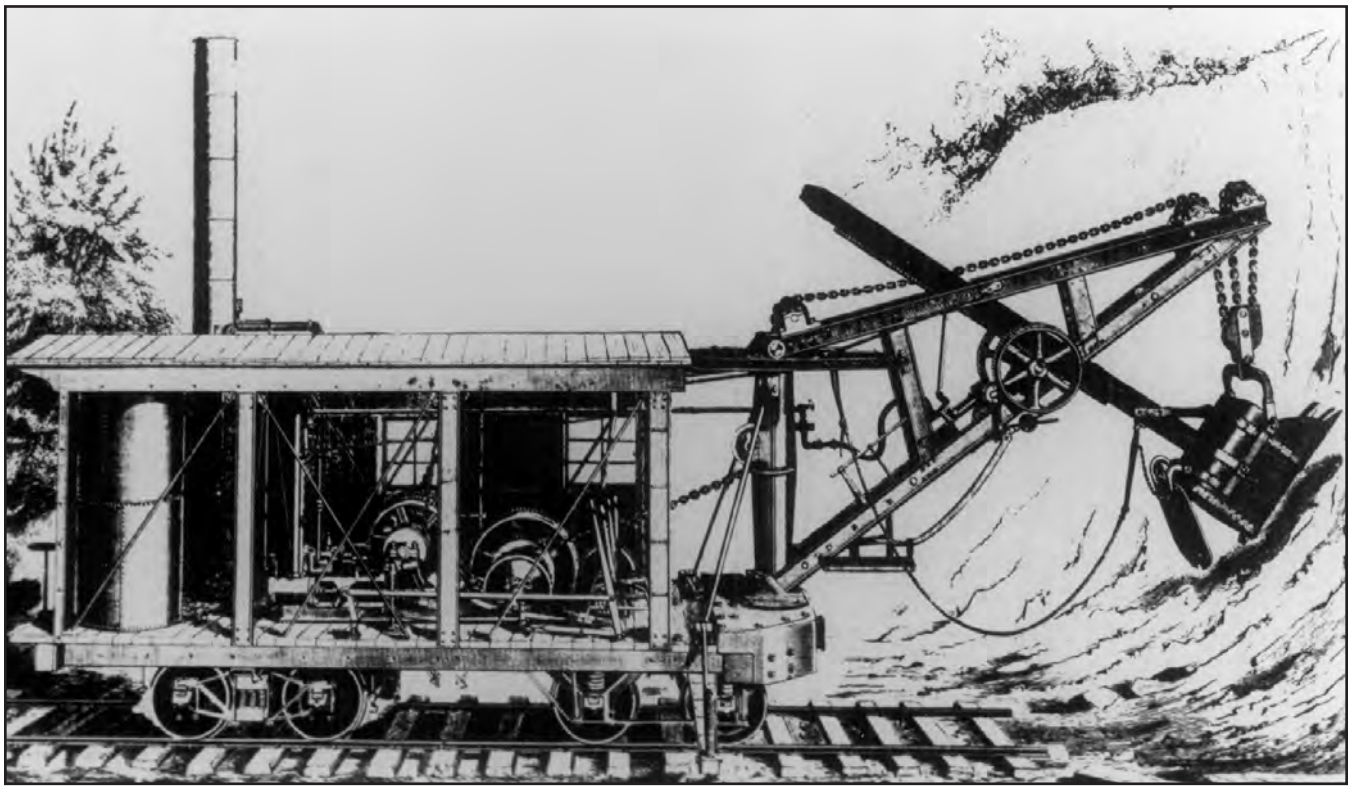


FIGURE 17.—The first Bucyrus shovel, called the *Thompson* after its designer, was coal fired and built in 1882 for use by the Ohio Central Railroad. This illustration originally appeared in the July 1883 Railroad Gazette (Anderson, 1980, p. 16). Reprinted with permission from Bucyrus-Erie Company.

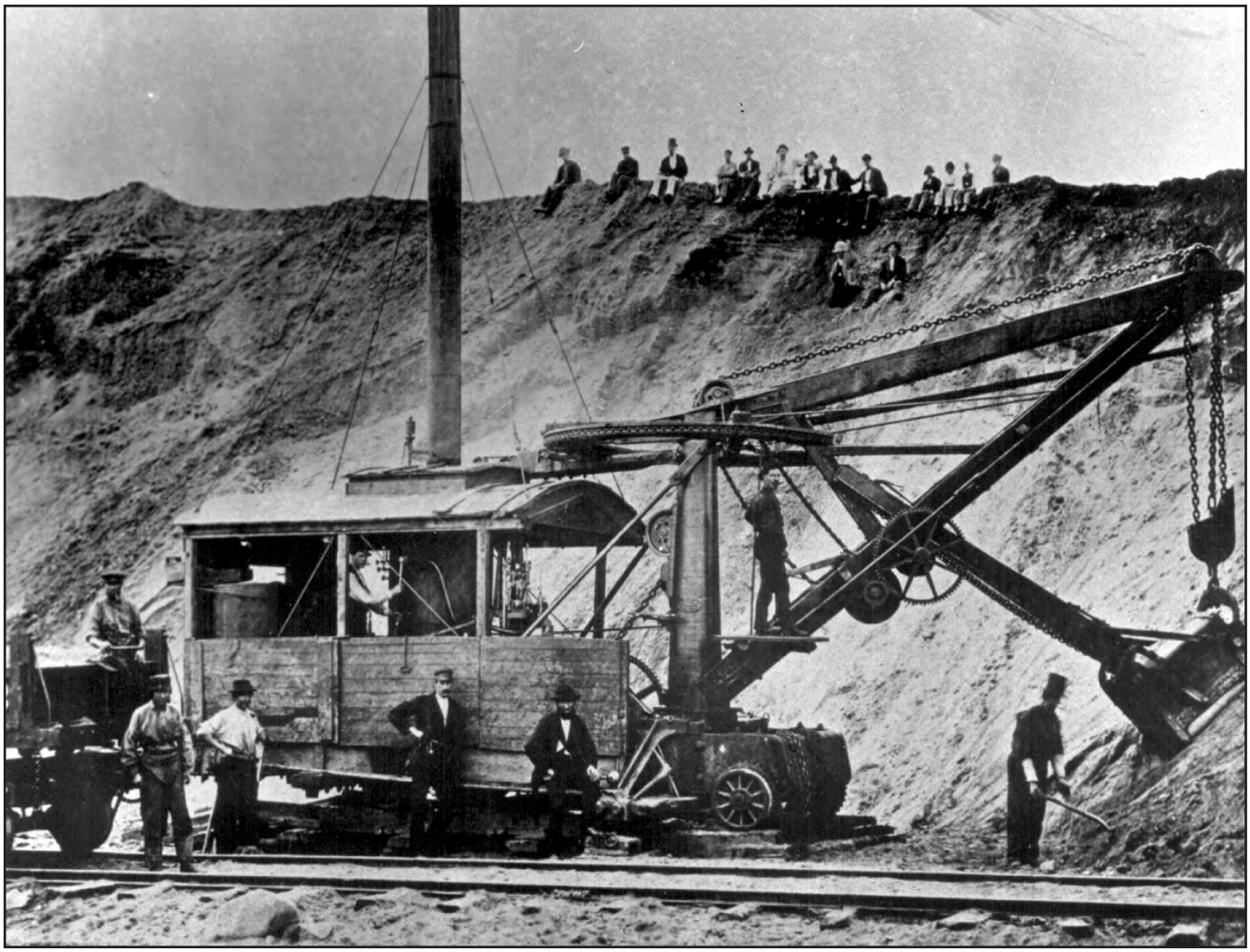


FIGURE 18.—A coal-fired steam shovel that operated on rails. *Circa* 1890's, location unknown. Photo courtesy of Ohio Department of Natural Resources, Division of Reclamation, from the Dale Davis collection.

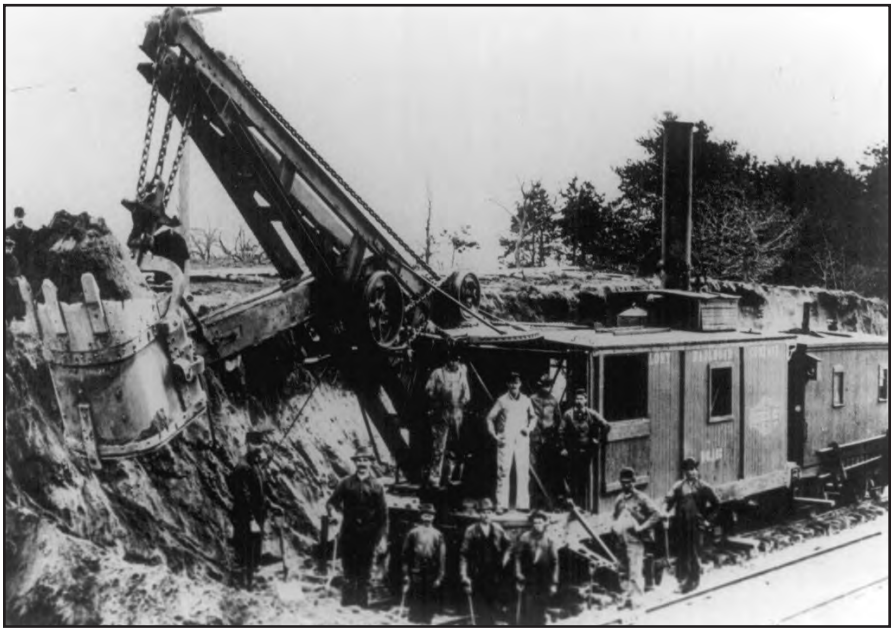


FIGURE 19.—An 1890-vintage coal-fired railroad shovel, which required at least seven men to shift track, clean up, provide fuel and water, and operate (Anderson, 1980, p. 22). Although originally built for railroad construction, these shovels were soon adapted to surface mine coal in Ohio. Reprinted with permission from Bucyrus-Erie Company.

FIGURE 21.—A Marion model 271 electric shovel working in a surface mine near Smithfield, in Smithfield Township, Jefferson County. Advertisement for the General Electric Company in The Coal Trade Bulletin (v. 35, no. 3, July 1, 1916, p. 19).

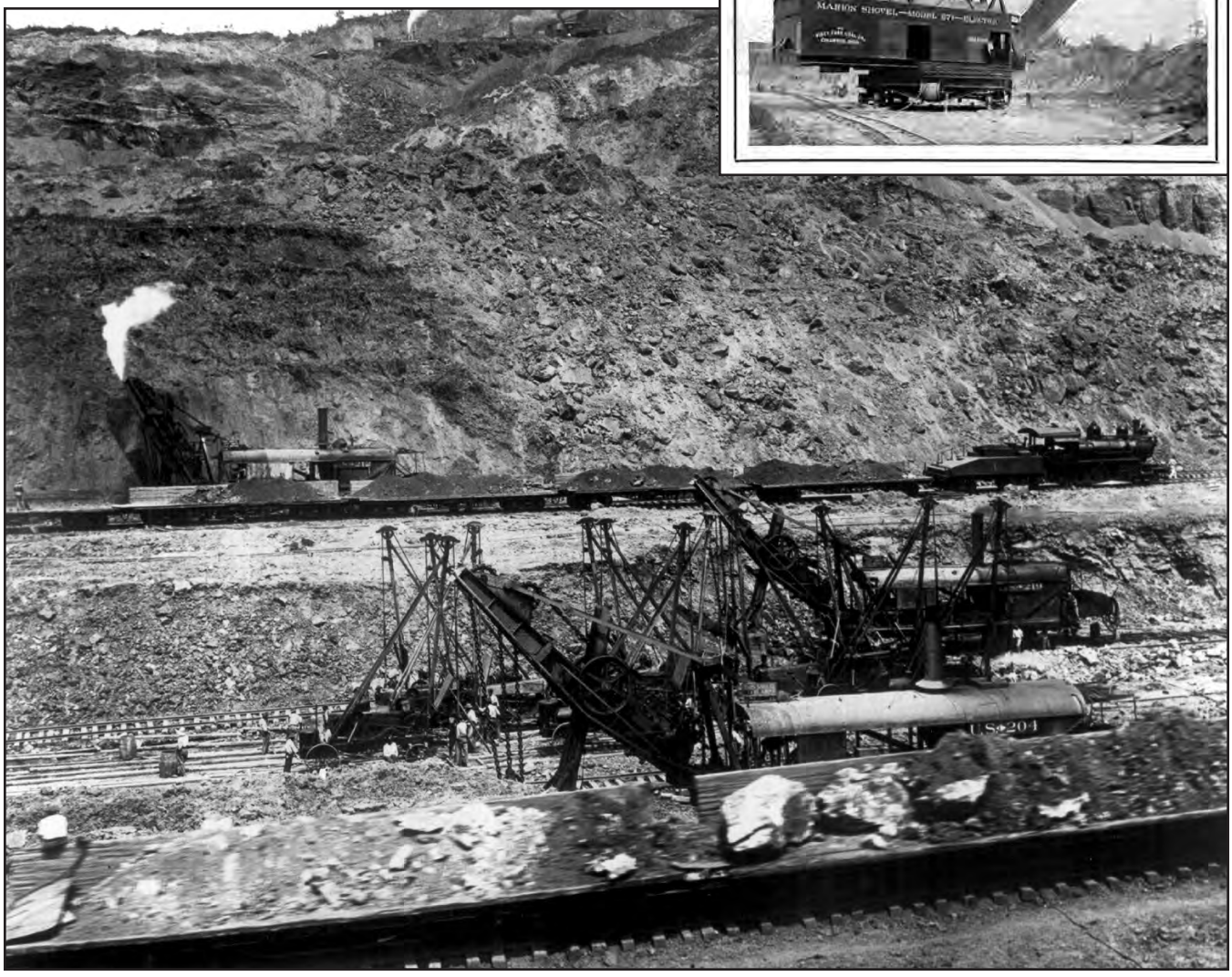


FIGURE 20.—Coal-fired steam shovels excavating rock during construction of the Panama Canal. After completion of the canal some of these steam shovels were used in eastern Ohio surface mines. *Circa* 1910. Photo courtesy of Dale Davis.

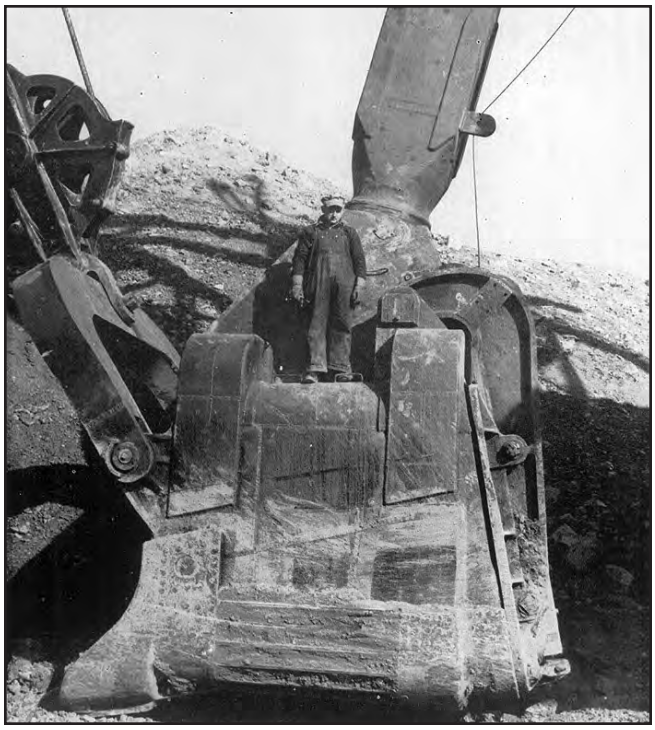


FIGURE 22.—A coal miner at a Hanna Coal Company surface mine near Georgetown, Harrison County, standing on top of a 35-cubic-yard bucket of a new electric power shovel built by the Marion Steam Shovel Company. During World War II, large surface-mining equipment helped Ohio meet the war-time fuel requirements as Ohio's underground mines struggled to maintain production levels due to a loss of experienced miners to the armed forces. Photo courtesy of Dale Davis, from Hanna Coal News (November 1944, p. 5).

FIGURE 23.—Side-by-side view of Hanna Coal Company's A (right) and B (left) shovels in a surface mine near Georgetown. Both shovels are 35-cubic-yard capacity, Marion 5561 electric-powered shovels. *Circa* 1947. Photo courtesy of Dale Davis. (For another photo of this mine see fig. 50.)

FIGURE 24.—The *Mountaineer*, an electric-powered shovel built by the Marion Power Shovel Company and heralded as the world's largest shovel in 1956. The *Mountaineer* is seen here alongside one of the last coal-fired steam locomotives operating commercially in Ohio's coal fields. *Circa* 1956. Photo courtesy of Ohio Historical Society.

FIGURE 25.—The *Green Hornet,* a 50-cubic-yard capacity, electric-powered Marion 5561 shovel. This shovel was operated by the Hanna Coal Company at the Georgetown No. 12 surface mine in Athens and Short Creek Townships, Harrison County. *Circa* 1950's. Ohio Division of Geological Survey file photo.

FIGURE 26.—The *GEM,* built by Bucyrus-Erie, stood taller than a 12-story building and had a 105-cubic-yard bucket capacity. This electric-powered shovel was operated by the Consolidation Coal Company in the Mahoning Valley No. 33 surface mine (Hn-700) near Cadiz in Athens and Short Creek Townships, Harrison County. *Circa* late 1970's. Ohio Division of Geological Survey file photo.

had evolved to such a degree that the size and efficiency of surface-mining equipment grew tremendously (figs. 22, 23); they no longer needed rails to move about, they no longer were steam powered (see fig. 212) and they were capable of quickly chewing up enormous stretches of land.

Ohio boasts of some of the largest surface-mining equipment in the world. The *Mountaineer* was heralded in 1956 as the world's largest power shovel (fig. 24; see also fig. 10). This power shovel, owned and operated in eastern Ohio by the Hanna Coal Company (Division of Pittsburgh Consolidation Coal Company), stood as tall as a 16-story building, had a 65-cubic-yard (about 100 tons) capacity bucket, and was capable of moving about 7,200 tons of material per hour (Kefauver, 1959, p. 23). The *Mountaineer* was used in surface mines of southern Harrison and northern Belmont Counties from 1956 to 1979, was capable of removing overburden up to 90 feet thick, and was dismantled in 1987. Currently, the largest, mobile, surface-mining machine in the world is the *Big Muskie* (see fig. 11), a walking dragline operated by the Central Ohio Coal Company in Muskingum County. The *Big Muskie* has a 310-foot-long boom from which is suspended a 220-cubic-yard (about 325 tons) capacity bucket, which can move 4 to 4.5 million yards of material a month (Coal Age, 1969, p. 50-52). The *Big Muskie* weighs about 27 million pounds and was built in 1969 by Bucyrus-Erie at a cost of $24 million! The *Big Muskie* is currently idle. There were other extraordinarily large earth-moving equipment used in the strip mines of Ohio. Some of these machines were given colorful names such as *Green Hornet* (fig. 25), *The Tiger, Coal Chief, GEM of Egypt* (fig. 26), and *Silver Spade* (fig. 27). The *Silver Spade,* taller than a 12-story building and having a bucket capacity of 105 cubic yards, is the only ultra-large power shovel still in operation (as of 1993) in the coal fields of eastern Ohio. The day of the ultra-large power shovels in Ohio appears to have passed, as these machines have been largely replaced by smaller, more efficient and versatile, hydraulically actuated front-end loaders and power shovels (figs. 28, 29).

FIGURE 27.—The *Silver Spade,* twin to the *GEM*, and the only big shovel of the Consolidation Coal Company still operating (as of 1993) in eastern Ohio. This shovel was dedicated November 25, 1965. *Circa* 1966. Photo courtesy of Ohio Department of Natural Resources, Division of Reclamation, from the Dale Davis collection.

FIGURE 28.—Hydraulically actuated front-end loader loading Meigs Creek (No. 9) coal into a 160-ton coal hauler at the Central Ohio Coal Company Muskingum mine (Ne-41), located in Muskingum, Noble, and Morgan Counties. *Circa* 1988. Ohio Division of Geological Survey file photo.

UNDERGROUND MINING

From 1800 until 1948, underground mining was the principal method of mining coal in Ohio (fig. 30). Since 1800, 2,103,912,374 tons of coal have been reported as produced from underground mines (table 2). Coal was mined entirely by hand from underground mines in Ohio until about 1876, when the first coal-cutting machine, the compressed-air-driven Lechner (fig. 31), was introduced in mines of the Straitsville Central Mining Company in Perry County. These mines operated in the Middle Kittanning (No. 6) coal in the Hocking Valley (Roy, 1883, p. 115). The first year of reported production by coal-cutting machinery was 1889 (State Inspector of Mines, 1889), when electric-powered mining machines were introduced (figs. 32, 33). By 1900, electric-hauling equipment (figs. 34-38) was rapidly replacing mules and dogs (see figs. 90-97) in underground mines (State Inspector of Mines, 1900, p. 17).

The introduction of mechanization and electricity transformed the nature of mining in Ohio by the late 1890's. Whether in hauling coal from the face or raising cars to the tipple, Ohio's most productive mines replaced the mules of former years with electric power (Boryczka and Cary, 1982, p. 130).

By 1910, Ohio became the leading state in the nation in the production of machine-mined coal when 84 percent of the total production was mined by machines (Shurick, 1912, p. 1238).

FIGURE 29.—Scene at a surface mine of the Waterloo Coal Company in Bloomfield Township, Jackson County. Today's surface-mine operators in Ohio use smaller, more efficient mining equipment rather than the very large mining equipment of the mid-20th century such as the *Big Muskie* and the *Mountaineer*. Photo taken by Doug Crowell in 1993.

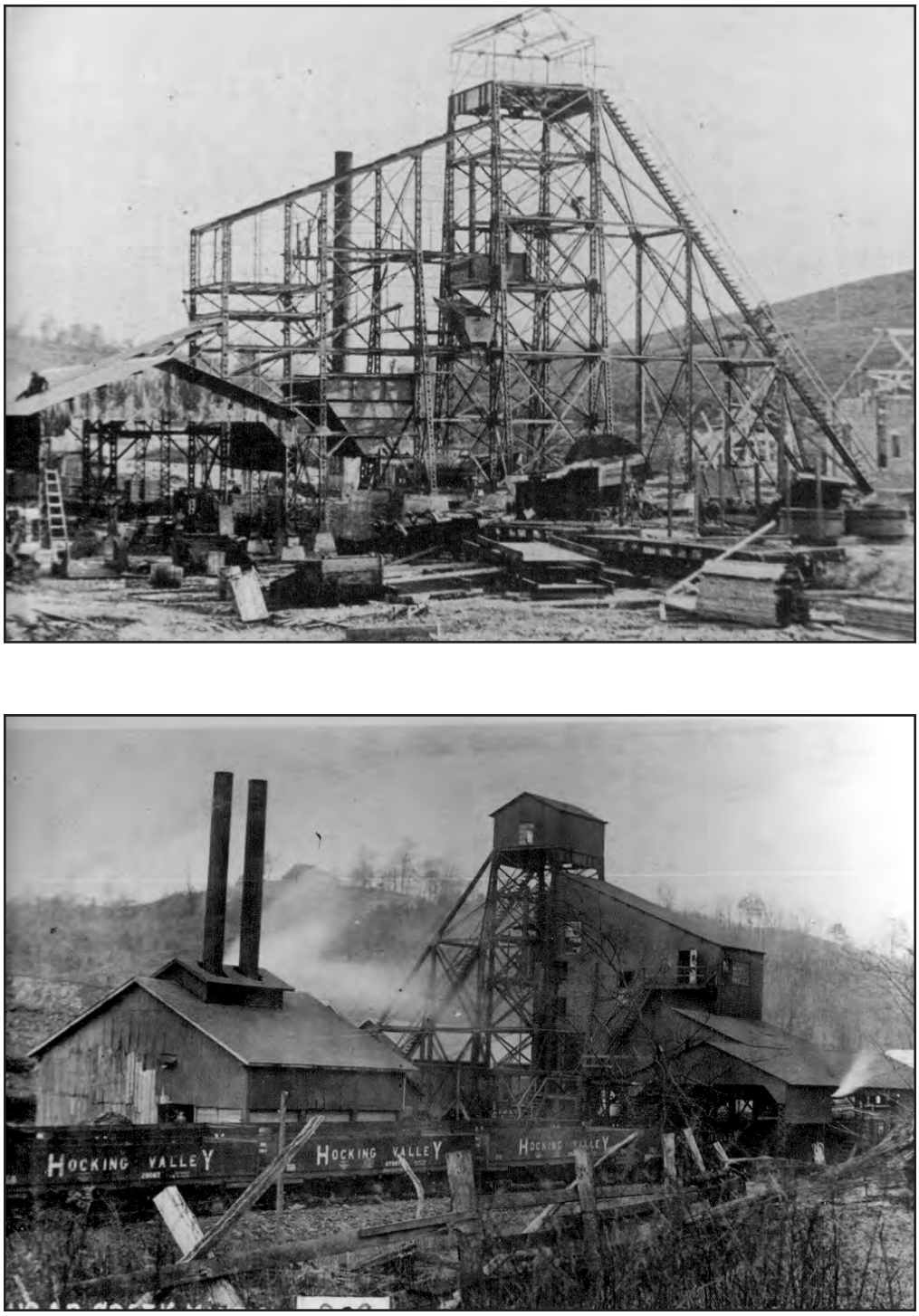


FIGURE 30.—Construction (top photo) of the hoisting-shaft headframe and tipple of the Continental Coal Company mine No. 209 (As-111) was completed in early 1905. This structure was built near Sugar Creek, in Dover Township, Athens County. Mine No. 209 provided Middle Kittanning (No. 6) coal to the Hocking Valley Railroad (bottom photo; date unknown) for 19 years until it was abandoned in 1923. Photos courtesy of Mark Wharton.

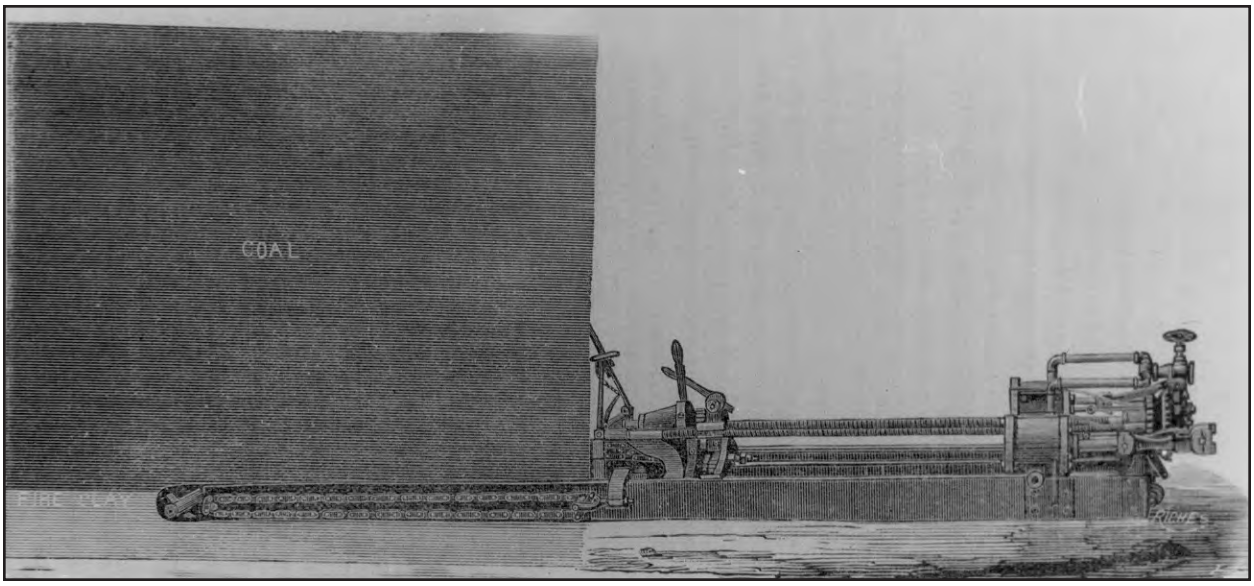


FIGURE 31.—Lechner coal-cutting machine (from State Inspector of Mines Report, 1881, p. 62). This compressed-air-driven machine was first used in 1876 in the mines of the Straitsville Central Mining Company in Perry County.

Although the number of underground mines in Ohio has dropped significantly since 1950, coal production by underground mining in Ohio has decreased very little over the past 43 years because of the development of automated mining equipment and sophisticated roof-support and coal-haulage systems and the use of longwall mining systems. In 1993, 10,472,326 tons (37.9 percent of the total production) of coal were mined underground from nine underground mines in seven Ohio counties; in comparison, 14,584,297 tons were produced from 526 underground mines in 23 counties in 1950 (table 2).

Types of underground mining

There are three types of underground mines: shaft, slope, and drift (fig. 39), each named for the principal type of opening used to gain access to the seam being mined. The terms shaft, slope, and drift commonly are used casually, but each is a distinct type of entry into an underground mine. A shaft opening (fig. 40) is a vertical passageway, a slope opening (fig. 41) is an inclined passageway, and a drift opening (fig. 42) is a horizontal passageway. Drift openings exploit coal seams where they crop out. In Ohio, drift mines (figs. 43, 44) constitute the largest number of the three types of underground mines.

Shaft and slope openings primarily exploit coal that is either below regional drainage or under thick cover; some openings are more than 450 feet deep. The three coal mines with the deepest shaft openings in Ohio are the Jensie mine (Jfn-260)[1] in Jefferson County, the Nelms No. 1 mine (Hn-68) in Harrison County, and the Canaanville mine (As-134) (see fig. 60) in Athens County. These mines, all of which are now abandoned, were 480, 450, and 450 feet deep, respectively at their hoisting-shaft openings. The coal mine with the greatest amount of cover in Ohio is the Nelms-Cadiz Portal, an active slope mine in Green Township, Harrison County; it has 529 feet of overburden at the mouth of the slope. The deepest shaft mine in Ohio is the Barberton mine (St-36), an abandoned limestone mine in Summit County, which is 2,200 feet deep at the hoisting shaft.

[1]The Ohio Department of Industrial Relations, Division of Mines assigns a mine number to each Ohio mine. Each mine number includes a prefix consisting of an abbreviation of the name of the county in which the mine is located. Although many mines changed operators and names over the years, the Division of Mines number remained the same and thus is useful in tracking the history of a mine.

Methods of underground mining

The primary method of mining coal underground in Ohio has been the room-and-pillar method, in which the coal is mined in rooms separated at regular intervals by roof-supporting pillars or ribs (fig. 45). In some instances, as the initial mining neared completion, the pillars would be "drawn" or "robbed," that is, either partially or completely removed, leaving little or no roof support. Another method of underground mining is longwall mining, which involves removal of an entire section (up to 1,100 feet wide and nearly 3 miles long) of a seam during a single pass of the mining machine (fig. 46). Until recently, longwall mining has been a little-used mining technique in Ohio. The first mention of longwall mining in Ohio was for two mines in Columbiana County, one at Lisbon and one at Washingtonville, in 1874 (State Inspector of Mines, 1874, p. 63). These mines were followed by longwall mining in a mine near Leetonia, Columbiana County, in 1875 (State Inspector of Mines, 1875, p. 16). Longwall mining was used to a limited extent at the Allen shaft mine (Cl-4) in 1893 (West, 1898, p. 11). This mine is located near Dellroy, in Monroe Township, Carroll County, and was abandoned in 1897. The La Belle shaft mine (Jfn-83) at Steubenville, Jefferson County, operated on the longwall mining system from 1913 to 1927. Since 1977, longwall mining has been used in underground mines in Belmont (Powhatan No. 6), Meigs (Meigs No. 2 and Meigs No. 31), and Monroe Counties (Powhatan No. 4).

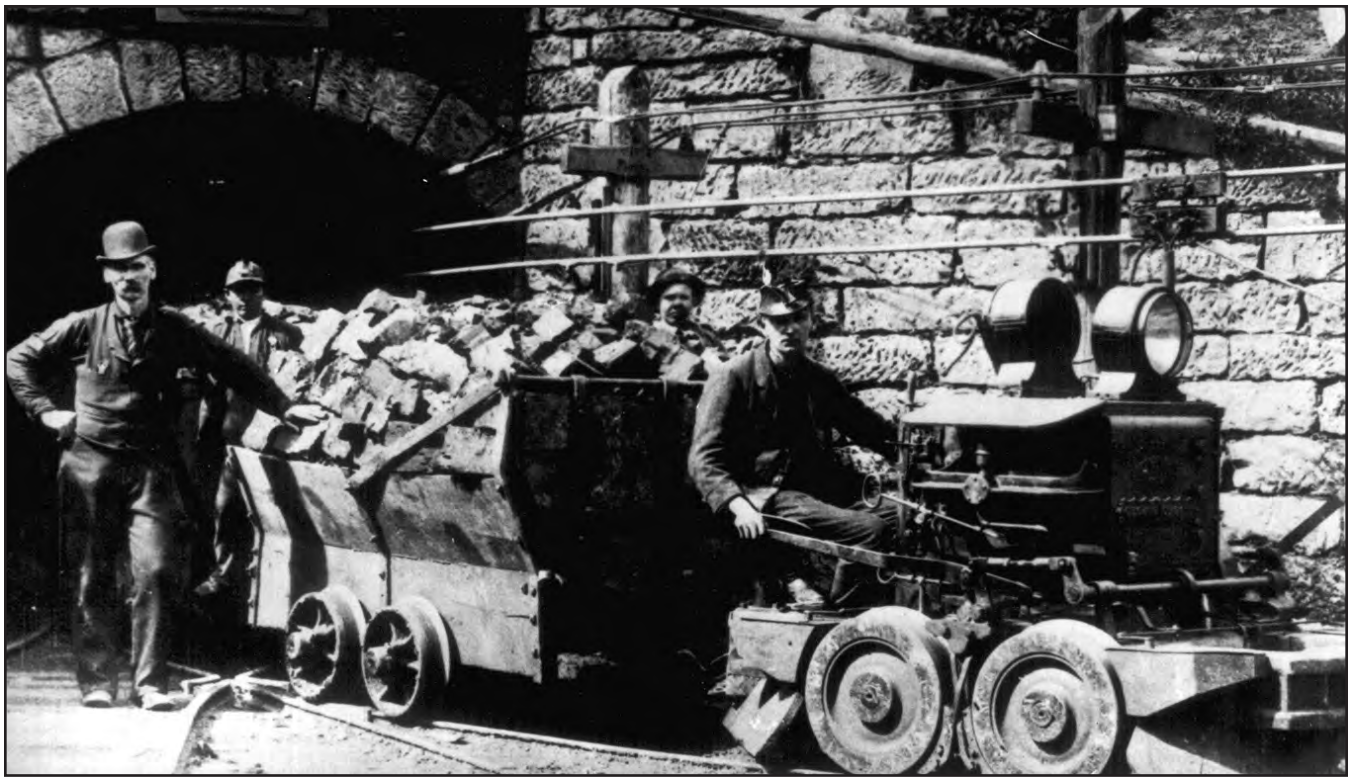


FIGURE 32.—The first electric locomotives to be used successfully in a bituminous coal mine in the United States were built by the Jeffrey Manufacturing Company (later the Jeffrey Mining Equipment Company) in 1888. These locomotives were installed at the Shawnee & Ironpoint Coal & Iron Company Ironpoint mine (Py-51), located approximately 1 mile north of Shawnee in Salt Lick Township, Perry County (State Inspector of Mines, 1890, p. 185). The Ironpoint mine, a drift mine in the Middle Kittanning (No. 6) coal, was abandoned in 1916. Photo first appeared in The Coal Industry (v. 1, no. 3, March 1918, p. 105). Photo courtesy of Ohio Historical Society.

FIGURE 33.—Two miners undercutting a seam of coal in an eastern Ohio coal mine using a coal-cutting machine built by Jeffrey Mining Equipment Company. Note the low ceiling and the carbide lamps and cloth hats worn by the miners. Date and location unknown. Ohio Division of Geological Survey file photo.

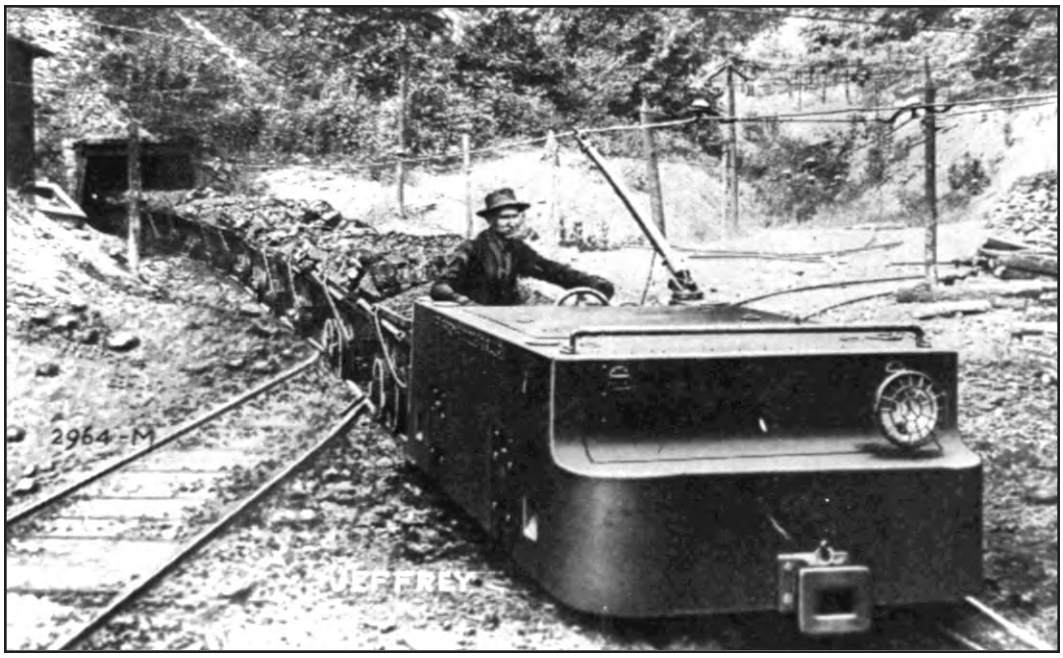


FIGURE 34.—Ten-ton electric locomotive manufactured by Jeffrey Mining Equipment Company towing a shuttle train loaded with coal from the Alma mine (Vn-18) operated by the Alma Cement Company. This drift mine, located near Oreton, Vinton Township, Vinton County, produced both Clarion (No. 4A) coal and Vanport limestone. It was abandoned in 1909. The mine was reopened by the Manhattan Coal Company and finally abandoned in 1924. *Circa* 1908. Photo from State Inspector of Mines Report (1909, p. 100).

FIGURE 35.—A 20-ton haulage locomotive emerging from an entry of the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) on its way to the outside. Note the clean appearance of the entries. The ceiling and coal pillars (walls) have been sprayed with gunite, a mixture of cement and sand, to reduce roof failure and water seepage. The Willow Grove No. 10 mine, a drift mine in the Pittsburgh (No. 8) coal between St. Clairsville and Neffs in Richland Township, Belmont County, opened in 1917 and was abandoned in 1954. *Circa* 1953. Photo courtesy of Hanna Coal Company. (For other photos of this mine see figs. 79, 82, 93, 110, 117, 119, 120, 123, 140-142, 153, 154, 193.)

FIGURE 36.—A loaded "trip" or train of mine cars, led by a 20-ton haulage locomotive, leaving the Hanna Coal Company Piney Fork No. 1 mine (Jfn-243), passing a string of empties preparing to enter the mine. *Circa* 1955. Photo courtesy of Hanna Coal Company. (For other photos of this mine see figs. 74, 101, 116, 121, 159.)

FIGURE 37.—Coal miners riding an electric shuttle train en route to an eastern Ohio mine. Shuttle trains carrying miners to and from the mine are commonly referred to as man trips. Date and location unknown. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

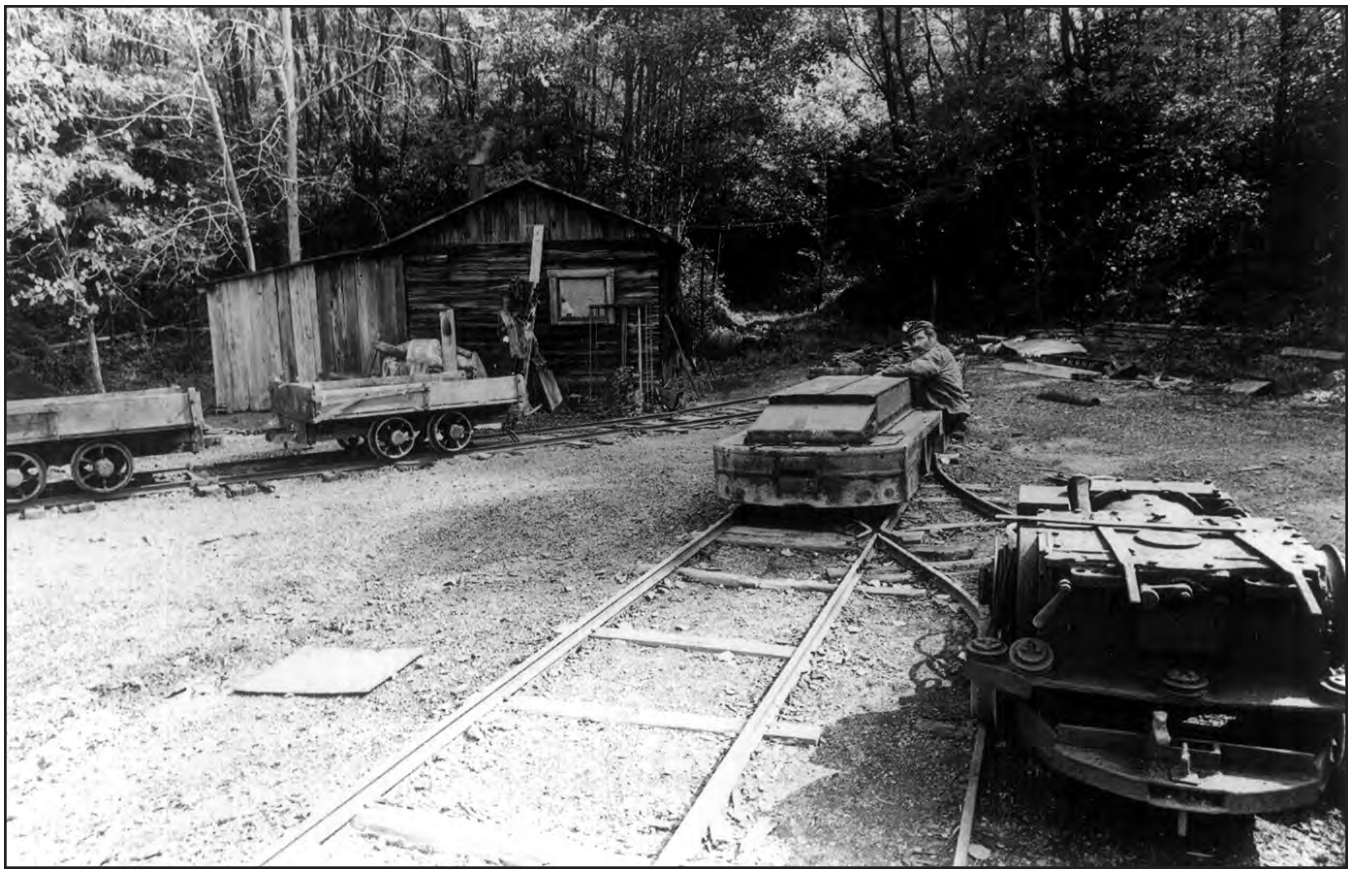


FIGURE 38.—Converging tracks lead through the trees in the background to Ray Stahl's one-man coal mine. Stahl built most of his equipment, including the locomotive he's driving. The machine on the right, mounted on rails, is a coal cutter which Stahl used to mine about 4 tons of coal per day. The mine cars on the left each hold about 1,700 pounds of coal, which Stahl would load by hand. Photo by Fred Shannon, from the Columbus Dispatch Sunday Magazine, January 28, 1979, p. 9. Reprinted with permission. (See also cover photo.)

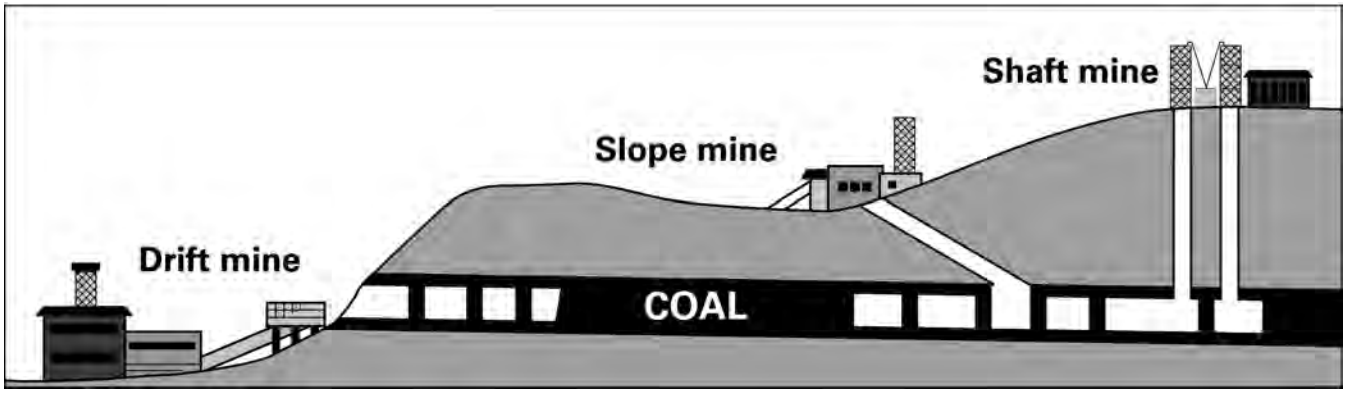


FIGURE 39.—Types of underground mines used in Ohio (from Collins, 1988).

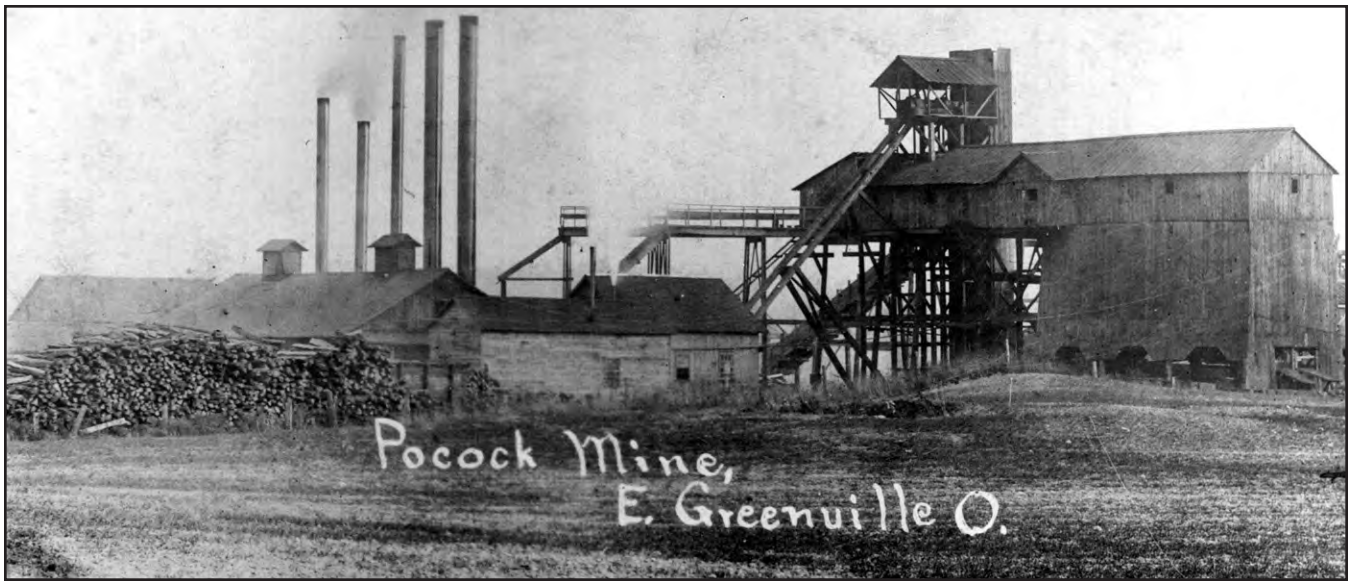


FIGURE 40.—Hoisting-shaft headframe, tipple, and powerhouse of the Pocock mine (Sk-102), located about 1 mile south of East Greenville in Tuscarawas Township, Stark County. This shaft mine, operated by the Pocock Coal Company, was abandoned in 1902. Note the stack of timber (left foreground) to be used for roof support in the mine. Date unknown. Photo courtesy of The Massillon Museum.

FIGURE 41.—Opening and coal-haulage tracks to the Hisylvania Coal Company mine No. 22 (As-22) in Trimble, Trimble Township, Athens County. This slope mine was abandoned in 1925. *Circa* 1901.

FIGURE 42.—Three drift openings. *Circa* early 1900's. Location unknown. Photo courtesy of Ohio Historical Society.

FIGURE 43.—Small drift mine operated by C.J. Van Fossen on the west side of Jakes Run, about 2½ miles south of Bethesda, in section 20, Goshen Township, Belmont County. This mine produced Uniontown (No. 10) coal, called the "Three-Foot soft coal" by the local miners in order to distinguish it from the Waynesburg (No. 11) coal, known as the "Four-Foot hard coal" (Condit, 1923, p. 99). Coal seams generally were given informal names that varied locally. Note the wooden planks used as track for a mine car. The wooden structure in front of the drift opening probably served as a crude loading ramp for wheelbarrows or carts below the mine-car track. *Circa* 1914. Photo appeared in Condit (1923, plate IVA). Photo courtesy of U.S. Geological Survey, D. Dale Condit (#108) collection.

FIGURE 44.—Top photo, view from the coal tipple of the Big Five Coal Company looking south across McMahon Creek toward the drift openings of the Big Five coal mine (Bt-228), located near Stewartsville, in Richland Township, Belmont County. This mine was abandoned in 1935. *Circa* early 1900's. Bottom photo, opposite view from the drift opening of the Big Five coal mine looking north across McMahon Creek toward the tipple. *Circa* 1911. Both photos illustrate the wire-rope haulage system used to move mine cars between the coal mine and tipple. Photos courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment collection.

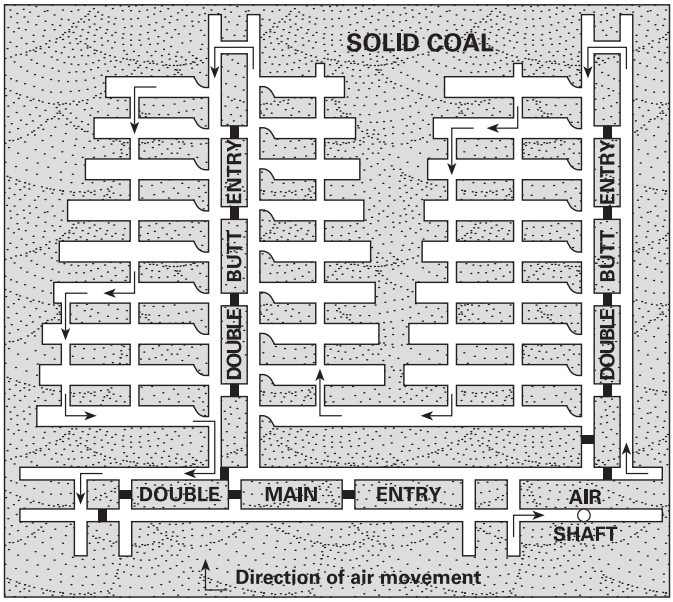


FIGURE 45.—Idealized double-entry room-and-pillar mine layout (from DeLong, 1988, p. 1). Illustration is a modification of a drawing in Roy (1884, p. 333).

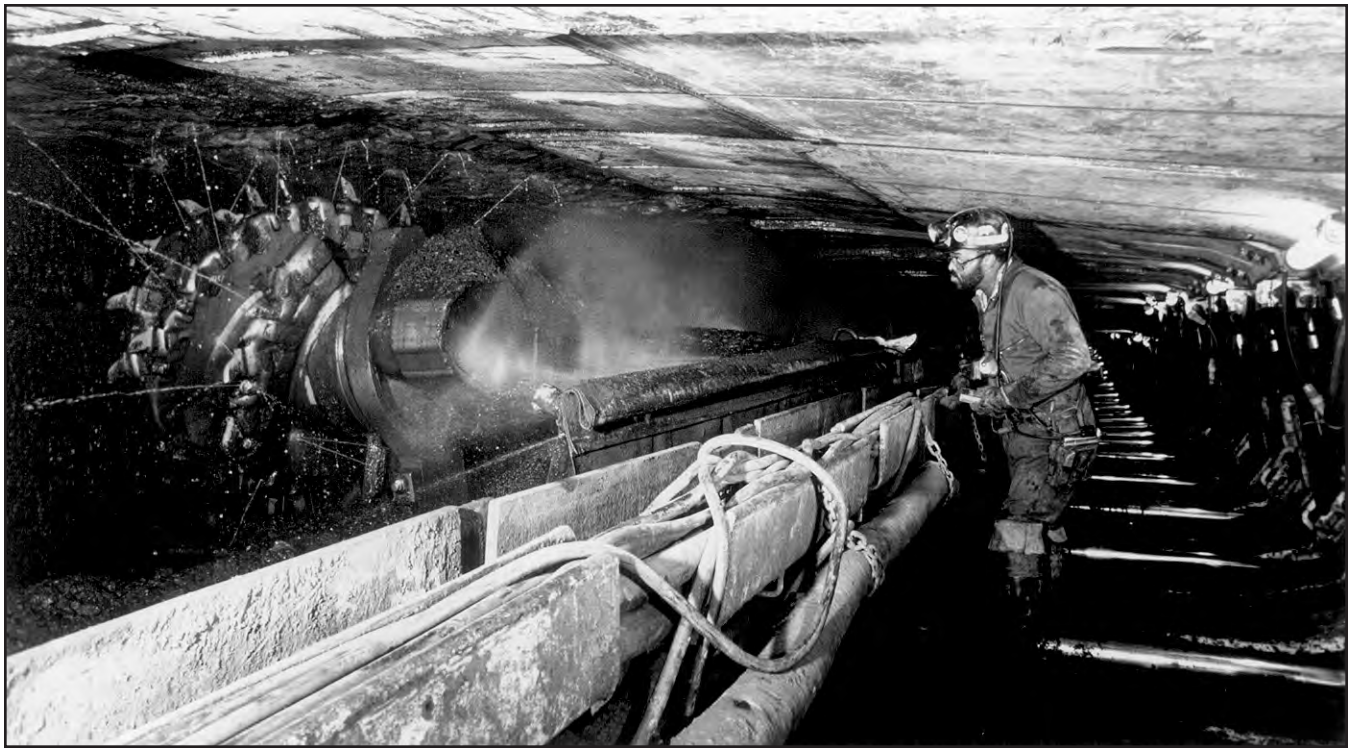


FIGURE 46.—Longwall mining operation at the Southern Ohio Coal Company Meigs No. 31 mine (Ms-293) in Salem Township, Meigs County, and Wilkesville Township, Vinton County. This longwall unit set a world production record in 1992, mining 527,835 raw tons of coal in a single month. In this mining operation, coal is mined from one long face—the longwall. The area mined can be up to 15,000 feet long and 1,100 feet wide. The mining machinery includes a revolving cylinder, studded with tungsten carbide bits or "teeth," which shears off chunks of coal while moving back and forth across the working face. Water is sprayed on the coal to minimize the amount of coal dust generated. The miner is protected overhead by hydraulic shields that can support up to 600 tons each. *Circa* 1990. Photo courtesy of American Electric Power Service Corporation. (For other photos of this mine see figs. 201, 216, 219.)

Repine (1986, p. 35) provides an interesting anecdote concerning the La Belle mine:

Early on a typical morning in 1915, a shift of coal miners living in Steubenville, Ohio, left their homes and headed towards the La Belle mine of the La Belle Iron Works. Arriving at the La Belle Shaft #1, they were lowered straight down through 200 feet of rock to reach the mine workings. From the bottom of the shaft the miners proceeded east, leaving Ohio. Traveling through passageways called River Entry, Water Course, and River Headings, they entered West Virginia by walking under the Ohio River. When they finally reached their workplace the miners were over one mile inside the Mountain State.

The La Belle Shaft #1 is also variously known as the shaft #1 of the Jefferson Iron Company and the Rolling Mill Shaft (State Inspector of Mines, 1877, p. 15).

According to Roy (1885, p. 78), the coal beneath Steubenville and extending under the Ohio River into West Virginia was discovered by Adam Wise

. . . in 1829 while boring a hole for water for the supply of one of the village manufacturers. The coal [Lower Freeport (No. 6A)] *was met at a depth of 225 feet below the surface, and was pronounced to be eleven feet thick. As the Pittsburgh* [No. 8] *vein was found in the hills surrounding the village, the idea of sinking a shaft to such a depth was not conceived for many years afterwards. . . . The shaft was laid out at the upper end of Market Street . . . . Coal was struck in the fall of 1857, but instead of being eleven feet it was found to be less than four feet.*

This shaft is variously known as the High Shaft (Jfn-116) and Market Street Shaft (Newberry, 1878b, p. 757). According to Repine (1986, p. 35),

Although the coal was six to seven feet thinner than Mr. Wise had stated, other shafts soon followed and a substantial amount of high-quality coal was mined for use by railroads and for coke production at local iron works such as La Belle. It was from some of these shafts that mines would later extend under the Ohio River and into West Virginia.

The map of the La Belle mine (Jfn-83) (fig. 47) shows that it had five hoisting shafts, three of which have entries driven into West Virginia. The date these extensions of the La Belle mine were begun is not known, but by 1878 the eastward extensions were well underway, as indicated by the following account by Newberry (1878b, p. 758):

In the mine of the Jefferson Iron Company an effort has been made to drive galleries under the Ohio to reach coal lands on the other side. This has not been fully accomplished, but in the judgment of the proprietors, all difficulties have been overcome, and no obstacles oppose the extension of their works as far eastward as may be deemed advisable.

Additional attempts were made to mine underneath the Ohio River, as evidenced by the following accounts of the State Inspector of Mines (1875, p. 10, 11):

the workings of the Rolling Mill shaft have been pushed under the Ohio River but they are now abandoned in that part of the mine because of the danger of the river bursting in drowning the colliery . . . . The shaft of the Rush Run Coal Company has but one opening [250 feet deep] *. . . part of the workings of this mine also extend under the Ohio River a distance of fifty yards or more.*

The State Inspector of Mines (1877, p. 16, 17) stated further,

The Rolling Mill shaft has a pair of entries sixteen hundred feet in length, driven in an eastern direction from the bottom of the shaft. They passed directly under the Ohio River, and were stopped after passing one hundred feet into West Virginia. At this point they encountered a feeder of water, and the coal itself became so soft that it was deemed prudent to stop operations . . . . The Rolling Mill Shaft, Everick's, Boreland's and Rush Run have extended their workings under the Ohio River; but all such work is now abandoned, never to be renewed.

However, perhaps the difficulty with water encountered in the Rush Run mine was overcome and mining continued, as is suggested in the following account by Orton (1884b, p. 221):

The last shaft that reaches the coal is located at Rush Run, 5 miles below Brilliant, and 11 miles below Steubenville . . . . Two parallel entries were advanced under the river for 150 yards. The coal was strengthening in this direction [attaining a thickness of 7 feet], *the whole seam showing an excellent appearance.*

The extent of the Rush Run mine is not known, as no map is available which shows its workings.

Another type of mining is auger mining (fig. 48), which is a combination of surface and underground methods. Large-diameter augers or drill bits bore up to several hundred feet horizontally into a seam of coal that either crops out or is exposed by surface mining, but continued surface mining is impractical. Production by auger mining in Ohio was first reported in 1954, when 938,643 tons of coal were auger mined. Since 1954, 40,963,267 tons of coal have been auger mined in Ohio, averaging less than 1.5 million tons annually (table 2). In 1993, auger mining contributed 1,030,484 tons (3.7 percent) of Ohio's total coal production.

RECLAMATION

By necessity, surface land is disturbed in the process of mining coal. The area of disturbed land can range in size from a few acres up to 50 square miles, as in the Central Ohio Coal Company Muskingum mine (Ne-41). However, the ecological and environmental impact of mined land can reach far beyond the limit of mining as a result of (1) acid mine drainage, (2) streams choked by excessive sediment loads, and (3) mine subsidence. Reclamation is a process of systematically restoring land to productive uses, *a kind of landscape plastic surgery that transforms former coal mines into productive, attractive, and useful areas* (National Coal Association, 1984, p. 3).

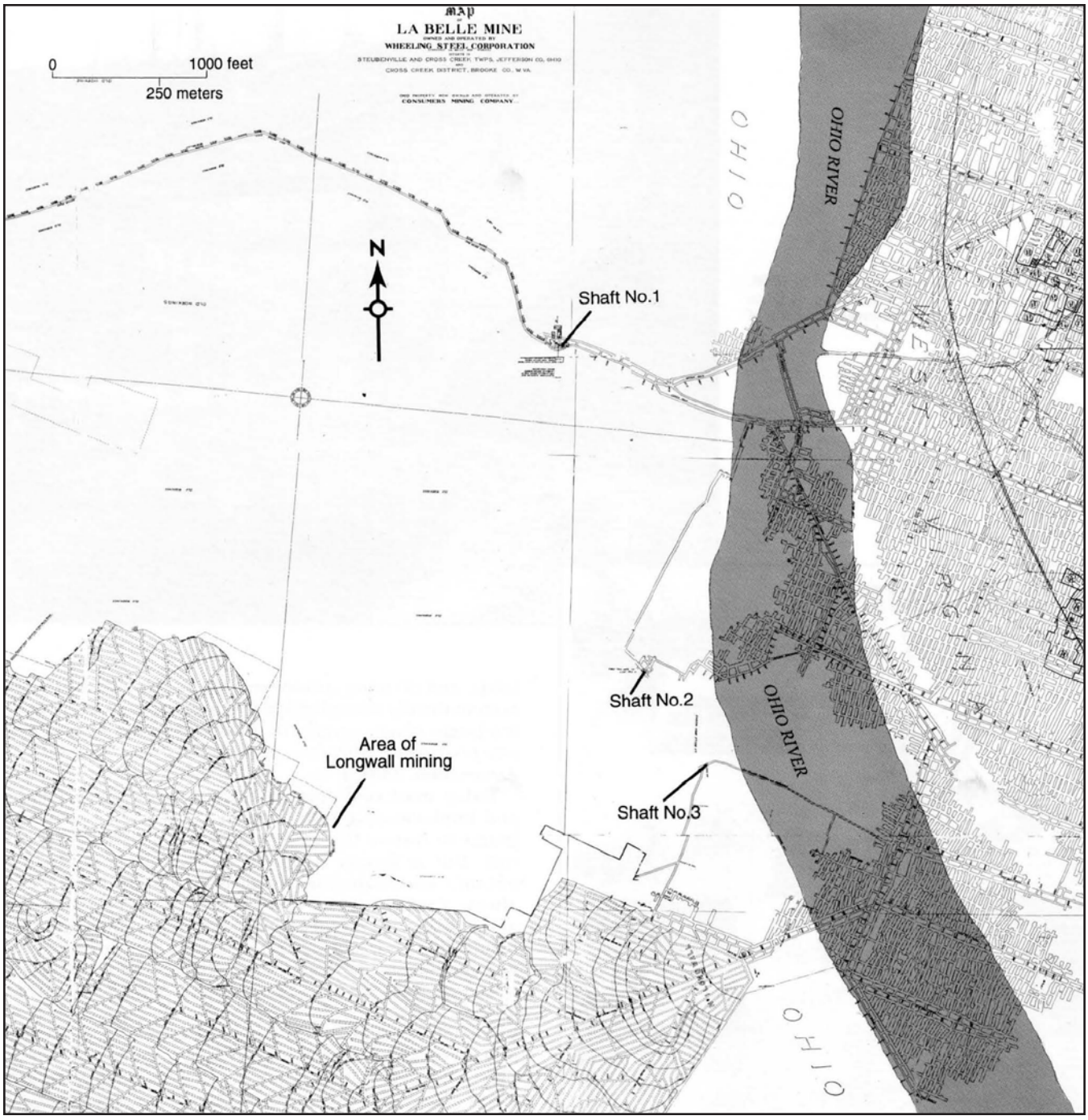


FIGURE 47.—Map of the La Belle mine (Jfn-83) at Steubenville, Jefferson County. During the late 1870's, entries were extended from the La Belle mine underneath the Ohio River and eventually into West Virginia.

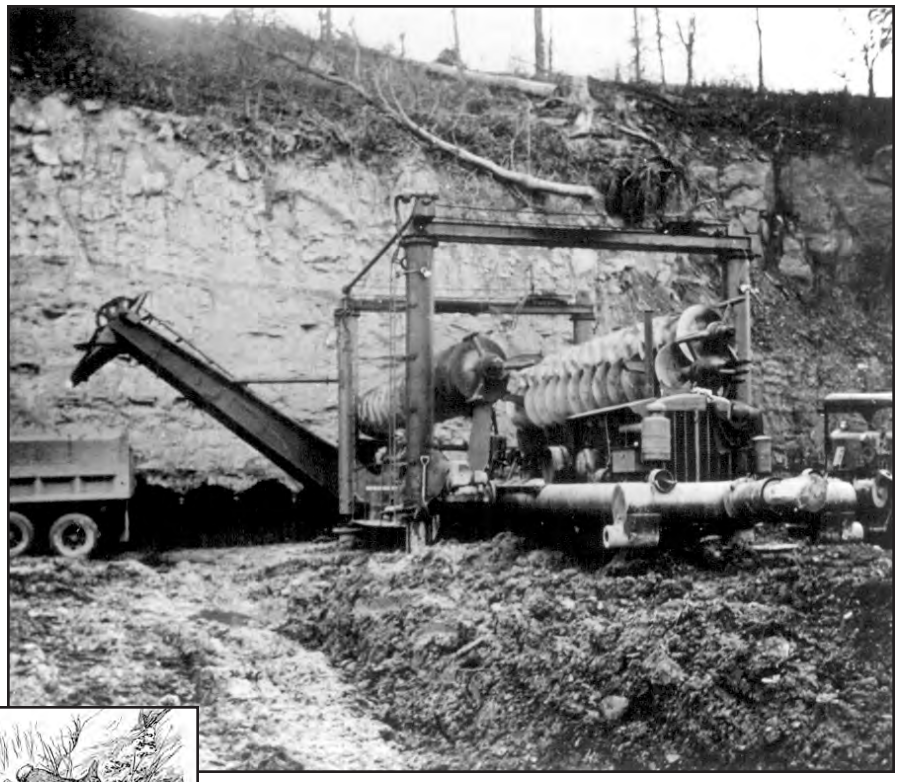


FIGURE 48.—Coal-auger mine. *Circa* 1956. Location unknown. Photo courtesy of Ohio Department of Natural Resources, Division of Reclamation.

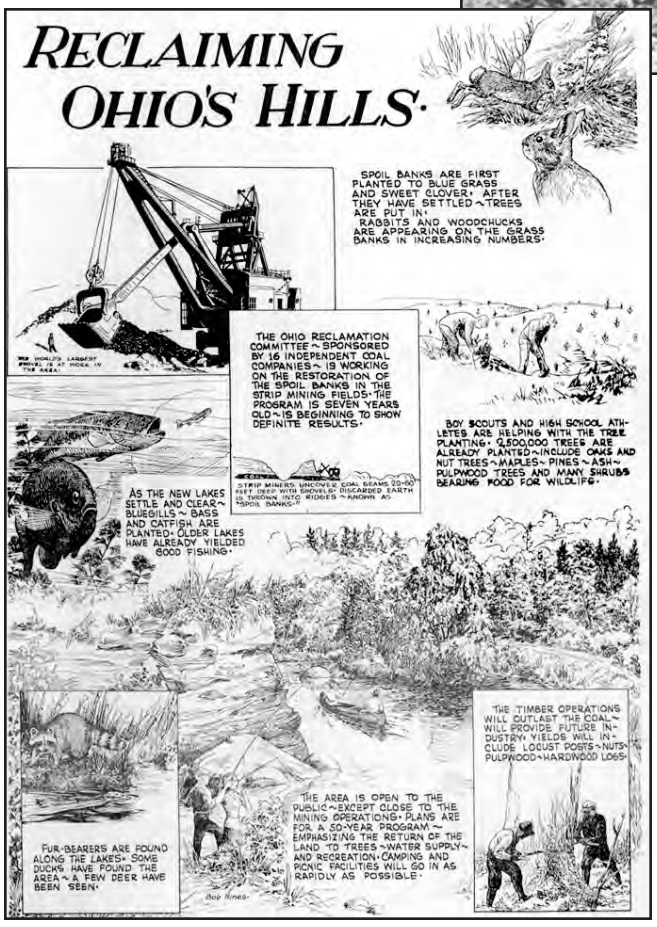


FIGURE 49.—An illustration of the reclamation efforts by some of Ohio's coal operators during the early 1940's (from Hanna Coal News, May 1944, p. 1).

Today most coal operators are responsible in planning and implementing well-thought-out, comprehensive programs to restore the land that must be disturbed to mine coal. But in former times, prior to an awakening of the nation's environmental awareness, mined land was not always treated with care and respect. Most early coal operators held an apparent lack of concern for mined land. As a result, few attempts were made to revegetate mined land, and spoil banks generally were left exposed and ungraded, allowing great amounts of fertile topsoil be lost through erosion and causing many streams to become choked with sediment. In addition, because pyrite-bearing rocks generally were left exposed to weathering, allowing pyrite to react chemically with water to form sulfuric acid, many areas of Ohio's coal fields were adversely impacted by acid mine drainage. This attitude resulted from the fact that reclaiming mined land was not considered justifiable from a business standpoint.

In those days, even if a particular coal operator desired to protect the ecology of the land, reclamation costs were an additional burden that would prevent him from meeting the stiff price of competition from operators who avoided such expense (National Coal Association, 1984, p. 3).

However, there were some attempts by early coal operators at reclaiming mined land.

According to the records of the Ohio Division of Forestry, coal operators in Ohio have been planting timber since 1910. In the spring of 1946 alone, through the Ohio Reclamation Association, they planted over 1 1/3 million trees (Ohio Coal Association, 1947, p. 14).

FIGURE 50.—Aerial view of the Hanna Coal Company Georgetown surface mine (Hn-12) showing hundreds of young pine trees planted systematically on unleveled banks. The company's A and B shovels (see fig. 23) also can be seen in operation. Photo courtesy of Dale Davis, from Hanna Coal News (September 1947, p. 4).

In 1921, Harmon Creek Coal Company used clover and shrub pine trees to reclaim surface-mined land near Hopedale and East Cadiz, in Green Township, Harrison County (Virgin, 1921, p. 344). Also in 1921, the Ohio Experiment Station in co-operation with Wayne Coal Company planted black locust trees on surface-mined land in Green Township, Harrison County (Coal Trade Bulletin, 1921, v. 44, no. 12, p. 412).

In 1941, the Ohio Reclamation Committee, sponsored by 16 coal companies, began reclaiming Ohio's surface-mined areas by planting 800,000 trees. The goal of the Ohio Reclamation Committee is to transform the "eye-sores" of the coal-mining industry into thriving and productive forests (Hanna Coal News, December 1942, p. 3) (fig. 49).

In 1945, the Ohio Reclamation Association was formed as an outgrowth of the Ohio Reclamation Committee. By 1956, the Ohio Reclamation Association had planted more than 19 million trees on 21,564 acres and seeded an additional 16,087 acres of surfaced-mined land in Ohio (Cook, 1950, p. 1; 1956, p. 4). But there were too few attempts at land restoration and fewer success stories by the early coal operators. Remnants of neglect by mining practice of a former era have resulted in a legacy of unproductive and unattractive lands in portions of Ohio and a mountain of legislation regulating coal mining and land restoration.

Ohio's first surface-mine law was passed in 1947. (See Chapter 6 for information on early mine laws in Ohio.) This law, administered by the Ohio Department of Industrial Relations, Division of Mines, required the identification of the land to be affected, a bond of $100 per acre mined, and the planting of trees (fig. 50), grasses, or shrubs at a cost not to exceed $50 per acre. This initial law was strengthened in 1949 and created the Division of Reclamation in the Department of Agriculture. The Division of Reclamation was charged with administering this law, which required burial of exposed coal seams by at least 3 feet of material, levelling off peaks and ridges in spoil piles, identification of property ownership within the affected area, and posting of a $50 registration fee and a bond of $190 per acre mined. In 1955, Ohio's surface-mine law was amended, raising the bond rate to $220 per acre mined and transferring the Division of Reclamation to the Ohio Department of Natural Resources. Further statutory changes were made in 1965, including requirements of successful vegetation and grading of gently rolling, sloping, or terraced topography and prohibiting long, uninterrupted slopes. The 1965 law also required coal operators for the first time to submit a plan for reclamation along with their surface-mine license application.

These early surface-mining statutes were weak in some respects and resulted in a lack of demonstrated progress in restoring surface-mined land. As a result, the Ohio General Assembly passed substantially tougher legislation, known as the 1972 Ohio Strip Mine Law. This law included the requirement of establishing grasses and/or legumes instead of trees on reclaimed land to minimize the amount of valuable topsoil lost through erosion. Ohio's 1972 law served as the model for the federal Surface Mining Control and Reclamation Act of 1977. The federal law sought uniformity of reclamation requirements throughout the nation and created the Office of Surface Mining within the U.S. Department of Interior as the regulatory agency. Ohio further refined its surface-mining law in 1981 through legislation known as the Coal Mining and Reclamation Law. This law required (1) restoration of coal-mined land to its original, pre-mining contour, (2) concurrent reclamation, (3) establishment of successful vegetation which must be monitored for a period a five years before bond monies are fully released to the operator, and (4) advertisement in local newspapers of permit applications and bond-release requests. In 1982, Ohio was granted primacy in regulating its surface-mining and reclamation programs because Ohio's 1981 law was as effective as the 1977 federal law.

In accordance with the refinements brought about by the 1981 law, which were finalized in 1989, the Ohio Division of Reclamation began to regulate the surface operations and surface effects of underground coal mines. Underground coal-mine operators are now required to make repair of and/or compensate for damages caused by longwall mining as well as make a pre-mining assessment of structures which may potentially be affected by longwall mining. Also, today's coal-mine operators must specify how topsoil, water conditions, vegetation, wildlife, and archaeological resources will be protected, in addition to outlining how the land will be mined and reclaimed. Bond monies of $2,500 per acre mined are now posted by the coal operator to ensure that successful land restoration is carried out. Furthermore, for each ton of coal mined, Ohio coal operators pay federal and state severance taxes to be used in reclaiming abandoned mined lands. As of 1993, the federal severance tax is 35 cents per ton for surface-mined coal and 15 cents per ton for underground coal; the state severance tax is 9 cents per ton.

Today's coal operator must comply with a mountain of regulations. As a result, some may say that coal operators are over regulated, perhaps to the point of being forced out of business. However, in spite of the increasing regulation of and cost to today's coal operator to perform acceptable reclamation, there are numerous examples demonstrating that it is possible for a coal operator to have a profitable business and at the same time restore mined land to usefulness and productivity.

From 1948 to 1968, mining by the Hanna Coal Company affected 31,720 acres. Of this total, 28,520 acres were graded and planted with grasses and crownvetch. Prior to 1948, Hanna planted a variety of grasses (sweet clover, bluegrass, and alfalfa) to revegetate unleveled surface-mine banks. In addition, from 1941 to 1947, Hanna planted over 1.9 million trees on 2,125 acres of unleveled banks, and from 1948 to 1968 planted 10.9 million trees on 11,000 acres of graded slope (Consol News, 1969, v. 8, no. 5, p. 1, 3).

Ohio Power Company's ReCreation Land in Muskingum County is an outstanding example of how surface-mined land has been transformed into an attractive, useful parkland, which is very popular for its camping and fishing. This 30,000-acre parkland was reclaimed beginning in 1943 by the Ohio Power Company, through its subsidiary Central Ohio Coal Company, and is managed in co-operation with the Ohio Department of Natural Resources. In addition to ReCreation Land, Central Ohio Coal Company won the Director's Award, the top award in the national 1991 Excellence in Surface Coal Mining Reclamation Awards competition, for exemplary reclamation with recreation as a postmining land use. This prestigious award was presented in 1992 by the U.S. Department of Interior, Office of Surface Mining to Central Ohio Coal Company in recognition of its achievement of restoring 9,154 acres of surface-mined land for the development of The International Center for the Preservation of Wild Animals. This center, known as "The Wilds," serves as a breeding site for rare and endangered animals.

Chapter 4

MINE STRUCTURES

TIPPLES

The cornerstone of a mining operation is the tipple. The primary function of a coal tipple is to sort coal into different size fractions, such as pea, nut, egg, and lump (fig. 51). The tipple is also where coal is separated from impurities, weighed, and loaded for transport to market. The tipple is the connecting link between the mine and the commercial market. Traditionally, considerable effort and expense has been expended by construction/mechanical engineers to produce a material-handling facility that is efficient, durable, and safe (Garcia, 1913, p. 786). The tipple generally is constructed as close as possible to the mine, but is almost always located for ease of shipping access with respect to railroads, trucks, or boats (figs. 52-58).

Until the early 1900's, coal tipples were constructed of wood and were vulnerable to weathering and fire.

Fires at wooden tipples were not unusual. Unfortunately, a fire at a mine tipple, coal hopper, or engine house (which often were quite close together) might throw a large number of workers out of jobs (Tribe, 1989, p. 15).

San Toy, in Monroe Township, Perry County, was once a thriving mining community. It had a population of about 2,500 in 1920. But, following tipple fires at both the San Toy No. 1 (Py-59) (September 22, 1924) and San Toy No. 2 (Py-64; fig. 59) (August 29, 1928) mines, San Toy had become a ghost town in 1928.

After the No. 2 tipple burned, the [Sunday Creek] *Coal Company transferred everything salvageable around the mine to other mines they owned in the Hocking Valley but all the material and machinery inside was left there. They just walked out and left everything like they did any other day, apparently, thinking the mine would be back to work in a week or so* (Addison, 1987).

A transformation in the construction of coal-mine tipples began during the early 1900's. Tipple construction changed from wood to steel and concrete to minimize the risk of fires and to accommodate the use of shaker screens in the coal-size sorting process. Wooden structures lacked *sufficient rigidity to prevent the vibration of the screens from affecting the scales and seriously damaging the main building* (Garcia, 1913, p. 786).

One of the first tipples of steel design [in Ohio] *was constructed by the Canaan Coal Company in 1906 at Canaanville* (Palka, 1986, p. 45) (fig. 60).

There were other tipples of unusual design. The Hisylvania Coal Company constructed a brick and concrete tipple (fig. 61), believed to be the only one of its kind in the nation. This tipple was built to handle the coal from Hisylvania Coal Company mine No. 22 (As-22) at Glouster, in Trimble Township, Athens County. The Black Diamond Coal Company built an all concrete tipple (fig. 62) for its mine No. 2 (As-141) near Lathrop, in Bern Township, Athens County. This tipple was constructed in 1911 to replace a wooden tipple which had burned down the previous year.

COMPANY HOUSING AND STORES

Mining communities commonly developed at or very near coal-mine entrances (fig. 63). Many of these communities included homes, stores, and other buildings built by the mining company for its employees. The company coal town originated in the isolation of the coal camps. Of necessity, mine operators built towns for the miners because coal mines generally are located in rural areas (figs. 64-66). Company housing placed the miners close to the mine. Proximity was important because, until the advent of the automobile, long-distance commutes by the miner was impossible. Also, and more important, construction of company homes near the mine was an economic benefit to the company. It minimized the amount of land required to be held in fee simple.

It was more beneficial for the operators to lease the mineral rights and only purchase a single tract of contiguous land on which to build the mine site and company houses. It was to their advantage to minimize the size of the parcel and to maximize its development (Palka, 1986, p. 57).

An additional factor which dictated the need for company houses was based upon the land ownership patterns . . . . Only a small portion of the land was held in fee simple by the mining companies. In most cases the property comprising the coal land was leased for the purpose of extracting the coal. Since companies only held the mineral rights and did not own the land, they could not legally sell plots to their employees for the purpose of allowing them to build their own homes. Consequently, the most accepted solution was to construct inexpensive, uncomplicated structures that were designed to house the families for the duration of the mining operation. In those cases when coal operators were successful in purchasing the land from the original owners, they often sold the company houses to their employees as the operation neared its end (Palka, 1986, p. 51, 52).

Company stores were established in many of Ohio's coal mining communities (figs. 67-72).

In many cases, a company store was aligned with a particular mine and only served employees of that mine. At other times, when a large company [such as Sunday Creek Coal Company] *operated several mines in close proximity to each other, a single store was established at a central location to serve all the miners* (Palka, 1986, p. 60).

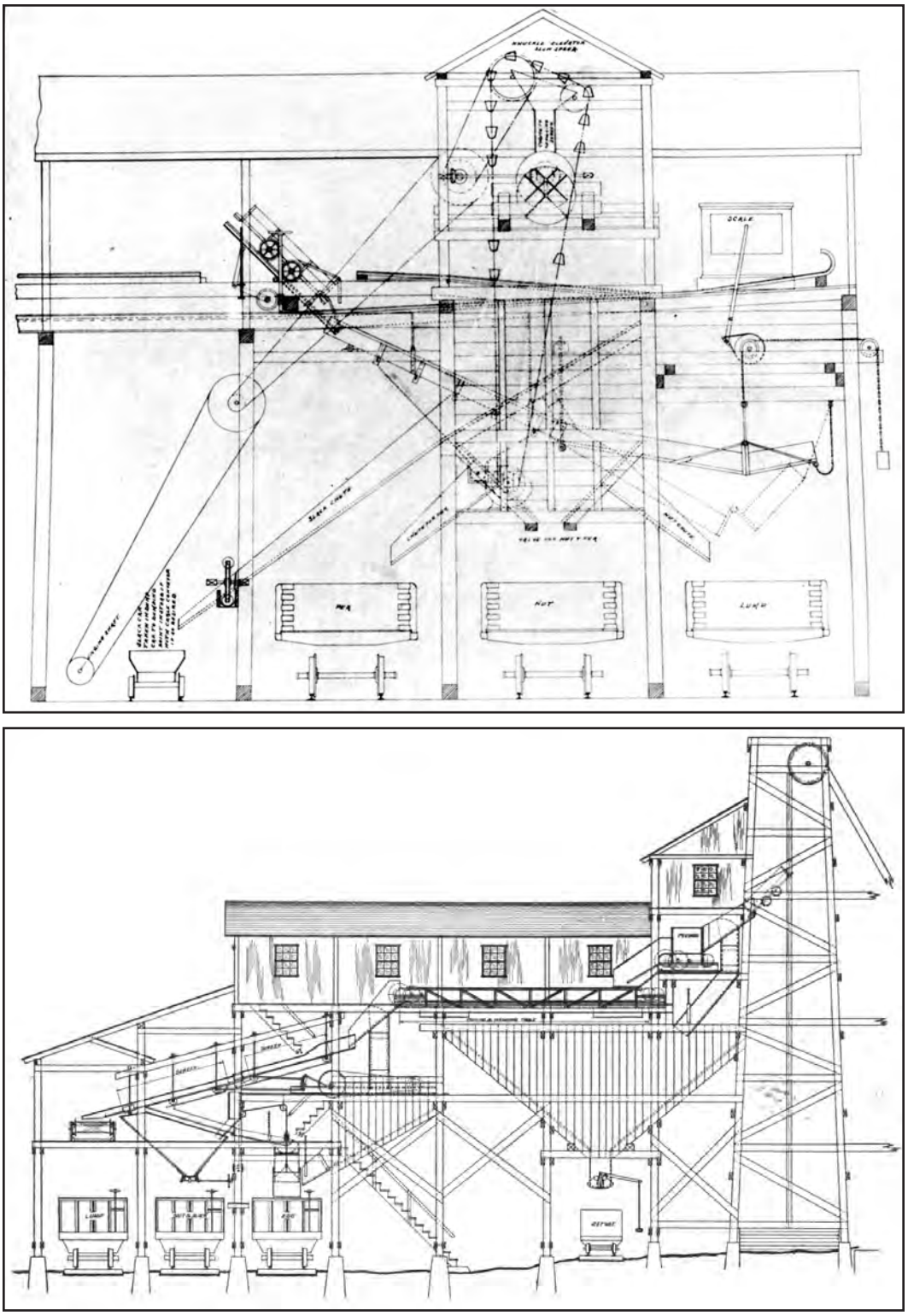


FIGURE 51.—Schematic diagrams of a typical railroad-loading coal tipple. Top drawing shows position of a mine car (upper left) being unloaded. Coal from this mine car is then separated (center) and loaded into rail cars for (left to right) slack (waste), pea, nut, and lump coal. Drawing dated July 25, 1894. Illustration courtesy of the Ohio Historical Society, from the Jeffrey Mining Equipment collection. Bottom diagram is of the hoisting-shaft headframe and tipple of the Hocking Valley Mining Company showing the location of the picking tables (where impurities are separated from coal by hand), screens (where coal is separated into different size fractions), and railroad cars for lump, nut and slack, and egg coal, and refuse. *This plant is one of the most modernly equipped tipples in the state.* Illustration and quote from The Coal Industry (1922, v. 5, no. 2, p. 97).

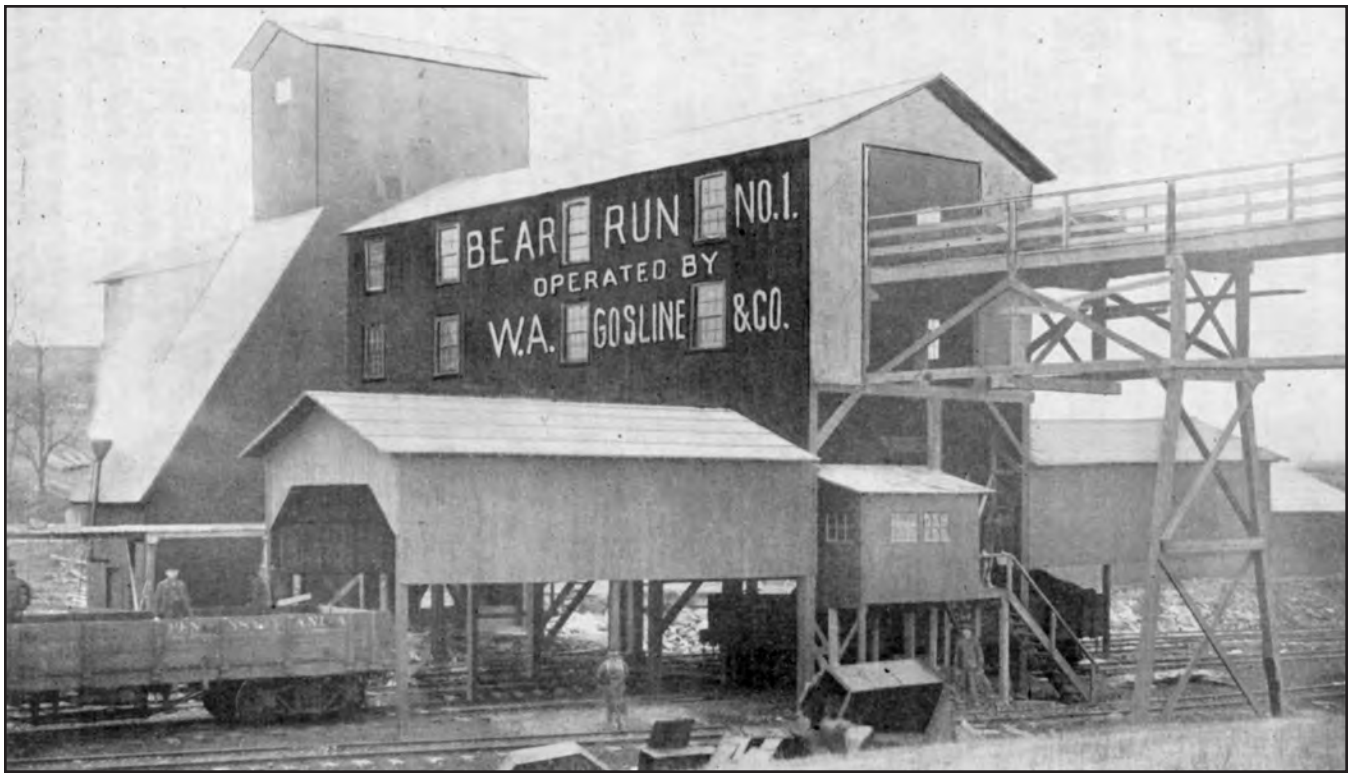


FIGURE 52.—Tipple of the Bear Run No. 1 mine (Py-214), which is about 3 miles east of New Lexington, in Pike Township, Perry County. This mine, operated by W. A. Gosline & Son, was served by the Cleveland & Marietta branch of the Pennsylvania Railroad. The Bear Run No. 1 mine was abandoned in 1924. Photo from State Inspector of Mines Report (1905, p. 32).

FIGURE 53.—Coal tipple under construction. Coal was moved downhill from the mine mouth to the tipple, where it was separated by size (see fig. 51) for shipment by rail. *Circa* 1890's. Location unknown. Photo courtesy of Ohio Historical Society, Jeffrey Mining Equipment collection.

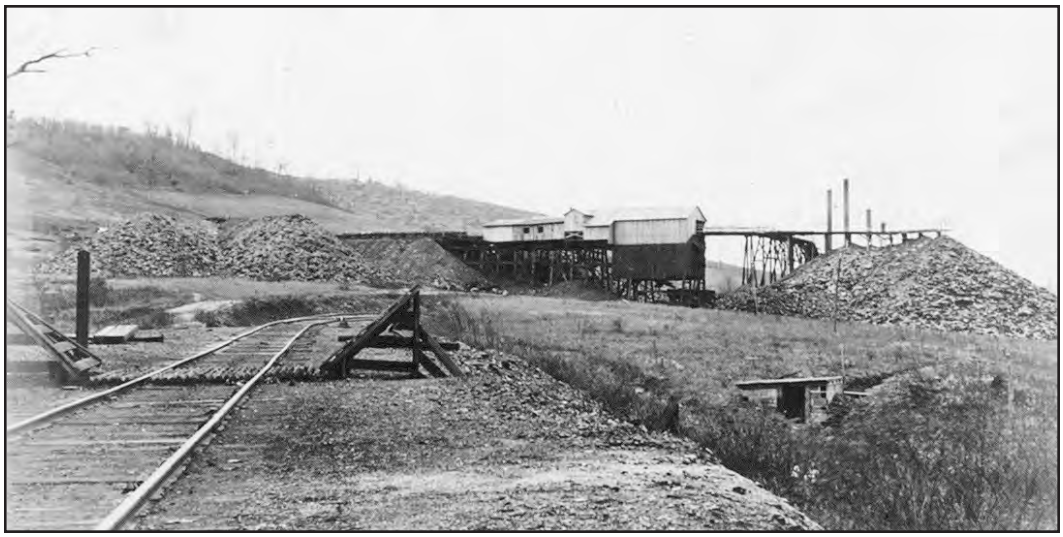


FIGURE 54.—Railroad-car-loading tipple of the Sterling mine (Cl-59), about 1 mile west of Salineville, in Fox Township, Carroll County. The Sterling mine had drift openings into the Mahoning (No. 7A) coal, which averaged 3 feet in thickness. This mine was opened by the Sterling Mining Company in 1901 and was abandoned, under the ownership of the Hirst Coal Company, in 1961. Note the large piles of "gob" or waste material, a by-product of the coal mining or coal cleaning process. *Circa* 1910. Ohio Division of Geological Survey file photo by D. Dale Condit.

Company stores were often a point of contention between miners and operators. Miners would complain that goods were overpriced and that they were restricted from patronizing noncompany stores (Long, 1989, p. 79). Operators would contend that they were providing the goods their employees needed, a service that was burdensome to the operator, and that if other outlets for the same goods were available there would have been no company store. Whether or not running a company store was burdensome, many operators found it to be a lucrative business. Commenting on the profitability of the company store, Roy (1906, p. 221) stated,

The thick coal mines [of the Hocking Valley area] *were generally overcrowded with miners, who flocked there on account of its* [working] *height, and found ready employment, as most of the operators owned stores and gave employment to a surplus of miners for the sake of the store trade, which was very profitable.*

Although rental of company homes and operation of company stores was revenue generating for the operator, coal companies were generally in business to mine and market coal, not to design, construct, and manage rental homes and general stores. As a result, the architecture and construction of early mining communities was poor, monotonous, and unattractive. In addition, the company town, and its store, enabled the operator to do quite well while ignoring the problem of increasing productivity of the work force, which became excessive in size.

Prior to 1885 many miners worked for companies that paid their employees in scrip or "checks" that were redeemable only at company-owned stores, homes, or rooming houses. Scrip was a common form of payment used by coal-

FIGURE 55.—Small truck-loading tipple for a drift mine in the Clarion (No. 4A) coal along Ohio Route 278, in Brown Township, Vinton County. Tipples such as this were common throughout eastern Ohio to supply local domestic fuel needs. *Circa* 1953. Ohio Division of Geological Survey file photo.

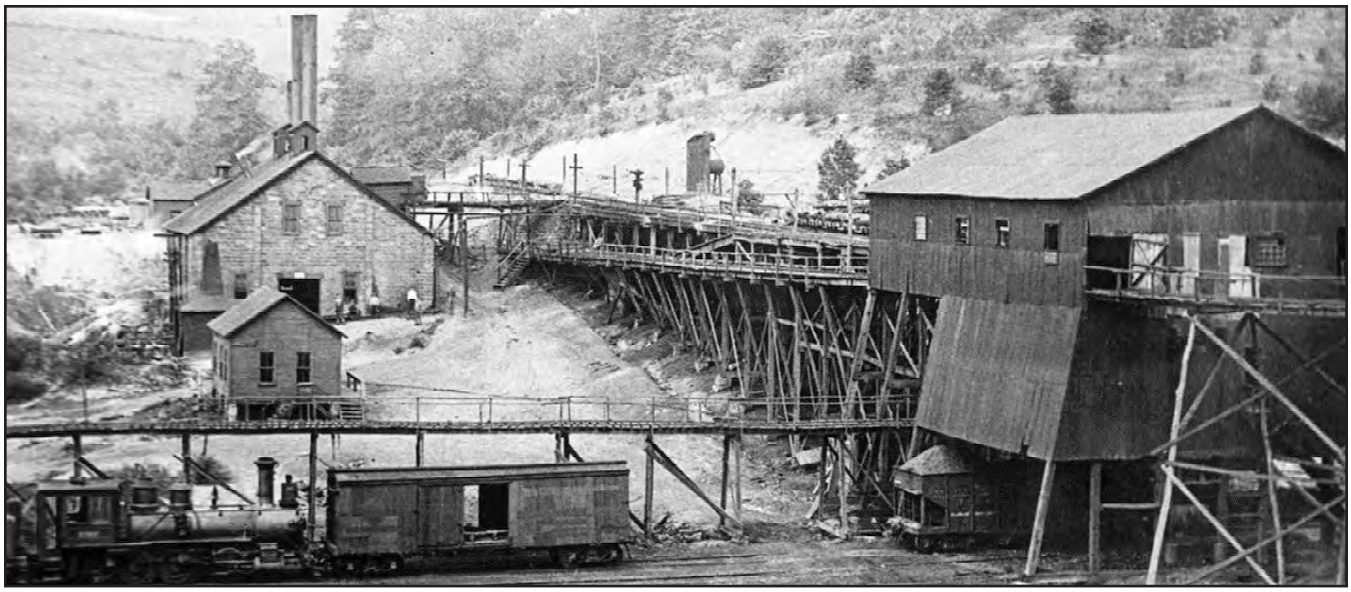


FIGURE 56.—Railroad-car-loading tipple of the Mullins No. 1 mine (Ts-365), about 6 miles northeast of New Philadelphia, in Fairfield Township, Tuscarawas County. The Mullins No. 1 mine, formerly known as the Little Egypt mine, was opened by the James Mullins Coal Company in 1903 and abandoned, under the ownership of the Underhill Coal & Mining Company, in 1923. This drift mine used electric and compressed-air mining machines, as well as pick mining, and motorized haulage equipment to mine a 4-foot-thick seam of Middle Kittanning (No. 6) coal. The coal pillars were mined prior to abandonment, which was a common practice in Ohio coal mines during the late 19th and early 20th centuries. Date unknown. Photo courtesy of Tuscarawas County Historical Society.

mine operators in place of currency during the 1800's. Scrip was a promissory note payable by the company after a period of time (as much as 5 or 10 years) (Boryczka and Cary, 1982, p. 10). More commonly, scrip was redeemed by the miner to obtain goods and supplies from the company-owned store in exchange for work performed or owed by the miner. This practice, called the "truck system," had it roots in the British coal fields and was used throughout Ohio by some mine operators but was especially common in the Hocking Valley area. *Miners were paid in checks ranging from two cents to five dollars redeemable in merchandise at the company's store, where no money exchanged hands* (Roy, 1906, p. 227). Because of this unfortunate practice, the coal company literally owned the miner; it could guarantee itself a source of cheap and readily available labor and a sizeable profit. It is not surprising that coal-mining towns consisting of company-owned stores and homes commonly looked very economically depressed. In 1885 the Ohio legislature passed the Jones Law, which made use of scrip and overpricing at company stores illegal (Tribe, 1989, p. 54).

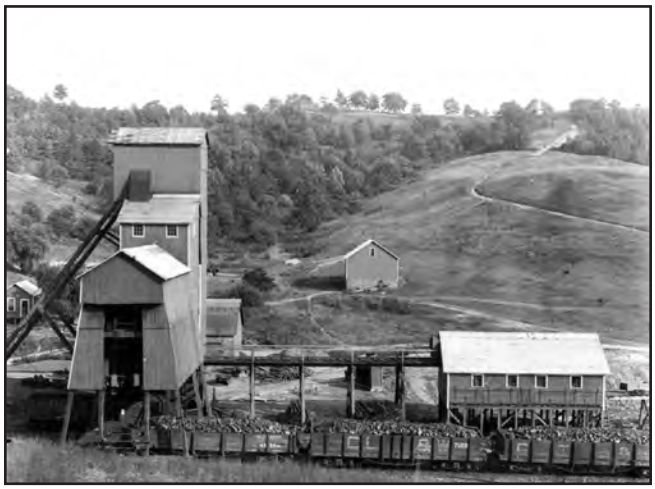


FIGURE 57.—Loading a string of railroad cars at the railroad-car-loading tipple and hoisting-shaft headframe of the Midvale No. 4 mine (Ts-337), formerly Beaver Dam No. 2 mine and Scott B No. 1 mine. This mine, located about 11/2 miles east of Midvale, in Union Township, Tuscarawas County, opened in 1904 and used an 85-foot-deep shaft to mine a 4-foot-thick seam of Middle Kittanning (No. 6) coal. It was operated at various times by the Goshen Coal Company, the Beaver Dam Coal Company, the Scott Coal Company, and John Marchesi and was abandoned in 1943 under the ownership of the Midvale Coal Company, Inc. Date unknown. Photo courtesy of Tuscarawas County Historical Society.

During the early 1900's coal operators started realizing that productivity, which generally translates directly to profit, depends upon the well-being of skilled employees. Mining communities of poor design, construction, and management generally had a correspondingly high employee turnover rate and low productivity levels. Skilled employees and employees with families were hard to keep. In contrast, mining communities which were well planned and managed had lower employee turnover rates and higher levels of productivity. Successful mining communities, such as San Toy, offered homes of good construction and in a variety of architectural styles, recreational facilities (movie theaters and amusement halls), churches, grocery stores, drug stores, medical clinics, and hospitals (Electrical Mining, 1918, p. 97-99). To assist coal operators in the development of their mining community, companies which specialized in the design and construction of complete mining towns advertised in various trade journals (fig. 73). The cost of a typical four-room miner's house, with rooms 14 by

FIGURE 58.—Railroad-car-loading tipple of the Powhatan No. 3 mine (Bt-282), operated by the Powhatan Mining Company (formerly by North American Coal Corporation). This slope mine in Mead Township, Belmont County, mined the Pittsburgh (No. 8) coal from 1911 to 1986, when it was abandoned. *Circa* 1950. Photo courtesy of North American Coal Corporation.

14 feet and excluding plumbing and electricity, cost $709 to construct in 1917 (Huebner, 1917, p.719).

By 1947, . . . *about two-thirds—over 260,000—of the nation's Bituminous Coal miners own their own homes or rent from private landlords; the remaining one-third live in company-owned houses . . . at rentals below those ordinarily available to workers in other industries. For example, newly built modern homes in the Appalachian region rent for as little as $18 per month.*

Home-ownership among miners is increasing—due in no small measure to encouragement and financial aid from mine owners who realize that a man becomes a better worker and a better citizen as he develops pride in "a home of his own" (from an advertisement for the Bituminous Coal Institute in Newsweek, 1947, v. 30, p. 9).

FIGURE 59.—A crowd gathered at the Sunday Creek Coal Company San Toy No. 2 mine (Py-64) to celebrate the announcement in November 1918 that World War I had ended. The hoisting-shaft headframe and tipple can be seen. This mine was located northwest of San Toy in Bearfield Township, Perry County, and was abandoned in 1927, following a miners' strike that began in April 1927. The tipple was destroyed by fire in 1928. Photo courtesy of Mark Wharton. (For another photo of this mine see fig. 63.)

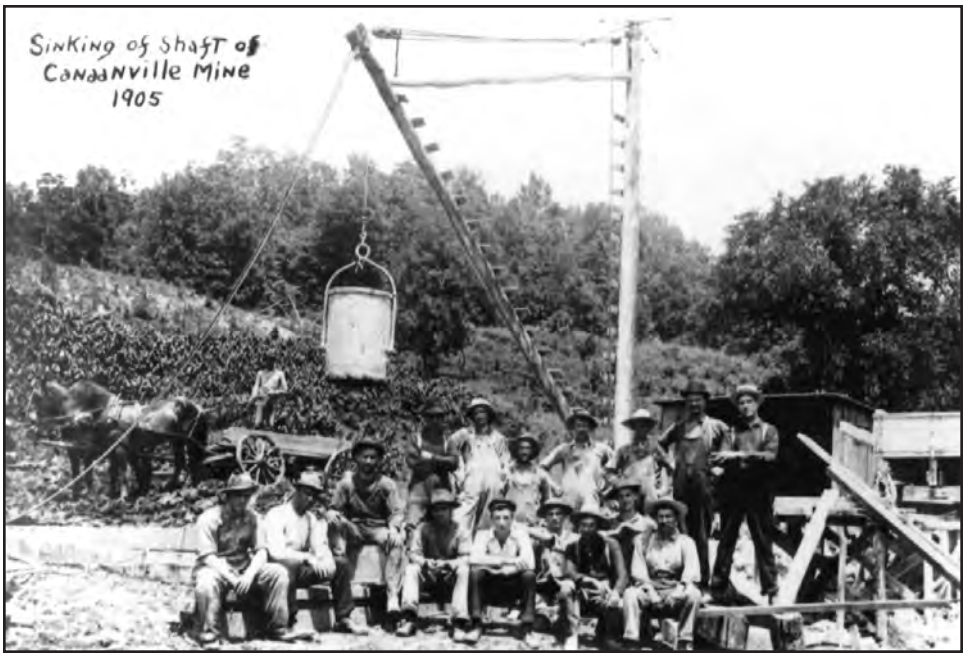


FIGURE 60.—Top photo, men and hoisting equipment used to construct the 450-foot-deep shaft of the Canaanville mine No. 1 (As-134), located at Canaanville, in Canaan Township, Athens County. Bottom photo, hoisting-shaft headframe and tipple of the Canaanville mine No. 1 as it appeared in 1909. This mine, built in 1905, was operated by the Canaan Coal Company until it was abandoned in 1925. Top photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection; bottom photo courtesy of Mark Wharton.

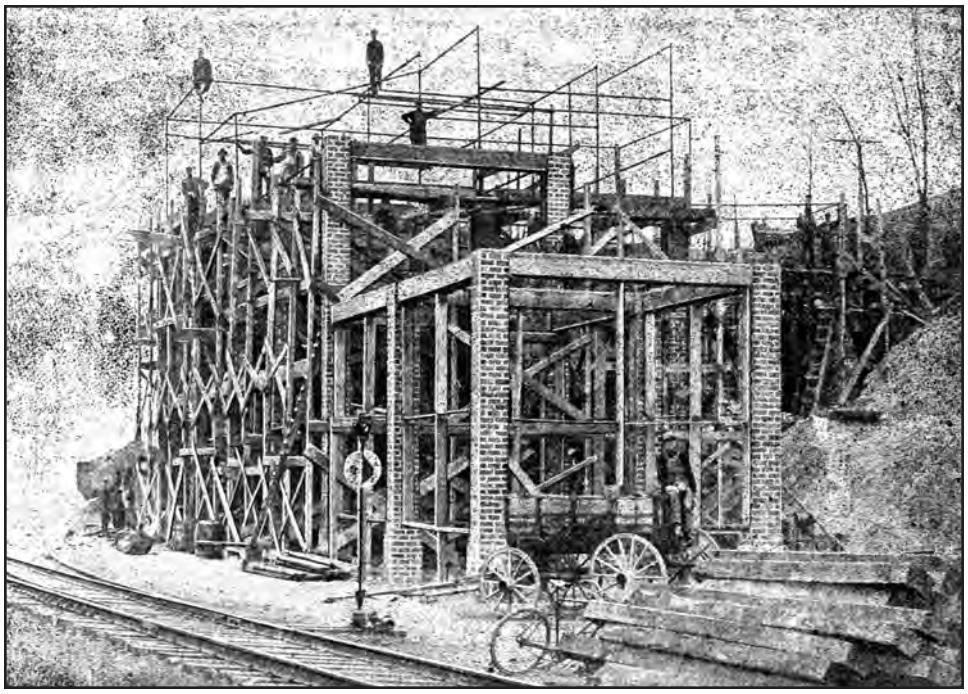


FIGURE 61.—Brick and concrete tipple under construction for the Hisylvania Coal Company mine No. 22 (As-22) at Glouster, in Trimble Township, Athens County. In 1912, this tipple was the only one of its kind in the country. Mine No. 22 had a slope opening 620 feet long and used room-and-pillar mining with double entries. At mine No. 22, the Middle Kittanning (No. 6) coal is 12 feet thick, but only the lower 6 1/2 feet was mined. Each entry was 12 feet wide and 6 1/2 feet high, pillars were 30 feet wide and 60 feet long, and rooms were 30 feet wide and 300 feet long with breakthroughs every 60 feet. At the foot of the slope was a 33 x 16 x 6 foot deep sump for collection of mine water, which had to be constantly pumped out. The capacity of the tipple was 1,400 tons of coal per day. This mine was abandoned in 1925. Photo from Burroughs (1921a, p. 97).

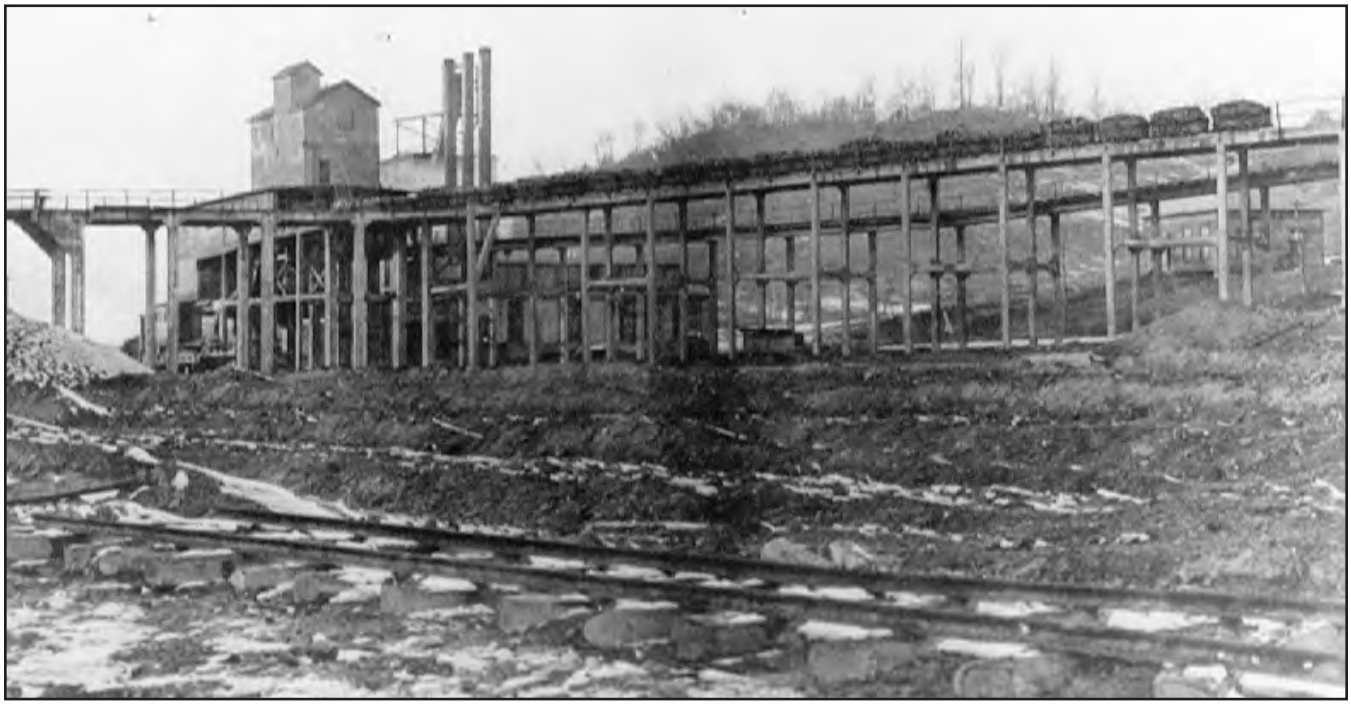


FIGURE 62.—Unique concrete coal tipple and trestle of the Black Diamond No. 2 mine (As-141), operated by the Black Diamond Coal Company near Lathrop, in Bern Township, Athens County. Photo from State Inspector of Mines Report (1912, p. 289).

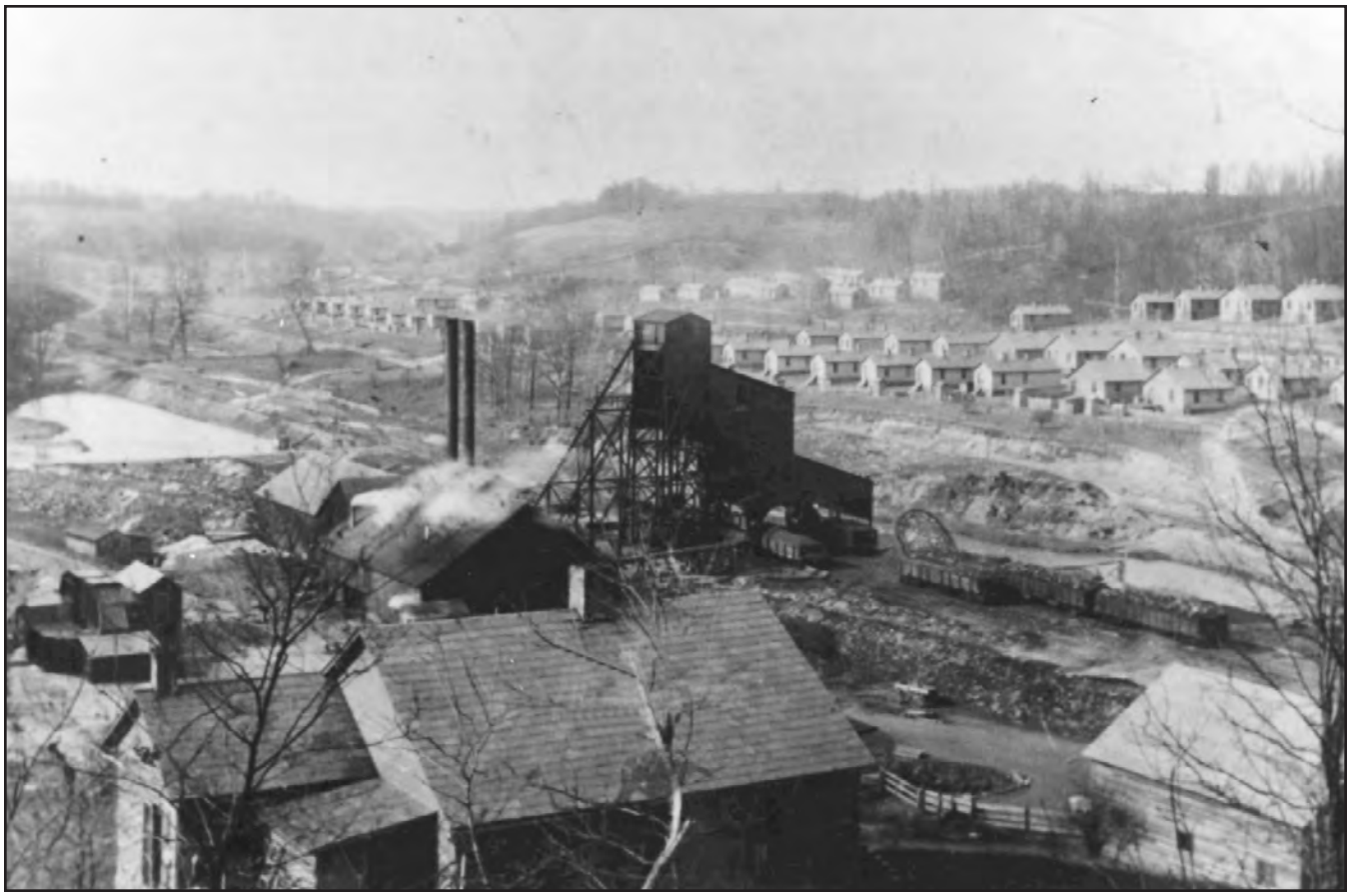


FIGURE 63.—Hoisting-shaft headframe and railroad-car-loading tipple of the Sunday Creek Coal Company San Toy mine No. 2 (Py-64) surrounded by company-owned homes and buildings. Date unknown. Photo courtesy of Forrest Walton. (For another photo of this mine see fig. 59.)

FIGURE 64.—Typical coal-mine camp scene in eastern Ohio—company-owned homes built close to the rail line leading to the mine. *Circa* early 1900's. Location unknown. Photo courtesy of Forrest Walton.

FIGURE 65.—*Even when newly constructed, multi-family company housing in this Hocking Valley coal town was stark and primitive* (Boryczka and Cary, 1982, p. 65). *Circa* mid-1890's. Photo courtesy of Ohio Historical Society, from the Frank W. Jennings collection, collection number P6.

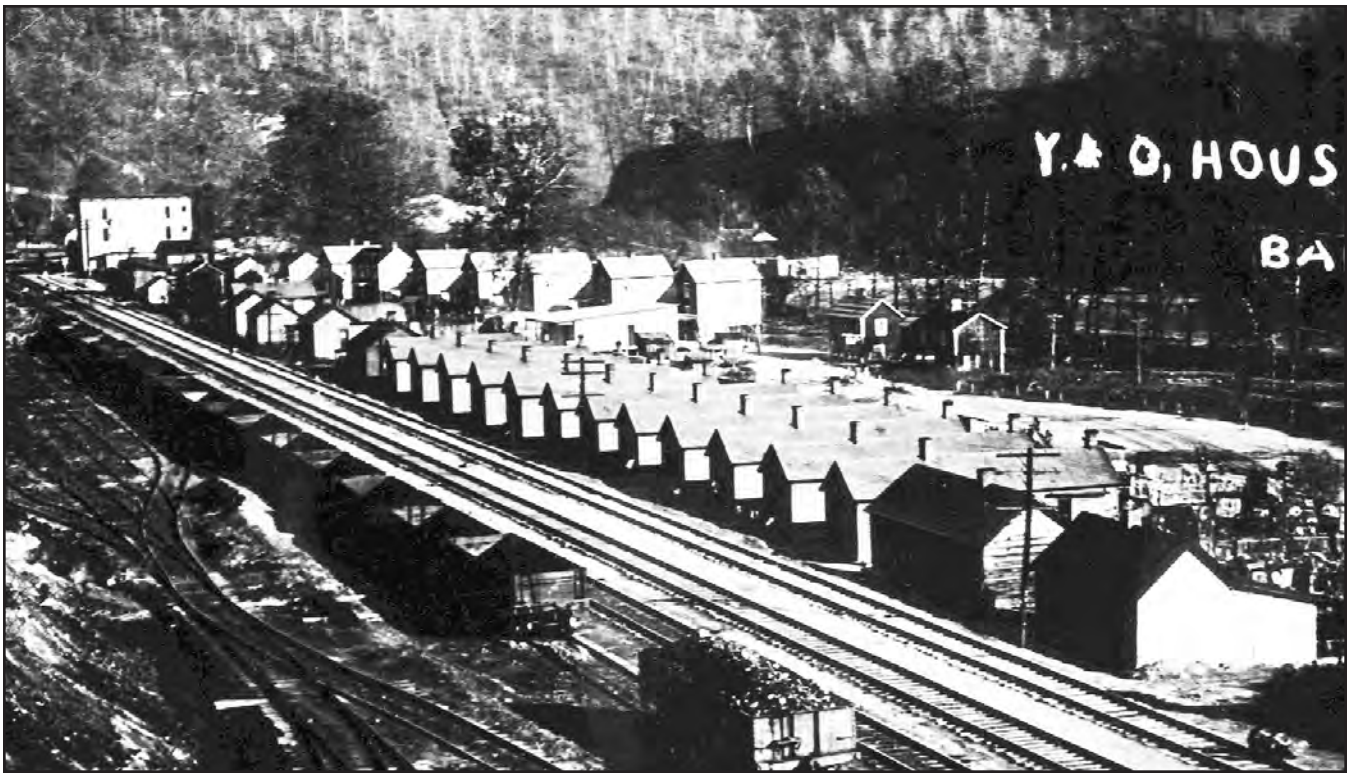
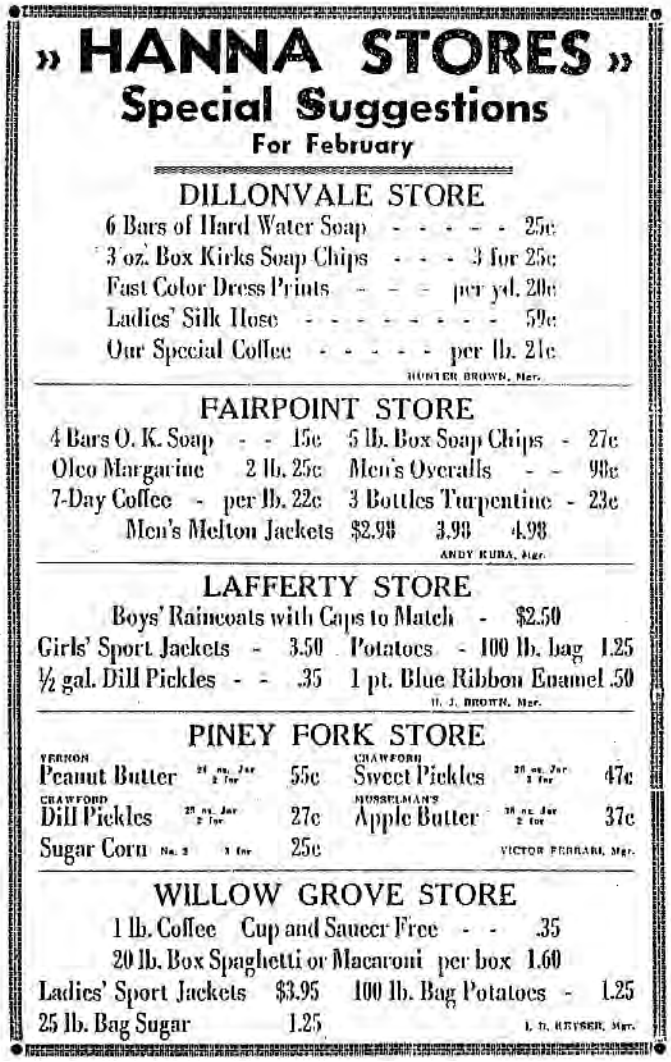


FIGURE 66.—Company-owned housing for coal miners at Barton, Belmont County. Date unknown. Photo courtesy of the Ohio Historical Society.

FIGURE 67.—Company store and offices of the Canaan Coal Company in Canaanville, Athens County. Date unknown. Photo courtesy of Mark Wharton.

FIGURE 68.—*The company store in Coalton* [Jackson County], *circa 1880, was operated by John Patterson, the future founder of the National Cash Register Company* (Boryczka and Cary, 1982, p. 66). Photo from the Dayton Daily News. Reprinted with permission.

FIGURE 69.—The Neff Store Company operated a store at Neffs, in Richland Township, Belmont County, for the miners of the Neffs Coal Company, which operated several coal mines in the vicinity. Date unknown. Photo courtesy of Charles "Bud" Fry.



» HANNA STORES »

Special Suggestions

For February

DILLONVALE STORE

6 Bars of Hard Water Soap - - - - - 25c
3 oz. Box Kirks Soap Chips - - - 3 for 25c
Fast Color Dress Prints - - - per yd. 20c
Ladies' Silk Hose - - - - - - - - 59c
Our Special Coffee - - - - - per lb. 21c

HUNTER BROWN, Mgr.

FAIRPOINT STORE

4 Bars O. K. Soap - - 15c — 5 lb. Box Soap Chips - 27c
Oleo Margarine 2 lb. 25c — Men's Overalls - - 98c
7-Day Coffee - per lb. 22c — 3 Bottles Turpentine - 23c
Men's Melton Jackets $2.98 3.98 4.98

ANDY KUBA, Mgr.

LAFFERTY STORE

Boys' Raincoats with Caps to Match - $2.50
Girls' Sport Jackets - 3.50 — Potatoes - 100 lb. bag 1.25
½ gal. Dill Pickles - - .35 — 1 pt. Blue Ribbon Enamel .50

H. J. BROWN, Mgr.

PINEY FORK STORE

VERNON Peanut Butter 24 oz. Jar 2 for 55c
CRAWFORD Sweet Pickles 28 oz. Jar 2 for 47c
CRAWFORD Dill Pickles 28 oz. Jar 2 for 27c
MUSSELMAN'S Apple Butter 38 oz. Jar 2 for 37c
Sugar Corn No. 2 3 for 25c

VICTOR FERRARI, Mgr.

WILLOW GROVE STORE

1 lb. Coffee Cup and Saucer Free - - .35
20 lb. Box Spaghetti or Macaroni per box 1.60
Ladies' Sport Jackets $3.95 — 100 lb. Bag Potatoes - 1.25
25 lb. Bag Sugar 1.25

I. D. KEYSER, Mgr.

October Specials

EDWARDS CORNED BEEF 2 for - .39
EDWARDS MILAN HOMINY 2 for - .23
Edwards Pancake Flour with Syrup Pitcher - - - - - - - - - - .23

Edwards Milan Green Beans 2 for - .25
Edwards Milan Apple Butter-38 oz. - .18
Edwards Bartlett Pears No. 2½ - - - .23
Edwards Milan Salmon 2 for - - - - - .27

Our Special Coffee - - - - .19
Dry Salt Side - - - - - - - - .16
Assorted Lunch Meat - - - .28
Oleomargarine 2 lbs. for .25

CAPITAL BRICK CHEESE

Bonita Brand Coffee (good quality) .24
Fountain Square Coffee (vac'm pkd) .32
Wisconsin Long Horn Cheese - - - - - .20
2 for .31

MEN'S Fall Suits

Ladies Coats - - - - - - - - $14.95-$16.95
Ladies Twin Sweaters - - - $1.19-$3.49
Ladies Outing Gowns - - - - - - - - - .89
Ladies House Slippers - - .75 to $1.50
Mens Sweaters - - - - - - $1.98 to 4.95
Mens Zipper Jackets - $4.95 to $12.00
Mens House Slippers - $1.29 to $2.25
Boys Sweaters - - - - - $1.00 to $2.98
Boys Knickers and Long Pants - - - - - $1.49 to $2.89

Mens Emerson Hats

$3.95 to $4.95

(CLOTH CRAFT) 2 Pants $25.00

Boys Blue Chambray Shirts .59
Single Cotton Blankets - - - .79
Double Blankets- Part Wool - $2.98 to $5.75

Moores Heating Stoves - - - $65.75 to $95.95
Moores Cooking Ranges - - $85.95 to $99.95

HANNA COAL HANNA CO. STORES

H. J. BROWN, Manager Piney Fork Store — I. D. KEYSER, Manager Willow Grove Store — ANDY KUBA, Manager Dun Glen Store

FIGURE 70.—Advertisements such as these from the Hanna Coal News (left: February 1935, p. 2; above: October 1938, p. 7) give some idea of the cost of products available to miners and their families at Hanna Coal Company-owned stores. Hanna Coal Company began operating stores in 1928. By 1932, Hanna discontinued the use of scrip and began a policy whereby patronage of the stores by Hanna miners was entirely optional (Hanna Coal News, December 1935, p. 11).

FIGURE 71.—Company store of the Sunday Creek Coal Company at Modoc, in Trimble Township, Athens County. This store served the miners of mine No. 281 (As-132), located approximately 1/2 mile northwest of Modoc, and possibly the miners of mine No. 255 (As-191 and As-132; see fig. 7), located approximately 1/2 mile southeast of Modoc. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

FIGURE 72.—Company store of the New Pittsburgh Coal Company mine No. 9 (As-130). This shaft mine was west of Chauncey, in Dover Township, Athens County, and was abandoned in 1925. The company store was in Nelsonville and was torn down in the late 1920's or early 1930's. Lumber from the store was used to build the York Township Grange on Athens County Road 1. Date unknown. Photo courtesy of Forrest Walton.

FIGURE 73.—Advertisement for The Aladdin Company, which specialized in the construction of prefabricated homes for mining communities (from The Coal Industry, 1919, v. 2, no. 6, p. 6).

Chapter 5

OHIO'S COAL MINERS

The development of Ohio's coal resources has had a positive effect on the state's economy in the form of jobs. Between 1800 and 1991, Ohio's coal-mining industry has employed between 100,000 and 200,000 miners (fig. 74). Most of the early coal miners in the United States were European immigrants, primarily of English, Scottish, and Welsh nationality, who were well experienced in the art of mining coal (fig. 75). In fact, *coal had been mined along its outcrop in the British isles with picks made of oak and flint before the birth of Christ* (Roy, 1906, p. 12). By the late 1800's the ranks of Ohio's coal miners also included many

. . . Poles, Slovaks, Hungarians, Czechs, Lithuanians, Italians, and Irish. Word had gone out to their homelands that jobs were plentiful in the United States and coal fields were hiring. Not many of the newly arrived workers could speak English, but were willing and able-bodied workers. And usually some relative or countryman, having arrived earlier, could assist with communication. This diligence was rewarded with a weekly paycheck, much more than could ever have been earned in the homeland (McAfee, 1991, p. 1).

In 1942, the ranks of Hanna Coal Company miners in Ohio included the following nationalities and ethnic groups: American, Austrian, Belgian, Bohemian, Canadian, Croatian, Dutch, English, Finnish, French, German, Greek, Hungarian, Irish, Italian, Lithuanian, Mexican, Negro, Norwegian, Polish, Puerto Rican, Serbian, Slavish, Slovak, Spanish, Swedish, Ukrainian, Welsh, and Yugoslavian (Hanna Coal News, December 1942, p. 4).

The earliest accurate coal-employment records in Ohio date back to 1884, when the annual average employment in Ohio coal mines was 20,101 individuals (table 2). Between 1884 and 1908 the labor force in Ohio coal mines increased steadily, reaching an annual maximum of 50,267 individuals employed. During the teens and 1920's, employment in Ohio coal mines fluctuated widely and, since the 1930's, has declined steadily in spite of increasing coal production until 1970. In 1993 there were 4,116 individuals employed in Ohio's coal-mining industry. The reduction in size of the

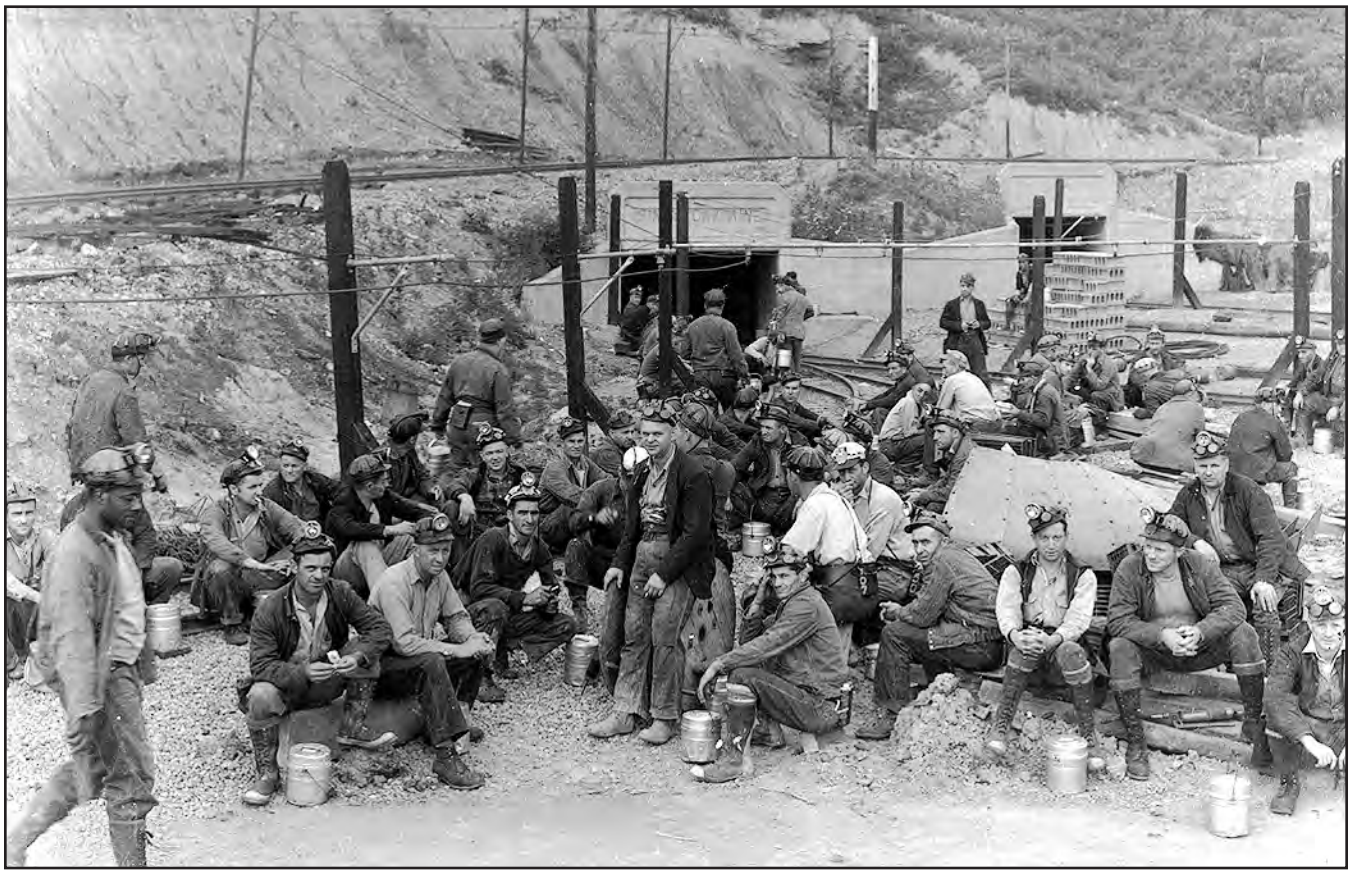


FIGURE 74.—Miners waiting to start the afternoon shift at the Hanna Coal Company Piney Fork No. 1 mine (Jfn-243) in 1943. During World War II this mine employed over 1,000 men and was one of the country's leading coal producers. This drift mine near Smithfield, Jefferson County, was abandoned in 1959. Note the dinner buckets at many of the miners' feet. Photo courtesy of Ohio Department of Natural Resources, Division of Reclamation, from the Dale Davis collection. (For other photos of this mine see figs. 36, 101, 116, 121, 159.)

labor force in the coal-mining industry of Ohio, particularly since World War II, is due to technological advances in the mining industry and a reduction in the number of operating mines, especially underground mines, which generally require a larger work force than do surface mines.

Historically coal miners too often have been considered a strange breed of men—unkempt, dirty, cantankerous, intemperate, and unruly. The State Inspector of Mines (1876, p. 85), commenting on the lack of understanding by the general public in regard to coal miners and their working conditions stated,

The character which I have drawn of miners seldom finds its way into the public press, and what the public usually knows of this race of men has been learned of them during the prevalence of a strike, when their blood is hot and their evil passions are aroused. Even then the vices and follies of miners are exaggerated one hundred fold.

Too few people know coal miners for the hard-working, heroic people that they are. Miners work daily under strenuous and perilous conditions (fig. 76). In commenting on the character of coal miners, the State Inspector of Mines (1877, p. 84, 85) stated,

Miners, from whatever nationality they may have originally come, or whether natives for generations, have many ideas in common. Working by the piece, or ton, each is, in a sense, his own boss. When work is plenty and cars are abundant, they work with uncommon energy, one man often doing in eight or nine hours what would be a fair day's work for two men. No man will admit that another can put more coal than he, and the younger and more robust will seldom acknowledge that they are ever tired.

Some of the noblest deeds ever performed by man—deeds which, had they occurred on the battle-field [fig. 77], *would have been rewarded with high public honors and emoluments—have been performed by miners on the occasion of mining catastrophes* [fig. 78]. *On the occurrence of every accident, however dangerous, there are a dozen or one hundred men ready to plunge into danger, or death itself, in the hope of rescuing a fellow-workman. This race of men are also as remarkable for their generosity as for their spirit of daring* [fig. 79]. *When any one of their number gets hurt in the mine in the pursuit of his calling, his associates are always ready to assist his family until their fellow-craftsman's wounds are healed, and he is again fit for work.*

TOOLS AND TECHNIQUES

Prior to the advent of mechanized mining equipment in Ohio coal mines in the late 1870's, coal was mined entirely by the brute force of well-muscled men who used a variety of tools such as *picks, shovels, scrapers, wedges, sledge hammers and powder cans. Miners wore canvas caps, fashioned with metal attachments to which their carbide head lamps were clipped* (McAfee, 1991, p. 2).

The following account by Roy (1885, p. 108-110) describes some of the tools (fig. 80) and techniques employed by the underground coal miners prior to mechanized mining:

The manner of digging the coal is artful and curious. The tools of the miner consist of a sledge eight to ten pounds in weight, several steel wedges six to eight inches long, three to six picks from two and a half to three pounds in weight, with handles twenty-eight to thirty-two inches in length, set of drilling tools, to wit: a drill, a scraper, a needle, and a tamping bar.

Two miners work together in rooms and entries; they keep each other company, assist in setting props, one watches while the other works in dangerous situations, and if one is caught the other can raise the alarm and call in adjoining comrades to the rescue.

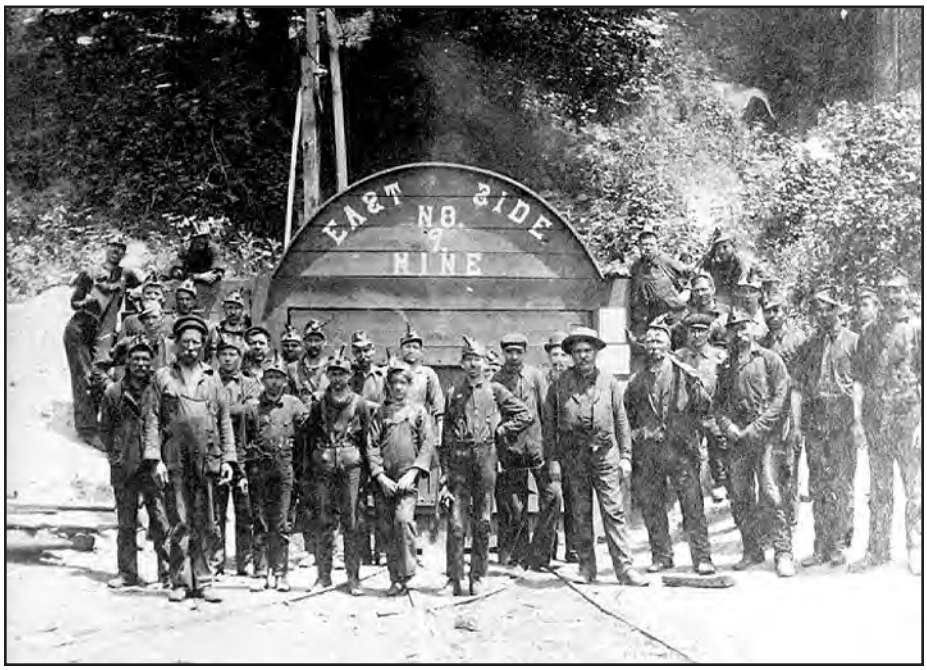


FIGURE 75.—Coal miners in front of the slope opening to the East Side No. 9 mine (Py-124) operated by the Sunday Creek Coal Company. This mine, located near Carrington, in Salt Lick Township, Perry County, was abandoned in 1931. Date unknown. Photo courtesy of Forrest Walton.

The first and most laborious part of the work of coal digging consists in undermining, or bearing in, or holing the rooms. This is generally performed in the bottom of the coal seam with the pick. An undermining is made of varying depth—sometimes three to four feet, frequently five to six feet [fig. 81]; *the miner stands* [or kneels] *and strikes with all his strength, until a few inches in depth is cut; he then sits down on the floor of the mine, his legs stretched wide apart in front of his body, and cuts in six inches to a foot deeper; finally, he stretches his body along the floor, his shoulder and arm to the elbow resting upon his thigh, and in this constrained position finishes up the undermining. It will take two active miners four or five hours to undermine a room eight yards wide and four to five feet in depth. Forty to fifty blows of the pick are delivered per minute, and considerable skill is exercised in holing. Miners raised to the work from boyhood are both speedier and cleaner workmen than those who assume the calling after manhood . . . . Having finished the undermining, the next thing in order is boring a hole for the blast* [fig. 82] . . . . *The amount of powder required for a shot varies from one to eight pounds . . . . As a general rule, a pound of powder is burned for every three tons of coal mined* [fig. 83].

Mining coal by hand was back-breaking work (fig. 84). If the miner was lucky, he worked in a mine where the working height was sufficient to allow the miner to stand erect or nearly erect (fig. 85). However, it was not uncommon for the working height in the mine to be only 2½ to 4 feet, requiring work to be done on hands and knees, squatting, kneeling, sitting, or lying down (fig. 86). Shoveling coal or wielding a pick in a mine under low ceiling conditions for hours on end was torturous and exhausting labor. The Sterling mine (Jfn-823), an active drift mine operated by the Sterling Mining Company in Brush Creek Township, Jefferson County, has a working height that averages 35 inches. Although mechanized mining equipment is used (fig. 87), much of the work performed in the Sterling mine is done by kneeling or squatting as it was done in Ohio mines over 100 years ago (fig. 88).

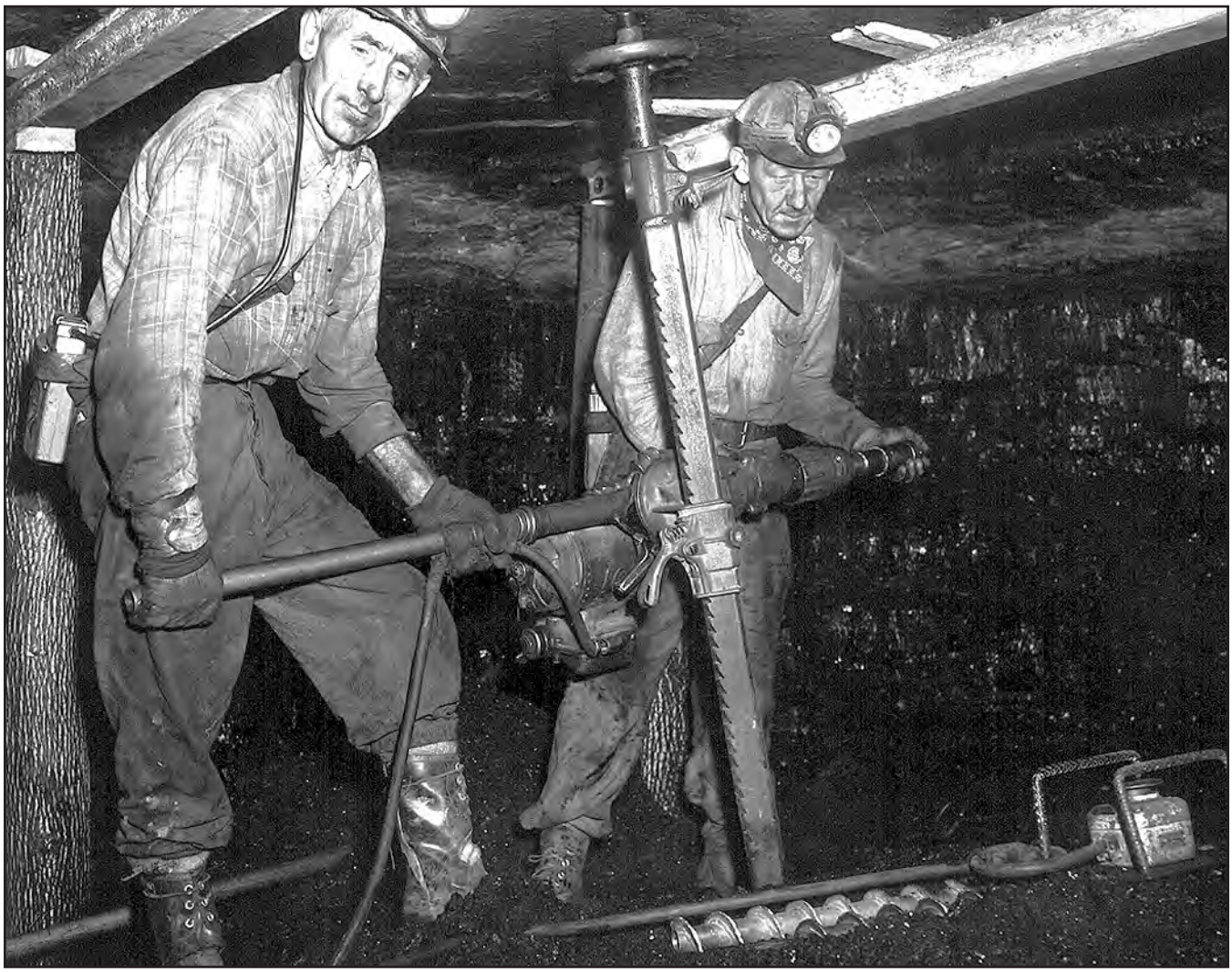
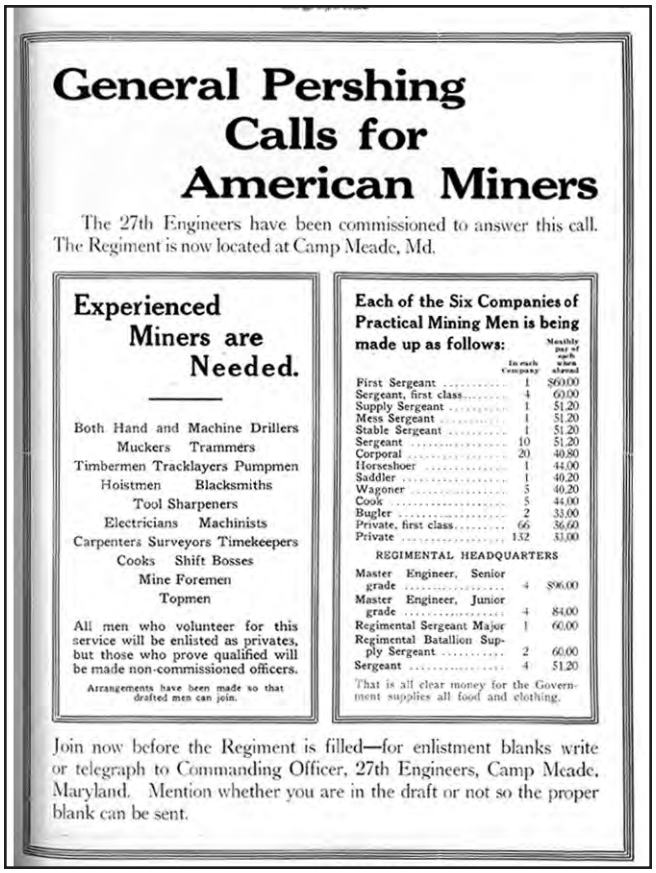


FIGURE 76.—Coal miners operating a compressed-air-driven drill in an eastern Ohio coal mine. Miners usually worked in pairs and never alone for the purpose of safety. Date unknown. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.



General Pershing Calls for American Miners

The 27th Engineers have been commissioned to answer this call. The Regiment is now located at Camp Meade, Md.

Experienced Miners are Needed.

Both Hand and Machine Drillers
Muckers Trammers
Timbermen Tracklayers Pumpmen
Hoistmen Blacksmiths
Tool Sharpeners
Electricians Machinists
Carpenters Surveyors Timekeepers
Cooks Shift Bosses
Mine Foremen
Topmen

All men who volunteer for this service will be enlisted as privates, but those who prove qualified will be made non-commissioned officers.

Arrangements have been made so that drafted men can join.

Each of the Six Companies of Practical Mining Men is being made up as follows:

	In each Company	Monthly pay of each when abroad
First Sergeant	1	$60.00
Sergeant, first class	4	60.00
Supply Sergeant	1	51.20
Mess Sergeant	1	51.20
Stable Sergeant	1	51.20
Sergeant	10	51.20
Corporal	20	40.80
Horseshoer	1	44.00
Saddler	1	40.20
Wagoner	5	40.20
Cook	5	44.00
Bugler	2	33.00
Private, first class	66	36.60
Private	132	33.00
REGIMENTAL HEADQUARTERS		
Master Engineer, Senior grade	4	$96.00
Master Engineer, Junior grade	4	84.00
Regimental Sergeant Major	1	60.00
Regimental Batallion Supply Sergeant	2	60.00
Sergeant	4	51.20

That is all clear money for the Government supplies all food and clothing.

Join now before the Regiment is filled—for enlistment blanks write or telegraph to Commanding Officer, 27th Engineers, Camp Meade, Maryland. Mention whether you are in the draft or not so the proper blank can be sent.

FIGURE 77.—During World War I, patriotic advertisements appeared in various coal trade journals calling on experienced coal miners to join the war effort. Advertisement from The Coal Industry (1918, v. 1, no. 4, p. 17).

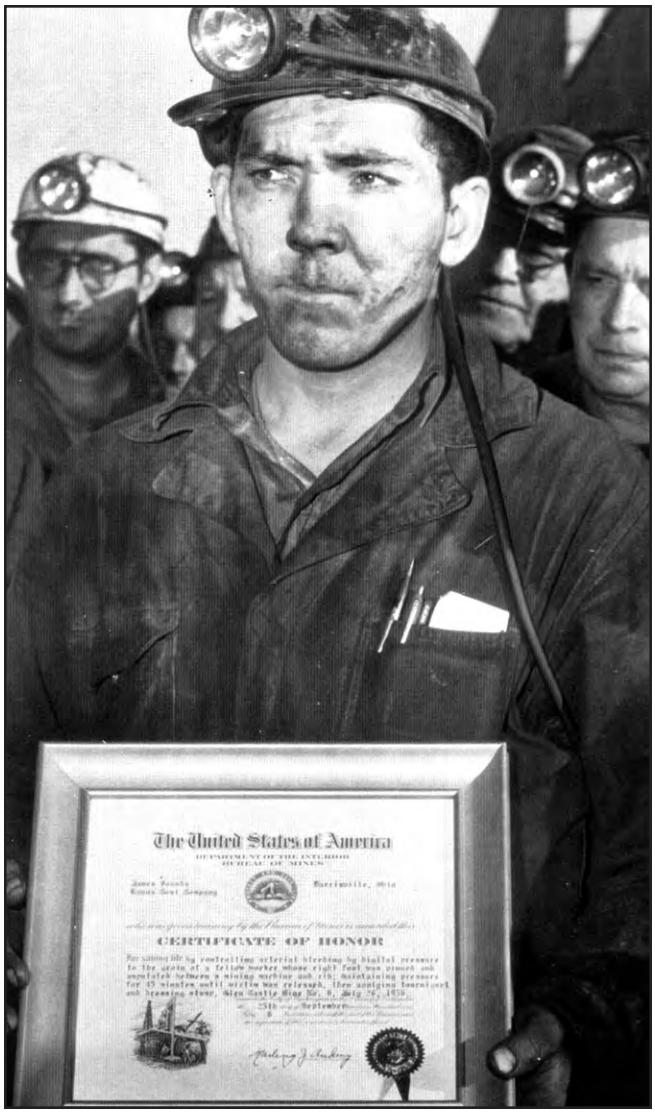


FIGURE 78.—James Faunda, a Hanna Coal Company miner, surrounded by co-workers, holding his Certificate of Honor, awarded by the U.S. Bureau of Mines *for saving life by controlling arterial bleeding . . . of a fellow worker whose right foot was pinned and amputated between a mining machine and rib* [of coal] *and maintaining pressure for 45 minutes until the victim was released . . . .* Faunda, a member of the Glen Castle No. 6 mine (Hn-38) first-aid team, used quick thinking and his first-aid training to heroically save the life of a co-worker. The Glen Castle No. 6 mine at Harrisville, in Short Creek Township, Harrison County, had a 549-foot-long slope opening to mine Pittsburgh (No. 8) coal. This slope mine began operation in 1955 and was abandoned in 1962. Photo and caption quote from Hanna Coal News (January 1957, p. 8, 9). (For other photos of this mine see figs. 103 and 160.)

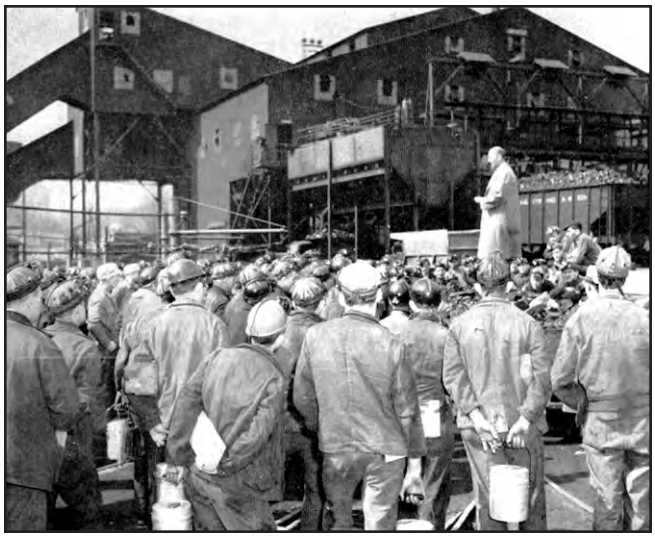


FIGURE 79.—Bernard G. Witten, Judge of Belmont County Court of Common Pleas, addressing miners of the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) on behalf of the government's voluntary war-bond purchasing plan. Nearly 90 percent of Hanna's miners participated in the war-time program. In addition, not only did coal miners support the war effort financially, but by November 1943 nearly 65,000 of the nation's coal miners were serving in the United States armed forces. Photo courtesy of Dale Davis, from Hanna Coal News (April, 1942, p. 8). (For other photos of this mine see figs. 35, 82, 93, 110, 117, 119, 120, 123, 140-142, 153, 154, 193.)

FIGURE 80.—Types of hand tools used by coal miners. Advertisement for The Martin Hardscog Company in The Coal Industry (1919, v. 2, no. 9, p. 49).

FIGURE 81.—A miner shoveling coal from a kneeling position. This scene was not uncommon for many Ohio coal mines. Note the hard hat and battery-powered lamp worn by this miner and the pick behind the miner. Date unknown. Photo courtesy of U.S. Bureau of Mines.

FIGURE 82.—Earl Warner, shooter (left), and Joseph Povolika, driller (right), drilling in the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) preparatory to shooting down the coal and loading it. Once the coal had been undercut, it would be shot down using an explosive charge. The explosive charge used at the Willow Grove No. 10 mine, known as Cardox, consisted of liquid carbon dioxide, which, when ignited, exerted a pressure of 19,000 pounds per square inch. Photo courtesy of Dale Davis, from Hanna Coal News (November 1944, p. 6, 7). (For other photos of this mine see figs. 35, 79, 93, 110, 117, 119, 120, 123, 140-142, 153, 154, 193.)

FIGURE 83.—Left photo, a coal miner loading a cannister with an explosive charge (black-shot powder) prior to blasting coal loose from the working face. Right photo, an explosive-filled cannister is placed into a hole drilled by hand or by power auger. Prior to drilling, the working face was undercut by hand, using a pick, or by a coal-cutting machine. Following the explosive shot, the loosened coal was loaded into coal cars by hand (see fig. 84) onto conveyor/loading machinery. This style of mining, widely used in Ohio, is called conventional mining. Note in the left photo the open-flame illumination from the miner's lamp. Dates unknown. Photos courtesy of U.S. Bureau of Mines.

FIGURE 84.—A pair of miners loading coal by hand in an eastern Ohio coal mine. Coal was lifted or shoveled onto a chain conveyor, which loaded a mine car. Until the mid-1930's and the development of automatic coal-loading machines, coal was loaded into mine cars by hand. *Circa* early 1900's. Location unknown. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment collection.

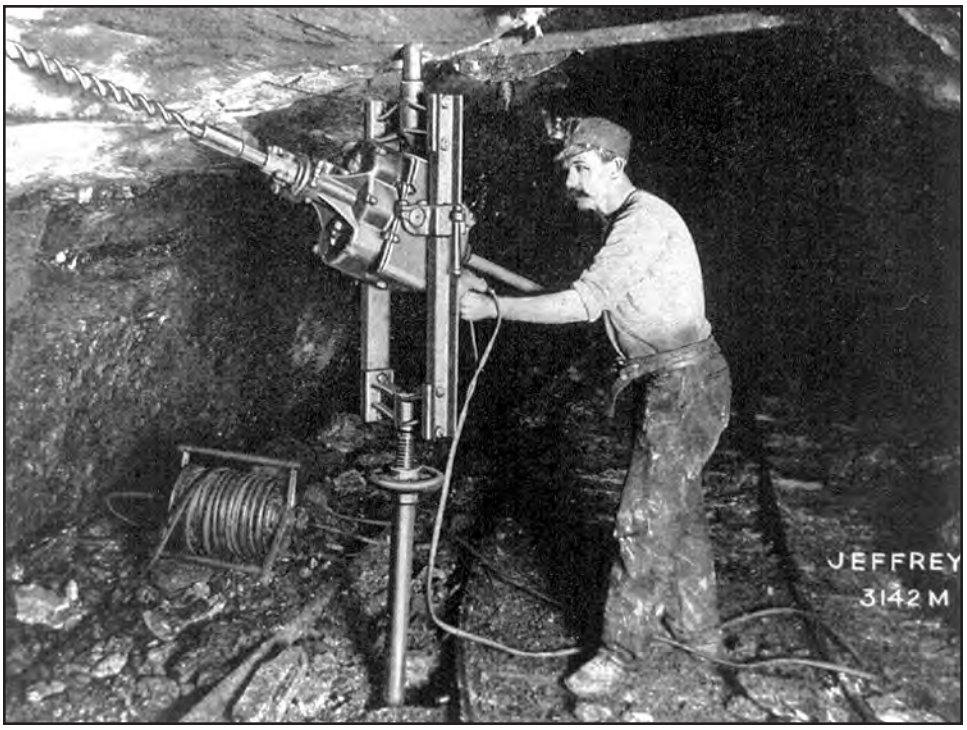


FIGURE 85.—Electric rotary drill, built by the Jeffrey Mining Equipment Company, in use in a coal mine of the Sunday Creek Coal Company along Sugar Creek, Dover Township, Athens County. Note the adequate head room. Photo from State Inspector of Mines Report (1909, plate VI).

FIGURE 86.—Braced between the floor and ceiling of this rather low-ceilinged mine, an Ingersoll-Sergeant "radial" coal-cutting machine undercuts a seam of coal. This machine, powered by compressed air, could double as a rock drill. Note there are no air hoses connected to the machine. Also note the soft caps, with carbide lamps, worn by the miners. Photo from State Inspector of Mines Report (1905, p. 81).

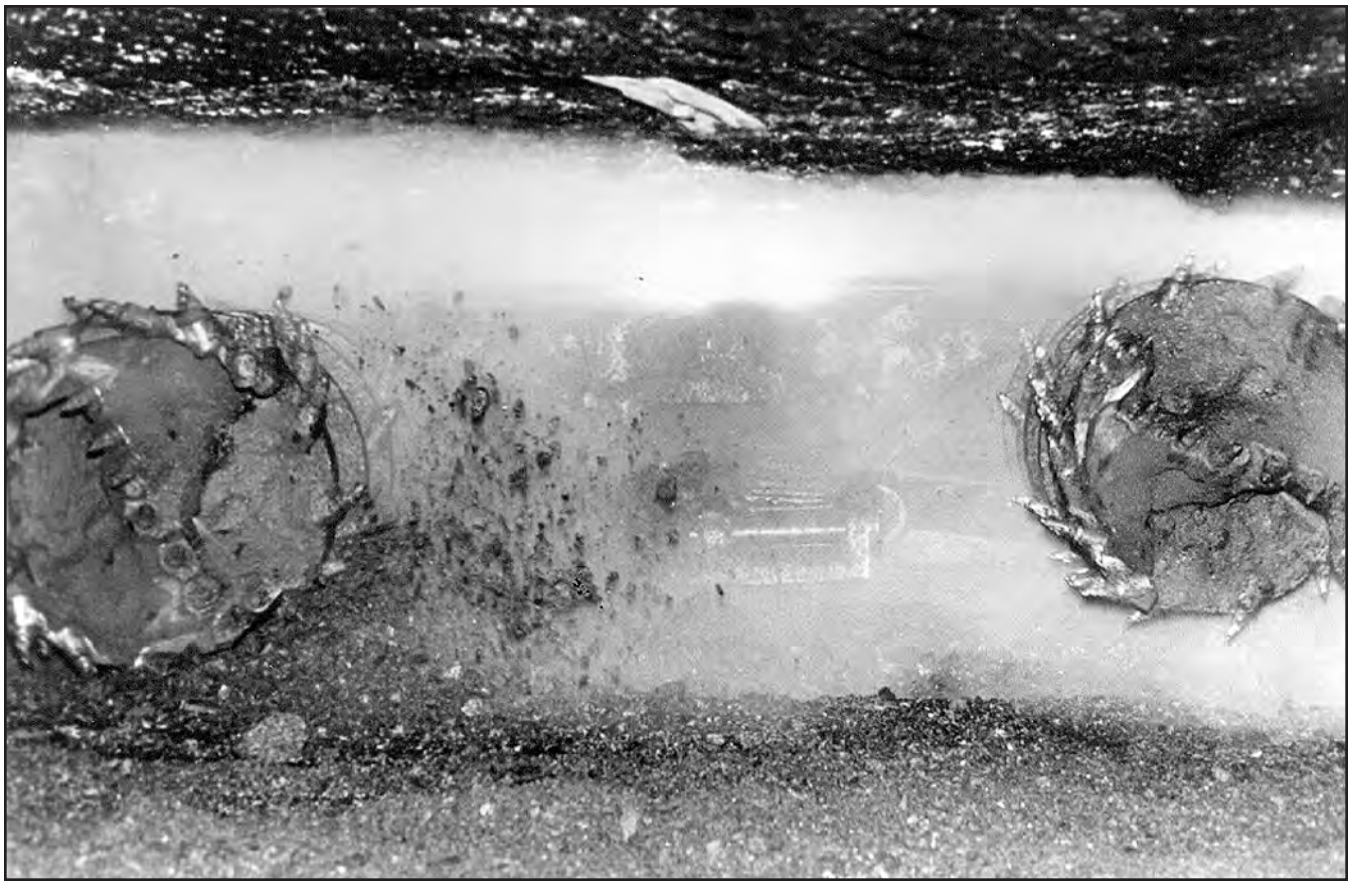


FIGURE 87.—Top photo, head-on view of a Fairchild 410 auger-style continuous miner making a cross-cut entry through a pillar of coal in the Sterling mine (Jfn-823) in Brush Creek Township, Jefferson County. Bottom photo, the same continuous miner at idle. This continuous miner uses two rotating cylinders (augers), 32 inches in diameter and studded with tungsten carbide bits, extended on arms which swing horizontally side to side and raise and lower vertically. When this continuous miner is in operation, water is continuously sprayed to retard the generation of coal dust. The coal seam in this mine is the Mahoning (No. 7A), and mine height averages 35 inches. Photo taken in 1992. Photo courtesy of Tim Miller. (For other photos of this mine see figs. 88 and 114.)

FIGURE 88.—A modern coal miner kneeling to work in the Sterling Mining Company Sterling mine (Jfn-823) (see also fig. 87). Although today's underground coal mines are highly mechanized and automated through computers, a significant amount of work is done by hand just as it was in Ohio mines more than 100 years ago. Note the heavy plastic knee guards, battery-powered lamp, and hard hat worn by this miner. Photo taken in 1993. Photo courtesy of Tim Miller. (For another photo of this mine see fig. 114.)

MINE ANIMALS

To make work easier, many miners used beasts of burden such as goats, oxen, dogs, ponies, or mules to pull mine cars loaded with either coal or miners (figs. 89-93). In the Boreland mine, one of the shaft mines at Steubenville, both Shetland ponies and mules were used.

These ponies are only three feet two inches to three feet six inches high. This mine has seven of these hardy and useful animals underground. In the galleries and hauling roads a foot or more of the fire-clay floor is taken up to make height for the hauling mules . . . . The mine mules are kept day and night under ground; the stables [fig. 94] *are hewn out of the solid coal pillars at the bottom of the pit, and they are dry, well aired, and comfortable. The mules are fed at four o'clock in the morning by the fire-viewers* [men who, prior to the next day's shift, would check for excessive accumulations of methane in the mine using special open-flame lanterns]. *Work commenced at six o'clock, an hour is allowed at noon for dinner, and work ceased at five in the evening* (State Inspector of Mines, 1877, p. 14, 15).

In many cases, these animals, once taken into a mine, would never again return to the surface; their remains would become part of the working environment of the underground mine. However, there were exceptions. In December 1896 a fire in the Sunday Creek Coal Company mine No. 10 (As-37) in Trimble Township, Athens County, killed 32 horses and mules. During the clean-up process it was felt that the most humanitarian and healthful approach in the treatment of the dead animals was to remove them from the mine for disposal (Coxe, 1899, p. 73, 88).

In some mines a few inches of roof rock or floor rock would be excavated along with the coal in the main passageways or haulageways to provide a working height of at least 5 feet on the mine-car rail (Newberry, 1857, p. 51). This practice allowed a mule, pony, or ox to pass through without touching the ceiling. Apparently, it was nearly impossible to free an ox once it become wedged in a low-ceilinged mine without causing the animal physical harm. Horses were used in mines where the coal seam attained a thickness of 6 feet; mules were used in mines where the coal seam was less than 6 feet thick. However, in thin coal seams, a common practice was to hire "pushers" (men or, in some cases, boys) to push the mine cars from the working faces to the hauling roads or entries because it was cheaper to hire pushers than to excavate ceiling or floor rock (Orton, 1884, p. 337).

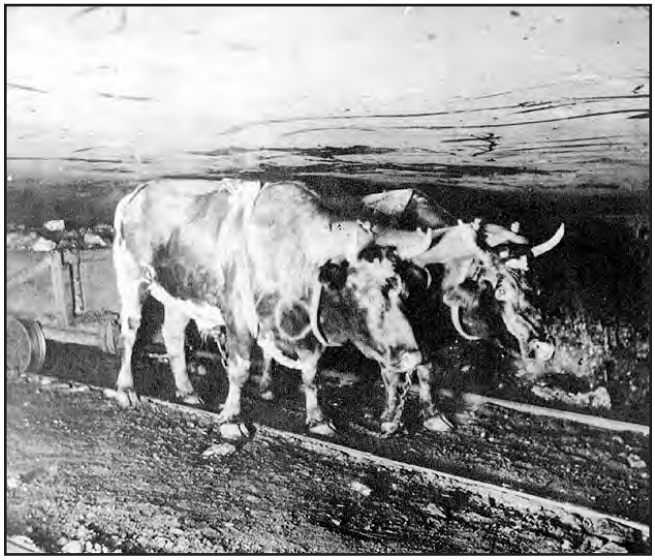


FIGURE 89.—Mine animals less commonly used in Ohio coal mines: oxen and goats. Dates and locations unknown. Ohio Division of Geological Survey file photos.

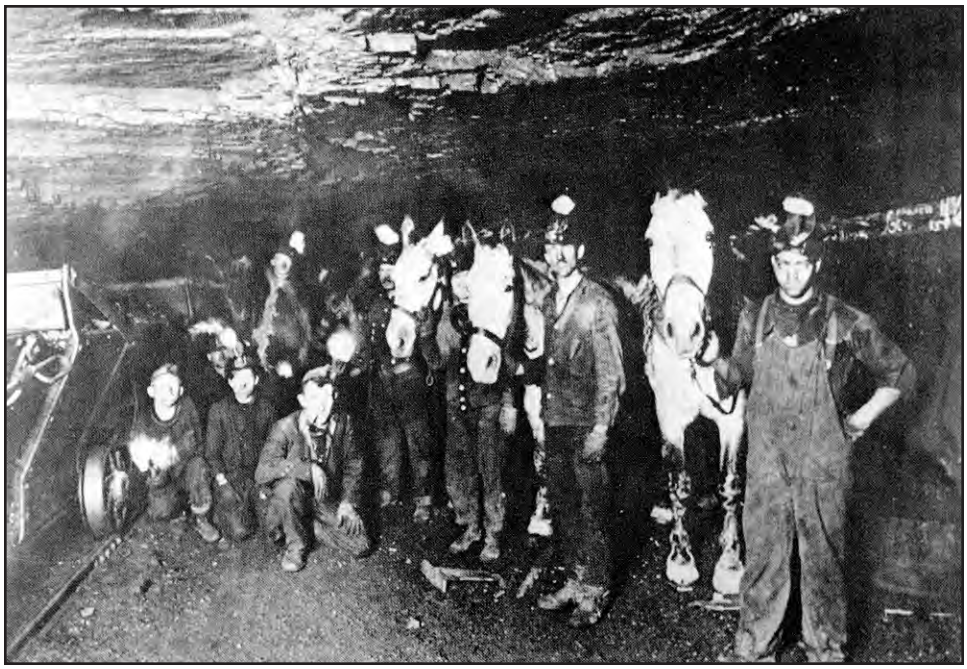


FIGURE 90.—The use of mules and ponies was a common practice in many Ohio coal mines in the 19th and early 20th centuries. Date and location unknown. Ohio Division of Geological Survey file photo.

The task of driving a team of mules (fig. 95) was one which apparently required a special skill. Abe James, a coal miner born in Jackson, Ohio, on December 10, 1867, and raised in Coalton, Ohio, reminisced on his mining career as follows,

I began work on the coal tipple of Pimlot and Hall [Darling mine near Coalton, Coal Township, Jackson County]. *My work was greasing* [coal] *cars. I was called the Grease Monkey on the job. I then learned to swear and was promoted to a mule driver. On the job I became an expert—I could swear the scale up and down—forward and backward and the mule said nothing but HeHaw* (Anonymous, 1953). *Mule-power was the mode and the manipulation of mules in the underground passages required a special technique and language all of its own* (Youngstown Vindicator, January 19, 1930).

The practice of using dogs to assist coal miners in hauling coal from the working face out of the mine began with pioneer miners in the early 1800's along the Monongahela River in Pennsylvania. This practice persisted until the early 1900's in some of the small coal mines in Muskingum County along the Muskingum River and the Cincinnati and Muskingum Valley Railroad (figs. 96, 97). In describing the relationship between the miner and his dog, Roy (1906, p. 45) stated,

FIGURE 91.—The Ironton Engine Company, located in Ironton, Lawrence County, used this scene to illustrate their advertisement that one 5½-ton electric locomotive was capable of performing the same amount of work as six mules. Photo from The Coal Industry (1919, v. 2, no. 7, p. 32).

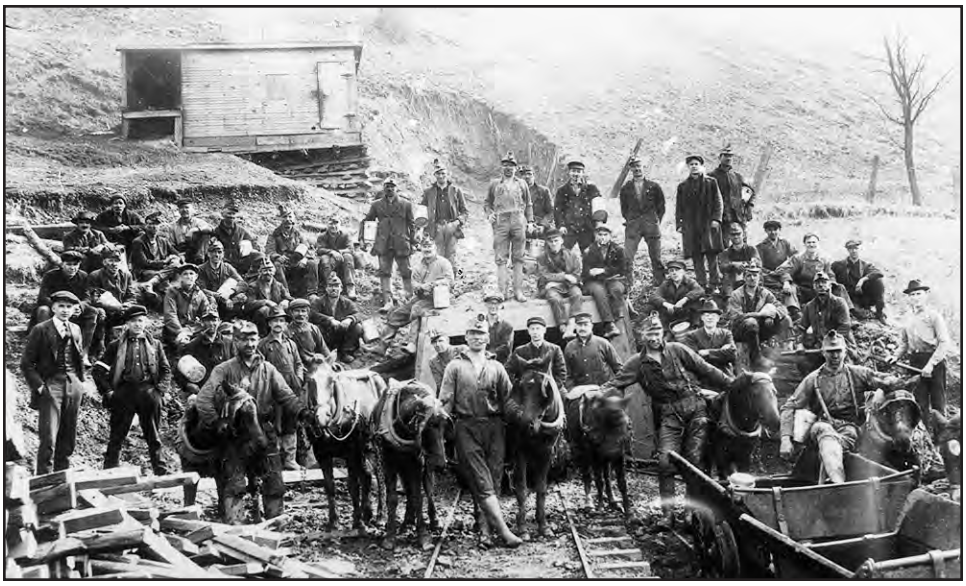


FIGURE 92.—Group of miners and several mules at the entrance of the Marchesi mine (Ts-129), about 2½ miles south of New Philadelphia, in Warwick Township, Tuscarawas County. The Marchesi mine, a drift mine operated by the Marchesi Coal Company, mined a 4-foot-thick seam of Middle Kittanning (No. 6) coal and was abandoned in 1941. Date unknown. Photo courtesy of Tuscarawas County Historical Society.

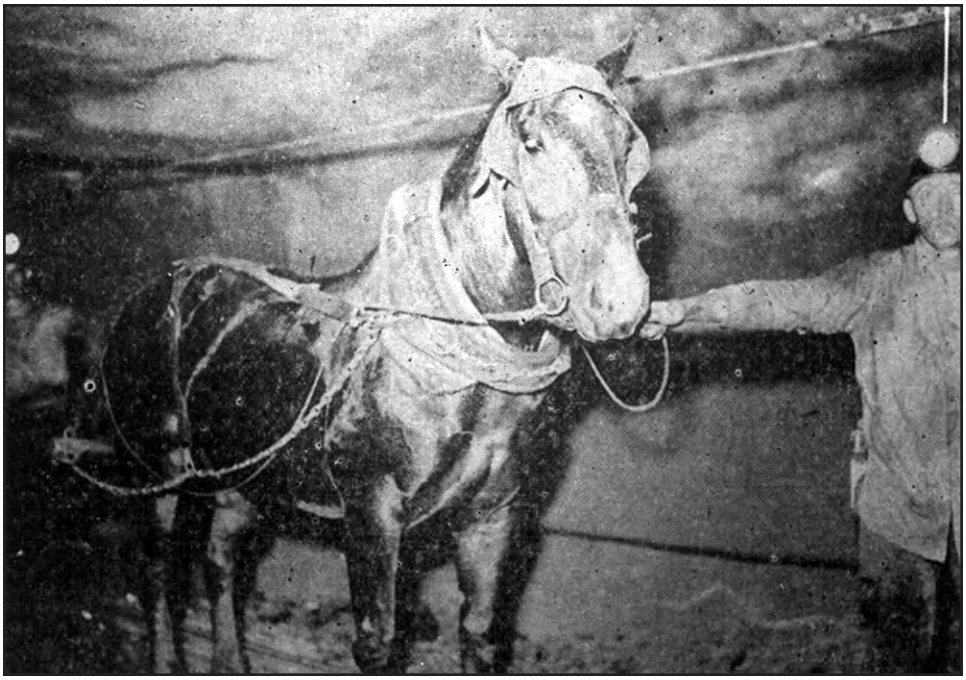


FIGURE 93.—Pictured with "Old Dobbin" are coal miners John Hudock and John Frieberg, employed at the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). Mules generally were used in mines for hauling coal because of their small size. However, at the Willow Grove No. 10 mine, where the ceiling is high and the entries wide, horses were just as efficient. Photo courtesy of Dale Davis, from the Hanna Coal News (September 1935, p. 8). (For other photos of this mine see figs. 35, 79, 82, 110, 117, 119, 120, 123, 140-142, 153, 154, 193.)

FIGURE 94.—Livestock stable in an underground mine. This stable was constructed of steel beams to provide horse and mules with good quarters. Location unknown. Photo from The Coal Trade Bulletin (1916, v. 35, no. 1, p. 12).

FIGURE 95.—Mules straining against their harnesses to pull a loaded coal car. Date and location unknown. Photo courtesy of Forrest Walton.

. . . the miner and his dog were inseparable subterranean companions. The dog was harnessed up to the front of the car, the miner pushed behind. When they went back with the empty wagon the miner enjoyed the luxury of a ride. The dog laid down in the gob to rest while his master was loading up, and at the word of command came promptly forth, was harnessed and hitched to the loaded car. The dogs were quiet, well behaved and faithful.

In the Stelover mine on the east side of Zanesville, Muskingum County, 27 miners and 40 dogs were employed to mine and haul coal (State Inspector of Mines, 1882, p. 78). In commenting further on the use of dogs in the mines of Muskingum County, the State Inspector of Mines (1884, p. 83) reported,

It is a thing of rare occurrence to find a mine with coal of sufficient height to admit the entrance of a mule. For the purpose of hauling to and from the mines, a substitute is found in the canine race, and the burly mastiff supplies the motive power. Where the roads are level, and in good order, a dog weighing about 70 pounds is capable of drawing a small mine-car loaded with from 12 to 15 bushels [960 to 1,200 pounds] *of coal. Where the grade is heavier two or three dogs are hitched, one in front of the other, each one seemingly doing its best to pull its share of the load. I inquired if they did not, when wearied, become ill-tempered and balky, but was told that cases of that kind were the exception, rather than the rule.*

In addition to the beasts of burden used for hauling of mine cars, canaries and mice commonly were used in mines because of their sensitivity to carbon monoxide gas (see following section for more information on mine gases). Canaries and mice will collapse from the effects of carbon monoxide more readily than a man, so that miners and mine-rescue teams know that as long as the bird or mouse keeps his poise they are safe, but that when the bird or mouse collapses it is time to quickly retreat to safety (Koster, 1919, p. 67). The U.S. Bureau of Mines routinely kept canaries and mice at their rescue stations in the event of mine-rescue work (Burrell, 1914, p. 30). A technical report of the International Mine-Rescue Standardization Committee published in U.S. Bureau of Mines Technical Paper 334 stated, *a canary in a small portable cage is an almost indispensable adjunct to rescue work after a mine explosion or during a mine fire* (The Coal Trade Bulletin, 1923, v. 49, no. 5, p. 219).

Canaries were raised in the community of Greens Run, in Trimble Township, Athens County, solely for detecting carbon monoxide gas in coal mines. Canaries also were used during the rescue operation in the Millfield mine explosion (Cartwright, 1993) (see Chapter 6 of this bulletin). However, in spite of their sensitivity to carbon monoxide, canaries are not reliable in concentrations of carbon monoxide less than 1 percent and, therefore, were eventually replaced by chemical or electronic gas detectors. In 1920, a carbon monoxide gas detector was marketed which used a dry chemical reaction to detect concentrations as low as 0.05 percent (The Coal Industry, 1920, v. 3, no. 8, p. 405).

FIGURE 96.—Dogs commonly were used to pull mine cars at coal mines primarily in Muskingum County during the 19th and early 20th centuries. Photo from The Coal Trade Bulletin (1922, v. 47, no. 9, p. 352).

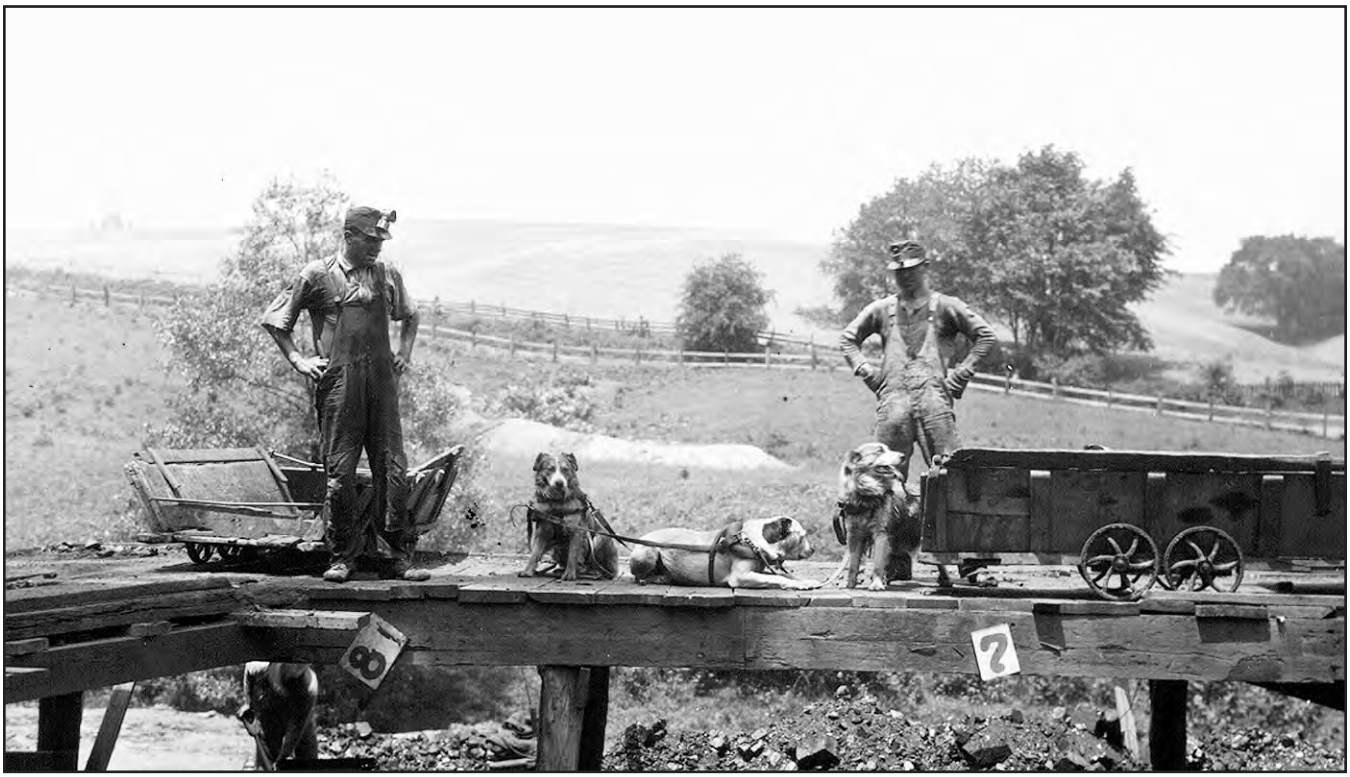


FIGURE 97.—Three dogs hitched in tandem at a Middle Kittanning (No. 6) coal mine on the property of Lewis Fisher in Wayne Township, Muskingum County (see Hansen, 1990, p. 1). Ohio Division of Geological Survey file photo taken by Wilber Stout in 1917.

MINE GASES

Coal mines commonly exhibit a variety of gases, any one of which could be dangerous or deadly under certain conditions. The most common gaseous impurity in coal mines is carbon dioxide (CO_2), or carbonic acid gas, which is generally known as blackdamp or chokedamp. However, strictly speaking, blackdamp refers to a mixture containing up to 15 percent carbon dioxide and 85 percent nitrogen. *The term damp . . . has a Dutch or German origin (Damf, vapor, fumes), and means suffocating or noxious gases* (Burroughs, 1920a, p. 313).

Carbon dioxide is colorless, odorless, tasteless, and heavier than air. It is exhaled during respiration, is the result of combustion, and is given off naturally by coal. The accumulation of carbon dioxide causes difficulty in breathing and an open flame to be extinguished or to burn with difficulty. Blackdamp is the result of mine fires or an explosive ignition of methane. It results in an atmosphere that is depleted of oxygen rather than containing an excess of carbon dioxide. Blackdamp accumulates along the floor of a mine and suffocates its victims.

Hydrogen sulfide (H_2S) or stinkdamp, although a lethal gas at concentrations more than 0.1 percent, fortunately is seldom present in coal mines. Hydrogen sulfide is colorless, heavier than air, and occurs naturally from the decay of sulfur-containing organic matter. Stinkdamp has a characteristic odor of rotten eggs at concentrations of less than 0.003 percent.

Carbon monoxide (CO) or whitedamp is colorless, odorless, tasteless, and lighter than air. It is the result of mine fires or an explosive ignition of methane or coal dust and commonly is associated with light-colored smoke (Burroughs, 1920b, p. 431). Whitedamp is the deadliest of all mine gases:

Where the percentage of carbon monoxide in the mine air is high (concentrations greater than 0.25 percent), as is often the case after an explosion, men lose consciousness very quickly and apparently without any pain or suffering (Koster, 1919, p. 67).

Carbon monoxide is preferentially absorbed by the hemoglobin in blood to the exclusion of oxygen. One-tenth of 1 percent of this gas may be fatal in 10 minutes.

Methane (CH_4) or firedamp (also called marsh gas) is colorless, odorless, tasteless, and lighter than air. Methane forms an explosive mixture when it occurs with air in concentrations greater than 5.5 percent (Koster, 1919, p. 67). It is a natural by-product formed during the decomposition of coal or carbonaceous matter. It burns with a pale-blue flame. It is detected by safety lamps or gas detectors held along the mine ceiling or into crevices or cavities in the mine ceiling.

Afterdamp is a term applied to a mixture of gases which result from a mine fire or an explosion of methane or coal dust. Afterdamp may consist of carbon dioxide, water vapor, nitrogen, oxygen, carbon monoxide, and in some cases free hydrogen and hydrogen sulfide, but generally consists principally of carbon dioxide and nitrogen and, therefore, is not breathable (Burrell and Seibert, 1914, p. 50, 51).

FIGURE 98.—Coal miner working underground. Note the cloth cap and carbide miner's lamp. *Circa* early 1900's. Location unknown. Photo courtesy of Ohio Historical Society, from the Steubenville Coal and Mining collection, donated by Thomas J. Sherrard.

SAFETY LAMPS AND CARBIDE LAMPS

Safety lamps were constructed to detect firedamp and provide illumination in early coal mines. The use of safety lamps dates back to 1815 and the development of the Davy lamp (The Coal Industry, v. 1, no. 5, p. 189). The first Davy lamp operated by enclosing a lighted candle within a cylinder of wire gauze. This design allowed an explosive or flammable mixture of gas to enter the lamp and be ignited by the flame, but the flame of combustion could not pass through the gauze to ignite the gas outside the lamp and ignite a mine fire (Burroughs, 1920c, p. 519).

The basic design of modern (Koehler or Wolf) safety lamps has changed little since the development of the Davy lamp. Fuel for safety lamps has varied and has included oil, gasoline, alcohol, benzene, naphtha, and acetylene. Safety lamps which used acetylene are more commonly known as carbide lamps. In carbide lamps, acetylene (C_2H_2) is produced by a chemical reaction of calcium carbide (CaC_2) with water (Burroughs, 1921b, p. 407). Carbide lamps were widely used because they provided greater illumination than other safety lamps and were compact in size, allowing them to be easily fitted onto miners' caps (figs. 98, 99). By 1919, between 80 and 90 percent of all miners preferred the carbide lamp above all others (Phelps, 1919, p. 153).

These carbide lamps operated by means of an open flame. Obviously, open-flame lamps presented a danger to the miner when they were used in mines where methane gas was present. One coal-mine disaster in Ohio that was caused by the open flame of a miner's lamp igniting methane gas is the explosion at the Robbins (or Rockhill) mine at Robbins Station northwest of Lisbon, in Center Township, Columbiana County, on February 10, 1881 (Orton, 1884b, p. 194-195). In describing the Robbins mine explosion, O'Malley (1891, p. 155) gave the following narrative:

FIGURE 99.—Two miners on break in an eastern Ohio coal mine. Note the cloth miner's caps with carbide lamps, the numerous logs used as roof support, and the electrical cables draped across the mine-car rails. *Circa* early 1900's. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment collection.

FIGURE 100.—Dick Beamer, age 38, wears a battery-powered electric miner's lamp as he operates a coal-cutting machine in the Midvale No. 7 mine (Ts-389), about 2 miles east of Midvale, in Union Township, Tuscarawas County. This slope mine was operated by the Columbia Southern Chemical Corporation (formerly by the Midvale Coal Company, Inc.) and produced Middle Kittanning (No. 6) coal until it was abandoned in 1971. Photo by NEWSWEEK-O.C. Sweet, cover ©1947, Newsweek, Inc. All rights reserved. Reprinted by permission.

FIGURE 101.—Group of coal miners at the Hanna Coal Company Piney Fork No. 1 mine (Jfn-261) listening to comments by section foreman Walter Spontaneo. Note the electric miner's lamps and the various styles of hard hats worn by the miners. Listening to Spontaneo, from left to right, are Carl Hipscher, Richard Smith, Emil Waldman, Joe Lippian, and Charles Silora. Photo courtesy of Dale Davis, from Hanna Coal News (June 1948, p. 7). (For other photos of this mine see figs. 36, 74, 116, 121, 159.)

FIGURE 102.—Pair of miners using a safety lamp to check for flammable gas along the ceiling of an eastern Ohio coal mine. Note the battery-powered electric miner's lamps on the miners' hats. Date unknown. Photo courtesy of Charles "Bud" Fry.

At the time of the explosion a team of mules was hitched to a train of [coal] *cars five or six in number, and five or six men in them were waiting at the change about 100 feet inside the mouth of the mine; and although the explosion was over 200 yards farther in the mine, such was its terrific force, that it blew the team of mules and the train of cars completely out of the mouth of the mine and over 50 feet clear of a railroad that passed the tipple, knocking down the bridge that crossed the track, killing one of the men who were in the cars and crushed the others severely.*

Modern miners wear hard hats fitted with electric lamps (fig. 100) that run on battery packs attached to a miner's belt. Electronic combustible-gas detectors, which are hand held or located on certain electric mining equipment, or hand-held flame-safety lamps are commonly used to signal dangerous levels of methane (see figs. 102-104).

Electric lamps were offered for sale in the United States as early as 1902. However, they were not well received because they were too heavy. By 1909, electric lamps had gained in popularity, in spite of safety flaws such as bulb breakage and battery-pack leakage (Burroughs, 1921c, p. 559). The safety shortcomings were overcome, and by 1916 an estimated 70,000 electric miner's lamps were in use in the United States. Eventually electric lamps replaced the carbide miner's lamp for illumination (fig. 101). However, in spite of their growing popularity, electric lamps did not replace flame safety lamps entirely because flame safety lamps had become an essential tool for gas detection in underground coal mines. Procedural recommendations for use of safety lamps in gaseous coal mines included having proper flame safety lamps (figs. 102, 103) or other suitable gas-detection devices, in addition to portable electric lamps (Burroughs, 1922, p. 200; Ohio Division of Mines, 1993, p. 164).

FIRE BOSS

The fire boss is the coal company employee who is responsible for inspecting underground coal mines for firedamp (fig. 104) and correct ventilation. A fire boss is certified, having undergone specialized training. Foremost among his duties is the examination of all the working places, traveling ways, and entrances to old workings within the mine using an approved safety lamp not more than three hours prior to the time set for the employees to enter the mine. He also has the responsibility to designate areas as being unsafe where dangerous levels of gas are detected or where proper ventilation is required to remove standing gas (Ohio Division of Mines, 1993, p. 69). Until the fire boss

FIGURE 103.—Coal miners enjoying lunch underground in the Hanna Coal Company Glen Castle No. 6 mine (Hn-38). Note the battery-powered electric miner's lamps and compartmentalized, aluminum lunch buckets. *Circa* late 1950's. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 78 and 160.)

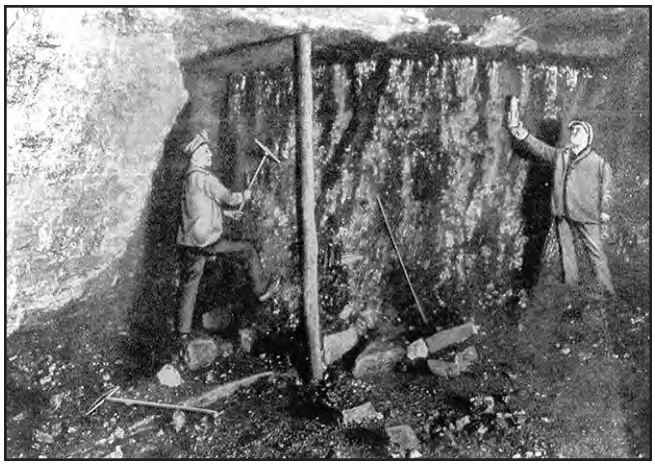


FIGURE 104.—A miner, holding a safety lamp, checks for firedamp along the ceiling of a coal mine. Note the single timber for roof support. Photo from The Coal Industry (1919, v. 2, no. 2, p. 66).

FIGURE 105.—The inside of a typical turn-of-the-century coal mine in southeastern Ohio (possibly near Shawnee or New Straitsville). Note the poor lighting, the height of the entry in comparison to the coal cars, and the wooden roof-support timbers. Ohio Division of Geological Survey file photo.

makes his inspection and has posted his observations at the mine office, no one is allowed in the mine. Furthermore, "dangerous" areas are restricted to all except designated personnel until the gas/ventilation problem is corrected. It is obvious that a great number of lives and a large capital investment of the company rely on the faithfulness and diligence of the fire boss in carrying out his duties.

WORKPLACE CONDITIONS

In addition to being capable of handling very rigorous work, coal miners who worked underground were not timid or faint hearted. Underground coal mines generally are cool, damp, and dark or poorly lit places to work (fig. 105). Underground mines also can be frighteningly quiet, except for the occasional popping or creaking noise caused by the weight of the overlying rocks on the pillars of coal that are left as roof supports. The roof of a coal mine generally was given additional support by bracing with timbers or wooden planks (figs. 106-108). However, numerous roof falls and mine-room cave-ins occurred in spite of the extra bracing. In addition, roof-support timbers deteriorate quickly in coal mines. The average life of a 10-inch by 12-inch support timber may be as short as two years (Woodworth, 1909, p. 50). Therefore, mine timbers had to be replaced frequently (figs. 109-112). Although in some areas wood was plentiful, the constant replacement of mine timbers could deplete forest reserves quickly. As a result, steel beams were introduced in coal mines as an alternative to wooden timbers.

The first use of steel beams for roof support in Ohio coal mines was in the mines of the Youghiogheny & Ohio (Y & O) Coal Company between St. Clairsville and Barton, in Richland and Belmont Townships, Belmont County. During the early 1900's, among the first Y & O mines to install steel I-beams were the Boggs (Bt-252; fig. 113), Barton (Bt-161), and Maple Hill (Bt-91) mines (Woodworth, 1909, p. 50; State Inspector of Mines, 1909, p. 396; 1911, p. 400). The Roby Coal Company in 1908 installed I-beams along 9,000 feet of the main haulageway in its Robyville or Drift No. 1 mine (Hn-23). The Robyville mine is near Adena, in Smithfield and Mount Pleasant Townships, Jefferson County, and Short Creek Township, Harrison County (State Inspector of Mines, 1909, p. 409; Woodworth, 1909, p. 50).

Modern underground coal mines use 3- or 4-foot-long roof bolts made of flexible steel which are drilled and epoxied into the roof of the mine on approximate 4-foot centers (fig. 114). This system of roof bolting has greatly added to the safety of the coal miner. Ohio mining law limits mining activity in areas of an unsupported roof.

The coal miner's office at the working face of the mine was always a dirty, grimy place laden with coal dust. After hours of work, the miner's clothing and all exposed areas of the

miner himself would become extremely sooty and would require a thorough washing to clean. However, after years of working under such filthy conditions and breathing in coal dust, many coal miners paid a heavy price by succumbing to coal miners' asthma (black lung), a debilitating and life-shortening disease. Present-day coal-mine operators go to great lengths to minimize the presence of coal dust in the mine by spraying water on the coal during the mining operation (see fig. 87 bottom), spraying exposed coal faces with rock dust (generally lime) after the mining process (fig. 115), providing ventilation to all the active working areas of the mine, and sealing off unused portions of the mine.

Underground coal mines are commonly damp or wet places to work. To compensate for water problems, miners of yesteryear would, if possible, advance underground mine workings outward from the lowest point of the coal seam, so that water would flow away from the working face and out of the mine or flow to a place where it could be pumped out of the mine. In addition, mining in an uphill direction made it easier to move fully loaded coal cars by hand. Abandoned mines or the unused portions of a mine sometimes would fill with water. These water-filled areas could be potentially catastrophic if the mine wall separating the flooded mine from the active mining area were suddenly and unintentionally ruptured or breached.

On July 11, 1993, Meigs mine No. 31, operated by the Southern Ohio Coal Company, was inundated by water, idling the mine and forcing 300 miners out of work. The water which flooded Meigs No. 31 came from an abandoned portion of the adjoining Raccoon No. 3 mine. In 1989, the Raccoon No. 3 and Meigs No. 1 mines were connected underground to form an underground mine complex known as Meigs No. 31. The unused portions of Raccoon No. 3 were sealed using reinforced concrete bulkheads and were allowed to accumulate water. Apparently, the area below one of the bulkheads failed, allowing an estimated 1 billion gallons of water to flow into Meigs No. 31 mine. The few maintenance workers in the mine at the time exited safely. After a significant rehabilitation effort, Southern Ohio Coal Company restarted their mining operation at the Meigs No. 31 mine on February 25, 1994. The company thus avoided a long term or permanent shutdown, which would have been very costly in terms of jobs lost by miners, loss of tax revenues to local communities, and a sizeable reduction of coal normally produced for consumption by the Gen. James M. Gavin power-generating station (see figs. 201, 216).

The Eggert or Hi-Heat mine (We-35) near Rogue Hollow, in Chippewa Township, Wayne County, was abandoned in 1940 due to flooding. In regard to the flooding of the Hi-Heat mine, Frey (1958, p. 25, 26) wrote:

. . . *miners of the* [Hi-Heat] *mine cut with* [an electric cutting] *tool into a tunnel of the Messenger mine* [We-4, abandoned in 1896], *which was flooded. They had to run for their lives. This led to the abandoning of the mine.*

Rogue Hollow is the location of a former mining commu-

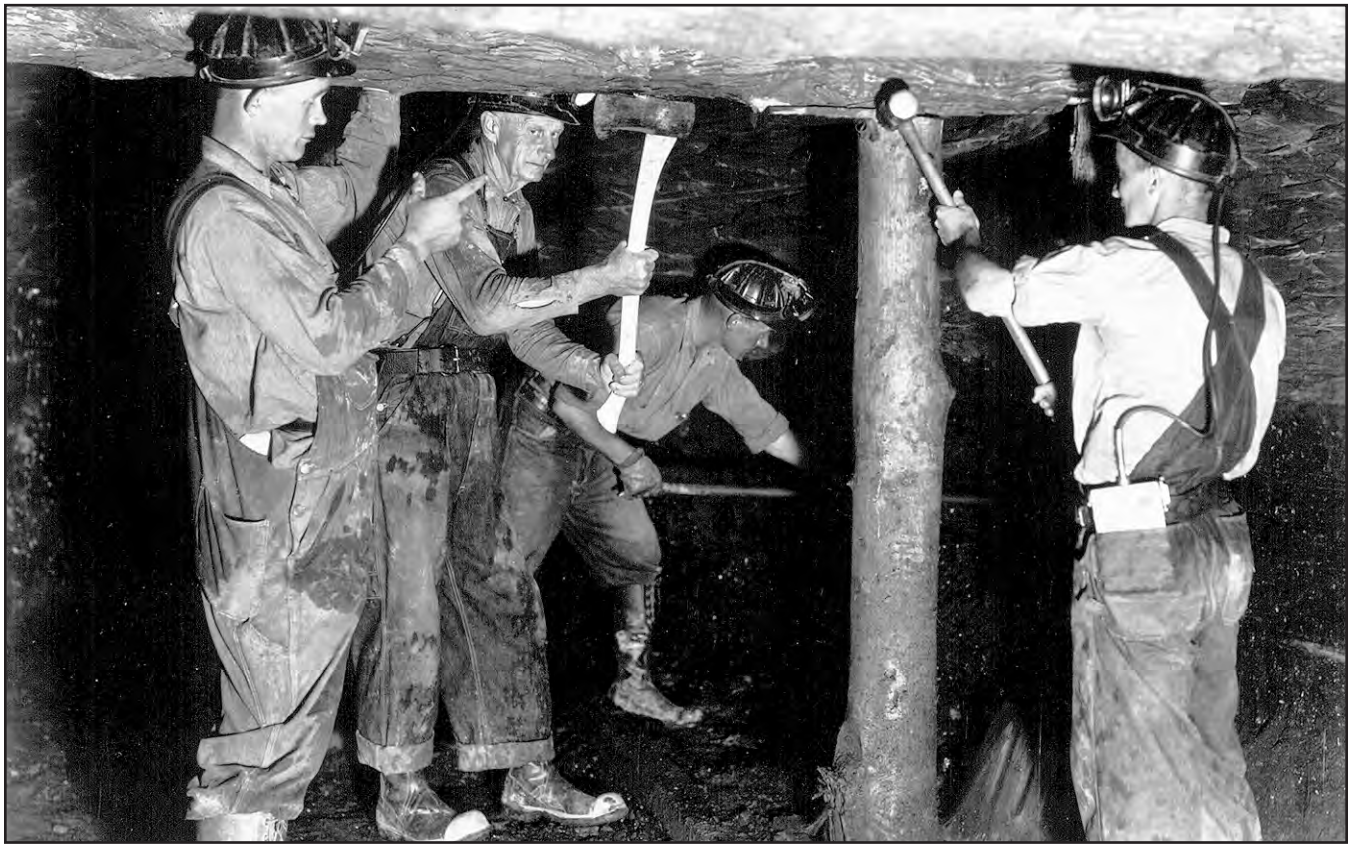


FIGURE 106.—Coal miners setting roof-support timbers in an underground mine near New Straitsville, Perry County. *Circa* 1936. Photo courtesy of Ohio Historical Society, from the WPA Ohio collection.

FIGURE 107.—Coal miner shoveling gob (waste material). Note the roof-support system of timbers and wooden wedges. Date and location unknown. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

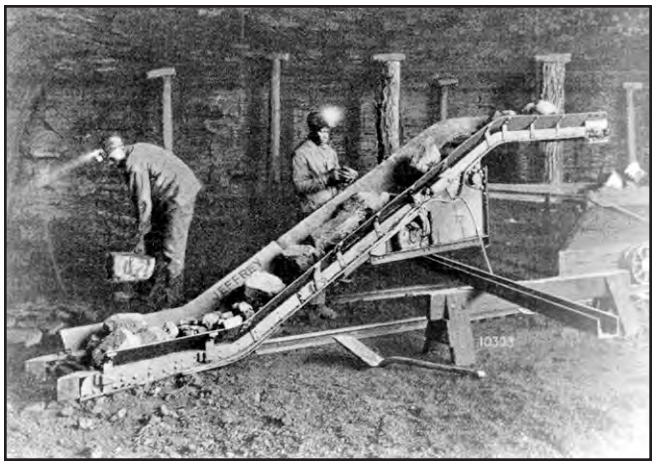


FIGURE 108.—Coal miners shoveling coal by hand onto a conveyor that loads a mine car. Note the wooden roof-support system. Location unknown. Photo from The Coal Trade Bulletin (1918, v. 39, no. 11, p. 47).

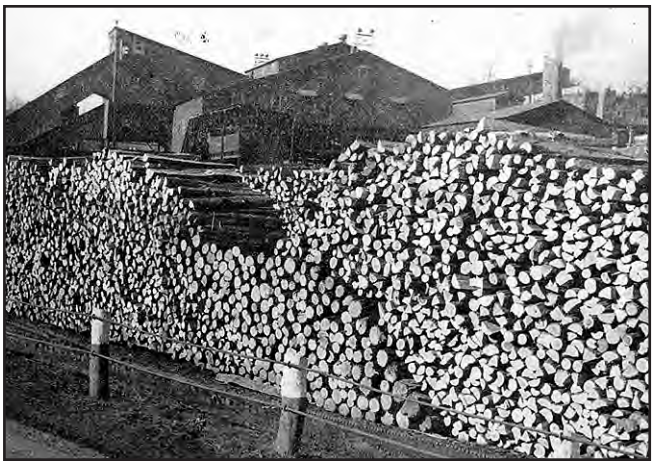


FIGURE 109.—Stockpile of roof-support timber cut from 125 trees for use in coal mines operated by the Hanna Coal Company. This stockpile amounts to half a week's supply. Hanna estimated they used 20,000 trees annually to provide sufficient supply of roof-support timber for their coal mines in Ohio. Photo courtesy of Dale Davis, from Hanna Coal News (February 1946, p. 3).

FIGURE 110.—An employee of the Hanna Coal Company Willow Grove No. 10 mine busily stacking timbers to be used as roof support in the mine. As this man unloads the truckful of timber, he probably wishes the stack of timber would last longer than half a week! *Circa* 1937. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 35, 79, 82, 93, 117, 119, 120, 123, 140-142, 153, 154, 193.)

FIGURE 111.—Stacks of roof-support timbers to be used in the mine form the backdrop for two outside workers at the Crow Hollow (Bradley) mine (Jfn-179). This mine is about 2 miles north of Dillonvale (at Bradley), in Smithfield Township, Jefferson County. Ten drift openings were driven into the Pittsburgh (No. 8) coal by the United States Coal Company in 1902. For a brief period following the opening of the mine, these drift openings were grouped into districts. Openings Nos. 1 through 4 were known as Bradley District No. 1, openings Nos. 5 and 6 were Bradley District No. 2, openings Nos. 7 and 8 were Bradley District No. 3, and openings Nos. 9 and 10 were Bradley District No. 4. In 1912, the name Bradley was dropped and Crow Hollow was adopted. The Crow Hollow mine was operated by the United States Coal Company from 1902 to 1932 and by the Jefferson Coal Company from 1932 to 1944, when it was abandoned. In 1907, the mine had a daily capacity of 2,500 tons. *Circa* 1910. Photo courtesy of Dale Davis, from the Leonard Corona collection.

nity located about midway between Clinton and Dolyestown, in Chippewa Township, Wayne County. Rogue Hollow has a colorful past and once had an unsavory reputation as a mining community. In discussing the former character and reputation of Rogue Hollow, Frey (1958, 9-16) wrote,

Rogues' Hollow was the toughest damn spot in the whole United States . . . . At one time Rogues' Hollow was the rendezvous of the toughest characters to be found anywhere. It was much like taking your life in your hands to pass through there after a monthly pay at the coal mines, which were many . . . . Miners back in those days [1860's and 1870's] *were paid once a month. On payday some of the miners went on benders or drinking bouts. Frequently they would be absent from the mine for days, sometimes as much as two weeks, or just as long as their money held out . . . .* [They] *lived hard and played hard. They drank their liquor straight and thought it was smart to be in on the fights every Saturday night.*

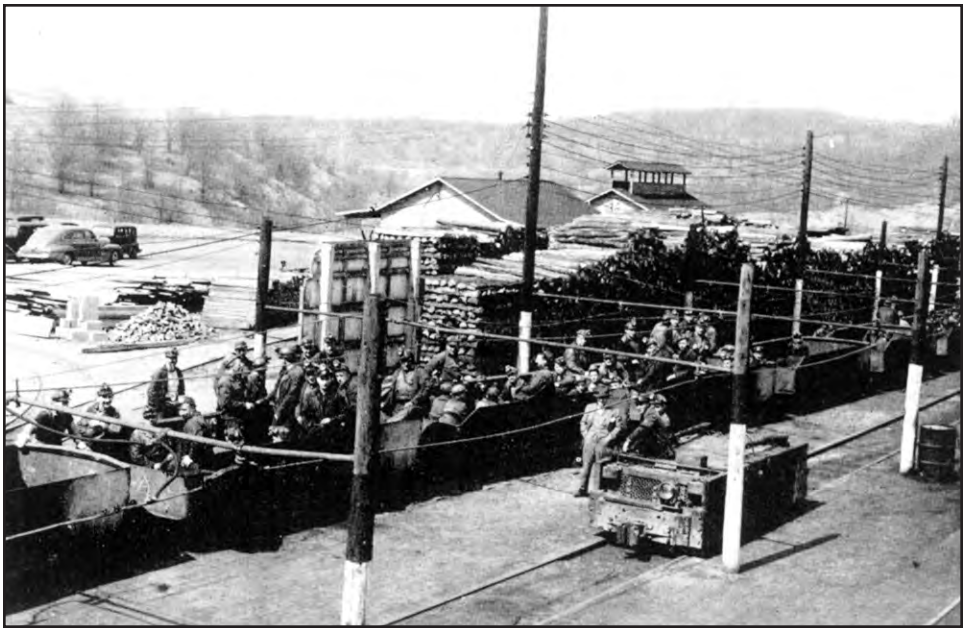


FIGURE 112.—Coal miners on the night shift at the Hanna Coal Company Dun Glen No. 11 mine (Jfn-129) preparing to enter the mine. Note the stacks of timbers to be used as roof support. This drift mine is about 1 mile west of Dillonvale, in Mount Pleasant Township, Jefferson County. It produced Pittsburgh (No. 8) coal from 1936 until 1955, when it was abandoned. Photo courtesy of Dale Davis, from Hanna Coal News (May 1943, p. 8). (For other photos of this mine see figs. 118 and 196.)

FIGURE 113.—Steel beams were used as roof support instead of wood timbers in the Youghiogheny & Ohio (Y & O) Coal Company Boggs mine (Bt-252), located approximately 1 mile east of St. Clairsville, in Richland Township, Belmont County. The Boggs mine, a drift mine, was opened in 1887 and was operated until 1906 by E. N. Boggs. Y & O operated the Boggs mine from 1906 until it was abandoned in 1927. Pittsburgh (No. 8) coal, 5½ feet thick, was produced from this mine. Photo from The Coal Trade Bulletin (1909, v. 21, no. 5, p. 21).

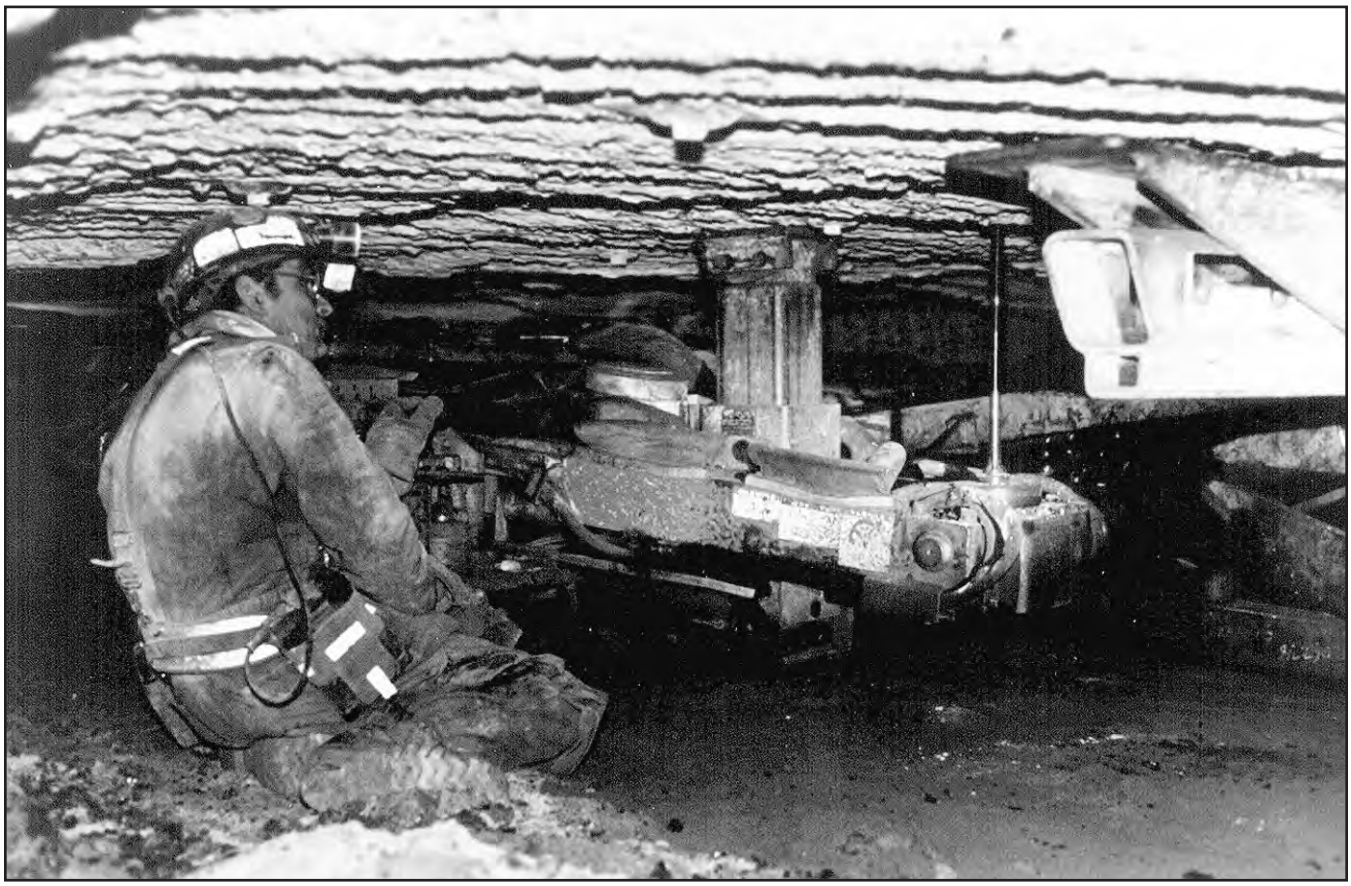


FIGURE 114.—A coal miner operating a Fletcher II roof bolter in the Sterling mine (Jfn-823), a drift mine operated by the Sterling Mining Corporation in Brush Creek Township, Jefferson County. Note the confined height in which this miner is working. Photo taken in 1993. Photo courtesy of Tim Miller. (For other photos of this mine see figs. 87 and 88.)

FIGURE 115.—*A powerful blower sprays the underground roof and walls* [of a Hanna Coal Company mine in eastern Ohio] *with "rock dust"-lime rock ground as fine as talcum powder. This dilutes the coal dust, neutralizes its explosive qualities*, and safeguards against explosions (Bituminous Coal Institute in Newsweek, 1947, v. 30, p. 9). Circa 1950. Ohio Division of Geological Survey file photo.

FIGURE 116.—Group of miners at the Hanna Coal Company Piney Fork No. 1 mine (Jfn-261) following a 1,080-ton shift. Photo courtesy of Dale Davis, from Hanna Coal News (June 1945, p. 6). (For other photos of this mine see figs. 36, 74, 101, 121, 159.)

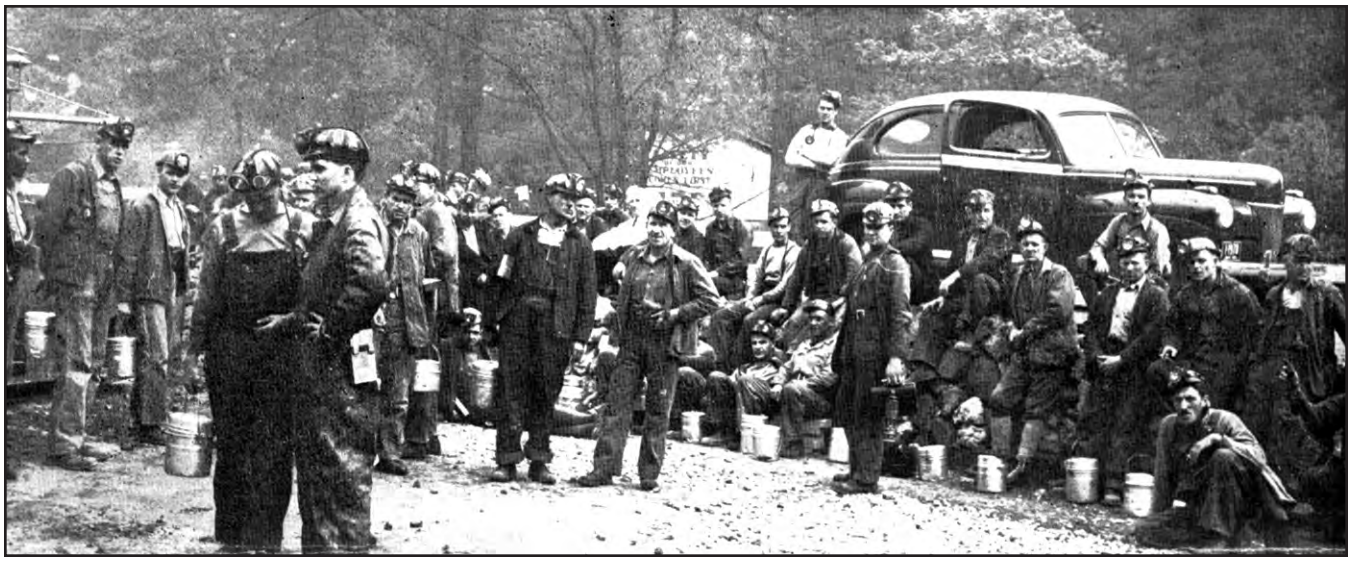


FIGURE 117.—Group of coal miners on the night shift waiting outside the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) for the man trip. Photo courtesy of Dale Davis, from Hanna Coal News (May 1941, p. 1). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 119, 120, 123, 140-142, 153, 193.)

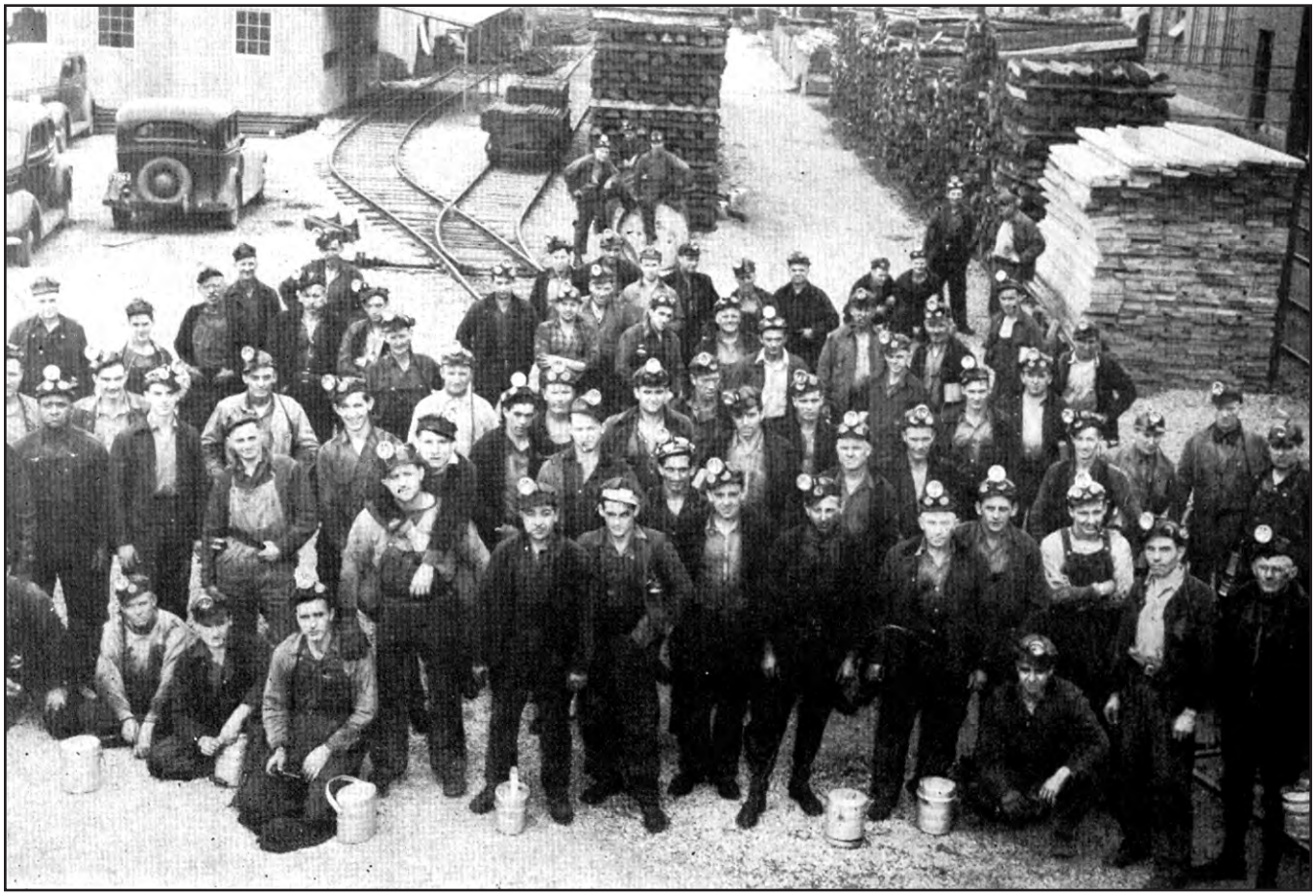


FIGURE 118.—The night crew gathered before entering the Hanna Coal Company Dun Glen No. 11 mine (Jfn-129). *Piles of supplies, posts, and lumber, used underground in the operation of the mine can be seen in the background as well as the Cardox preparation house, on the left, where the safety explosive is made ready in cartridges for blasting down the coal.* Photo and caption quote from Hanna Coal News (June 1941, p. 1). Photo courtesy of Dale Davis. (For other photos of this mine see figs. 112 and 196).

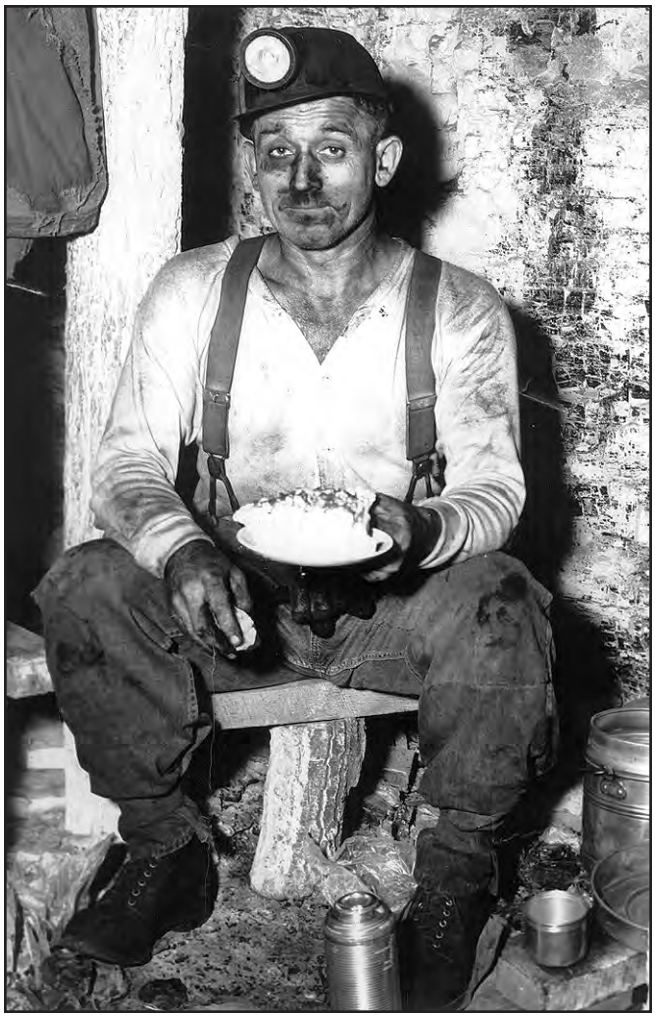


FIGURE 119.—A coal miner eating his lunch inside the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). Note the compartmentalized lunch bucket and electric miner's lamp. Date unknown. Photo courtesy of Charles "Bud" Fry. (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 120, 123, 140-142, 153, 154, 193.)

HUMANITY OF MINERS

Speaking on the humanity of coal miners, McAfee (1991, p. 9) stated:

The miners were also reputed to be gamblers, especially the young and single ones. It is said they gambled, even between digging and shoveling. When a miner had no money to gamble, he might bet the loading of a coal car or two. If he were the loser, his labor paid the cost. But most miners [figs. 116-118] *were family men and did not indulge or risk their hard-earned money on gambling. Miners were said to be a superstitious lot. Meeting a woman on his way to work was supposed to be bad luck, for the miner. Mine rats were believed to be good luck and they were fed tidbits from the miner's dinner pail. A miner never purposely killed a rat because the animals were quick to sense danger from an imminent slatefall. Strange behavior on the part of rats often alerted miners to vacate an area.*

McAfee (1991, p. 9) stated further:

A miner usually started off with a light breakfast, and carried his noon meal in an aluminum bucket made up into three compartments [figs. 119-121]. *The bottom held water, the middle, his pie or cake, and the top held thick sandwiches of homemade bread and meat (often pork chops). There was no lunch hour and men grabbed a bite when they could, as they wanted to load more coal and have a bigger paycheck. When the miner came home, he bathed, changed clothes, and sat down to a big meal with his family. Since the breadwinner always got the choice foods for his bucket, he often left over some goodies for the children who met him after work and looked for the treats. But even the goodies had a mine taste after being underground all day.*

Miners' meal buckets commonly were constructed of aluminum after the turn of the century. Prior to this time, miners' meal buckets were made out of graniteware or tinplated steel.

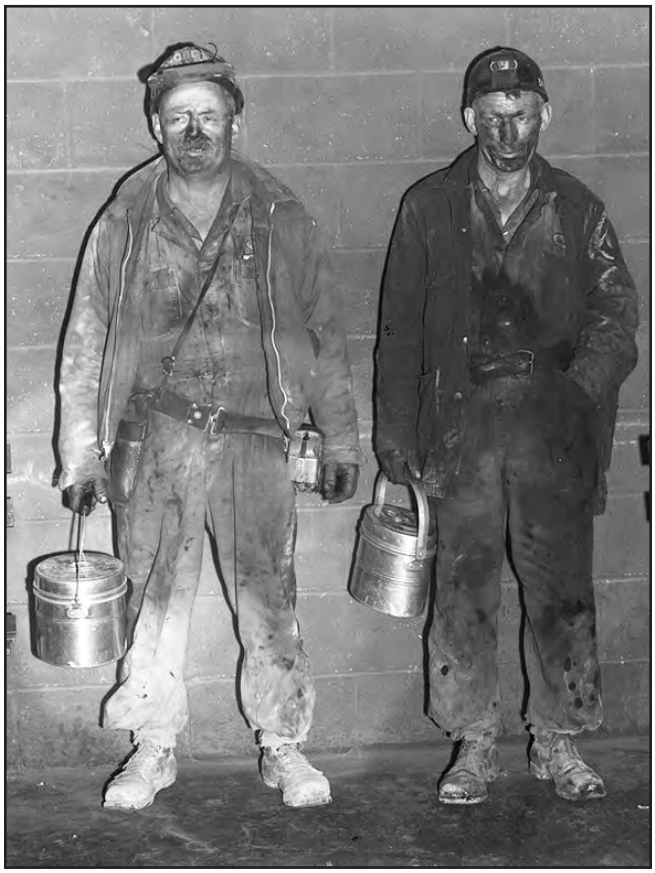


FIGURE 120.—Sooty and weary, these two coal miners, lunch buckets in hand, at the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) are ready to wash up and go home. Date unknown. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 123, 140-142, 153, 154, 193.)

FIGURE 121.—Eager to begin work, three miners at the Hanna Coal Company Piney Fork No. 1 mine (Jfn-261) waiting for the next man trip to take them to their assignments. Note the "WORK SAFE" sign posted overhead in the background. The miner in the middle has yet to get his miner's lamp. Date unknown. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 36, 74, 101, 116, 159.)

FIGURE 122.—Ida Mae Stull of Cadiz, Ohio, was prohibited from mining coal in 1934 by an old Ohio law, when she was discovered mining coal from the Megan mine near Cadiz, Ohio (Gorisek, 1977, p. 12). A court ruling later allowed her to return to mining coal. Born in 1896, *Ida Stull was one of 18 children born to a poor coal mining man—a family so poor that children were put out to work at the age of six or seven, according to Ida's younger sister, Elizabeth, who became a farmhand at the age of seven. Ida Stull was not unique. Other girls worked the small "country bank" coal mines of Appalachia in those Depression days. What made Ida Stull unusual was that she was willing to fight for her right to dig coal* (Gorisek, 1977, p. 12). In providing her personal views of coal mining, Miss Stull stated, *I don't like house-keeping. A pick feels better than a broom. My face gets black but I prefer coal dust to a powder puff* (The New Philadelphia Times-Reporter, May 13, 1994, p. D-2). To Miss Stull, mining coal was a personal adventure. *First you hack yourself a portal in the side of a hill, bracing it with sturdy timbers of oak and locust. You dig 300 feet below the earth, exposing the vein of prized fuel as you go. To loosen the stubborn rock, you drill a hole, needle in the treacherous black powder, light the squib and while the fuse burns, dancing and jumping crazily—you run out of the mine to wait for the blast. Is this any work for a woman? Ida Stull shakes her head, snorting. . . . "I could dig coal faster and better than any man alive"* (Gorisek, 1977, p. 12). Photo *circa* 1935, courtesy of Dale Davis.

WOMEN COAL MINERS

Although some women probably worked in coal mines alongside their husbands or sons, very little has been written concerning women working in Ohio coal mines. One example of a woman coal miner in Ohio is Ida Mae Stull (fig. 122), who was considered Ohio's only woman coal miner in 1934. Miss Stull had worked in Ohio coal mines since the age of 6, *carrying her daddy's lantern to light his way underground* (Gorisek, 1977, p. 12). In March 1934, she was prohibited from mining coal by James Berry, Chief of the Ohio Division of Mines. Berry's action toward Miss Stull was based on . . . *an old Ohio law which forbids women from being coal miners, taxi drivers and other "dangerous" occupations* (Hanna Coal News, March 1934, p. 1). However, following an appeal by Miss Stull to Governor George White, she was allowed to continue mining coal because she was the owner of the coal mine. Attorney General John Bricker stated . . . *women may work in coal mines in Ohio—providing they own the mine. However, they are not permitted to "hire out" as a miner for a wage* (Hanna Coal News, January 1935, p. 7). The near absence of women coal miners is probably because of the superstitious belief that women in coal mines bring bad luck. Some male coal miners held the belief that . . . *a woman is as welcome in a coal mine as a Republican would be in South Carolina or a bad case of itch to a man in a straight jacket* (Hanna Coal News, April 1946, p. 8). In fact, some superstitious coal miners might point out the fact that prior to the explosion in the Willow Grove No. 10 mine in 1940 (see Chapter 6), the mine was visited by several women, including First Lady Eleanor Roosevelt (fig. 123) in April 1935. But no one seems to know where this superstitious belief originated.

FIGURE 123.—First Lady Eleanor Roosevelt touring the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). She traveled 2½ miles into the mine to learn about coal from the men who mined it. Photo courtesy of Dale Davis, from Hanna Coal News (May 1935, p. 8). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 140-142, 153, 154, 193.)

WAGES

There are few accounts of the salary early coal miners earned. Coal miners were paid either on a per-day or per-ton basis. Wages were generally low and quite variable, depending on the thickness of the coal seam being mined. Miners working in thin seams earned higher wages on a per-ton basis than miners who worked in thick seams.

The expense attending the working of a three-feet vein is often considerably greater than working one four feet, exclusive of the dead work. This is a general but not universal rule, and obtains in mines like those of the Mahoning and Tuscarawas Valleys, where the coal varies suddenly in thickness. In such mines, for digging all coal below four feet, 5 cents per ton extra is paid for every 3 inches of decreasing height, until the seam falls to two feet, when it is regarded as unmineable (Roy, 1884b, p. 327).

The State Inspector of Mines (1876, p. 28, 29) offered the following explanation for the apparent disparity of wages when working coal seams of different thicknesses:

The coal of the mines of Washingtonville and Leetonia [Columbiana County], *although only two feet four inches high, costs, in some cases, only sixty-eight cents a ton for digging and loading, while the ten-feet coal of Perry County costs sixty cents a ton. At Leetonia all the coal is sent out as it comes from the workmen's picks, and no powder* [explosive] *is used to get it down. In the thick seam of* [New] *Straitsville and Shawnee* [Perry County] *two layers of slate are interstratified with the* [coal] *bed, to clean which it costs the miner much time and trouble, and in addition about one-fifth of the coal which the miner hews at these thick seams is made into slack* [waste] *and nut coal, for which nothing is paid. In coal-mining the quality of the mineral is of more importance than the height of seam. The miner's ability to produce a given quantity of tons per day is not always in proportion to the height of the seam.*

According to Mather (1838a, p. 6), *In 1838, coal in Ohio was worth from 4 to 18 cents per bushel and a man's daily labor from 50 cents to $1.50.*

Morrow (1956, p. 99) reported,

. . . for a twenty year period following the arrival of the Scioto and Hocking Valley Railroad in 1853-54 practically all the coal mined in Jackson County was used in Jackson. This, more or less, tied the wages of the miners to the standards paid in the major industry—75 cents to 90 cents per day.

Again in Jackson County, in 1878, according to Morrow (1956, p. 100):

. . . the average weekly wages for men [were] *$7.89 and boys $4.02 with employment during 37 weeks in the year. If the average is figured on* [the] *basis of 52 weeks these rates would be reduced to $5.68 and $2.83 respectively. The rate of pay for pick mining was the basis for all wages.*

By 1863, coal miners working the mines of the Mahoning Valley area could earn as high as $220 a month. *Their pay ranged from $2.05 per ton for mining a coal vein 2½ feet thick to $1.70 per ton for coal 4½ feet thick. More money was realized in the smaller veins* [because of working a coal relatively free of impurities and the excessive difficulty in working in such a confined space]. *Many strikes occurred . . .* (Hubbard News, September 13, 1934).

Again in the Mahoning Valley area, during the 1870's-1880's and later, *no electric power* [in mining] *was used . . . . If a miner earned as high as $3 a day he felt he was getting big money, mine cars could hold 1½ tons. Two cars was a good day's work* (Youngstown Vindicator, January 19, 1930).

The use of scrip (see Chapter 4) as payment also made determination of wages complicated. After passage of the Jones Law by the Ohio legislature in 1885 making the use of scrip and selling store goods or supplies to employees at excessive prices illegal (Tribe, 1989, p. 54), Ohio coal miners worked for companies that paid salaries in currency.

In 1897, average earnings of the miners of Ohio were $192.05 for the entire year; equal to $16.00 per month (Morrow, 1956, p. 104). In Jackson County the average daily wages remained under $2 from 1890 until 1903. By 1920 the these wages increased to $6.90. Following the severely depressed economic conditions during the late 1920's, the average daily wages were separated into categories of inside (underground mines) work and outside (including surface mines) work. By 1933, wages fell to $3.60 for outside work and $4.60 for inside work. These wages remained below $6 until 1937 for inside work and 1941 for outside work. During World War II, wages increased steadily, exceeding $10 per day for outside work in 1945 and for inside work in 1946. Following World War II, daily wages continued to increase, reaching, in 1956, $18.93 for outside work and $20.25 for inside work (Morrow, 1956, p. 109). According to annual reports of the Ohio Division of Mines, the average annual wages of coal-mine workers were: $3,351 in 1950, $5,500 in 1960, $9,522 in 1970, and $22,338 in 1980. Beginning in 1981, the Ohio Division of Geological Survey began maintaining and reporting on employment, wage, and production statistics of Ohio's mineral industries, including coal. In 1993, the average annual wages of all Ohio coal miners had risen to $35,734; the average wage for surface miners was $32,566, compared to $41,252 for underground miners.

The greatest complaints of the early miners included wages, company stores, and company houses. These complaints often escalated into work stoppages or strikes by the coal miners.

WORK STOPPAGES

One of the most famous strikes by Ohio coal miners occurred in the Hocking Valley area in 1884. Prior to 1884, miners in the Hocking Valley area were earning 80 cents per ton, but other mining districts were paying out 5 to 10 cents per ton more because the seams of coal were thinner than that in the Hocking Valley area. The coal in the Hocking Valley area, the Middle Kittanning (No. 6), is renowned in Ohio for its thickness of as much as 14 feet. *However, in spite of its great thickness, this coal contains two bands of shale, and frequently a band of bone coal, which have to be sorted out* [by hand] *by the miner, which militates considerably against his producing power* (Roy, 1884b, p. 327) (fig. 124). Low wages and the disparity in wages between mining districts led to many strikes in the Hocking Valley area. Roy (1906, p. 222) made the following observation concerning the miners of the Hocking Valley area at the time:

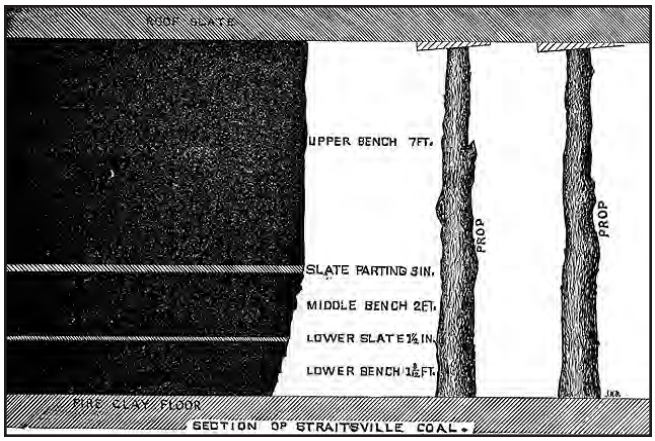


FIGURE 124.—Diagram of the Middle Kittanning (No. 6) coal in mines of the Hocking Valley area (from Roy, 1884b, p. 326).

The miners had abundant leisure, and as Satan finds some mischief for idle hands to do, they employed their idle time in the discussion of real or imaginary grievances. The more a matter is discussed, the more important it becomes. The mine committees, which were established at every mine in the valley, called meetings during working hours on frivolous matters, and sometimes as many as three strikes were inaugurated in a single day. The patience of the operators was put to the utmost test, and they seized every favorable opportunity to revenge themselves on their fault-finding and obstreperous workmen.

To remain competitive with other coal-mining districts in the state in 1883, the coal companies in the Hocking Valley area consolidated into two companies, the Ohio Coal Exchange and the Columbus & Hocking Valley Coal & Iron Company; the latter company was generally known as the "Syndicate." During 1884, the market for coal was severely depressed and the Hocking Valley companies were paying their miners 70 cents per ton and offering work of only 4 to 10 days per month (State Inspector of Mines, 1884, p. 33). On June 20, 1884, the miners were notified by the Syndicate of a wage reduction to 60 cents an hour. This offer was rejected by the area's nearly 3,000 miners, who went on strike on June 23. On July 14, 250 Italians were brought in at $1.40 per day to work in the mines. Shortly thereafter, an additional 1,250 men were employed to replace the striking miners. All of the newly hired workers were protected day and night by armed guards. Throughout the strike, which lasted until March 18, 1885, there were numerous disturbances, which caused Governor George Hoadly to send four companies of the Ohio militia into the area between August 31 and October 3, 1884, to help maintain peace (figs. 125, 126).

Commenting on the desperate conditions in the Hocking Valley due to the miners' strike, a correspondent for Frank Leslie's Illustrated Newspaper (December 20, 1884, p. 283) wrote,

The women seem even more determined than the men to resist the operators. One woman with scarcely enough clothing to cover her, said: "I will go out and lie down on the bank of the creek and die with my baby in my arms before I will allow my husband to work for fifty cents a ton."

The railroad people have boycotted the mines of Mr. W. P. Rend, who is about the only proprietor on the miner's side, while the syndicate continues to import Italian and Hungarian immigrants, and to guard the miners with troops and fortifications. In Buchtel alone there are fifty guards; and strong forts, from which half a dozen men could repel an army, have been built on the hill-tops and at the entrances to the mines. These positions are guarded night and day, and every night a patrol train runs over the branches of railroad which penetrate the disturbed districts.

Another perspective of the miners' strike is provided by a correspondent for Harper's Weekly (December 1884, p. 861), who wrote:

The strike of the coal miners in the Hocking Valley region of Ohio has been one of the most important, most expensive and most costly that the country has ever seen . . . . The Hocking Valley coal miners are unusually favored . . . . [The coal of the area] *lies in veins varying from nine to thirteen feet in thickness. This fact, with the comparative softness of the coal, makes it very easy to mine, as the men can work at it in an erect posture, and not, as in many of the* [Ohio] *mines, cramped on their hands and knees. It also favors the use of machinery, steam-drills, and steam-cars for drawing out. But the Miner's Union has from the start been a very powerful and close organization in the Hocking Valley, and it has steadily resisted all propositions to introduce machinery. The union has moreover, limited the amount of coal that any one man could dig to three and a half tons per day, and has been very exacting in the same spirit in other regards. The pay has been pretty uniformly seventy cents a ton. The owners of the mines have therefore not only had but little profit from their natural advantages, but have had to keep the price of coal so high throughout the valley that the iron furnaces in the region have been unable to compete with those of other regions, and a number of them have on this account closed down within the past year.*

The company announced a cut in wages from seventy cents to sixty cents, and the men went out on strike. The company immediately suspended all work, and as rapidly as possible put machinery into their mines . . . . The com-

FIGURE 125.—Sketch of the Hocking Valley miners' strike. The illustration and following comments are from a correspondent for Harper's Weekly (v. 29, January 3, 1885, p. 4, 7): *Mouth of the mine at Buchtel. The indications are that this disastrous strike is practically at an end. Many of the miners are returning to work, although more than two thousand are still idle . . . . Great sympathy is felt for the distressed miners and their families, and influential men are making strong endeavors to effect a compromise, as well as to prevent violence toward the imported laborers. It seems probable that these efforts will be successful, although the Miner's Association as a body still endeavors to prevent individual members from acting on their own responsibility.* Illustration courtesy of Ohio Historical Society.

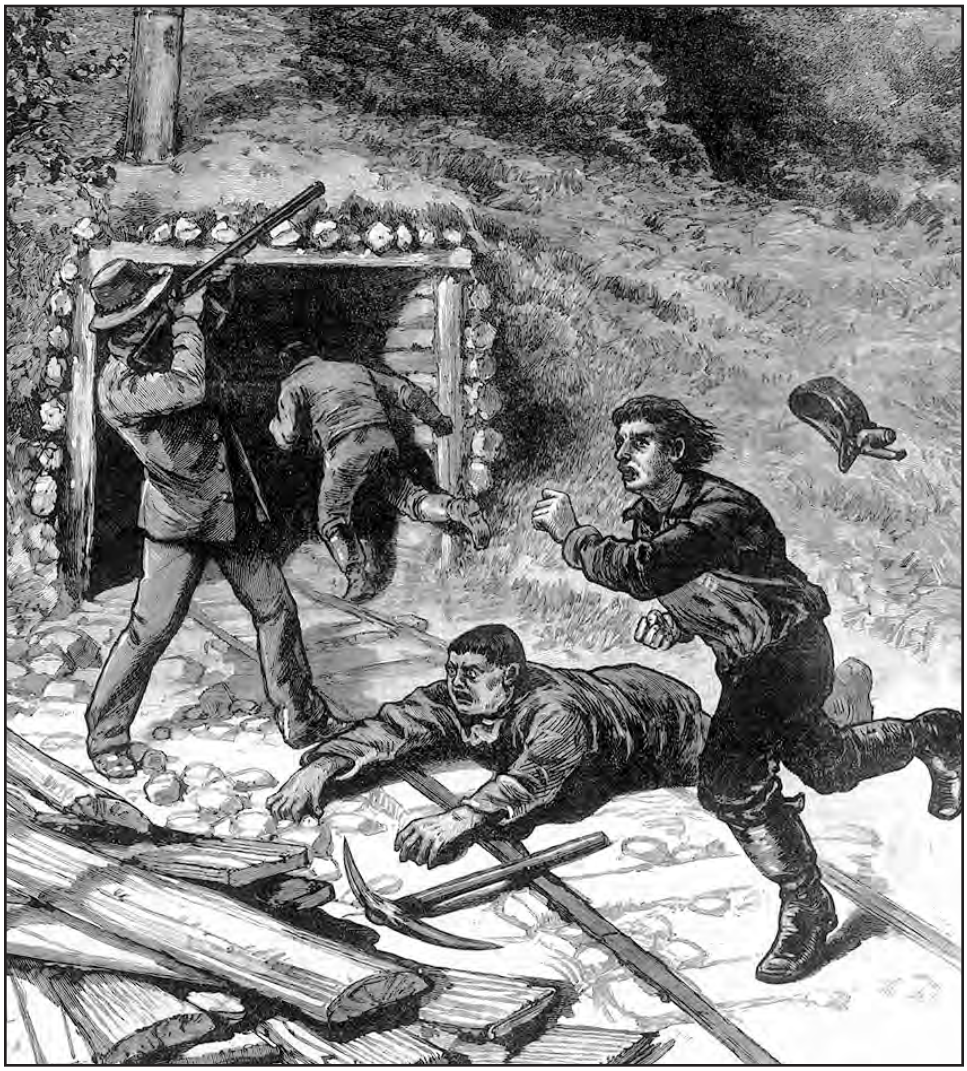


FIGURE 126.—Sketch of the Hocking Valley miners' strike. The illustration and following comments are from a correspondent for Frank Leslie's Illustrated Newspaper (v. 59, November 1, 1884, p. 161, 167): Mine no. 25. *A Pinkerton guard is exchanging shots with a belligerent party on the hillside, while two or three terrified "black-leg" miners scramble frantically for the friendly shelter of the pit mouth. Guards armed with Winchester rifles protect the mines and such Hungarians and Negroes as have been brought in to replace the strikers.* Illustration courtesy of Ohio Historical Society.

pany won over the "bank bosses" from among the strikers to act as instructors, and brought in a lot of new men. They were obliged to have them guarded by Pinkerton's detectives, heavily armed. The strikers became violent, fired into a train loaded with new men, surrounded the lodging-house where the new men were, drove out some of them, and beat them badly. Then the company went a step further, and ejected all the strikers living in the company's houses, brought in more men, and doubled their guards. The men became even more desperate. The winter was upon them. They were homeless, and literally suffering for food.

[On Sunday, August 31, 1884, the strikers attacked a mining facility near Logan.] *One guard was killed and two others were badly wounded. However the assailants were repelled by the guards. During the melee the buildings connected with the mine were* [set on] *fire, and a considerable amount of property was destroyed . . . . Telegraph wires in every direction were out . . . . Governor Hoadly was beset by telegrams from sheriffs in the valley that riot, bloodshed, and murder were spreading in all directions, and they were powerless to preserve the peace.*

On October 11, 1884, coal was set on fire in five mines near New Straitsville and Sand Run, one mine at Carbon Hill, and one mine at Shawnee (State Inspector of Mines, 1884, p. 40). Abandoned mine maps (Py-35 and Py-69) have several notations identifying coal mines which were set on fire by the striking miners (figs. 127, 128). Most of these fires were extinguished; however, some fires continue to burn 110 years later. Much valuable coal has been destroyed. In the first 50 years of burning, it is estimated that the mine fire of the Shawnee-New Straitsville area spread over an area of 6 square miles and consumed millions of tons of coal (Forbes and others, 1934, p. 3) (fig. 129). During the mid-1930's the Depression-born Work Progress Administration, employing about 300 men, failed in three separate projects to extinguish the mine fire (Columbus Dispatch Magazine, February 21, 1967, p. 17).

Every now and again, the mine fire burns through to the surface and becomes a point of considerable public attraction (figs. 130, 131) and concern, as is evidenced in the following comments:

A part of New Straitsville is being undermined by the fire. A schoolhouse was recently condemned and abandoned because of being directly over a section invaded by flames. A short distance from where the schoolhouse stands smoke curls from a mine crater. Sooner or later the ground on which the building stands will collapse (The Coal Trade Bulletin, 1918, v. 39, no. 12, p. 60).

The blaze is an inferno and the draft forces the flames nearly 100 feet and it can be seen for miles along the hills, resembling a volcano. It is said that the wall of fire extends more than three miles . . . . A number of dwellings in the new line of fire will shortly be razed. There are great fissures in the earth near New Straitsville as a result of the fire (The Coal Trade Bulletin, 1922, v. 47, no. 11, p. 440).

The mine fire caused a portion of Ohio Route 216 southeast of New Straitsville to subside and buckle, resulting in the posting of "mine fire" highway signs (fig. 132) and requiring the construction of a new highway to by-pass the affected area (Columbus Dispatch Magazine, February 21, 1960, p. 17; Cleveland Plain Dealer, March 26, 1968, p. 14). Reports of the mine fire are as recent as May 1993 (Ohio Division of Reclamation, personal communication, 1993).

Work stoppages due to labor unrest in the coal-mining industry, as in any business, generally have a negative effect on a particular year's production. Between 1952 and 1991 there were 18 major strikes involving Ohio's coal-mining industry (table 3). Most of these strikes occurred from 1970 to 1981 and were related to contract negotiations of the United Mine Workers of America. These stoppages were coincident with decreases in annual coal production in Ohio.

TABLE 3.—MAJOR WORK STOPPAGES BY COAL MINERS IN OHIO

Year	Duration	Reason
1884	6 months	Wage dispute
1897	51 days	Wage dispute
1914	5 months	Wage dispute; Run of Mine Law, which changed the system of weighing and paying for mined coal
1919	NA	NA
1946	NA	NA
1949	NA	NA
1952	15 days	Wage increase
1964	18 days	Dissatisfaction with UMWA-BCOA agreement
1965	20 days	Sympathy for layoffs of West Virginia mine workers
1966	17 days	Contract
1968	12 days	Sympathy for jailed pickets in Pennsylvania
	31 days	Contract
1969	24 days	Black lung legislation
1970	4 days	NA
	24 days	NA
1971	7 days	Sympathy for federal decision ordering UMWA President W. A. Boyle to step down as trustee of the UMWA Welfare and Retirement Fund
	57 days	Contract
1974	41 days	Contract
1975	23 days	Delay in distribution of bituminous coal contract
	48 days	Safety dispute
	43 days	Delay in implementing grievanvce procedure
1976	31 days	Contract
1977-78	111 days	Contract
1981	72 days	Contract

NA = not available.

Sources: 1884 and 1897: Roy (1906)
1914: State Inspector of Mines (1915)
1919: Encyclopedia Brittannica (1978)
1949-1976: Le Grande (1977)
1977-1981: Ohio Mining and Reclamation Association (1988)

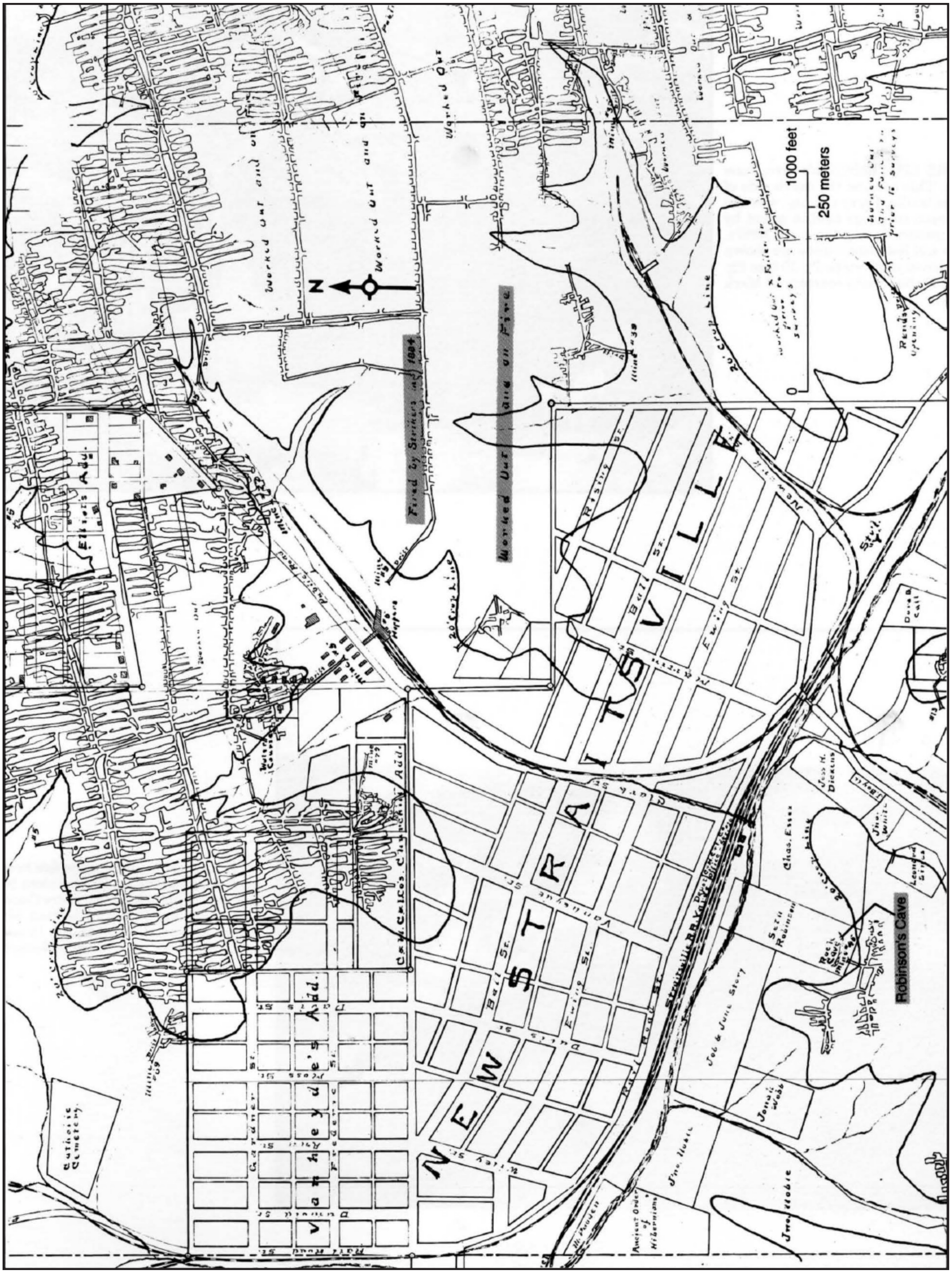


FIGURE 127.—Portion of the map (Py-35) of the Columbus & Hocking Coal & Iron Company coal mines at New Straitsville, in Coal Township, Perry County. This map shows several notations of mines set on fire during the 1884 Hocking Valley coal miners' strike. The rock cave on Seth Robinson's property (see fig. 128) also is no

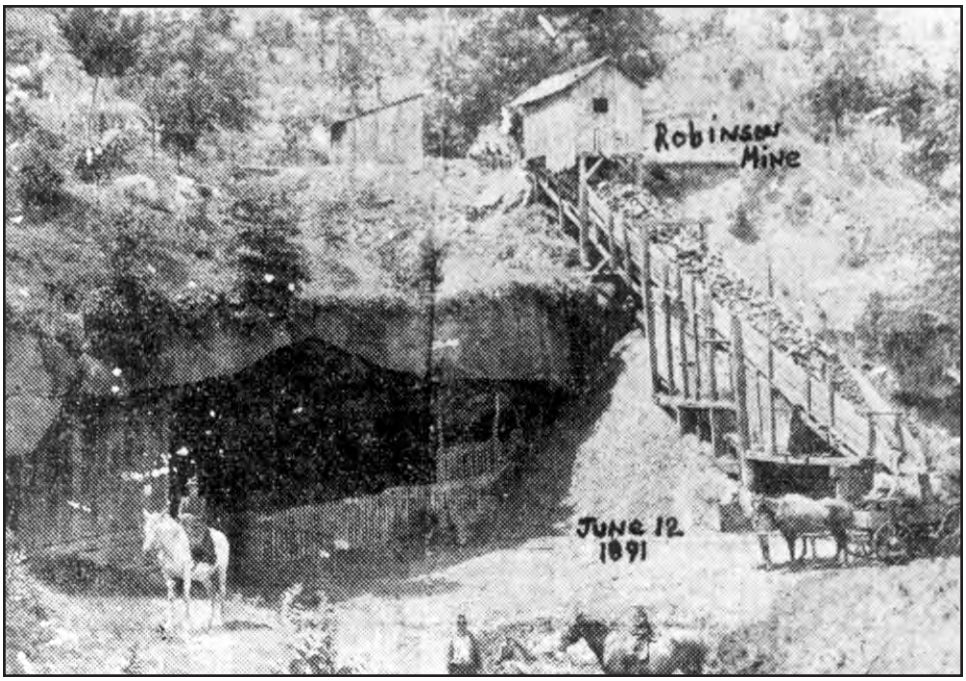


FIGURE 128.—Robinson's cave, June 12, 1891. This cave on the south side of New Straitsville, Perry County, was the site of union meetings held in secret by the coal miners during the early 1890's. The cave and Robinson's mine are shown on abandoned mine maps Py-35 (see fig. 127) and Py-69. Photo courtesy of Mark Wharton.

FIGURE 129.—Coal-mine fire breaking through to the surface between New Straitsville and Shawnee, Perry County. Photo was published in United Mine Workers Journal, 1938, March 15 issue, p. 17. Photo courtesy of Ohio Historical Society.

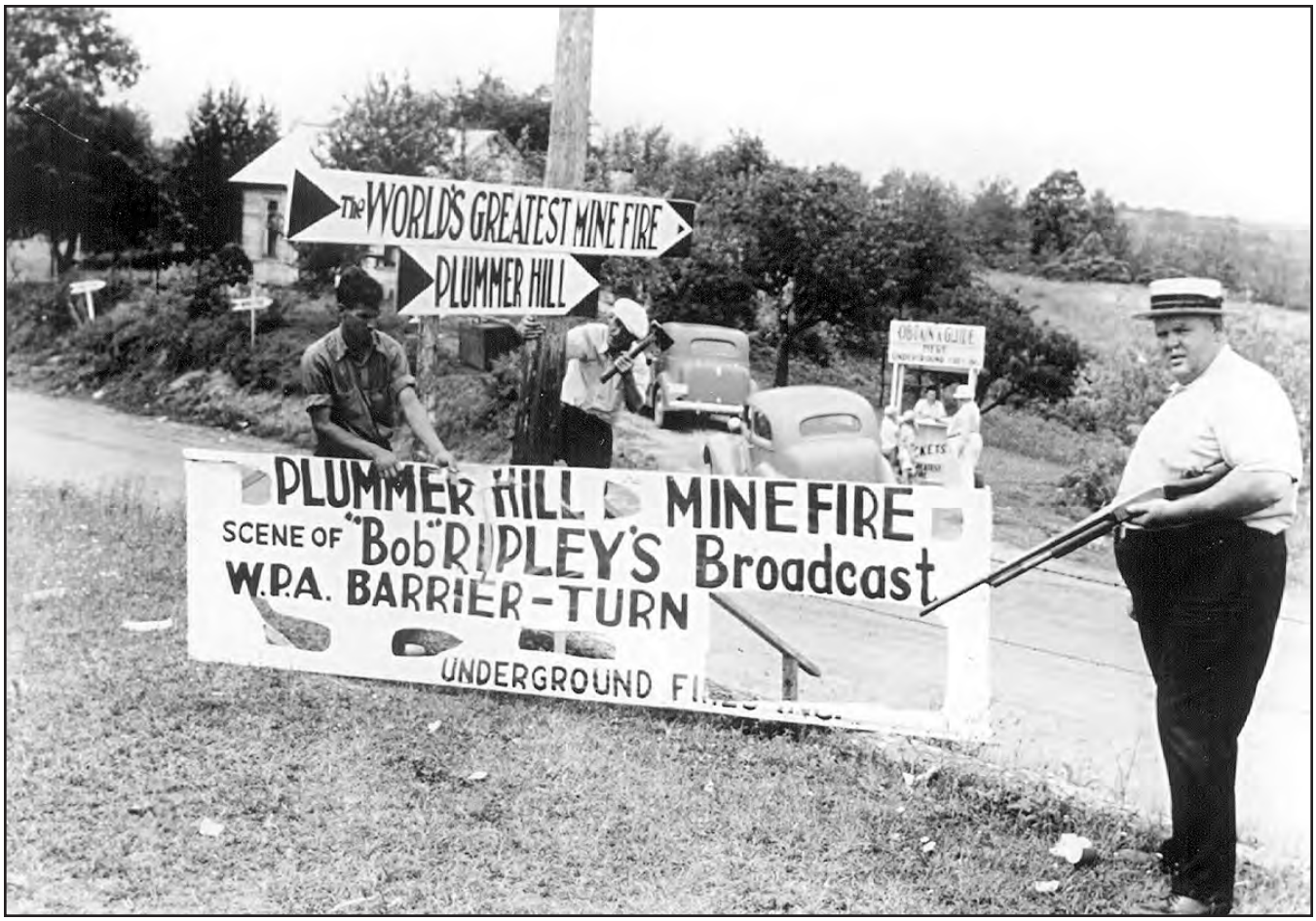


FIGURE 130.—The novelty of smoke rising through fissures in the ground and heat sufficient for cooking (see fig. 131) radiating from an underground coal-mine fire brought tourists to New Straitsville, Perry County. Tour companies, such as Underground Fires, Inc., and Subterranean Fires Company, competed so fiercely for business they required armed guards to protect their attractions. Date unknown. Photo courtesy of The Plain Dealer. Reprinted with permission.

FIGURE 131.—Heat generated from the underground coal-mine fire near New Straitsville could boil water for instant coffee and cook eggs in a frying pan. Date unknown. Photo courtesy of The Plain Dealer. Reprinted with permission.

FIGURE 132.—"MINE FIRE" signs were posted along Ohio Route 216 near New Straitsville cautioning travelers of potential dangers (subsidence and smoke) from an underground coal-mine fire. Date unknown. Photo courtesy of The Plain Dealer. Reprinted with permission.

UNIONS

The beginning of the United Mine Workers of America in the form of local and district organizations dates back to about 1845 and the formation of trade unions by British immigrants (Roy, 1906, p. 58). The American Miner's Association, formed in the southern Illinois coal fields in January 1861, was the first national organization of coal miners. By March 1863, this organization was established in the Massillon, Ohio, coal-mining district, and by 1865 had spread throughout the coal fields of Ohio. But, by 1867, because of internal dissension, only a few locals remained. About 1867, the Miner's and Laborer's Benevolent Association was formed in the anthracite region of Pennsylvania and spread into Ohio shortly after the collapse of the remaining locals of the American Miner's Association. In October 1873, a national convention of coal miners met in Youngstown, Ohio, and formed the National Association of Miners (Watkins, 1937, p. 40). This organization absorbed the Miner's and Laborer's Benevolent Association and tried in vain to organize coal miners on a national level but lasted only two years. From 1870 to 1885, the Knights of Labor, a secretive organization, united mine workers on a local level (Eavenson, 1942, p. 378). In 1885, coal-mine workers were again organized nationally through two associations: the Nation Union of Miners, which became the National Progressive Union in 1889, and the National Assembly of Miners of the Knights of Labor. Considerable animosity existed between the two unions at the expense of the worker and working conditions, until January 25, 1890, when the two unions joined forces in Columbus, Ohio, to form the United Mine Workers of America (UMWA) (Roy, 1906, p. 262-263). John McBride, a native Ohioan from Wayne County and a coal miner since the age of 15, presided over this historic meeting. McBride also was a state senator, president of the National Progressive Union, and the second president of the United Mine Workers of America (1892-1895) (Watkins, 1937, p. 64).

The membership of the UMWA was initially 24,000. By 1920 the membership of the UMWA had grown to 375,000 on the strength of its ability to establish regional wage and pricing scales which were equitable. However, because of a decline in the demand for coal following World War I and an inability to meet competitive pricing by nonunion mines and to establish an equitable wage scale for its members regionally during the 1920's, the membership of the UMWA dropped to 80,000 by 1929 (Perry, 1981, p. 76). However, the UMWA was revitalized in 1933 with passage of the National Industrial Recovery Act, which gave the UMWA the right to organize and bargain collectively (Coal Age, 1986, p. 125). This legislation provided a vehicle through which coal miners could strive toward better working conditions, a higher standard of living as a result of equitable wages and a realistic pricing competitiveness, and a fulfillment of the ideology of the UMWA, which is voiced by these words from the preamble of the 1890 constitution of the UMWA:

There is no fact more generally known, nor widely believed, than that without coal there would not have been any such grand achievements, privileges and blessings as those which characterize the nineteenth century civilization, and believing, as we do, that those whose lot it is to daily toil in the recesses of the earth, mining and putting out this coal which makes these blessings possible, are entitled to a fair and equitable share of the same, therefore, we have formed "The United Mine Workers" of America, for the purpose of more readily securing the objects sought, by educating all mine workers in America to realize the necessity of unity of action and purpose, in demanding and securing by lawful means the just fruits of our toil . . . .

Chapter 6

PERILS OF MINING COAL UNDERGROUND

MINING CATASTROPHES/DISASTERS

Conditions under which early coal miners worked were commonly poor and unsafe and received little public notice except, unfortunately, only through mining catastrophes (table 4). One of the first mine disasters in the United States occurred in 1856, about *11 a.m., on Friday, April 25* (Howe, 1900, p. 342), near Blue Rock, Harrison Township, Muskingum County, *at the confluence of Blue Rock Creek and the Muskingum River* (Gilmore, 1856, p. 8). Four men survived a 14-day imprisonment in a mine in which the pillars had ruptured. Of the Blue Rock mine (Mm-112) disaster the State Inspector of Mines (1876, p. 160, 161) reported,

The whole hill came down over a large area of the mine excavation and imprisoned four of twenty miners who were underground when the crush came on. The miners who escaped, and all the workmen of the surrounding mines, as well as hundreds of people in other occupations of life, worked heroically for fourteen days and thirteen hours, rescuing the imprisoned miners. The unfortunate men were supposed to be dead after the first week of imprisonment, but on Thursday of the second week one of the rescuers heard the sound of human voices beyond the fall, and called the attention of his comrades to the fact. A miner, named Edwards, shouted through the rocks, and was immediately answered. The four entombed men were all alive, but were in the dark, the black damp having accumulated and put out every light in the mine. They were all got out alive and soon recovered [fig. 133]. *Two of them are now dead, but the other two, Edward Savage* [fig. 134] *and William Edgell, are still pursuing their perilous occupation. Edgell was a soldier during the war of the rebellion* [Civil War], *and had his left arm, below the elbow, shot away in battle. He now has a wooden arm and iron hand, and still swings his pick with the energy of former years.*

According to Howe (1900, v. 2, p. 342),

The point at which the miners were rescued was about 700 feet from the entrance of the mine, and it had been necessary to burrow through about 400 feet of earth and rock before

TABLE 4.—NOTABLE OHIO COAL-MINE DISASTERS

Year	Date	Mine name	Location	Cause	No. of casualties
1872	July 3	Atwater Slope	Atwater Twp., Portage Co.	mine fire	10
1877	July 11	Brookfield	Brookfield Twp., Trumbull Co.	asphyxiation	7
1881	Feb. 10	Robbins (Rock Hill)	Center Twp., Columbiana Co.	explosion	6
1906	Nov. 3	San Toy No. 1	Monroe Twp., Perry Co.	shaft fall	5
1910	April 21	Amsterdam	Springfield Twp., Jefferson Co.	explosion	15
1913	May 17	Imperial (Noble)	Noble Twp., Noble Co.	explosion	15
1919	Oct. 29	Mine No. 2	Springfield Twp., Jefferson Co.	mine fire	20
1925	Dec. 23	Webb	Mead Twp., Belmont Co.	mine fire	9
1930	Nov. 5	Mine No. 6	Dover Twp., Athens Co.	explosion	82
1931	Jan. 3	Midvale No. 4	Warwick Twp., Tuscarawas Co.	explosion	5
1937	June 21	Rupert	Bloomfield Twp., Jackson Co.	explosion	6
1940	Mar. 16	Willow Grove No. 10	Richland Twp., Belmont Co.	explosion	72
1940	Nov. 29	Nelms	Green Twp. Harrison Co.	explosion	31
1943	Jan. 10	Belle Valley No. 1	Noble Twp., Noble Co.	explosion	3
1944	July 5	Powhatan No. 1	York Twp., Belmont Co., and Switzerland Twp., Monroe Co.	mine fire	66

Sources: Adams and others (1941), Humphrey (1959), Keenan (1963), O'Malley (1891).

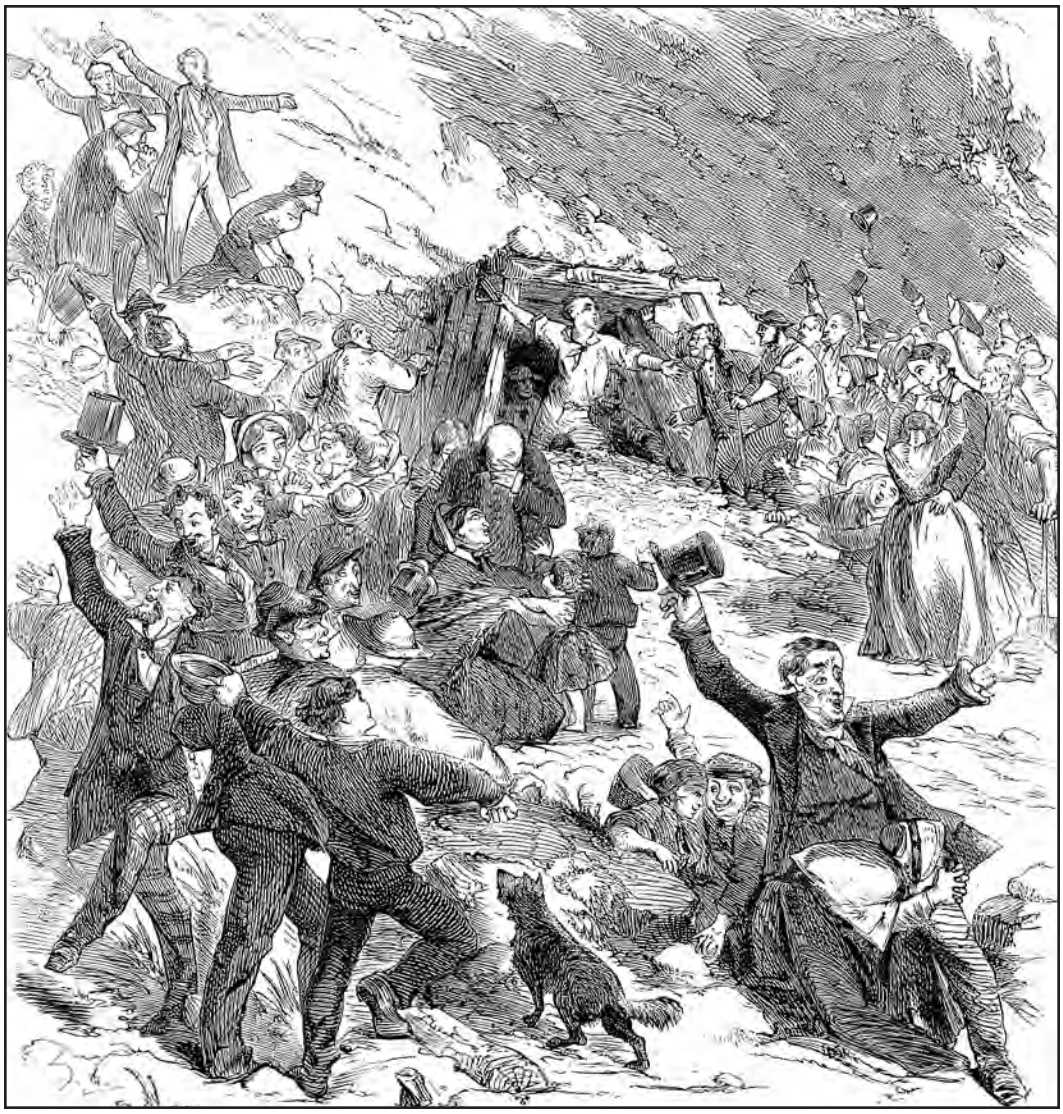


FIGURE 133.—Top, scene illustrating the excitement at the announcement of the rescue of the trapped miners from the Blue Rock mine (Mm-112) in 1856. Bottom, rescued miners are led from the mine. Illustrations from Frank Leslie's Illustrated Newspaper (May 31, 1856, p. 388).

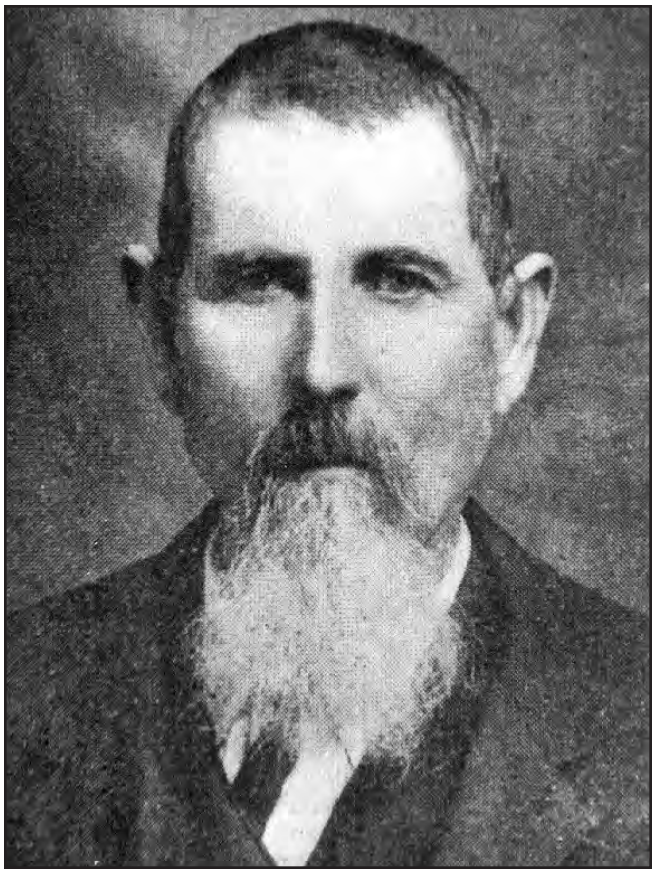


FIGURE 134.—Edward Savage in his later years. When he was 16 years old, Savage was one of four men rescued 14 days after the Blue Rock mine (Mm-112) cave-in. Photo courtesy of Mark Wharton.

they were reached. The men survived by drinking water which had collected in a depression on the mine floor.

In June 1865, nine miners were killed in an explosion at the Rolling Mill Shaft mine (Jfn-83) at Steubenville (State Inspector of Mines, 1884, p. 82). On July 3, 1872, a fire in a slope mine near Atwater, Portage County, claimed the lives of 10 coal miners (Roy, 1906, p. 127-128). There were 21 miners in the mine when the support timbers of the slope opening caught on fire (O'Malley, 1891, p. 155).

The worst coal-mining disaster in Ohio history occurred at 11:45 a.m., Wednesday, November 5, 1930, in the No. 6 mine (As-142) (fig. 135) of the Sunday Creek Coal Company at the town of Millfield, in Athens County. A total of 82 men were killed—73 employees, five company officials, including W. E. Titus, the president of Sunday Creek Coal Company, and four visitors (Smith, 1930, p. 1; Harris, 1957, p. 99). On that day an explosion was triggered by a rock fall that broke an electrical (trolley wire) cable, which then shorted against an underground train rail, producing an arc which ignited a pocket of methane gas that had collected in that portion of the mine (Columbus Dispatch, November 4, 1990, p. 4D).

When the explosion occurred, there were 230 men in the mine. Fortunately, 119 of these men were [in parts of the mine] *away from the explosion. These men were thrown about by the force of the explosion but none of them were seriously injured and all of them were able to leave the mine by the main motor road which was the intake airway of the mine* (Smith, 1930, p. 1).

A few miners survived by climbing out a ventilation shaft, and an additional 17 miners, protected from a deadly cloud of carbon monoxide by ventilation partitions, were rescued 10 hours after the blast (figs. 136-138). Apparently most of the miners were killed by asphyxiation from the carbon monoxide that resulted from the ignition of the methane gas. This mine was reopened a month later and operated until it closed in 1945. As a result of this mine explosion,

fifty-nine women were widows and seventy-nine sons and seventy-five daughters of various ages, were made fatherless. The health of the few who survived was wrecked in a number of cases. Many families were several times sorrowed—one mother lost five sons (Harris, 1957, p. 99) (fig. 139).

The No. 6 mine (formerly known as the Poston No. 6) was opened by the Millfield Coal Mining Company and leased to the Poston Consolidation Company in 1911. In September 1929, Sunday Creek Coal Company acquired the coal rights to Poston No. 6. When mine No. 6 was taken over by the Sunday Creek Coal Company, it was in very poor condition. Sunday Creek Coal Company made extensive improvements, and all recommendations made by state mine inspectors had been complied with except the installation of a ventilation fan at a newly constructed air shaft. The installation of the fan would have been completed in less than a week had the explosion not intervened (Ray and Bonnet, 1930, p. 21). It is sadly ironic that the explosion took place when an official party was touring the mine to inspect new safety devices that had been installed in connection with the newly constructed air shaft (Watkins, 1937, p. 7).

Another major mine explosion occurred in the Hanna

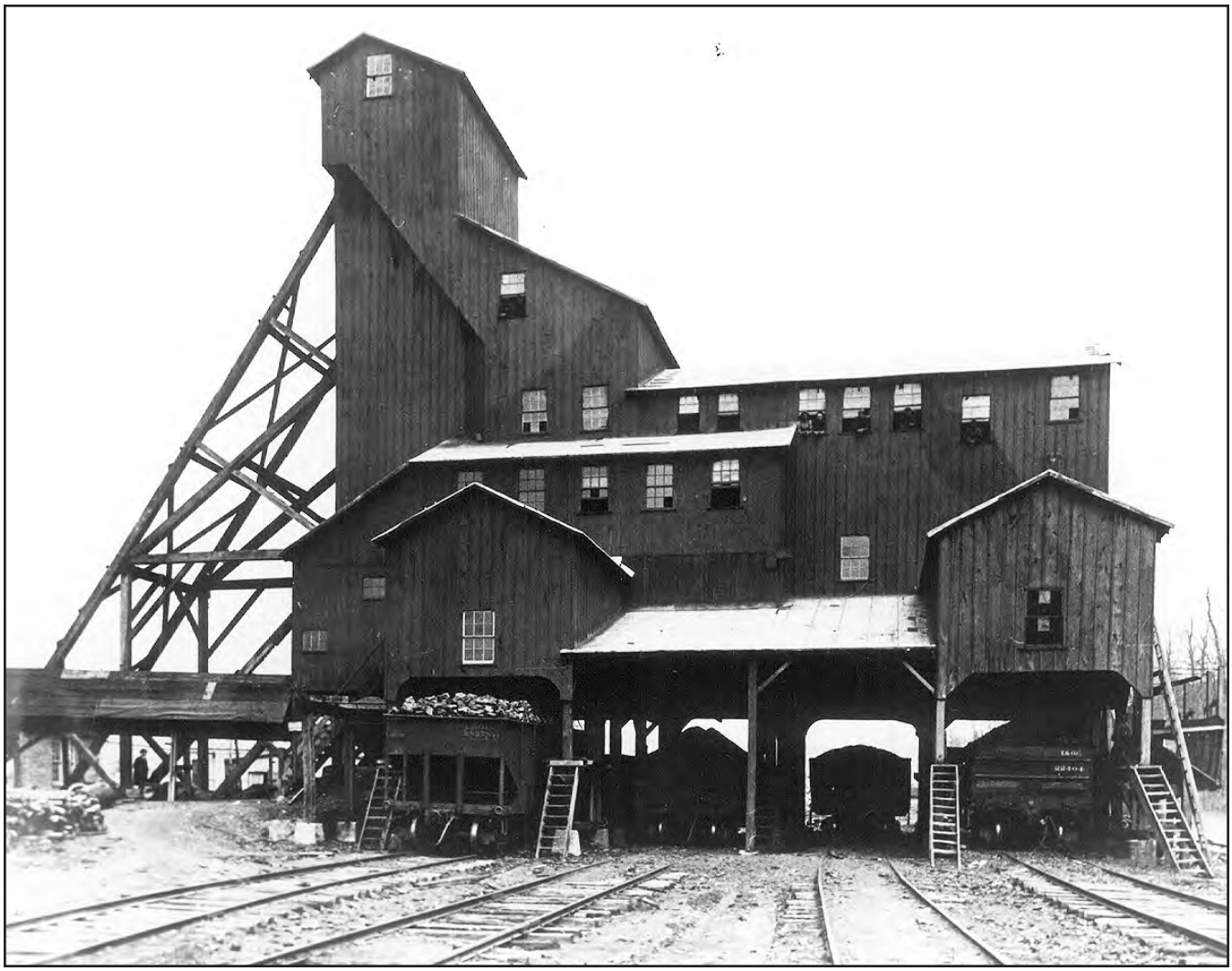


FIGURE 135.—Hoisting-shaft headframe and tipple of the Sunday Creek Coal Company mine No. 6 (As-142). This mine is about 1 mile east of Millfield, in Dover Township, Athens County, and was the site of Ohio's worst coal-mine disaster in 1930. *Circa* 1940. Photo courtesy of Walter R. Ervin.

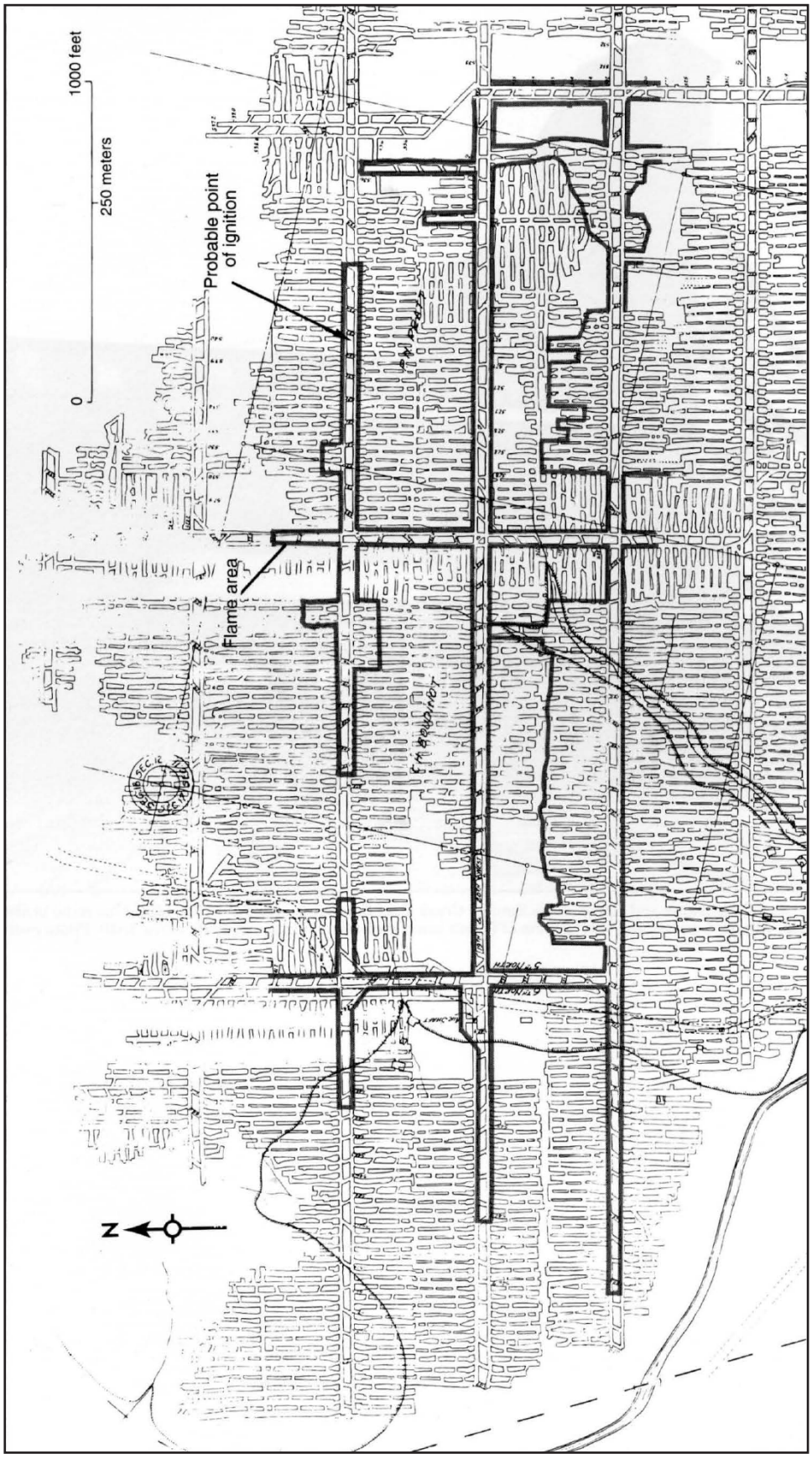


FIGURE 136.—A portion of the abandonment map of the Sunday Creek Coal Company mine No. 6 (As-142) (modified from Humphrey, 1959, p. 126). This map highlights the extent of the mine workings (shaded outline) as of November 5, 1930. Also shown are the locations of the casualties, those miners who were rescued, and the probable point of ignition for the methane-gas explosion. (See also figs. 137 and 138.)

Coal Company Willow Grove No. 10 mine (Bt-163), between St. Clairsville and Neffs, in Richland Township, Belmont County, at about 11:05 a.m., March 16, 1940 (figs. 140-142).

Seventy-two men were killed as a result of this explosion, of which number 66 were killed outright by burns and violence, three were killed by burns and afterdamp, two were asphyxiated, and one died six days later from the effects of carbon monoxide poisoning. One additional man was severely burned and injured by the explosion and two others were severely injured by a rock fall while engaged in recovery work 11 days after the explosion. Twenty-two others were overcome by afterdamp, rescued [fig. 143], *taken to the surface, and revived, and 79 uninjured men were temporarily imprisoned and five hours later led to the surface through the air shaft by rescue parties. A total of 176 men were in the mine at the time of the explosion* (Forbes and others, 1940, p. 1).

The Willow Grove mine explosion apparently was caused by the firing of a shot charged with black (pellet) powder which ignited excessive ambient coal dust. Normally coal dust is allayed by spraying water during the mining process and by rock-dusting the mine walls after the mining process; apparently both procedures were little used in the Willow Grove mine prior to the explosion (compare fig. 35, a photo of this mine taken in 1953). The Willow Grove No. 10 drift mine, which had opened in 1917, continued to operate until it was abandoned in 1954.

One coal-mine disaster that had a happy ending occurred at the Betsy No. 3 mine (Jfn-258), located south of Fernwood, in Cross Creek Township, Jefferson County. *At approximately 7:45 A.M. on June 26, 1957, a cave-in occurred at the Betsy No. 3 mine of the Powhatan Mining Company that resulted in the entombment of five workmen* (Dusz and others, 1957, p. 1).

The openings of this drift mine in the Pittsburgh (No. 8) coal were constructed into the base of a surface-mine highwall. The area adjacent to where the men were entombed had been mined out by a series of auger holes and room-and-pillar mining. Apparently, the cave-in was caused by the removal of too large an amount of coal and leaving pillars too small in size. The five mine workers were rescued by using a coal auger to drill large-diameter holes horizontally into the coal seam (fig. 144). On the third attempt, the coal auger drilled into the room where the miners were trapped, and the men were freed (fig. 145) at 10:50 p.m., a little over 15 hours after they had been trapped. Mining continued at the Betsy No. 3 mine until it was abandoned in 1960.

OHIO'S MINE LAW

Coal-mining disasters and near mining disasters in Ohio and neighboring states during the mid-1800's led Ohio to pass pioneering legislation in 1874 governing the regulation, ventilation, and inspection of underground mines in Ohio. Ohio's mine law of 1874 was the first legislation in the nation enacted by state authority to provide protection to bituminous coal miners (Humphrey, 1959, p. 11). Of significance to this legislation was the provision for the regular inspection of coal mines by state authority. Those found not in compliance with the law could be fined up to $500. The Mine Law of 1874 was preceded by three other mining-related acts. The first Ohio mine law was passed in 1871 under the heading of "Mines." This law provided for the *surveying of mines, and its object was the protection of persons owning mineral lands, adjoining mines in operation, in case of trespass by the operators of such mines* (Roy, 1888, p. 21).

A second mine-related act in 1871 created a mining commission to report to the Governor and the General Assembly on the condition of the mines with respect to ventilation and other health and safety concerns (Ohio Mining Commission, 1872, p. 7). Appointed to this mining commission were Charles Reemlelin, B. M. Skinner, and Andrew Roy. Their findings led to the passage in 1872 of "An Act to Regulate Coal Mines and the Workings Thereof." Although the 1872 act made provisions for health and safety, it was generally ignored because it did not require inspection of the mines. For information on modern mine law, see section on Reclamation in Chapter 3.

CHILD MINERS

An interesting provision to the early mine law of Ohio was that

no boy under twelve years of age shall be allowed to work in any mine, nor any minor between the ages of twelve and sixteen years, unless he can read and write; and in all cases of minors applying for work it shall be the duty of the agent of such mine to see that the provisions of this section are not violated. Apparently it was common for young boys to work alongside their fathers in the bituminous mines of the 1870's (Long, 1989, p. 71) (fig. 146).

The following testimonies of several Ohio coal miners before the Ohio Mining Commission in 1871 indicate that the acceptance and promotion of children working in coal mines was a tradition brought by the immigrant miners from their former countries (fig. 147):

I was born in Scotland, and have been in this country about twenty-four years. I mined coal in Scotland from my eighth to my twenty-fourth year (p. 107).

I am a native of England, emigrated to this country in 1863; am 37 years old; have been a miner 30 years (p. 137).

I was a miner in my native land—Wales—from my twelfth year (p. 149).

I have been a miner for 22 years, am now 32 years old (p. 129).

My experience does not justify me in saying that the employment of boys under 12 years of age in mines, as it is practiced here, is injurious to society. The chief objection, that they are kept out of school, is true, but it does not exist to the extent as to create a public grievance (p. 147).

I do think that boys may be usefully employed about mines, to some extent; but boys should be provided with education. Boys are employed upon the urgent demand of the miners,

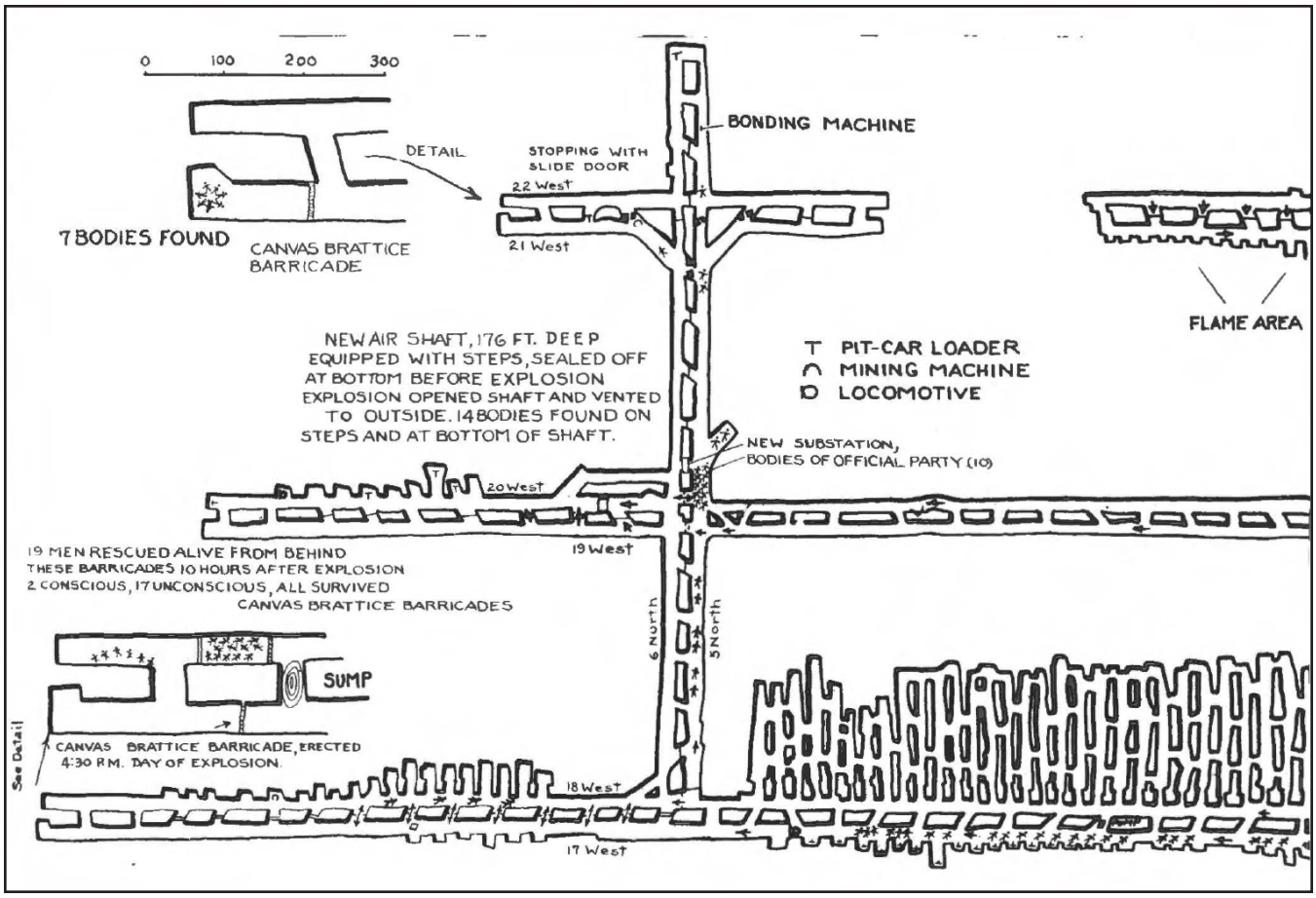


FIGURE 137.—Map of west half of explosion area of Sunday Creek Coal Company mine No. 6 (As-142) (from Humphrey, 1959, p. 126, fig. 82).

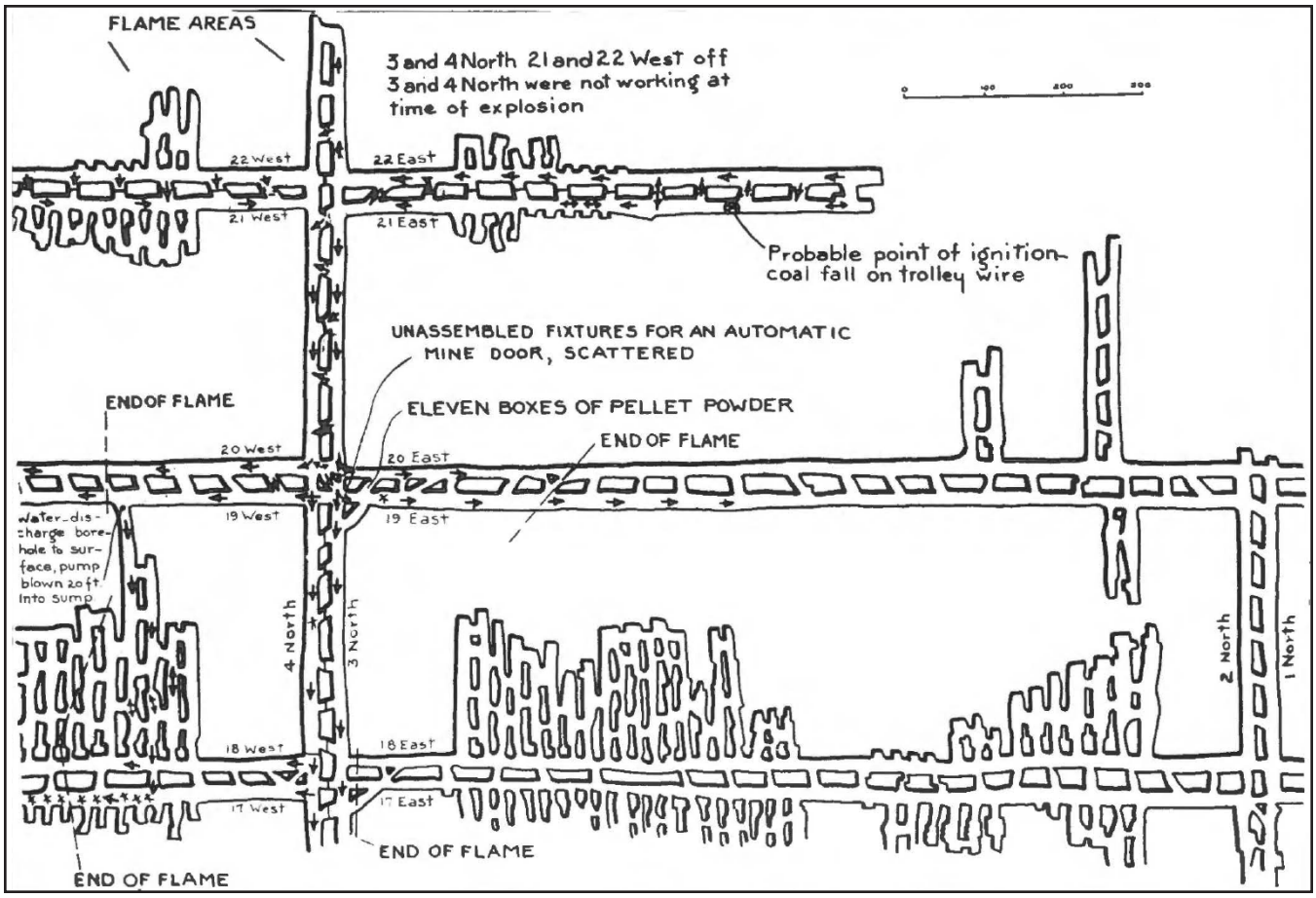


FIGURE 138.—Map of east half of explosion area of Sunday Creek Coal Company mine No. 6 (As-142) (from Humphrey, 1959, p. 126, fig. 83).

FIGURE 139.—Miners, newsmen, and Red Cross volunteers waiting for news of survivors and casualties at the scene of the Millfield mine disaster on November 5, 1930. Photo courtesy of Ohio Historical Society.

FIGURE 140.—Aerial view of the huge preparation plant and tipple at the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) which turned out 5,000 tons of cleaned coal daily. The morning shift of men is leaving the mine entrance to check in their lamps and clean up at the mine bath house before going home. *Circa* 1946. Photo courtesy of Dale Davis, from Hanna Coal News (September 1946, p. 12). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 141, 142, 153, 154, 193.)

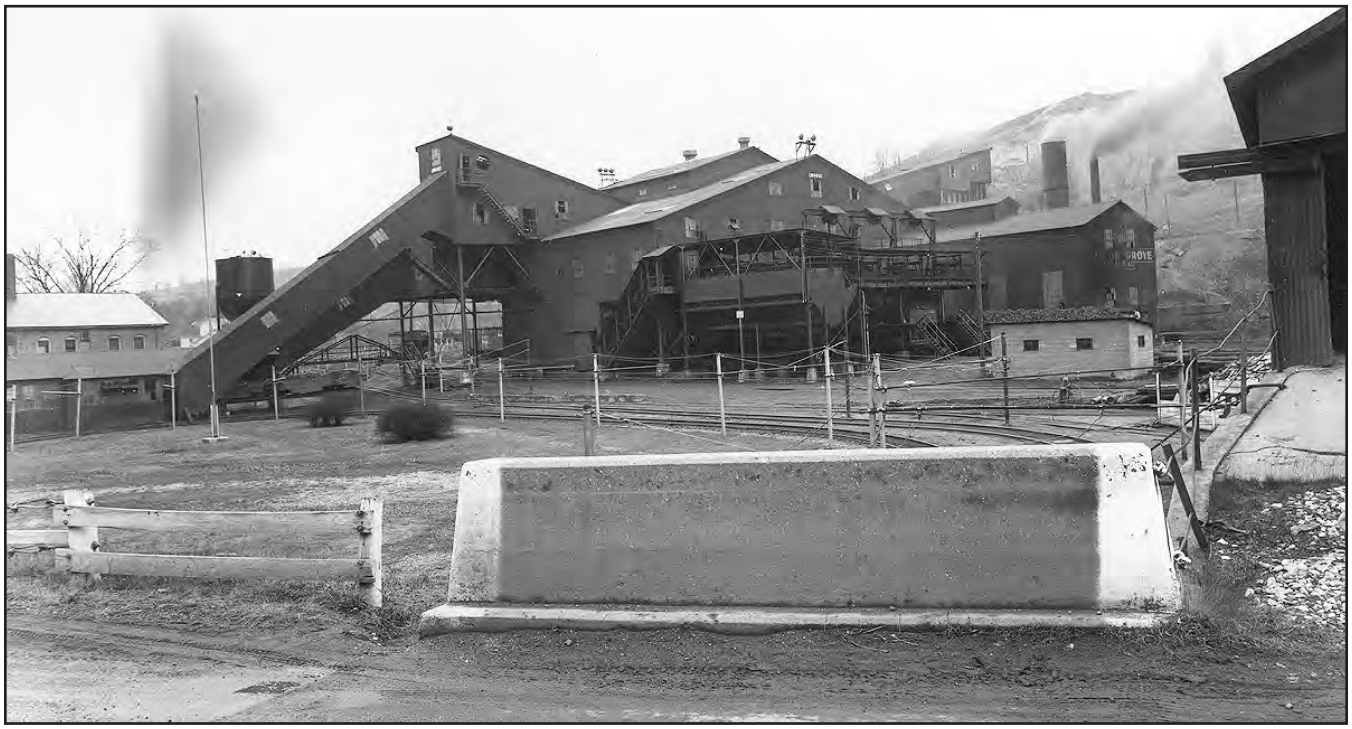


FIGURE 141.—Preparation plant and railroad-car-loading tipple at the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). *Circa* 1946. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 140, 142, 153, 154, 193.)

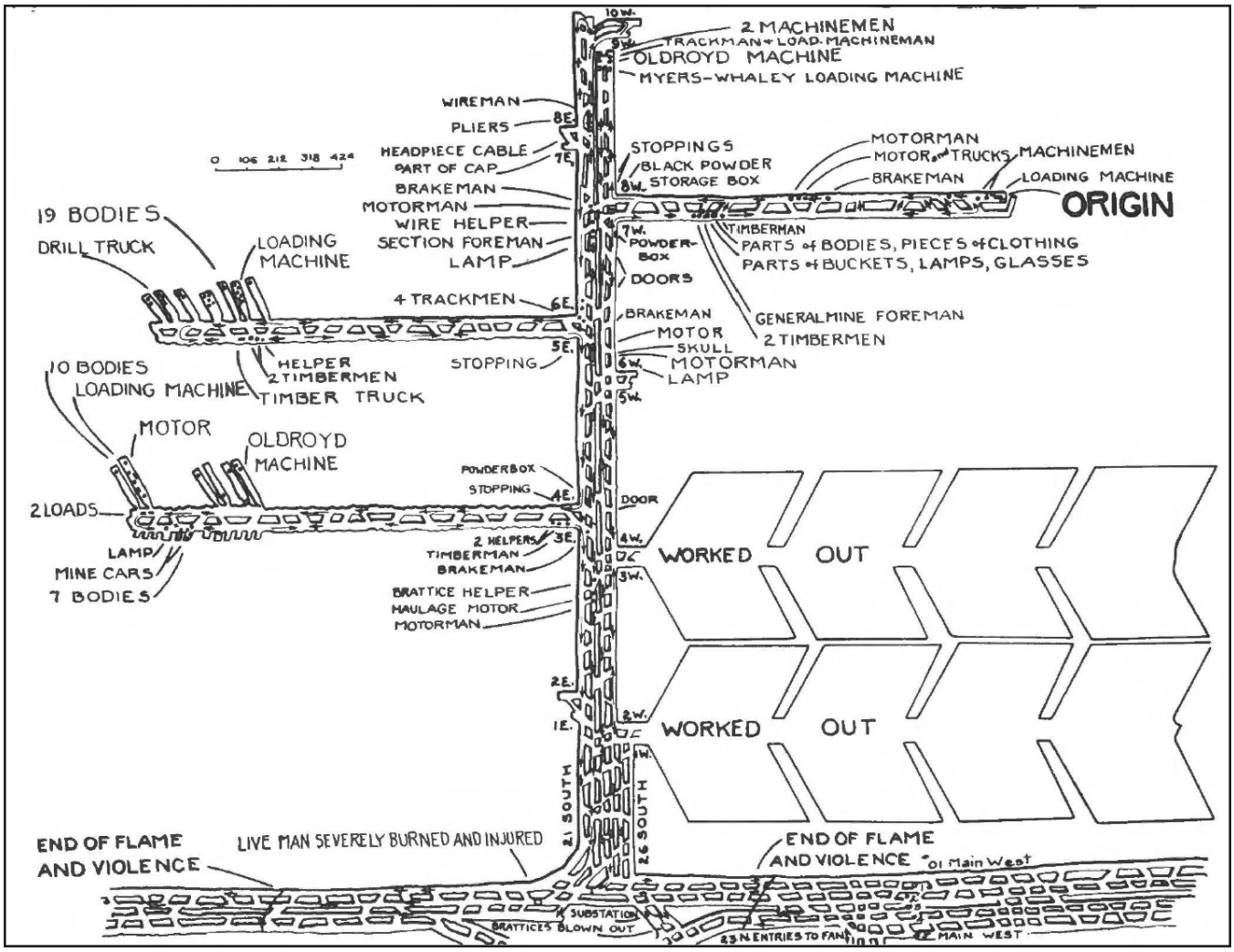


FIGURE 142.—Map of explosion area in the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) on March 16, 1940 (from Humphrey, 1959, p. 151, fig. 101). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 140, 141, 153, 154, 193.)

FIGURE 143.—On March 17, 1940, the day after the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) explosion, this photo and the following caption were carried over the news services: *Survivors of Ohio mine blast carried to safety at St. Clairsville, Ohio .... A dramatic scene showing rescuers carrying an unidentified survivor away from emergency exit of the Willow Grove mine, near St. Clairsville, Ohio, where forty men are trapped after an explosion that claimed the lives of two would-be rescuers. At least 108 of the 179 miners underground when the blast let loose had been accounted for. No contact-telephone or direct-had been made with section 22 south which held the fate of some two-score miners*. A total of 72 miners lost their lives in Ohio's second-worst mine disaster. Photo courtesy of Ohio Historical Society.

FIGURE 144.—Auger used to rescue trapped miners on June 26, 1957, at the Powhatan Mining Company Betsy No. 3 mine (Jfn-258) near Fernwood, Cross Creek Township, Jefferson County. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

who want them to be employed so as to help support the family, to learn the mining business, and to be their company. It would be a hardship on many families to prohibit boys under 12 years of age from entering the mines. It would also clash with general economy of mines, as boys are very useful as trappers, opening doors, etc., as the work is light, and suits their capacities. Unless there were compulsory education by the laws of the State, and boys were expelled from the mines, many of them would turn loafers, and learn all kinds of bad practices; for idleness is the mother of crime (p. 133).

It was a matter of tradition to learn the trade and skills of mining through apprenticeship at a very young age.

Typically, the skilled or practical miner had begun his learning as a boy, either at his father's side as a helper or as a trapper boy. From trapping, he advanced to mule driving, a job usually done by adolescents [fig. 148]. *Next, he would become a laborer, working for a miner, and finally he would be assigned his own room, paid by the ton, and in a position to hire his own laborer* (Long, 1989, p. 36).

Apparently, the mine law of 1874 was not closely adhered to, as the State Inspector of Mines reported in 1876 (p. 81) that *boys under ten and twelve years in age are still employed at many mines* (fig. 149).

Even into the 20th century, boys under the age of 16 worked in Ohio coal mines. Harry Stanley started work in coal mines at age 11 in 1904 as a trapper boy earning 40 cents a day (Hanna Coal News, April 1941, p. 1). In 1946, a group of 15 Ohio coal miners were recognized as Master Miners for their collective 750 years of accident-free work in Ohio coal mines (Hanna Coal News, October 1946, p. 9). More than half of this distinguished group of miners began their careers under the age of 16; three members of the group began working in Ohio coal mines at the age of 11.

During the mid-20th century, several eastern Ohio high

FIGURE 145.—Martin Kovalski and his wife a few moments after his rescue from the Powhatan Mining Company Betsy No. 3 mine (Jfn-258). Martin was trapped for 15 hours after the mine roof collapsed on June 26, 1957. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

FIGURE 146.—Child labor was used in some coal mines. Date and location unknown. Photo courtesy of Forrest Walton.

FIGURE 147.—Child coal miner, *circa* 1900. Location unknown. Photo courtesy of Forrest Walton.

FIGURE 148.—A boy miner and his haulage mule. Date and location unknown. Photo from Humphrey (1959, p. 35).

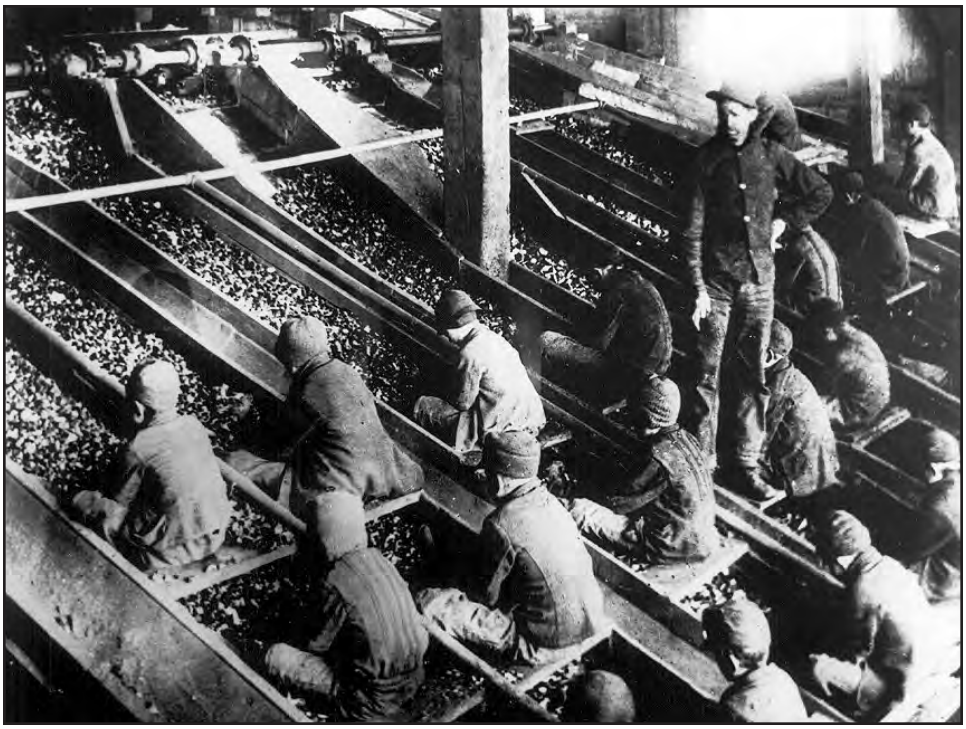


FIGURE 149.—*In a little room in this big black shed . . . forty boys are picking their lives away. The floor of the room is an inclined plane, and a stream of coal pours constantly in from some unseen place above, crosses the room, and pours out again into some unseen place below. Rough board seats stretch across the room, five or six rows of them, very low and very dirty, and on these the boys sit and separate the slate from the coal as it runs down an inclined plane. They work here, in this little black hole, all day and every day, trying to keep cool in the summer, trying to keep warm in the winter, picking away among the black coals, bending over until their little spines are curved, never saying a word all the live long day . . . the coal makes such a racket that they cannot hear anything a foot from their ears . . . . Not three boys in this roomful could read and write . . . . They have no games . . . . They know nothing except the difference between coal and slate* (Labor Standard, quoted in Long, 1989, p. 75, 76). Location unknown. *Circa* early 1900's. Photo courtesy of U.S. Bureau of Mines.

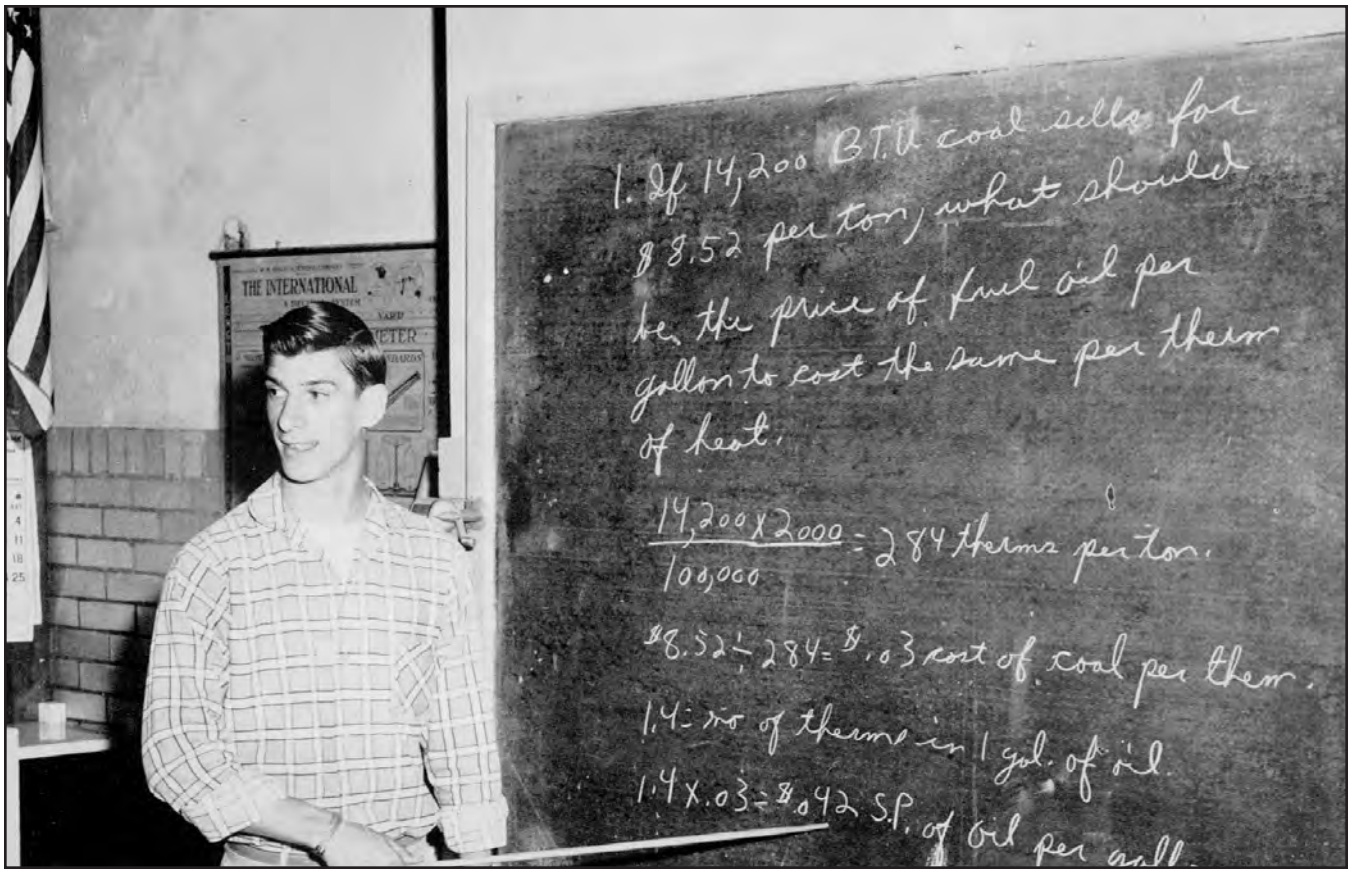


FIGURE 150.—Mike Belan, a student in the mining science class of Smithfield High School, Smithfield, Jefferson County, Ohio, demonstrated that fuel oil cost a penny more than coal per therm of heat in 1957. The heat content of Ohio's coal averages 12,700 Btu per pound and the average cost per ton of Ohio coal in 1993 was $27.44. In comparison, the heat content of crude oil is 5.8 million Btu per barrel and the average cost per barrel of Ohio crude oil in 1993 was $17.26. Adapting Belan's equations, in 1993, the average cost of Ohio coal per million Btu is $1.08, whereas the average cost of Ohio crude oil per million Btu is $2.97. Smithfield High School began offering a vocational course in the science of coal mining in 1945. Photo courtesy of Dale Davis, from Hanna Coal News (July 1957, p. 5).

FIGURE 151.—Smithfield High School mining class of 1951 put their classroom knowledge into practical experience during a tour of an unidentified eastern Ohio coal mine. Photo courtesy of Dale Davis.

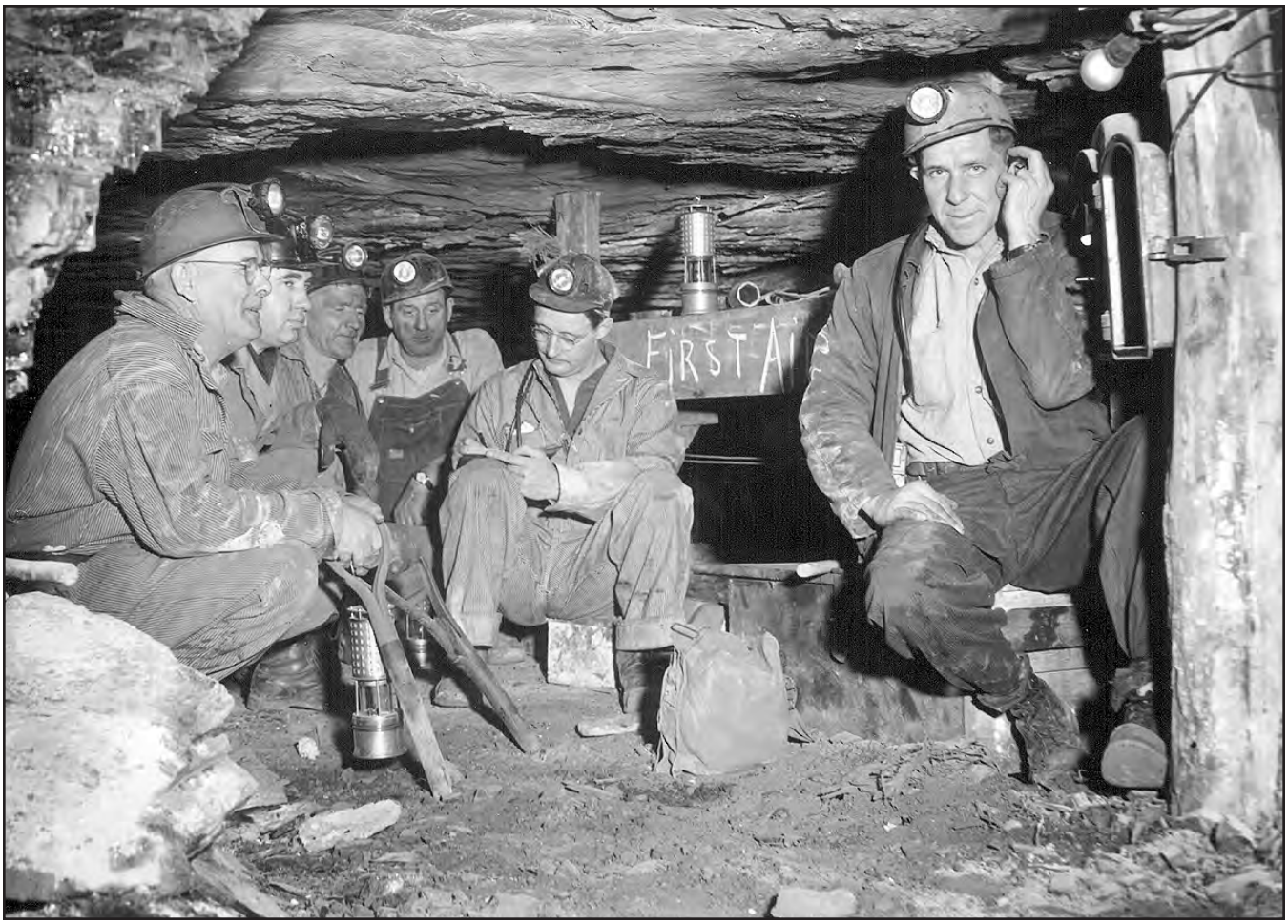


FIGURE 152.—Coal miners gathered for a safety meeting in an eastern Ohio mine. Note the low ceiling, timber roof support, sawed-off shovel handles to assist walking in low-ceilinged areas, and safety lamp on top of the first-aid sign. Date and location unknown. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

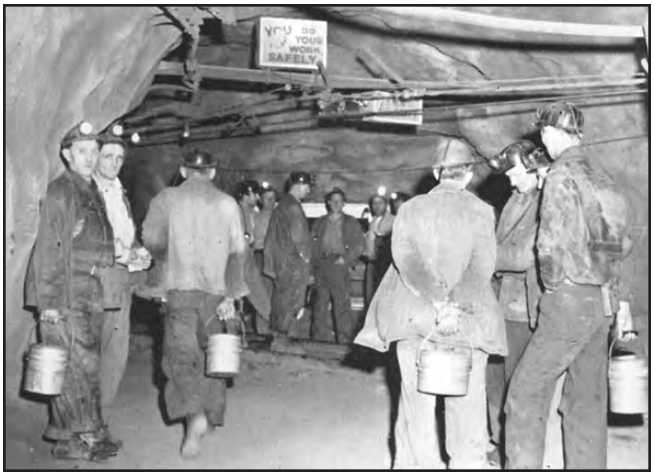


FIGURE 153.—A posted safety reminder greets the night crew at the Hanna Coal Company Willow Grove No. 10 mine (Bt-163) as they wait for the next man trip to take them to their working areas. Photo courtesy of Dale Davis, from Hanna Coal News (July 1947, p. 8). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 140-142, 154, 193.)

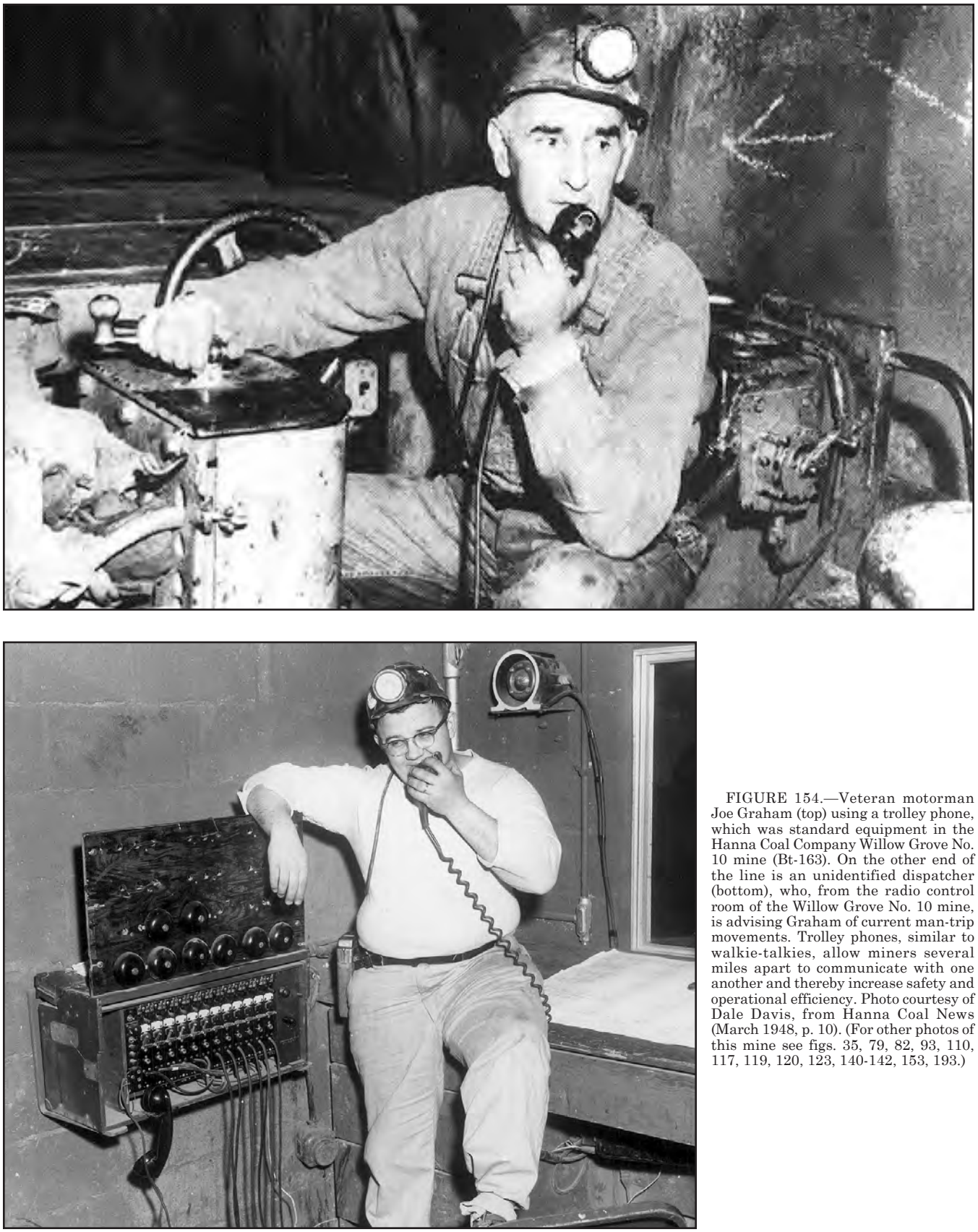


FIGURE 154.—Veteran motorman Joe Graham (top) using a trolley phone, which was standard equipment in the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). On the other end of the line is an unidentified dispatcher (bottom), who, from the radio control room of the Willow Grove No. 10 mine, is advising Graham of current man-trip movements. Trolley phones, similar to walkie-talkies, allow miners several miles apart to communicate with one another and thereby increase safety and operational efficiency. Photo courtesy of Dale Davis, from Hanna Coal News (March 1948, p. 10). (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 140-142, 153, 193.)

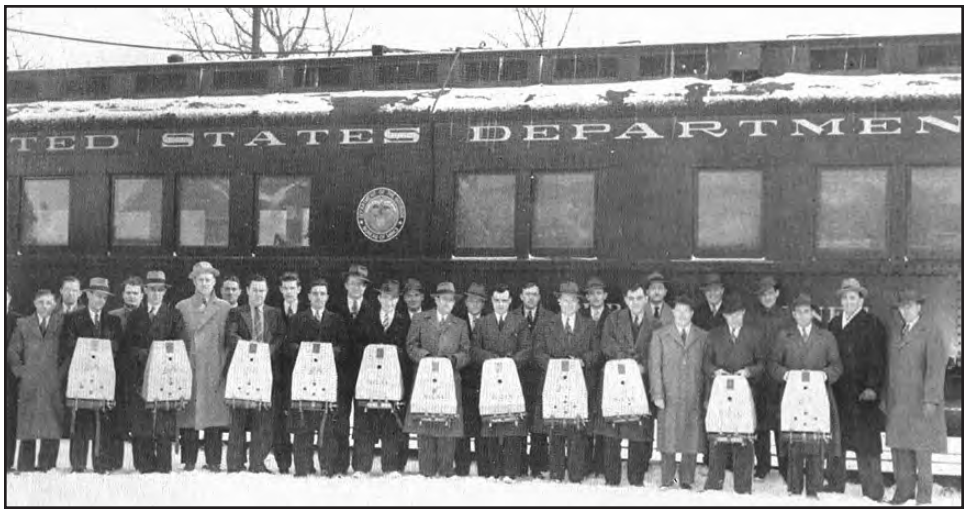


FIGURE 155.—One of several groups of Hanna Coal Company miners who completed training in mine rescue. These miners, holding their self-contained breathing equipment, are standing in front of one of the mobile training/rescue railroad cars operated by the U.S. Bureau of Mines. Mine training/rescue centers resulted from safety initiatives by Joseph Holmes, the first director of the Bureau of Mines. He is credited with making popular the slogan "safety first," and was responsible for many major improvements in mine safety. Under his direction, research was conducted in analyzing the flammability of coal dust and methane and studying the ability of rock dusting and water to retard explosions. He initiated the use of self-contained breathing equipment for mine-rescue work and testing of electric equipment for use in mines (Holmes Safety Association Bulletin, February 1994, p. 6-9). Photo courtesy of Dale Davis, from Hanna Coal News (February 1943, p. 4).

FIGURE 156.—Members of the mine-rescue squad at the Nelms No. 1 mine (Hn-68) ready to respond to any call for help. Safety concerns after an explosion at this mine in 1940 killed 31 miners (see table 4) led to the formation of this mine-rescue squad. The Nelms No. 1 mine, a shaft mine operated by the Youghiogheny & Ohio (Y & O) Coal Company in the Lower Freeport (No. 6A) coal in Green Township, Harrison County, was abandoned in 1979. *Circa* 1942. Photo courtesy of Dale Davis, from the John McNab collection.

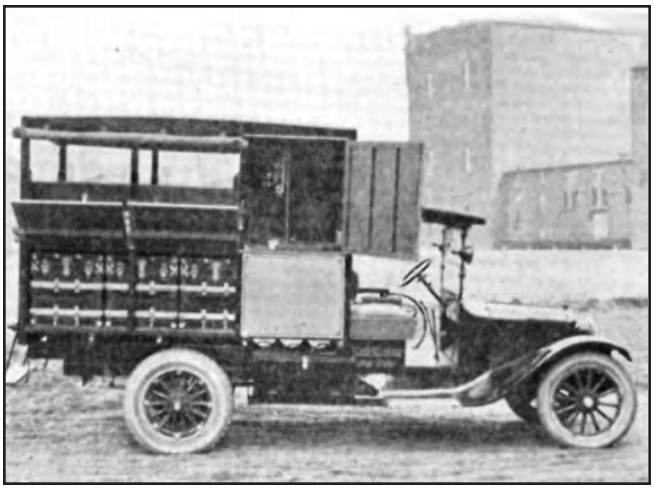


FIGURE 157.—One of five new mine-rescue automobiles, equipped with the latest rescue apparatus, commissioned by the Ohio Division of Mines in 1922. Included in the rescue equipment are three 200-cubic-foot oxygen cylinders; air regenerators; 12 Kohler mine safety lamps; 6 sets of army stretchers equipped with woolen and rubber blankets; 5 electric flashlights; tool box with saw, hatchets, axes, wrench, nails, etc.; 2-gallon-capacity fire extinguisher; linseed oil; and medical supplies. Photo from The Coal Industry (1922, v. 5, no. 4, p. 186).

schools began offering vocational coal-mining courses to prepare their students for careers in the Ohio coal-mining industry (figs. 150, 151). These courses offered a broad range of topics including mine layout, ventilation, safety training/equipment, haulage, roof support, geology, mining machinery, mine gases, rock dusting, and use of electricity.

FIRST STATE INSPECTOR OF MINES

In addition to being instrumental in the formulation of Ohio's mine law, Andrew Roy also was appointed by Governor William Allen in 1874 to be Ohio's first State Inspector of Mines, a post Roy served until his retirement in 1884 (Howe, 1900, p. 110). Andrew Roy was born in Lanarkshire, Scotland, in 1834. His long career in mining began at the age of eight when he started work in the coal mines of Scotland. In 1850, his family emigrated to the United States, where Andrew worked in the coal mines of Maryland. A few years later, he worked in mines of the western United States and by 1860 was working in coal mines of Arkansas. His mining career was interrupted for several years by the Civil War, during which he was wounded and imprisoned. Following the war, he moved to Ohio, where he resumed his involvement in mining by representing safety concerns of Ohio miners at the state legislative level.

MINE SAFETY

The passage of Ohio's mine law made great advances in protection of the coal miner, especially with respect to providing adequate ventilation and emergency escapeways in underground mines and requiring frequent and regular inspection of underground mine workings and mining equipment. However, there are some who believe *underground mining has never been and is not today a safe or healthful industry in which to be employed* (Perry, 1981, p. 29). From 1874 to 1936 a total of 190 deaths and 265 injured miners were recorded in Ohio coal mines as a result of 163 explosions (Owings, 1938). Since 1874, a total of 4,921 coal-mine workers were killed while working in Ohio coal mines. These fatalities (including surface-mine fatali-

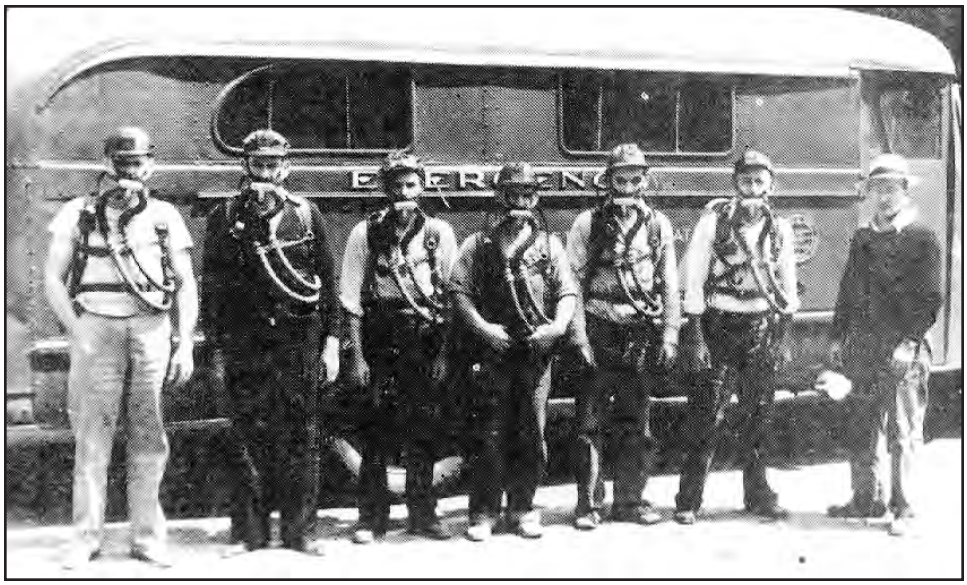


FIGURE 158.—Group of mine-rescue specialists wearing self-contained breathing equipment standing in front of an Ohio Division of Mines mine-rescue vehicle. *Circa* 1941. Photo courtesy of Dale Davis, from Hanna Coal News (June 1941, p. 3).

FIGURE 159.—Mine-rescue personnel next to an underground ambulance parked outside the Hanna Coal Company Piney Fork No. 1 mine (Jfn-261). Believed to be first of its kind in the nation, this ambulance was constructed to more quickly respond to an accident inside an underground mine. *Circa* 1946. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 36, 74, 101, 116, 121.)

ties) resulted from suffocation or asphyxiation, fires, explosions, crushing by equipment or rock, and falling down a mine shaft. Not included are deaths that resulted from mine-related infections or diseases such as pneumonia and black lung.

At the Senate hearings in 1969 on the federal Coal Mine Health and Safety Act, the U.S. Department of the Interior stated that

while the coal mining industry has made great strides in its ability to extract the natural resource coal from the depths of the earth, it has lagged behind other industries in protecting its most valuable resource—the miner (U.S. Congress, 1970, quoted in Perry, 1981, p. 29).

In fact, some of Ohio's worst underground mine disasters (table 4) occurred long after passage of Ohio's mine law of 1874, further testifying to the inherent danger and risk facing miners of underground coal mines.

On the other hand, there are others who believe that mining coal as an occupation is as or more healthful and safe than many other occupations. In 1920, the Prudential Life Insurance Company of America identified occupations having the highest incidence of industrial accidents per $1,000 payroll. They found that workers in concrete construction had the highest incidence of industrial accidents at 29.4 percent. This occupation was followed by anthracite coal[2] mining, logging, stevedoring, carpentry, steel work (open hearth), blast furnace, masonry, ship building, sawmills, quarrying, and bituminous coal mining (16.2 percent). Also, the Metropolitan Life Insurance Company identified from its mortality tables that the average life expectancy of coal miners in 1920 was 51.3 years. This average life expectancy was higher than the average life expectancy for other occupations such as book-keepers, railway workers, plumbers, teamsters, bartenders, machinists, longshoremen, textile workers, iron molders, painters,

[2]Anthracite coal is hard, black, has a glassy appearance, and contains a high percentage of fixed carbon and a low percentage of volatile matter. Anthracite is difficult to ignite, burns with very little or no smoke, and produces an intensely hot fire. Bituminous coal is soft, dark brown to black, contains a high percentage of fixed carbon and between 15 and 50 percent volatile matter, and burns with a smoky flame.

FIGURE 160.—Group of coal miners pausing for a daily safety talk at the Hanna Coal Company Glen Castle No. 6 mine (Hn-38). *Circa* late 1950's. Photo courtesy of Dale Davis. (For other photos of this mine see figs. 78 and 103.)

FIGURE 161.—Rescue Unit 1, one of four mine-rescue and first-aid vehicles of the Ohio Department of Industrial Relations, Division of Mines. These vehicles are equipped with the latest in rescue and first-aid equipment and are used for training and mine-rescue work. In this photo, Rescue Unit 1 is parked at the Peabody Coal Company Training Center at the Sunnyhill South mine (Py-265) in Perry County. Active participation in mine-rescue, safety, and first-aid training by Ohio coal operators has helped to greatly reduce accidents and fatalities. *Circa* 1990. Photo courtesy of Ohio Department of Industrial Relations, Division of Mines.

FIGURE 162.—Coal Miner's Accident and Safety Meet held in August 1948 at Perkins Athletic Field in Bridgeport, Belmont County. Photo courtesy of Dale Davis, from Hanna Coal News (August 1948, back cover).

tobacco workers, and bankers. Occupations which had an average life expectancy exceeding that of coal miners were masons and bricklayers, blacksmiths, and farmers and farm laborers (The Coal Trade Bulletin, 1920, v. 43, no. 11, p. 330). Since 1920, owing in part to the passage of the Mine Health and Safety Act in 1969, the incidence of coal-mine-related fatalities in Ohio has remained relatively low. In fact, according to the Occupational Safety and Health Law Center in Washington, D.C., Southern Ohio Coal Company, which operates one of the largest underground mining complexes (Meigs No. 2 and Meigs No. 31 mines) in the nation, has been among the national leaders in accident-free work in recent years (American Electric Power Service Corporation, 1993, p. 9).

There is a risk involved in mining coal underground as there are risks involved in many industrial occupations. However, the comparatively lower incidence of industrial accidents and higher average life expectancy among coal miners has been the result of coal companies, the United Mine Workers of America, and government working together to stimulate safety awareness (figs. 152, 153), promote good safety practices (fig. 154), and provide regular safety training/education among coal miners (figs. 155-161). To further this goal, many coal companies have participated in safety and first-aid competitions at the state and national level. The first annual first-aid and safety contest in Ohio was held August 16, 1924, in Bellaire, Belmont County. This competition was won by mine-rescue team no. 15 representing Lore City, in Guernsey County (The Coal Trade Bulletin, 1924, v. 51, no. 5, p. 192; v. 51, no. 7, p. 289). Since 1924, Ohio has held annual mine-rescue/first-aid and safety contests (fig. 162). The mine-rescue team from the Southern Ohio Coal Company Meigs No. 31 mine won the 1993 Ohio Valley Mine Rescue Contest, held at St. Clairsville, Belmont County. The annual Ohio Valley Mine Rescue Contest was recognized in 1987 by Richard Trumka, president of the United Mine Workers of America, for its *contribution and dedication in the promotion of safety in the mining industry* . . . . [and its] *great responsibility . . . in aiming for perfection in mine rescue for the purpose of saving human life and preserving property* (plaque given by the United Mine Workers of America, August 29, 1987).

In September 1993, Eric Gryszka, of the mine-rescue team from the Southern Ohio Coal Company Meigs No. 31 mine, won the Benchman's Contest at the National Mine

Rescue and First-Aid Contest held at Louisville, Kentucky. The Benchman's Contest tests knowledge and use of self-contained breathing apparatus in performing mine-rescue work.

Awards also are given to mining companies based on the safety performance of their workers. The most prestigious and coveted safety award is the Sentinels of Safety trophy, which is given to the safest coal miners in the nation. The 1992 trophy, co-sponsored by the federal Mine Safety and Health Administration (MSHA) and the American Mining Congress, was awarded to the employees of the Harrison Mining Corporation Nelms No. 2 Mine-Cadiz Portal (Hn-710), in Green Township, Harrison County, who worked 145,506 accident-free hours in 1992.

The "Sentinels of Safety" award was founded in 1925 and the national safety competition has continued uninterrupted to the present day. President Herbert Hoover conceived the national safety competition for the mining industry in 1923 when he was serving as Secretary of Commerce. Hoover, a former mining engineer, realized the need . . . to stimulate greater interest in safety among the nation's mineral extractive industries and to encourage the development of more effective accident-prevention programs by according national recognition to operations achieving outstanding safety records (Steubenville Herald Star, August 1, 1993).

Mine rescue and safety training is available to coal companies at state- and federal-sponsored training facilities. The Ohio Department of Industrial Relations, Division of Mines operates four mine-rescue/safety-training centers, located at Athens (Athens County), Cambridge (Guernsey County), Lansing (Belmont County), and Shadyside (Belmont County). MSHA operates a mine-rescue facility at Pittsburgh, Pennsylvania, and a training academy at Beckley, West Virginia. These mine-rescue/training facilities are equipped with the latest safety equipment. As a result of toughened safety awareness by and extensive safety training for coal miners, no coal mining-related fatalities were recorded for Ohio coal mines in 1992 or 1993.

Chapter 7

SHIPMENT OF COAL

RIVERS

The development of Ohio's transportation system was an important factor that aided in the growth of Ohio's coal industry. The Ohio River and its tributaries, such as the Muskingum River, were the principal arteries for westward expansion of pioneer travel, settlements, and economy. Transportation by water provided the earliest recorded long-distance shipment of Ohio coal. *As early as 1806 coal was being floated down the Ohio River on log rafts from the mines at Coalport and Silver Run, Meigs County* (Eavenson, 1942, p. 265). In 1808, Pittsburgh coal was being shipped down the Ohio River to Marietta. Of this coal Zadok Cramer (quoted in Eavenson, 1942, p. 265) said,

The hills on both sides of the Ohio as low as Grave Creek [near Moundsville, West Virginia] *below Wheeling, are filled with excellent coal. Below this, coal grows scarce, and what is found is not of good quality. Coal has been boated down from Grave Creek to Marietta, where it sold for 25 cents per bushel. Even at this high price, it is not a very advantageous article of trade.*

By 1819, coal from Pomeroy, Meigs County, had been shipped by flatboat to Louisville, where it sold for 25 cents a bushel (Howe, 1900, v. 2, p. 215). By 1833, coal for domestic purposes was routinely shipped on the Ohio River from Pomeroy. Pioneer river traffic consisted of rafts and keelboats until 1811, when the first steamboat, the *New Orleans,* a side-wheeler built at Elizabeth, Pennsylvania, descended the Ohio River (Caldwell, 1880, p. 485; Doyle, 1910, p. 219). The next steamboat to operate on the Ohio River, the *Comet,* was built in 1812-1813, followed by the *Enterprise,* a stern-wheeler built in 1814 at Brownsville, Pennsylvania (Doyle, 1910, p. 219). The first coal-fired steamboat, the *Bazaleel Wells,* a side-wheeler, was built in 1820 at Steubenville, Ohio. This steamboat was named after Bazaleel Wells, who founded Steubenville in 1797 as well as Canton, Ohio, in 1804 (Doyle, 1910, p. 329, 330). The *Bazaleel Wells* was followed by the *Robert Thompson,* also coal fired, built in 1821. From 1811 to 1832, 348 steamboats had been constructed for navigating the "western rivers." Of these boats, 68 were built at Cincinnati, 7 at Marietta, 2 at Zanesville, 3 at Portsmouth, and 3 at Steubenville (Mack, 1879, p. 55). The success demonstrated by these coal-fired steamers (fig. 163) helped Steubenville become active in the construction of steamboats. Among the steamboats built at the Steubenville boat yards and their year of construction are: *U.S. Mail* (1835), *Post Boy* (1835), *Utah* (1836), *Steubenville* (1837), *Wabash* (1838), *Cabinet* (1839), *Veroca* (1845-46), *Convoy* (late 1850's), and *James Means* (1860).

The Muskingum River also had its share of river traffic (fig. 164). The first river steamer was wood fired and traveled from Marietta to Zanesville in 1824. In 1827, the *Hope* steamed into Dresden, and in 1829 the *Mary Ann* steamed to Coshocton. Both these latter excursions were made only during high-water levels. In 1831, a side-cut at Dresden linked the Ohio Canal with the Muskingum River. Between 1836 and 1841, locks and dams were built on the Muskingum River to facilitate navigation from Marietta to Dresden (Schneider, 1968, p. 20, 21). These improvements made it possible to ship coal from the interior of the state to ports either on Lake Erie or the Ohio River.

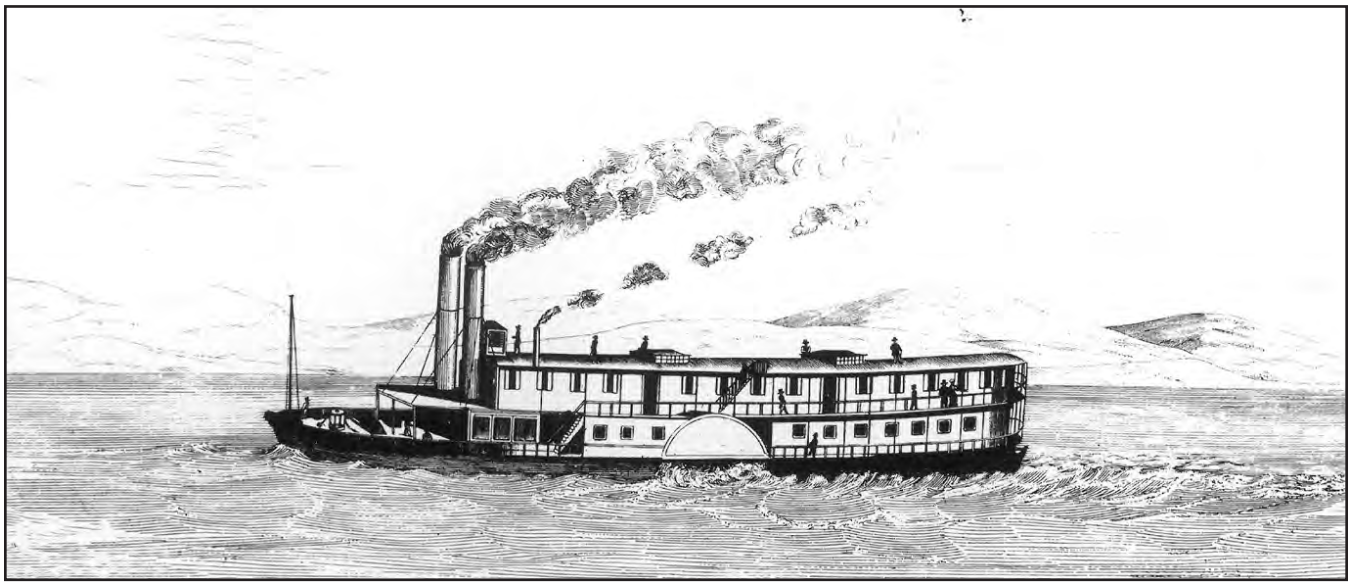


FIGURE 163.—Sketch of a coal-fired steamboat (from Stevenson, 1838, plate V). This side-wheeler is typical of the steamboats that navigated the Ohio River in the 1830's.

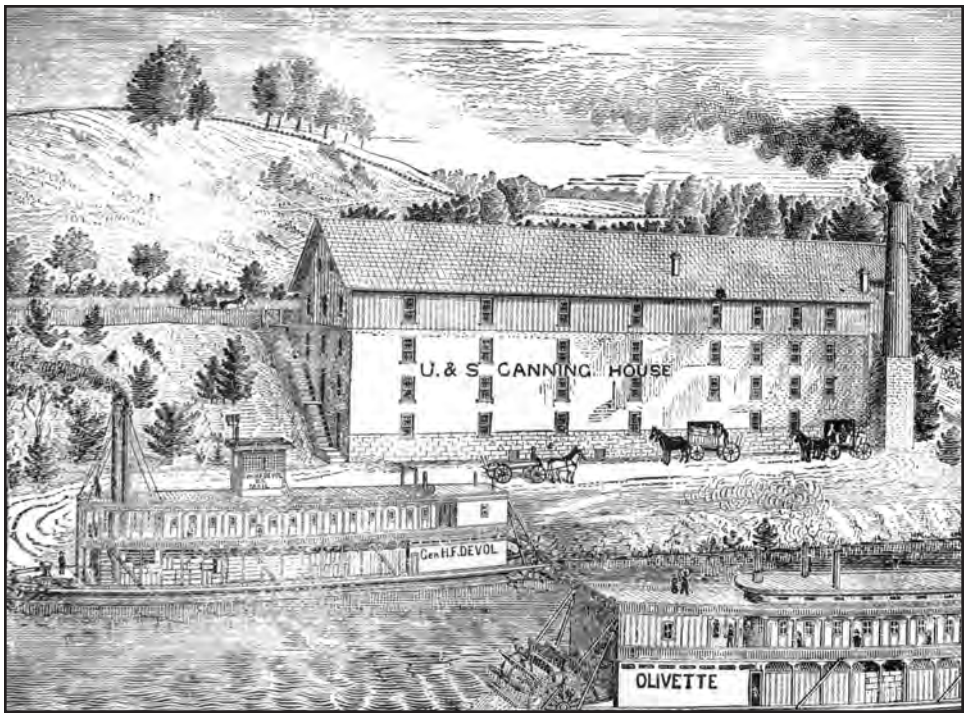


FIGURE 164.—River traffic on the Muskingum River near Zanesville in the late 1800's (from Everhart & Co., 1882, p. 280a).

Although railroad competition started to have its influence on river traffic by 1860, the Ohio River and its tributaries remained an important avenue for transporting materials well into the 20th century. Between 1857 and 1875, 649 steamboats were built on the upper Ohio and Monongahela Rivers (Doyle, 1910, p. 230); 163 were built at Marietta from 1822 to 1900 (Schneider, 1968, p. 26).

Originally, coal was rafted down the Ohio River to market by one or two barges lashed together carrying 5,000 or 6,000 bushels apiece (Doyle, 1910, p. 232). It was not until the mid-1830's that steam power was used to "tow" these barges. The first steamboat built to tow coal barges was constructed in 1836. This steamboat, named the *Condor,* towed loaded coal barges from Pomeroy to Cincinnati, a distance of 225 miles (State Inspector of Mines, 1876, p. 105). In sharing a discussion about coal mining in Ohio, Hildreth (1836, p. 12) reported,

A large-steam boat [*Condor*] *built expressly for the purpose, tows from four to six loaded barges, carrying each from five to seven thousand bushels of coal to Cincinnati and back again empty; performing the trip in five or six days—at this spot* [Pomeroy], *which three years since looked like a neglected wilderness, a smart village has sprung up, filled with an industrious race of men. Steam saw-mills, shops, and a large boat-yard are in active operation. The colliers are chiefly experienced miners from Wales, with their families. A church and a school-house are about being built from the fine sandstone, for the cultivation of the rising intellect, and encouraging the growth of morality and religion amongst the miners. A spot which a few years ago was considered by the neighboring inhabitants as almost worthless, and parcels of the coal lands often actually sold for less than a dollar and a half per acre, is now worth an incalculable sum . . . . The Pomeroy* [Redstone coal] *beds, alone, will probably in another year furnish a million bushels* [about 40,000 tons] *of coal to the markets on the shores of the Ohio . . . .*

Roy (1876, p. 299, 300) also remarked on the practice of towing coal:

The scheme of towing coal, an article of so little value and such great bulk, so great a distance as two hundred and twenty-five miles was ridiculed by the old steamboat owners as a visionary enterprise. The experiment, however, proved a success, and a few years afterwards another tug, the Lake Erie, *was built at Pittsburgh. During the seasons of shipping, the Ohio River is now covered with tow-boats, some of which extend their trips from Pittsburgh to New Orleans.*

Until about 1860, *most steamboats were side-wheelers, stern-wheelers were not regarded with favor* (Doyle, 1910, p. 224). However, a class of powerful stern-wheel boats gradually developed. These boats were capable of towing 8,000 to 10,000 bushels apiece. In 1903, the acme in coal towing was reached when the *Sprague* (fig. 165) was launched and towed over 1,000,000 bushels (40,000 tons) on a single trip (Doyle, 1910, p. 232). Large coal barges fighting the currents of the Ohio River were a considerable attraction.

The sight when the coal fleet is going down the river is one not seen anywhere else in the world. The water is covered with acres of coal, each bunch having behind it a steamer of enormous power, the belching smoke and steam, paddling of great wheels, and this repeated for miles along the river is a sight worth going miles to see (Doyle, 1910, p. 233) (figs. 166, 167).

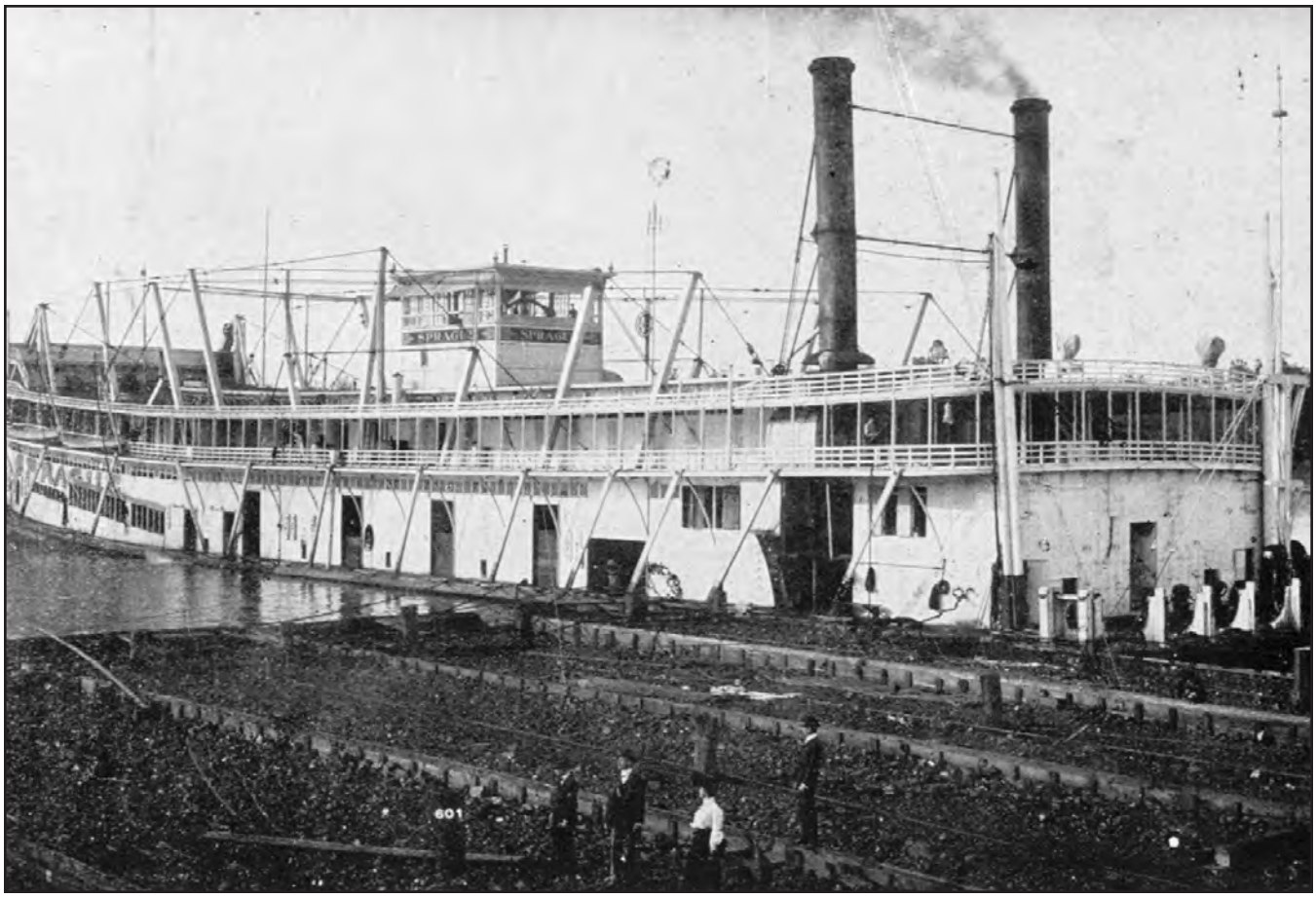


FIGURE 165.—The coal-fired steamer *Sprague* of the Monongahela River Consolidated Coal & Coke Company pushing 56 coal barges, each containing 1,000 tons of coal. *Circa* 1909. Photo from The Coal Trade Bulletin (v. 21, no. 2, June 15, 1909, p. 20).

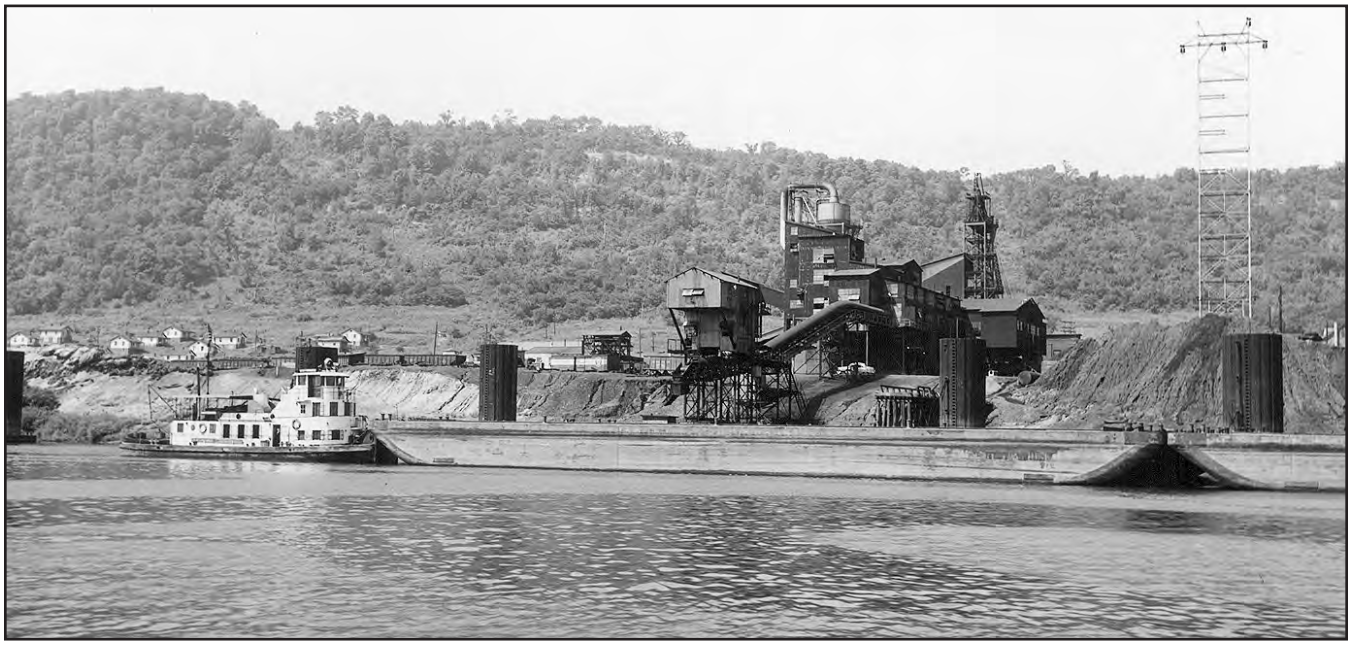


FIGURE 166.—Coal being loaded into barges at the barge-loading dock at the North American Coal Corporation Powhatan No. 1 mine (Bt-270). The Powhatan No. 1 mine, a slope mine in York Township, Belmont County, produced Pittsburgh (No. 8) coal from about 1923 to 1981, when it was abandoned. *Circa* 1953. Photo courtesy of North American Coal Corporation.

FIGURE 167.—Loaded coal barges on the Ohio River. The American Electric Power (AEP) Transportation Division moves approximately 20 million tons of coal each year to AEP System generating stations. *Circa* 1990. Photo courtesy of American Electric Power Service Corporation.

CANALS

Recognizing the need to develop the agricultural and industrial potential of the state, in 1825 Ohio's legislature passed the Canal Law, which authorized the construction of the Ohio and Erie Canal and the Miami and Erie Canal. The passage of this act marked the beginning of the period of canal building in Ohio, which continued to about 1848.

During this period, the State of Ohio built 813 miles of canals, 32,903 acres of reservoirs, 29 dams across streams, 294 lift-locks, 44 aqueducts, and hundreds of smaller structures, at a cost of $15,967,652.69 (Ohio Department of Natural Resources, no date) (fig. 168).

Built primarily to transport agricultural goods to market, Ohio's canal system also facilitated the production and movement of Ohio industrial minerals and coal. Among the principal canals are:

the Ohio and Erie Canal or Grand Canal, 309 miles long, built between July 1, 1825, and October 1832, and abandoned in 1913 (Willard, 1916, p. 92; Ohio Historical Society, 1971);

the Miami and Erie Canal, 244.5 miles long, built between July 21, 1825, and 1845, and abandoned in 1909 (Wilcox, 1969, p. 68; Ohio Historical Society, 1971);

the Sandy and Beaver Canal, 90.5 miles long, built between 1834 and 1848, and abandoned in 1884 (Wilcox, 1969, p. 77, 82; Ohio Historical Society, 1971);

the Pennsylvania and Ohio or Cross-Cut Canal, 80 miles long, built between 1835 and 1848, and abandoned about 1877 (Davis, 1929; Ohio Historical Society, 1971);

the Hocking or Side-Cut Canal, 50 miles long, built between 1826 and 1843, and abandoned about 1894 (Inter-State Publishing Co., 1883, p. 131; Ohio Historical Society, 1971).

The first canal boat, the *State of Ohio,* to use the Ohio and Erie Canal was launched from Akron on June 23, 1827 (The Ohio Repository and Stark County Gazette, 1827, v. 18, no. 18, July 5, p. 3). This historic event was closely followed by the passage of the first canal boat from Akron to Cleveland on the Ohio and Erie Canal on July 1, 1827 (Doerschuk, 1926, p. 111). By 1828, coal was being shipped from Tallmadge (Summit County) to Cleveland, a distance of about 28 miles, on a portion of the Ohio and Erie Canal (Whittlesey, 1872a, p. 26). Colonel Charles Whittlesey (1872b, p. 2) claimed that the honor of being the first to ship coal to Cleveland via the Ohio and Erie Canal belonged to his father, Asaph Whittlesey, who with Samuel Newton opened the first drift mine at the southern end of Coal Hill (now known as Chapel Hill, a north-south-trending hill about 1½ miles west of Tallmadge) in 1820. However, this

FIGURE 168.—Map of Ohio canal routes published in 1900 in the Report of the Chief Engineer of Public Works and General Superintendent of Canals (from Smith, 1977, p. 222).

FIGURE 169.—The canal boat *North Dell* loaded with coal moored south of Main Street in Massillon. *Circa* 1896. Photo courtesy of The Massillon Museum.

FIGURE 170.—The canal boat *E. Moore* taking on a load of coal from the tipple of the Trenton mine (Ts-74), on the west bank of the Ohio and Erie Canal at Tuscarawas (formerly Trenton), in Warwick Township, Tuscarawas County. The Trenton mine, a drift mine in the Middle Kittanning (No. 6) coal, was operated by Henry C. Minnich and was abandoned in 1902. Coal from the Trenton mine was taken to northern markets. Coal mined in the vicinity of Trenton, amounting to 48 boatloads, was first shipped to Cleveland via the Ohio and Erie Canal in 1836 (Heydinger, 1974, p. 36). *Circa* 1889. Photo courtesy of The University of Akron Archives, Canal Society of Ohio collection.

honor has generally been given to Henry Newberry (Akron Beacon Journal, March 1, 1866, p. 1; Newberry, 1873, p. 215; State Inspector of Mines, 1877, p. 99; 1880, p. 57; Perrin, 1881, p. 190, 471, 472). Henry Newberry was the father of John Strong Newberry, State Geologist (1869-1882) of the second Geological Survey of Ohio. Henry Newberry opened his drift mine at the north end of Coal Hill at a place referred to as "the Corners" in 1826 or 1827 (Whittlesey, 1872, p. 25). In a letter (quoted in Perrin, 1881, p. 472), H. V. Bronson, a pioneer of canal coal-carriers, stated,

It was in the summer of 1828, that I carried the first load of coal over the Ohio Canal from the Tuscarawas Valley. It came from the mine of Henry Newberry, near Cuyahoga Falls—I can't tell the exact location. It was brought from the mine by wagon to Lock 20 [about 2,800 feet north of where Tallmadge Avenue crosses the Little Cuyahoga River in Akron], *where it was loaded on the boat. There was about one hundred tons of it. We took it to Cleveland, and it required Newberry three years to get rid of it, and he never sold one-third of that even.*

Even though lock 20 was identified by Bronson as the port of origin for the first shipment of coal by canal to Cleveland, several other locks have also been suggested as the point of origination. Whittlesey (1872a, p. 26; 1883, p. 16) and Heydinger (1974, p. 34) identify lock 19 as the port of origin. Lock 19 was located just south of Tallmadge Avenue. The Akron Beacon Journal (June 24, 1857, p. 3) stated that the first shipment of coal from Newberry's mine left for Cleveland from lock 16, located 1,120 feet northwest of where North Street crosses the Ohio and Erie Canal. The Beacon Journal's account is supported by the Tallmadge Historical Society (1957, p. 66), which stated Newberry's coal was *hauled to lock 16 by two, 3-horse teams driven by Mr. McAllister and Mr. Batterson and a team of two oxen by William Russell.* However, John Wunderle (1993, personal communication), member of the Ohio Canal Society, believes it is likely the coal was shipped from lock 15 (located 270 feet north of North Street). He suggests that the route probably taken in 1828 from Newberry's mine to the Ohio and Erie Canal would have followed present-day Thomas Road south to Evans Road and west to North Street, continuing west to the canal. This route leads past lock 15 and became a popular route for shipment of coal from Coal Hill. In 1839, a tramway approximately 2 miles long was constructed for coal shipment from Coal Hill by the Tallmadge Coal Company along a portion of this route to "Port Carbon," the terminus of the tramway at the intersection of Evans Road and the Pennsylvania and Ohio Canal (Lawrence, 1984, p. 3). To haul coal to lock 16, one would have traveled 850 feet past lock 15 and found difficult passage through the narrows between the canal and the Little Cuyahoga River.

Although Newberry's first boat load of coal to Cleveland

FIGURE 171.—Canal boats on the Ohio and Erie Canal south of West Tremont Avenue in Massillon, *circa* 1890's. Photo courtesy of The Massillon Museum.

in 1828 was not an overwhelming success, it did mark the beginning of coal movement on the canal system. In its first 24 years, nearly 8,000 canal boats shipped about 662,800 tons of coal on the Ohio and Erie Canal to Cleveland from mines located near the following cities: Tallmadge, Massillon (fig. 169), New Castle, Trenton (fig. 170), Middlebury, Clinton, Rogue Hollow, Youngstown, Zoar, Cuyahoga Falls, Girard, and Rochester (Whittlesey, 1872a, p. 26; Heydinger, 1974, p. 34).

By 1833, the Ohio and Erie Canal was opened from Portsmouth to Cleveland, which was receiving regular shipments of coal. By 1835, the first shipments of coal from Tuscarawas County mines were arriving in Cleveland. By 1844, coal from Rogue Hollow and Clinton was shipped to Cleveland via the Ohio and Erie Canal. The following accounts describe the importance of the canals for shipment of coal produced at Ohio's pioneer coal mines:

Coal [mined in the Mahoning Valley] *was little used, except for blacksmith purposes, until the opening of the* [Pennsylvania and Ohio] *canal in 1840, when Governor Tod sent a few boat loads to Cleveland to be used as an experiment for generating steam on the lakes* (Hazeltine, 1882, p. 36).

The line of the Ohio canal, which passes along this [Tuscarawas] *valley, is from 35 to 40 miles in length; and nearly or quite through the whole distance, the hills, on either side, contain valuable beds of coal . . . . Not unfrequently the canal passes along the base of the hills, so that by the construction of railroads two or three hundred feet or yards in length, it can be conveyed to the boats which may be used in its transportation . . . . The shipments of* [coal] *from the Tuscarawas valley, during the past season, as furnished me by Mr. Ransom of the board of canal commissioners, amounts to 173,210 bushels, of which 87,000 were sent northward towards the lake* (Briggs, 1838, p. 149, 150).

The amount of coal sent by canal to Cleveland annually, part of which is consumed there, and part shipped to various ports around the lake in New York, Pennsylvania, Ohio, Michigan and Canada, is supposed to amount to about one million of bushels. This branch of industry must now give employment to at least one thousand men as miners, boatmen, etc., of Ohio, most of whom are heads of families, and the value produced is at least $500,000, per annum (Mather, 1838b, p. 12).

In 1884, the State Inspector of Mines reported (p. 91) that *there is a large quantity* [of coal from mines in Tuscarawas County] *conveyed to northern markets over the Ohio Canal* (figs. 171-174). However, by 1886 the fate of the Ohio and Erie Canal was apparent to the owners of coal

FIGURE 172.—Canal boat family transporting a load of coal on the Ohio and Erie Canal near Navarre in the summer of 1896. Photo courtesy of The Massillon Museum.

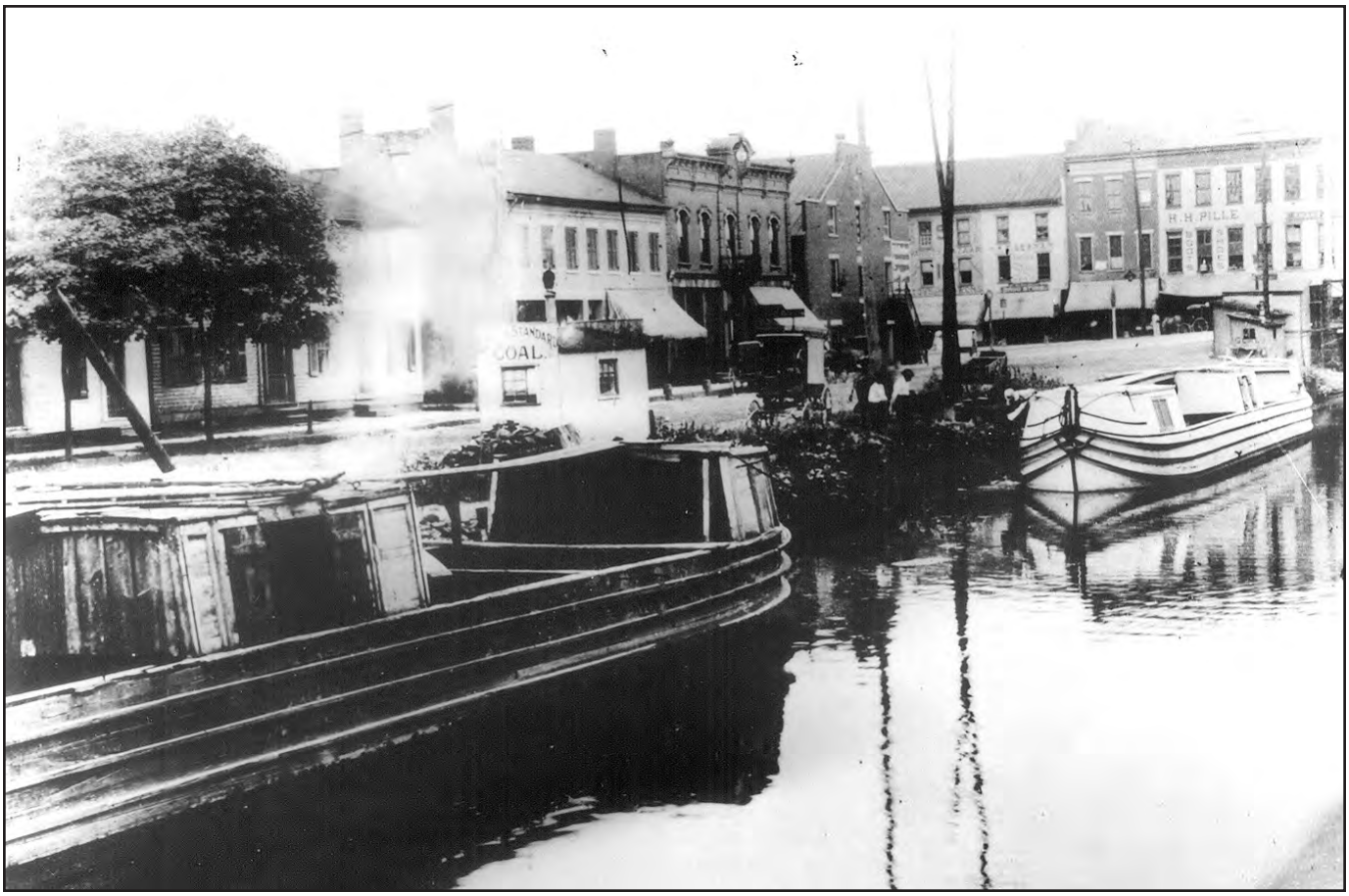


FIGURE 173.—Canal boats moored at the public landing in Massillon, *circa* 1898. View is looking north toward Lincoln Way. In the background is a small building with the name, L. Hess Standard Coal, printed on it, a reminder of former times when large amounts of coal was moved by canal boat from mines of the Tuscarawas Valley. Photo courtesy of The Massillon Museum.

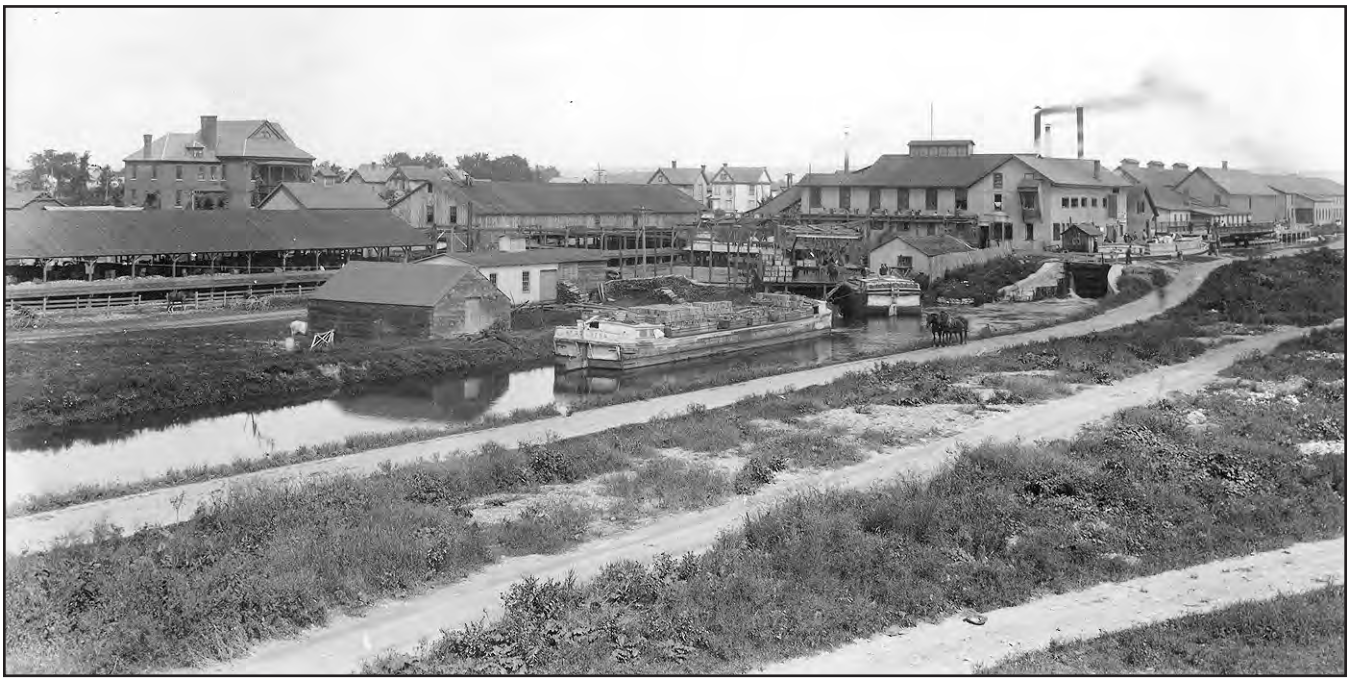


FIGURE 174.—Canal boats on one of Ohio's canals during the 1890's. Very little coal was shipped by canal boat after the advent of the railroads. Location unknown. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment collection.

mines in Tuscarawas County, as the State Inspector of Mines reported (1886, p. 89):

It seems to be a settled fact, in the minds of the owners of these mines along the Ohio Canal, that it is only a question of time when it will be impracticable and unprofitable to ship their coal to northern markets by boat, railroad being far more convenient to them as well as the consumers.

An interesting anecdote about the boat traffic on the Ohio and Erie Canal is given in the following account by Perkins (1926, p. 602):

One [boat captain] *prided himself on being the only person whose boat was run over and cut in two by a railroad train. His boat was passing through a point where an inclined plane led from a coal mine above the canal. The engineer of the loaded coal cars failed to see that the track was not clear, started the cars down the incline and crashed into the boat. All hands jumped in time but the boat was cut in two and two mules were killed.*

President James A. Garfield, when he was a boy 15 years of age (1847), worked as a canal-boat driver transporting coal on the Pennsylvania and Ohio Canal and the Ohio and Erie Canal from the mines of David Tod (who later would be elected Governor of Ohio in 1861) at Briar Hill, near Youngstown, to Cleveland (Howe, 1900, v. 1, p. 112-113).

Just as the development of the coal fields of the Tuscarawas and Mahoning Valleys was due to the construction of the Ohio and Erie and the Pennsylvania and Ohio Canals, so too the initial development of the Hocking Valley coal field was due largely to the construction of the Hocking Canal. This canal, a branch of the Ohio and Erie Canal known as the Side-Cut, was completed to Athens in 1841 (State Inspector of Mines, 1877, p. 101). Prior to the building of the canal,

the coal put to use in Nelsonville was taken from the river bed, but the use was very limited, being confined almost entirely to the blacksmith shops. Two wagon loads of coal were hauled to Columbus in April 1830, the first being a six-horse load, fifty-eight bushels, sold . . . at four cents a bushel, delivered. But little coal was taken to market until the canal was finished (Inter-State Publishing Co., 1883, p. 421).

Shortly after the location of the Hocking Canal was determined, extensive land purchases were made along the line of the canal by several wealthy businessmen with the intent of mining coal. As a result, numerous mines were opened on both sides of the Hocking Canal *at Nelsonville, and the coal was hauled in wagons from the mouth of the mines to the canal, dumped on the wharf and loaded on the boats with wheelbarrows* (Inter-State Publishing Co., 1883, p. 421).

The first coal was shipped from the mines at Nelsonville via the Hocking Canal were made in September 1840 (Roy, 1885, p. 70). During the years 1843-1869 the Hocking Canal provided the major means of transporting coal to market, principally Columbus and Newark. Until 1842, more coal was shipped to Newark than to Columbus. One of the earliest buyers in Columbus of Hocking Valley coal was the old Neil House (Roy, 1885, p. 72), an historic hotel built in 1839 across from the State capitol. It was demolished in 1923 to make way for a new Neil House. The second Neil House was constructed in 1925 and was demolished in 1983 to make room for the Huntington Center and the Riffe Center. From 1840 to 1860, approximately 623,888 tons of coal was transported on the Hocking Canal (Tribe, 1986, p. 7, 11). From 1871 to 1875, an additional 13,261 tons of coal were shipped on the Hocking Canal (Read, 1878c, p. 700).

It should be emphasized that the canal was probably more successful in attracting investors and bringing attention to the economic potential for the coal of the Hocking Valley than it was in providing an efficient means for transporting the mineral to markets. One cannot refute the fact that mining productivity did increase dramatically during the canal era; yet, low water levels, harsh winters, maintenance problems, and sedimentation posed continuous obstacles to the coal shipments along the canal and served to limit the growth of the area's coal industry (Palka, 1986, p. 20).

Prior to 1930, figures on disposition of Ohio coal by method of shipment were not recorded. From 1930 to 1993, approximately 173.4 million tons were shipped by water (table 5). In 1993, 3.0 million tons (8.1 percent of annual production) of Ohio coal were shipped by water. Although shipment of coal by water provided an early boost to Ohio's coal industry, it was eventually replaced by quicker, cheaper, and more efficient methods of transportation. The amount of Ohio coal transported historically by water probably is very minor compared to shipment by rail or truck.

RAILROADS

The first railroad in Ohio, the Erie & Kalamazoo, which initially was horse drawn, was constructed in 1836 (Howe, 1900, v. 1, p. 44). This railroad was chartered in Michigan on April 22, 1833, to operate between Port Lawrence, Michigan, and the Kalamazoo River (Marvin, 1953, p. 49). Following the Michigan and Ohio War of 1835, Port Lawrence became Toledo, Ohio. This boundary dispute resulted in the transfer of ownership of land in the northwest corner of the state from Michigan to Ohio; included in the settlement was the transfer of ownership of the Erie & Kalamazoo Railroad.

The first railroad chartered in Ohio was the Mad River & Lake Erie, on January 5, 1832 (Marvin, 1953, p. 35). This railroad was constructed to connect Dayton (on the Miami and Erie Canal) and Sandusky (on Lake Erie) and began partial operation in 1838 (Stevenson, 1838, p. 277). *The first locomotive to run on the Mad River tracks was the* Sandusky, *weighing nine tons* (Marvin, 1953, p. 86). This steam locomotive, a 4-2-0 type (see following section on steam locomotives), was built in 1837 by the Rogers Locomotive and Machine Works of New Jersey for the New Jersey Railroad and Transportation Company. It was later sold to the Mad River & Lake Erie Railroad, where it remained in operation for many years (Bruce, 1952, p. 25, 51).

Railroad construction in Ohio had a meager beginning during the second quarter of the 19th century. In 1841, only 36 miles of railroad track had been built in Ohio; by 1850, there were 299 miles of railroad track in Ohio (Commissioner of Railroads and Telegraphs, 1877, p. 7). But in the next quarter-century railroad construction reached almost a fever pitch. The miles of track laid in the state grew from

TABLE 5.—DISPOSITION OF OHIO COAL BY METHOD (IN SHORT TONS), 1930-1993

Year	Rail	Water	Truck	Wagon	Conveyor	Pipeline	Mine	Stored	Other
1930	19,605,210	6,621	220,508	1,142,926	-	-	767,700	25,555	533
1931	18,294,340	6,858	281,866	1,268,223	-	-	529,683	41,980	30
1932	11,561,794	351,157	286,423	1,304,816	-	-	377,803	42,421	-
1933	16,816,601	365,032	1,800,294	153,906	-	-	429,351	59,380	-
1934	17,085,433	379,150	2,246,722	68,718	-	-	430,353	130,598	-
1935	17,322,034	421,749	2,746,957	72,112	-	-	430,835	82,539	-
1936	18,785,542	576,190	3,371,116	45,058	-	-	625,141	58,985	-
1937	19,831,233	563,181	3,432,910	42,078	-	-	555,898	83,892	-
1938	14,079,720	751,875	3,014,521	22,740	-	-	342,131	91,639	-
1939	14,420,663	653,272	4,531,194	26,806	-	-	340,714	62,590	-
1940	NA	NA	NA	NA	NA	NA	NA	NA	NA
1941	NA	NA	NA	NA	NA	NA	NA	NA	NA
1942	24,107,334	862,998	5,999,566	41,424	-	-	-	-	480,098
1943	23,979,849	1,181,281	5,164,605	12,190	-	-	490,409	180,689	-
1944	25,324,939	1,093,241	4,846,141	5,790	-	-	231,885	144,592	-
1945	25,523,956	404,847	5,307,988	-	-	-	217,472	63,792	-
1946	25,228,622	44,330	5,216,286	-	-	-	178,858	89,955	26,970
1947	29,837,778	51,438	6,853,086	-	-	-	201,782	77,696	46,830
1948	28,571,434	588,598	8,801,848	-	-	-	216,973	111,618	23,886
1949	21,428,850	771,653	8,298,176	-	-	-	196,889	57,848	23,796
1950	25,530,840	915,428	10,235,682	-	-	-	204,949	80,950	10,083
1951	25,322,395	1,120,760	11,034,897	-	-	-	232,217	99,336	7,103
1952	22,899,114	1,366,749	10,959,875	-	-	-	190,253	66,016	5,224
1953	21,634,231	2,213,062	9,921,306	-	-	-	174,849	124,896	44,404
1954	18,444,112	2,341,662	10,306,358	-	-	-	148,386	202,902	28,646
1955	21,126,172	3,600,382	10,724,197	-	1,241,250	-	110,796	146,976	84,548
1956	21,861,033	4,392,088	10,783,435	-	1,410,492	-	93,959	212,944	54,626
1957	19,934,064	4,050,747	11,273,435	-	1,727,736	-	64,408	393,717	49,528
1958	14,387,701	3,812,738	11,317,901	-	1,952,552	276,859	54,893	214,849	88,897
1959	14,577,060	3,760,435	13,027,518	-	2,355,630	1,335,231	48,021	152,033	66,361
1960	12,918,215	3,711,600	13,410,498	-	2,231,683	1,295,040	14,678	227,032	87,751
1961	12,346,366	3,294,056	11,668,262	-	2,823,652	1,289,950	29,507	251,048	30,900
1962	13,476,605	3,356,914	12,621,360	-	2,914,682	1,084,197	115,353	426,722	14,991
1963	16,153,948	3,555,111	12,609,501	-	3,491,241	754,551	13,404	332,361	6,624
1964	17,799,809	3,330,728	13,231,647	-	2,800,992	-	70,554	153,410	3,338
1965	19,571,622	3,183,087	13,516,742	-	3,007,772	-	-	19,257	33,080
1966	22,770,503	3,159,456	14,186,317	-	2,876,011	-	-	43,048	33,112
1967	24,727,339	3,691,134	14,554,639	-	2,621,226	-	-	190,735	106,542
1968	26,851,979	3,799,806	14,700,375	-	2,636,603	-	-	138,947	159,163
1969	28,745,594	3,723,736	14,068,579	-	4,379,505	-	-	102,279	173,335
1970	30,122,435	3,143,878	16,022,048	-	5,546,868	-	-	151,235	150,235
1971	24,307,170	2,633,202	17,476,293	-	4,359,586	-	-	108,645	131,877
1972	25,370,402	3,714,061	15,601,154	-	5,524,386	-	-	151,486	210,097
1973	20,935,446	3,877,439	15,980,698	-	4,249,598	-	-	379,190	244,116
1974	18,943,629	3,726,948	16,824,911	-	5,424,965	-	-	256,785	174,364
1975	17,680,474	3,837,835	22,284,725	-	2,607,662	-	-	162,200	99,875
1976	17,138,351	4,486,975	17,584,558	-	7,042,235	-	-	415,243	136,519
1977	13,173,305	3,281,374	23,537,731	-	6,475,668	-	-	329,797	142,256
1978	11,381,021	2,942,108	23,261,649	-	2,284,523	-	-	54,790	129,591
1979	12,072,666	2,942,108	20,864,845	-	7,184,914	-	-	207,340	255,778
1980	7,939,676	3,395,400	19,696,135	-	6,959,054	-	-	144,757	815,645
1981	6,523,986	2,959,991	18,276,336	-	6,924,814	-	-	274,893	2,918,786
1982	8,468,139	3,784,702	16,642,930	-	6,955,037	-	-	536,530	2,495,273
1983	7,317,123	6,438,478	12,052,460	-	7,586,867	-	-	825,345	212,066
1984	6,698,817	7,427,603	16,015,282	-	8,723,778	-	-	388,174	137,966
1985	5,225,662	6,372,497	14,070,936	-	9,723,241	-	-	386,499	193
1986	5,092,511	6,895,069	13,705,565	-	9,198,969	-	-	380,804	5,280
1987	3,871,917	5,486,546	14,976,495	-	8,979,813	-	-	423,853	7,165
1988	2,544,027	5,295,641	15,777,821	-	7,780,894	-	-	341,874	42
1989	2,145,547	5,476,358	16,474,880	-	7,624,677	-	-	269,380	3
1990	1,915,577	5,283,316	17,971,455	-	7,633,935	-	-	616,166	0
1991	2,643,626	3,160,080	14,941,500	-	8,668,523	-	-	378,344	17
1992	3,121,997	2,372,771	16,425,890	-	6,983,562	-	-	835,389	25
1993	3,607,898	2,953,269	14,766,647	-	6,340,977	-	-	335,963	20
TOTAL	1,031,125,436	173,470,799	727,805,675	4,206,787	199,255,573	6,035,828	8,130,104	13,384,909	9,957,588

NA = not available.

Sources: Ohio Division of Labor Statistics (1931-1950), Ohio Division of Mines (1944, 1945-1981), Ohio Division of Geological Survey (1983-1994).

FIGURE 175.—Railroad map of Ohio, 1875 (from Commissioner of Railroads and Telegraphs, 1876).

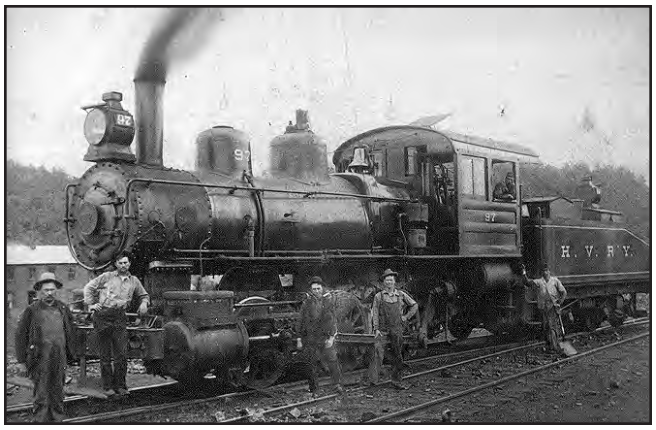


FIGURE 176.—Coal-fired steam locomotive in the Hocking Valley Rail Yard near Nelsonville, Athens County. Date unknown. Photo courtesy of Forrest Walton.

572 in 1851 to approximately 4,461 in 1875 (fig. 175); 56 companies owned, wholly or in part, track in Ohio (Smith, 1977, p. 224, 226). In 1880, there were 73 railroads operating on 6,000 miles of track within the state, and by 1885 there were 60 railroad companies operating on 7,124 miles of track (Commissioner of Railroads and Telegraphs, 1886, p. 31), which is not much less than the mileage of modern rail lines in Ohio. In 1974, only 16 major railroad companies and 15 terminal or switching companies operated on a total of 7,949 miles of track in Ohio (Dalton, Dalton, Little, Newton, 1974, p. VI-11).

During the 30-year period of rapid growth, beginning in 1851, the rail lines in Ohio began servicing many of the coal mines across eastern Ohio, largely replacing water as the principal means of coal shipment (figs. 176, 177). Railroads could deliver coal to market much faster than water transport. In 1869, *coal from the Hocking Valley area could be delivered to Columbus in less than seven hours, a vast improvement over the two weeks sometimes required to move a canal boat the same distance* (Tribe, 1986, p. 22).

Railroads also allowed the development of distant markets such as northern Illinois, Wisconsin, Michigan, and western Canada (Andrews, 1873b, p. 4) (fig. 178). In addition, Andrews (1873b, p. 43) correctly predicted that *by these lines of railroads penetrating the upper Sunday Creek Valley Columbus, Cincinnati, Toledo and Cleveland . . . are, or will soon become, the great centers of consumption and distribution of Ohio coals.*

The arrival of the railroads also spurred the opening of new mines and the continued growth of old mines in Ohio's coal fields. Construction of the Cleveland and Pittsburgh Railroad (C & P) was begun in July 1847 and was completed from Cleveland to Wellsville on March 4, 1852. It was not until the end of 1856 that the line was completed between Wellsville and Pittsburgh (Commissioner of Railroads and Telegraphs, 1868, p. 126). The impact that the C & P made on coal mining is revealed in the following account by Mack (1879, p. 262):

When the Cleveland and Pittsburgh Railroad was completed in 1852, coal mining upon an enlarged scale set in, and having steadily increased in extent since that time, the business now amounts to upwards of two millions of dollars annually.

By 1856, the C & P had extended a line from Wellsville through Steubenville to Bellaire to connect with the Central Ohio Railroad. From 1857 until the early 1870's several shaft mines were developed at Steubenville. These mines provided an enormous amount of coal for coke ovens located at Steubenville, fuel for the steam locomotives of the C & P, and shipment to Cleveland (Caldwell, 1880, p. 491, 498).

The construction of the Central Ohio Railroad (CO) and the Marietta and Pittsburgh Railroad is another example of how railroads helped in the development of Ohio's coal mines. In 1850, there was only one coal mine in operation near Cambridge (Porter, 1993). Construction of the CO to connect Columbus, Newark, Zanesville, Cambridge, and Bellaire began in June 1850, and a portion of the rail line was open for traffic in November 1854 (Commissioner of Railroads and Telegraphs, 1868, p. 61). In 1866, the CO was leased to the Baltimore and Ohio Railroad (B & O) (Everhard, 1882, p. 262). In 1871 construction began on the Marietta and Pittsburgh Railroad (M & P) to connect Marietta, Cambridge, Dover, and Cleveland. The M & P became the Marietta, Pittsburgh and Cleveland Railroad in 1873, was reorganized under the name of Cleveland and Marietta Railroad in 1879, and was purchased by the Wheeling and Lake Erie Railroad (W & LE) in 1880 (Warner Beers & Co., 1884, p. 397) (fig. 179). By 1886, there were 12 mines in active operation near Cambridge, most which were located along either the B & O or W & LE rail lines. By 1905, there were 26 mines producing coal in the Cambridge coal field; nearly all of these mines were served by the railroads and used coal as a source of fuel. Because of the railroads, numerous mines having extensive operations were developed in the Cambridge coal field. This major coal-producing area in Guernsey County is bounded principally by the communities of Cambridge, Old Washington, Senecaville, and Lore City.

Railroad construction also had a tremendous effect on the development of coal mining in the Hocking Valley coal field. Construction of the Columbus and Hocking Valley Railroad (C & HV), originally known as the Mineral Railroad (Commissioner of Railroads and Telegraphs, 1876, p. 91), from Columbus to Athens was completed in 1870. The C & HV was consolidated with the Columbus and Toledo and the Ohio and West Virginia Railway Companies to become the Columbus, Hocking Valley and Toledo Railroad (C HV & T) in 1881 (Inter-State Publishing Co., 1883, p. 139, 140; Commissioner of Railroads and Telegraphs, 1905, p. 87). From 1869 to 1872, its first four years of operation, the C & HV shipped 838,389 tons of coal from Nelsonville (Tribe, 1986, p. 23), more than the total amount shipped by canal boat on the Hocking Canal from 1840 to 1860. In addition, from 1879 to 1888, this railroad carried well over 1 million tons of coal annually (Jennings, 1888, p. 10, 11). Construction of the Newark, Somerset and Straitsville Railroad (N S & S) began in 1869 and was completed in 1872 from Newark to Shawnee, Perry County (Tribe, 1986, p. 48). Upon its completion, the N S & S was leased to the Sandusky, Mansfield and Newark Railroad Company and was operated by the B & O (Commissioner of Railroads and Telegraphs, 1876, p. 117). In its first year of operation, the N S & S shipped 115,881 tons of coal, nearly all of it originating in Shawnee (Tribe, 1986, p. 49). The Ohio Central Railroad (OC), known as the Atlantic and Lake Erie Railroad from 1869 to 1876, completed construction from New Lexington to Athens in 1881. In 1885, the

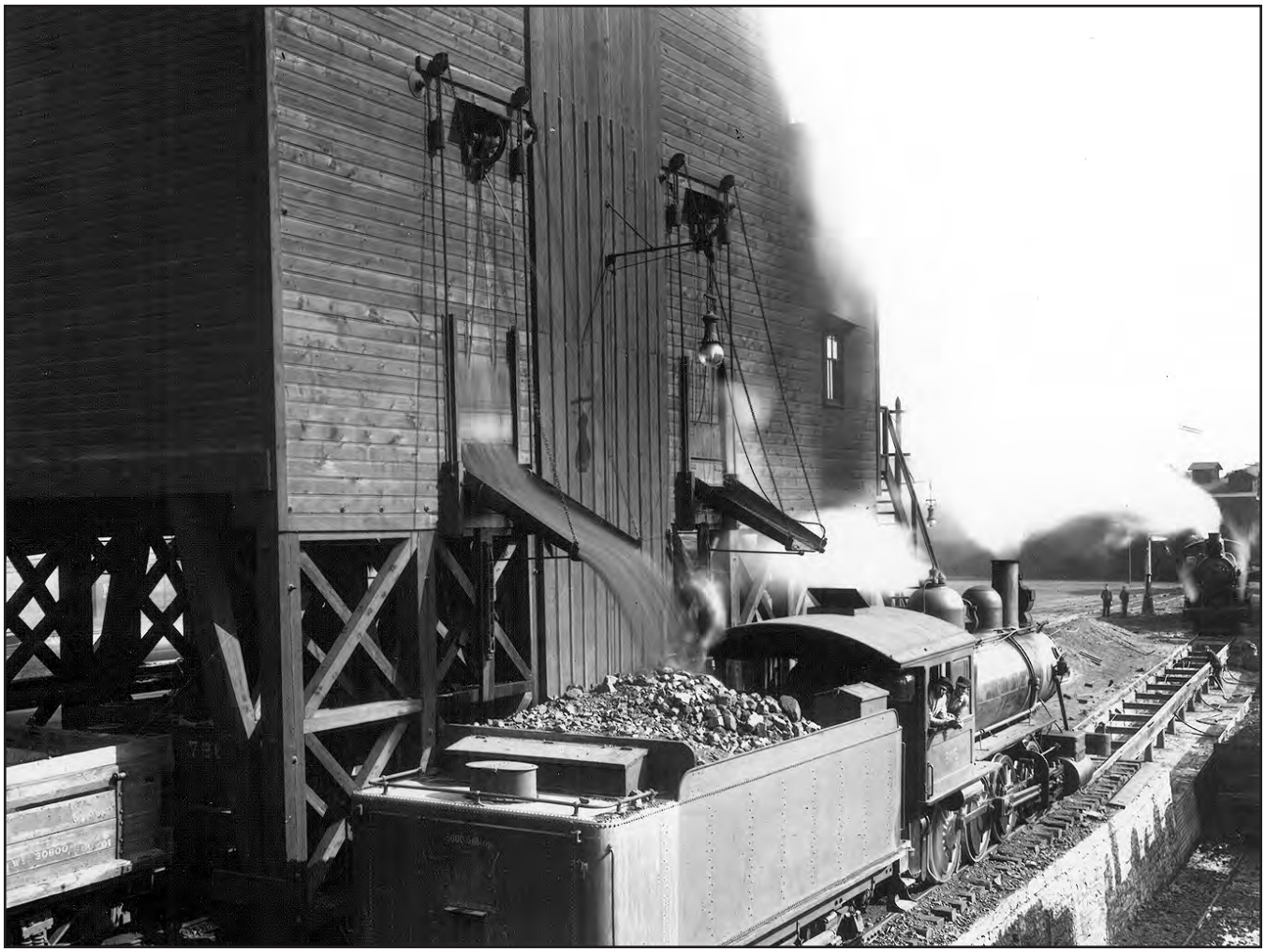


FIGURE 177.—Steam locomotive of the Hocking Valley Railroad taking on a supply of fuel from a coal tipple, *circa* early 1900's. Location unknown. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment collection.

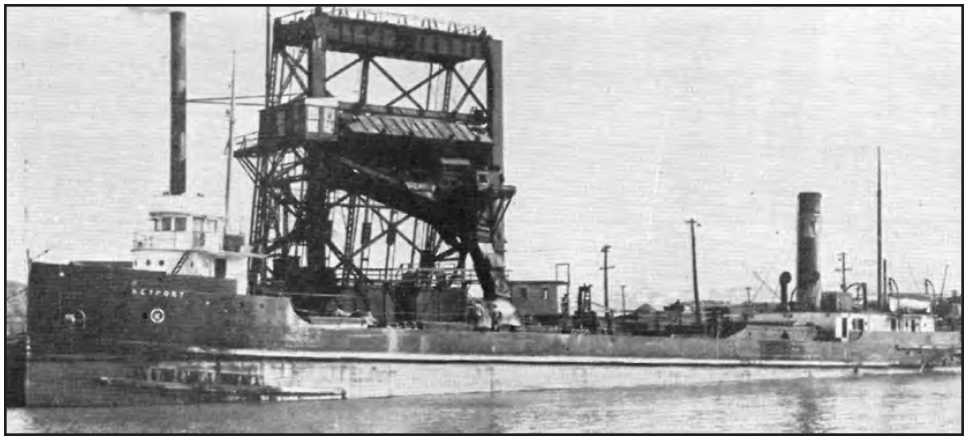


FIGURE 178.—Lake Erie ports, including Ashtabula Harbor shown here, shipped an estimated 25 million tons of coal during 1922 from mines in Ohio, Pennsylvania, and West Virginia to ports on Lakes Michigan, Huron, and Erie in both the United States and Canada. Photo from The Coal Trade Bulletin (1923, v. 48, no. 3, p. 107).

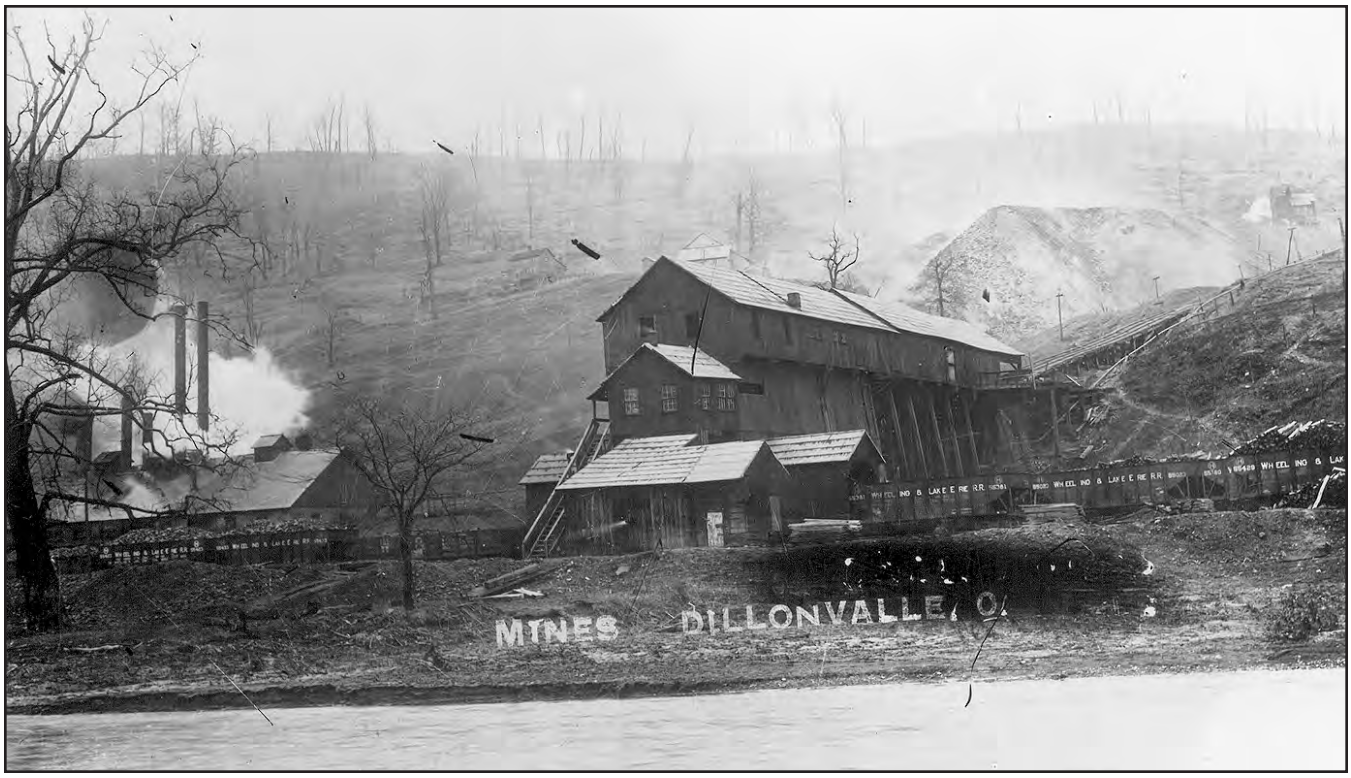


FIGURE 179.—Tipple at Dillonvale in Mount Pleasant and Smithfield Townships, Jefferson County, supplying coal to the Wheeling & Lake Erie Railroad. *Circa* 1910. Photo courtesy of Ohio Historical Society.

OC became the Toledo and Ohio Central Railway. In 1883, OC shipped an estimated 850,000 tons of coal. The amount of coal shipped on the C HV & T and N S & S in 1883 was estimated at 2,000,000 tons and 450,000 tons, respectively (Tribe, 1986, p. 82).

There existed more than just a casual relationship between some railroads and coal mining. The railroads of the 19th and early 20th centuries needed a ready supply of fuel for the generation of steam, and coal mines needed an inexpensive and fast method of transporting coal to market (figs. 180, 181) in order maintain and expand mining operations. One example of this interdependent relationship between the railroads and coal mines is the OC.

Construction of the Ohio Central Railroad had begun in 1869, its objective being to connect the coal fields of New Lexington, Ohio, in the southeastern part of the State with Bucyrus, in the northcentral part, eventually connecting to a port at Toledo in the North. [Ohio Central's main repair shops were located in Bucyrus by the late 1880's.] *The railroad had also acquired 12,500 acres of coal land and organized the Ohio* [Central] *Coal Company* (Anderson, 1980, p. 15).

During the summer of 1880 the Ohio Central Coal Company (OCC Co.) opened a number of extensive mines in the upper Sunday Creek valley in Monroe Township, Perry County (State Inspector of Mines, 1881, p. 28). Among the mines opened by the OCC Co. were five shaft mines in the Middle Kittanning (No. 6) coal in the vicinity of Corning and Rendville, and one at Buckingham. In the same vicinity the OCC Co. also operated four drift mines in the Upper Freeport (No. 7) coal (State Inspector of Mines, 1882, p. 44, 45).

Not only were the railroads a prime mover of coal (figs. 182, 183), they were a major consumer (figs. 184-190) of coal for steam-generated locomotion until the 1930's and 1940's, when large diesel-electric freight locomotives were developed. In 1915, railroads in the United States consumed an estimated 128,200,000 tons of coal, or 24 percent of the total national output, in order to carry passengers and freight (The Coal Trade Bulletin, 1916, v. 35, no. 5, p. 26).

By 1949, only thirteen steam locomotives were ordered by domestic railroads as compared with 2,800 diesel-electric locomotives for the same year; in 1950, the number of new steam locomotives ordered had dropped to zero, while diesels increased by 3,150 . . . . [However, the fact that] *there are still about 26,000 steam locomotives in service as of 1951 as against 15,000 diesel-electrics indicates that complete dieselization has not yet been effected on all U.S. railroads* (Bruce, 1952, p. 3).

FIGURE 180.—A typical scene at Ashtabula Harbor during the 1920's—coal from approximately 3,000 coal-filled railroad cars, including coal cars of the New York Central Railroad (NYC) and the Pittsburgh, McKeesport & Youghiogheny Railroad (P McK & Y), waiting for transport by lake freighter. Photo from The Coal Trade Bulletin (1923, v. 48, no. 3, p. 111).

FIGURE 181.—Coal elevator at Ashtabula Harbor dumping coal into lake freighters a carload at a time. The elevator raises the railroad car to the level of the hopper, where the railroad car is tipped over, dumping the coal into the hopper, which feeds the freighter. The entire process of raising, dumping, and lowering a railroad car takes only a minute. Photo from The Coal Trade Bulletin (1923, v. 48, no. 3, p. 110).

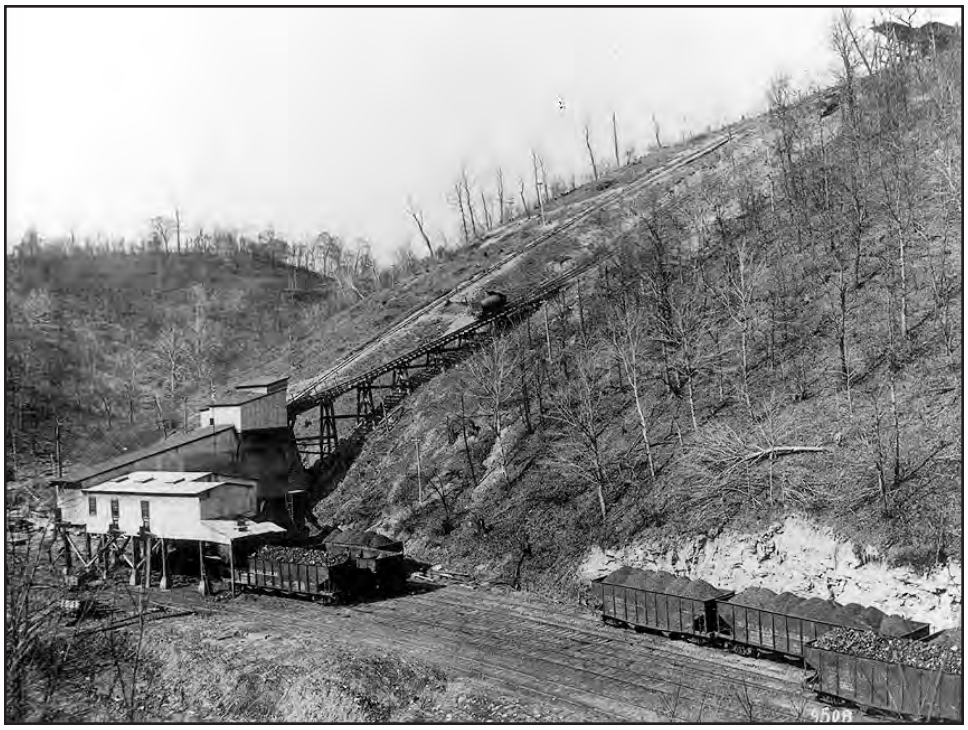


FIGURE 182.—Crusher and railroad-car-loading coal tipple to the Beech Flats mine (Jfn-56), located near Rush Run, in Wells Township, Jefferson County. This surface mine, operated by the Beech Flats Coal Company, was abandoned in 1924. Date unknown. Photo courtesy of Ohio Historical Society.

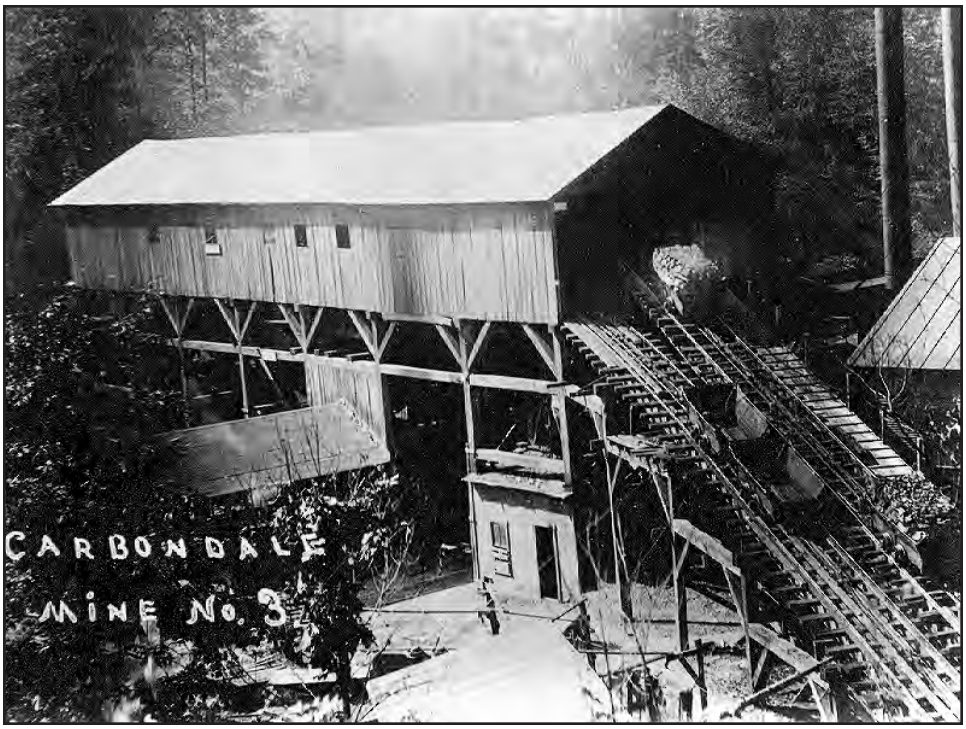


FIGURE 183.—Railroad-car-loading tipple of the Carbondale Coal Company mine No. 3 (As-256). This mine, located northwest of Carbondale, in York Township, Athens County, was abandoned in 1952. Note the loaded and empty coal cars being moved by wire-line hoists. Date unknown. Photo courtesy of Mark Wharton.

FIGURE 184.—B & O EM-1 2-8-8-4 #676 hauling a Holloway Humper through Bannock (Belmont County) on a brisk November afternoon in 1957. Hauling 97 cars carrying 8,700 tons of coal, the EM-1 pulls mightily to get the train to the summit at Flushing (Belmont County). Holloway Humper is a term applied to trains bringing coal out of the Ohio Valley over the summit at Flushing to be assembled into longer trains at the railyards in nearby Holloway for shipment to Lake Erie ports. Photo and information on engine courtesy of J. J. Young, Jr.

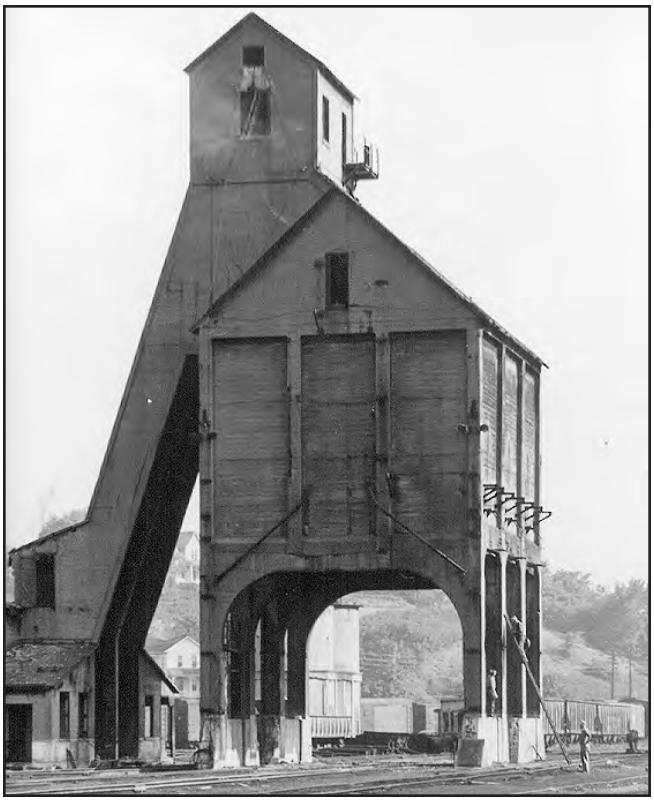


FIGURE 185.—Coal tipple at the railroad yards in Dennison, Tuscarawas County. *Circa* 1955. Photo courtesy of Dennison Railroad Museum, Don Case collection.

FIGURE 186.—B & O Q-4b 2-8-2 #438 applying a lot of muscle to the hind end of an 8,700-ton Holloway Humper rolling through Bannock (Belmont County). Photo taken in November 1957. Photo and information courtesy of J. J. Young, Jr.

FIGURE 187.—Nickel Plate Railroad 2-8-4 #826 (nee W & LE #6426) about to cut away from the caboose and back onto pick-up tracks to fill out the train's tonnage with coal from the Saginaw mine (Bt-643) before heading to Adena and Pine Valley in Jefferson County. The Saginaw mine, a slope mine in the Pittsburgh (No. 8) coal located just southwest of St. Clairsville, in Richland Township, Belmont County, was operated by the Saginaw Mining Company and ceased operations in December 1992. *Circa* 1956. Photo and information on engine courtesy of J. J. Young, Jr.

FIGURE 188.—In the B & O yards at Holloway (Belmont County) an L-2 0-8-0 takes an EM-1 2-8-8-4 (background) to be loaded with coal and water. A sister EM-1, #7629 (center), awaits a call to take coal to the port of Lorain. Photo taken in October 1953. Photo and information courtesy of J. J. Young, Jr.

FIGURE 189.—B & O Q-4b #4449, running in reverse with a Vanderbilt tender leading, blasts out of the Barton tunnel with a load of coal from the mines around Bannock and Lafferty, Belmont County. Photo taken in December 1952. Photo and information courtesy of J. J. Young, Jr.

FIGURE 190.—On a brisk December afternoon in 1956, a pair of Nickel Plate Railroad 2-8-4's, #817 and #811 (nee W & LE #6417 and #6411), pulled 6,500 tons of Pittsburgh (No. 8) coal from the Pine Valley yards at Dillonvale (Jefferson County) on the tough grade out of the Ohio River valley bound for Brewster (Stark County). Photo and information courtesy of J. J. Young, Jr.

STEAM LOCOMOTIVES

The first steam locomotive to run on rails in America was built in 1826 by Colonel John Stevens at Hoboken, New Jersey (Bruce, 1952, p. 21) (fig. 191). During the 19th century, steam locomotives went through many stages of evolution until about 1900. From 1901 to 1950, the basic elements of the boiler, frame structure, driving wheels, and trucks remained practically unchanged in both appearance and function for the locomotive engines with reciprocating pistons (Bruce, 1952, p. 95). The principal means of describing or identifying steam locomotives is by the number and arrangement of the wheels. When present, the leading and trailing wheels (called trucks) on a steam locomotive are small. Between these sets of wheels are large-diameter driving wheels. The steam locomotive *Sandusky* of the Mad River & Lake Erie Railroad was a 4-2-0 type, which means that it had four leading wheels, two driving wheels, and no trailing wheels. The workhorse of steam locomotives used on practically all railroads in the United States was the 2-8-0 type locomotive (figs. 192, 193), which was built from about 1866 to 1916.

The car trailing immediately behind the locomotive on which the fuel and water were carried is called the tender (fig. 194). The carrying capacities of tenders varied through the years. Tenders carried 2,000 gallons of water in 1870, 6,000 gallons by 1900, 12,000 gallons by 1920, 20,000 gallons by 1925, and 45,000 gallons by 1940 (Bruce, 1952, p. 344-345). The amount of coal carried on the tender was generally more than twice the amount required to evaporate the amount of water carried. For example, a tender carrying 6,000 gallons of water would carry at least 17,000 pounds of coal. The first 8,500 pounds of coal would be used to evaporate the water carried on the tender; the remaining coal would be used to evaporate a second load of water, which would be taken on while en route. In other words, steam locomotives made twice as many stops to take on water as to refuel. In 1876, there were 456 water and fuel stations located along rail lines in Ohio for use by the 2,321 steam locomotives operating in Ohio at that time (Commissioner of Railroads and Telegraphs, 1876, p. 168, 169).

Nearly all of the early steam locomotives burned wood, though those operating in eastern Pennsylvania soon changed to burning anthracite coal. By 1870, bituminous coal was the most common fuel used by steam locomotives. The preference of coal over wood as a fuel in 1876 is illustrated by the following fuel consumption statistics by the Commissioner of Railroads and Telegraphs (1877): 31 locomotives of the Columbus and Hocking Valley Railroad consumed 794 cords of wood and 15,136 tons of coal; 111 locomotives of the Pittsburgh, Cincinnati and St. Louis Railroad consumed 2,605 cords of wood and 101,984 tons of coal; 97 locomotives of the Cleveland and Pittsburgh Railroad consumed 7,042 cords of wood and 38,723 tons of coal; 43 locomotives of the Baltimore and Ohio Railroad consumed 1,394 cords of wood and 51,463 tons of coal; and 73 locomotives of the Marietta and Cincinnati Railroad

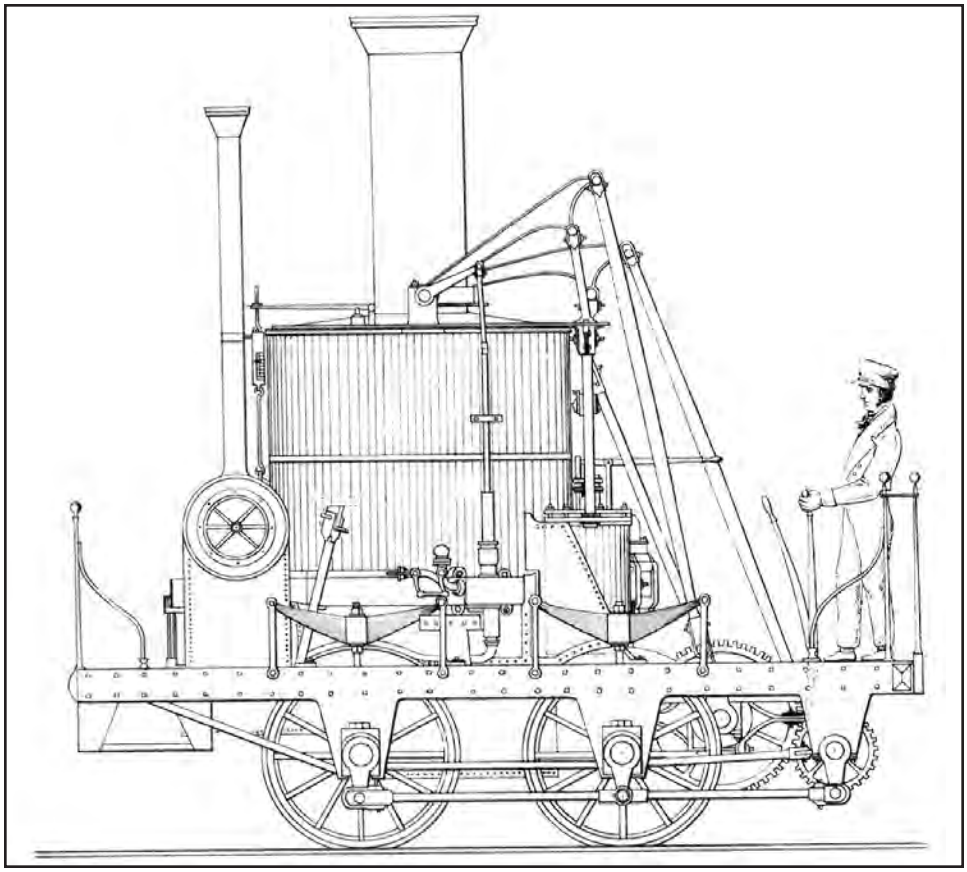
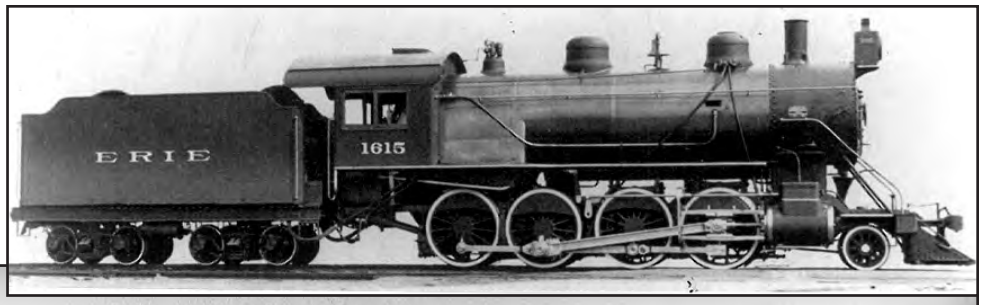


FIGURE 191.—A 1830's-vintage coal-fired steam locomotive (from Stevenson, 1838, plate XII). This locomotive was used on the Washington & Baltimore Railway and burned anthracite coal.



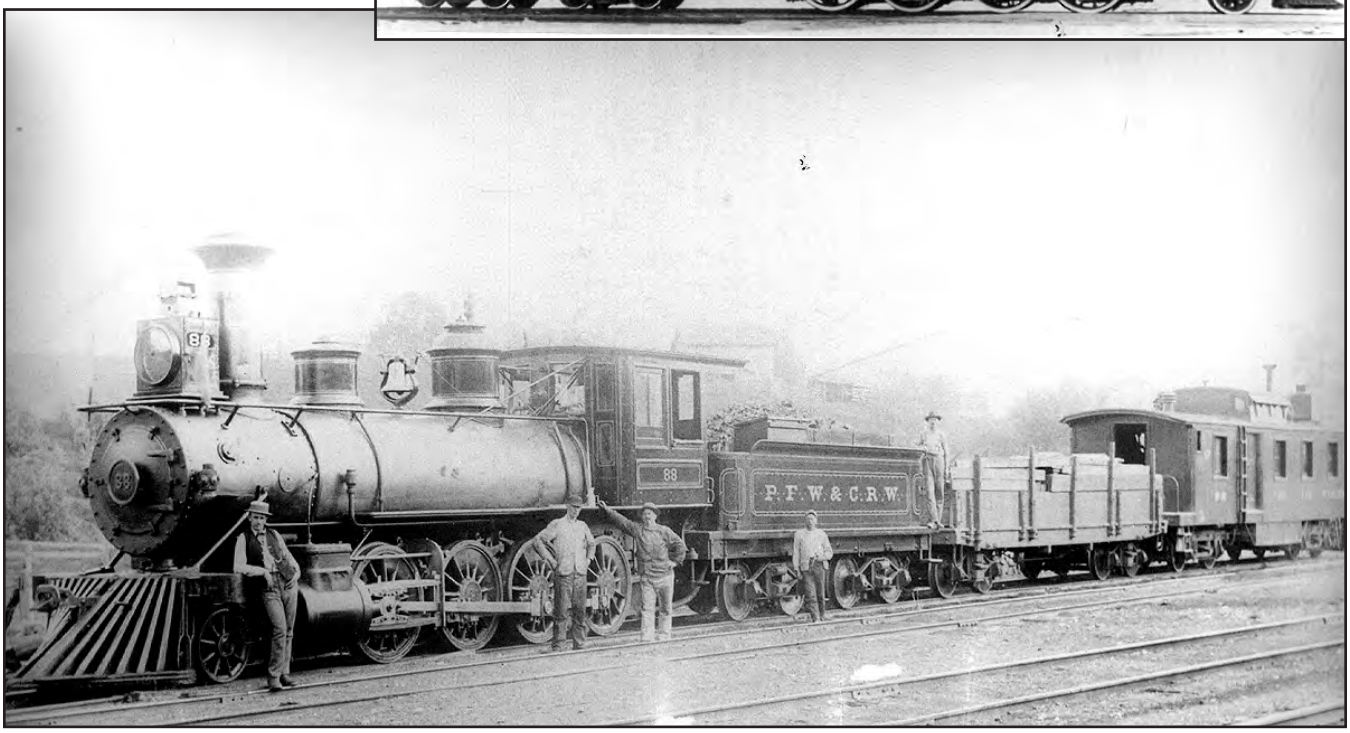


FIGURE 192.—Two 2-8-0 steam locomotives, #1615 of the Erie Railroad (top) and #88 of the Pittsburgh, Fort Wayne & Chicago Rail Way (bottom). These engines were the workhorses on practically all U.S. railroads from 1866 to well into the 20th century. Top photo, date unknown, from Bruce (1952, photo no. 37); bottom photo, *circa* early 1900's, courtesy of The Massillon Museum.

consumed 735 cords of wood and 65,924 tons of coal.

One pound of coal having a heat content of 13,000 Btu will evaporate 0.7 gallon of water (Bruce, 1952, p. 342). The 1900's-style fire box on a large bituminous-coal-fired locomotive measured 120 inches by 42 inches. Such a locomotive was hand fired and burned about 5,000 pounds of coal per hour to evaporate about 3,500 gallons of water. Assuming that one locomotive ran 8 hours per day (excluding water and refueling stops), 5 days per week, 50 weeks per year and burned coal at a rate of 2.5 tons per hour, one 1900's steam locomotive was capable of consuming about 5,000 tons of coal per year.

Railroads remained the chief means of coal shipment until 1975, when trucks became the primary mover of coal. The peak year of coal shipment by railroads was 1970, when about 30 million tons were shipped (figs. 195, 196). Over the past six decades (1930's to 1990's), railroads have moved an amount of coal nearly equal to one-third of the total coal produced in Ohio over the past 193 years (1800 to 1993). In 1993, 3.6 million tons (13.0 percent of annual production) of Ohio coal were shipped by railroads.

FIGURE 193.—W & LE 2-8-0 #680 hauling a load of Pittsburgh (No. 8) coal from the Hanna Coal Company Willow Grove No. 10 mine (Bt-163). *Circa* 1917. Photo courtesy of Charles "Bud" Fry. (For other photos of this mine see figs. 35, 79, 82, 93, 110, 117, 119, 120, 123, 140-142, 153, 154.)

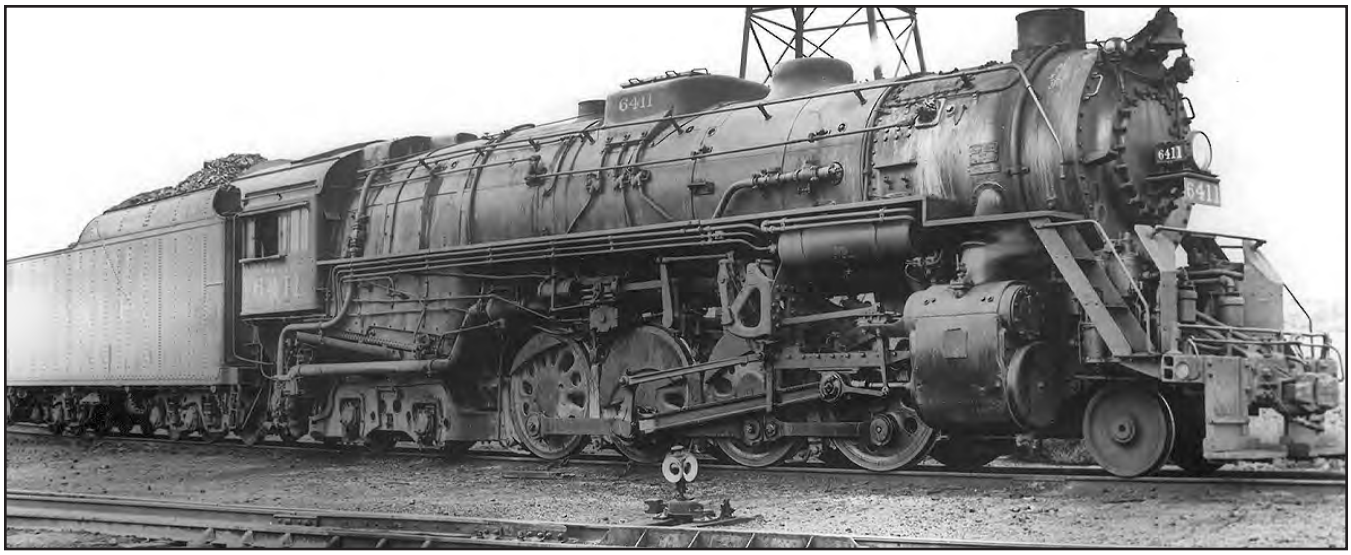


FIGURE 194.—W & LE 2-8-4 #6411, a Berkshire-type steam locomotive, and its tender. This locomotive was built by the American Locomotive Company at Schenectady, New York, in December 1938. It jumped the tracks at Snively Siding, north of Brewster (Stark County) on December 17, 1939. It was rebuilt and thereafter was known as the *Swamp Jumper*. Date unknown. Photo courtesy of The Massillon Museum.

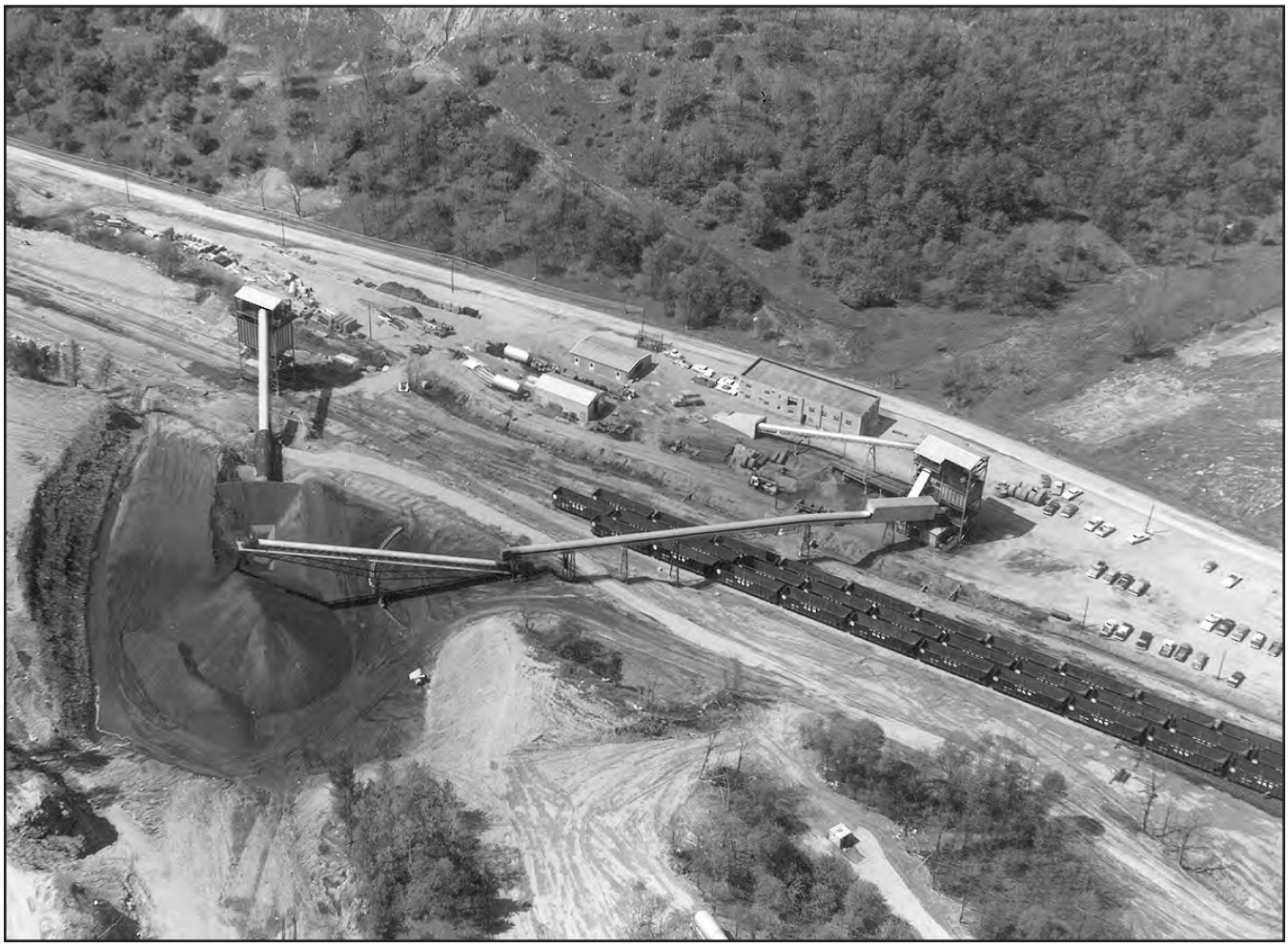


FIGURE 195.—Aerial view of railroad-car-loading tipple, coal stockpile, conveyors, and slope opening to the Hanna Coal Company Rose Valley No. 6 mine (Hn-69), near Cadiz, in Green Township, Harrison County. Development of the mine began in October 1966 with the construction of a 1,752-foot slope opening to the Lower Freeport (No. 6A) coal. The tipple (top left) was capable of delivering 3,000 tons per hour and loading 100 railroad cars in about 3½ hours. The mine was abandoned in 1980. This photo was featured on the cover of Coal Age (1968, v. 73, no. 9). Photo courtesy of Dale Davis.

TRUCKS, CONVEYORS, AND PIPELINES

Although wagons or carts were probably the earliest method used to ship coal to market, it wasn't until the early 1930's that trucks began to contribute significantly to the movement of Ohio's coal to market (figs. 197-199). Trucks eventually became the preferred method to ship coal (fig. 200). Since the 1950's, shipment of coal by trucks increased significantly in Ohio as result of the development of the interstate highway system, the advent of diesel-powered trucks, and an increasing demand for fuel by electric utilities. By 1970, there were 10 times more miles of highways than railroad track in Ohio (Noble and Korsok, 1975, p. 124). Because of Ohio's well-developed highway infrastructure, the amount of Ohio coal moved by trucks increased steadily, reaching an annual record of about 23.5 million tons in 1977 (see table 5). In 1993, 14.8 million tons (53.5 percent of annual production) of Ohio coal were shipped by truck.

The first reported shipment of coal by conveyor belt in Ohio was 1955. Shipment of coal in Ohio by conveyor belt (fig. 201) increased gradually, reaching an annual maximum of 9.7 million tons in 1985. By 1983, conveyors had replaced railroads as the second most important method of transporting Ohio coal. In 1993, 6.3 million tons (22.9 percent of annual production) of Ohio coal was moved by conveyor belt.

From 1957 to 1963, some Ohio coal was transported by a slurry pipeline (figs. 202, 203). A 10-inch pipeline built by the Hanna Coal Company carried a total of about 6 million tons of coal from Hanna's Georgetown mine near Cadiz (Harrison County) to the Cleveland Electric Illuminating Company Eastlake Generating Station in Eastlake (Lake County), a distance of about 108 miles (Consol News, 1964, v. 3, no. 1, p. 17; Hanna Coal News, February 1961, p. 3-27; Kefauver, 1959, p. 26). The coal slurry carried by the Hanna pipeline consisted of 50 percent by weight each of water and crushed coal (14 to 200 mesh in size) and traveled the distance in 36 hours. The pipeline was constructed to provide an economic alternative to high railroad rates in transporting coal. The pipeline was so successful that railroads quickly developed low-rate unit trains for coal shipment and the pipeline was no longer used for shipment of coal after 1963.

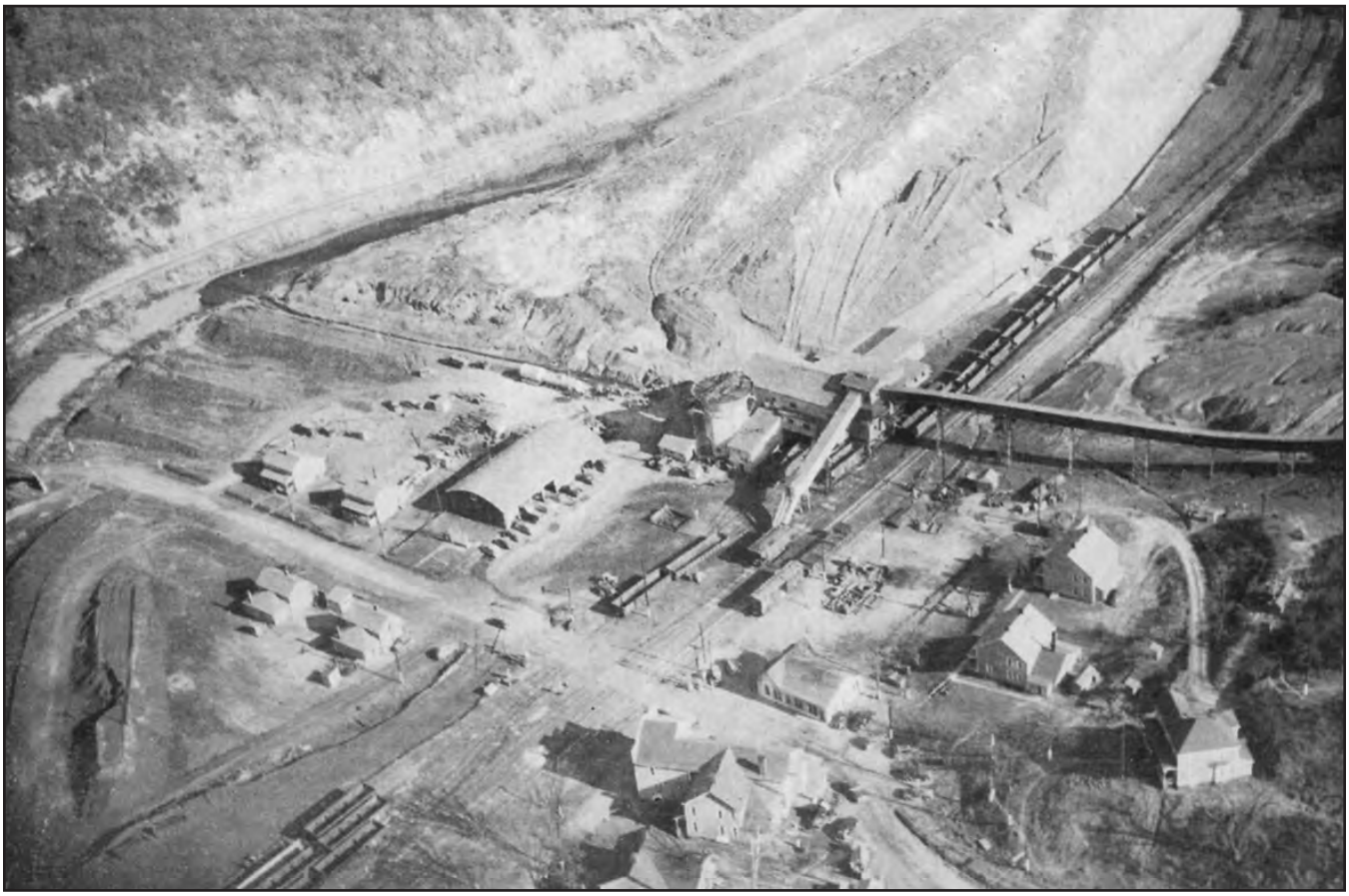


FIGURE 196.—Aerial view looking east toward the railroad-car-loading tipple and preparation plant at the Hanna Coal Company Dun Glen No. 11 mine (Jfn-129). Just west of the tipple (at lower left corner of the photo) is the community of Newton, constructed to provide modern housing for Hanna Coal Company miners who worked at the Dun Glen No. 11 mine and the Dillonvale No. 1 mine (Jfn-87). Photo courtesy of Dale Davis, from Hanna Coal News (November 1947, back cover). (For other photos of this mine see figs. 112 and 118.)

FIGURE 197.—Bucket-conveyor wagon loader loading a horse-drawn wagon at the railyards in Toledo. The coal was shipped by the Big Four Coal Company. *Circa* early 1900's. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment Company collection.

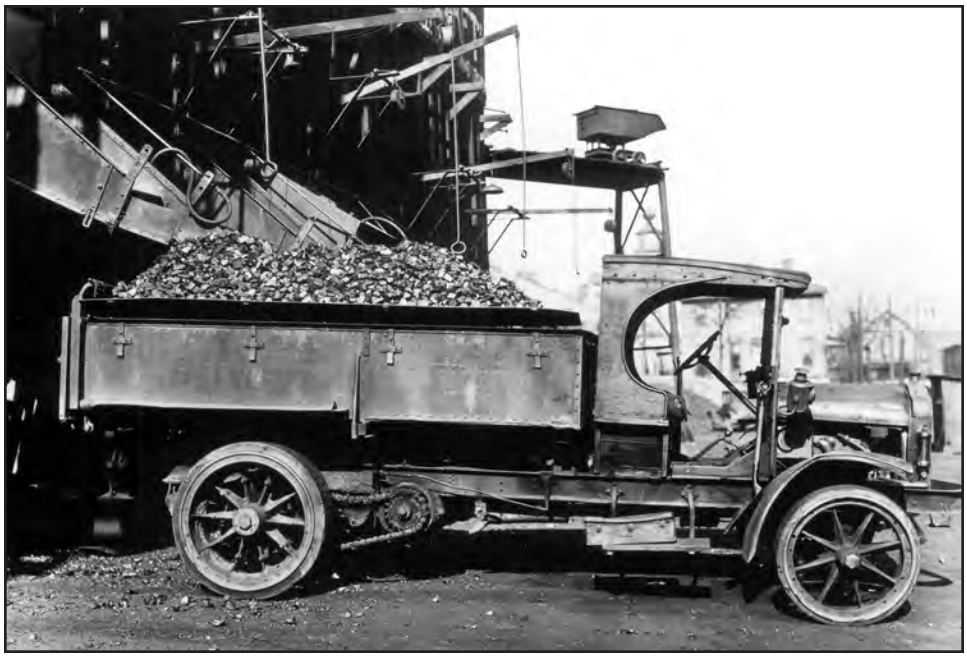


FIGURE 198.—Early truck transport of coal. Date and location unknown. Photo courtesy of Ohio Historical Society, from the Steubenville Coal and Mining Company collection.

FIGURE 199.—One man, shoveling coal by hand onto an electric-powered conveyor, could load a 2-ton delivery truck in 5 minutes. Without the conveyor, four good men took 30 minutes to load the same truck. Photo from The Coal Trade Bulletin (1923, v. 49, no. 5, p. 215).

FIGURE 200.—The Central Ohio Coal Company uses 160-ton coal haulers to move coal from its active mining pits to a tipple, where the coal is loaded into Muskingum Electric Railroad train cars. Date and location unknown. Photo courtesy of American Electric Power Service Corporation. (For other photos of this mine see figs. 11 and 13.)

FIGURE 201.—Portion of a 10-mile-long overland conveyor that carries coal from the Southern Ohio Coal Company Meigs Division underground mine complex (Meigs No. 2 and No. 31 mines, Ms-293 and Ms-294) to the Gen. James M. Gavin generating station (background). The belt line of this conveyor runs at speeds up to 1,000 feet per minute. Date unknown. Photo courtesy of American Electric Power Service Corporation. (See also figs. 46, 216, 219.)

FIGURE 202.—Coal-slurry pipeline under construction in 1956. The 10-inch, 108-mile-long pipeline linked the Hanna Coal Company Georgetown preparation plant (see fig. 203) near Cadiz, Harrison County, with the Cleveland Electric Illuminating Company Eastlake Generating Station in Eastlake, Lake County. This pipeline supplied about 6 million tons of coal to the Eastlake Generating Station from 1957 to 1963. Location unknown. Photo courtesy of Dale Davis.

FIGURE 203.—Coal-slurry plant at the Hanna Coal Company Georgetown preparation plant, about 1½ miles south of Cadiz, in Cadiz Township, Harrison County. At the coal-slurry plant, crushed coal was mixed with water in the tank to the left and pumped 108 miles to the Cleveland Electric Illuminating Company Eastlake Generating Station. *Circa* 1960. Photo courtesy of Dale Davis.

Chapter 8

VALUE AND USES OF COAL

COST OF OHIO COAL

Coal has been and remains the single most important mineral commodity produced in Ohio (see table 5). Prophetic in his estimation on the importance of coal to Ohio's economy, Mather (1838, p. 1) stated

The working of the coal mines of Ohio, which may be considered inexhaustible, must become one of the most productive branches of industry in the State.

In fact, throughout the past 20 years the value of coal surpassed or was equal to the combined value of all other mineral commodities produced in Ohio. The value of coal produced at the mine in 1993 was $759,130,295, which is 43 percent of the total value of all the mineral commodities, including oil and gas, produced in Ohio (Ohio Division of Geological Survey, 1994).

Throughout the 1800's, the price of coal varied considerably and was expressed in cost per bushel, per barrel, or per ton. According to Eavenson (1942, p. 11), 1 bushel of coal weighs 80 pounds and 1 barrel of coal weighs 200 pounds and equals 2.5 bushels of coal in weight; 1 ton of coal equals 25 bushels. In 1819, 1,200 bushels (48 tons) of coal was shipped from Pomeroy, Meigs County, to Louisville, Kentucky, where it was sold for 25 cents per bushel (Eavenson, 1942, p. 267), which equals $6.25 per ton. The price of coal from Bellaire, Belmont County, sold in 1830 at sugar refineries in New Orleans was $1.50 per barrel (Eavenson, 1942, p. 272), which equals $13.63 per ton. Also in 1830, two wagon loads—116 bushels—of Middle Kittanning (No. 6) coal was shipped from Nelsonville to Columbus and were sold for 4 cents per bushel (Tribe, 1986, p. 3), which equals $1.00 per ton. In 1838, *coal is worth, in Ohio, from 4 to 18 cents per bushel* [$1.00 to $4.50 per ton]; *and a man's daily labor, from 50 cents to $1.50* (Mather, 1838a, p. 6). In 1850, the highest price paid for coal in the Cleveland market was $3.50 per ton; in 1856, the same coal was uniformly sold for $4.50 per ton (Newberry, 1857, p. 56). In the late 1800's, Sharon (No. 1) coal from the mines in the vicinity of Youngstown was sold in Cleveland as high as $20 per ton (Hubbard News, September 13, 1934). Coal produced from the Federal Creek area of Athens County was priced in 1864 at 2.16 cents per bushel (54 cents per ton) (Eavenson, 1942, p. 272); in 1883, Federal Creek coal for the smelting of iron was priced from $1.35 to $1.50 per ton (Lord, 1884, p. 481).

The first consistent records of the price per ton of coal mined in Ohio began about 1923. The price per ton of Ohio coal was low and static, ranging between approximately $1 and $4, until 1974, when the price rose to about $10 per ton. Prices continued to rise, doubling to about $20 per ton in 1978, and skyrocketing to a record $38.97 in 1985 (see table 2). In 1993 the average price per ton of Ohio coal was $27.44. There are many reasons for the staggering increase in the cost of Ohio coal during the past 22 years. Some of these are:

1. Passage of the federal Coal Mine Health and Safety Act in 1969, which limited the activities of miners, particularly those who work underground.
2. Passage of the revised federal Black Lung Act in 1978, which placed a tax of 50 cents and 25 cents per ton, respectively, for coal deep mined and strip mined. In 1981, the Black Lung tax for deep-mined coal was doubled.
3. Passage of the federal Surface Mining Control and Reclamation Act in 1977, which included a severance tax of 35 and 15 cents per ton, respectively, for coal surface mined and underground mined.
4. Passage of Ohio's amended strip mine law in 1972, which became Ohio's most stringent regulation of active surface mining since the enactment of Ohio's first strip mine law in 1948. It provided a severance tax of 4 cents per ton of coal mined. Ohio's strip mine law was amended again in 1981 and 1982 to comply with the federal Strip Mine Law of 1977.
5. Several contract renewals by the United Mine Workers of America (UMWA), which more than tripled the average daily UMWA labor rate from $35 in 1970 to $112 in 1985.
6. Inflation, other government imposed taxes (such as gasoline and highway taxes), and increased costs of fuel and equipment.

COAL AS A FUEL

The early pioneers first mined coal for domestic use, but, before long, coal was recognized as an inexpensive and plentiful fuel for industrial use. Mills Day made a journey through Ohio in 1810. In writing about Zanesville in his diary, he said,

Iron ore and coal are found in any requisite quantity near the town. A furnace and forge are already erected on Licking Creek near the mouth. Coal is so easily obtained that the inhabitants of the town use it altogether for fuel, notwithstanding the supply of timber in the neighborhood (quoted in Stoddard, 1929, p. 226).

In 1812, coal sold in Marietta for 3 cents a bushel (75 cents a ton), and was preferred for fuel when wood could be bought for $1 a cord (Eavenson, 1942, p. 266).

As early as 1818, 44,000 bushels of coal mined near Pomeroy, Meigs County, was routinely shipped down the Ohio River to Cincinnati to be used as a fuel in an iron foundry, steam mills, a sawmill, and in the manufacture of sugar; an additional 60,000 bushels was shipped to Maysville and Louisville (Roy, 1884b, p. 322). By 1830, coal from Bellaire, Belmont County, had been shipped down the Ohio River by flatboat to fire the boilers of the sugar refineries in New Orleans (Eavenson, 1942, p. 268). Coal mined in Ohio also was used to fire the boilers of drilling rigs during the early development of the oil and gas fields of Washington and Monroe Counties (Denton, 1960, p. 42).

Blacksmith forges and steamboats

The first industrial use of coal in Ohio was as a fuel to fire the blacksmith's hearth. By 1808, the Quakertown (No. 2) coal was mined near Chapman, Jackson County, for blacksmith purposes (Stout, 1944a, p. 2). By 1810, coal was mined near Tallmadge, Summit County, for the local blacksmith trade (Whittlesey, 1872b, p. 1). As early as 1820, Sharon (No. 1) coal was produced from mines along Buffalo Skull Road and the valley of Horse Creek, approximately 4 to 6 miles southwest of Wellston, Jackson County, and hauled to blacksmiths of Ross County (Morrow, 1956, p. 77). In 1823, Quakertown coal was surface mined on the farm of George Reigle and was hauled to blacksmiths of Scioto and Pike Counties and Chillicothe (Ross County) (Anonymous, 1953). The Sharon and Quakertown coals were particularly well suited for blacksmithing purposes because of their clean-burning (low-sulfur) character. During the 1820's, Middle Kittanning (No. 6) coal was used by blacksmiths of Nelsonville, Athens County (Tribe, 1986, p. 3). Coal used by blacksmiths of Tiverton Center, Coshocton County, was hauled by wagon 21 miles from mines located near Coshocton. This coal was valued at $1.80 per ton at the mine and the cost of freight was an additional $5 per load (Hodge, 1878, p. 568).

The first coal-fired river steamer, the Bazaleel Wells, began operation in 1820. By 1828, coal from Summit County was being shipped to Cleveland as a replacement fuel for the Great Lakes steamboats. By the 1830's, coal became the fuel of choice for steamboats. Mather (1838b, p. 12) made this observation about the preference of coal over wood:

Many of our boats now use coal in preference to the best wood for a double reason, (viz.) that the fire can be kept more uniform and generate a great quantity of steam; 2nd, that the expense is much less . . . .

The price of coal on the Ohio River varies at different points, from five to sixteen cents per bushel. The average is probably about ten cents per bushel. The average price of wood on the Ohio, is about $2.50 per cord. It is now generally admitted that coal at 25 cents per bushel is equivalent to wood at $2.50 per cord, while it has but one third the weight and occupies only one ninth the bulk. The advantage, therefore, to steam boats where weight, bulk and time [loading time for coal was one fourth that for wood] *are valuable, is sufficiently manifest. The coal now used within this State, on the banks of the Ohio, is estimated to be about two millions of bushels per annum . . . .*

By 1844, the steamboats on the Ohio River were changing from wood to coal as the preferred fuel (Eavenson, 1942, p. 270) (figs. 204, 205). By 1845, coal had wholly replaced wood as a fuel on lake steamboats (Whittlesey, 1872b, p. 3).

Salt furnaces

The manufacture of salt in Ohio by pioneers began in 1796 along Leading Creek, in Rutland Township, Meigs County (Hildreth, 1838, p. 60). This endeavor was followed by the manufacture of salt at the Scioto Licks along Salt Creek, a tributary to the Scioto River, in Jackson County. Salt production at the Scioto Licks reached its zenith between 1806 and 1808, when there were 20 furnaces in operation making between 50 and 70 bushels of salt per week (Hildreth, 1838, p. 57). As early as 1802, Henry Daniels erected a small furnace in Ross Township, Jefferson County, for boiling brine to make salt (Caldwell, 1880, p. 572). This furnace was followed by the establishment of evaporator works along Salt Creek in Muskingum County in 1804; along Chickamoga [Chickamauga] Creek, south of Gallipolis, Gallia County, in 1807; in Columbiana County in 1809; along Leading Creek in Dover Township, Athens County, in 1820; and in other places at later dates (Hildreth, 1838, p. 56-60).

In 1810, the Ohio legislature authorized a reduced rental fee for the agents of the Muskingum salt works if coal was successfully substituted for wood (Foster, 1838, p. 95). This legislation was passed to offer pricing incentives to use coal instead of wood in order to better manage timber resources. However, the fuel used in salt evaporators was wood until about 1820, when coal was substituted by Mordecai Moore at the evaporator works in Ross Township, Jefferson County. The use of coal so facilitated the process of making salt from brine . . . *that the salt water was pumped up into a reservoir and conducted by means of wooden pipes back to the bluff, a quarter mile distant, where the coal could be conveniently procured* (Caldwell, 1880, p. 572).

By 1823, coal was mined in Jackson County to fuel the boilers of salt furnaces and iron furnaces (Eavenson, 1942, p. 267). So great was the demand for salt by the pioneers that 47 evaporator works had been erected in Muskingum County, 26 of which were in active operation, having an annual salt production of 100,000 bushels (Foster, 1838, p. 98). Coal served as the fuel at more than half of the these evaporators.

During the second half of the 19th century, Pomeroy, Ohio, became one of the best known salt centers in the country because it possessed strong brines, access to river transportation, and fuel in the adjacent hills (Bownocker, 1906, p. 17). The Pomeroy salt industry included: Pomeroy Salt Works, constructed in 1852; Coal Ridge Works, chartered in 1852 and put into production in 1854; Koehler's Excelsior Salt Works, established in 1860; Buckeye Salt Company, established in 1865; and Syracuse Salt, Bromine and Calcium Works, put into production in 1856 (Bownocker, 1906, p. 18-23). Abandoned mine maps of the Peacock mine (Ms-18), Coal Ridge mine (Ms-1), Excelsior and Rolling Mill mines (Ms-3 and Ms-50), Buckeye and Charter Oak mines (Ms-2 and Ms-50), and Syracuse mine (Ms-6, Ms-7, and Ms-78) show rail lines leading from these coal mines to the salt furnaces in Pomeroy.

By the time of the Civil War, numerous coal-fired evaporating furnaces had been built and Ohio had become second in the nation behind New York in salt production. Following the Civil War, Michigan surpassed both New York and Ohio in the production of salt because of a superior brine. Interestingly, Michigan's early salt industry was fueled exclusively by Ohio coal (Root, 1888, p. 659).

Drill-rig boilers

The presence of oil in Ohio, as evidenced by seeps, was undoubtedly known by the early pioneers. The state's, and perhaps the nation's, first oil well was drilled in 1814 near Caldwell in Olive Township, Noble County. Although, this

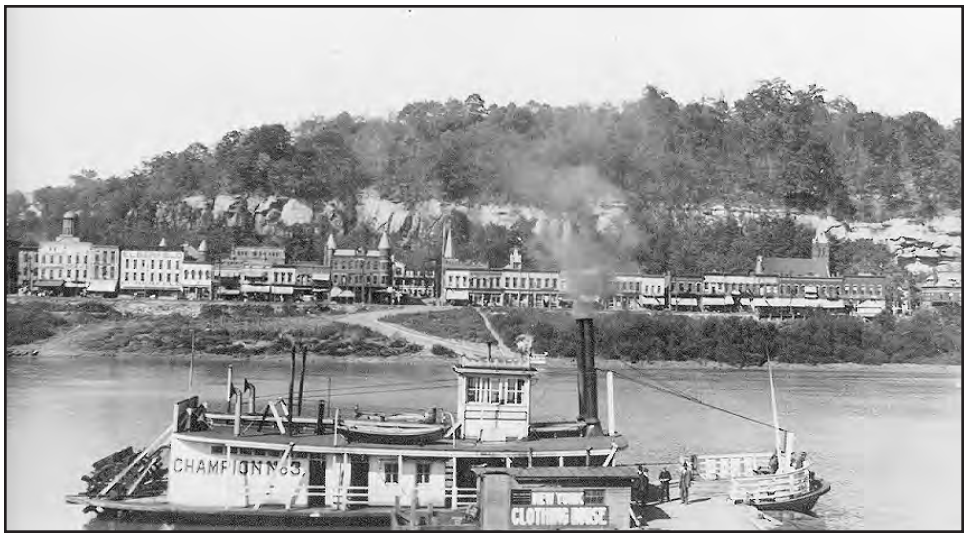


FIGURE 204.—*Champion No. 3,* a coal-fired paddle boat, moored on the Ohio River across from Pomeroy, Ohio. In the background is the massive Pomeroy sandstone, which overlies the Redstone (No. 8A) coal. This coal was extensively mined in the area. *Circa* 1910. Ohio Division of Geological Survey file photo by Wilber Stout.

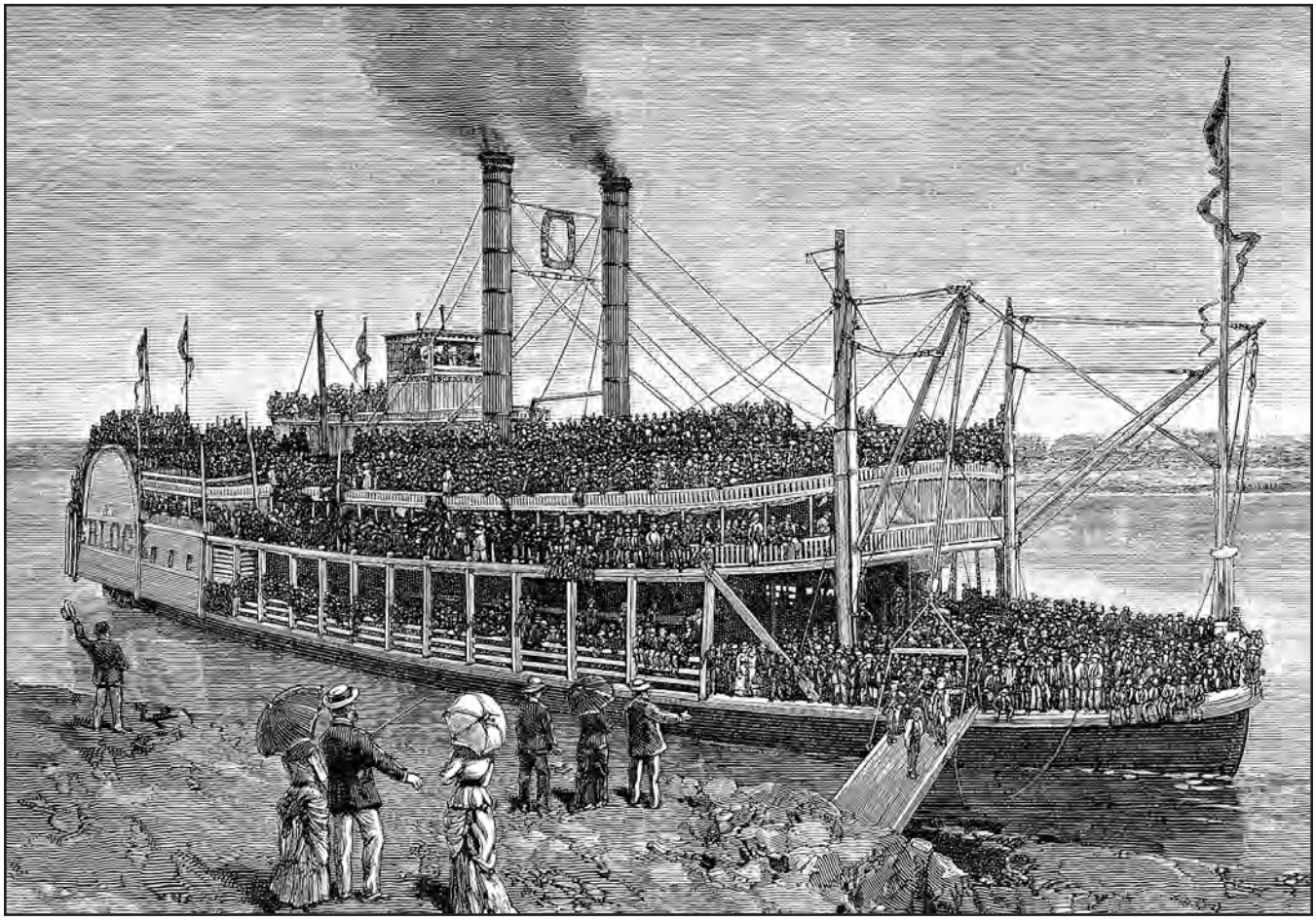


FIGURE 205.—Sunday excursion on the Ohio River aboard the coal-fired *Thomas Sherlock*. This 285-foot-long steamer had a carrying capacity of 1,700 tons. Round-trip excursions from Cincinnati to New Orleans required 20 days and cost $40, including room and meals. Illustration from Harper's Weekly (1881, v. 25, no. 1277, p. 396).

well, financed by Silas Thorla and Robert McKee, was drilled in search of brine for the manufacture of salt, it produced small quantities of oil (Hansen, 1993, p. 1-3). Drilling for oil in Ohio began in the spring of 1860 at West Mecca in Mecca Township, Trumbull County. This well was closely followed by a numerous wells drilled along Duck Creek in southern Noble County and central Washington County.

The machinery in vogue [in 1860] *was the spring-pole and treadle; and the motive power, human muscle. In that day, it was essential that the driller be sound in both wind and limb* (Minshall, 1888, p. 444).

During the 1860's, human muscle as the driving force in drilling was replaced by steam power. The boilers and engines for drilling and pumping wells were built in the style of locomotive boilers (15- or 20-horse-power boilers) set up at a safe distance from the engine and derrick (fig. 206). Although natural gas was the preferred fuel, most boilers along Duck Creek were fired by the Macksburg (Meigs Creek) coal, which was mined from numerous openings (Newell, 1888, p. 483). In the Report of Progress of the Second Geological Survey of Ohio, Andrews (1871, p. 136) made this observation:

On Duck creek and Little Muskingum river, a limited quantity of coal is mined for local use, chiefly for the generation of steam at the oil wells.

According to Bownocker (1903, p. 160), the *Meigs Creek coal is well spoken of by oil men who use it in boilers along Duck Creek and its tributaries.* The Meigs Creek coal was also mined along Bear Creek in Salem Township and north of Lowell in Adams Township, Washington County, for use in the oil fields.

The value of coal to the early oil industry can be inferred from an investment prospectus of the Ohio Petroleum Company (1864, p. 7), in which the following statements are made:

There are two veins of bituminous coal on these lands [along Federal Creek in Morgan County], *one of three and one-half feet thick, the other has not been tested. This coal is known to be of the most superior quality and underlies a considerable portion of this company's lands. To mine and cart it a few rods to our pumping engines, only involves a cost of some five cents per bushel, while fifty cents per bushel is the ordinary price at the Pennsylvania Oil Wells. Nowhere in the world can refining be conducted at a cost less than on this property, owing to the close proximity of petroleum to the land.*

Coal-oil production

Coal was not only a fuel but also a raw material in the production of oil in Ohio. Cannel coal from several places around Ohio was distilled to produce oil. Cannel coal is a variety of nonbanded bituminous coal that is compact and uniform in texture, has a greasy appearance, and breaks in a conchoidal or shell-like fracture. It also ignites easily, burns with a luminous flame, and has a high percentage of volatile matter.

A cannel coal has been long mined in the vicinity of Canfield, Mahoning County, where it was distilled for illuminating oil (Bownocker, 1917, p. 45).

Widespread mining of cannel coal occurred in Ohio between 1855 and 1859. In 1860 there were 55 coal-oil companies in the United States, including 11 operating in Ohio: Zanesville (2), Canfield (2), Cleveland (1), Cincinnati (3), Newark (1), Coshocton (1), and Perry County (1) (Ashley, 1918, p. 43). Cannel coal was mined from the Flint Ridge area, in Hopewell Township, Licking County, at least as early as the 1830's. Prior to 1869, for a short period of time, coal oil was distilled from cannel coal mined along Whipple's Run in Fearing Township, Washington County (Andrews, 1871, p. 128).

The process by which oil was distilled from coal at distilleries in Bedford and Jefferson Townships, Coshocton County, is briefly described in the following account by Hill (1881, p. 467):

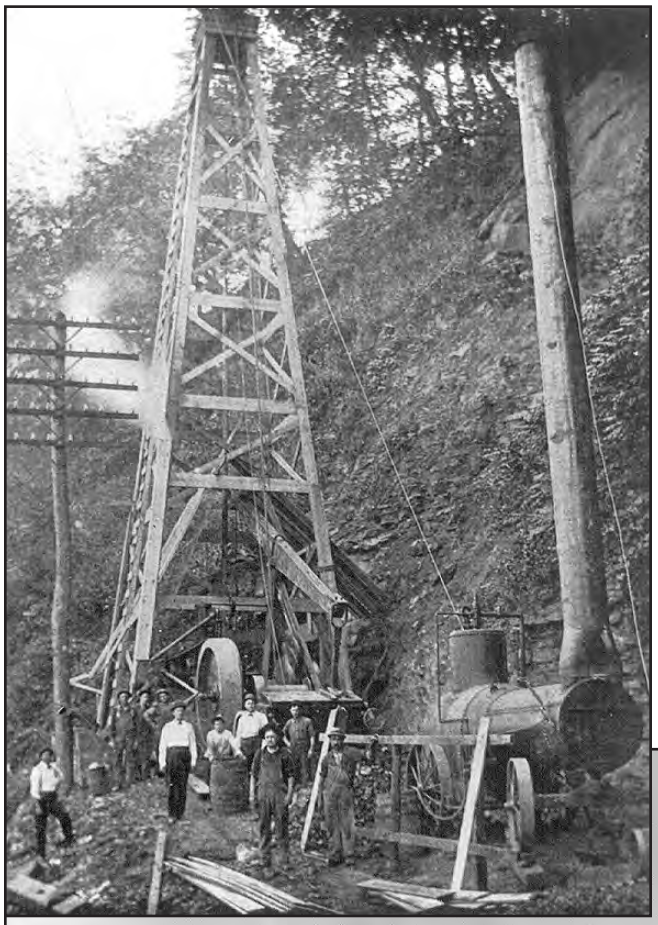
The retorts by which the oil was distilled were various kinds, the most common pattern being an upright, cast-iron retort, about nine feet high and four feet thick. It was filled with coal, made air-tight, and heat was then applied on the outside. The vapors thus set free were conveyed through a worm and condensed . . . . A ton of coal usually produced about forty gallons of crude oil, worth at first fifty cents a gallon, but toward the end sold at a narrow margin at ten cents a gallon. Mixed with the crude lamp oil were lubricating oil, asphaltum and paraffin. These, in the early stages of the manufacture, were regarded and treated as waste products; afterward they were utilized, the lubricating oil first, then the asphaltum and paraffin. For a year or two after the [Civil] *war some of the works were operated solely for these latter compounds, the crude oil being relied upon, however, to pay expenses.*
The works had scarcely become thoroughly established when the petroleum oil wells in Western Pennsylvania, which developed rapidly and produced oil in immense quantities, furnished the burning fluid at a figure which made it utterly impossible for the manufacturers here to compete with them, and the business received its death blow.

Although it was never mined for the production of coal oil, there is a very important occurrence of cannel coal in Ohio at the Diamond mine (Jfn-48 and Jfn-209) in Saline Township, Jefferson County.

In 1855 the Ohio Diamond Coal Company opened a drift mine [in the Upper Freeport (No. 7) coal] *near Linton. Although the original firm went bankrupt within two years, the mine continued in operation through a series of owners. During peak production in the 1870's, some twenty miners removed more than two hundred fifty tons of coal each day, most of it going to fuel locomotives. By 1892, with the coal nearly exhausted, the mine closed. The Diamond Coal Mine was reopened briefly during World War I and the coal remaining in the pillars was removed* (Hook, 1986, p. 4).

The Diamond mine is famous for the fossil remains of 50 species of amphibians and fishes found in a thin seam of cannel coal underlying the main seam of bituminous coal.

FIGURE 206.—Coal-fired, steam-powered rig drilling for oil at Mingo Junction, Steubenville Township, Jefferson County. *Circa* 1890. Ohio Division of Geological Survey file photo, from postcard owned by David A. Stith.



Of the approximately six thousand fossils of back-boned animals recovered from the Linton Diamond Mine, more than five thousand are fishes (Hook, 1986, p. 8).

Iron furnaces

Very important to the early development of coal as a fuel was the contemporaneous development of Ohio's iron industry, which began in 1804 with the smelting of iron from the charcoal-fired Hopewell blast furnace located near Poland in Mahoning County (Stout, 1944b, p. 3). This furnace was closely followed by the Rebecca, a blast furnace constructed in 1808 at Lisbon in Columbiana County (Mack, 1879, p. 108). After construction of the Hopewell and Rebecca Furnaces, Ohio's iron industry steadily grew, and by the early 1920's about 226 blast furnaces had been built, principally in the Cleveland, Hanging Rock, Hocking Valley, and Mahoning Valley areas. These blast furnaces included 86 charcoal fired, 56 coal fired, 126 coke fired (Stout, 1944b, p. 3).

Among the better known of Ohio's iron furnaces are those from the Hanging Rock region. Located within this region are the following furnaces (Willard, 1916), listed by county and including date of construction:

Adams County: Brush Creek (1811).
Lawrence County: Union (1826); Pine Grove (1828); Etna (1832); Buckhorn (fig. 207), Hecla, Mount Vernon, and Vesuvius (1833); Lawrence (1834); Lagrange and Centre (1836); Olive (1846).

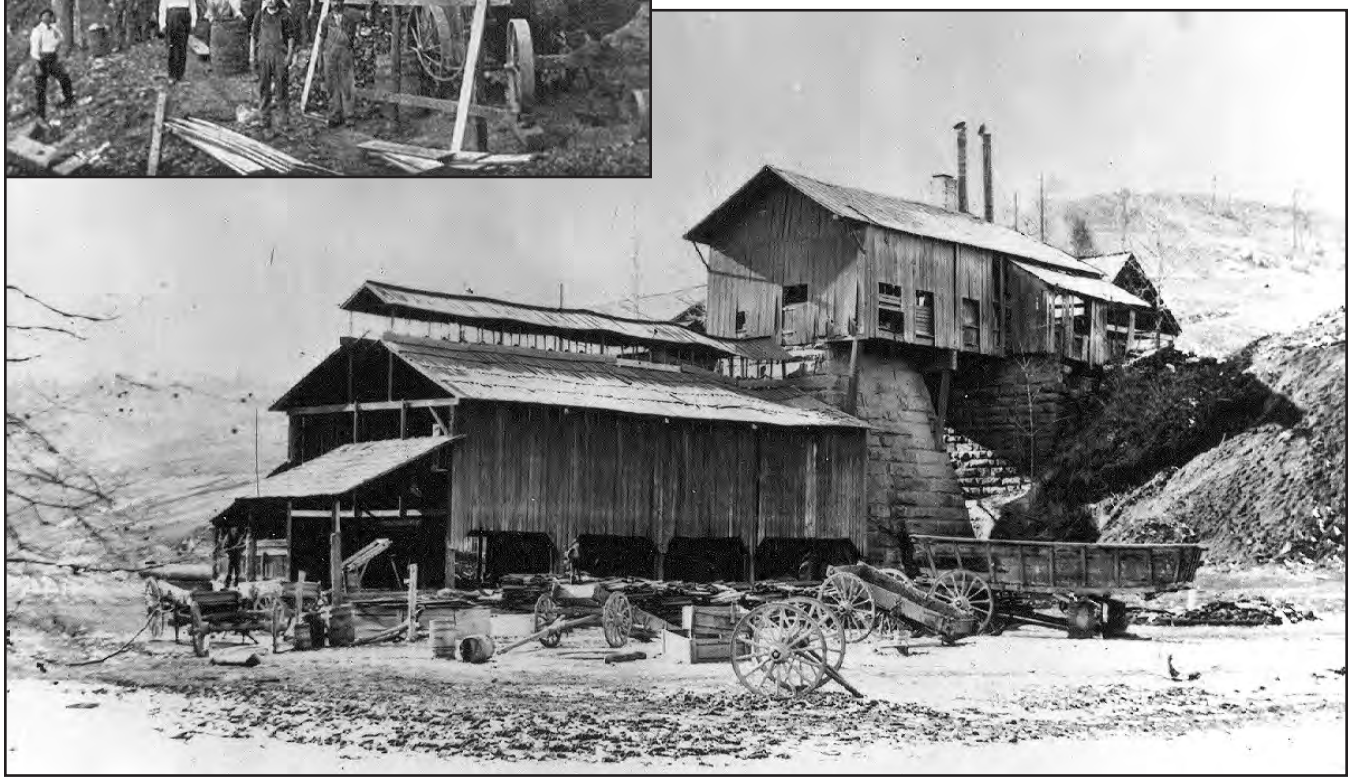


FIGURE 207.—Buckhorn Furnace, near Buckhorn, in Decatur Township, Lawrence County. This furnace, built in 1833, was a charcoal-fired iron furnace. Note the lack of trees surrounding the furnace. Depletion of forests near charcoal furnaces forced many furnace operators to use coal as a fuel rather than charcoal, even though pig iron produced from charcoal was of a superior quality. *Circa* 1865-1877. Photo courtesy of Ohio Historical Society, from the Wilber Stout collection.

FIGURE 208.—The famous gun *Swamp Angel,* used by General Quincy A. Gillmore in the siege of Charleston, South Carolina. Metal used in the construction of the *Swamp Angel* was forged at Hecla Furnace in Lawrence County. Illustration from Frank Leslie's Illustrated Newspaper (April 14, 1888, p. 1).

Scioto County: Franklin (1827); Scioto (1828); Bloom, Clinton,and Junior (1832); Ohio (1845); Empire (1846).
Jackson County: Jackson (1838); Keystone (1849); Buckeye and Washington (1853); Iron Valley, Cambria, Jefferson, Latrobe, Madison, and Young America (1854); Limestone (1855), and Monroe (1856).
Gallia County: Gallia (1847).
Vinton County: Hamden (1851), Eagle (1852), Cincinnati and Vinton (1853); Zaleski (1858).

The Hecla Furnace had the distinction of furnishing armor during the Civil War for the gunboats that stormed Fort Henry and Fort Donelson. It supplied metal for the manufacture of ordnance at Pittsburgh, and the guns used in the siege of Charleston, South Carolina, were forged from Hecla metal. One of these guns, the *Swamp Angel* (fig. 208), was noted for its ability to throw a 100-pound shell 5½ miles, which at that time was considered an exceptional feat in artillery warfare (Willard, 1916, p. 285).

Until about the mid-19th century all of Ohio's iron furnaces were fired by charcoal. The first iron smelted from raw coal in the United States was in 1845 from the Sharon coal of the Shenango Valley in the Clay Furnace at Clarksville, Pennsylvania. In the following year, Ohio began producing iron from raw coal (Sharon) at the Lowell Furnace, located near Poland, Mahoning County (Roy, 1906, p. 40). In discussing the use of coal in the manufacture of pig iron, in a letter dated Niles, December 17th, 1856 (quoted in Newberry, 1857, p. 54, 55), Jason Ward stated,

We have been using the Black-band ore at our blast furnace for more than three years past . . . . Three and a half tons of raw ore will make a gross ton of pig metal, and two and a half of roasted ore will do the same. It is very easily smelted, requiring but two tons of coal to make a ton of metal, while our other ores require three tons of coal for a ton of iron . . . . We have been manufacturing here for some fourteen years, and when stone-coal iron first came into use, it was an up hill business to get it introduced; but we have persevered till we have accomplished the manufacture of bar iron from stone coal metal exclusively, and that of a quality suitable for locomotives and cars, for which it is extensively used . . . . We consider this [Mahoning Valley] *the best location for manufacturing iron in the States, as we have vast fields of coal and iron ores of almost all varieties, convenient to the lakes. The coal has been tested and found to be the best adapted for iron, of any in the country. It is now used by six blast furnaces.*

Lord (1884, p. 452) reported that

With the employment of block coal [at the Clay and Lowell Furnaces], *other furnaces were erected for its use until it became the basis of the most important iron district in the State, and in 1873 there were nearly fifty furnaces dependent upon it in Northeastern Ohio and Northern Pennsylvania.*

As early as 1854 several car loads of coal mined at Jackson, Ohio, were taken to and used successfully in the Washington Furnace, in Jackson County. Some of the other furnaces in Jackson County which began using coal are: Diamond (in 1856), Orange (in 1865), and Star (in 1866).

The use of coal at the Diamond Furnace is described in the following account by Willard (1916, p. 477, 478):

The coal shaft is in the same building with the furnace. A small engine raises the coal from the pit and it is screened and emptied on the north side of the building. The pea coal, or the fine portion of the coal, is used to run the engine, heat the blast, etc. The other coal together with the ore is raised to the top of the stack by water power.

To this material, limestone was added. This mixture was then poured down the stack into the furnace where the coal was ignited. Exhaust heat was vented through boilers, where steam was generated to drive pumps which forced air through a separate furnace. This air was heated and forced into the iron furnace, where it supplied additional heat and oxygen to the burning fuel, causing the iron ore and limestone to melt. The resultant impurities formed a glassy waste, called slag, which floated on the heavier molten iron. The iron and the slag were drawn off separately.

The first coal-fired iron furnace in the Hocking Valley region was the Baird Furnace, constructed in 1874-75 (Hunt, 1881, p. 113). In addition to the Baird Furnace, the following coal-fired iron furnaces were built in the Hocking Valley region: Fannie No. 1 (1875); Gore and Fannie No. 2 (1876); Mollie or Vilas, Akron, Ogden or Helen, and XX (1877); Bessie, Winona, Moxahala, and Monday Creek or Loe (1878); and Crafts (1879).

Coal-fired iron furnaces generally consumed 2½ to 3½ tons of coal for each ton of pig iron produced (Hunt, 1881, p. 118). The Gore Furnace (fig. 209), built by the Thomas Iron Company in 1876 in Hocking County, used coal brought by a narrow-gauge railway from the mines of the Columbus & Hocking Coal & Iron Company (Inter-State Publishing Co., 1883, p. 891). The Gore Furnace consumed

an average of 108 tons of coal to produce 40 tons of iron daily (Lord, 1892, p. 39). In 1879, the Fannie No. 1 Furnace consumed 32,994 tons of coal to produce 9,030 tons of iron (Hunt, 1881, p. 114).

The introduction and use of coal as a fuel in blast furnaces, even though iron made from charcoal was superior to that made from coal, was stimulated by the depletion of wood as a source of fuel (see fig. 207). Commenting on the scarcity of timber as a source of fuel in the manufacture of iron, Lord (1884, p. 443, 444) stated,

The magnificent forests which covered the country west of the Alleghenies, at the time of the early settlers, provided a cheap and abundant source of fuel for smelting purposes . . . . However, the rapid growth of the population, the clearing of the forests for agricultural and building purposes, together with the demands of the iron smelter, soon compelled the iron-masters to look elsewhere than to charcoal for fuel, so that now coal has replaced the use of wood where iron is smelted throughout the State, excepting in the extreme southern part, and in a few localities in the northwest . . . .

It may be safely stated, that at present (1883) eight-ninths of this available timber land of the southern Ohio manufacturing districts has been cleared.

Lord (1884, p. 483) emphasized further,

The disappearance of the forests under the demands of the furnaces, which is now so apparent throughout the region, increases every year the difficulty of obtaining the necessary fuel, and marks very plainly the fate of the charcoal iron industry. The large amount of wood necessary to sustain a blast-furnace may be appreciated when it is known that some 13,000 cords of wood, the yield of 325 to 350 acres of forest land, are required per year for each furnace. And already a number of furnaces have been abandoned because of the scarcity of accessible timber, though the supply of ore has hardly been much diminished. The use of charcoal must yield, as it has done in all other parts of the State, and is now doing in other States, to the more extended employment of mineral fuel. The manufacture of charcoal iron, nevertheless, will be a matter of considerable importance for some time to come, and the fine quality and high value of the iron will do much to foster its production.

Although the smelting of native Ohio iron ores ceased about 1923, the development of Ohio's iron industry had established Ohio as a leader in the production of steel and at the same time aided in the development of Ohio's coal industry. In spite of the large number of blast furnaces which operated in Ohio, native coal had been used with little success to produce metallurgical coke, the principal fuel for smelting iron in the late 1800's, because most Ohio coals are too high in impurities, particularly sulfur, and too low in carbon content. However, foremost in the production of coke from Ohio coals was the Lower Kittanning (No. 5) coal mined in the vicinity of Leetonia, Columbiana County, followed by the Pittsburgh (No. 8) coal from Belmont County. The Pittsburgh coal mined in Athens County was coked at Utley (125 coking ovens) and Lathrop (50 coking ovens). Coke produced at these Athens County towns was shipped to Cleveland, Toledo, Chicago, Cincinnati, and other locations (Bownocker and others, 1908, p. 72). The Middle Kittanning (No. 6), Lower Freeport (No. 6A), and Upper Freeport (No. 7) coals also were mined to a minor

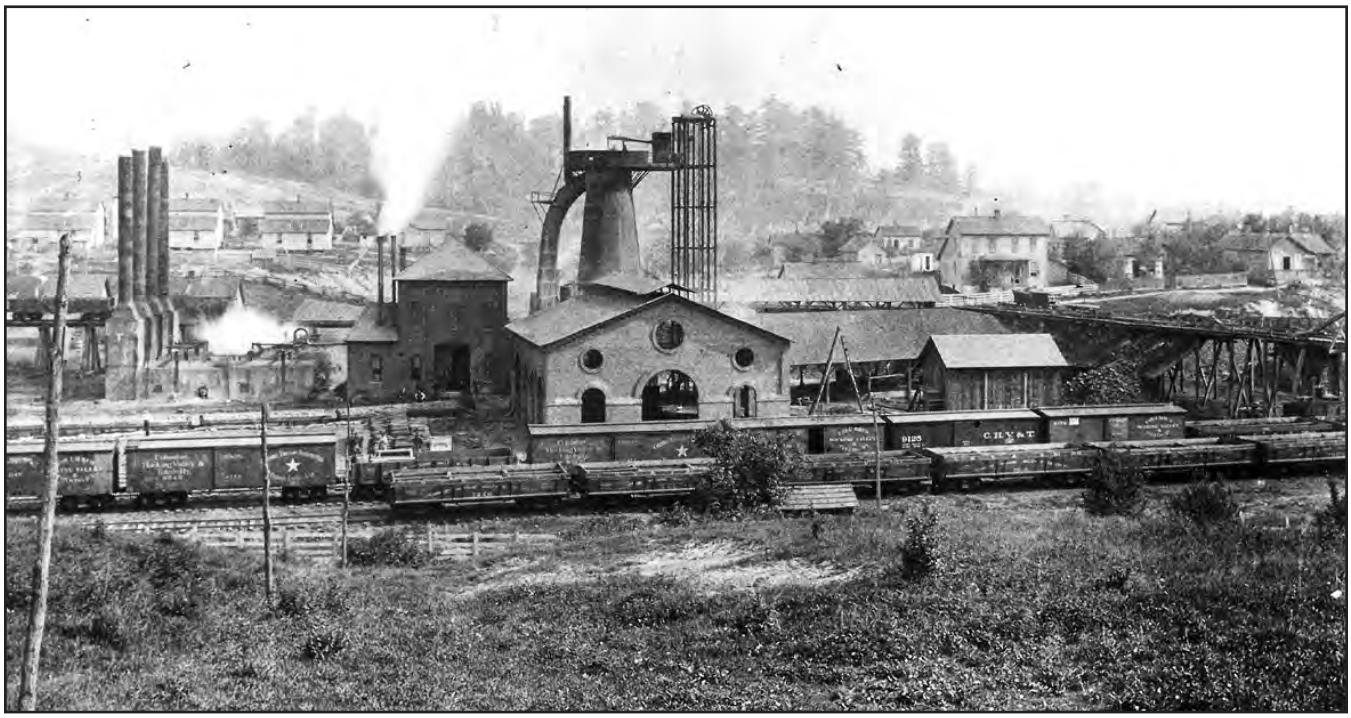


FIGURE 209.—Gore Furnace, at Gore, Hocking County. This coal-fired furnace, built in 1876, was one of the largest of the Hocking Valley iron furnaces. *Circa* 1887. Photo courtesy of Ohio Historical Society, from the W. E. Buchanon collection.

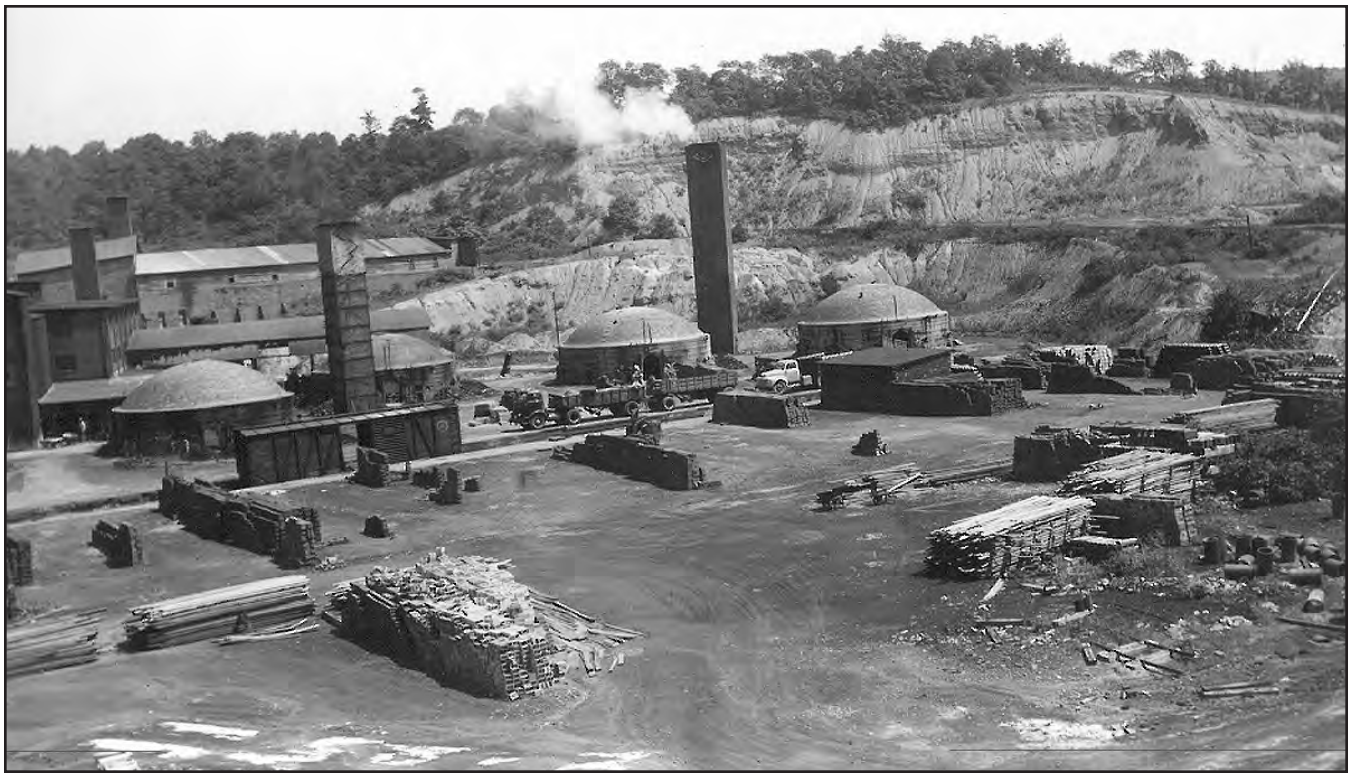


FIGURE 210.—Plant and shale pit of the General Clay Products Company, 1/2 mile northeast of Baltic, in Clark Township, Holmes County. The Lower Kittanning (No. 5) and Middle Kittanning (No. 6) coals were used until the mid-1960's to heat kilns in the manufacture of tile. *Circa* 1949. Ohio Division of Geological Survey file photo by George W. White.

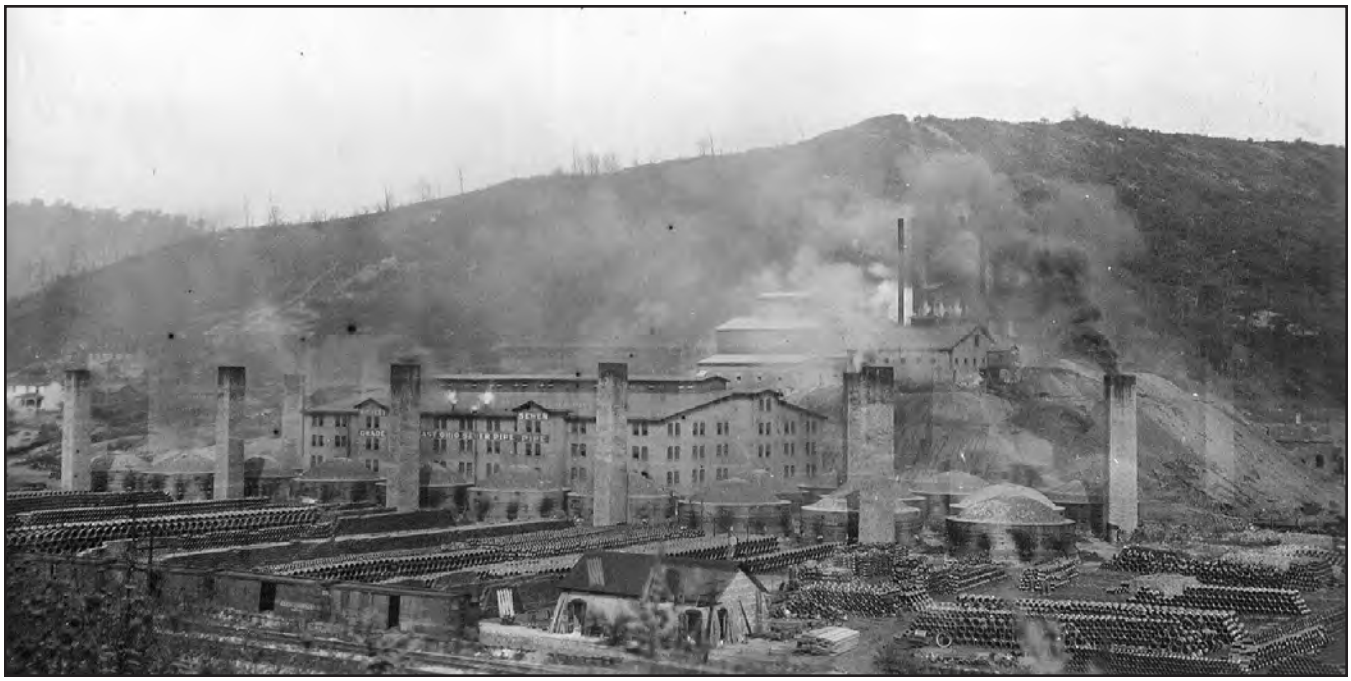


FIGURE 211.—Plant of the East Ohio Sewer Pipe Company, at Irondale, in Saline Township, Jefferson County. Clarion (No. 4A) coal was used to heat kilns in the manufacture of sewer pipe, flue lining, chimney tops, and clay stove pipe. *Circa* 1923. Ohio Division of Geological Survey file photo by Wilber Stout.

extent for coke production (Bownocker, 1917, p. 86). Presently, all the coal used for coking purposes in Ohio is imported from other states.

Cholera

Perhaps one of the most interesting and obscure uses of coal came during a cholera epidemic in southeastern Ohio in 1832. Coal fires were kept burning in the streets of Bellaire, as well as Wheeling, West Virginia, in the belief that doing so would fumigate the atmosphere (Caldwell, 1880, p. 255). I am not aware whether or not this use of coal was successful in combating cholera. The obscurity of this use suggests that burning coal has little real medicinal value as a fumigating agent.

Brick and pottery industries

Coal was an important fuel for the manufacture of clay products in Ohio. The first use of common brick in Ohio was in the construction of the fortification Campus Martius at Marietta in 1788-1791 (Stout and others, 1923, p. 7). During the late 1700's and early 1800's, the establishment of brickyards was widespread, including the following Ohio cities: Zanesville (1799), Cincinnati (1803), Athens (1803 or 1804), Dayton (1805), Salem (1806), and Chillicothe (1807). Pottery was manufactured as early as 1799 at Cincinnati, 1806 at Steubenville, and 1808 at Zanesville. By the 1840's, the fire-brick industry was mining underclays (clays which occur directly underneath seams of coal) at several eastern Ohio cities such as East Liverpool (1841), Wellsville (1846), and Hammondsville and Toronto (1852). In the late 1800's, Ohio clays and shales were used to manufacture a variety of products, including fireproofing materials, paving brick, hollow block and brick, and electrical porcelain (figs. 210, 211).

When coal was first used by the clay industry is not certain, but it is probable that coal was being used to heat kilns by the 1850's or 1860's. Although a few companies still used wood for the manufacture of some of their clay products, by the late 1800's coal was the preferred fuel for drying and firing of most clay products. Coal generally was used by the Ohio clay industry until the mid-20th century, when natural gas became the preferred fuel.

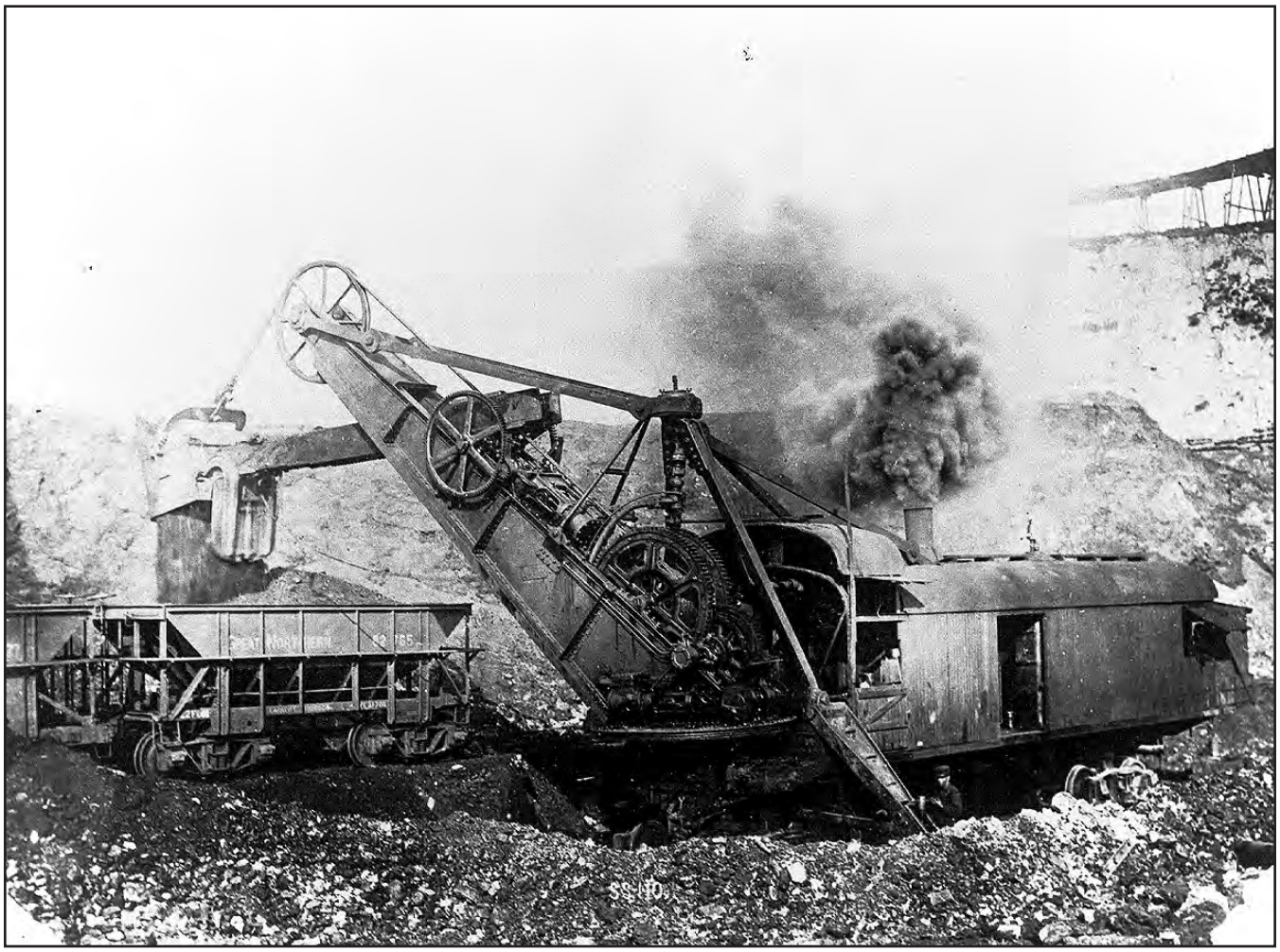


FIGURE 212.—Coal-fired power shovel operating in an eastern Ohio surface mine. Date and location unknown. Photo courtesy of Ohio Department of Natural Resources, Division of Reclamation, from the Dale Davis collection.

Steam boilers

The technology of burning coal in boilers for the generation of steam power was adapted for a variety of mechanical equipment, such as power shovels and excavators (fig. 212), sawmills (fig. 213), coal-mine power plants (fig. 214), and farm machinery (fig. 215). An 1890's-vintage, steam-powered farm tractor would burn about 400 pounds of coal during 10 hours of operation.

Electric utilities

The commercial generation of electricity by steam power from coal-fired boilers started in the early 1880's. The first coal-fired electric generating plant built in the United States was Thomas A. Edison's Pearl Street plant at New York City in September 1883. The first coal-fired electric generating station built in Ohio was the Tiffin Edison Electric Illuminating Company (now Ohio Power) plant in Tiffin, Seneca County, in December 1883. The Tiffin plant included one 100-horsepower coal-fired boiler, one 120-horsepower engine, and two dynamos of 500 lights each which supplied direct-current service to about half of Tiffin (Glasco, 1986, p. 10, 11).

In 1888, E. M. Poston's Nelsonville Electric-Light Company built the first alternating current generating station west of the Allegheny Mountains. Poston began a practice that is still in use today . . . locating electric generating facilities at the mouth of a coal mine. This started the concept of "coal by wire," transporting energy by electricity instead of the fuel from which it was produced, thus saving untold dollars in transportation costs (Columbus and Southern Ohio Electric Company, undated, unpaged).

In recent years, the largest consumers of coal, and therefore a very important factor in the continued growth of Ohio's coal industry, are the electric-utility companies and power-generating stations which operate coal-fired steam generators (fig. 216). Nearly all of the coal mined in Ohio is used by the electric-utility industry. The degree to which Ohioans have become dependent on coal as a fuel source for the generation of electricity is indicated by the following:

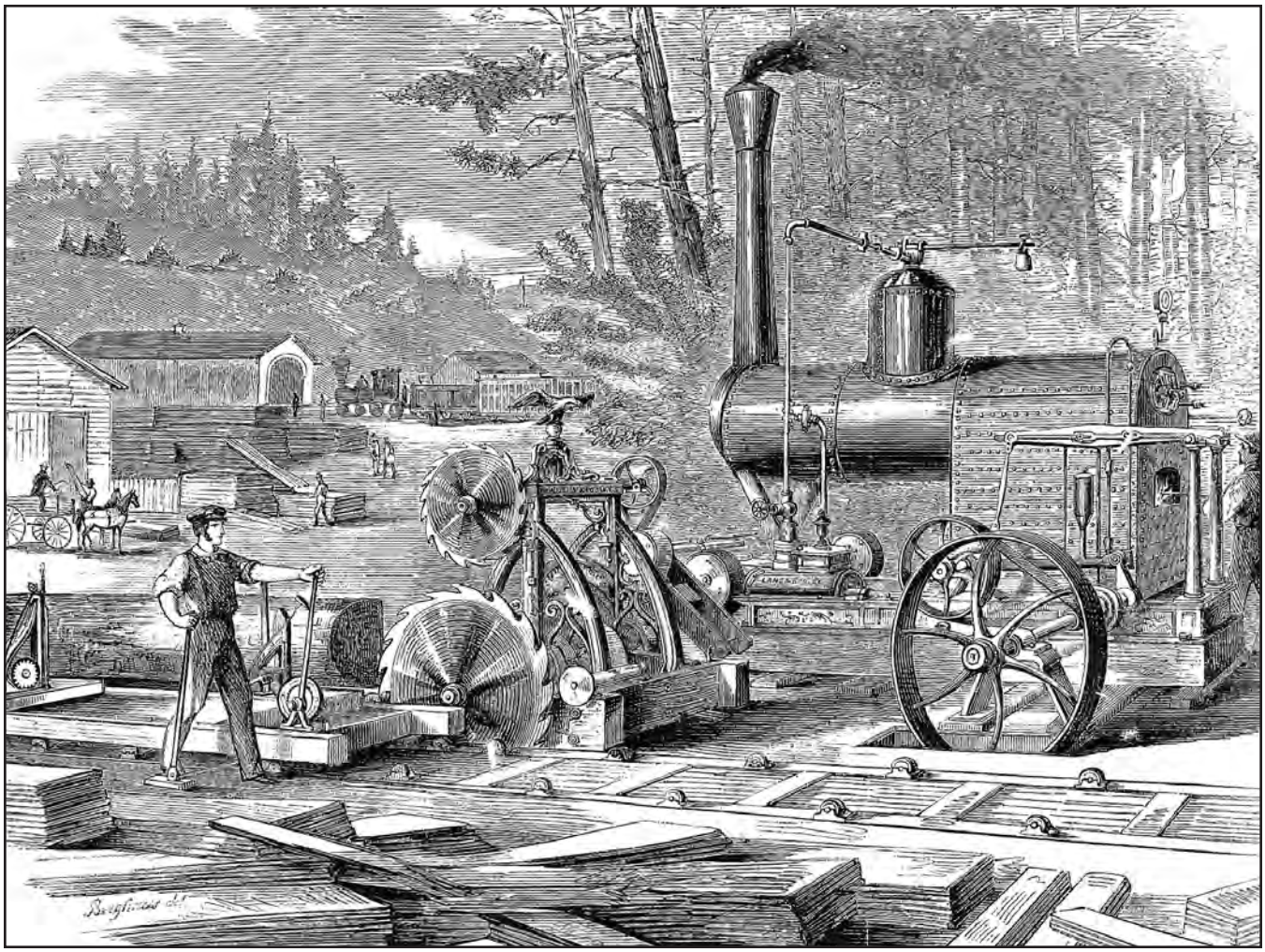


FIGURE 213.—Portable, coal-fired, steam-powered circular sawmill. Lane & Bodley, iron founders and machinists at Cincinnati, produced portable sawmills with blades up to 54 inches in diameter which turned at 450 rpm, cut 20,000 board-feet per day, and cost $1,600 to $2,200. Illustration from Frank Leslie's Illustrated Newspaper (October 20, 1860, p. 346).

1. The Energy Information Administration (1994a, p. 9) estimates that in 1993 coal provided approximately 56.9 percent of the electricity generated by utilities in the United States (petroleum, 3.5 percent; gas, 9.0 percent; hydroelectric, 9.2 percent; nuclear, 21.2 percent; other sources, 0.3 percent).
2. The Public Utilities Commission of Ohio (PUCO) (1993, p. 8) estimates that 91.59 percent of the total electricity generated in Ohio in 1992-93 was from coal, 0.04 percent was from gas and oil, and 8.37 percent was from nuclear generation.
3. The Energy Information Administration (1994b, p. 77) and the Public Utilities Commission of Ohio (personal communication, 1994) estimate that Ohio utilities consumed about 51.5 million tons of coal in 1993, of which about 45 percent (or 23.1 million tons) was coal produced from Ohio mines.
4. Of Ohio's total coal production in 1993, the Energy Information Administration (1994b, p. 18) estimates that 93 percent (or 25.6 million tons) was consumed by electric-utility companies in the nation; the remaining 7 percent was consumed by industry and domestic users.

Furthermore, although Ohio in 1993 was 12th nationally in coal production, it was third in total coal consumption (59.0 million tons), behind Texas and Indiana, and second in coal consumed (51.5 million tons) by electric utilities, behind Texas (Energy Information Administration, 1994b, p. 76, 77).

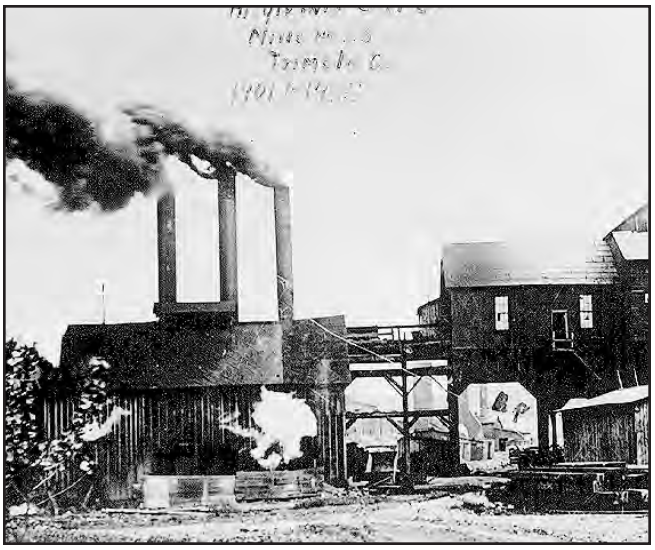


FIGURE 214.—Tipple and powerhouse of Hisylvania Coal Company mine No. 23 (As-16), formerly Jobs No. 23 of Wm. Job Coal Company, located at Trimble, Trimble Township, Athens County. Mine No. 23 had a slope opening 450 feet long, was constructed in 1901, and was abandoned in 1925. Date unknown. Photo courtesy of Ohio University, Vernon R. Alden Library, from the Mathaney collection.

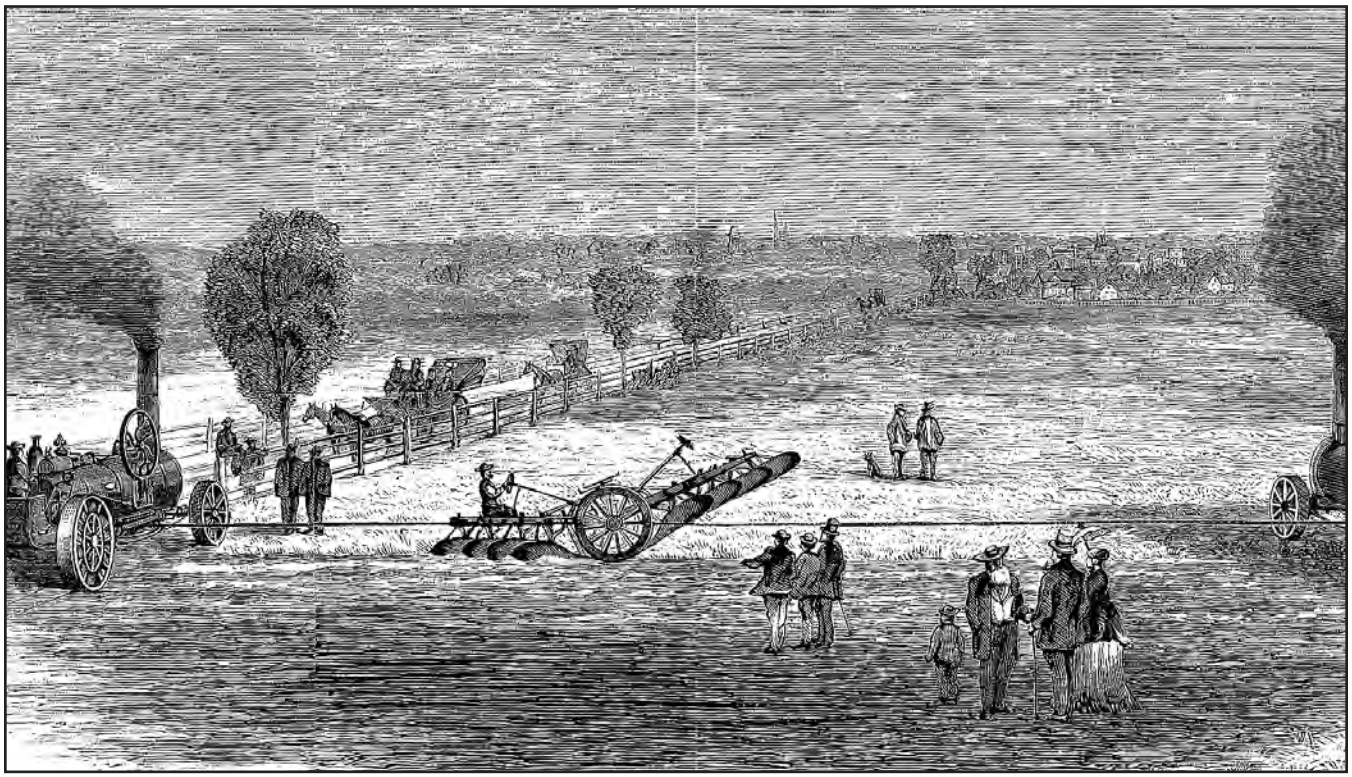


FIGURE 215.—A 2-gang plow pulled between two 14-horse-power coal-fired steam engines (from Harper's Weekly, 1869, v. 13, no. 656, p. 476).

Power plants and scrubbers

In generating electricity, most coal-fired power plants mix pulverized coal with hot air and inject the fine particles into a furnace lined with water-filled tubes. A conventional boiler operates at temperatures from 2,800°F to 3,200°F. The water is heated to produce steam. The steam is used to spin steam-turbine generators to produce electricity, which is transmitted through distribution lines to homes and other consumers. The gases and particulates emitted from burning coal are released into the atmosphere or are captured by flue-gas cleaning devices such as electrostatic precipitators or scrubbers.

Scrubbers are actually complex chemical plants installed as postcombustion gas-processing facilities between the boiler and the smoke stack. In this cleaning process, a slurry of finely ground limestone or lime is injected into the flue gases. The SO_2 in the flue gas reacts chemically with the slurry to produce a precipitate of calcium sulfite and calcium sulfate. Scrubber technology is currently capable of processing up to 1 million cubic feet of flue gas per minute and of achieving 70 to 90 percent SO_2 reduction. However, on the negative side, over an average lifetime of about 25 years, a 500-megawatt coal-fired power plant will likely produce enough sludge to fill a 500-acre disposal pond to a depth of about 40 feet. Also, scrubbers are very expensive to install and operate. They siphon off some of the power plant's thermal energy, decreasing the power plant's efficiency, and they require enormous amounts of water to operate. One example of a coal-fired power plant in Ohio using scrubbers is the Columbus and Southern Power Company Conesville Generating Station near Coshocton.

COAL WASHING

Once the coal is mined, it may be shipped untreated directly to the user. However, because most of Ohio's coal contains impurities, it is cleaned before use. These impuri-

FIGURE 216.—The Gen. James M. Gavin power-generating station on the Ohio River at Cheshire, Gallia County, began service in 1974 and is the largest electricity-generating station in Ohio; generating capacity is 2.6 million kilowatts. Most of the fuel consumed by this generating station comes by conveyor from the Southern Ohio Coal Company Meigs Division underground mine complex (Meigs No. 2 and No. 31 mines, Ms-294 and Ms-293). The remaining fuel is delivered by rail or river barge (foreground). *Circa* 1990. Photo courtesy of American Electric Power Service Corporation. (See also figs. 46, 201, 219.)

ties include roof and/or floor rock, clay or shale partings, calcite, pyritic sulfur (FeS_2), sulfate sulfur in the form of gypsum ($CaSO_4$), and organic sulfur. The occurrence of pyritic sulfur in coal is due to the influence of sea water during the coal-forming process. Sea water contains high levels of ($SO_4^=$) ions, which readily combine with iron to produce pyrite in a chemical environment where peat accumulation can occur (peat is the first step in the conversion of plant remains into coal). Organic sulfur is that sulfur which was originally part of the plant before it died.

Ohio's coal averages about 3.5 percent sulfur, which places it in a high-sulfur category. Ohio's coal also averages 11.2 percent ash (the residue that is left after coal is burned), and 12,700 Btu. Physical cleaning of the coal can remove most of the pyritic sulfur, but it cannot remove the organic sulfur, which is chemically combined with the coal. Ohio's coal contains an average of 2.2 percent pyritic sulfur, 0.01 percent sulfate sulfur, and 1.3 percent organic sulfur. Using average percent sulfur and Btu content of Ohio coal, on a moisture-free basis, the average sulfur dioxide (SO_2) emission from burning Ohio coal is about 5.22 pounds per million Btu.

Early coal-cleaning methods consisted of separating large rock fragments from the coal by hand. This process was done assembly-line fashion along conveyor-fed tables, called picking tables (figs. 217, 218). However, during 1871-72, an elaborate coal-washing establishment was built near Irondale, in Yellow Creek Township, Jefferson County (Fraser, 1923, p. 72). This early coal-washing facility was constructed with the intent of removing pyritic sulfur using gravity separation in water from the coal mined at Irondale for the manufacture of coke.

Modern coal cleaning or washing techniques are based on the principle that coal is lighter than its associated rock and impurities. This cleaning process uses pulsating water currents, high-velocity liquids, and liquids of varying densities to separate the impurities from the coal (fig. 219). Part of the cleaning process, called float/sink, works on the principle of gravity separation; heavier impurities sink and large-sized chunks of coal float in a slurry of finely ground magnetite and water. The other portion of the cleaning process, called froth flotation, involves a physical/chemical process in which finely sized coal adheres to air bubbles in a reagent and floats while the impurities sink. In both processes, coal is separated from the impurities, recovered, and dried to remove the moisture in preparation for shipment.

The coal-washing process generally can remove 30 to 50 percent of the pyritic sulfur and about 60 percent of the ash-forming minerals. As a result of washing, the SO_2 emissions from burned coal can be reduced. For example, the Pittsburgh coal in Ohio averages 3.04 percent total sulfur and 12,948 Btu (on a moisture-free basis) and when burned will yield approximately 4.46 pounds of SO_2 per million Btu. After washing and removal of up to 50 percent of the pyritic sulfur content, the average Pittsburgh coal in Ohio may yield, when burned, approximately 2.59 pounds of SO_2 per million Btu, a SO_2 emission reduction of 42 percent. During the washing process there is an increase in the heat value of the coal in addition to a reduction of the sulfur content, which should result in an even greater SO_2 emission reduction. However, in commercial wash plants pyritic sulfur reductions of 50 percent occur under ideal conditions and vary considerably from coal to coal. Therefore, the SO_2 emission level estimated for the average washed Pittsburgh coal should be considered a minimum at best and is probably over-optimistic. This consideration becomes more apparent when it is compared to the average emission rate of 3.82 pounds SO_2 per million Btu for Ohio's 26 coal-fired electric-generating stations in 1990 (Ohio Coal Development Office, 1992, p. 47). In 1993, 17,274,721 tons—nearly 63 percent—of Ohio coal produced was washed (table 6). The Conesville Preparation Plant is the newest coal-processing facility of the American Electric Power System in Ohio. Built at a cost of $35 million, this coal-cleaning facility began commercial operation in 1985 and has the capability of cleaning nearly 1,000 tons of coal per hour.

FEDERAL CLEAN AIR ACT

The production of coal can be influenced by many factors such as prevailing economic conditions, technological advances, employment issues, and legislation. In Ohio, for example, the federal Clean Air Act has, in spite of its positive environmental impact, had a generally negative influence on coal production.

The passage of the federal Clean Air Act in 1970 and its amendment in 1977 placed stringent controls on the emissions from burned coal (fig. 220). The current emission-control standard set forth in 1971 by the U.S. Environmental Protective Agency (USEPA) is 1.2 lbs. of SO_2 emitted per million Btu burned. In 1979, the USEPA introduced its New Source Performance Standards for SO_2 emissions, requiring emission reduction from new power plants of 70 to 90 percent SO_2. The impact the Clean Air Act has had on Ohio's industry is indicated by the general decrease in Ohio's annual coal production since 1970. However, the passage of several other legislative acts which placed additional restrictions on the coal-mining industry during the 1970's probably also has contributed in some measure to the general decline in Ohio's annual coal production. The impact of the Clean Air Act on Ohio's coal-mining industry is indicated by comparing the amount of Ohio coal washed to the amount of coal consumed by Ohio utilities since 1970.

The amount of coal consumed by Ohio utilities from 1970 to 1993 has increased from 34 million tons to 51.5 million tons; at the same time, the percentage of Ohio coal consumed by Ohio utilities has decreased from 69 to 45 percent (table 6), and the amount of Ohio coal being washed has increased from 34 to 63 percent. These trends indicate that Ohio utilities, while trying to meet the increasing demand for electricity and comply with emission standards, are consuming greater amounts of out-of-state coal, even though greater amounts of Ohio coal are being washed. Unfortunately, current commercial coal-washing technology is incapable of bringing most Ohio coals into compliance when burned.

CLEAN AIR ACT AMENDMENTS OF 1990

In 1990, Congress passed the Clean Air Act Amendments (CAAA90), a bill which imposes severe emission standards on coal-fired utilities. CAAA90 was passed, according to some, without adequate research on acid rain causes. The immediate and primary concern of Ohio's coal industry is

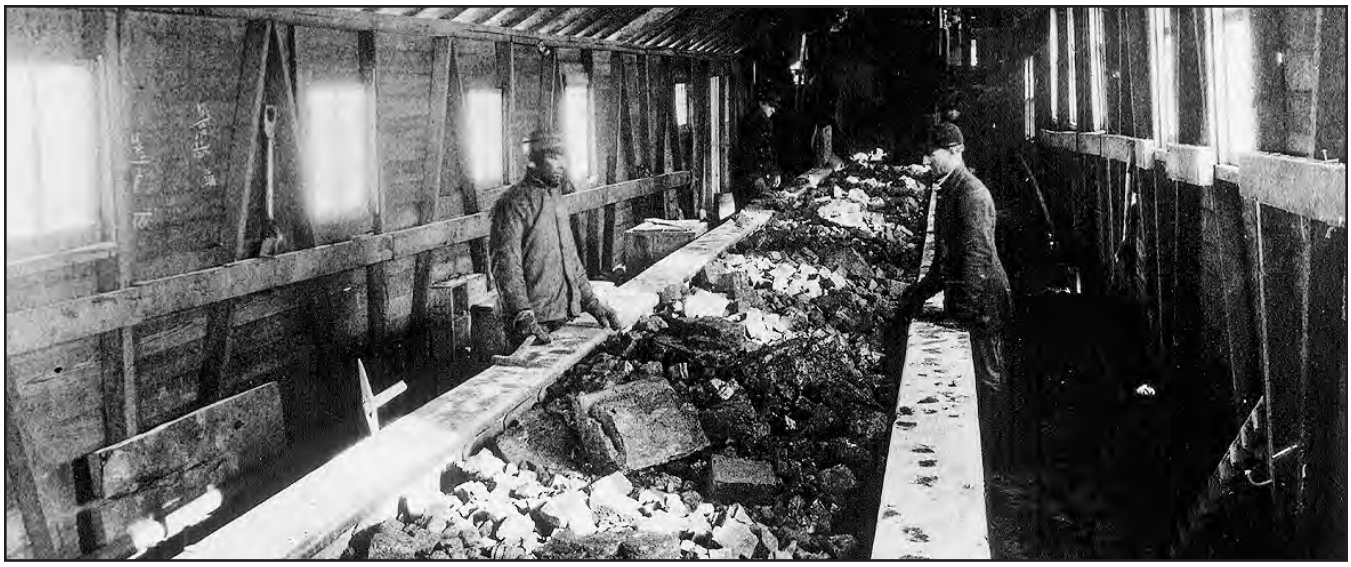


FIGURE 217.—Picking (or breaker) table where waste material is separated from coal by hand. This picking table is in the tipple of the Superior Coal Company at Wellston, in Milton Township, Jackson County. *Circa* early 1900's. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment Company collection.

FIGURE 218.—Early coal cleaning involved separation by hand of the waste material from the coal as the coal passed by the "pickers" on a conveyor. *Circa* early 1900's. Location unknown. Photo courtesy of Ohio Historical Society, from the Jeffrey Mining Equipment Company collection.

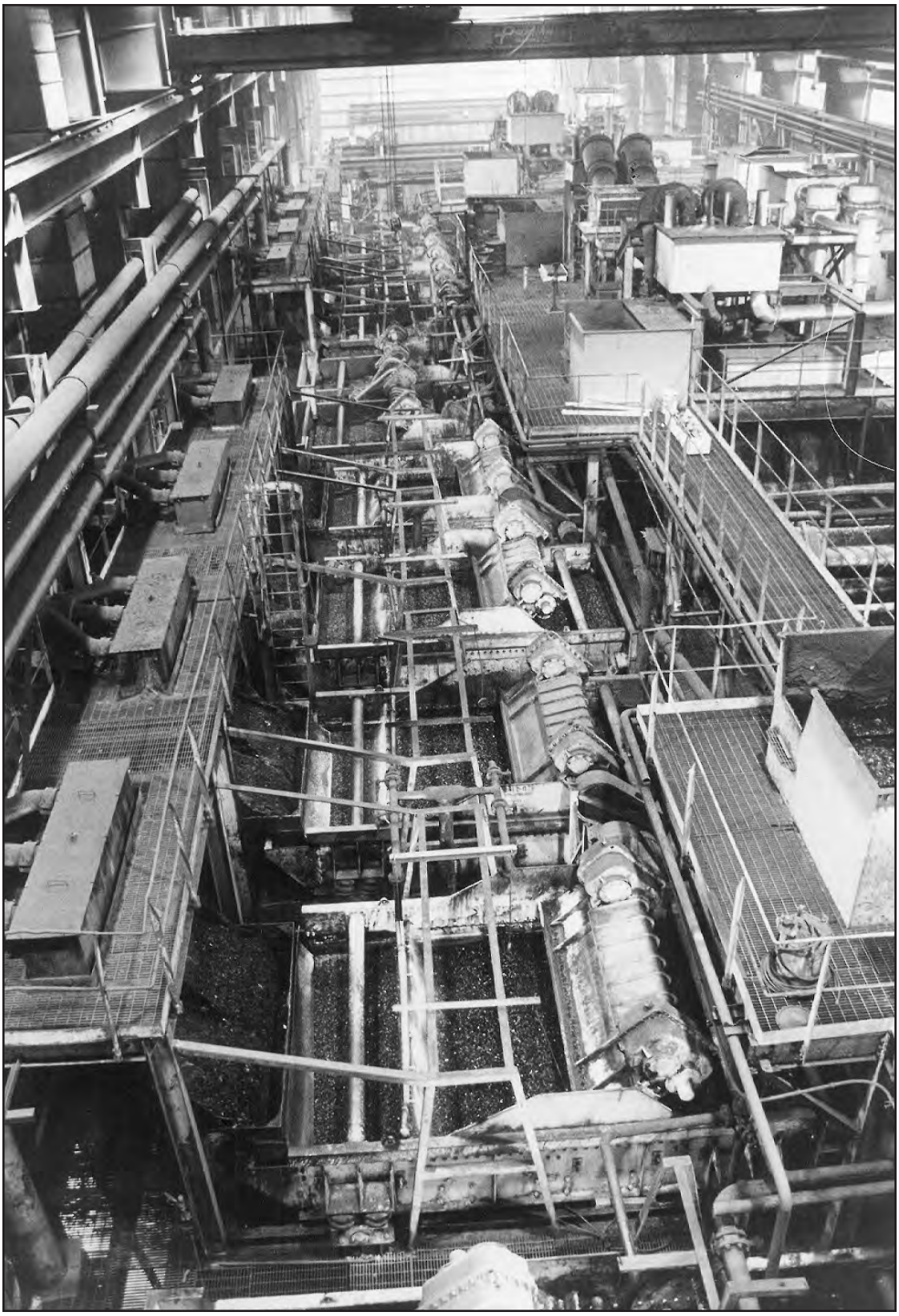


FIGURE 219.—Interior of the Southern Ohio Coal Company Meigs Division Preparation Plant, approximately 5 miles east of Wilkesville, in Salem Township, Meigs County. Built in the early 1970's, this preparation plant is perhaps the largest coal-washing facility in North America, has the capacity to clean more than 2,200 tons of raw coal per hour, and is capable of producing 6 million tons of clean coal annually. After washing, the coal is shipped via conveyor to the Gen. James M. Gavin power-generating station. Date unknown. Photo courtesy of American Electric Power Service Corporation. (See also figs. 46, 201, 216.)

TABLE 6.—COMPARISON OF WASHED COAL AND COAL CONSUMED BY OHIO UTILITIES TO OHIO COAL PRODUCTION (IN SHORT TONS), 1946-1993

Year	Production	Washed coal	Percent washed coal	Coal consumed by Ohio utilities			Percent Ohio coal consumption versus production
				Ohio coal	Total coal	Percent Ohio coal consumed	
1946	30,785,021	9,215,087	30	NA	NA	NA	NA
1947	37,068,655	10,329,750	28	NA	NA	NA	NA
1948	38,314,357	10,852,521	28	NA	NA	NA	NA
1949	30,777,212	10,203,704	33	NA	NA	NA	NA
1950	36,977,932	12,238,528	33	NA	NA	NA	NA
1951	37,816,708	17,526,084	46	NA	NA	NA	NA
1952	35,487,231	17,336,481	49	NA	NA	NA	NA
1953	34,112,748	14,345,330	42	NA	NA	NA	NA
1954	31,472,066	12,623,160	40	NA	NA	NA	NA
1955	37,034,321	20,342,617	55	NA	NA	NA	NA
1956	38,808,577	22,040,343	55	NA	NA	NA	NA
1957	37,493,450	19,943,618	53	NA	NA	NA	NA
1958	32,106,390	17,894,845	56	NA	NA	NA	NA
1959	35,322,289	19,272,470	55	NA	NA	NA	NA
1960	33,896,497	17,825,078	53	NA	NA	NA	NA
1961	31,733,741	16,052,218	51	NA	NA	NA	NA
1962	34,010,824	16,098,467	47	NA	NA	NA	NA
1963	36,916,741	18,013,774	49	NA	NA	NA	NA
1964	37,390,478	18,253,212	49	NA	NA	NA	NA
1965	39,331,560	19,135,701	49	NA	NA	NA	NA
1966	43,068,447	20,103,130	47	NA	NA	NA	NA
1967	45,891,615	19,022,028	41	NA	NA	NA	NA
1968	48,286,873	19,555,419	41	NA	NA	NA	NA
1969	51,193,028	22,193,873	43	NA	NA	NA	NA
1970	55,136,699	18,660,978	34	25,428,000	34,145,000	69	47
1971	49,016,773	17,055,704	35	25,428,000	38,579,000	66	52
1972	50,571,568	20,287,499	40	27,902,000	42,238,000	66	55
1973	45,666,487	20,067,203	44	27,671,000	41,745,000	66	61
1974	45,351,602	17,118,272	38	27,051,000	44,171,000	66	60
1975	46,341,004	16,761,247	36	29,000,000	46,414,000	62	62
1976	45,868,411	17,820,724	39	31,994,000	50,113,000	64	68
1977	46,157,872	17,414,137	38	31,686,000	52,336,000	61	68
1978	39,519,844	16,483,194	42	26,093,000	48,833,000	53	65
1979	42,820,429	20,738,191	48	27,582,000	53,377,000	52	69
1980	40,445,427	15,530,563	38	24,878,000	50,494,000	49	61
1981	37,341,959	17,911,542	48	24,040,000	45,042,000	53	63
1982	38,882,611	18,747,605	48	23,996,700	45,948,600	52	62
1983	33,216,630	20,803,335	63	22,074,030	40,388,116	55	66
1984	38,824,002	25,702,586	66	26,731,400	47,601,190	56	69
1985	35,465,374	25,540,000	72	23,802,480	44,218,230	54	67
1986	34,733,410	25,570,876	74	24,308,180	47,163,748	52	70
1987	33,152,316	20,982,236	63	24,714,312	48,281,250	51	75
1988	31,164,003	23,585,855	75	22,432,700	48,893,000	46	72
1989	31,431,757	21,260,594	68	24,375,000	50,479,000	48	78
1990	33,127,567	21,393,607	65	24,819,300	48,848,000	51	75
1991	29,357,683	19,902,423	68	21,885,900	49,577,000	44	75
1992	29,403,063	18,473,112	63	22,352,400	50,358,000	44	74
1993	27,585,575	17,274,721	63	23,066,300	51,456,000	45	81

NA = not available.

Sources: Energy Information Adminstration (1994b), Ohio Division of Geological Survey (1983-1994), Ohio Division of Mines (1947-1981), Public Utilities Commission of Ohio (1993).

Title IV of the CAAA90, which sets as a target for the year 2000 a cutback in annual SO_2 emission of at least 10 million tons from the 1980 level. Total SO_2 emissions from all electric power plants will be restricted to 9.9 million tons annually. This reduction will occur in two phases. By January 1, 1995, the beginning of Phase I, the 110 largest sulfur-emitting power plants (greater than 100 megawatts) must reduce their emissions to an average of 2.5 pounds of SO_2 per million Btu or less. By January 1, 2000, the start of Phase II, affected plants will be required to reduce their SO_2 emissions to no more than 1.2 pounds per million Btu. This legislation has placed an even tighter stranglehold on Ohio's coal industry by extending to all coal-fired utilities larger than 25 megawatts the emission limit of 1.2 pounds of SO_2 per million Btu of the 1971 New Source Performance Standards.

Annual allowances (credits), each permitting the emission of 1 ton of SO_2, are allocated initially by the U.S. Environmental Protection Agency (USEPA). Utilities which operate within the compliance limit of 1.2 pounds of SO_2 per million Btu may trade or sell SO_2 credits to utilities which exceed the compliance limit. In addition to the annual allowances, there are several methods by which utilities may meet the emission restrictions. They may choose to reduce emissions by switching to low-sulfur coal, a coal blend containing low-sulfur coal, or an alternative fuel such as natural gas. They may also reduce emissions by producing less electricity from plants that emit relatively high levels of SO_2 and increasing generation from their less polluting plants. Another option is to reduce emissions by installing flue-gas scrubbers or by using new clean-coal technologies. Utilities may use any combination of these methods to meet SO_2 emission limitations of the CAAA90. Ohio has 112 boilers and 32 electric-generating stations, of which 51 boilers and 26 generating stations are coal fired. The 51 boilers and 17 of the coal-fired power plants are affected by the Phase I compliance date. Three Ohio power plants (Zimmer, Conesville, and Eastbend) currently use scrubbers, and a scrubbing facility is being constructed at Gavin. Fuel switching either to low-sulfur out-of-state coal or natural gas is planned for most of Ohio's generating units because, even after washing, few of Ohio's coals, when burned, will meet Phase I compliance standards, and virtually none will meet Phase II compliance standards without significant blending or some advanced clean-coal technology such as scrubbers or fluidized-bed combustion. Until clean-coal technology can inexpensively and effectively solve the problem of SO_2 emissions from burned Ohio coal, it is likely that Ohio's coal-mining industry will continue to decline.

CLEAN-COAL TECHNOLOGY

In 1984, Ohio's Clean Coal Technology Program was created to investigate and develop methods by which Ohio's high-sulfur coal could be used without adversely affecting the environment. In 1985, Ohio voters passed, by a 2-to-1 margin, legislation endowing the program with up to $100 million. Since 1985, the program has co-sponsored 80 clean-coal projects. A total of $1.2 billion has been funded for Ohio clean-coal projects by the state and federal governments and by the private sector. Until clean-coal technolo-

FIGURE 220.—Although the Clean Air Act placed stringent controls on the emissions released by burning coal, this legislation pales in comparison to the regulation imposed by King Edward I. *Arrested for burning coal! Forbidden by royal proclamation and punished by hanging or imprisonment, burning coal in London was a risky undertaking during the reign of Edward I (1274 to 1307). "Sea-coale", as it was called, was all that could be had. Picked from the outcrops where mining was easy, it was soft and crumbly. Dense smoke arose from fires fed with this coal. London was dirty enough, so the King forbade its use.* Sketch and caption quote from an advertisement of the Hercules Powder Company in The Coal Trade Bulletin (1922, v. 47, no. 5, inside cover).

gies emerged in the last few years, the flue-gas scrubber was the only commercial technology capable of achieving the requirements of the Clean Air Act. Currently, there are several clean-coal systems being developed into demonstration projects which appear to not only achieve high environmental performance but also enhance the performance of the power plant.

One promising clean-coal system is the fluidized-bed combustion process. In this process, pulverized coal is mixed with finely crushed limestone and the mixture is then injected into the boiler. As the coal burns, the sulfur is released and the limestone acts like a chemical sponge to "soak up" or capture the sulfur before it can escape the boiler. During this process the combustion temperature remains between 1,400°F and 1,600°F, which is about half the temperature of a conventional boiler. These lower temperatures are below the temperature threshold at which nitrogen pollutants form. As a result, this process is able to meet both SO_2 and NO_x emission standards without additional pollution-control equipment.

Chapter 9

SUMMARY

The coal-mining industry of Ohio is rich in history. Its beginnings were meager, occurring at a time when thoughts of statehood were being shared by the influx of pioneers, and Tecumseh, the famous Shawnee Indian chief, and Simon Kenton, the well-known Ohio frontiersman, were still participants in Ohio's life. Ohio's coal-mining industry grew slowly and steadily until coal became Ohio's most important economic resource. The growth of this industry in many respects paralleled the growth of the state. Shortly after statehood, politicians and business interests worked hard to develop Ohio's agricultural and industrial potential. Among the early legislation passed in Ohio were acts which authorized a variety of internal improvements, such as the construction of canals and railroads. These improvements were promoted to attract settlers and stimulate commerce. Ohio's coal-mining industry is one of many industries which benefited from such improvements.

Most of Ohio's early coal production was localized, and production rates were very small. However, with the development of the canal and railroad systems, Ohio's coal-mine operators were able to market their product farther and farther from the mines, eventually marketing Ohio coal on the national and international level. Railroad lines criss-crossed Ohio, especially the eastern Ohio coal fields, to facilitate shipment of coal and to have a readily accessible supply of fuel. The development of the railroad lines enabled existing mines to continue to grow and stimulated the development of new mines. Word spread that there were opportunities for work mining coal in Ohio. As a result, many European immigrants, looking for employment and a better way of life, took up residence in Ohio's coal-mining communities. Work was not always plentiful, but it was often strenuous and dangerous, and always dirty.

Countless stories could be told of Ohio's coal miners: their endurance, courage, heroism, and ingenuity. Many of Ohio's coal miners were immigrants, some were children who were learning the art of coal mining from their fathers, most worked under difficult and risky conditions, few became rich, but all could take pride in knowing that through their efforts Ohio became one of the industrial leaders of the nation. Unquestionably, Ohio's industrial growth, variety of commerce, and economic prosperity are a result of the development of her natural resources, especially coal. Coal has supplied the fuel for a myriad of purposes. The location and development of many of Ohio's eastern and southeastern cities and towns are a result of coal mining. Modern conveniences, such as air conditioners, stereo equipment, TV's, VCR's, and desktop computers, are operated by electricity, nearly all of which in Ohio is generated by coal-fired power plants.

Few would disagree that Ohio's coal industry has contributed significantly to our present high standard of living. But what of the future? What is in store for Ohio's coal-mining industry? There are those who say that the heyday of coal mining in Ohio has passed and the coal industry as a whole is on the wane. These doom-sayers cite as evidence for a dying industry: lost coal contracts, several large underground mines recently idled or abandoned, companies reorganized or reduced into smaller operations, and the moving of some major coal operators from Ohio to other states. The effect of such corporate actions unfortunately has resulted in fewer coal-mining jobs, lost tax revenues to communities which grew around and became dependent on coal income, and a decrease or elimination of business by associated industries that supplied goods and services to Ohio's coal mines. However, there are some who are optimistic about the future in spite of the continuing decline in Ohio's coal production. These optimistic individuals are hopeful that the industry will be saved by one or more of the promising clean-coal technologies currently being developed. Whatever the future holds for Ohio coal, all Ohioans are hopeful that electricity will remain affordable and be produced in an environmentally sound manner.

ACKNOWLEDGMENTS

I am grateful to the following reviewers, whose comments greatly enhanced this manuscript: Richard M. DeLong (Ohio Division of Geological Survey, retired), Randall Neff (Senecaville, Ohio), Dr. Roy Palmer (Hocking Technical College), Elizabeth Reeb (Ohio Historical Society), and Phil Styer (Ohio Department of Health).

My sincere thanks to the following individuals and organizations that contributed or assisted in providing photographs, many of which are rare and provide valuable insight into Ohio's coal mining history: Shephard Black, Karen Jones, and Doug McCabe (Ohio University, Vernon R. Alden Library); Joseph Cerenzia (Consol, Inc.); W. R. Ervin (Millfield, Ohio); Daniel L. Frizzi (Bellaire, Ohio); Charles "Bud" Fry (Bellaire, Ohio); Dale Davis (Ohio Department of Natural Resources, Division of Reclamation); Jenny Barnard and Jim Hatch (The Plain Dealer); Tauny Graham, Elizabeth Reeb, and Vernon Will (Ohio Historical Society); Eve Karlin (NEWSWEEK); Paul Kidney and Forrest Walton (Ohio Department of Industrial Relations, Division of Mines); M. A. Meese (Tuscarawas County Historical Society); John Miller (The University of Akron Archives); Timothy Miller (East Fairfield Coal Company); Skip Peterson (Dayton Daily News); Lou Prosser (U.S. Bureau of Mines); James Rosso (Bucyrus-Erie Company); Arthur P. Sanda (COAL); Robert Smith (The Columbus Dispatch); Margy Vogt (The Massillon Museum); Dave Waitkus (American Electric Power Service Corporation); Mark Wharton (Senecaville, Ohio); J. J. Young, Jr. (Binghamton, New York); and Wendy Zucal (Dennison Railroad Museum).

Many thanks to the following individuals who provided valuable historical information relative to coal mining in Ohio: Patsy Cartwright (Nelsonville, Ohio); C. E. Glasco (Columbus, Ohio); Dr. Joseph T. Hannibal (The Cleveland Museum of Natural History); Gene O. Johnson (Public Utilities Commission of Ohio); Karen Jones (Ohio University, Vernon R. Alden Library); Paul Kidney and Forrest Walton (Ohio Department of Industrial Relations, Division of Mines); Earl Olmstead (Tuscarawas County Historical Society); Dr. Lorle Porter (Muskingum College); Phyllis Taylor (Barberton Public Library); and John Wunderle (Cuyahoga Falls, Ohio).

REFERENCES CITED

Adams, W. W., Geyer, L. E., and Parry, M. G., 1941, Principal coal-mine disasters in the United States: U.S. Bureau of Mines Bulletin 437 (reprint), p. 111-118.

Addison, W. G., 1987, San Toy, "the town that ain't no more," ghost town of Morgan County and Perry Counties: Morgan County Historical Society, unpaged.

American Electric Power Service Corporation, 1993, Pocket facts: Lancaster, Ohio, AEP Fuel Supply, 28 p.

Anderson, G. B., 1980, One hundred booming years: history of the Bucyrus-Erie Company 1880-1980: South Milwaukee, Wisconsin, Bucyrus-Erie Company, 182 p.

Andrews, E. B., 1871, Report of progress in the Second District: Ohio Division of Geological Survey Report of Progress in 1869, p. 55-142.

_____ 1873a, Report on the second geological district: Gallia, Meigs, Athens, Morgan, Muskingum Counties: Ohio Division of Geological Survey, v. 1, pt. 1, Geology, p. 225-364.

_____ 1873b, Coal and iron deposits of the upper Sunday Creek and Moxahala Valleys, in Perry County, Ohio: Columbus, Ohio, Ohio State Journal Office, 44 p.

_____ 1874, Report on the second district: Surface geology of southeastern Ohio; Geology of Washington, Noble, Guernsey (southern half), Belmont (southern half), Monroe, Pickaway and Fairfield Counties; Salt in the second geological district: Ohio Division of Geological Survey, v. 2, pt. 1, Geology, p. 439-608.

Anonymous, 1953, History of Coalton and Coal Township: Sesqui-Centennial Edition, privately published, unpaged.

Ashley, G. H., 1918, Cannel coal in the United States: U.S. Geological Survey Bulletin 659, 127 p.

Ballou, Ellis, 1856, An account of the coal bank disaster at Blue Rock, Ohio: Malta, Ohio, privately published, 32 p.

Boryczka, Raymond, and Cary, L. L., 1982, No strength without union, an illustrated history of Ohio workers 1803-1980: Columbus, Ohio, Ohio Historical Society, 328 p.

Bownocker, J. A., 1903, The occurrence and exploration of petroleum and natural in Ohio: Ohio Division of Geological Survey Bulletin 1, 325 p.

_____ 1906, Salt deposits and the salt industry in Ohio: Ohio Division of Geological Survey Bulletin 8, 42 p.

_____ 1917, The coal fields of Ohio: U.S. Geological Survey Professional Paper 100-B, p. 35-96.

Bownocker, J. A., and Condit, D. D., 1908, The Pomeroy coal in Ohio: Economic Geology, v. 3, no. 3, p. 183-199.

Bownocker, J. A., Lord, N. W., and Somermeier, 1908, Coal: Ohio Division of Geological Survey Bulletin 9, 342 p.

Briggs, Charles, Jr., 1838, Report (on Wood, Crawford, Athens, Hocking, and Tuscarawas Counties): Ohio Division of Geological Survey Second Annual Report, p. 108-154.

Bruce, A. W., 1952, The steam locomotive in America; its development in the twentieth century: New York, W. W. Norton & Company, Inc., 443 p.

Burrell, G. A., 1914, Relative effects of carbon monoxide on small animals: The Coal Trade Bulletin, v. 31, no. 8, p. 30-50.

Burrell, G. A., and Seibert, F. M., 1914, Gases found in coal mines, part II: The Coal Trade Bulletin, v. 31, no. 2, p. 50-54.

Burroughs, W. G., 1919, Coal stripping in the United States: The Coal Industry, v. 2, no. 1, p. 1-5.

_____ 1920a, Safety lamp and its uses at coal mines, part II: The Coal Industry, v. 3, no. 7, p. 313-317.

_____ 1920b, Safety lamp and its uses at coal mines, part III: The Coal Industry, v. 3, no. 9, p. 431-436.

_____ 1920c, Safety lamp and its uses at coal mines, part V: The Coal Industry, v. 3, no. 11, p. 519-522.

_____ 1921a, Unique tipple and mines of the Hisylvania Coal Company: The Coal Industry, v. 4, no. 2, p. 97-99.

_____ 1921b, Safety lamp and its uses at coal mines, part XI: The Coal Industry, v. 4, no. 8, p. 402-410.

_____ 1921c, The electric safety mine lamp: The Coal Industry, v. 4, no. 11, p. 559-561.

_____ 1922, The electric safety mine lamp: The Coal Industry, v. 5, no. 4, p. 200-204.

Caldwell, J. A., 1880, History of Belmont and Jefferson Counties, Ohio, and incidentally historical collections pertaining to border warfare and the early settlement of the adjacent portion of the Ohio Valley: Wheeling, West Virginia, Historical Publishing Company, 611 p.

Cartwright, Patsy, 1993, Coal mining and its importance to man: unpublished paper, Ohio Mineral Industries Teacher's Workshop, unpaged.

Coal Age, 1969, Big Muskie; King of the Giants: v. 74, no. 12, p. 50-61.

_____ 1986, Laws increase constraints: v. 91, no. 6, p. 125.

Collins, H. R., 1976, Coal production in Ohio—1800-1974: Ohio Division of Geological Survey Information Circular 44, 33 p.

_____ 1987, A historical sketch of the mineral industries in Ohio: Ohio Division of Geological Survey Information Circular 54, 6 p.

_____ 1988, Coal: Ohio Division of Geological Survey Educational Leaflet 8.

Columbus and Southern Ohio Electric Company, no date, A brief history: Columbus and Southern Ohio Electric Company, pamphlet, unpaged.

Commissioner of Railroads and Telegraphs, 1868-1910, Annual report to the Govenor of the State of Ohio: Columbus, Ohio, annual reports 1867-1909.

Cook, Larry, 1950, New forests for Ohio: reprint from American Forests, November 1950, 4 p.

_____ 1956, Reclamation of strip lands: reprint from Mechanization, September 1956, 4 p.

Coxe, E. H., 1899, The fire in the Sunday Creek Coal Company's Mine Number 10: Ohio Mining Journal, Whole No. 27, p. 73-91.

Cutler, Manasseh, 1788, Ohio in 1788, translated from the French by John Henry James, 1888: Columbus, Ohio, A. H. Smythe, 104 p.

Dalton, Dalton, Little, Newton, 1974, Ohio transportation development report: Cleveland, Ohio, E. S. Preston Associates, Inc., unpaged.

Davis, H. E., 1929, The Pennsylvania-Ohio Canal: Hiram Historical Society, No. 1, unpaged.

Denton, G. H., 1960, Coal resources of the upper part of the Monongahela formation and the Dunkard group in Ohio: Ohio Division of Geological Survey Report of Investigations 38, 50 p.

Doerschuk, A. N., 1926, The last canal boat: Ohio Archaeological and Historical Society, v. 34, p. 109-116.

Doyle, J. B., 1910, 20th century history of Steubenville and Jefferson County, Ohio, and representative citizens: Chicago, Richmond-Arnold Publishing Co., 1,197 p.

Dusz, H. J., Chadwick, Joseph, Martin, Gerald, and McCartney, Thomas, 1957, Report of cave-in at Betsy No. 3 mine of the Powhatan Mining Company: Ohio Department of Industrial Relations, Division of Mines, 5 p.

Eavenson, H. N., 1942, The first century and a quarter of American coal industry: Pittsburgh, Pennsylvania, privately published, 710 p.

Electrical Mining, 1918, Sunday Creek Coal Company, San Toy, Ohio: October, p. 95-118; reprinted by the Morgan County Historical Society.

Energy Information Administration, 1993, U.S. coal reserves; an update by heat and sulfur content: U.S. Department of Energy, DOE/EIA-0529 (92), February 1993, 86 p.

_____ 1994a, Electric Power Monthly: U.S. Department of Energy, DOE/EIA-0226 (94/05), May 1994, 199 p.

_____ 1994b, Quarterly coal report, October-December 1992: U.S. Department of Energy, DOE/EIA-0121 (93/4Q), 154 p.
Forbes, J. J., Fene, W. J., and Ankeny, M. J., 1934, Mine fires—vicinity of New Straitsville, Ohio: U.S. Bureau of Mines, 16 p.
Forbes, J. J., Grove, G. W., Fene, W. J., and Ankeny, M. J., 1940, Final report, explosion, Willow Grove No. 10, Hanna Coal Company of Ohio, Neffs, Ohio, March 16, 1940: U.S. Bureau of Mines, 49 p.
Foster, J. W., 1838, Report (on Muskingum County and parts of Licking and Franklin Counties): Ohio Division of Geological Survey Second Annual Report, p. 9-10, 73-107.
Frey, R. W., 1958, The history and legends of Rogues' Hollow: privately published, 101 p.
Fraser, Thomas, 1923, Early history of the coal washing industry: The Coal Industry, v. 6, no. 1, p. 69-72.
Garcia, J. A., 1913, Modern steel-tipple design: Coal Age, v. 3, no. 21, May 24, p. 786-788.
Gilmore, R. H., 1856, The thrilling narrative of Edgell, Pearson, Gatwood, and Savage who were rescued after having been buried alive seven hundred feet underground for fourteen days and thirteen hours without food, in the Blue Rock coal mines: Zanesville, Ohio, Gilmore & Bennett, 48 p.
Glasco, C. E., 1986, Corporate history of the Ohio Power Company: Ohio Historical Society, unpublished manuscript, 61 p.
Gorisek, Sue, 1977, Ida Stull fought laws to a be a miner: United Mine Workers Journal, v. 88, no. 17, p. 12.
Hansen, M. C., 1990, Mine dogs: Ohio Division of Geological Survey, Ohio Geology, Fall, p. 1-4.
_____ 1993, The first oil well: Ohio Division of Geological Survey, Ohio Geology, Spring, p. 1-4.
Harris, C. H., 1957, The Harris history; a collection of tales of long ago of southeastern Ohio and adjoining territories: The Athens Messenger, 329 p.
Hazeltine, R. M., 1882, Development of the mineral resources of the Mahoning Valley, and the surveying of mines: Ohio Mining Journal, Whole No. 1, p. 36-44.
Heydinger, Earl, 1974, Early coal traffic on the Ohio & Erie: Towpaths, v. 12, no. 3, p. 34-36.
Hildreth, S. P., 1836, Report of the special committee, appointed by the last legislature to report on the best method of obtaining a complete geological survey of the State of Ohio: Columbus, James B. Gardiner, Printer to the State, 18 p.
_____ 1838, Report (on the coal measures): Ohio Division of Geological Survey First Annual Report, p. 25-63.
Hill, N. N., Jr., 1881, History of Coshocton County, Ohio: Its past and present, 1740-1881: A. A. Graham & Co., 833 p.
Hodge, J. T., 1878, Report on the geology of Coshocton County: Ohio Division of Geological Survey, v. 3, p. 562-595.
Hook, R. W., 1986, Coal is not without its poetry; fossil traces from the Paleozoic: Timeline [Ohio Historical Society], v. 3, no. 1, p. 2-15.
Howe, Henry, 1900, Historical collections of Ohio: Cincinnati, Ohio, C. J. Krehbiel & Co., The Ohio Centennial Edition, v. 1, 911 p.; v. 2, 992 p.
Huebner, A. F., 1917, Houses for mine villages: Coal Age, v. 27, October, p. 717-720.
Humphrey, H. B., 1959, Historical summary of coal-mine explosions in the United States: U.S. Bureau of Mines Information Circular 7900, 275 p.
Hunt, T. S., 1881, Coal and iron in southern Ohio; the mineral resources of the Hocking Valley: Boston, Massachusetts, S. E. Cassina, 152 p.
Industrial Commission of Ohio, 1915-1919, Statistics of mines and quarries in Ohio: Department of Investigation and Statistics, annual reports 1913-1917.
Inter-State Publishing Co., 1883, History of Hocking Valley, Ohio: Chicago, 1,392 p.
Jennings, W. H., 1888, President's address, read at the meeting of the Ohio Institute of Mining Engineers: Ohio Mining Journal, Whole No. 17, p. 7-12.
Keenan, C. M., 1963, Historical documentation of major coal-mine disasters in the United States not classified as explosions of gas or dust: 1846-1962: U.S. Bureau of Mines Bulletin 616, 90 p.
Kefauver, Hazel, 1959, Coal production in Ohio, 1958, in Annual Report for 1958: Ohio Department of Industrial Relations, Division of Mines, p. 23-28.
Klein, M. S., 1956, Bituminous coal production in Ohio by county, 1800-1955: Ohio Division of Geological Survey, chart.
Koster, J. W., 1919, Gases commonly met within coal mines: The Coal Industry, v. 2, no. 2, p. 66-68.
Lawrence, F. A., 1984, About old Tallmadge: Tallmadge Historical Society, 54 p.
LeGrande, L. H., 1977, Collective bargaining in the bituminous coal industry: U.S. Department of Labor, Division of Industrial Relations, Report 514, 13 p.
Lewis, T. W., 1928, History of southeastern Ohio and the Muskingum Valley, 1788-1928: Chicago, S. J. Clarke Publishing Co., v. 2, 620 p.
Long, Priscilla, 1989, Where the sun never shines, a history of America's bloody coal industry: New York, Paragon Press, 420 p.
Lord, N. W., 1884, The iron ores of Ohio: Ohio Division of Geological Survey, v. 5, p. 438-554.
_____ 1892, Blast furnace tar and ammonia: Ohio Mining Journal, Whole No. 20, p. 36-46.
Mack, Horace, 1879, History of Columbiana County, Ohio, with illustrations and biographical sketches of some of its prominent men and pioneers: Philadelphia, D. W. Ensign & Co., 334 p.
Marvin, W. R., 1953, Columbus and the railroads of central Ohio before the Civil War: Ph.D. dissertation (unpub.), Ohio State University, 349 p.
Mather, W. W. (and others), 1838a, The first annual report on the geological survey of the State of Ohio: Columbus, Samuel Medary, Printer to the State, 134 p.
_____ 1838b, The second annual report on the geological survey of the State of Ohio: Columbus, Samuel Medary, Printer to the State, 286 p.
McAfee, Rose, 1991, Down in the depths with pick and shovel: privately published, 60 p.
Minshall, F. W., 1888, The history and development of the Macksburg oil field: Ohio Division of Geological Survey, v. 6, p. 443-475.
Morrow, F. C., 1956, A history of industry in Jackson County, Ohio: Athens, Ohio, Lawhead Press, Inc., 291 p.
National Coal Association, 1984, Coal and your environment: Washington, D.C., 29 p.
Newberry, J. S., 1857, Annual report of the directors and chief engineer of the Ashtabula & New Lisbon Rail Road Co.; also the geological report of its mineral resources: Cleveland, Ohio, Cowles & Co., 56 p.
_____ 1871, Report on the progress of the geological survey of Ohio in 1869: Ohio Division of Geological Survey Report of Progress in 1869, p. 3-53.
_____ 1873, Geology of Summit County: Ohio Division of Geological Survey, v. 1, p. 201-222.
_____ 1878a, Report on the geology of Tuscarawas County: Ohio Division of Geological Survey, v. 3, p. 52-89.
_____ 1878b, Report on the geology of Jefferson County: Ohio Division of Geological Survey, v. 3, p. 716-788.
Newell, F. H., 1888, The drilling and care of oil wells: Ohio Division of Geological Survey, v. 6, p. 476-515.
Noble, A. G., and Korsok, A. J., 1975, Ohio—an American heartland: Ohio Division of Geological Survey Bulletin 65, 230 p.
Ohio Coal Association, 1947, Ohio coal reserves: Ohio State University Engineering Experiment Station News, v. 19, no. 2, p. 10-14.
Ohio Coal Development Office, 1992, Ohio coal development agenda: Ohio Department of Development, 210 p.

Ohio Department of Natural Resources, no date, Map of the State of Ohio showing existing, abandoned and proposed canal routes: Office of Real Estate and Land Management, 1 p.; modified from the Map of the State of Ohio (Plate 3) in Report of the Chief Engineer of Public Works and General Superintendent of Canals made in 1900 to the Board of Public Works.
Ohio Division of Geological Survey, 1983-1994, Report on Ohio mineral industries: Annual reports, 1981-1993.
Ohio Division of Labor Statistics, 1919-1943, Statisitcs of mines and quarries in Ohio: Department of Industrial Relations, annual reports 1918-1941.
_____ 1944-1946, Coal report: Department of Industrial Relations, annual reports 1943-1945.
_____ 1947-1950, Coal and nonmetallic mineral report: Department of Industrial Relations, annual reports 1946-1949.
_____ Ohio Division of Mines, 1944, Coal operators: Department of Industrial Relations, annual report for 1942.
_____ 1951-1965, Coal and nonmetallic mineral report: Department of Industrial Relations, annual reports 1950-1964.
_____ 1966-1981, Annual report: Department of Industrial Relations, annual reports 1965-1980.
_____ 1993, Mining laws of Ohio: Department of Industrial Relations, 250 p.
Ohio Historical Society, 1971, Canals of Ohio: poster.
Ohio Mining and Reclamation Association, 1988, Ohio coal facts: pamphlet, 15 p.
_____ 1992, Ohio coal facts: pamphlet, 17 p.
Ohio Mining Commission, 1872, Report of the Mining Commission . . . to His Excellency the Governor Rutherford B. Hayes, November 14th, 1871: Columbus, Nevins & Meyers, 199 p.
Ohio Petroleum Company, 1864, Prospectus: New York, E. S. Dodge & Co., 11 p.
O'Malley, T. T., 1891, Adventures in the mines; or perils underground: Akron, Ohio, privately published, 384 p.
Orton, Edward, 1884, The coal seams of the lower coal measures of Ohio: Ohio Division of Geological Survey, v. 5, p. 129-300.
Owings, C. W., 1938, Coal-mine explosions in Ohio, 1874-1936: U.S. Bureau of Mines Information Circular 6956, 37 p.
Palka, E. J., 1986, Artifacts of the coal age, Athens County region: Athens, Ohio, The Athens County Historical Society & Museum, 88 p.
Perkins, George, 1926, The Ohio Canal: Ohio Archaeological and Historical Society, v. 34, p. 597-604.
Perrin, W. H., 1881, History of Summit County with an outline sketch of Ohio: Chicago, Baskin & Battey, Historical Publishers, 1,050 p.
Perry, C. R., 1981, Collective bargaining and the decline of the United Mine Workers: University of Pennsylvania, Major Industrial Research Studies No. 60, 273 p.
Phelps, C. C., 1919, Illumination and the safety problem: The Coal Industry, v. 2, no. 4, p. 153-156.
Porter, Lorle, 1993, The immigrant cocoon, Chapter 1, Iron and steel: unpublished manuscript.
Public Utilities Commission of Ohio, 1993, Ohio short term forecast of utility fuels, 1993-1994: Division of Forecasting, 77 p.
Ray, F. A., and Bonnet, E. S., 1930, Report of the explosion which occurred November 5, 1930 in Poston No. 6 mine owned by the Sunday Creek Coal Company located at Millfield, Athens County, Ohio: unpublished report, 23 p.
Read, M. C., 1878a, Report of the geology of Knox County: Ohio Division of Geological Survey, v. 3, p. 324-347.
_____ 1878b, Report of the geology of Ashland County: Ohio Division of Geological Survey, v. 3, p. 519-528.
_____ 1878c, Report on the geology of the Hocking Valley coal field: Ohio Division of Geological Survey, v. 3, p. 647-715.
Repine, T. E., 1986, Mining beneath the Ohio: West Virginia Geological and Economic Survey, Mountain State Geology, p. 35-39.
Root, W. J., 1888, The manufacture of salt and bromine: Ohio Division of Geological Survey, v. 6, p. 653-670.
Roy, Andrew, 1876, The coal mines; containing a description of the various systems of working and ventilating mines, together with a sketch of the principal coal regions of the globe, including statistics of the coal production: Cleveland, Ohio, Robinson, Savage & Co. 367 p.
_____ 1883, Coal cutting machinery in Ohio mines: Ohio Mining Journal, Whole No. 3, p. 114-118.
_____ 1884a, The Ohio coal field: Ohio Mining Journal, Whole No. 7, p. 121-129.
_____ 1884b, Coal mining in Ohio: Ohio Division of Geological Survey, v. 5, p. 301-370.
_____ 1885, The practical miner's companion; or, papers on geology and mining in the Ohio coal field: Columbus, The Westbote Printing Company, 288 p.
_____ 1888, A brief history of mining legislation in the State of Ohio: Ohio Mining Jornal, Whole No. 17, p. 21-24.
_____ 1906, A history of the coal miners of the United States: Columbus, Ohio, J. L. Trauger Printing Co., 455 p.
Schneider, N. F., 1968, The Muskingum River; a history and guide: Ohio Historical Society, 47 p.
Shurick, A. T., 1912, The Federal Valley field in Ohio: Coal Age, v. 1, no. 38, June 29, p. 1236-1238.
Smith, E. W., 1930, Report of Millfield mine explosion: Ohio Department of Industrial Relations, Division of Mines, 6 p.
Smith, T. H., 1977, The mapping of Ohio: Kent State University Press, 252 p.
State Inspector of Mines, 1875-1915, Annual reports of the Chief Inspector of Mines: v. 1-40, annual reports 1874-1914, also titled as: Inspector of Mines (1882, 7th annual report), Chief Inspector of Mines (1890-1915, 15th-50th annual reports), and Industrial Commission, Division of Mines (1915, 40th annual report).
Stevenson, David, 1838, Sketch of the civil engineering of North America: London, John Weale, Architectural Library, 320 p.
Stoddard, P. W., 1929, The knowledge of coal and iron in Ohio before 1835: Ohio Archaeological and Historical Quarterly, v. 38, p. 219-230.
Stoek, H. H., 1917a, Development of the steam shovel for mining coal: The Coal Trade Bulletin, v. 37, no. 9, October 1, p. 43-52.
_____ 1917b, Steam shovel mining of bituminous coal: The Coal Trade Bulletin, v. 37, no. 8, September 15, p. 27-32.
Stout, Wilber, 1940, A geologist's sketch of Meigs County: Ohio State University Engineering Experiment Station News, v. 12, no. 5, p.3-7.
_____ 1944a, Coal, pt. 1 of Ohio's mineral resources: Ohio State University Engineering Experiment Station Circular 45, p. 1-9.
_____ 1944b, The iron ore bearing formations of Ohio: Ohio Division of Geological Survey Bulletin 45, 230 p.
Stout, Wilber, Stull, R. T., McCaughey, W. J., and Demorest, D. J., 1923, Coal formation clays of Ohio: Ohio Division of Geological Survey Bulletin 26, 588 p.
Sturgeon, M. T., 1945, The history of Ohio's northernmost coal mine: Ohio Journal of Science, v. 44, no. 6, p. 255-262.
Tallmadge Historical Society, 1957, A history of Tallmadge: Tallmadge Historical Society, 136 p.
Tribe, I. M., 1986, Little cities of black diamonds: Athens, Ohio, Athens Ancestree, 130 p.
_____ 1989, Sprinkled with coal dust: Athens, Ohio, Athens County Historical Society and Museum, 168 p.
Virgin, R. Z., 1921, Daylight mines in Western Pennsylvania: The Coal Trade Bulletin, v. 44, no. 10, April 16, p. 342-346.
Warner, Beers & Co., 1884, The history of Tuscarawas County, Ohio: Chicago, 1,007 p.
Watkins, D. D., 1937, Keeping the home fires burning: Columbus, Ohio, The Ohio Company, 183 p.
West, Thomas, 1898, Long wall mining and its merits: Ohio Mining Journal, Whole No. 24, proceedings for the year 1895, p. 27-35.
White, G. W., 1949, Geology of Holmes County: Ohio Division of

Geological Survey Bulletin 47, 373 p.
Whittlesey, Charles, 1872a, Review of the past, and prospects of the future increase, of the coal and iron business of the city of Cleveland, in Directory of Cleveland and adjoining towns for 1872-73: Cleveland, Ohio, Cleveland Directory Office, chapter IV, p. 25-31.
_____ 1872b, History of the coal and iron business from Cleveland as it is, 1872: Cleveland, privately published, 8 p.
_____ 1883, Discovery of coal in Ohio and early mine work: Ohio Mining Journal, v. 2, p. 15-17.
Wilcox, Frank, 1969, The Ohio canals: Kent State University Press, 106 p.
Willard, E. B., 1916, A standard history of the Hanging Rock iron region of Ohio: Chicago, Lewis Publishing Company, v. 1, 641 p.
Woodworth, R. E., 1909, The application of steel to mine timbering: The Coal Trade Bulletin, v. 21, no. 10, October 15, p. 49-56.

APPENDIX.—OHIO COAL PRODUCTION (IN SHORT TONS) BY COUNTY, 1800-1993

These production statistics, organized alphabetically by county, give the known production for each county by year from 1800 to 1993. These statistics provide an update of Klein's 1956 chart and Collins' 1976 compilation. Klein's comments concerning source data are cited here verbatim:

Sources

1800-1871 Production data for the years 1800-1871 inclusive, with minor corrections for the years 1841, 1842, 1843, 1849, 1867 and 1869, were selected from the book, "The First Century and a Quarter of American Coal Industry" by Howard N. Eavenson [1942]. This book presents estimates as well as likely actual production figures from many diverse sources. These sources are of varying reliability, and occasionally a questionable figure comes to light, e.g., coal production reported by Eavenson for Crawford and Licking Counties is not included, since there are no known coal beds located in these two counties. Crawford County in particular is located many miles from the Ohio coal-bearing area. The 1918 report of the Ohio Bureau of Mines, however, does show a small tonnage for Licking County.

Rather than copy each footnote indicating the author's sources we have tried to classify them, and the reader who needs to trace any production entry to its ultimate source is referred to the book, pp. 511-520. The many original areas explored by Mr. Eavenson include annual reports of government agencies, histories, magazine and newspaper articles, letters, railroad reports, and the like. The list in part contains:

Annual Reports:
Ohio Secretary of State
Ohio Commissioner of Statistics
Ohio Mines Inspector
Ohio Geological Survey
Ohio Archeological and Historical Society

Histories:
Hardesty: History of Meigs County, Ohio
Interstate Publishing Co.: History of Hocking Valley
Martzluff: History of Perry County, Ohio
Stoddard: Economic History of Ohio
Walker: History of Athens County, Ohio
Whittlesey: History of the Coal and Iron Business, 1872

Magazines and newspapers:
DeBow's Review
Greensburg, Pa., Farmer's Register
Hunt's Merchant's Magazine
Lawrence, Pa., Journal
Mining Magazine
Pittsburgh Gazette
Pittsburgh Mercury

Miscellaneous:
Columbus and Hocking Valley Railway reports
Congressional Reports
Kilbourne, John: Gazetteer of Ohio
Mather, W. W., Report to Coal Grove Co., 1844
Saward: The Coal Trade, 1879
U.S.R.R. and Mining Register, 1865
Miscellaneous letters, reports, surveys, etc.

1872-1912 Annual reports of the Chief Inspector of Mines in combination with Eavenson's figures through 1885. The years 1872 and 1873, for example, use totals reported by the Ohio Division of Mines, but contain estimated county distributions based on Eavenson's estimates with minor corrections. For instance, his 1874 total, if the county distribution is assumed to be correct, should be 4,307,875 rather than the 4,015,013 reported. With the additional correction for Crawford and Licking County tonnages of that year the revised total of 4,304,975 tons here recorded is obtained. Totals for the years 1881-1883 are derived from reports of the Ohio Division of Mines, but again estimated county distributions are used.

1913-1917 Annual reports of the Industrial Commission of Ohio, Department of Investigation and Statistics.

1918-1955 Annual reports of the Ohio Department of Industrial Relations, Division of Labor Statistics and Division of Mines.

Production data for the years 1956 to 1980 were taken from the Department of Industrial Relations, Division of Mines annual reports.

Production data for the years 1981 to 1993 were taken from the Division of Geological Survey annual Report on Ohio mineral industries.

As in all statistical tabulations of this kind, some errors are to be expected. Klein (1956) called attention to the problem of reliability:

No completely accurate gauge of the reliability of the published data for early years up to the 1880's is, of course, available. Mr. Eavenson undertook a monumental assignment in his determination to secure these figures by county as well as by years from the numerous sources recorded here. His book will continue as the principal source of production data throughout these very early years. In the more formal reporting to public agencies many omissions are still evident even though the coverage is somewhat more adequate. Facilities for collecting and assembling such material required a period of years to become satisfactorily established. Even now laxness on the part of the collecting agency must be watched and avoided at all costs. Negligence or refusal to prepare required reports on the part of the operator and lack of information about new mine openings on the part of the collecting agency may contribute to an incomplete annual report. In recent years, however, continued attempts to encourage reporting have been made to the point where the public agency figures are probably within at least 95% of the true production.

Even though there may be some gaps in the information, it is felt that the data presented here are as accurate as can reasonably be obtained and as such provide valuable insights into the coal industry of Ohio.

ATHENS COUNTY

Year	Total	Surface	Cumulative
1820	200	-	200
1821	200	-	400
1822	200	-	600
1823	200	-	800
1824	200	-	1,000
1825	200	-	1,200
1826	200	-	1,400
1827	200	-	1,600
1828	200	-	1,800
1829	500	-	2,300
1830	900	-	3,200
1831	1,300	-	4,500
1832	1,600	-	6,100
1833	2,000	-	8,100
1834	2,400	-	10,500
1835	2,700	-	13,200
1836	3,000	-	16,200
1837	3,200	-	19,400
1838	3,200	-	22,600
1839	3,300	-	25,900
1840	3,368	-	29,268
1841	1,222	-	30,490
1842	1,297	-	31,787
1843	4,000	-	35,787
1844	36,000	-	71,787
1845	33,000		104,787
1846	30,000	-	134,787
1847	26,307		161,094
1848	28,604	-	189,698
1849	10,527	-	200,225
1850	10,273	-	210,498
1851	10,600	-	221,098
1852	17,287	-	238,385
1853	60,000	-	298,385
1854	80,000	-	378,385
1855	20,852	-	399,237
1856	11,675	-	410,912
1857	27,286	-	438,198
1858	37,000	-	475,198
1859	47,000	-	522,198
1860	56,204	-	578,402
1861	65,000	-	643,402
1862	74,000	-	717,402
1863	83,000	-	800,402
1864	92,000	-	892,402
1865	101,788	-	994,190
1866	190,036	-	1,184,226
1867	196,922	-	1,381,148
1868	168,590	-	1,549,738
1869	150,000	-	1,699,738
1870	131,140	-	1,830,878
1871	142,000	-	1,972,878
1872	550,000	-	2,522,878
1873	575,000	-	3,097,878
1874	448,726	-	3,546,604
1875	509,586	-	4,056,190
1876	484,675	-	4,540,865
1877	519,745	-	5,060,610
1878	623,126	-	5,683,736
1879	373,630	-	6,057,366
1880	835,000	-	6,892,366
1881	831,976	-	7,724,342
1882	923,624	-	8,647,966
1883	832,515	-	9,480,481
1884	627,944	-	10,108,425
1885	823,139	-	10,931,564
1886	899,046	-	11,830,610
1887	1,083,543	-	12,914,153
1888	1,336,698	-	14,250,851
1889	1,466,328	-	15,717,179
1890	1,420,280	-	17,137,459
1891	1,374,320	-	18,511,779
1892	1,590,507	-	20,102,286
1893	1,632,851	-	21,735,137
1894	1,457,579	-	23,192,716
1895	1,435,744	-	24,628,460
1896	1,383,709	-	26,012,169
1897	1,299,454	-	27,311,623
1898	1,533,188	-	28,844,811
1899	1,761,775	-	30,606,586
1900	2,594,859	-	33,201,445
1901	3,066,533	-	36,267,978
1902	3,666,993	-	39,934,971
1903	3,905,904	-	43,840,875
1904	3,854,078	-	47,694,953
1905	3,848,440	-	51,543,393
1906	4,370,912	-	55,914,305
1907	4,753,044	-	60,667,349
1908	4,170,995	-	64,838,344
1909	4,354,074	-	69,192,418
1910	5,943,638	-	75,136,056
1911	4,532,595	-	79,668,651
1912	4,886,476	-	84,555,127
1913	5,239,631	-	89,794,758
1914	3,415,057	0	93,209,815
1915	2,536,793	-	95,746,608
1916	3,743,672	-	99,490,280
1917	6,313,619	200	105,803,899
1918	6,742,867	-	112,546,766
1919	5,181,643	-	117,728,409
1920	6,872,646	0	124,601,055
1921	4,154,994	0	128,756,049
1922	3,368,351	0	132,124,400
1923	4,444,351	0	136,568,751
1924	2,972,483	0	139,541,234
1925	2,502,126	0	142,043,360
1926	2,765,451	107,650	144,808,811
1927	1,229,575	42,127	146,038,386
1928	1,084,098	9,103	147,122,484
1929	2,875,220	5,159	149,997,704
1930	3,056,822	0	153,054,526
1931	2,698,595	0	155,753,121
1932	1,244,918	0	156,998,039
1933	2,093,732	0	159,091,771
1934	2,330,358	0	161,422,129
1935	2,368,358	0	163,790,487
1936	2,793,218	0	166,583,705
1937	2,918,258	0	169,501,963
1938	1,582,368	0	171,084,331
1939	1,649,151	0	172,733,482
1940	1,867,104	79	174,600,586
1941	2,031,070	0	176,631,656
1942	2,232,113	0	178,863,769
1943	2,069,486	0	180,933,255
1944	2,285,496	156,872	183,218,751
1945	1,868,266	296,070	185,087,017
1946	1,738,267	383,591	186,825,284
1947	2,009,233	482,885	188,834,517
1948	1,494,586	491,339	190,329,103
1949	821,308	237,669	191,150,411
1950	866,008	203,191	192,016,419
1951	965,910	145,165	192,982,329
1952	795,956	147,723	193,778,285
1953	551,143	75,187	194,329,428
1954	503,812	32,985	194,833,240
1955	649,296	67,126	195,482,536
1956	552,128	107,369	196,034,664
1957	479,038	74,939	196,513,702
1958	738,627	404,084	197,252,329
1959	340,530	94,933	197,592,859
1960	284,172	25,096	197,877,031
1961	235,006	40,139	198,112,037
1962	243,852	34,179	198,355,889
1963	182,506	29,588	198,538,395
1964	148,726	20,688	198,687,121
1965	143,180	30,439	198,830,301
1966	99,736	4,661	198,930,037
1967	119,819	19,531	199,049,856
1968	228,699	158,673	199,278,555
1969	113,426	65,447	199,391,981
1970	51,233	38,440	199,443,214
1971	12,164	12,164	199,455,378
1972	1,400	1,400	199,456,778
1973	0	0	199,456,778
1974	36,944	36,944	199,493,722
1975	117,392	117,392	199,611,114
1976	93,892	93,892	199,705,006
1977	96,636	96,636	199,801,642
1978	20,766	20,766	199,822,408
1979			199,822,408
1980	0	0	199,822,408
1981	0	0	199,822,408
1982	0	0	199,822,408
1983	2,658	2,658	199,825,066
1984	2,833	2,833	199,827,899
1985	12,102	12,102	199,840,001
1986	31,489	31,489	199,871,490
1987	150,700	150,700	200,022,190
1988	137,236	137,236	200,159,426
1989	151,021	151,021	200,310,447
1990	130,259	130,259	200,440,706
1991	68,272	68,272	200,508,978
1992	0	0	200,508,978
1993	0	0	200,508,978

BELMONT COUNTY

Year	Total	Surface	Cumulative
1816	500	-	500
1817	500	-	1,000
1818	500	-	1,500
1819	500	-	2,000
1820	500	-	2,500
1821	500	-	3,000
1822	500	-	3,500
1823	600	-	4,100
1824	700	-	4,800
1825	700	-	5,500
1826	800	-	6,300
1827	800	-	7,100
1828	900	-	8,000
1829	900	-	8,900
1830	1,000	-	9,900
1831	1,000	-	10,900
1832	1,700	-	12,600
1833	2,400	-	15,000
1834	3,100	-	18,100
1835	3,800	-	21,900
1836	4,500	-	26,400
1837	5,200	-	31,600
1838	5,900	-	37,500
1839	6,700	-	44,200
1840	7,528	-	51,728
1841	7,700	-	59,428
1842	7,900	-	67,328
1843	8,000	-	75,328
1844	8,000	-	83,328
1845	8,000	-	91,328
1846	8,000	-	99,328
1847	8,000	-	107,328
1848	9,000	-	116,328
1849	15,000	-	131,328
1850	21,000	-	152,328
1851	27,000	-	179,328
1852	34,000	-	213,328
1853	40,000	-	253,328
1854	80,000	-	333,328
1855	110,000	-	443,328
1856	125,000	-	568,328
1857	140,000	-	708,328
1858	138,000	-	846,328
1859	135,000	-	981,328
1860	133,000	-	1,114,328
1861	130,000	-	1,244,328
1862	128,000	-	1,372,328
1863	125,000	-	1,497,328
1864	122,000	-	1,619,328
1865	119,000	-	1,738,328
1866	115,870	-	1,854,198
1867	90,972	-	1,945,170
1868	69,626	-	2,014,796
1869	97,000	-	2,111,796
1870	123,901	-	2,235,697
1871	120,000	-	2,355,697
1872	229,000	-	2,584,697
1873	225,000	-	2,809,697
1874	164,158	-	2,973,855
1875	213,955	-	3,187,810
1876	199,834	-	3,387,644
1877	274,720	-	3,662,364
1878	305,000	-	3,967,364
1879	336,332	-	4,303,696
1880	462,082	-	4,765,778
1881	571,300	-	5,337,078
1882	650,000	-	5,987,078
1883	576,326	-	6,563,404
1884	643,129	-	7,206,533
1885	744,446	-	7,950,979
1886	573,779	-	8,524,758
1887	721,767	-	9,246,525
1888	1,108,806	-	10,355,331
1889	814,699	-	11,170,030
1890	827,568	-	11,997,598
1891	1,259,570	-	13,257,168
1892	1,249,423	-	14,506,591
1893	1,277,540	-	15,784,131
1894	1,193,329	-	16,977,460
1895	961,367	-	17,938,827
1896	1,082,964	-	19,021,791
1897	905,378	-	19,927,169
1898	1,168,567	-	21,095,736
1899	1,259,520	-	22,355,256
1900	1,595,369	-	23,950,625
1901	1,544,832	-	25,495,457
1902	2,058,066	-	27,553,523
1903	2,612,025	-	30,165,548
1904	3,283,189	-	33,448,737
1905	3,871,846	-	37,320,583
1906	4,467,295	-	41,787,878
1907	6,355,582	-	48,143,460
1908	5,591,719	-	53,735,179
1909	5,993,418	-	59,728,597
1910	8,336,428	-	68,065,025
1911	8,040,333	-	76,105,358
1912	9,316,850	-	85,422,208
1913	10,454,795	-	95,877,003
1914	2,624,023	0	98,501,026
1915	4,403,754	0	102,904,780
1916	10,553,088	0	113,457,868
1917	11,156,626	0	124,614,494
1918	12,030,431	8,732	136,644,925
1919	9,999,648	0	146,644,573
1920	10,953,668	116,844	157,598,241
1921	11,634,028	16,398	169,232,269
1922	6,802,199	56,629	176,034,468
1923	13,295,035	93,246	189,329,503
1924	10,973,709	9,456	200,303,212
1925	9,263,176	0	209,566,388
1926	9,128,799	0	218,695,187
1927	3,694,788	0	222,389,975
1928	3,815,155	0	226,205,130
1929	7,187,338	0	233,392,468
1930	6,919,036	0	240,311,504
1931	6,702,362	0	247,013,866
1932	3,862,991	0	250,876,857
1933	5,933,491	0	256,810,348
1934	6,056,803	0	262,867,151
1935	5,782,459	0	268,649,610
1936	6,887,094	0	275,536,704
1937	7,786,096	0	283,322,800
1938	5,565,993	0	288,888,793
1939	4,953,697	69,344	293,842,490
1940	5,362,533	0	299,205,023
1941	8,209,536	74,006	307,414,559
1942	8,860,706	308,035	316,275,265
1943	8,739,167	448,027	325,014,432
1944	8,303,187	505,470	333,317,619
1945	7,994,882	1,134,456	341,312,501
1946	7,953,868	1,213,981	349,266,369
1947	9,242,973	1,692,242	358,509,342
1948	8,744,582	1,613,780	367,253,924
1949	6,435,371	1,029,376	373,689,295
1950	8,331,998	1,988,813	382,021,293
1951	9,708,811	2,209,919	391,730,104
1952	8,730,192	2,317,999	400,460,296
1953	7,110,804	1,053,808	407,571,100
1954	6,060,510	1,172,619	413,631,610
1955	6,932,101	1,258,572	420,563,711
1956	7,422,636	1,352,181	427,986,347
1957	7,573,861	1,969,098	435,560,208
1958	6,266,370	2,008,341	441,826,578
1959	6,538,310	2,198,008	448,364,888
1960	6,015,652	1,782,889	454,380,540
1961	5,444,365	1,533,439	459,824,905
1962	6,614,873	2,614,937	466,439,778
1963	7,934,782	3,598,161	474,374,560
1964	7,837,517	3,380,104	482,212,077
1965	7,712,173	3,373,019	489,924,250
1966	8,314,843	3,360,861	498,239,093
1967	10,649,565	4,592,481	508,888,658
1968	12,524,677	6,671,787	521,413,335
1969	14,109,302	7,373,874	535,522,637
1970	15,247,965	8,367,156	550,770,602
1971	13,753,001	8,635,047	564,523,603
1972	16,607,855	8,890,971	581,131,458
1973	15,862,841	8,726,767	596,994,299
1974	15,585,348	9,443,623	612,579,647
1975	15,179,586	9,023,650	627,759,233
1976	13,328,284	6,416,106	641,087,517
1977	11,943,666	7,073,584	653,031,183
1978	9,234,819	5,343,599	662,266,002
1979	9,807,764	5,016,463	672,073,766
1980	7,626,676	4,336,004	679,700,442
1981	7,833,517	5,481,951	687,533,959
1982	8,473,706	5,437,942	696,007,665
1983	6,810,754	5,136,716	702,818,419
1984	6,863,941	5,201,885	709,682,360
1985	5,576,562	4,034,768	715,258,922
1986	5,190,242	3,406,211	720,449,164
1987	5,898,452	4,440,647	726,347,616
1988	5,155,456	3,288,265	731,503,072
1989	4,963,841	2,697,023	736,466,913
1990	5,141,451	1,805,036	741,608,364
1991	4,517,577	1,496,844	746,125,941
1992	5,330,313	1,663,746	751,456,254
1993	5,904,179	1,936,078	757,360,433

Year	Total	Surface	Cumulative
CARROLL COUNTY			
1853	40,000	-	40,000
1854	40,000	-	80,000
1855	40,000	-	120,000
1856	40,000	-	160,000
1857	40,000	-	200,000
1858	38,000	-	238,000
1859	36,000	-	274,000
1860	33,000	-	307,000
1861	30,000	-	337,000
1862	28,000	-	365,000
1863	26,000	-	391,000
1864	24,000	-	415,000
1865	21,000	-	436,000
1866	19,000	-	455,000
1867	16,000	-	471,000
1868	14,000	-	485,000
1869	12,000	-	497,000
1870	10,000	-	507,000
1871	9,000	-	516,000
1872	15,000	-	531,000
1873	15,000	-	546,000
1874	20,052	-	566,052
1875	60,000	-	626,052
1876	9,980	-	636,032
1877	9,328	-	645,360
1878	10,939	-	656,299
1879	18,272	-	674,571
1880	20,692	-	695,263
1881	173,600	-	868,863
1882	200,000	-	1,068,863
1883	173,615	-	1,242,478
1884	102,531	-	1,345,009
1885	150,695	-	1,495,704
1886	216,630	-	1,712,334
1887	293,328	-	2,005,662
1888	355,092	-	2,360,754
1889	430,995	-	2,791,749
1890	420,078	-	3,211,827
1891	205,521	-	3,417,348
1892	273,272	-	3,690,620
1893	290,259	-	3,980,879
1894	285,180	-	4,266,059
1895	326,670	-	4,592,729
1896	278,296	-	4,871,025
1897	162,537	-	5,033,562
1898	261,535	-	5,295,097
1899	212,051	-	5,507,148
1900	205,641	-	5,712,789
1901	254,510	-	5,967,299
1902	251,652	-	6,218,951
1903	326,095	-	6,545,046
1904	354,594	-	6,899,640
1900	205,641	-	5,712,789
1901	254,510	-	5,967,299
1902	251,652	-	6,218,951
1903	326,095	-	6,545,046
1904	354,594	-	6,899,640
1905	235,826	-	7,135,466
1906	209,360	-	7,344,826
1907	371,542	-	7,716,368
1908	439,080	-	8,155,448
1909	398,085	-	8,553,533

Year	Total	Surface	Cumulative
1910	309,328	-	8,862,861
1911	269,687	-	9,132,548
1912	310,018	-	9,442,566
1913	369,437	-	9,812,003
1914	241,186	4,477	10,053,189
1915	328,407	0	10,381,596
1916	326,714	0	10,708,310
1917	487,092	1,356	11,195,402
1918	518,996	0	11,714,398
1919	361,823	0	12,076,221
1920	388,513	0	12,464,734
1921	287,833	3,500	12,752,567
1922	371,511	0	13,124,078
1923	465,854	0	13,589,932
1924	344,719	47,756	13,934,651
1925	312,895	82,395	14,247,546
1926	396,772	32,669	14,644,318
1927	416,783	11,042	15,061,101
1928	381,777	0	15,442,878
1929	334,392	0	15,777,270
1930	268,936	0	16,046,206
1931	275,983	3,745	16,322,189
1932	268,557	0	16,590,746
1933	212,293	5,294	16,803,039
1934	166,061	2,747	16,969,100
1935	217,311	5,740	17,186,411
1936	242,561	6,634	17,428,972
1937	274,525	26,852	17,703,497
1938	282,606	64,085	17,986,103
1939	413,071	139,406	18,399,174
1940	507,969	184,844	18,907,143
1941	553,623	174,525	19,460,766
1942	602,434	222,580	20,063,200
1943	609,716	307,298	20,672,916
1944	408,378	127,186	21,081,294
1945	470,555	192,941	21,551,849
1946	548,092	298,536	22,099,941
1947	436,297	195,019	22,536,238
1948	671,570	212,167	23,207,808
1949	570,687	340,588	23,778,495
1950	552,842	352,651	24,331,337
1951	336,865	199,064	24,668,202
1952	301,314	195,034	24,969,516
1953	366,533	287,307	25,336,049
1954	249,819	184,258	25,585,868
1955	414,328	346,048	26,000,196
1956	458,966	391,335	26,459,162
1957	323,816	262,899	26,782,978
1958	340,965	284,858	27,123,943
1959	522,894	438,412	27,646,837
1960	498,664	364,639	28,145,501
1961	524,431	408,801	28,669,932
1962	353,628	281,179	29,023,560
1963	304,290	254,740	29,327,850
1964	268,754	263,600	29,596,604
1965	267,870	264,374	29,864,474
1966	271,740	266,501	30,136,214
1967	444,410	432,576	30,580,624
1968	487,463	487,363	31,068,087
1969	362,402	362,102	31,430,489
1970	447,920	447,920	31,878,409
1971	466,412	466,412	32,344,821
1972	422,012	422,012	32,766,833
1973	258,029	258,029	33,024,862
1974	216,511	216,511	33,241,373

Year	Total	Surface	Cumulative
1975	233,609	233,609	33,474,982
1976	287,445	287,445	33,762,427
1977	310,370	308,646	34,072,797
1978	279,622	279,622	34,352,419
1979	249,251	246,648	34,601,670
1980	175,032	174,076	34,776,702
1981	346,195	346,195	35,122,897
1982	321,740	321,740	35,444,637
1983	233,311	233,311	35,677,948
1984	364,671	364,671	36,042,619
1985	707,371	707,371	36,749,990
1986	280,852	280,852	37,030,842
1987	298,370	298,370	37,329,212
1988	496,860	496,860	37,826,072
1989	793,097	793,097	38,619,169
1990	1,015,557	1,015,557	39,634,726
1991	605,299	605,299	40,240,025
1992	349,973	349,973	40,589,998
1993	107,572	107,572	40,697,570
COLUMBIANA COUNTY			
1803	100	-	100
1804	100	-	200
1805	100	-	300
1806	100	-	400
1807	200	-	600
1808	200	-	800
1809	200	-	1,000
1810	300	-	1,300
1811	300	-	1,600
1812	300	-	1,900
1813	400	-	2,300
1814	400	-	2,700
1815	500	-	3,200
1816	500	-	3,700
1817	600	-	4,300
1818	600	-	4,900
1819	700	-	5,600
1820	700	-	6,300
1821	800	-	7,100
1822	800	-	7,900
1823	900	-	8,800
1824	900	-	9,700
1825	1,000	-	10,700
1826	1,300	-	12,000
1827	1,600	-	13,600
1828	2,000	-	15,600
1829	2,300	-	17,900

Year	Total	Surface	Cumulative
COLUMBIANA COUNTY (cont.)			
1830	2,700	-	20,600
1831	3,100	-	23,700
1832	3,500	-	27,200
1833	3,900	-	31,100
1834	4,300	-	35,400
1835	4,700	-	40,100
1836	5,100	-	45,200
1837	5,500	-	50,700
1838	5,900	-	56,600
1839	6,200	-	62,800
1840	6,520	-	69,320
1841	7,000	-	76,320
1842	7,500	-	83,820
1843	8,000	-	91,820
1844	8,000	-	99,820
1845	8,000	-	107,820
1846	8,000	-	115,820
1847	8,000	-	123,820
1848	8,000	-	131,820
1849	22,000	-	153,820
1850	36,000	-	189,820
1851	50,000	-	239,820
1852	64,000	-	303,820
1853	80,000	-	383,820
1854	120,000	-	503,820
1855	100,000	-	603,820
1856	80,000	-	683,820
1857	58,600	-	742,420
1858	6,400	-	748,820
1859	1,013	-	749,833
1860	1,483	-	751,316
1861	4,000	-	755,316
1862	6,000	-	761,316
1863	8,000	-	769,316
1864	11,000	-	780,316
1865	14,000	-	794,316
1866	16,881	-	811,197
1867	36,057	-	847,254
1868	215,639	-	1,062,893
1869	212,000	-	1,274,893
1870	209,677	-	1,484,570
1871	235,000	-	1,719,570
1872	340,000	-	2,059,570
1873	350,000	-	2,409,570
1874	287,814	-	2,697,384
1875	332,446	-	3,029,830
1876	371,167	-	3,400,997
1877	293,568	-	3,694,565
1878	383,466	-	4,078,031
1879	331,197	-	4,409,228
1880	541,466	-	4,950,694
1881	567,000	-	5,517,694
1882	630,000	-	6,147,694
1883	572,082	-	6,719,776
1884	469,708	-	7,189,484
1885	462,733	-	7,652,217
1886	336,063	-	7,988,280
1887	516,057	-	8,504,337
1888	466,191	-	8,970,528
1889	628,041	-	9,598,569
1890	541,851	-	10,140,420
1891	664,569	-	10,804,989
1892	610,179	-	11,415,168
1893	636,608	-	12,051,776
1894	501,783	-	12,553,559
1895	644,823	-	13,198,382
1896	516,005	-	13,714,387
1897	735,041	-	14,449,428
1898	886,053	-	15,335,481
1899	799,474	-	16,134,955
1900	718,108	-	16,853,063
1901	792,533	-	17,645,596
1902	868,426	-	18,514,022
1903	874,602	-	19,388,624
1904	721,144	-	20,109,768
1905	705,824	-	20,815,592
1906	554,047	-	21,369,639
1907	686,585	-	22,056,224
1908	516,780	-	22,573,004
1909	714,325	-	23,287,329
1910	740,345	-	24,027,674
1911	668,039	-	24,695,713
1912	482,878	-	25,178,591
1913	565,254	-	25,743,845
1914	398,108	0	26,141,953
1915	543,943	0	26,685,896
1916	518,862	0	27,204,758
1917	616,925	341	27,821,683
1918	738,473	22,016	28,560,156
1919	650,971	20,628	29,211,127
1920	957,811	47,451	30,168,938
1921	566,880	43,838	30,735,818
1922	699,231	89,529	31,435,049
1923	974,092	179,531	32,409,141
1924	279,921	49,179	32,689,062
1925	290,099	0	32,979,161
1926	394,929	0	33,374,090
1927	346,147	0	33,720,237
1928	255,402	0	33,975,639
1929	267,972	0	34,243,611
1930	243,993	0	34,487,604
1931	130,894	0	34,618,498
1932	138,801	0	34,757,299
1933	185,302	9,300	34,942,601
1934	248,517	27,878	35,191,118
1935	285,614	125,777	35,476,732
1936	421,347	262,337	35,898,079
1937	324,106	120,310	36,222,185
1938	297,365	132,852	36,519,550
1939	620,626	394,363	37,140,176
1940	469,573	307,712	37,609,749
1941	885,892	659,362	38,495,641
1942	940,493	721,498	39,436,134
1943	855,316	655,132	40,291,450
1944	770,599	614,070	41,062,049
1945	695,094	572,514	41,757,143
1946	617,840	478,516	42,374,983
1947	820,568	669,183	43,195,551
1948	1,161,992	997,677	44,357,543
1949	1,208,589	1,062,853	45,566,132
1950	1,432,479	1,279,245	46,998,611
1951	1,401,357	1,304,370	48,399,968
1952	1,184,917	1,117,433	49,584,885
1953	1,262,657	1,200,862	50,847,542
1954	1,230,421	1,156,049	52,077,963
1955	1,343,978	1,269,569	53,421,941
1956	1,417,695	1,384,402	54,839,636
1957	1,509,286	1,471,780	56,348,922
1958	1,697,834	1,648,469	58,046,756
1959	1,557,276	1,510,518	59,604,032
1960	1,378,900	1,345,257	60,982,932
1961	1,162,383	1,145,754	62,145,315
1962	1,131,574	1,110,921	63,276,889
1963	1,324,902	1,300,011	64,601,791
1964	1,533,786	1,513,113	66,135,577
1965	1,471,314	1,445,694	67,606,891
1966	1,355,002	1,319,032	68,961,893
1967	1,281,186	1,237,983	70,243,079
1968	1,135,865	1,104,523	71,378,944
1969	1,160,951	1,116,255	72,539,895
1970	1,241,934	1,181,276	73,781,829
1971	1,099,305	974,041	74,881,134
1972	1,031,157	1,002,369	75,912,291
1973	851,510	817,640	76,763,801
1974	762,468	714,967	77,526,269
1975	779,268	740,352	78,305,537
1976	1,019,161	932,915	79,324,698
1977	1,173,230	1,080,485	80,497,928
1978	1,027,252	1,003,868	81,525,180
1979	976,225	966,733	82,501,405
1980	1,028,488	1,020,009	83,529,893
1981	1,002,345	992,900	84,532,238
1982	1,046,516	1,039,332	85,578,754
1983	988,007	979,345	86,566,761
1984	985,931	976,731	87,552,692
1985	615,515	608,882	88,168,207
1986	707,485	700,388	88,875,692
1987	765,309	739,404	89,641,001
1988	1,182,310	601,185	90,823,311
1989	1,222,322	614,528	92,045,633
1990	1,053,887	480,883	93,099,520
1991	1,137,687	376,464	94,237,207
1992	1,087,279	471,755	95,324,486
1993	1,131,047	640,275	96,455,533
COSHOCTON COUNTY			
1864	5,000	-	5,000
1865	10,000	-	15,000
1866	15,962	-	30,962
1867	30,516	-	61,478
1868	44,000	-	105,478
1869	58,000	-	163,478
1870	73,026	-	236,504
1871	42,000	-	278,504
1872	60,000	-	338,504
1873	60,000	-	398,504
1874	54,835	-	453,339

Year	Total	Surface	Cumulative
COSHOCTON COUNTY (cont.)			
1875	90,669	-	544,008
1876	66,589	-	610,597
1877	18,560	-	629,157
1878	46,488	-	675,645
1879	213,331	-	888,976
1880	62,990	-	951,966
1881	80,000	-	1,031,966
1882	80,000	-	1,111,966
1883	80,000	-	1,191,966
1884	56,562	-	1,248,528
1885	99,609	-	1,348,137
1886	52,934	-	1,401,071
1887	124,791	-	1,525,862
1888	167,903	-	1,693,765
1889	156,341	-	1,850,106
1890	146,837	-	1,996,943
1891	205,793	-	2,202,736
1892	244,749	-	2,447,485
1893	305,769	-	2,753,254
1894	181,127	-	2,934,381
1895	161,723	-	3,096,104
1896	342,625	-	3,438,729
1897	326,981	-	3,765,710
1898	342,904	-	4,108,614
1899	364,702	-	4,473,316
1900	366,145	-	4,839,461
1901	360,635	-	5,200,096
1902	410,309	-	5,610,405
1903	422,221	-	6,032,626
1904	326,467	-	6,359,093
1905	388,932	-	6,748,025
1906	358,128	-	7,106,153
1907	397,229	-	7,503,382
1908	366,805	-	7,870,187
1909	390,302	-	8,260,489
1910	435,903	-	8,696,392
1911	438,369	-	9,134,761
1912	356,299	-	9,491,060
1913	370,893	-	9,861,953
1914	186,617	0	10,048,570
1915	237,568	0	10,286,138
1916	316,045	0	10,602,183
1917	371,785	0	10,973,968
1918	438,919	0	11,412,887
1919	274,998	0	11,687,885
1920	458,841	-	12,146,726
1921	224,729	-	12,371,455
1922	269,493	-	12,640,948
1923	287,365	-	12,928,313
1924	237,573	-	13,165,886
1925	253,541	-	13,419,427
1926	265,539	-	13,684,966
1927	199,663	-	13,884,629
1928	228,112	-	14,112,741
1929	175,350	-	14,288,091
1930	148,218	0	14,436,309
1931	126,810	0	14,563,119
1932	123,299	0	14,686,418
1933	185,927	7,500	14,872,345
1934	196,089	7,161	15,068,434
1935	223,766	21,824	15,292,200
1936	228,424	14,661	15,520,624
1937	213,903	12,423	15,734,527
1938	186,819	20,854	15,921,346
1939	227,444	19,966	16,148,790
1940	266,633	22,714	16,415,423
1941	350,462	24,327	16,765,885
1942	311,347	45,620	17,077,232
1943	339,217	12,136	17,416,449
1944	284,744	0	17,701,193
1945	335,595	50,365	18,036,788
1946	446,669	132,215	18,483,457
1947	530,155	221,163	19,013,612
1948	780,875	484,678	19,794,487
1949	842,440	596,643	20,636,927
1950	964,851	748,656	21,601,778
1951	1,016,137	792,056	22,617,915
1952	1,025,481	858,529	23,643,396
1953	1,033,174	848,219	24,676,570
1954	840,747	706,353	25,517,317
1955	957,826	813,201	26,475,143
1956	1,044,960	902,341	27,520,103
1957	1,073,478	938,315	28,593,581
1958	1,256,342	1,105,817	29,849,923
1959	1,760,182	1,583,463	31,610,105
1960	1,759,742	16,552,828	33,369,847
1961	1,936,195	1,796,268	35,306,042
1962	1,742,048	1,452,494	37,048,090
1963	1,914,513	1,590,708	38,962,603
1964	2,202,397	1,849,673	41,165,000
1965	2,507,304	2,122,054	43,672,304
1966	2,762,321	2,432,310	46,434,625
1967	2,821,019	2,550,911	49,255,644
1968	2,710,806	2,503,246	51,966,450
1969	2,773,284	2,341,231	54,739,734
1970	2,717,257	2,186,147	57,456,991
1971	2,306,339	1,869,560	59,763,330
1972	2,512,839	2,015,433	62,276,169
1973	2,053,403	1,279,650	64,329,572
1974	1,890,334	1,151,851	66,219,906
1975	2,143,545	1,525,949	68,363,451
1976	1,724,257	1,281,172	70,087,708
1977	1,829,929	1,489,733	71,917,637
1978	1,653,642	1,454,743	73,571,279
1979	1,491,221	1,491,221	75,062,500
1980	1,855,794	1,855,794	76,918,294
1981	1,042,776	1,042,776	77,961,070
1982	1,339,251	1,339,251	79,300,321
1983	1,274,883	1,274,883	80,575,204
1984	1,573,917	1,573,917	82,149,121
1985	1,383,651	1,383,651	83,532,772
1986	1,573,503	1,573,503	85,106,275
1987	1,539,958	1,539,958	86,646,233
1988	1,508,920	1,508,920	88,155,153
1989	1,891,950	1,891,950	90,047,103
1990	2,117,347	2,117,347	92,164,450
1991	1,316,246	1,316,246	93,480,696
1992	1,226,435	1,226,435	94,707,131
1993	1,347,597	1,347,597	96,054,728
1840	616	-	616
1841	800	-	1,416
1842	1,000	-	2,416
1843	1,200	-	3,616
1844	120	-	3,736
1845	1,000	-	4,736
1846	1,400	-	6,136
1847	1,600	-	7,736
1848	1,800	-	9,536
1849	4,600	-	14,136
1850	7,400	-	21,536
1851	10,200	-	31,736
1852	13,000	-	44,736
1853	16,000	-	60,736
1854	24,000	-	84,736
1855	24,000	-	108,736
1856	24,000	-	132,736
1857	24,000	-	156,736
1858	23,000	-	179,736
1859	22,000	-	201,736
1860	21,000	-	222,736
1861	20,000	-	242,736
1862	19,000	-	261,736
1863	18,000	-	279,736
1864	17,000	-	296,736
1865	16,000	-	312,736
1866	15,000	-	327,736
1867	14,000	-	341,736
1868	13,000	-	354,736
1869	12,000	-	366,736
1870	11,000	-	377,736
1871	10,000	-	387,736
1872	12,000	-	399,736
1873	8,000	-	407,736
1874	6,800	-	414,536
1875	5,420	-	419,956
1876	12,716	-	432,672
1877	12,459	-	445,131
1878	8,776	-	453,907
1879	6,940	-	460,847
1880	19,941	-	480,788
1881	10,100	-	490,888
1882	15,000	-	505,888
1883	10,156	-	516,044
1884	20,372	-	536,416
1885	16,383	-	552,799
1886	17,424	-	570,223
1887	15,365	-	585,588
1888	16,722	-	602,310
1889	14,868	-	617,178
1890	15,160	-	632,338
1891	18,277	-	650,615
1892	19,634	-	670,249
1893	5,292	-	675,541
1894	13,367	-	688,908
1895	10,341	-	699,249
1896	6,671	-	705,920
1897	15,704	-	721,624
1898	17,391	-	739,015
1899	14,470	-	753,485

GALLIA COUNTY

Year	Total	Surface	Cumulative
GALLIA COUNTY (cont.)			
1900	16,138	-	769,623
1901	15,740	-	785,363
1902	26,450	-	811,813
1903	23,889	-	835,702
1904	18,979	-	854,681
1905	18,551	-	873,232
1906	43,895	-	917,127
1907	36,635	-	953,762
1908	13,692	-	967,454
1909	9,920	-	977,374
1910	13,923	-	991,297
1911	17,114	-	1,008,411
1912	27,523	-	1,035,934
1913	20,561	-	1,056,495
1914	14,886	0	1,071,381
1915	7,350	0	1,078,731
1916	6,883	0	1,085,614
1917	28,270	0	1,113,884
1918	27,122	0	1,141,006
1919	12,514	0	1,153,520
1920	22,207	0	1,175,727
1921	9,367	0	1,185,094
1922	22,993	0	1,208,087
1923	11,902	0	1,219,989
1924	12,308	0	1,232,297
1925	10,935	0	1,243,232
1926	3,001	0	1,246,233
1927	2,746	0	1,248,979
1928	1,960	0	1,250,939
1929	3,176	0	1,254,115
1930	3,710	0	1,257,825
1931	4,096	0	1,261,921
1932	4,096	0	1,266,017
1933	4,271	0	1,270,288
1934	5,103	0	1,275,391
1935	27,178	0	1,302,569
1936	49,373	0	1,351,942
1937	52,355	0	1,404,297
1938	30,052	0	1,434,349
1939	31,274	0	1,465,623
1940	55,318	10,524	1,520,941
1941	103,178	10,218	1,624,119
1942	101,485	7,377	1,725,604
1943	114,109	3,725	1,839,713
1944	108,671	1,418	1,948,384
1945	97,436	0	2,045,820
1946	76,286	0	2,122,106
1947	212,160	1,344	2,334,266
1948	393,457	19,217	2,727,723
1949	465,986	173,877	3,193,709
1950	576,696	256,105	3,770,405
1951	568,995	241,644	4,339,400
1952	638,591	416,524	4,977,991
1953	776,732	613,568	5,754,723
1954	868,118	667,428	6,622,841
1955	828,606	648,163	7,451,447
1956	757,371	683,366	8,208,818
1957	776,486	704,588	8,985,304
1958	794,448	721,266	9,779,752
1959	782,499	692,173	10,562,251
1960	866,426	777,900	11,428,677
1961	721,045	645,415	12,149,722
1962	743,341	651,618	12,893,063
1963	649,159	567,091	13,542,222
1964	614,805	528,728	14,157,027
1965	604,289	543,527	14,761,316
1966	290,654	248,762	15,051,970
1967	171,109	92,107	15,223,079
1968	109,834	91,634	15,332,913
1969	93,520	76,552	15,426,433
1970	209,285	198,092	15,635,718
1971	232,306	229,618	15,868,024
1972	104,920	104,920	15,972,944
1973	30,282	30,282	16,003,226
1974	109,566	109,566	16,112,792
1975	285,348	285,348	16,398,140
1976	401,593	401,593	16,799,733
1977	431,599	431,599	17,231,332
1978	562,113	562,113	17,793,445
1979	570,614	570,614	18,364,059
1980	364,633	364,633	18,728,692
1981	395,481	395,481	19,124,173
1982	391,411	931,411	19,515,584
1983	275,325	275,325	19,790,909
1984	444,789	444,789	20,235,698
1985	430,624	390,601	20,666,322
1986	446,041	380,997	21,112,363
1987	140,619	107,827	21,252,982
1988	2,891	2,891	21,255,873
1989	0	0	21,255,873
1990	0	0	21,255,873
1991	0	0	21,255,873
1992	0	0	21,255,873
1993	0	0	21,255,873
GUERNSEY COUNTY			
1835	1,000	-	1,000
1836	1,200	-	2,200
1837	1,400	-	3,600
1838	1,700	-	5,300
1839	2,000	-	7,300
1840	2,234	-	9,534
1841	2,300	-	11,834
1842	2,300	-	14,134
1843	2,400	-	16,534
1844	2,400	-	18,934
1845	2,400	-	21,334
1846	2,400	-	23,734
1847	2,400	-	26,134
1848	2,400	-	28,534
1849	10,000	-	38,534
1850	17,000	-	55,534
1851	25,000	-	80,534
1852	32,000	-	112,534
1853	40,000	-	152,534
1854	60,000	-	212,534
1855	56,000	-	268,534
1856	52,000	-	320,534
1857	48,000	-	368,534
1858	47,000	-	415,534
1859	46,000	-	461,534
1860	46,000	-	507,534
1861	45,000	-	552,534
1862	45,000	-	597,534
1863	44,000	-	641,534
1864	44,000	-	685,534
1865	43,000	-	728,534
1866	43,000	-	771,534
1867	42,000	-	813,534
1868	41,008	-	854,542
1869	57,000	-	911,542
1870	73,389	-	984,931
1871	91,000	-	1,075,931
1872	120,000	-	1,195,931
1873	130,000	-	1,325,931
1874	105,000	-	1,430,931
1875	135,425	-	1,566,356
1876	145,320	-	1,711,676
1877	162,000	-	1,873,676
1878	180,000	-	2,053,676
1879	198,032	-	2,251,708
1880	168,480	-	2,420,188
1881	192,600	-	2,612,788
1882	250,000	-	2,862,788
1883	192,555	-	3,055,343
1884	375,427	-	3,430,770
1885	297,267	-	3,728,037
1886	433,800	-	4,161,837
1887	553,613	-	4,715,450
1888	383,728	-	5,099,178
1889	319,397	-	5,418,575
1890	547,072	-	5,965,647
1891	498,859	-	6,464,506
1892	572,281	-	7,036,787
1893	534,416	-	7,571,203
1894	641,561	-	8,212,764
1895	972,505	-	9,185,269
1896	1,068,453	-	10,253,722
1897	861,776	-	11,115,498
1898	1,176,524	-	12,292,022
1899	1,313,774	-	13,605,796

Year	Total	Surface	Cumulative
GUERNSEY COUNTY (cont.)			
1900	1,904,381	-	15,510,177
1901	2,094,887	-	17,605,064
1902	2,968,108	-	20,573,172
1903	2,715,946	-	23,289,118
1904	3,084,220	-	26,373,338
1905	2,896,756	-	29,270,094
1906	3,348,934	-	32,619,028
1907	4,009,141	-	36,628,169
1908	2,926,448	-	39,554,617
1909	3,108,686	-	42,663,303
1910	4,473,022	-	47,136,325
1911	3,901,529	-	51,037,854
1912	4,333,963	-	55,371,817
1913	4,324,682	-	59,696,499
1914	2,970,815	0	62,667,314
1915	3,247,938	0	65,915,252
1916	4,397,262	0	70,312,514
1917	4,024,265	0	74,336,779
1918	4,497,303	0	78,834,082
1919	3,342,915	0	82,176,997
1920	3,760,463	0	85,937,460
1921	2,983,034	0	88,920,494
1922	2,115,065	0	91,035,559
1923	3,344,851	0	94,380,410
1924	2,633,807	0	97,014,217
1925	1,097,538	0	98,111,755
1926	1,231,533	0	99,343,288
1927	707,557	0	100,050,845
1928	556,494	0	100,607,339
1929	1,702,155	0	102,309,494
1930	1,868,137	0	104,177,631
1931	1,478,272	0	105,655,903
1932	1,224,954	0	106,880,857
1933	1,178,641	0	108,059,498
1934	1,242,836	0	109,302,334
1935	1,161,200	0	110,463,534
1936	1,063,660	0	111,527,194
1937	882,029	0	112,409,223
1938	547,173	0	112,956,396
1939	524,821	0	113,481,217
1940	543,946	0	114,025,163
1941	557,542	0	114,582,705
1942	625,195	0	115,207,900
1943	651,422	30,223	115,859,322
1944	789,418	171,174	116,648,740
1945	370,852	182,452	117,019,592
1946	311,539	137,397	117,331,131
1947	727,042	481,203	118,058,173
1948	383,016	246,020	118,441,189
1949	312,674	206,423	118,753,863
1950	523,116	423,221	119,276,979
1951	578,887	484,226	119,855,866
1952	471,002	403,445	120,326,868
1953	387,909	338,856	120,714,777
1954	405,185	329,826	121,119,962
1955	720,726	517,617	121,840,688
1956	633,158	571,184	122,473,846
1957	796,868	742,680	123,270,714
1958	293,955	248,601	123,564,669
1959	261,614	229,184	123,826,283
1960	246,601	217,127	124,072,884
1961	188,112	167,708	124,260,996
1962	273,813	249,496	124,534,809
1963	352,520	340,590	124,887,329
1964	298,348	285,904	125,185,677
1965	323,389	322,022	125,509,066
1966	1,844,730	1,844,615	127,353,796
1967	1,991,798	1,991,786	129,345,594
1968	482,280	470,280	129,827,874
1969	58,015	57,912	129,885,889
1970	619,108	619,108	130,504,997
1971	804,524	794,524	131,309,521
1972	1,164,127	794,727	132,473,648
1973	806,380	806,380	133,280,028
1974	872,879	872,879	134,152,907
1975	1,129,110	1,100,333	135,282,017
1976	706,423	700,272	135,988,440
1977	963,749	963,749	136,952,189
1978	706,729	706,729	137,658,918
1979	795,163	795,163	138,454,081
1980	474,932	474,932	138,929,013
1981	680,490	680,490	139,609,503
1982	652,402	652,402	140,261,905
1983	399,008	399,008	140,660,913
1984	562,128	562,128	141,223,041
1985	444,708	444,708	141,667,749
1986	222,446	222,446	141,890,195
1987	217,206	217,206	142,107,401
1988	165,193	165,193	142,272,594
1989	139,065	139,065	142,411,659
1990	156,140	156,140	142,567,799
1991	296,261	296,261	142,864,060
1992	562,807	562,807	143,426,867
1993	402,250	402,250	143,829,117
HARRISON COUNTY			
1830	200	-	200
1831	900	-	1,100
1832	1,600	-	2,700
1833	2,300	-	5,000
1834	3,000	-	8,000
1835	3,700	-	11,700
1836	4,400	-	16,100
1837	5,100	-	21,200
1838	5,800	-	27,000
1839	6,600	-	33,600
1840	7,580	-	41,180
1841	7,700	-	48,880
1842	7,800	-	56,680
1843	8,000	-	64,680
1844	8,000	-	72,680
1845	8,000	-	80,680
1846	8,000	-	88,680
1847	8,000	-	96,680
1848	8,000	-	104,680
1849	9,000	-	113,680
1850	10,000	-	123,680
1851	10,000	-	133,680
1852	11,000	-	144,680
1853	12,000	-	156,680
1854	20,000	-	76,680
1855	20,000	-	196,680
1856	20,000	-	216,680
1857	20,000	-	236,680
1858	20,000	-	256,680
1859	20,000	-	276,680
1860	19,000	-	295,680
1861	19,000	-	314,680
1862	19,000	-	333,680
1863	19,000	-	352,680
1864	18,000	-	370,680
1865	18,000	-	388,680
1866	18,000	-	406,680
1867	18,000	-	424,680
1868	18,000	-	442,680
1869	18,000	-	460,680
1870	16,990	-	477,670
1871	17,600	-	495,270
1872	25,000	-	520,270
1873	25,000	-	545,270
1874	32,569	-	577,839
1875	26,000	-	603,839
1876	20,678	-	624,517
1877	19,820	-	644,337
1878	15,606	-	659,943
1879	25,286	-	685,229
1880	58,260	-	743,489
1881	17,800	-	761,289
1882	20,000	-	781,289
1883	17,797	-	799,086
1884	0	-	799,086
1885	0	-	799,086
1886	5,509	-	804,595
1887	4,032	-	808,627
1888	2,865	-	811,492
1889	1,080	-	812,572
1890	4,792	-	817,364
1891	4,316	-	821,680
1892	8,646	-	830,326
1893	14,698	-	845,024
1894	27,537	-	872,561
1895	26,003	-	898,564
1896	28,391	-	926,955
1897	28,159	-	955,114
1898	38,144	-	993,258
1899	29,852	-	1,023,110
1900	36,087	-	1,059,197
1901	111,847	-	1,171,044
1902	293,841	-	1,464,885
1903	249,106	-	1,713,991
1904	307,206	-	2,021,197
1905	402,679	-	2,423,876
1906	335,928	-	2,759,804
1907	489,118	-	3,248,922
1908	447,805	-	3,696,727
1909	576,162	-	4,272,889
1910	599,741	-	4,872,630
1911	476,914	-	5,349,544
1912	750,831	-	6,100,375
1913	752,600	-	6,852,975
1914	203,485	0	7,056,460

Year	Total	Surface	Cumulative
HARRISON COUNTY (cont.)			
1915	308,570	0	7,365,030
1916	990,641	67,213	8,355,671
1917	1,222,561	286,987	9,578,232
1918	1,772,670	487,665	11,350,902
1919	1,452,061	404,977	12,802,963
1920	1,917,607	665,627	14,720,570
1921	1,879,116	441,090	16,599,686
1922	2,302,547	1,328,510	18,902,233
1923	2,854,753	1,093,905	21,756,986
1924	2,422,023	1,377,284	24,179,009
1925	2,836,495	1,930,525	27,015,504
1926	2,478,139	1,522,567	29,493,643
1927	2,005,068	1,469,206	31,498,711
1928	2,395,917	1,294,859	33,894,628
1929	2,722,889	1,182,128	36,617,517
1930	2,288,553	887,439	38,906,070
1931	2,074,504	682,757	40,980,574
1932	1,780,414	534,490	42,760,988
1933	2,446,761	731,544	45,207,749
1934	2,249,630	592,052	47,457,379
1935	2,476,161	691,916	49,933,540
1936	2,707,940	640,699	52,641,480
1937	2,521,418	524,755	55,162,898
1938	1,786,741	246,093	56,949,639
1939	2,582,565	632,104	59,532,204
1940	2,917,211	664,919	62,449,415
1941	3,822,605	1,485,467	66,272,020
1942	5,297,796	2,851,253	71,569,816
1943	5,946,876	3,546,927	77,516,692
1944	6,382,764	3,814,697	83,899,456
1945	6,415,411	4,495,135	90,314,867
1946	6,111,595	4,503,637	96,426,462
1947	6,623,052	4,890,659	103,049,514
1948	6,405,794	4,956,996	109,455,308
1949	5,216,264	4,266,817	114,671,572
1950	5,659,971	4,797,212	120,331,543
1951	5,713,514	4,633,078	126,045,057
1952	5,832,424	4,753,749	131,877,481
1953	7,076,376	5,957,231	138,953,857
1954	6,208,299	5,084,833	145,162,156
1955	8,515,382	6,386,268	153,677,538
1956	8,666,938	7,205,802	162,344,476
1957	8,960,372	6,070,276	171,304,848
1958	6,833,724	4,803,472	178,138,572
1959	7,633,469	5,162,554	185,772,041
1960	7,378,734	4,811,656	193,150,775
1961	7,414,130	4,912,991	200,564,905
1962	7,829,447	4,856,299	208,394,352
1963	8,358,417	4,490,592	216,752,769
1964	7,639,005	3,479,180	224,391,774
1965	8,478,034	4,080,282	232,869,808
1966	10,456,699	5,829,795	243,326,507
1967	10,802,183	5,785,578	254,128,690
1968	10,526,024	4,796,990	264,654,714
1969	10,923,722	4,807,558	275,578,436
1970	11,381,684	5,883,917	286,960,120
1971	7,909,679	4,643,014	294,869,799
1972	7,343,488	3,832,928	302,213,287
1973	6,837,982	3,094,103	309,051,269
1974	5,495,491	2,505,637	314,546,760
1975	6,495,851	3,536,745	321,042,611
1976	6,802,100	3,823,012	327,844,711
1977	5,989,033	3,057,568	333,833,744
1978	5,136,486	2,854,619	338,970,230
1979	5,878,262	3,637,308	344,848,492
1980	4,560,628	3,440,330	349,409,120
1981	3,993,262	2,539,613	353,402,382
1982	4,497,768	2,479,967	357,900,150
1983	2,803,038	1,069,922	360,703,188
1984	3,914,476	1,473,121	364,617,664
1985	3,111,377	1,095,537	367,729,041
1986	3,374,168	1,275,271	371,103,209
1987	2,803,707	1,462,241	373,906,916
1988	2,146,114	1,679,726	376,053,030
1989	2,387,099	2,065,225	378,440,129
1990	2,040,603	1,997,541	380,480,732
1991	1,763,088	1,337,571	382,243,820
1992	2,130,988	1,242,756	384,374,808
1993	2,447,095	1,271,922	386,821,903
HOCKING COUNTY			
1840	673	-	673
1841	1,222	-	1,895
1842	1,297	-	3,192
1843	1,720	-	4,912
1844	2,500	-	7,412
1845	3,300	-	10,712
1846	4,079	-	14,791
1847	7,630	-	22,421
1848	10,444	-	32,865
1849	10,527	-	43,392
1850	10,273	-	53,665
1851	10,600	-	64,265
1852	17,287	-	81,552
1853	20,521	-	102,073
1854	45,289	-	147,362
1855	20,852	-	168,214
1856	11,675	-	179,889
1857	27,287	-	207,176
1858	25,000	-	232,176
1859	22,800	-	254,976
1860	20,689	-	275,665
1861	24,000	-	299,665
1862	27,600	-	327,265
1863	31,200	-	358,465
1864	34,700	-	393,165
1865	38,200	-	431,365
1866	42,587	-	473,952
1867	52,355	-	526,307
1868	68,277	-	594,584
1869	72,000	-	666,584
1870	75,560	-	742,144
1871	125,000	-	867,144
1872	560,000	-	1,427,144
1873	575,000	-	2,002,144
1874	325,402	-	2,327,546
1875	509,587	-	2,837,133
1876	484,676	-	3,321,809
1877	519,745	-	3,841,554
1878	623,123	-	4,464,677
1879	208,123	-	4,672,800
1880	415,000	-	5,087,800
1881	589,100	-	5,676,900
1882	650,000	-	6,326,900
1883	589,159	-	6,916,059
1884	372,694	-	7,288,753
1885	656,441	-	7,945,194
1886	741,571	-	8,686,765
1887	853,063	-	9,539,828
1888	1,086,538	-	10,626,366
1889	911,488	-	11,537,854
1890	1,239,576	-	12,777,430
1891	1,622,429	-	14,399,859
1892	1,863,303	-	16,263,162
1893	1,889,996	-	18,153,158
1894	1,453,391	-	19,606,549
1895	1,432,741	-	21,039,290
1896	1,351,511	-	22,390,801
1897	1,381,414	-	23,772,215
1898	1,254,740	-	25,026,955
1899	1,929,753	-	26,956,708
1900	2,311,679	-	29,268,387
1901	2,348,869	-	31,617,256
1902	2,118,805	-	33,736,061
1903	1,967,636	-	35,703,697
1904	1,894,869	-	37,598,566
1905	1,695,763	-	39,294,329
1906	1,553,507	-	40,847,836
1907	1,392,616	-	42,240,452
1908	1,282,647	-	43,523,099
1909	1,036,743	-	44,559,842
1910	1,451,147	-	46,010,989
1911	1,547,839	-	47,558,828
1912	2,046,175	-	49,605,003
1913	1,587,163	-	51,192,166
1914	1,192,230	0	52,384,396
1915	1,421,117	0	53,805,513
1916	1,435,188	0	55,240,701
1917	2,211,858	0	57,452,559
1918	2,332,304	0	59,784,863
1919	1,162,366	0	60,947,229
1920	1,855,499	0	62,802,728
1921	567,704	0	63,370,432
1922	763,098	0	64,133,530
1923	878,797	0	65,012,327
1924	712,102	0	65,724,429
1925	865,557	23,781	66,589,986
1926	608,129	15,878	67,198,115
1927	256,161	0	67,454,276
1928	284,937	0	67,739,213
1929	458,710	0	68,197,923
1930	326,069	1,561	68,523,992
1931	319,452	750	68,843,444
1932	125,667	0	68,969,111
1933	181,923	0	69,151,034
1934	170,331	222	69,321,365
1935	162,071	9,201	69,483,436
1936	223,187	7,690	69,706,623
1937	215,469	22,166	69,922,092
1938	226,113	8,275	70,148,205
1939	254,321	25,694	70,402,526

Year	Total	Surface	Cumulative
HOCKING COUNTY (cont.)			
1940	246,257	0	70,648,783
1941	378,154	24,439	71,026,937
1942	415,479	15,876	71,442,416
1943	375,890	0	71,818,306
1944	448,040	13,910	72,266,346
1945	662,719	259,306	72,929,065
1946	737,578	366,716	73,666,643
1947	673,889	211,308	74,340,532
1948	398,706	63,057	74,739,238
1949	136,022	29,525	74,875,260
1950	113,901	44,092	74,989,161
1951	137,676	77,660	75,126,837
1952	86,063	21,287	75,212,900
1953	65,478	16,872	75,278,378
1954	48,191	15,964	75,326,569
1955	84,689	59,224	75,411,258
1956	62,336	36,789	75,473,594
1957	88,471	62,340	75,562,065
1958	67,313	47,606	75,629,378
1959	39,107	17,980	75,668,485
1960	60,571	47,923	75,729,056
1961	54,919	48,360	75,783,975
1962	78,850	72,967	75,862,825
1963	81,965	74,814	75,944,790
1964	70,976	64,192	76,015,766
1965	104,084	101,476	76,119,850
1966	78,579	75,723	76,198,429
1967	59,995	58,955	76,258,424
1968	129,834	129,834	76,388,258
1969	95,406	95,290	76,483,664
1970	165,648	165,121	76,649,312
1971	177,450	177,287	76,826,762
1972	166,688	166,688	76,993,450
1973	246,762	246,762	77,240,212
1974	364,197	364,197	77,604,409
1975	518,822	518,822	78,123,231
1976	840,468	840,468	78,963,699
1977	1,153,399	1,153,399	80,117,098
1978	803,369	803,369	80,920,467
1979	618,833	618,833	81,539,300
1980	548,858	548,858	82,088,158
1981	674,345	674,345	82,762,503
1982	573,731	573,731	83,336,234
1983	550,618	550,618	83,886,852
1984	544,904	544,904	84,431,756
1985	214,393	214,393	84,646,149
1986	149,363	149,363	84,795,512
1987	72,198	72,198	84,867,710
1988	88,932	88,932	84,956,642
1989	126,965	126,965	85,083,607
1990	96,736	96,736	85,180,343
1991	52,925	52,925	85,233,268
1992	108,573	108,573	85,341,841
1993	0	0	85,341,841

Year	Total	Surface	Cumulative
HOLMES COUNTY			
1840	200	-	200
1841	200	-	400
1842	200	-	600
1843	200	-	800
1844	200	-	1,000
1845	200	-	1,200
1846	300	-	1,500
1847	400	-	1,900
1848	400	-	2,300
1849	4,300	-	6,600
1850	8,200	-	14,800
1851	12,100	-	26,900
1852	16,000	-	42,900
1853	20,000	-	62,900
1854	32,000	-	94,900
1855	32,000	-	126,900
1856	32,000	-	158,900
1857	32,000	-	190,900
1858	30,400	-	221,300
1859	28,800	-	250,100
1860	27,200	-	277,300
1861	25,600	-	302,900
1862	24,000	-	326,900
1863	22,400	-	349,300
1864	20,800	-	370,100
1865	19,200	-	389,300
1866	17,600	-	406,900
1867	16,000	-	422,900
1868	14,400	-	437,300
1869	12,200	-	449,500
1870	10,073	-	459,573
1871	6,000	-	465,573
1872	10,000	-	475,573
1873	5,000	-	480,573
1874	3,616	-	484,189
1875	14,000	-	498,189
1876	12,600	-	510,789
1877	11,200	-	521,989
1878	9,710	-	531,699
1879	12,301	-	544,000
1880	17,460	-	561,460
1881	24,000	-	585,460
1882	24,000	-	609,460
1883	24,000	-	633,460
1884	12,052	-	645,512
1885	11,459	-	656,971
1886	12,670	-	669,641
1887	10,526	-	680,167
1888	8,121	-	688,288
1889	10,142	-	698,430
1890	13,358	-	711,788
1891	16,811	-	728,599
1892	16,666	-	745,265
1893	14,181	-	759,446
1894	15,616	-	775,062
1895	12,665	-	787,727
1896	10,164	-	797,891
1897	19,313	-	817,204
1898	15,601	-	832,805
1899	12,321	-	845,126
1900	12,966	-	858,092
1901	16,548	-	874,640
1902	17,187	-	891,827
1903	32,099	-	923,926
1904	30,850	-	954,776

Year	Total	Surface	Cumulative
1905	24,820	-	979,596
1906	43,080	-	1,022,676
1907	14,447	-	1,037,123
1908	18,768	-	1,055,891
1909	15,844	-	1,071,735
1910	13,203	-	1,084,938
1911	11,242	-	1,096,180
1912	11,059	-	1,107,239
1913	9,998	-	1,117,237
1914	15,883	0	1,133,120
1915	16,464	0	1,149,584
1916	14,826	0	1,164,410
1917	20,144	0	1,184,554
1918	13,431	0	1,197,985
1919	11,512	0	1,209,497
1920	9,645	0	1,219,142
1921	9,484	0	1,228,626
1922	12,751	0	1,241,377
1923	14,959	0	1,256,336
1924	27,221	0	1,283,557
1925	18,577	0	1,302,134
1926	17,172	0	1,319,306
1927	20,716	0	1,340,022
1928	15,282	0	1,355,304
1929	21,929	0	1,377,233
1930	18,219	0	1,395,452
1931	9,057	1,483	1,404,509
1932	11,438	1,761	1,415,947
1933	14,438	0	1,430,385
1934	28,817	5,169	1,459,202
1935	52,290	22,389	1,511,492
1936	51,241	12,835	1,562,733
1937	39,358	4,243	1,602,091
1938	37,985	5,801	1,640,076
1939	38,764	4,208	1,678,840
1940	38,466	4,208	1,717,306
1941	45,953	14,290	1,763,259
1942	21,789	700	1,785,048
1943	24,848	12,566	1,809,896
1944	8,924	0	1,818,820
1945	17,147	9,764	1,835,967
1946	114,850	105,957	1,950,817
1947	52,050	43,568	2,002,867
1948	12,735	10,307	2,015,602
1949	4,539	3,255	2,020,141
1950	12,478	9,598	2,032,619
1951	11,776	10,024	2,044,395
1952	4,766	3,131	2,049,161
1953	2,512	1,619	2,051,673
1954	7,828	7,090	2,059,501
1955	21,969	21,810	2,081,470
1956	29,724	28,344	2,111,194
1957	15,966	12,748	2,127,160
1958	58,260	54,726	2,185,420
1959	104,943	102,172	2,290,363
1960	83,537	80,447	2,373,900
1961	166,483	163,506	2,540,383
1962	245,372	240,361	2,785,755
1963	344,575	341,789	3,130,330
1964	260,127	257,769	3,390,457
1965	171,755	169,713	3,562,212
1966	168,379	168,151	3,730,591
1967	105,161	105,126	3,835,752
1968	216,919	216,919	4,052,671
1969	288,347	288,347	4,341,018

Year	Total	Surface	Cumulative
HOLMES COUNTY (cont.)			
1970	364,741	364,741	4,705,759
1971	502,019	502,019	5,207,778
1972	743,234	743,234	5,951,012
1973	567,312	567,312	6,518,324
1974	699,287	699,287	7,217,611
1975	658,108	658,108	7,875,719
1976	559,358	559,358	8,435,077
1977	680,887	680,887	9,115,964
1978	709,654	709,654	9,825,618
1979	526,248	526,248	10,351,866
1980	507,322	507,322	10,859,188
1981	633,720	633,720	11,492,908
1982	433,281	433,281	11,926,189
1983	361,374	361,374	12,287,563
1984	355,228	355,228	12,642,791
1985	327,133	327,133	12,969,924
1986	471,396	471,396	13,441,320
1987	464,585	464,585	13,905,905
1988	561,871	561,871	14,467,776
1989	452,349	452,349	14,920,125
1990	459,129	459,129	15,379,254
1991	335,059	335,059	15,714,313
1992	212,658	212,658	15,926,971
1993	153,635	153,635	16,080,606

Year	Total	Surface	Cumulative
JACKSON COUNTY			
1820	2,000	-	2,000
1821	2,000	-	4,000
1822	3,000	-	7,000
1823	5,000	-	12,000
1824	5,000	-	17,000
1825	5,000	-	22,000
1826	2,000	-	24,000
1827	2,000	-	26,000
1828	2,000	-	28,000
1829	2,000	-	30,000
1830	2,000	-	32,000
1831	2,100	-	34,100
1832	2,100	-	36,200
1833	2,100	-	38,300
1834	2,100	-	40,400
1835	2,100	-	42,500
1836	2,100	-	44,600
1837	2,200	-	46,800
1838	2,200	-	49,000
1839	2,200	-	51,200
1840	2,220	-	53,420
1841	2,300	-	55,720
1842	2,300	-	58,020
1843	2,400	-	60,420
1844	2,500	-	62,920
1845	2,600	-	65,520
1846	2,700	-	68,220
1847	2,800	-	71,020
1848	3,000	-	74,020
1849	10,000	-	84,020
1850	17,000	-	101,020
1851	24,000	-	125,020
1852	32,000	-	157,020
1853	40,000	-	197,020
1854	60,000	-	257,020
1855	61,000	-	318,020
1856	63,000	-	381,020
1857	64,000	-	445,020
1858	64,800	-	509,820
1859	65,600	-	575,420
1860	66,400	-	641,820
1861	67,200	-	709,020
1862	68,000	-	777,020
1863	68,800	-	845,820
1864	69,600	-	915,420
1865	70,400	-	985,820
1866	71,200	-	1,057,020
1867	72,000	-	1,129,020
1868	72,800	-	1,201,820
1869	72,800	-	1,274,620
1870	74,821	-	1,349,441
1871	66,000	-	1,415,441
1872	110,000	-	1,525,441
1873	125,000	-	1,650,441
1874	82,336	-	732,777
1875	117,730	-	1,850,507
1876	90,217	-	1,940,724
1877	79,000	-	2,019,724
1878	68,593	-	2,088,317
1879	85,373	-	2,173,690
1880	96,452	-	2,270,142
1881	533,600	-	2,803,742
1882	620,000	-	3,423,742
1883	533,599	-	3,957,341
1884	831,720	-	4,789,061

Year	Total	Surface	Cumulative
1885	791,608	-	5,580,669
1886	856,740	-	6,437,409
1887	1,135,605	-	7,573,014
1888	1,088,761	-	8,661,775
1889	1,257,731	-	9,919,506
1890	1,291,775	-	11,211,281
1891	1,598,876	-	12,810,157
1892	1,770,742	-	14,580,899
1893	1,778,770	-	16,359,669
1894	1,499,281	-	17,858,950
1895	2,072,939	-	19,931,889
1896	1,651,199	-	21,583,088
1897	1,649,493	-	23,232,581
1898	1,804,792	-	25,037,373
1899	2,179,757	-	27,217,130
1900	2,319,321	-	29,536,451
1901	2,141,466	-	31,677,917
1902	2,316,123	-	33,994,040
1903	2,412,116	-	36,406,156
1904	1,958,538	-	38,364,694
1905	1,887,904	-	40,252,598
1906	1,452,176	-	41,704,774
1907	1,303,529	-	43,008,303
1908	836,997	-	43,845,300
1909	823,034	-	44,668,334
1910	933,238	-	45,601,572
1911	673,663	-	46,275,235
1912	783,334	-	47,058,569
1913	596,497	-	47,655,066
1914	559,332	0	48,214,398
1915	572,941	0	48,787,339
1916	727,999	0	49,515,338
1917	1,016,249	1,457	50,531,587
1918	1,018,063	4,055	51,549,650
1919	478,474	110	52,028,124
1920	841,314	0	52,869,438
1921	187,886	0	53,057,324
1922	336,036	0	53,393,360
1923	273,944	0	53,667,304
1924	160,937	0	53,828,241
1925	183,853	250	54,012,094
1926	159,537	0	54,171,631
1927	183,431	0	54,355,062
1928	157,253	0	54,512,315
1929	144,896	0	54,657,211
1930	141,062	0	54,798,273
1931	102,267	0	54,900,540
1932	55,623	0	54,956,163
1933	118,222	43,348	55,074,385
1934	205,183	90,240	55,279,568
1935	311,863	188,785	55,591,431
1936	246,469	97,610	55,837,900
1937	247,902	76,075	56,085,802
1938	225,966	80,181	56,311,768
1939	162,305	8,716	56,474,073
1940	185,475	37,410	56,659,548
1941	216,736	59,393	56,876,284
1942	206,043	47,764	57,082,327
1943	241,608	53,902	57,323,935
1944	191,979	55,697	57,515,914
1945	182,109	34,814	57,698,023
1946	160,790	72,092	57,858,813
1947	200,374	103,828	58,059,187
1948	273,922	153,165	58,333,109
1949	261,237	212,783	58,594,346

Year	Total	Surface	Cumulative
JACKSON COUNTY (cont.)			
1950	159,079	113,023	58,753,425
1951	305,313	243,433	59,058,738
1952	578,981	542,626	59,637,719
1953	530,473	490,499	60,168,192
1954	483,894	438,473	60,652,086
1955	557,867	529,436	61,209,953
1956	628,423	597,628	61,838,376
1957	438,267	401,726	62,276,643
1958	268,351	221,140	62,544,994
1959	265,119	225,496	62,810,113
1960	398,665	354,048	63,208,778
1961	294,924	252,119	63,503,702
1962	294,827	249,676	63,798,529
1963	397,789	347,982	64,196,318
1964	561,890	514,241	64,758,208
1965	604,341	557,987	65,362,549
1966	841,105	808,256	66,203,654
1967	983,153	944,430	67,186,807
1968	907,490	874,896	68,094,297
1969	991,693	914,448	69,085,990
1970	966,813	865,901	70,052,803
1971	1,235,799	1,058,927	71,288,602
1972	1,365,738	1,038,937	72,654,340
1973	984,825	744,164	73,639,165
1974	462,580	399,274	74,101,745
1975	611,070	544,284	74,712,815
1976	941,192	838,225	75,654,007
1977	1,045,126	1,041,768	76,699,133
1978	974,781	951,403	77,673,914
1979	776,845	759,195	78,450,759
1980	808,633	655,885	79,259,392
1981	825,432	673,813	80,084,824
1982	766,289	648,124	80,851,113
1983	707,438	620,578	81,558,551
1984	1,036,750	928,660	82,595,301
1985	1,175,310	1,028,501	83,770,611
1986	1,330,420	1,198,341	85,101,031
1987	1,670,508	1,498,094	86,771,539
1988	962,102	908,189	87,733,641
1989	1,028,866	992,849	88,762,507
1990	1,200,883	1,200,683	89,963,390
1991	873,360	873,360	90,836,750
1992	1,156,225	1,156,225	91,992,975
1993	1,250,717	1,250,717	93,243,692

Year	Total	Surface	Cumulative
JEFFERSON COUNTY			
1800	100	-	100
1801	100	-	200
1802	100	-	300
1803	100	-	400
1804	100	-	500
1805	100	-	600
1806	150	-	750
1807	150	-	900
1808	150	-	1,050
1809	150	-	1,200
1810	150	-	1,350
1811	150	-	1,500
1812	150	-	1,650
1813	200	-	1,850
1814	200	-	2,050
1815	200	-	2,250
1816	200	-	2,450
1817	200	-	2,650
1818	200	-	2,850
1819	300	-	3,150
1820	300	-	3,450
1821	300	-	3,750
1822	300	-	4,050
1823	300	-	4,350
1824	300	-	4,650
1825	300	-	4,950
1826	300	-	5,250
1827	300	-	5,550
1828	300	-	5,850
1829	400	-	6,250
1830	400	-	6,650
1831	400	-	7,050
1832	400	-	7,450
1833	400	-	7,850
1834	400	-	8,250
1835	400	-	8,650
1836	400	-	9,050
1837	500	-	9,550
1838	500	-	10,050
1839	500	-	10,550
1840	500	-	11,050
1841	500	-	11,550
1842	500	-	12,050
1843	500	-	12,550
1844	500	-	13,050
1845	600	-	13,650
1846	700	-	14,350
1847	900	-	15,250
1848	1,000	-	16,250
1849	5,000	-	21,250
1850	10,000	-	31,250
1851	20,000	-	51,250
1852	30,000	-	81,250
1853	40,000	-	121,250
1854	80,000	-	201,250
1855	120,000	-	321,250
1856	180,000	-	501,250
1857	200,000	-	701,250
1858	145,000	-	846,250
1859	90,000	-	936,250
1860	34,438	-	970,688
1861	44,000	-	1,014,688
1862	55,000	-	1,069,688
1863	66,000	-	1,135,688
1864	76,000	-	1,211,688

Year	Total	Surface	Cumulative
1865	87,000	-	1,298,688
1866	98,171	-	1,396,859
1867	117,374	-	1,514,233
1868	161,531	-	1,675,764
1869	212,000	-	1,887,764
1870	266,830	-	2,154,594
1871	182,000	-	2,336,594
1872	200,000	-	2,536,594
1873	200,000	-	2,736,594
1874	108,226	-	2,844,820
1875	195,265	-	3,040,085
1876	166,582	-	3,206,667
1877	156,000	-	3,362,667
1878	145,646	-	3,508,313
1879	226,227	-	3,734,540
1880	389,679	-	4,124,219
1881	352,600	-	4,476,819
1882	450,000	-	4,926,819
1883	352,597	-	5,279,416
1884	316,777	-	5,596,193
1885	271,329	-	5,867,522
1886	275,666	-	6,143,188
1887	293,875	-	6,437,063
1888	243,178	-	6,680,241
1889	294,664	-	6,974,905
1890	571,909	-	7,546,814
1891	666,187	-	8,213,001
1892	879,500	-	9,092,501
1893	1,138,083	-	10,230,584
1894	997,888	-	11,228,472
1895	861,185	-	12,089,657
1896	670,867	-	12,760,524
1897	744,790	-	13,505,314
1898	829,526	-	14,334,840
1899	935,979	-	15,270,819
1900	971,209	-	16,242,028
1901	1,303,308	-	17,545,336
1902	1,789,432	-	19,334,768
1903	2,320,419	-	21,655,187
1904	2,495,375	-	24,150,562
1905	3,337,799	-	27,488,361
1906	2,998,476	-	30,486,837
1907	4,648,263	-	35,135,100
1908	3,565,008	-	38,700,108
1909	4,056,148	-	42,756,256
1910	5,111,563	-	47,867,819
1911	4,321,829	-	52,189,648
1912	4,641,908	-	56,831,556
1913	5,095,024	-	61,926,580
1914	2,067,577	136,969	63,994,157
1915	3,539,979	268,285	67,534,136
1916	5,366,393	429,110	72,900,529
1917	5,742,240	767,845	78,642,769
1918	7,239,909	1,807,283	85,882,678
1919	4,964,610	890,573	90,847,288
1920	6,713,531	1,623,948	97,560,819
1921	4,441,357	446,220	102,002,176
1922	4,527,809	1,046,221	106,529,985
1923	6,554,154	986,153	113,084,139
1924	4,337,603	498,189	117,421,742
1925	4,888,948	431,975	122,310,690
1926	5,110,294	623,223	127,420,984
1927	2,764,293	797,522	130,185,277
1928	2,638,713	684,059	132,823,990
1929	3,373,388	459,717	136,197,378

Year	Total	Surface	Cumulative
JEFFERSON COUNTY (cont.)			
1930	3,371,559	122,993	139,568,937
1931	3,229,207	77,579	142,798,144
1932	2,291,371	112,191	145,089,515
1933	3,286,261	18,804	148,375,776
1934	3,209,137	91,573	151,584,913
1935	3,588,599	617,895	155,173,512
1936	4,183,598	862,334	159,357,110
1937	4,657,851	991,471	164,014,961
1938	3,967,285	1,220,940	167,982,246
1939	4,484,447	1,242,348	172,466,693
1940	5,416,498	1,757,290	177,883,191
1941	5,984,890	2,210,320	183,868,081
1942	6,345,071	2,346,915	190,213,152
1943	5,552,208	1,975,320	195,765,360
1944	5,686,882	2,158,087	201,452,242
1945	5,740,650	2,712,960	207,192,892
1946	4,707,459	1,937,393	211,900,351
1947	6,169,375	2,753,912	218,069,726
1948	6,089,350	3,133,863	224,159,076
1949	4,666,151	2,536,503	228,825,227
1950	5,107,824	2,905,143	233,933,051
1951	5,592,161	2,791,016	239,525,212
1952	4,726,581	2,267,072	244,251,793
1953	4,572,661	2,271,245	248,824,454
1954	4,201,695	1,958,438	253,026,149
1955	4,646,516	2,422,963	257,672,665
1956	5,702,089	2,678,499	263,374,754
1957	4,060,329	2,712,495	267,435,083
1958	3,356,303	2,231,190	270,791,386
1959	3,454,739	2,365,589	274,246,125
1960	3,397,590	2,599,027	277,643,715
1961	2,920,267	2,205,763	280,563,982
1962	3,273,994	2,538,828	283,837,976
1963	3,872,311	3,016,258	287,710,287
1964	4,199,244	3,464,224	291,909,531
1965	5,040,840	4,187,528	296,950,371
1966	4,806,555	3,967,578	301,756,926
1967	4,716,127	3,793,226	306,473,053
1968	5,026,318	4,193,410	311,499,371
1969	5,148,433	4,268,950	316,647,804
1970	5,110,042	4,275,139	321,757,846
1971	5,216,346	4,573,864	326,974,192
1972	5,787,383	4,935,937	332,761,575
1973	5,022,655	4,143,493	337,784,230
1974	5,045,104	4,272,811	342,829,334
1975	4,101,153	3,430,555	346,930,487
1976	3,679,255	3,272,029	350,609,742
1977	4,052,713	3,684,964	354,662,455
1978	2,656,380	2,654,288	357,318,835
1979	2,588,653	2,588,653	359,907,488
1980	1,858,847	1,858,847	361,766,335
1981	1,783,555	1,783,555	363,549,890
1982	1,854,874	1,854,874	365,404,764
1983	1,836,214	1,836,214	367,240,978
1984	2,077,305	2,077,305	369,318,283
1985	1,933,602	1,933,602	371,251,885
1986	1,985,742	1,985,742	373,237,627
1987	2,054,127	2,054,127	375,291,754
1988	1,940,009	1,940,009	377,231,763
1989	1,915,949	1,915,949	379,147,712
1980	1,858,847	1,858,847	361,766,335
1981	1,783,555	1,783,555	363,549,890
1982	1,854,874	1,854,874	365,404,764
1983	1,836,214	1,836,214	367,240,978
1984	2,077,305	2,077,305	369,318,283

Year	Total	Surface	Cumulative
1985	1,933,602	1,933,602	371,251,885
1986	1,985,742	1,985,742	373,237,627
1987	2,054,127	2,054,127	375,291,754
1988	1,940,009	1,940,009	377,231,763
1989	1,915,949	1,915,949	379,147,712
1990	2,086,436	2,086,436	381,234,148
1991	1,321,927	1,321,927	382,556,075
1992	1,847,670	1,690,895	384,403,745
1993	1,673,447	1,411,655	386,077,192
LAWRENCE COUNTY			
1844	1,000	-	1,000
1845	10,000	-	11,000
1846	19,000	-	30,000
1847	28,000	-	58,000
1848	37,000	-	95,000
1849	46,000	-	141,000
1850	55,000	-	196,000
1851	64,000	-	260,000
1852	72,000	-	332,000
1853	80,000	-	412,000
1854	120,000	-	532,000
1855	114,000	-	646,000
1856	108,000	-	754,000
1857	100,000	-	854,000
1858	102,000	-	956,000
1859	104,000	-	1,060,000
1860	106,000	-	1,166,000
1861	108,000	-	1,274,000
1862	110,000	-	1,384,000
1863	112,000	-	1,496,000
1864	114,000	-	1,610,000
1865	117,000	-	1,727,000
1866	120,000	-	1,847,000
1867	100,006	-	1,947,006
1868	88,967	-	2,035,973
1869	72,000	-	2,107,973
1870	56,390	-	2,164,363
1871	61,000	-	2,225,363
1872	125,000	-	2,350,363
1873	161,191	-	2,511,554
1874	78,446	-	2,590,000
1875	122,484	-	2,712,484
1876	103,831	-	2,816,315
1877	90,336	-	2,906,651
1878	108,074	-	3,014,725
1879	132,646	-	3,147,371

Year	Total	Surface	Cumulative
1880	139,462	-	3,286,833
1881	153,800	-	3,440,633
1882	200,000	-	3,640,633
1883	158,793	-	3,799,426
1884	176,412	-	3,975,838
1885	145,916	-	4,121,754
1886	166,933	-	4,288,687
1887	143,559	-	4,432,246
1888	137,806	-	4,570,052
1889	111,815	-	4,681,867
1890	108,505	-	4,790,372
1891	88,440	-	4,878,812
1892	127,074	-	5,005,886
1893	80,741	-	5,086,627
1894	75,292	-	5,161,919
1895	125,280	-	5,287,199
1896	81,746	-	5,368,945
1897	124,448	-	5,493,393
1898	68,835	-	5,562,228
1899	135,064		5,697,292
1900	112,873	-	5,810,165
1901	143,678	-	5,953,843
1902	186,635	-	6,140,478
1903	249,139	-	6,389,617
1904	194,192	-	6,583,809
1905	212,949	-	6,796,758
1906	257,049	-	7,053,807
1907	246,562	-	7,300,369
1908	180,265	-	7,480,634
1909	214,685	-	7,695,319
1910	190,465	-	7,885,784
1911	84,567	-	7,970,351
1912	88,104	-	8,058,455
1913	195,389	-	8,253,844
1914	162,709	0	8,416,553
1915	131,971	0	8,548,524
1916	166,261	0	8,714,785
1917	241,333	0	8,956,118
1918	322,917	0	9,279,035
1919	140,433	0	9,419,468
1920	286,399	0	9,705,867
1921	58,731	0	9,764,598
1922	156,151	0	9,920,749
1923	135,159	0	10,055,908
1924	112,826	0	10,168,734
1925	122,795	0	10,291,529
1926	105,340	0	10,396,869
1927	126,710	0	10,523,579
1928	108,538	0	10,632,117
1929	117,158	0	10,749,275
1930	81,116	0	10,830,391
1931	59,330	0	10,889,721
1932	56,964	0	10,946,685
1933	71,807	0	11,018,492
1934	60,403	0	11,078,895
1935	72,517	0	11,151,412
1936	85,580	824	11,236,992
1937	95,543	1,064	11,332,535
1938	71,717	707	11,404,252
1939	85,363	969	11,489,615
1940	51,304	362	11,540,919
1941	133,603	0	11,674,522
1942	74,069	0	11,748,591
1943	49,743	0	11,798,334
1944	57,188	222	11,855,522

Year	Total	Surface	Cumulative
LAWRENCE COUNTY (cont.)			
1945	53,043	148	11,908,565
1946	49,219	974	11,957,784
1947	57,996	24,583	12,015,780
1948	163,538	30,028	12,179,318
1949	143,879	38,574	12,323,197
1950	180,905	102,142	12,504,102
1951	225,537	165,886	12,729,639
1952	245,640	191,986	12,975,279
1953	151,738	119,117	13,127,017
1954	192,372	171,457	13,319,389
1955	431,847	399,809	13,751,236
1956	366,938	304,436	14,118,174
1957	297,711	278,013	14,415,885
1958	225,613	218,529	14,641,498
1959	396,088	391,999	15,037,586
1960	442,617	439,537	15,480,203
1961	392,348	389,908	15,872,551
1962	390,079	387,573	16,262,630
1963	333,169	330,541	16,595,799
1964	304,570	301,736	16,900,369
1965	294,503	292,675	17,194,872
1966	267,965	267,130	17,462,837
1967	175,608	174,667	17,638,445
1968	298,397	298,156	17,936,842
1969	333,512	333,310	18,270,354
1970	320,865	320,738	18,591,219
1971	199,623	199,554	18,790,842
1972	48,221	48,203	18,839,063
1973	21,984	21,984	18,861,047
1974	96,294	96,294	18,957,341
1975	193,570	193,570	19,150,911
1976	198,892	198,892	19,349,803
1977	242,181	242,181	19,591,984
1978	75,163	75,163	19,667,147
1979	163,176	163,176	19,830,323
1980	85,593	85,593	19,915,916
1981	5,065	5,065	19,920,981
1982	178,577	178,577	20,099,558
1983	410,173	410,173	20,509,731
1984	392,587	392,587	20,902,318
1985	374,984	374,984	21,277,302
1986	370,953	370,953	21,648,255
1987	228,782	228,782	21,877,037
1988	110,031	110,031	21,987,068
1989	26,532	26,532	22,013,600
1990	316,025	316,025	22,329,625
1991	867,036	867,036	23,196,661
1992	227,079	227,079	23,423,740
1993	9,611	9,611	23,433,351

Year	Total	Surface	Cumulative
LICKING COUNTY			
1976	606	606	606
1977	0	0	606
1978	0	0	606
1979	6,232	6,232	6,838
1980	100,251	100,251	107,089
1981	0	0	107,089
1982	0	0	107,089
1983	0	0	107,089
1984	0	0	107,089
1985	0	0	107,089
1986	0	0	107,089
1987	0	0	107,089
1988	0	0	107,089
1989	0	0	107,089
1990	0	0	107,089
1991	0	0	107,089
1992	0	0	107,089
1993	0	0	107,089

Year	Total	Surface	Cumulative
MAHONING COUNTY			
1840	200	-	200
1841	500	-	700
1842	700	-	1,400
1843	1,000	-	2,400
1844	1,000	-	3,400
1845	4,100	-	7,500
1846	3,700	-	11,200
1847	4,000	-	15,200
1848	15,000	-	30,200
1849	25,851	-	56,051
1850	29,000	-	85,051
1851	32,000	-	117,051
1852	36,000	-	153,051
1853	40,000	-	193,051
1854	140,000	-	333,051
1855	150,000	-	483,051
1856	162,000	-	645,051
1857	173,600	-	818,651
1858	168,000	-	986,651
1859	162,000	-	1,148,651
1860	156,701	-	1,305,352
1861	144,000	-	1,449,352
1862	132,000	-	1,581,352
1863	120,000	-	1,701,352
1864	108,000	-	1,809,352
1865	96,000	-	1,905,352
1866	12,708	-	1,918,060
1867	84,643	-	2,002,703
1868	67,775	-	2,070,478
1869	88,000	-	2,158,478
1870	108,830	-	2,267,308
1871	125,000	-	2,392,308
1872	270,000	-	2,662,308
1873	257,507	-	2,919,815
1874	91,031	-	3,010,846
1875	271,689	-	3,282,535
1876	82,484	-	3,365,019
1877	106,950	-	3,471,969
1878	156,896	-	3,628,865
1879	54,076	-	3,682,941
1880	347,635	-	4,030,576
1881	244,400	-	4,274,976
1882	300,000	-	4,574,976
1883	244,371	-	4,819,347
1884	241,599	-	5,060,946
1885	275,944	-	5,336,890
1886	313,040	-	5,649,930
1887	272,349	-	5,922,279
1888	231,035	-	6,153,314
1889	217,118	-	6,370,432
1890	228,761	-	6,599,193
1892	242,515	-	7,074,054
1891	232,346	-	6,831,539
1893	198,370	-	7,272,424
1894	97,062	-	7,369,486
1895	101,866	-	7,471,352
1896	52,277	-	7,523,629
1897	92,283	-	7,615,912
1898	75,149	-	7,691,061
1899	74,309	-	7,765,370
1900	109,348	-	7,874,718
1901	52,765	-	7,927,483
1902	94,773	-	8,022,256
1903	89,218	-	8,111,474
1904	86,495	-	8,197,969

Year	Total	Surface	Cumulative
MAHONING COUNTY (cont.)			
1905	117,074	-	8,315,043
1906	121,412	-	8,436,455
1907	95,280	-	8,531,735
1908	86,326	-	8,618,061
1909	63,974	-	8,682,035
1910	66,312	-	8,748,347
1911	64,276	-	8,812,623
1912	47,511	-	8,860,134
1913	27,457	-	8,887,591
1914	26,055	0	8,913,646
1915	24,167	0	8,937,813
1916	28,842	0	8,966,655
1917	50,537	0	9,017,192
1918	64,832	0	9,082,024
1919	40,160	0	9,122,184
1920	55,985	1,400	9,178,169
1921	40,550	404	9,218,719
1922	58,182	0	9,276,901
1923	66,328	0	9,343,229
1924	56,998	0	9,400,227
1925	50,814	0	9,451,041
1926	59,203	0	9,510,244
1927	56,783	0	9,567,027
1928	58,413	0	9,625,440
1929	62,183	0	9,687,623
1930	60,909	347	9,748,532
1931	56,530	300	9,805,062
1932	89,442	0	9,894,504
1933	121,621	5,496	10,016,125
1934	115,434	0	10,131,559
1935	97,010	0	10,228,569
1936	92,547	0	10,321,116
1937	161,822	65,935	10,482,938
1938	265,164	159,539	10,748,102
1939	434,776	362,372	11,182,878
1940	456,532	354,211	11,639,410
1941	421,562	385,544	12,060,972
1942	313,078	295,308	12,374,050
1943	259,302	248,714	12,633,352
1944	280,691	270,141	12,914,043
1945	183,877	173,769	13,097,920
1946	104,972	99,262	13,202,892
1947	185,298	179,348	13,388,190
1948	507,507	502,629	13,895,697
1949	535,833	531,594	14,431,530
1950	634,034	631,165	15,065,564
1951	753,674	753,674	15,819,238
1952	722,730	722,730	16,541,968
1953	599,968	599,968	17,141,936
1954	663,000	663,000	17,804,936
1955	687,760	687,567	18,492,696
1956	602,351	602,351	19,095,047
1957	704,761	704,761	19,799,808
1958	684,878	684,878	20,484,686
1959	903,333	903,333	21,388,019
1960	982,460	982,460	22,370,479
1961	1,060,032	1,060,032	23,430,511
1962	1,049,076	1,049,076	24,479,587
1963	899,123	899,123	25,378,710
1964	722,208	722,208	26,100,918
1965	559,028	559,028	26,659,946
1966	518,927	518,927	27,178,873
1967	563,502	563,502	27,742,375
1968	505,207	505,207	28,247,582
1969	396,278	396,278	28,643,860
1970	444,524	444,524	29,088,384
1971	456,458	456,458	29,544,842
1972	384,750	384,750	29,929,592
1973	398,266	398,266	30,327,858
1974	499,437	499,437	30,827,295
1975	380,834	380,834	31,208,129
1976	266,637	266,637	31,474,766
1977	296,581	296,581	31,771,347
1978	346,108	346,108	32,117,455
1979	419,876	419,876	32,537,331
1980	348,762	348,762	32,886,093
1981	338,747	338,747	33,224,840
1982	351,176	351,176	33,576,016
1983	210,170	210,170	33,786,186
1984	183,582	183,582	33,969,768
1985	284,156	284,156	34,253,924
1986	323,278	323,278	34,577,202
1987	262,854	262,854	34,840,056
1988	183,382	183,382	35,023,438
1989	198,159	198,159	35,221,597
1990	191,160	191,160	35,412,757
1991	100,261	100,261	35,513,018
1992	7,552	7,552	35,520,570
1993	4,837	4,837	35,525,407
MEDINA COUNTY			
1871	1,200	-	1,200
1872	2,400	-	3,600
1873	3,680	-	7,280
1874	4,800	-	12,080
1875	80,000	-	92,080
1876	81,600	-	173,680
1877	83,160	-	256,840
1878	90,000	-	346,840
1879	97,000	-	443,840
1880	106,000	-	549,840
1881	30,200	-	580,040
1882	32,000	-	612,040
1883	30,186	-	642,226
1884	77,160	-	719,386
1885	152,721	-	872,107
1886	252,411	-	1,124,518
1887	225,487	-	1,350,005
1888	198,452	-	1,548,457
1889	132,706	-	1,681,163
1890	181,861	-	1,863,024
1891	157,410	-	2,020,434
1892	220,149	-	2,240,583
1893	197,405	-	2,437,988
1894	143,196	-	2,581,184
1895	265,411	-	2,846,595
1896	195,669	-	3,042,264
1897	159,987	-	3,202,251
1898	147,714	-	3,349,965
1899	158,216	-	3,508,181
1900	152,767	-	3,660,948
1901	183,391	-	3,844,339
1902	139,933	-	3,984,272
1903	136,803	-	4,121,075
1904	103,910	-	4,224,985
1905	91,205	-	4,316,190
1906	104,729	-	4,420,919
1907	47,181	-	4,468,100
1908	18,103	-	4,486,203
1909	12,465	-	4,498,668
1910	27,604	-	4,526,272
1911	16,942	-	4,543,214
1912	10,395	-	4,553,609
1913	9,990	-	4,563,599
1914	10,674	0	4,574,273
1915	7,717	0	4,581,990
1916	9,205	0	4,591,195
1917	10,088	0	4,601,283
1918	7,353	0	4,608,636
1919	5,249	0	4,613,885
1920	6,652	0	4,620,537
1921	2,404	0	4,622,941
1922	1,222	0	4,624,163
1923	10,871	0	4,635,034
1924	6,336	0	4,641,370
1925	7,409	0	4,648,779
1926	7,978	0	4,656,757
1927	5,752	0	4,662,509
1928	6,475	0	4,668,984
1929	6,651	0	4,675,635
1930	2,624	0	4,678,259
1931	3,178	0	4,681,437
1932	11,465	1,663	4,692,902
1933	7,806	2,254	4,700,708
1934	10,473	0	4,711,181
1935	10,330	0	4,721,511
1936	10,208	0	4,731,719
1937	10,243	0	4,741,962
1938	6,769	0	4,748,731
1939	4,804	0	4,753,535
1940	825	0	4,754,360
1941	420	0	4,754,780
1942	0	0	4,754,780
1943	0	0	4,754,780
1944	0	0	4,754,780
1945	0	0	4,754,780
1946	0	0	4,754,780
1947	0	0	4,754,780
1948	0	0	4,754,780
1949	0	0	4,754,780
1950	0	0	4,754,780
1951	0	0	4,754,780
1952	0	0	4,754,780
1953	0	0	4,754,780
1954	0	0	4,754,780

Year	Total	Surface	Cumulative
MEDINA COUNTY (cont.)			
1955	0	0	4,754,780
1956	0	0	4,754,780
1957	0	0	4,754,780
1958	0	0	4,754,780
1959	0	0	4,754,780
1960	0	0	4,754,780
1961	0	0	4,754,780
1962	0	0	4,754,780
1963	0	0	4,754,780
1964	0	0	4,754,780
1965	0	0	4,754,780
1966	0	0	4,754,780
1967	0	0	4,754,780
1968	0	0	4,754,780
1969	0	0	4,754,780
1970	0	0	4,754,780
1971	0	0	4,754,780
1972	0	0	4,754,780
1973	0	0	4,754,780
1974	0	0	4,754,780
1975	0	0	4,754,780
1976	0	0	4,754,780
1977	0	0	4,754,780
1978	0	0	4,754,780
1979	0	0	4,754,780
1980	0	0	4,754,780
1981	0	0	4,754,780
1982	0	0	4,754,780
1983	0	0	4,754,780
1984	0	0	4,754,780
1985	0	0	4,754,780
1986	0	0	4,754,780
1987	0	0	4,754,780
1988	0	0	4,754,780
1989	0	0	4,754,780
1990	0	0	4,754,780
1991	0	0	4,754,780
1992	0	0	4,754,780
1993	0	0	4,754,780

Year	Total	Surface	Cumulative
MEIGS COUNTY			
1806	100	-	100
1807	100	-	200
1808	100	-	300
1809	100	-	400
1810	100	-	500
1811	100	-	600
1812	150	-	750
1813	150	-	900
1814	150	-	1,050
1815	150	-	1,200
1816	150	-	1,350
1817	150	-	1,500
1818	150	-	1,650
1819	200	-	1,850
1820	200	-	2,050
1821	200	-	2,250
1822	200	-	2,450
1823	400	-	2,850
1824	500	-	3,350
1825	500	-	3,850
1826	500	-	4,350
1827	500	-	4,850
1828	500	-	5,350
1829	500	-	5,850
1830	500	-	6,350
1831	500	-	6,850
1832	500	-	7,350
1833	2,000	-	9,350
1834	6,000	-	15,350
1835	11,000	-	26,350
1836	15,000	-	41,350
1837	20,000	-	61,350
1838	24,000	-	85,350
1839	29,000	-	114,350
1840	33,736	-	148,086
1841	38,000	-	186,086
1842	43,000	-	229,086
1843	48,000	-	277,086
1844	60,000	-	337,086
1845	66,000	-	403,086
1846	73,000	-	476,086
1847	80,000	-	556,086
1848	100,000	-	656,086
1849	144,000	-	800,086
1850	188,000	-	988,086
1851	232,000	-	1,220,086
1852	276,000	-	1,496,086
1853	320,000	-	1,816,086
1854	360,000	-	2,176,086
1855	340,000	-	2,516,086
1856	320,000	-	2,836,086
1857	400,000	-	3,236,086
1858	470,000	-	3,706,086
1859	540,000	-	4,246,086
1860	611,718	-	4,857,804
1861	570,000	-	5,427,804
1862	550,000	-	5,977,804
1863	530,000	-	6,507,804
1864	500,000	-	7,007,804
1865	380,000	-	7,387,804
1866	260,139	-	7,647,943
1867	207,940	-	7,855,883
1868	353,190	-	8,209,073
1869	308,000	-	8,517,073

Year	Total	Surface	Cumulative
1870	268,700	-	8,785,773
1871	314,000	-	9,099,773
1872	360,000	-	9,459,773
1873	390,000	-	9,849,773
1874	324,405	-	10,174,178
1875	369,300	-	10,543,478
1876	393,228	-	10,936,706
1877	309,402	-	11,246,108
1878	293,316	-	11,539,424
1879	284,018	-	11,823,442
1880	388,786	-	12,212,228
1881	362,500	-	12,574,728
1882	450,000	-	13,024,728
1883	362,557	-	13,387,285
1884	248,436	-	13,635,721
1885	234,756	-	13,870,477
1886	192,263	-	14,062,740
1887	185,205	-	14,247,945
1888	242,483	-	14,490,428
1889	228,156	-	14,718,584
1890	268,599	-	14,987,183
1891	299,402	-	15,286,585
1892	308,127	-	15,594,712
1893	278,562	-	15,873,274
1894	219,971	-	16,093,245
1895	216,897	-	16,310,142
1896	259,296	-	16,569,438
1897	203,861	-	16,773,299
1898	193,355	-	16,966,654
1899	225,149	-	17,191,803
1900	249,060	-	17,440,863
1901	255,892	-	17,696,755
1902	340,700	-	18,037,455
1903	388,568	-	18,426,023
1904	212,395	-	18,638,418
1905	370,587	-	19,009,005
1906	530,476	-	19,539,481
1907	375,033	-	19,914,514
1908	482,630	-	20,397,144
1909	543,595	-	20,940,739
1910	648,149	-	21,588,888
1911	532,840	-	22,121,728
1912	635,940	-	22,757,668
1913	659,019	-	23,416,687
1914	567,210	0	23,983,897
1915	954,281	0	24,938,178
1916	1,025,036	0	25,963,214
1917	1,267,144	0	27,230,358
1918	1,373,479	0	28,603,837
1919	877,516	0	29,481,353
1920	1,539,162	0	31,020,515
1921	941,773	0	31,962,288
1922	736,480	0	32,698,768
1923	1,234,463	0	33,933,231
1924	232,792	0	34,166,023
1925	684,193	0	34,850,216
1926	920,059	0	35,770,275
1927	1,083,019	0	36,853,294
1928	781,616	0	37,634,910
1929	605,371	0	38,240,281
1930	404,296	0	38,644,577
1931	303,949	0	38,948,526
1932	233,234	0	39,181,760
1933	256,692	0	39,438,452
1934	361,753	0	39,800,205

Year	Total	Surface	Cumulative
MEIGS COUNTY (cont.)			
1935	337,861	0	40,138,066
1936	121,415	0	40,259,481
1937	120,866	0	40,380,347
1938	99,275	0	40,479,622
1939	172,878	0	40,652,500
1940	168,442	177	40,820,942
1941	234,534	33,327	41,055,476
1942	174,337	4,472	41,229,813
1943	245,913	400	41,475,726
1944	237,188	0	41,712,914
1945	189,034	6,658	41,901,948
1946	299,543	22,307	42,201,491
1947	342,146	51,971	42,543,637
1948	422,215	210,445	42,965,852
1949	222,396	79,634	43,188,248
1950	394,475	267,146	43,582,723
1951	407,561	279,467	43,990,284
1952	534,578	409,506	44,524,862
1953	644,870	531,280	45,169,732
1954	835,975	258,512	46,005,707
1955	657,301	264,771	46,663,008
1956	882,983	795,570	47,545,991
1957	583,826	503,267	48,129,817
1958	126,212	88,043	48,256,029
1959	490,949	443,216	48,746,978
1960	195,621	149,893	48,942,599
1961	234,020	185,178	49,176,619
1962	245,840	188,065	49,422,459
1963	350,809	296,384	49,773,268
1964	593,275	556,199	50,366,543
1965	207,469	184,442	50,574,012
1966	32,685	26,486	50,606,697
1967	69,177	50,376	50,675,874
1968	48,993	38,953	50,724,867
1969	12,532	6,989	50,737,399
1970	13,398	6,989	50,750,797
1971	1,508	1,508	50,752,305
1972	29,688	0	50,781,993
1973	357,710	0	51,139,703
1974	783,992	0	51,923,695
1975	1,158,994	0	53,082,689
1976	1,722,881	0	54,805,570
1977	1,637,367	0	56,442,937
1978	1,533,249	0	57,976,186
1979	2,775,778	5,173	60,751,964
1980	4,209,578	0	64,961,542
1981	3,591,920	0	68,553,462
1982	3,753,799	4,824	72,307,261
1983	2,259,488	0	74,566,749
1984	3,921,351	0	78,488,100
1985	4,015,480	4,749	82,503,580
1986	3,777,492	0	86,281,072
1987	3,901,859	0	90,182,931
1988	4,064,953	0	94,247,884
1989	3,734,156	0	97,982,040
1990	4,335,439	0	102,317,479
1991	4,671,674	0	106,989,153
1992	3,918,949	0	110,908,102
1993	2,895,853	0	113,803,955

Year	Total	Surface	Cumulative
MONROE COUNTY			
1840	218	-	218
1841	200	-	418
1842	200	-	618
1843	240	-	858
1844	200	-	1,058
1845	200	-	1,258
1846	300	-	1,558
1847	400	-	1,958
1848	600	-	2,558
1849	600	-	3,158
1850	700	-	3,858
1851	700	-	4,558
1852	800	-	5,358
1853	900	-	6,258
1854	1,000	-	7,258
1855	1,100	-	8,358
1856	1,200	-	9,558
1857	1,300	-	10,858
1858	1,400	-	12,258
1859	1,500	-	13,758
1860	1,600	-	15,358
1861	1,700	-	17,058
1862	1,800	-	18,858
1863	1,900	-	20,758
1864	2,000	-	22,758
1865	2,100	-	24,858
1866	2,200	-	27,058
1867	2,300	-	29,358
1868	2,400	-	31,758
1869	2,500	-	34,258
1870	2,600	-	36,858
1871	2,700	-	39,558
1872	2,712	-	42,270
1873	2,000	-	44,270
1874	5,374	-	49,644
1875	5,200	-	54,844
1876	4,900	-	59,744
1877	4,658	-	64,402
1878	2,868	-	67,270
1879	5,103	-	72,373
1880	2,412	-	74,785
1881	1,624	-	76,409
1882	1,624	-	78,033
1883	1,624	-	79,657
1884	0	-	79,657

Year	Total	Surface	Cumulative
1885	0	-	79,657
1886	0	-	79,657
1887	0	-	79,657
1888	0	-	79,657
1889	0	-	79,657
1890	0	-	79,657
1891	0	-	79,657
1892	0	-	79,657
1893	4,868	-	84,525
1894	2,411	-	86,936
1895	5,483	-	92,419
1896	2,825	-	95,244
1897	2,807	-	98,051
1898	4,451	-	102,502
1899	2,720	-	105,222
1900	2,933	-	108,155
1901	308	-	108,463
1902	132	-	108,595
1903	164	-	108,759
1904	0	-	108,759
1905	0	-	108,759
1906	0	-	108,759
1907	0	-	108,759
1908	0	-	108,759
1909	0	-	108,759
1910	0	-	108,759
1911	0	-	108,759
1912	180	-	108,939
1913	0	-	108,939
1914	803	0	109,742
1915	544	0	110,286
1916	988	0	111,274
1917	682	0	111,956
1918	841	0	112,797
1919	312	0	113,109
1920	516	0	113,625
1921	439	0	114,064
1922	128	0	114,192
1923	411	0	114,603
1924	433	0	115,036
1925	736	0	115,772
1926	535	0	116,307
1927	568	0	116,875
1928	436	0	117,311
1929	550	0	117,861
1930	2,625	0	120,486
1931	3,178	0	123,664
1932	0	0	123,664
1933	0	0	123,664
1934	224	0	123,888
1935	0	0	123,888
1936	0	0	123,888
1937	0	0	123,888
1938	0	0	123,888
1939	0	0	123,888
1940	0	0	123,888
1941	0	0	123,888
1942	0	0	123,888
1943	0	0	123,888
1944	0	0	123,888
1945	0	0	123,888
1946	0	0	123,888
1947	4,183	4,183	128,071
1948	0	0	128,071
1949	0	0	128,071

Year	Total	Surface	Cumulative
MONROE COUNTY (cont.)			
1950	0	0	128,071
1951	0	0	128,071
1952	10,000	10,000	138,071
1953	0	0	138,071
1954	0	0	138,071
1955	0	0	138,071
1956	0	0	138,071
1957	0	0	138,071
1958	0	0	138,071
1959	0	0	138,071
1960	0	0	138,071
1961	0	0	138,071
1962	0	0	138,071
1963	0	0	138,071
1964	0	0	138,071
1965	0	0	138,071
1966	952,374	0	1,090,445
1967	1,225,523	0	2,315,968
1968	1,401,388	0	3,717,356
1969	1,368,687	0	5,086,043
1970	1,240,834	0	6,326,877
1971	892,756	0	7,219,633
1972	690,695	0	7,910,328
1973	881,941	0	8,792,269
1974	823,971	0	9,616,240
1975	1,125,702	0	10,741,942
1976	1,475,351	0	12,217,293
1977	1,387,303	0	13,604,596
1978	1,252,749	0	14,857,345
1979	1,827,728	0	16,685,073
1980	2,421,916	0	19,106,989
1981	1,849,036	0	20,956,025
1982	2,108,205	0	23,064,230
1983	2,877,716	0	25,941,946
1984	3,474,096	0	29,416,042
1985	3,194,227	0	32,610,269
1986	3,571,638	0	36,181,907
1987	2,116,550	0	38,298,457
1988	2,283,919	0	40,582,376
1989	1,980,914	0	42,563,290
1990	2,540,848	0	45,104,138
1991	2,128,435	0	47,232,573
1992	1,461,650	0	48,694,223
1993	827,377	0	49,521,600

Year	Total	Surface	Cumulative
MORGAN COUNTY			
1869	1,000	-	1,000
1870	3,000	-	4,000
1871	5,000	-	9,000
1872	5,431	-	14,431
1873	5,000	-	19,431
1874	5,759	-	25,190
1875	5,600	-	30,790
1876	5,422	-	36,212
1877	6,224	-	42,436
1878	10,059	-	52,495
1879	10,237	-	62,732
1880	10,520	-	73,252
1881	5,200	-	78,452
1882	5,200	-	83,652
1883	180	-	83,832
1884	7,636	-	91,468
1885	5,536	-	97,004
1886	4,370	-	101,374
1887	4,100	-	105,474
1888	0	-	105,474
1889	0	-	105,474
1890	0	-	105,474
1891	0	-	105,474
1892	19,000	-	124,474
1893	14,500	-	138,974
1894	13,599	-	152,573
1895	17,930	-	170,503
1896	19,080	-	189,583
1897	22,165	-	211,748
1898	26,940	-	238,688
1899	24,881	-	263,569
1900	29,954	-	293,523
1901	33,504	-	327,027
1902	50,437	-	377,464
1903	82,315	-	459,779
1904	83,700	-	543,479
1905	173,551	-	717,030
1906	222,891	-	939,921
1907	290,422	-	1,230,343
1908	217,036	-	1,447,379
1909	187,241	-	1,634,620
1910	126,544	-	1,761,164
1911	175,699	-	1,936,863
1912	196,622	-	2,133,485
1913	281,445	-	2,414,930
1914	194,743	0	2,609,673
1915	105,276	0	2,714,949
1916	258,721	0	2,973,670
1917	326,008	0	3,299,678
1918	380,046	0	3,679,724
1919	208,671	0	3,888,395
1920	276,852	0	4,165,247
1921	198,788	0	4,364,035
1922	168,281	0	4,532,316
1923	214,975	0	4,747,291
1924	182,294	0	4,929,585
1925	278,874	0	5,208,459
1926	309,455	0	5,517,914
1927	79,370	0	5,597,284
1928	43,692	0	5,640,976
1929	258,574	0	5,899,550

Year	Total	Surface	Cumulative
1930	256,017	0	6,155,567
1931	316,015	0	6,471,582
1932	96,153	0	6,567,735
1933	391,130	0	6,958,865
1934	376,041	0	7,334,906
1935	391,410	0	7,726,316
1936	285,714	0	8,012,030
1937	201,658	0	8,213,688
1938	79,916	186	8,293,604
1939	40,294	0	8,333,898
1940	72,671	0	8,406,569
1941	196,551	0	8,603,120
1942	230,750	0	8,833,870
1943	268,403	0	9,102,273
1944	301,195	0	9,403,468
1945	374,929	95,332	9,778,397
1946	300,062	42,412	10,078,459
1947	323,851	35,980	10,402,310
1948	278,383	7,825	10,680,693
1949	159,866	30,604	10,840,559
1950	180,214	143,768	11,020,773
1951	86,046	58,233	11,106
1952	33,321	15,253	11,140,140
1953	50,419	16,583	11,190,559
1954	1,022,306	1,010,863	12,212,865
1955	1,650,872	1,288,476	13,863,737
1956	1,777,696	1,473,211	15,641,433
1957	1,919,361	1,740,729	17,560,794
1958	1,983,708	1,969,466	19,544,502
1959	2,371,093	2,363,711	21,915,595
1960	2,244,971	2,243,394	24,160,566
1961	2,301,007	2,300,069	26,461,573
1962	2,223,539	2,222,701	28,685,112
1963	2,475,677	2,474,916	31,160,789
1964	1,870,064	1,869,058	33,030,853
1965	1,801,248	1,800,177	34,832,101
1966	1,380,045	1,379,329	36,212,146
1967	1,020,256	1,019,553	37,232,402
1968	790,741	790,222	38,023,143
1969	825,624	824,921	38,848,767
1970	509,562	509,196	39,358,329
1971	487,321	487,321	39,845,650
1972	732,248	732,248	40,577,898
1973	963,424	963,424	41,541,322
1974	558,164	558,164	42,099,486
1975	484,002	484,002	42,583,488
1976	82,307	82,307	42,665,795
1977	264,494	264,494	42,930,289
1978	191,023	191,023	43,121,312
1979	0	0	43,121,312
1980	0	0	43,121,312
1981	0	0	43,121,312
1982	0	0	43,121,312
1983	0	0	43,121,312
1984	0	0	43,121,312
1985	0	0	43,121,312
1986	0	0	43,121,312
1987	0	0	43,121,312
1988	0	0	43,121,312
1989	0	0	43,121,312
1990	43,243	0	43,164,555
1991	0	0	43,164,555
1992	0	0	43,164,555
1993	46,549	46,549	43,211,104

MUSKINGUM COUNTY

Year	Total	Surface	Cumulative
1810	200	-	200
1811	400	-	600
1812	400	-	1,000
1813	600	-	1,600
1814	800	-	2,400
1815	1,000	-	3,400
1816	1,200	-	4,600
1817	1,400	-	6,000
1818	1,600	-	7,600
1819	1,800	-	9,400
1820	2,000	-	11,400
1821	2,300	-	13,700
1822	2,600	-	16,300
1823	2,900	-	19,200
1824	3,200	-	22,400
1825	3,600	-	26,000
1826	4,000	-	30,000
1827	4,400	-	34,400
1828	4,800	-	39,200
1829	5,200	-	44,400
1830	5,600	-	50,000
1831	6,000	-	56,000
1832	6,400	-	62,400
1833	6,800	-	69,200
1834	7,200	-	76,400
1835	7,500	-	83,900
1836	7,800	-	91,700
1837	8,000	-	99,700
1838	9,500	-	109,200
1839	11,000	-	120,200
1840	12,500	-	132,700
1841	14,000	-	146,700
1842	15,500	-	162,200
1843	17,000	-	179,200
1844	18,500	-	197,700
1845	20,000	-	217,700
1846	21,500	-	239,200
1847	23,000	-	262,200
1848	24,500	-	286,700
1849	26,000	-	312,700
1850	28,000	-	340,700
1851	30,000	-	370,700
1852	32,310	-	403,010
1853	80,000	-	483,010
1854	80,000	-	563,010
1855	80,000	-	643,010
1856	80,000	-	723,010
1857	80,000	-	803,010
1858	80,000	-	883,010
1859	80,000	-	963,010
1860	80,000	-	1,043,010
1861	80,000	-	1,123,010
1862	80,000	-	1,203,010
1863	80,000	-	1,283,010
1864	80,000	-	1,363,010
1865	78,000	-	1,441,010
1866	76,189	-	1,517,199
1867	80,615	-	1,597,814
1868	77,000	-	1,674,814
1869	72,000	-	1,746,814
1870	67,078	-	1,813,892
1871	55,000	-	1,868,892
1872	120,000	-	1,988,892
1873	125,000	-	2,113,892
1874	126,113	-	2,240,005
1875	109,480	-	2,349,485
1876	13,109	-	2,362,594
1877	77,521	-	2,440,115
1878	6,743	-	2,446,858
1879	124,960	-	2,571,818
1880	150,000	-	2,721,818
1881	96,000	-	2,817,818
1882	100,000	-	2,917,818
1883	96,376	-	3,014,194
1884	84,398	-	3,098,592
1885	86,846	-	3,185,438
1886	96,601	-	3,282,039
1887	171,928	-	3,453,967
1888	211,861	-	3,665,828
1889	233,298	-	3,899,126
1890	249,666	-	4,148,792
1891	232,918	-	4,381,710
1892	264,473	-	4,646,183
1893	364,067	-	5,010,250
1894	248,286	-	5,258,536
1895	255,230	-	5,513,766
1896	264,105	-	5,777,871
1897	339,660	-	6,117,531
1898	250,718	-	6,368,249
1899	220,854	-	6,589,103
1900	311,547	-	6,900,650
1901	226,375	-	7,127,025
1902	286,532	-	7,413,557
1903	305,933	-	7,719,490
1904	300,310	-	8,019,800
1905	242,011	-	8,261,811
1906	368,320	-	8,630,131
1907	442,278	-	9,072,409
1908	436,947	-	9,509,356
1909	416,217	-	9,925,573
1910	270,416	-	10,195,989
1911	410,777	-	10,606,766
1912	522,198	-	11,128,964
1913	495,595	-	11,624,559
1914	371,273	0	11,995,832
1915	392,332	0	12,388,164
1916	396,289	0	12,784,453
1917	541,261	100	13,325,714
1918	672,321	35,827	13,998,035
1919	399,364	33,411	14,397,399
1920	669,960	133,193	15,067,359
1921	193,920	19,449	15,261,279
1922	434,843	85,929	15,696,122
1923	469,671	74,645	16,165,793
1924	380,788	8,365	16,546,581
1925	316,029	42,293	16,862,610
1926	230,822	0	17,093,432
1927	223,462	0	17,316,894
1928	185,233	0	17,502,127
1929	202,956	4,295	17,705,083
1930	314,374	92,932	18,019,457
1931	440,807	140,400	18,460,264
1932	390,402	127,850	18,850,666
1933	507,744	141,050	19,358,410
1934	550,580	129,148	19,908,990
1935	609,155	160,313	20,518,145
1936	693,793	160,700	21,211,938
1937	709,803	68,042	21,921,741
1938	974,379	67,280	22,896,120
1939	926,814	93,125	23,822,934
1940	1,063,495	675,766	24,886,429
1941	1,243,806	54,062	26,130,235
1942	1,343,333	38,960	27,473,568
1943	1,606,530	137,770	29,080,098
1944	1,927,063	470,301	31,007,161
1945	1,198,734	523,965	32,205,895
1946	1,113,030	789,725	33,318,925
1947	1,552,642	1,148,108	34,871,567
1948	2,195,125	1,700,703	37,066,692
1949	1,677,453	1,347,323	38,744,145
1950	1,888,432	1,458,657	40,632,577
1951	1,601,592	1,157,679	42,234,169
1952	1,341,989	1,055,163	43,576,158
1953	1,314,039	1,034,601	44,890,197
1954	1,057,053	845,557	45,947,250
1955	1,353,129	1,001,386	47,300,379
1956	1,159,100	883,389	48,459,479
1957	915,358	768,007	49,374,837
1958	721,126	641,684	50,095,963
1959	715,627	625,596	50,811,590
1960	591,635	427,137	51,403,225
1961	107,325	35,371	51,510,550
1962	269,706	195,652	51,780,256
1963	107,718	28,829	51,887,974
1964	117,941	46,254	52,005,915
1965	132,412	65,235	52,138,327
1966	259,405	228,098	52,397,732
1967	699,806	579,081	53,097,538
1968	2,050,799	1,988,140	55,148,337
1969	2,770,617	2,718,018	57,918,954
1970	4,496,252	4,446,261	62,415,206
1971	4,188,367	4,157,903	66,603,573
1972	4,098,678	4,059,275	70,702,251
1973	3,670,776	3,650,080	74,373,027
1974	5,053,499	5,043,559	79,426,526
1975	4,072,467	4,004,101	83,498,993
1976	5,069,650	4,880,200	88,568,643
1977	5,004,911	4,885,279	93,573,554
1978	4,165,553	4,165,553	97,739,107
1979	4,786,095	4,786,095	102,525,202
1980	4,232,118	4,232,118	106,757,320
1981	3,080,113	3,080,113	109,837,433
1982	2,813,069	2,813,069	112,650,502
1983	2,336,420	2,336,420	114,986,922
1984	2,213,173	2,213,173	117,200,095
1985	2,091,579	2,091,579	119,291,674
1986	1,822,078	1,822,078	121,113,752
1987	537,025	537,025	121,650,777
1988	475,800	475,800	122,126,577
1989	932,882	932,882	123,059,459
1990	349,773	349,773	123,409,232
1991	1,236,053	1,236,053	124,645,285
1992	2,412,803	2,412,803	127,058,088
1993	2,350,330	2,350,330	129,408,418

NOBLE COUNTY

Year	Total	Surface	Cumulative
1845	1,000	-	1,000
1846	3,000	-	4,000
1847	5,000	-	9,000
1848	7,000	-	16,000
1849	9,000	-	25,000
1850	11,000	-	36,000
1851	14,000	-	50,000
1852	17,000	-	67,000
1853	20,000	-	87,000
1854	20,000	-	107,000
1855	20,000	-	127,000
1856	20,000	-	147,000
1857	20,000	-	167,000
1858	18,500	-	185,500
1859	17,000	-	202,500
1860	15,500	-	218,000
1861	14,000	-	232,000
1862	12,500	-	244,500
1863	11,000	-	255,500
1864	9,500	-	265,000
1865	8,000	-	273,000
1866	6,500	-	279,500
1867	5,000	-	284,500
1868	4,000	-	288,500
1869	3,200	-	291,700
1870	2,695	-	294,395
1871	6,700	-	301,095
1872	12,645	-	313,740
1873	15,000	-	328,740
1874	19,737	-	348,477
1875	4,000	-	352,477
1876	11,190	-	363,667
1877	3,280	-	366,947
1878	6,288	-	373,235
1879	3,082	-	376,317
1880	21,520	-	397,837
1881	7,000	-	404,837
1882	7,000	-	411,837
1883	6,800	-	418,637
1884	0	-	418,637
1885	0	-	418,637
1886	3,342	-	421,979
1887	6,320	-	428,299
1888	6,205	-	434,504
1889	14,281	-	448,785
1890	11,565	-	460,350
1891	9,560	-	469,910
1892	9,995	-	479,905
1893	15,360	-	495,265
1894	21,867	-	517,132
1895	19,376	-	536,508
1896	42,507	-	579,015
1897	63,967	-	642,982
1898	62,912	-	705,894
1899	66,714	-	772,608
1900	89,046	-	861,654
1901	82,844	-	944,498
1902	34,992	-	979,490
1903	52,247	-	1,031,737
1904	154,970	-	1,186,707
1905	171,509	-	1,358,216
1906	409,114	-	1,767,330
1907	309,349	-	2,076,679
1908	208,192	-	2,284,871
1909	379,055	-	2,663,926
1910	441,823	-	3,105,749
1911	480,524	-	3,586,273
1912	641,677	-	4,227,950
1913	784,555	-	5,012,505
1914	507,010	0	5,519,515
1915	608,735	0	6,128,250
1916	864,695	0	6,992,945
1917	918,519	0	7,911,464
1918	994,989	0	8,906,453
1919	809,317	0	9,715,770
1920	638,237	0	10,354,007
1921	540,694	0	10,894,701
1922	341,626	0	11,236,327
1923	707,247	0	11,943,574
1924	493,301	0	12,436,875
1925	364,418	0	12,801,293
1926	431,431	0	13,232,724
1927	202,678	0	13,435,40
1928	327,281	0	13,762,683
1929	600,164	0	14,362,847
1930	544,405	0	14,907,252
1931	397,168	0	15,304,420
1932	429,182	0	15,733,602
1933	363,027	0	16,096,629
1934	323,438	0	16,420,067
1935	187,640	0	16,607,707
1936	384,073	0	16,991,780
1937	491,820	0	17,483,600
1938	139,995	0	17,623,595
1939	8,402	0	17,631,997
1940	6,751	0	17,638,748
1941	7,023	0	17,645,771
1942	96,557	0	17,742,328
1943	107,129	0	17,849,457
1944	14,227	11,857	17,863,684
1945	68,219	65,031	17,931,903
1946	240,785	227,820	18,172,688
1947	475,961	471,307	18,648,649
1948	1,338,666	1,329,894	19,987,315
1949	1,179,026	1,175,178	21,166,341
1950	2,027,850	2,024,724	23,194,191
1951	1,582,240	1,579,820	24,776,431
1952	1,866,647	1,866,203	26,643,078
1953	1,731,875	1,720,651	28,374,953
1954	1,265,081	1,235,742	29,640,034
1955	1,181,207	1,163,589	30,821,241
1956	1,149,672	1,145,952	31,970,913
1957	1,187,093	1,186,217	33,158,006
1958	936,359	936,185	34,094,365
1959	1,592,243	1,592,110	35,686,608
1960	1,955,705	1,955,575	37,642,313
1961	1,490,621	1,490,484	39,132,934
1962	1,680,006	1,679,970	40,812,940
1963	1,803,554	1,803,554	42,616,494
1964	2,679,084	2,678,748	45,295,578
1965	2,978,540	2,978,145	48,274,118
1966	2,187,121	2,187,077	50,461,239
1967	2,068,685	2,068,685	52,529,924
1968	2,379,476	2,379,476	54,909,400
1969	2,756,534	2,756,534	57,665,934
1970	2,671,647	2,671,647	60,337,581
1971	2,213,266	2,213,266	62,550,847
1972	1,219,135	1,219,135	63,769,982
1973	743,595	743,595	64,513,577
1974	793,542	793,542	65,307,119
1975	489,473	489,473	65,796,592
1976	246,592	246,592	66,043,184
1977	357,313	357,313	66,400,497
1978	129,081	129,081	66,529,578
1979	993,384	993,384	67,522,962
1980	1,876,227	1,876,227	69,399,189
1981	2,190,762	2,190,762	71,589,951
1982	2,688,626	2,688,626	74,278,577
1983	2,614,922	2,614,922	76,893,499
1984	2,794,430	2,794,430	79,687,929
1985	3,370,809	3,370,809	83,058,738
1986	2,747,938	2,747,938	85,806,676
1987	3,492,819	3,492,819	89,299,495
1988	3,470,317	3,470,317	92,769,812
1989	3,352,038	3,352,038	96,121,850
1990	3,814,089	3,814,089	99,935,939
1991	2,799,922	2,799,922	102,735,861
1992	1,195,606	1,195,606	103,931,467
1993	1,065,855	1,065,855	104,997,322

PERRY COUNTY

Year	Total	Surface	Cumulative
1816	100	-	100
1817	200	-	300
1818	300	-	600
1819	400	-	1,000
1820	600	-	1,600
1821	800	-	2,400
1822	1,000	-	3,400
1823	1,200	-	4,600
1824	1,400	-	6,000
1825	1,600	-	7,600
1826	1,700	-	9,300
1827	1,800	-	11,100
1828	1,900	-	13,000
1829	1,900	-	14,900
1830	2,000	-	16,900
1831	2,000	-	18,900
1832	1,900	-	20,800
1833	1,900	-	22,700
1834	1,800	-	24,500
1835	1,800	-	26,300
1836	1,700	-	28,000
1837	1,600	-	29,600
1838	1,500	-	31,100
1839	1,500	-	32,600
1840	1,368	-	33,968
1841	1,400	-	35,368
1842	1,400	-	36,768
1843	1,400	-	38,168
1844	1,400	-	39,568
1845	1,500	-	41,068
1846	1,500	-	42,568
1847	1,600	-	44,168
1848	1,600	-	45,768
1849	5,300	-	51,068
1850	9,000	-	60,068
1851	12,700	-	72,768
1852	16,400	-	89,168
1853	20,000	-	109,168
1854	40,000	-	149,168
1855	30,000	-	179,168
1856	20,000	-	199,168
1857	40,000	-	239,168
1858	42,000	-	281,168
1859	44,000	-	325,168
1860	47,000	-	372,168
1861	50,000	-	422,168
1862	53,000	-	475,168
1863	56,000	-	531,168
1864	59,000	-	590,168
1865	62,000	-	652,168
1866	65,000	-	717,168
1867	68,000	-	785,168
1868	71,000	-	856,168
1869	74,000	-	930,168
1870	77,000	-	1,007,168
1871	80,556	-	1,087,724
1872	550,000	-	1,637,724
1873	525,000	-	2,162,724
1874	435,017	-	2,597,741
1875	503,169	-	3,100,910
1876	504,448	-	3,605,358
1877	717,761	-	4,323,119
1878	508,896	-	4,832,015
1879	615,588	-	5,447,603
1880	1,445,572	-	6,893,175
1881	1,735,000	-	8,628,175
1882	1,913,152	-	10,541,327
1883	1,735,199	-	12,276,526
1884	1,379,100	-	13,655,626
1885	1,259,592	-	14,915,218
1886	1,607,666	-	16,522,884
1887	1,870,841	-	18,393,725
1888	1,736,100	-	20,129,825
1889	1,549,450	-	21,679,275
1890	1,714,762	-	23,394,037
1891	1,759,790	-	25,153,827
1892	2,056,896	-	27,210,723
1893	2,171,495	-	29,382,218
1894	1,460,831	-	30,843,049
1895	1,789,109	-	32,632,158
1896	1,703,816	-	34,335,974
1897	1,449,178	-	35,785,152
1898	1,789,890	-	37,575,042
1899	1,748,522	-	39,323,564
1900	2,517,258	-	41,840,822
1901	2,563,051	-	44,403,873
1902	2,830,962	-	47,234,835
1903	2,731,595	-	49,966,430
1904	2,491,682	-	52,458,112
1905	2,399,570	-	54,857,682
1906	2,609,701	-	57,467,383
1907	2,921,754	-	60,389,137
1908	2,108,050	-	62,497,187
1909	2,076,407	-	64,573,594
1910	2,394,961	-	66,968,555
1911	2,021,594	-	68,990,149
1912	2,164,130	-	71,154,279
1913	2,217,816	-	73,372,095
1914	1,349,323	0	74,721,418
1915	1,172,687	0	75,894,105
1916	1,195,127	0	77,089,232
1917	2,445,114	103,090	79,534,346
1918	3,514,841	254,130	83,049,187
1919	2,580,890	263,640	85,630,077
1920	3,700,511	619,542	89,330,588
1921	1,600,510	376,187	90,931,098
1922	1,841,754	293,539	92,772,852
1923	2,520,474	431,803	95,293,326
1924	1,785,700	296,364	97,079,026
1925	1,497,684	38,870	98,576,710
1926	1,706,052	122,040	100,282,762
1927	553,974	13,304	100,836,736
1928	283,430	13,480	101,120,166
1929	558,201	96,147	101,678,367
1930	653,948	10,316	102,332,315
1931	565,422	6,626	102,897,737
1932	327,447	0	103,225,184
1933	664,630	26,554	103,889,814
1934	893,754	37,930	104,783,568
1935	855,237	13,330	105,638,805
1936	704,843	620	106,343,648
1937	694,033	0	107,037,681
1938	682,293	12,014	107,719,974
1939	681,918	23,910	108,401,892
1940	751,460	169,248	109,153,352
1941	1,008,361	256,602	110,161,713
1942	963,544	294,031	111,125,257
1943	871,417	269,241	111,996,674
1944	1,107,419	501,434	113,104,093
1945	2,406,047	820,751	115,510,140
1946	2,960,720	872,928	118,470,860
1947	3,410,083	1,444,857	121,880,943
1948	3,397,948	1,815,076	125,278,891
1949	2,657,360	1,636,727	127,936,251
1950	3,261,991	1,685,147	131,198,242
1951	2,750,425	1,692,680	133,948,667
1952	2,376,324	1,496,241	136,324,991
1953	2,048,000	1,269,023	138,372,991
1954	1,762,831	1,317,570	140,135,822
1955	1,605,731	1,340,907	141,741,553
1956	1,676,695	1,417,286	143,418,248
1957	1,755,742	1,553,296	145,173,990
1958	1,849,209	1,736,353	147,023,199
1959	1,905,152	1,860,375	148,928,351
1960	1,569,876	1,537,560	150,498,227
1961	1,684,377	1,656,938	152,182,604
1962	1,932,189	1,850,719	154,114,793
1963	2,031,675	1,796,279	156,146,468
1964	2,196,801	1,875,454	158,343,269
1965	2,092,372	1,720,344	160,435,641
1966	2,126,281	1,636,782	162,561,922
1967	2,155,952	1,358,615	164,717,874
1968	3,101,500	1,371,776	167,819,374
1969	3,303,699	733,152	171,123,073
1970	3,703,297	1,146,763	174,826,370
1971	2,986,057	1,133,002	177,812,427
1972	2,929,946	759,343	180,742,373
1973	2,655,616	513,926	183,397,989
1974	2,138,722	172,153	185,536,711
1975	2,504,810	319,382	188,041,521
1976	2,275,072	460,005	190,316,593
1977	2,304,028	715,037	192,620,621
1978	2,302,855	781,400	194,923,476
1979	2,442,006	587,844	197,365,482
1980	2,378,058	530,793	199,743,540
1981	2,064,201	586,991	201,807,741
1982	2,036,412	476,485	203,844,153
1983	1,852,219	438,347	205,696,372
1984	2,090,261	664,782	207,786,633
1985	2,035,877	445,618	209,822,510
1986	2,201,464	451,642	212,023,974
1987	1,809,203	489,756	213,833,177
1988	1,355,728	418,247	215,188,905
1989	1,536,156	407,559	216,725,061
1990	1,375,486	377,695	218,100,547
1991	196,484	196,484	218,297,031
1992	262,085	262,085	218,559,116
1993	395,321	395,321	218,954,437

Year	Total	Surface	Cumulative
PIKE COUNTY			
1978	7,734	7,734	7,734
1979	28,270	28,270	36,004
1980	4,795	4,795	40,799
1981	0	0	40,799
1982	0	0	40,799
1983	0	0	40,799
1984	0	0	40,799
1985	0	0	40,799
1986	0	0	40,799
1987	0	0	40,799
1988	0	0	40,799
1989	0	0	40,799
1990	0	0	40,799
1991	0	0	40,799
1992	0	0	40,799
1993	0	0	40,799
PORTAGE COUNTY			
1870	1,500	-	1,500
1871	11,000	-	12,500
1872	10,023	-	22,523
1873	8,864	-	31,387
1874	1,920	-	33,307
1875	1,920	-	35,227
1876	2,940	-	38,167
1877	4,120	-	42,287
1878	2,804	-	45,091
1879	4,200	-	49,291
1880	26,500	-	75,791
1881	72,500	-	148,291
1882	100,000	-	248,291
1883	72,500	-	320,791
1884	65,647	-	386,438
1885	77,071	-	463,509
1886	70,339	-	533,848
1887	65,163	-	599,011
1888	70,923	-	669,934
1889	65,286	-	735,220
1890	70,687	-	805,907
1891	68,612	-	874,519
1892	87,925	-	962,444
1893	94,586	-	1,057,030
1894	92,946	-	1,149,976
1895	87,012	-	1,236,988
1896	48,060	-	1,285,048
1897	79,245	-	1,364,293
1898	75,851	-	1,440,144
1899	114,778	-	1,554,922
1900	103,241	-	1,658,163
1901	86,781	-	1,744,944
1902	97,928	-	1,842,872
1903	101,889	-	1,944,761
1904	97,692	-	2,042,453
1905	83,603	-	2,126,056
1906	109,227	-	2,235,283
1907	96,463	-	2,331,746
1908	88,543	-	2,420,289
1909	102,624	-	2,522,913
1910	105,155	-	2,628,068
1911	115,080	-	2,743,148
1912	83,293	-	2,826,441
1913	84,289	-	2,910,730
1914	54,569	0	2,965,299
1915	60,396	0	3,025,695
1916	69,432	0	3,095,127
1917	92,439	0	3,187,566
1918	88,523	0	3,276,089
1919	75,310	0	3,351,399
1920	121,943	0	3,473,342
1921	67,615	0	3,540,957
1922	66,012	0	3,606,969
1923	95,015	0	3,701,984
1924	83,396	0	3,785,380
1925	68,053	0	3,853,433
1926	62,145	0	3,915,578
1927	22,443	0	3,938,021
1928	9,161	0	3,947,182
1929	7,281	0	3,954,463
1930	10,251	0	3,964,714
1931	4,549	0	3,969,263
1932	11,866	0	3,981,129
1933	7,159	0	3,988,288
1934	15,010	0	4,003,298
1935	17,033	0	4,020,331
1936	22,498	0	4,042,829
1937	24,736	0	4,067,565
1938	23,569	4,120	4,091,134
1939	48,426	33,426	4,139,560
1940	95,613	81,863	4,235,173
1941	74,831	61,061	4,310,004
1942	83,082	71,605	4,393,086
1943	98,366	93,802	4,491,452
1944	94,013	94,013	4,585,465
1945	84,476	84,476	4,669,941
1946	94,100	94,100	4,764,041
1947	94,131	94,131	4,858,172
1948	103,472	103,472	4,961,644
1949	109,417	109,417	5,071,061
1950	153,272	153,272	5,224,333
1951	182,911	182,911	5,407,244
1952	191,991	191,991	5,599,235
1953	142,858	142,858	5,742,093
1954	73,356	73,356	5,815,449
1955	126,503	126,503	5,941,952
1956	135,034	135,034	6,076,986
1957	122,411	122,411	6,199,397
1958	104,515	104,515	6,303,912
1959	108,320	108,320	6,412,232
1960	84,331	84,331	6,496,563
1961	97,622	97,622	6,594,185
1962	94,950	94,950	6,689,135
1963	79,887	79,887	6,769,022
1964	72,502	72,502	6,841,524
1965	6,472	6,472	6,847,996
1966	0	0	6,847,996
1967	0	0	6,847,996
1968	0	0	6,847,996
1969	0	0	6,847,996
1970	0	0	6,847,996
1971	0	0	6,847,996
1972	0	0	6,847,996
1973	0	0	6,847,996
1974	0	0	6,847,996
1975	0	0	6,847,996
1976	0	0	6,847,996
1977	0	0	6,847,996
1978	0	0	6,847,996
1979	0	0	6,847,996
1980	0	0	6,847,996
1981	0	0	6,847,996
1982	0	0	6,847,996
1983	0	0	6,847,996
1984	0	0	6,847,996
1985	0	0	6,847,996
1986	0	0	6,847,996
1987	0	0	6,847,996
1988	0	0	6,847,996
1989	0	0	6,847,996
1990	0	0	6,847,996
1991	0	0	6,847,996
1992	0	0	6,847,996
1993	0	0	6,847,996
SCIOTO COUNTY			
1870	500	-	500
1871	1,500	-	2,000
1872	5,000	-	7,000
1873	3,651	-	10,651
1874	4,300	-	14,951
1875	4,900	-	19,851
1876	5,500	-	25,351
1877	6,224	-	31,575
1878	1,892	-	33,467
1879	1,560	-	35,027
1880	7,443	-	42,470
1881	3,400	-	45,870
1882	3,400	-	49,270
1883	3,400	-	52,670
1884	3,650	-	56,320
1885	2,440	-	58,760
1886	0	-	58,760
1887	0	-	58,760
1888	0	-	58,760
1889	0	-	58,760

SCIOTO COUNTY (cont.)

Year	Total	Surface	Cumulative
1890	1,090	-	59,850
1891	0	-	59,850
1892	1,180	-	61,030
1893	769	-	61,799
1894	1,391	-	63,190
1895	3,875	-	67,065
1896	1,785	-	68,850
1897	17,119	-	85,969
1898	12,140	-	98,109
1899	8,424	-	106,533
1900	11,657	-	118,190
1901	10,349	-	128,539
1902	8,351	-	136,890
1903	8,515	-	145,405
1904	12,224	-	157,629
1905	9,013	-	166,642
1906	10,331	-	176,973
1907	13,508	-	190,481
1908	8,460	-	198,941
1909	8,916	-	207,857
1910	9,834	-	217,691
1911	5,599	-	223,290
1912	7,794	-	231,084
1913	5,867	-	236,951
1914	4,170	0	241,121
1915	2,443	0	243,564
1916	617	0	244,181
1917	2,608	0	246,789
1918	1,086	0	247,875
1919	860	0	248,735
1920	904	0	249,639
1921	793	0	250,432
1922	4,470	0	254,902
1923	3,265	0	258,167
1924	1,868	0	260,035
1925	1,008	0	261,043
1926	1,063	0	262,106
1927	1,338	0	263,444
1928	968	0	264,412
1929	460	0	264,872
1930	3,739	0	268,611
1931	4,549	0	273,160
1932	2,287	0	275,447
1933	4,195	0	279,642
1934	6,558	0	286,200
1935	4,725	0	290,925
1936	3,475	0	294,400
1937	1,824	0	296,224
1938	782	0	297,006
1939	64	0	297,070
1940	20	0	297,090
1941	150	0	297,240
1942	20	0	297,260
1943	702	139	297,962
1944	76	35	298,038
1945	0	0	298,038
1946	0	0	298,038
1947	0	0	298,038
1948	4,149	4,149	302,187
1949	6,427	6,427	308,614
1950	7,380	7,380	315,994
1951	1,619	0	317,613
1952	0	0	317,613
1953	0	0	317,613
1954	0	0	317,613
1955	0	0	317,613
1956	0	0	317,613
1957	0	0	317,613
1958	0	0	317,613
1959	0	0	317,613
1960	0	0	317,613
1961	0	0	317,613
1962	0	0	317,613
1963	0	0	317,613
1964	0	0	317,613
1965	0	0	317,613
1967	0	0	317,613
1968	0	0	317,613
1969	0	0	317,613
1970	0	0	317,613
1971	1,142	1,142	318,755
1972	812	812	319,567
1973	0	0	319,567
1974	0	0	319,567
1975	0	0	319,567
1976	0	0	319,567
1977	0	0	319,567
1978	0	0	319,567
1979	0	0	319,567
1980	0	0	319,567
1981	0	0	319,567
1982	0	0	319,567
1983	0	0	319,567
1984	0	0	319,567
1985	0	0	319,567
1986	0	0	319,567
1987	0	0	319,567
1988	0	0	319,567
1989	0	0	319,567
1990	0	0	319,567
1991	0	0	319,567
1992	0	0	319,567
1993	0	0	319,567

STARK COUNTY

Year	Total	Surface	Cumulative
1833	819	-	819
1834	1,047	-	1,866
1835	776	-	2,642
1836	844	-	3,486
1837	1,421	-	4,907
1838	496	-	5,403
1839	1,100	-	6,503
1840	1,352	-	7,855
1841	1,240	-	9,095
1842	1,640	-	10,735
1843	1,400	-	12,135
1844	1,800	-	13,935
1845	6,000	-	19,935
1846	5,500	-	25,435
1847	6,000	-	31,435
1848	6,059	-	37,494
1849	6,100	-	43,594
1850	14,000	-	57,594
1851	23,000	-	80,594
1852	31,000	-	111,594
1853	40,000	-	151,594
1854	80,000	-	231,594
1855	80,000	-	311,594
1856	80,000	-	391,594
1857	80,000	-	471,594
1858	18,278	-	489,872
1859	29,353	-	519,225
1860	40,000	-	559,225
1861	61,000	-	620,225
1862	82,000	-	702,225
1863	103,000	-	805,225
1864	124,000	-	929,225
1865	146,000	-	1,075,225
1866	168,210	-	1,243,435
1867	472,844	-	1,716,279
1868	277,198	-	1,993,477
1869	200,000	-	2,193,477
1870	131,257	-	2,324,734
1871	260,000	-	2,584,734
1872	410,000	-	2,994,734
1873	430,106	-	3,424,840
1874	404,380	-	3,829,220
1875	408,180	-	4,237,400
1876	248,440	-	4,485,840
1877	203,489	-	4,689,329
1878	336,098	-	5,025,427
1879	373,574	-	5,399,001
1880	508,829	-	5,907,830
1881	359,000	-	6,266,830
1882	400,000	-	6,666,830
1883	358,775	-	7,025,605
1884	513,225	-	7,538,830
1885	391,418	-	7,930,248
1886	593,422	-	8,523,670
1887	784,164	-	9,307,834
1888	793,227	-	10,101,061
1889	1,028,649	-	11,129,710
1890	891,430	-	12,021,140
1891	925,370	-	12,946,510
1892	938,519	-	13,885,029
1893	831,024	-	14,716,053
1894	456,728	-	15,172,781
1895	860,733	-	16,033,514
1896	1,056,979	-	17,090,493
1897	777,042	-	17,867,535
1898	867,097	-	18,734,632
1899	1,073,750	-	19,808,382
1900	1,150,232	-	20,958,614
1901	1,049,093	-	22,007,707
1902	1,184,749	-	23,192,456
1903	926,180	-	24,118,636
1904	761,173	-	24,879,809

Year	Total	Surface	Cumulative
STARK COUNTY (cont.)			
1905	774,832	-	25,654,641
1906	772,583	-	26,427,224
1907	737,017	-	27,164,241
1908	524,052	-	27,688,293
1909	458,392	-	28,146,685
1910	547,635	-	28,694,320
1911	442,860	-	29,137,180
1912	417,823	-	29,555,003
1913	453,772	-	30,008,775
1914	469,388	0	30,478,163
1915	371,683	0	30,849,846
1916	335,487	0	31,185,333
1917	471,034	4,802	31,656,367
1918	535,423	1,136	32,191,790
1919	325,923	25,205	32,517,713
1920	498,118	1,150	33,015,831
1921	310,120	655	33,325,951
1922	537,116	1,149	33,863,067
1923	550,496	0	34,413,563
1924	462,552	5,337	34,876,115
1925	472,227	15,637	35,348,342
1926	410,138	13,202	35,758,480
1927	476,906	16,427	36,235,386
1928	388,696	11,267	36,624,082
1929	363,692	7,043	36,987,774
1930	322,201	11,288	37,309,975
1931	317,700	7,331	37,627,675
1932	318,963	4,919	37,946,638
1933	318,724	3,538	38,265,362
1934	452,372	54,958	38,717,734
1935	540,373	117,820	39,258,107
1936	605,207	185,266	39,863,314
1937	537,653	196,338	40,400,967
1938	441,657	238,707	40,842,624
1939	581,771	441,794	41,424,395
1940	608,114	516,473	42,032,509
1941	748,760	690,650	42,781,269
1942	543,143	506,946	43,324,412
1943	425,729	379,563	43,750,141
1944	251,412	213,753	44,001,553
1945	247,900	208,196	44,249,453
1946	249,596	232,730	44,499,049
1947	387,699	377,258	44,886,748
1948	666,582	657,086	45,553,330
1949	796,287	752,771	46,349,617
1950	1,020,379	964,973	47,369,996
1951	954,410	900,591	48,324,406
1952	1,034,069	976,896	49,358,475
1953	974,136	919,806	50,332,611
1954	869,710	796,725	51,202,321
1955	1,082,403	991,492	52,284,724
1956	899,492	807,653	53,184,216
1957	796,066	713,306	53,980,282
1958	616,968	534,759	54,597,250
1959	586,430	550,788	55,183,680
1960	614,977	614,977	55,798,657
1961	760,110	760,110	56,558,767
1962	656,576	656,576	57,215,343
1963	580,513	580,513	57,795,856
1964	476,127	476,127	58,271,983
1965	568,010	568,010	58,839,993
1966	501,825	501,825	59,341,818
1967	421,910	421,910	59,763,728
1968	340,286	340,286	60,104,014
1969	353,357	353,357	60,457,371
1970	344,101	344,101	60,801,472
1971	424,384	424,384	61,225,856
1972	371,490	371,490	61,597,346
1973	331,408	331,408	61,928,754
1974	429,409	429,409	62,358,163
1975	468,969	468,969	62,827,132
1976	449,057	449,057	63,276,189
1977	702,562	702,562	63,978,751
1978	705,081	705,081	64,683,832
1979	540,178	540,178	65,224,010
1980	651,706	651,706	65,875,716
1981	847,023	847,023	66,722,739
1982	861,037	861,037	67,583,776
1983	1,039,519	1,039,519	68,623,295
1984	917,880	917,880	69,541,175
1985	639,460	639,460	70,180,635
1986	540,662	540,662	70,721,297
1987	764,166	764,166	71,485,463
1988	506,183	506,183	71,991,646
1989	195,720	195,720	72,187,366
1990	170,635	170,635	72,358,001
1991	475,340	475,340	72,833,341
1992	331,867	331,867	73,165,208
1993	230,340	230,340	73,395,548
SUMMIT COUNTY			
1810	200	-	200
1811	200	-	400
1812	500	-	900
1813	800	-	1,700
1814	1,200	-	2,900
1815	1,500	-	4,400
1816	1,800	-	6,200
1817	2,200	-	8,400
1818	2,500	-	10,900
1819	2,800	-	13,700
1820	3,200	-	16,900
1821	3,500	-	20,400
1822	3,800	-	24,200
1823	4,100	-	28,300
1824	4,400	-	32,700
1825	4,800	-	37,500
1826	5,100	-	42,600
1827	5,400	-	48,000
1828	5,700	-	53,700
1829	6,000	-	59,700
1830	6,400	-	66,100
1831	6,800	-	72,900
1832	7,200	-	80,100
1833	7,600	-	87,700
1834	8,000	-	95,700
1835	8,400	-	104,100
1836	8,800	-	112,900
1837	9,200	-	122,100
1838	9,600	-	131,700
1839	9,900	-	141,600
1840	10,162	-	151,762
1841	15,500	-	167,262
1842	15,000	-	182,262
1843	14,472	-	196,734
1844	17,100	-	213,834
1845	25,000	-	238,834
1846	22,000	-	260,834
1847	51,487	-	312,321
1848	73,495	-	385,816
1849	75,000	-	460,816
1850	95,000	-	555,816
1851	115,000	-	670,816
1852	135,000	-	805,816
1853	160,000	-	965,816
1854	200,000	-	1,165,816
1855	218,000	-	1,383,816
1856	235,010	-	1,618,826
1857	240,000	-	1,858,826
1858	218,000	-	2,076,826
1859	196,000	-	2,272,826
1860	174,000	-	2,446,826
1861	152,000	-	2,598,826
1862	130,000	-	2,728,826
1863	108,000	-	2,836,826
1864	86,000	-	2,922,826
1865	64,000	-	2,986,826
1866	41,545	-	3,028,371
1867	21,726	-	3,050,097
1868	129,000	-	3,179,097
1869	275,000	-	3,454,097
1870	350,000	-	3,804,097
1871	500,000	-	4,304,097
1872	300,000	-	4,604,097
1873	215,818	-	4,819,915
1874	202,035	-	5,021,950
1875	274,876	-	5,296,826
1876	171,105	-	5,467,931
1877	119,586	-	5,587,517
1878	162,074	-	5,749,591
1879	159,699	-	5,909,290
1880	314,606	-	6,223,896
1881	170,500	-	6,394,396
1882	200,000	-	6,594,396
1883	170,500	-	6,764,896
1884	253,148	-	7,018,044
1885	145,134	-	7,163,178
1886	82,225	-	7,245,403
1887	95,815	-	7,341,218
1888	112,024	-	7,453,242
1889	84,438	-	7,537,680
1890	189,362	-	7,727,042
1891	143,549	-	7,870,591
1892	110,299	-	7,980,890
1893	97,040	-	8,077,930
1894	27,322	-	8,105,252

Year	Total	Surface	Cumulative
SUMMIT COUNTY (cont.)			
1895	49,260	-	8,154,512
1896	53,666	-	8,208,178
1897	83,238	-	8,291,416
1898	65,378	-	8,356,794
1899	86,100	-	8,442,894
1900	122,988	-	8,565,882
1901	123,541	-	8,689,423
1902	93,586	-	8,783,009
1903	44,329	-	8,827,338
1904	84,208	-	8,911,546
1905	115,529	-	9,027,075
1906	96,997	-	9,124,072
1907	99,971	-	9,224,043
1908	103,299	-	9,327,342
1909	78,268	-	9,405,610
1910	94,346	-	9,499,956
1911	85,711	-	9,585,667
1912	82,032	-	9,667,699
1913	82,331	-	9,750,030
1914	58,287	0	9,808,317
1915	51,432	0	9,859,749
1916	38,260	0	9,898,009
1917	29,680	0	9,927,689
1918	55,676	0	9,983,365
1919	37,397	0	10,020,762
1920	17,744	0	10,038,506
1921	12,632	0	10,051,138
1922	32,589	0	10,083,727
1923	27,399	0	10,111,126
1924	14,694	0	10,125,820
1925	15,864	0	10,141,684
1926	5,567	0	10,147,251
1927	5,007	0	10,152,258
1928	5,852	0	10,158,110
1929	3,314	0	10,161,424
1930	3,739	0	10,165,163
1931	4,549	0	10,169,712
1932	18,459	0	10,188,171
1933	22,962	0	10,211,133
1934	30,050	0	10,241,183
1935	32,457	0	10,273,640
1936	25,459	0	10,299,099
1937	24,201	0	10,323,300
1938	10,668	0	10,333,968
1939	6,496	0	10,340,464
1940	5,753	0	10,346,217
1941	0	0	10,346,217
1942	0	0	10,346,217
1943	0	0	10,346,217
1944	0	0	10,346,217
1945	0	0	10,346,217
1946	0	0	10,346,217
1947	0	0	10,346,217
1948	0	0	10,346,217
1949	0	0	10,346,217
1950	0	0	10,346,217
1951	0	0	10,346,217
1952	0	0	10,346,217
1953	0	0	10,346,217
1954	0	0	10,346,217
1955	0	0	10,346,217
1956	0	0	10,346,217
1957	0	0	10,346,217
1958	0	0	10,346,217
1959	0	0	10,346,217
1960	0	0	10,346,217
1961	0	0	10,346,217
1962	0	0	10,346,217
1963	0	0	10,346,217
1964	0	0	10,346,217
1965	0	0	10,346,217
1966	0	0	10,346,217
1967	0	0	10,346,217
1968	0	0	10,346,217
1969	15,500	15,500	10,361,717
1970	1,413	1,413	10,363,130
1971	0	0	10,363,130
1972	0	0	10,363,130
1973	0	0	10,363,130
1974	0	0	10,363,130
1975	0	0	10,363,130
1976	0	0	10,363,130
1977	0	0	10,363,130
1978	0	0	10,363,130
1979	0	0	10,363,130
1980	0	0	10,363,130
1981	0	0	10,363,130
1982	0	0	10,363,130
1983	0	0	10,363,130
1984	0	0	10,363,130
1985	0	0	10,363,130
1986	0	0	10,363,130
1987	0	0	10,363,130
1988	0	0	10,363,130
1989	0	0	10,363,130
1990	0	0	10,363,130
1991	0	0	10,363,130
1992	0	0	10,363,130
1993	0	0	10,363,130
TRUMBULL COUNTY			
1835	100	-	100
1836	200	-	300
1837	300	-	600
1838	400	-	1,000
1839	500	-	1,500
1840	600	-	2,100
1841	700	-	2,800
1842	800	-	3,600
1843	1,000	-	4,600
1844	1,000	-	5,600
1845	5,000	-	10,600
1846	4,500	-	15,100
1847	5,000	-	20,100
1848	6,000	-	26,100
1849	7,000	-	33,100
1850	11,000	-	44,100
1851	15,000	-	59,100
1852	19,000	-	78,100
1853	24,000	-	102,100
1854	80,000	-	182,100
1855	140,000	-	322,100
1856	160,000	-	482,100
1857	172,000	-	654,100
1858	132,000	-	786,100
1859	90,000	-	876,100
1860	42,846	-	918,946
1861	80,000	-	998,946
1862	120,000	-	1,118,946
1863	160,000	-	1,278,946
1864	200,000	-	1,478,946
1865	240,000	-	1,718,946
1866	285,618	-	2,004,564
1867	153,604	-	2,158,168
1868	365,608	-	2,523,776
1869	400,000	-	2,923,776
1870	628,279	-	3,552,055
1871	370,000	-	3,922,055
1872	675,000	-	4,597,055
1873	700,000	-	5,297,055
1874	639,434	-	5,936,489
1875	749,059	-	6,685,548
1876	320,000	-	7,005,548
1877	541,626	-	7,547,174
1878	452,699	-	7,999,873
1879	1,064,737	-	9,064,610
1880	902,920	-	9,967,530
1881	457,600	-	10,425,130
1882	500,000	-	10,925,130
1883	457,612	-	11,382,742
1884	257,683	-	11,640,425
1885	264,517	-	11,904,942
1886	188,531	-	12,093,473
1887	167,989	-	12,261,462
1888	157,826	-	12,419,288
1889	106,480	-	12,525,768
1890	105,333	-	12,631,101
1891	64,173	-	12,695,274
1892	55,775	-	12,751,049
1893	23,152	-	12,774,201
1894	33,137	-	12,807,338
1895	29,809	-	12,837,147
1896	7,172	-	12,844,319
1897	10,838	-	12,855,157
1898	7,471	-	12,862,628
1899	11,059	-	12,873,687
1900	19,181	-	12,892,868
1901	12,148	-	12,905,016
1902	8,143	-	12,913,159
1903	8,476	-	12,921,635
1904	6,635	-	12,928,270
1905	3,591	-	12,931,861
1906	1,956	-	12,933,817
1907	1,895	-	12,935,712
1908	7,534	-	12,943,246
1909	5,405	-	12,948,651

Year	Total	Surface	Cumulative
TRUMBULL COUNTY (cont.)			
1910	4,716	-	12,953,367
1911	3,496	-	12,956,863
1912	2,989	-	12,959,852
1913	2,185	-	12,962,037
1914	1,113	0	12,963,150
1915	1,182	0	12,964,332
1916	1,116	0	12,965,448
1917	1,266	0	12,966,714
1918	1,750	0	12,968,464
1919	1,347	0	12,969,811
1920	2,614	0	12,972,425
1921	813	0	12,973,238
1922	1,324	0	12,974,562
1923	1,039	0	12,975,601
1924	0	0	12,975,601
1925	0	0	12,975,601
1926	0	0	12,975,601
1927	0	0	12,975,601
1928	0	0	12,975,601
1929	0	0	12,975,601
1930	0	0	12,975,601
1931	4,550	0	12,980,151
1932	2,287	0	12,982,438
1933	7,160	0	12,989,598
1934	0	0	12,989,598
1935	0	0	12,989,598
1936	0	0	12,989,598
1937	0	0	12,989,598
1938	0	0	12,989,598
1939	450	0	12,990,048
1940	251	0	12,990,299
1941	0	0	12,990,299
1942	56	0	12,990,355
1943	0	0	12,990,355
1944	0	0	12,990,355
1945	0	0	12,990,355
1946	0	0	12,990,355
1947	0	0	12,990,355
1948	0	0	12,990,355
1949	0	0	12,990,355
1950	0	0	12,990,355
1951	0	0	12,990,355
1952	0	0	12,990,355
1953	0	0	12,990,355
1954	0	0	12,990,355
1955	0	0	12,990,355
1956	0	0	12,990,355
1957	0	0	12,990,355
1958	0	0	12,990,355
1959	0	0	12,990,355
1960	0	0	12,990,355
1961	0	0	12,990,355
1962	0	0	12,990,355
1963	0	0	12,990,355
1964	0	0	12,990,355
1965	0	0	12,990,355
1966	0	0	12,990,355
1967	0	0	12,990,355
1968	0	0	12,990,355
1969	0	0	12,990,355
1970	0	0	12,990,355
1971	0	0	12,990,355
1972	0	0	12,990,355
1973	0	0	12,990,355
1974	0	0	12,990,355
1975	0	0	12,990,355
1976	0	0	12,990,355
1977	0	0	12,990,355
1978	0	0	12,990,355
1979	0	0	12,990,355
1980	0	0	12,990,355
1981	0	0	12,990,355
1982	0	0	12,990,355
1983	0	0	12,990,355
1984	0	0	12,990,355
1985	0	0	12,990,355
1986	0	0	12,990,355
1987	0	0	12,990,355
1988	0	0	12,990,355
1989	0	0	12,990,355
1990	0	0	12,990,355
1991	0	0	12,990,355
1992	0	0	12,990,355
1993	0	0	12,990,355

Year	Total	Surface	Cumulative
TUSCARAWAS COUNTY			
1810	50	-	50
1811	50	-	100
1812	100	-	200
1813	100	-	300
1814	100	-	400
1815	100	-	500
1816	150	-	650
1817	150	-	800
1818	150	-	950
1819	150	-	1,100
1820	200	-	1,300
1821	500	-	1,800
1822	800	-	2,600
1823	1,100	-	3,700
1824	1,500	-	5,200
1825	1,800	-	7,000
1826	2,200	-	9,200
1827	2,500	-	11,700
1828	2,800	-	14,500
1829	3,200	-	17,700
1830	3,600	-	21,300
1831	3,900	-	25,200
1832	4,200	-	29,400
1833	4,600	-	34,000
1834	5,000	-	39,000
1835	5,400	-	44,400
1836	5,800	-	50,200
1837	6,300	-	56,500
1838	6,928	-	63,428
1839	9,000	-	72,428
1840	11,689	-	84,117
1841	12,000	-	96,117
1842	13,000	-	109,117
1843	14,000	-	123,117
1844	13,000	-	136,117
1845	12,000	-	148,117
1846	11,000	-	159,117
1847	11,000	-	170,117
1848	11,401	-	181,518
1849	12,000	-	193,518
1850	14,000	-	207,518
1851	16,000	-	223,518
1852	18,000	-	241,518
1853	20,000	-	261,518
1854	40,000	-	301,518
1855	50,000	-	351,518
1856	61,000	-	412,518
1857	71,836	-	484,354
1858	51,000	-	535,354
1859	30,000	-	575,061
1860	9,707	-	575,061
1861	15,000	-	590,061
1862	21,000	-	611,061
1863	26,000	-	637,061
1864	32,000	-	669,061
1865	37,000	-	706,061
1866	43,445	-	749,506
1867	25,638	-	775,144
1868	51,570	-	826,714
1869	81,000	-	907,714
1870	110,435	-	1,018,149
1871	83,000	-	1,101,149
1872	100,000	-	1,201,149
1873	100,000	-	1,301,149
1874	111,164	-	1,412,313
1875	107,000	-	1,519,313
1876	82,909	-	1,602,222
1877	112,523	-	1,714,745
1878	177,482	-	1,892,227
1879	255,495	-	2,147,722
1880	276,223	-	2,423,945
1881	364,000	-	2,787,945
1882	450,000	-	3,237,945
1883	364,066	-	3,602,011
1884	317,141	-	3,919,152
1885	285,545	-	4,204,697
1886	267,666	-	4,472,363
1887	506,466	-	4,978,829
1888	546,117	-	5,524,946
1889	643,866	-	6,168,812
1890	565,105	-	6,733,917
1891	733,374	-	7,467,291
1892	887,106	-	8,354,397
1893	794,681	-	9,149,078
1894	651,903	-	9,800,981
1895	753,286	-	10,554,267
1896	613,563	-	11,167,830
1897	730,473	-	11,898,303
1898	950,913	-	12,849,216
1899	1,053,238	-	13,902,454

Year	Total	Surface	Cumulative
TUSCARAWAS COUNTY (cont.)			
1900	1,267,185	-	15,169,639
1901	1,324,570	-	16,494,209
1902	1,577,654	-	18,071,863
1903	1,328,951	-	19,400,814
1904	1,296,876	-	20,697,690
1905	1,361,394	-	22,059,084
1906	1,429,565	-	23,488,649
1907	1,776,566	-	25,265,215
1908	1,331,248	-	26,596,463
1909	1,513,900	-	28,110,363
1910	811,782	-	28,922,145
1911	670,251	-	29,592,396
1912	1,311,301	-	30,903,697
1913	1,387,026	-	32,290,723
1914	906,459	0	33,197,182
1915	1,400,163	23,449	34,597,345
1916	1,547,110	36,830	36,144,455
1917	1,788,800	44,338	37,933,255
1918	2,120,827	24,360	40,054,082
1919	1,595,620	148,950	41,649,702
1920	2,231,345	353,212	43,881,047
1921	1,207,139	52,101	45,088,186
1922	1,388,546	204,057	46,476,732
1923	1,345,540	85,403	47,822,272
1924	1,073,558	39,232	48,895,830
1925	1,084,820	35,653	49,980,650
1926	1,153,600	15,479	51,134,250
1927	996,621	16,909	52,130,871
1928	961,740	24,231	53,092,611
1929	1,002,074	25,658	54,094,685
1930	675,093	28,063	54,769,778
1931	703,245	28,774	55,473,023
1932	768,369	9,528	56,241,392
1933	965,990	12,822	57,207,382
1934	898,244	12,923	58,105,626
1935	1,145,265	17,070	59,250,891
1936	1,219,548	31,847	60,470,439
1937	1,195,264	72,855	61,665,703
1938	669,651	104,484	62,335,354
1939	952,340	290,618	63,287,694
1940	1,184,404	474,561	64,472,098
1941	1,500,082	690,994	65,972,180
1942	1,606,156	764,546	67,578,336
1943	1,456,231	652,283	69,034,567
1944	1,571,811	786,846	70,606,378
1945	1,716,440	920,613	72,322,818
1946	1,627,366	864,607	73,950,184
1947	2,017,055	1,017,706	75,967,239
1948	1,775,234	775,212	77,742,473
1949	1,607,547	853,010	79,350,020
1950	2,274,528	1,265,798	81,624,548
1951	2,456,750	1,278,455	84,081,298
1952	2,264,075	1,262,136	86,345,373
1953	2,267,184	1,352,844	88,612,557
1954	2,269,927	1,327,608	90,882,484
1955	2,129,467	1,222,341	93,011,951
1956	2,248,258	1,443,437	95,260,209
1957	2,588,404	1,781,535	97,848,613
1958	2,429,726	1,781,010	100,278,339
1959	2,492,110	1,841,006	102,770,449
1960	2,436,397	1,872,006	105,206,846
1961	2,243,528	1,681,585	107,450,374
1962	2,446,209	1,857,486	109,896,583
1963	2,396,433	2,037,096	112,293,016
1964	2,506,713	2,152,621	114,799,729
1965	2,960,135	2,386,047	117,759,864
1966	3,171,612	2,545,279	120,931,476
1967	2,923,797	2,401,560	123,855,273
1968	2,522,563	2,184,878	126,377,836
1969	2,502,774	2,241,680	128,880,610
1970	2,187,629	1,865,145	131,068,239
1971	2,476,794	2,245,342	133,545,033
1972	1,996,693	1,927,142	135,541,726
1973	1,499,501	1,499,501	137,041,227
1974	1,454,461	1,454,461	138,495,688
1975	1,496,948	1,484,598	139,992,636
1976	1,516,003	1,492,733	141,508,639
1977	1,732,068	1,710,842	143,240,707
1978	2,106,350	2,106,350	145,347,057
1979	1,493,427	1,493,427	146,840,484
1980	1,207,361	1,207,361	148,047,845
1981	1,230,292	1,230,292	149,278,137
1982	1,095,137	1,095,137	150,373,274
1983	1,411,789	1,411,789	151,785,063
1984	1,594,545	1,594,545	153,379,608
1985	1,731,749	1,731,749	155,111,357
1986	1,648,980	1,648,980	156,760,337
1987	1,782,774	1,782,774	158,543,111
1988	2,082,623	2,082,623	160,625,734
1989	2,104,535	2,104,535	162,730,269
1990	1,949,601	1,949,601	164,679,870
1991	1,923,964	1,923,964	166,603,834
1992	1,888,644	1,888,644	168,492,478
1993	2,388,339	2,388,339	170,880,817
VINTON COUNTY			
1851	2,000	-	2,000
1852	6,000	-	8,000
1853	12,000	-	20,000
1854	60,000	-	80,000
1855	56,000	-	136,000
1856	52,000	-	188,000
1857	48,000	-	236,000
1858	47,700	-	283,700
1859	47,400	-	331,100
1860	47,100	-	378,200
1861	46,800	-	425,000
1862	46,500	-	471,500
1863	46,200	-	517,700
1864	45,900	-	563,600
1865	45,600	-	609,200
1866	45,300	-	654,500
1867	45,000	-	699,500
1868	44,700	-	744,200
1869	44,400	-	788,600
1870	44,100	-	832,700
1871	43,500	-	876,200
1872	43,026	-	919,226
1873	50,827	-	970,053
1874	45,728	-	1,015,781
1875	36,356	-	1,052,137
1876	48,580	-	1,100,717
1877	35,766	-	1,136,483
1878	47,436	-	1,183,919
1879	48,684	-	1,232,603
1880	61,908	-	1,294,511
1881	59,800	-	1,354,311
1882	60,000	-	1,414,311
1883	55,862	-	1,470,173
1884	69,740	-	1,539,913
1885	77,127	-	1,617,040
1886	60,013	-	1,677,053
1887	89,727	-	1,766,780
1888	108,695	-	1,875,475
1889	98,749	-	1,974,224
1890	86,611	-	2,060,835
1891	104,366	-	2,165,201
1892	88,305	-	2,253,506
1893	76,144	-	2,329,650
1894	62,496	-	2,392,146
1895	61,068	-	2,453,214
1896	46,503	-	2,499,717
1897	75,445	-	2,575,162
1898	85,144	-	2,660,306
1899	71,072	-	2,731,378
1900	77,231	-	2,808,609
1901	88,024	-	2,896,633
1902	110,423	-	3,007,056
1903	154,934	-	3,161,990
1904	240,524	-	3,402,514
1905	224,275	-	3,626,789
1906	226,904	-	3,853,693
1907	249,475	-	4,103,168
1908	183,542	-	4,286,710
1909	128,928	-	4,415,638
1910	159,006	-	4,574,644
1911	129,986	-	4,704,630
1912	100,084	-	4,804,714
1913	118,007	-	4,922,721
1914	72,432	0	4,995,153
1915	105,806	0	5,100,959
1916	106,376	0	5,207,335
1917	212,940	0	5,420,275
1918	377,892	0	5,798,167
1919	166,881	0	5,965,048
1920	340,866	10,200	6,305,914
1921	95,118	0	6,401,032
1922	130,058	0	6,531,090
1923	111,181	0	6,642,271
1924	86,043	0	6,728,314
1925	71,019	0	6,799,333
1926	71,943	0	6,871,276
1927	78,576	130	6,949,852
1928	88,376	0	7,038,228
1929	61,059	0	7,099,287

Year	Total	Surface	Cumulative
VINTON COUNTY (cont.)			
1930	33,597	0	7,132,884
1931	78,202	0	7,211,086
1932	23,415	0	7,234,501
1933	35,675	1,686	7,270,176
1934	123,130	86,720	7,393,306
1935	91,854	59,348	7,485,160
1936	94,358	54,364	7,579,518
1937	87,962	51,774	7,667,480
1938	67,166	33,272	7,734,646
1939	122,175	75,750	7,856,821
1940	104,677	52,890	7,961,498
1941	109,261	61,071	8,070,759
1942	74,216	38,980	8,144,975
1943	87,189	48,662	8,232,164
1944	134,438	84,737	8,366,602
1945	124,830	77,280	8,491,432
1946	180,698	138,243	8,672,130
1947	430,600	351,637	9,102,730
1948	351,411	263,935	9,454,141
1949	442,874	380,321	9,897,015
1950	397,213	313,229	10,294,228
1951	264,696	218,170	10,558,924
1952	220,704	172,335	10,779,628
1953	195,682	163,419	10,975,310
1954	171,555	131,181	11,146,865
1955	195,023	136,456	11,341,888
1956	168,269	110,081	11,510,157
1957	167,165	110,068	11,677,322
1958	204,735	144,697	11,882,057
1959	274,381	201,725	12,156,438
1960	254,532	203,956	12,410,970
1961	151,051	108,399	12,562,021
1962	107,045	58,718	12,669,066
1963	52,473	25,194	12,721,539
1964	160,787	134,600	12,882,326
1965	140,853	123,180	13,023,179
1966	155,414	140,493	13,178,593
1967	227,130	221,936	13,405,723
1968	226,826	221,614	13,632,549
1969	286,777	285,342	13,919,326
1970	605,640	605,570	14,524,966
1971	715,867	715,867	15,240,833
1972	581,488	581,488	15,822,321
1973	573,959	573,959	16,396,280
1974	1,124,757	1,046,927	17,521,037
1975	1,584,415	1,203,679	19,105,452
1976	2,060,236	1,515,582	21,165,688
1977	2,326,289	1,684,431	23,491,977
1978	2,377,156	1,716,289	25,869,133
1979	2,564,905	1,478,253	28,434,038
1980	2,817,647	1,296,483	31,251,685
1981	2,676,088	1,460,275	33,927,773
1982	2,420,094	996,823	36,347,867
1983	1,640,128	871,989	37,987,995
1984	2,235,081	1,105,061	40,223,076
1985	1,596,510	482,813	41,819,586
1986	1,784,578	714,535	43,604,164
1987	1,959,766	910,524	45,563,930
1988	2,106,878	1,217,364	47,670,808
1989	2,200,849	1,476,756	49,871,657
1990	2,444,537	1,371,444	52,316,194
1991	2,618,565	1,401,644	54,934,759
1992	3,642,356	2,359,646	58,577,115
1993	2,950,455	2,097,197	61,527,570

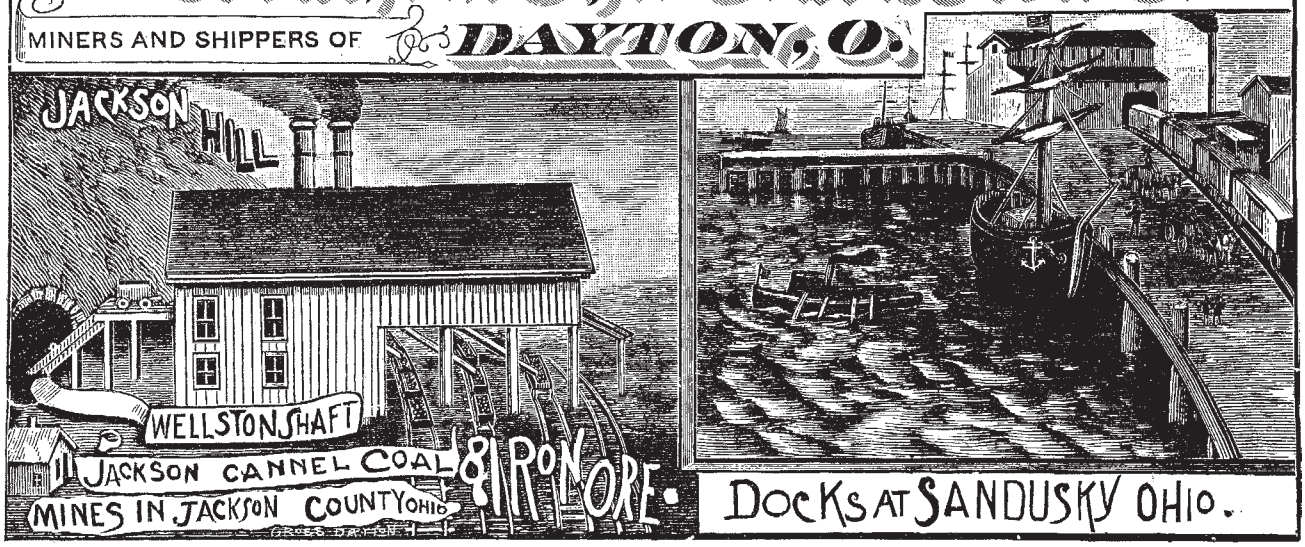
Year	Total	Surface	Cumulative
WASHINGTON COUNTY			
1867	2,000	-	2,000
1868	4,000	-	6,000
1869	6,000	-	12,000
1870	9,000	-	21,000
1871	12,000	-	33,000
1872	13,057	-	46,057
1873	13,384	-	59,441
1874	6,662	-	66,103
1875	12,425	-	78,528
1876	7,122	-	85,650
1877	8,181	-	93,831
1878	8,649	-	102,480
1879	26,600	-	129,080
1880	31,450	-	160,530
1881	10,000	-	170,530
1882	15,000	-	185,530
1883	7,380	-	192,910
1884	5,600	-	198,510
1885	5,000	-	203,510
1886	5,500	-	209,010
1887	1,880	-	210,890
1888	2,432	-	213,322
1889	2,770	-	216,092
1890	3,835	-	219,927
1891	3,796	-	223,723
1892	3,480	-	227,203
1893	1,936	-	229,139
1894	2,000	-	231,139
1895	4,533	-	235,672
1896	3,646	-	239,318
1897	2,974	-	242,292
1898	3,634	-	245,926
1899	2,099	-	248,025
1900	2,679	-	250,704
1901	1,738	-	252,442
1902	3,930	-	256,372
1903	4,000	-	260,372
1904	3,800	-	264,172
1905	3,600	-	267,772
1906	1,929	-	269,701
1907	691	-	270,392
1908	1,304	-	271,696
1909	1,232	-	272,928

Year	Total	Surface	Cumulative
1910	0	-	272,928
1911	355	-	273,283
1912	523	-	273,806
1913	615	-	274,421
1914	615	0	275,036
1915	653	0	275,689
1916	421	0	276,110
1917	1,137	0	277,247
1918	2,498	0	279,745
1919	4,543	0	284,288
1920	16,687	0	300,975
1921	5,719	0	306,694
1922	8,276	0	314,970
1923	3,903	0	318,873
1924	1,619	0	320,492
1925	2,056	0	322,548
1926	3,844	0	326,392
1927	21,310	0	347,702
1928	1,112	0	348,814
1929	4,117	0	352,931
1930	6,213	0	359,144
1931	4,280	0	363,424
1932	529	0	363,953
1933	6,388	0	370,341
1934	6,033	0	376,374
1935	17,680	0	394,054
1936	6,825	128	400,879
1937	2,556	0	403,435
1938	12,645	0	416,080
1939	6,972	0	423,052
1940	1,986	0	425,038
1941	7,618	0	432,656
1942	9,003	0	441,659
1943	1,824	0	443,483
1944	785	0	444,268
1945	1,293	0	445,561
1946	357	0	445,918
1947	686	0	446,604
1948	190,587	190,587	637,191
1949	168,704	168,704	805,895
1950	136,533	136,533	942,428
1951	106,896	106,896	1,049,324
1952	167,797	167,797	1,217,121
1953	138,492	138,492	1,355,613
1954	67,217	67,217	1,422,830
1955	151,053	151,053	1,573,883
1956	243,746	243,746	1,817,629
1957	250,055	250,055	2,067,684
1958	160,126	160,126	2,227,810
1959	138,984	138,984	2,366,794
1960	95,126	95,126	2,461,920
1961	73,961	73,961	2,535,881
1962	37,385	37,385	2,573,266
1963	6,030	6,030	2,579,296
1964	2,769	2,769	2,582,065
1965	116,695	116,695	2,698,760
1966	199,970	199,970	2,898,730
1967	177,396	177,396	3,076,126
1968	106,586	106,586	3,182,712
1969	117,274	117,274	3,299,986
1970	35,423	35,423	3,335,409
1971	227,569	227,569	3,562,978
1972	205,734	205,734	3,768,712
1973	0	0	3,768,712
1974	0	0	3,768,712

Year	Total	Surface	Cumulative
WASHINGTON COUNTY (cont.)			
1975	75,738	75,738	3,844,450
1976	84,269	84,269	3,928,719
1977	198,516	198,516	4,127,235
1978	501,051	501,051	4,628,286
1979	469,614	469,614	5,097,900
1980	243,348	243,348	5,341,248
1981	197,573	197,573	5,538,821
1982	144,182	144,182	5,683,003
1983	267,484	267,484	5,950,487
1984	251,520	251,520	6,202,007
1985	186,268	186,268	6,388,275
1986	181,202	181,202	6,569,477
1987	206,187	206,187	6,775,664
1988	159,730	159,730	6,935,394
1989	65,382	65,382	7,000,776
1990	64,281	64,281	7,065,057
1991	30,970	30,970	7,096,027
1992	29,576	29,576	7,125,603
1993	0	0	7,125,603
WAYNE COUNTY			
1840	400	-	400
1841	400	-	800
1842	400	-	1,200
1843	400	-	1,600
1844	400	-	2,000
1845	400	-	2,400
1846	400	-	2,800
1847	400	-	3,200
1848	400	-	3,600
1849	7,000	-	10,600
1850	15,000	-	25,600
1851	23,000	-	48,600
1852	31,000	-	79,600
1853	40,000	-	119,600
1854	60,000	-	179,600
1855	60,000	-	239,600
1856	60,000	-	299,600
1857	60,000	-	359,600
1858	59,000	-	418,600
1859	59,000	-	477,600
1860	59,000	-	536,600
1861	59,000	-	595,600
1862	58,000	-	653,600
1863	58,000	-	711,600
1864	58,000	-	769,600
1865	58,000	-	827,600
1866	57,088	-	884,688
1867	34,371	-	919,059
1868	46,423	-	965,482
1869	34,000	-	999,482
1870	21,650	-	1,021,132
1871	46,000	-	1,067,132
1872	80,000	-	1,147,132
1873	150,000	-	1,297,132
1874	159,136	-	1,456,268
1875	80,291	-	1,536,559
1876	58,340	-	1,594,899
1877	73,096	-	1,667,995
1878	118,369	-	1,786,364
1879	108,677	-	1,895,041
1880	127,707	-	2,022,748
1881	148,800	-	2,171,548
1882	200,000	-	2,371,548
1883	148,847	-	2,520,395
1884	120,571	-	2,640,966
1885	81,507	-	2,722,473
1886	109,057	-	2,831,530
1887	105,150	-	2,936,680
1888	91,157	-	3,027,837
1889	86,549	-	3,114,386
1890	71,431	-	3,185,817
1891	91,553	-	3,277,370
1892	80,188	-	3,357,558
1893	64,934	-	3,422,492
1894	32,142	-	3,454,634
1895	119,015	-	3,573,649
1896	69,058	-	3,642,707
1897	84,052	-	3,726,759
1898	41,598	-	3,768,357
1899	18,557	-	3,786,914
1900	45,566	-	3,832,480
1901	31,530	-	3,864,010
1902	94,015	-	3,958,025
1903	97,952	-	4,055,977
1904	123,520	-	4,179,497
1905	165,224	-	4,344,721
1906	204,573	-	4,549,294
1907	204,773	-	4,754,067
1908	125,525	-	4,879,592
1909	86,987	-	4,966,579
1910	164,724	-	5,131,303
1911	202,329	-	5,333,632
1912	184,381	-	5,518,013
1913	93,575	-	5,611,588
1914	90,375	0	5,701,963
1915	70,754	0	5,772,717
1916	84,996	0	5,857,713
1917	65,762	0	5,923,475
1918	33,410	0	5,956,885
1919	62,580	0	6,019,465
1920	70,837	0	6,090,302
1921	18,687	0	6,108,989
1922	28,413	0	6,137,402
1923	6,781	0	6,144,183
1924	7,289	1,488	6,151,472
1925	3,021	0	6,154,493
1926	639	0	6,155,132
1927	924	0	6,156,056
1928	901	0	6,156,957
1929	7,429	0	6,164,386
1930	6,213	0	6,170,599
1931	4,280	0	6,174,879
1932	11,821	0	6,186,700
1933	21,592	0	6,208,292
1934	8,612	0	6,216,904
1935	8,809	3,373	6,225,713
1936	8,377	3,451	6,234,090
1937	15,938	2,187	6,250,028
1938	20,514	0	6,270,542
1939	18,810	0	6,289,352
1940	20,773	4,535	6,310,125
1941	24,721	18,582	6,334,846
1942	20,125	20,125	6,354,971
1943	10,682	10,682	6,365,653
1944	0	0	6,365,653
1945	18,517	18,517	6,384,170
1946	39,740	39,740	6,423,910
1947	89,156	89,156	6,513,066
1948	108,955	108,955	6,622,021
1949	128,875	128,875	6,750,896
1950	119,483	119,483	6,870,379
1951	104,949	104,949	6,975,328
1952	101,098	101,098	7,076,426
1953	117,035	117,035	7,193,461
1954	113,164	113,164	7,306,625
1955	108,741	108,741	7,415,366
1956	121,919	121,919	7,537,285
1957	109,259	109,259	7,646,544
1958	90,723	90,723	7,737,267
1959	86,897	86,897	7,824,164
1960	58,995	58,995	7,883,159
1961	75,479	75,479	7,958,638
1962	52,605	52,605	8,011,243
1963	81,951	81,951	8,093,194
1964	52,062	52,062	8,145,256
1965	45,250	45,250	8,190,506
1966	24,480	24,480	8,214,986
1967	17,348	17,348	8,232,334
1968	27,902	27,902	8,260,236
1969	31,362	31,362	8,291,598
1970	38,484	38,484	8,330,082
1971	30,317	30,317	8,360,399
1972	31,149	31,149	8,391,548
1973	46,326	46,326	8,437,874
1974	54,645	54,645	8,492,519
1975	52,220	52,220	8,544,739
1976	37,430	37,430	8,582,169
1977	33,922	33,922	8,616,091
1978	61,078	61,078	8,677,169
1979	30,681	30,681	8,707,850
1980	58,224	58,224	8,766,074
1981	60,021	60,021	8,826,095
1982	81,328	81,328	8,907,423
1983	53,974	53,974	8,961,397
1984	28,623	28,623	8,990,020
1985	11,927	11,927	9,001,947
1986	0	0	9,001,947
1987	14,592	14,592	9,016,539
1988	16,565	16,565	9,033,104
1989	31,910	31,910	9,065,014
1990	34,022	34,022	9,099,036
1991	21,278	21,278	9,120,314
1992	11,975	11,975	9,132,289
1993	3,169	3,169	9,135,458

The Southern Ohio Coal & Iron Co.

MINERS AND SHIPPERS OF DAYTON, O.



A.

DAVID PATTERSON, President. J. E. NEWELL, Vice-President, Chicago. THOS. JOHNSON, Sec'y and Treas.

THE New Pittsburgh Coal Co.

MINERS AND SHIPPERS OF

NOCKING COAL

General Office: NELSONVILLE, O.

WESTERN OFFICE:

No. 225 Dearborn Street,

CHICAGO.

B.

CHAPMAN COAL CO.

Miners and Shippers of the Celebrated

JACKSON HILL COAL

None Better in the Market. Try it.

Capacity 1,000 Tons Daily. Coal Loaded in Box Cars When so Ordered, and Prompt Shipments Guaranteed.

OFFICE AND MINES AT JACKSON, OHIO.

C.

GENERAL OFFICE, COLUMBUS, OHIO.
J. S. MORTON, President. S. W. BRIGHT, 2d Vice Pres.
J. DERTHICK, Treasurer. J. F. STONE, Auditor.

TOLEDO, OHIO.
G. G. HADLEY, V. Pres. & Mng'r.
J. E. MARTIN, Secretary.

THE SUNDAY CREEK COAL COMPANY

MINES ON THE TOLEDO AND OHIO CENTRAL RAILWAY

Capacity, 5,000 Tons Daily.

SUNDAY CREEK, ANTHRACITE AND BLACKSMITHING

• • COAL. • •

PROMPT SHIPMENTS GUARANTEED BY LAKE OR RAIL.

T. C. LOUCKS, GEN'L WESTERN AGENT.

TELEPHONE 1321. 113 and 115 Phenix Bld'g, CHICAGO.

Yard, 470 South Clark Street.

D.

THE OLD RELIABLE!

PRIME WINTER WHITE

MINERS' OIL

CHEAPEST AND BEST

SEND IN YOUR ORDERS

A. G. HARBAUGH & CO.

CLEVELAND, OHIO.

E.

S. J. PATTERSON. J. A. MURPHY. J. W. LOWE.

THE TOM CORWIN COAL COMPANY
(LIMITED)
MINERS AND SHIPPERS OF
The Wellston Shaft Coal
Glen Roy, Jackson County, OHIO.
MAIN OFFICE, DAYTON, OHIO.
Shipments via Dayton and Ironton R. R. and Connections, Gondolas or Box Cars.
CORRESPONDENCE SOLICITED.

F.

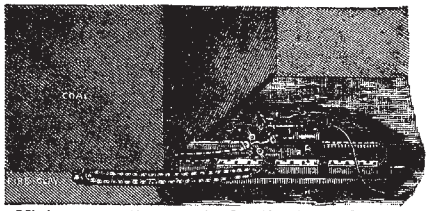
FLUHART COAL & MINING CO.
Miners and Shippers of the Celebrated
Wellston Jackson County, Shaft Coal.
Our Coal has no Superior for Steam or Domestic Purposes.
Operating Shafts Nos. 1 and 2 Producing 1,000 Tons Daily.
OFFICE: WELLSTON, OHIO.
MICHAEL J. KELLY,
NORTHWESTERN SALES AGENT,
14th and Dearborn Streets, CHICAGO, ILL.
NOTE:—Our Coal will not mash up in handling, is not so soft as many Jackson County Coals, but is hard, MINES COARSE, and is exceptionally pure and free of all foreign matter.

G.

ELEVATORS,
CONVEYORS
and CARRIERS,
FOR RAPID AND ECONOMICAL HANDLING OF
Coal, Ores, Broken Stone, Clay, Brick, Tile, Etc.

JEFFREY
Rotary Power
COAL DRILL.
Drills a hole 1¾ to 2 inches in diameter, to a depth of 6 feet, in four minutes.
Send for Illustrated 1888 Catalogue.

JEFFREY COAL
Mining Machine,
THE GREATEST INVENTION OF THE AGE.
Will undercut from 600 to 1,000 square feet of floor per 10 hours with one man and helper.



Mining properties examined, estimates made and machines furnished subject to sale after having worked on the basis of the estimate.

JEFFREY MANUFACTURING COMPANY, 143 EAST FIRST AVENUE, COLUMBUS, OHIO.

H.

General Offices, Columbus, Ohio.
THE OHIO COAL EXCHANGE.
L. R. DOTY, Pres't.
W. B. BROOKS, V.-Pres't.
F. S. BROOKS, Sec'y and Treas.
HOCKING COAL
THE OHIO COAL EXCHANGE. CHICAGO OFFICE JNO. H. WALKER, WEST. AGT. 85 WASHINGTON ST.
Coal Loaded in Box Cars at Mines a Specialty.

I.

S. J. PATTERSON
WESTERN SHIPPER OF
Anthracite and Blossburg
COAL
DAYTON, - - OHIO.

J.

Overleaf: Composite illustration of coal-mine-related advertisements from The Black Diamond for selected companies operating in Ohio during 1888 and 1889. A: 1889, v. 3, no. 4, p. 862; B and E: 1888, v. 4, no. 9, p. 289; C and D: 1888, v. 4, no. 8, p. 266; F: 1888, v. 4, no. 8, p. 254; G, H, and J: 1889, v. 4 no. 12, 409; I: 1888, v. no. 6, p. 2.


OHIO
Department of Natural Resources