

Kentucky Geological Survey
University of Kentucky, Lexington

Rocks to Roads to Ruin: A Brief History of Western Kentucky's Rock-Asphalt Industry, 1888–1957

J. Richard Bowersox

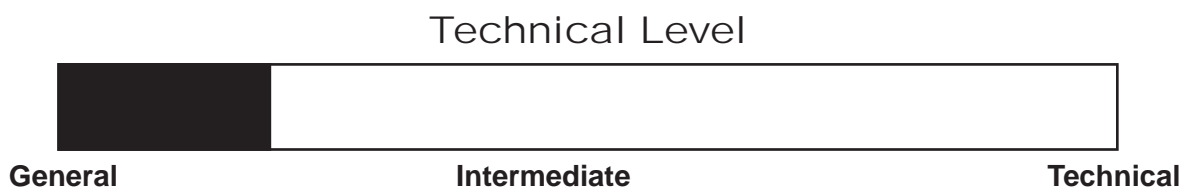


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On the cover

Abandoned quarry of the American Standard Asphalt Co. north of Russellville, Logan County, in 1919. Photo by S.D. Averitt from Miller (1919).

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Rocks to Roads to Ruin: A Brief History of Western Kentucky's Rock-Asphalt Industry, 1888–1957

J. Richard Bowersox

Abstract

The history of western Kentucky's rock-asphalt industry required substantial research of primary sources to correct the disjointed and often conflicting record published to date. Its history is checkered with characters from visionary entrepreneurs and ambitious businessmen to financial scoundrels. The earliest evidence of exploitation of bitumen resources at the surface in western Kentucky is in Native American artifacts recovered from several sites. Early settlers in the region used heavy oil and bitumen found in seeps as lubricants and wood preservatives, among other uses. The commercial value of the widespread western Kentucky rock-asphalt deposits was first recognized in the 1880's, leading to the development of a 70-year industry with a product used to pave roads in much of the midwestern and eastern United States, and in Canada, Cuba, and Brazil. From the industry's inception in 1889 to its closure in 1957, 19 companies developed rock-asphalt deposits in the Big Clifty Sandstone and Caseyville Formation in Grayson, Edmonson, Logan, Breckinridge, and Hardin Counties, although only about half of these companies were in business more than 6 years. The longest active was the Kentucky Rock Asphalt Co., in business from 1917 to 1957. Peak annual production was reached in 1927 when eight operators produced 344,220 tons, and an estimated total of 6.04 million tons from all Kentucky rock asphalt, containing an estimated 2.33 million barrels of bitumen, produced throughout the industry's entire history. Considering, however, the enormous volume of heavy oil and bitumen resources estimated to be in surface and shallow subsurface deposits in the rock-asphalt-producing counties, only about 0.1 percent of these resources have been produced to date.

Introduction

The western Kentucky industry of rock asphalt as a road-paving product had a checkered history over its development period of 1888 to 1957. Despite the huge resource available in surface and near-surface deposits in the Big Clifty Sandstone and Caseyville Formation (Fig. 1A, B), only 19 companies, including successors-in-interest, can be documented as having developed rock-asphalt deposits (Fig. 2). Of these, 10 operated for more than 5 years (Fig. 2). In Jillson's (1921a, p. 57) article promoting Kentucky rock asphalt, he stated

A study of the indisputable qualities of adaptability, convenience, cheapness, satisfaction, noiselessness, and life of roads constructed of Kentucky Asphalt Rock will invariably lead to but one conclusion—first choice. The qualities and virtues of this material are almost without number, and the disadvantages, if any, are inconsequential.

The primary value of a Kentucky rock-asphalt road surface was its skid resistance (Havens and Williams, 1956). In fact, though, the physical properties of Kentucky rock asphalt, as a natural product, were inconsistent, and installation required years of trial, and mostly error, to produce an acceptable

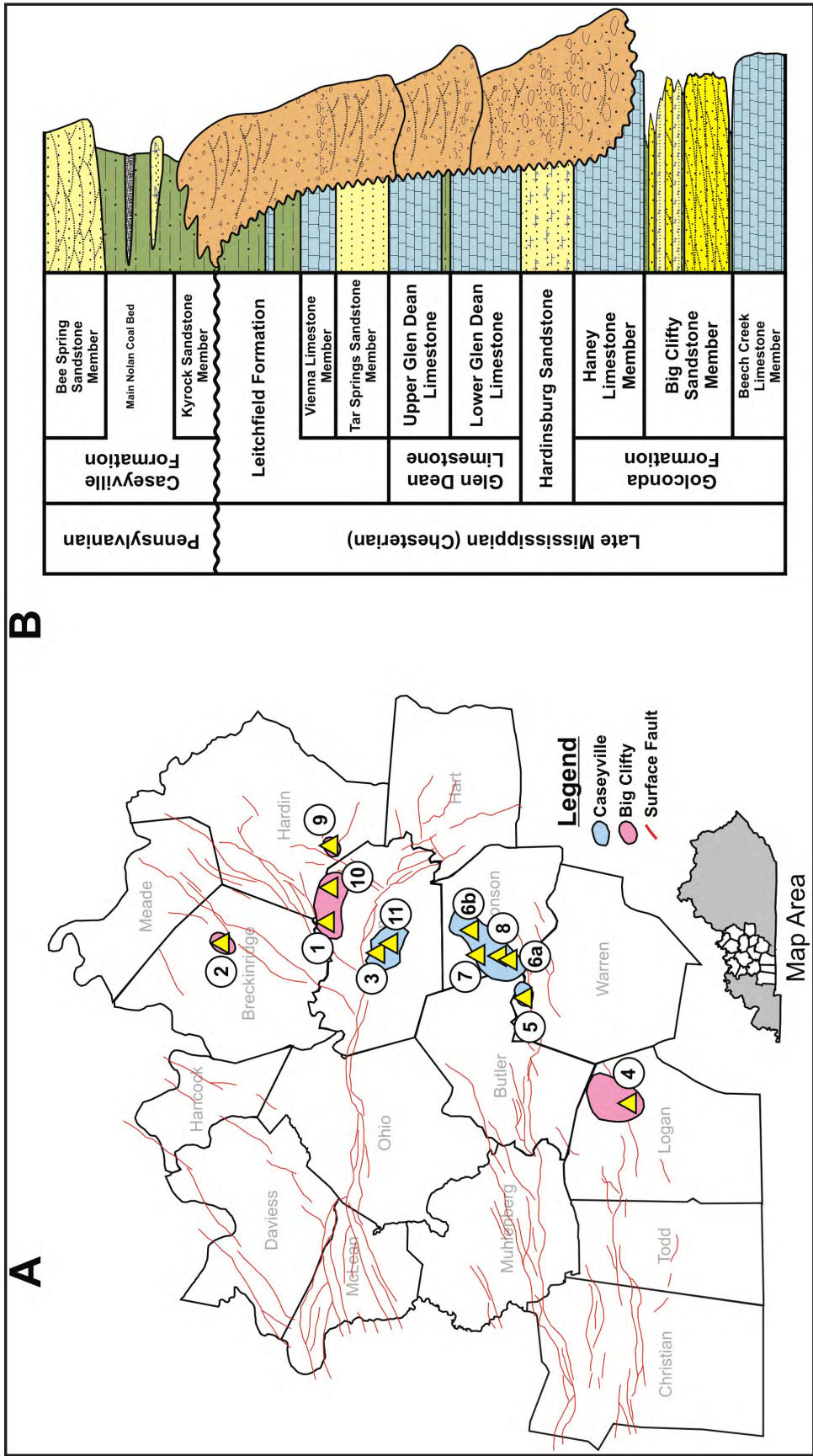


Figure 1. Locations of historic Kentucky rock-asphalt mines and the formations they developed. (A) Locations of mines and quarries are numbered and the rock-asphalt zones in outcrop are color-coded. Red areas developed rock-asphalt deposits in the Big Clifty Sandstone and blue area is the developed rock-asphalt deposits in the Caseville Formation. From Eldridge (1901), Richardson (1924), Clark and Crittenden (1965), Gildersleeve (1966, 1978), McGrain (1976), Williams and others (1982), this study. Nineteen rock-asphalt companies, including successor companies, were documented that operated in 11 productive areas (see text): 1. American Bituminous Rock Co. and Federal Asphalt Co. 2. Breckinridge Rock Asphalt Co., Garfield Rock Asphalt Co., and Gar-Rock Asphalt Co. 3. Schillinger Brothers. 4. American Standard Asphalt Co. 5. Green River Asphalt Co. 6a. Wadsworth Stone and Paving Co. 6b. Kentucky Rock Asphalt Co. 7. Natural Rock Asphalt Co. and Standard Rock Asphalt Co. 8. Rock Asphalt Co. of America, United Rock Asphalt Co., and Diamond Rock Asphalt Co. 9. Ohio Valley Rock Asphalt Co. 10. Continental Rock Asphalt Co. and Crown Rock Asphalt Co. 11. Black Rock Asphalt Co. (B) Upper Mississippian (Chesterian Series) and Lower Pennsylvanian stratigraphy of western Kentucky (after McGrain, 1976). Rock-asphalt deposits were first developed in the Big Clifty Sandstone in northern Grayson County in 1889 (Fig. 1A, location 1) and in the Caseville Formation in Warren County in 1900 (Fig. 1A, location 5).

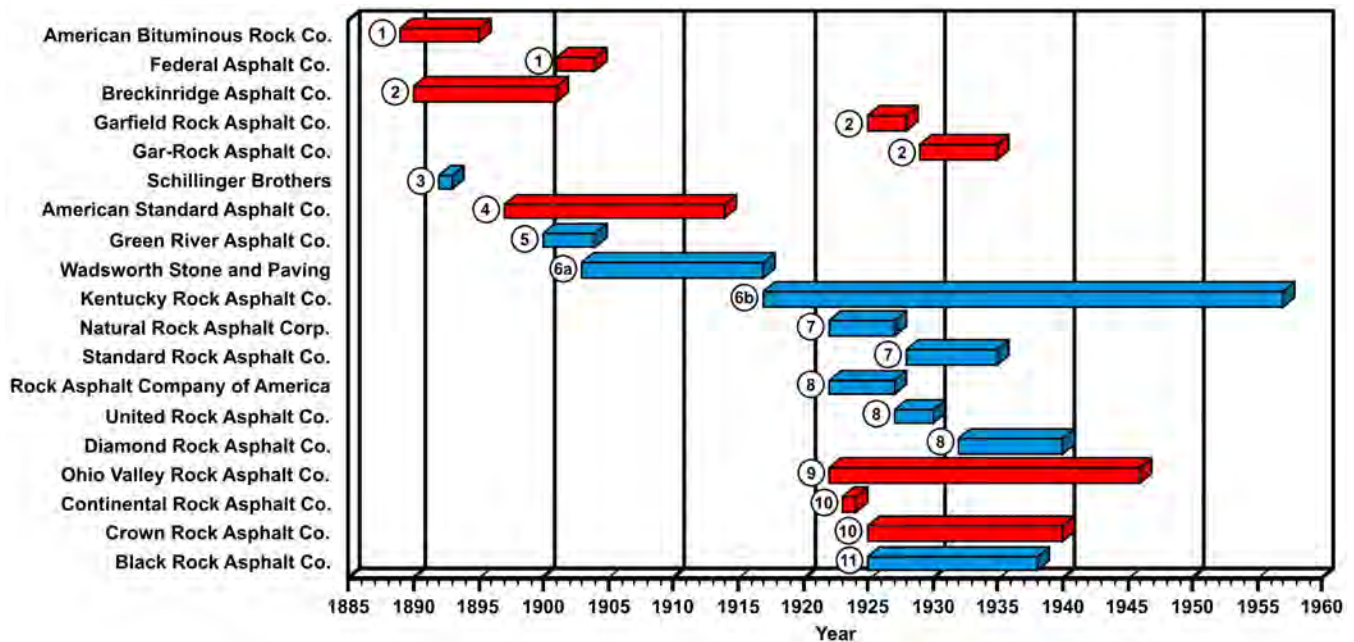


Figure 2. Timelines showing the years in operation for the 19 rock-asphalt companies listed in Figure 1A. Red bars were operating in the Big Clifty Sandstone and blue bars were operating in the Caseyville Formation. Numbers keyed to locations in Figure 1A. Data compiled from Orton (1891), Parker (1892, 1893a, b, 1895, 1896, 1897, 1898, 1899, 1901), Parker and Richardson (1894), Eldridge (1901), Burk (1903), Hovey (1904, 1905, 1906), Taff (1907, 1908), Day (1911a, b, 1912, 1913, 1914), Northrop (1916, 1917, 1919, 1920), Jillson (1921b), Osborn (1921), Cottrell (1922, 1923, 1924, 1925, 1926, 1927), Weller (1927), Hopkins and Coons (1928, 1930), Hopkins (1929), Redfield (1930, 1932a, b, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1941, 1943a, b, 1945, 1946, 1947, 1948, 1949), Redfield and Spencer (1949, 1951), Redfield and Sims (1953), Redfield and Granacher (1954), Coumbe (1955), Mote and Kaufman (1955, 1956), Coumbe and Avery (1956), Creason (1957), Reed and McFarlan (1957, 1958), and Reed and others (1959).

road surface (Havens and Williams, 1956). Havens and Williams (1956, p. iv-v) noted that

in its customary use, it has failed to overcome certain material deficiencies which in some cases have been detrimental to its performance. In the most serious cases, telltale signs of scaling, stripping, or sanding away have appeared within the first few days to a month after paving....As a result...the material has been either threatened with condemnation, or in instances actually condemned, on the basis of modern highway paving requirements.

These were issues that would challenge the Kentucky rock-asphalt industry from the first road paved with it in Brooklyn, N.Y., in 1889 (Tillson, 1900), to the closure of the last quarry in Edmonson County in 1957 (Creason, 1957). The durability of rock-asphalt road surfaces remained an unsettled topic even as long as 35 years afterward (see Rose, 1992).

Many books and professional journals, magazines, and newspaper articles, as well as current

online resources, provide disjointed chronicles of people, companies, and events in the history of the Kentucky rock-asphalt industry. Often names, places, and dates are conflicting between the various sources, requiring substantial research to resolve them. This report provides a short and well-documented history of an industry important to the economy of western Kentucky for almost 70 years, from its inception in the late 1880's to its last gasp in the mid-1950's. Reports of the Kentucky Geological Survey provided a framework of discussions that were then documented by primary sources contemporary to the events discussed. Among the primary sources consulted were newspaper and trade-journal articles, records of cases tried in federal and state courts, state corporation records, U.S. Geological Survey annual reports of mineral production, proceedings of professional associations' meetings, and private mineral evaluations conducted by Willard R. Jillson, sixth director of the Kentucky Geological Survey, during the 1920's.

The Kentucky Rock-Asphalt Industry

Oil and gas seeps are plentiful in Kentucky because of shallow reservoir depths, extensive fracture and fault systems, and exposures of oil-bearing rocks in outcrops (Owen, 1856, 1857; Peckham, 1884; Orton, 1891; Eldridge, 1901; Russell, 1932). The abundance of these seeps provided a petroleum resource that was exploited by the aboriginal people of Kentucky. Bitumen, also called asphalt or tar, is a solid to semisolid dark brown to black substance that melts at temperatures from about 150 to 200°F (Selley, 1998). It most often forms by the degradation of crude oil by organic and inorganic chemical processes and bacterial action (Selley, 1998). In west-central Kentucky, local oil and tar seeps provided the bitumen used by Late Archaic and Early Woodland people (ca. 1000 BCE) to cement stone points onto wood shafts (Moore, 1916; Webb, 1946; Collins, 1981). That the bitumen was a prized commodity to these people is evident by the 20-mile distance of archeological sites along the Green River in Ohio County to the nearest seeps in northern Logan County and adjacent Warren County (see Collins, 1981). The collection of bitumen from western Kentucky tar springs was considered by Collins (1981) as opportunistic, when happened upon, however, rather than the deliberate mining and collection of petroleum practiced by the Late Woodland people (1415–1440 CE) in northwestern Pennsylvania (Dickey, 1959; Selsor and others, 2000; Thomas and others, 2002; McCarthy, 2008). In his first survey of Kentucky, Owen (1856) described oil seeps in Breckinridge and Edmonson Counties and noted that the inhabitants of Edmonson County used the bitumen as a lubricant and sealant. Owen (1857) also suggested several medicinal uses for petroleum from the Breckinridge County seep at Tar Spring in his second survey. Bryant (1914) observed that settlers in the area used tar from seeps as a preservative for the buried ends of fence posts. It would be more than 30 years before a third use for the tar sands of western Kentucky would come about.

The first historical references to rock asphalt, as distinct from oil and bitumen seeps, described the deposits at Val de Travers in Neuchâtel Canton, Switzerland, in 1710 (Boorman, 1908). The

first modern asphalt road was constructed in Paris, France, in 1854 (Richardson and Parker, 1894; Boorman, 1908), followed by a second asphalt road in Paris in 1858 (Richardson and Parker, 1894). Subsequent European asphalt road construction projects were undertaken in London, United Kingdom, in 1869 and Berlin, Germany, about 1873–74 (Richardson and Parker, 1894). The first asphalt-surfaced road in the United States was laid in Santa Cruz, Calif., in 1868, where a small amount of bituminous rock was locally quarried to cover an older wood-block road (Richardson and Parker, 1894). By 1888, rock-asphalt mining was an important industry in California, most production coming from four mines in San Luis Obispo County, and asphalt roads were being constructed in many of the large California cities (Day, 1890); by 1897, there were 12 asphalt companies in California, such was the demand for their products (Mine and Quarry News Bureau, 1897). Imported rock asphalt from the Neuchâtel quarries was first used to pave Union Square, New York City, in 1872, followed by paving in Washington, D.C., by 1873 (Richardson and Parker, 1894). Trinidad asphalt, a semisolid bitumen mined from Pitch Lake, La Brea, Trinidad (Simm, 2014; Asphalt Associates, 2014), was first tested in the United States to surface a road in Newark, N.J., in 1870 (Richardson and Parker, 1894). Trinidad asphalt was laid in Washington, D.C., in 1876 and proved so successful that it became the required road surface in the city in 1878 because the prior rock asphalt streets were deemed to be too slippery (Richardson and Parker, 1894). By 1890, however, rock-asphalt roads had been extensively constructed in California, using material exclusively from California quarries, and were beginning to be constructed in the eastern United States (Mathewson, 1890).

Kentucky had an active industry exploring and developing petroleum throughout the commonwealth by 1880 (Peckham, 1884). Although William L. Breyfogle of Louisville is generally credited with founding the rock-asphalt industry in western Kentucky (Orton, 1891; Weller, 1927), Charles F. Very, a geologist from New Albany, Ind. (*New Albany Evening Tribune*, 1903), first recognized the economic potential of the tar sands, raised some capital, and acquired some smaller properties in 1881 (*Municipal Engineering*, 1903a).

Apparently, Very was unable to raise sufficient capital to begin mining rock asphalt himself, and in 1887 began examining the deposits on the eastern margin of the Western Kentucky Coal Field for Breyfogle (Weller, 1927). Breyfogle acquired properties in northern Grayson County, near the town of Big Clifty, and incorporated the American Bituminous Rock Co. (Fig. 1A, location 1; Fig. 2) before May 2, 1888, when his mining engineer, Thomas P. Shanes, joined the American Society of Civil Engineers (American Society of Civil Engineers, 1890). Initial development of the American Bituminous Rock Co.'s mine began before Jan. 15, 1889, when samples of their product were exhibited at the annual meeting of the Indiana Society of Civil Engineers and Surveyors in Indianapolis (Indiana Society of Civil Engineers and Surveyors, 1889). Large-scale road paving by the American Bituminous Rock Co. followed in 1890 (*Buffalo Morning Express*, 1890b). Additional operating companies quickly opened quarries in Breckinridge and Logan Counties, but it would not be until the 1920's that production from the Kentucky rock-asphalt industry grew to more than 50,000 tons per year (Fig. 3).

The 20th century would see expansion of Kentucky's rock-asphalt industry out of Breckinridge, Grayson, and Logan Counties with the development of quarries in Edmonson County and briefly in Warren County. Whereas the pre-1900 quarries all developed rock-asphalt deposits in the Big Clifty (Fig. 4), half of the quarries developed after 1920, and the largest quarries exploited the thick rock-asphalt deposits of the Caseyville in Edmonson County (Fig. 1A). The average bitumen content of commercially developed deposits was about 5 percent by weight, varying from a noncommercial 3 to 4 percent to as much as 15 percent bitumen by weight (Weller, 1927). The generally accepted bitumen

content of commercial Kentucky rock asphalt was 7 percent by weight (Weller, 1927), although rock asphalt as shipped by the Kentucky Rock Asphalt Co. in the mid-1920's varied from 6.5 to 8 percent (Weller, 1927). This bitumen content likely contributed to road-surface durability issues, because Havens and Williams (1956) concluded that "the optimum asphalt content for maximum stability ranges between 10.5 and 12.5 percent."

The industry was at its peak from 1923 to 1931 and reached its period of greatest production of rock asphalt, more than 300,000 tons per year, from 1926 to 1930 (Fig. 3). Peak annual production of 344,220 tons occurred in 1927 with eight active operators (Fig. 3). An average of seven operators quarried rock asphalt in western Kentucky from 1925 to 1933; however, with the deepening of the Great Depression, their numbers declined to only two by 1940 (Fig. 3). Although production recovered to about half of the industry's peak during World War II and the early post-war period, the development of modern roads and highways re-

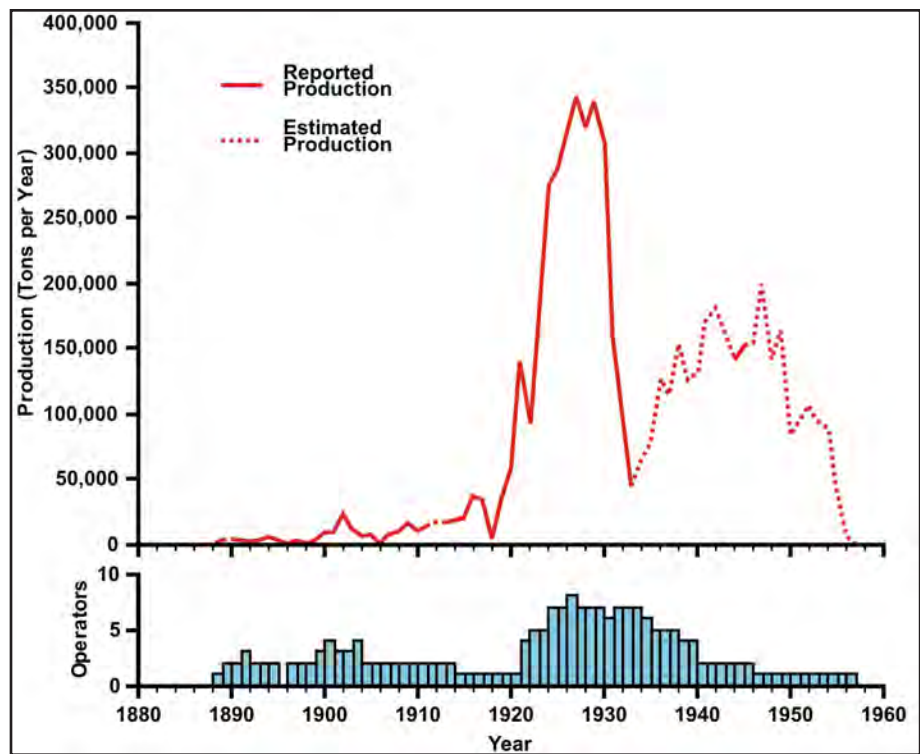


Figure 3. Annual production of Kentucky rock asphalt and number of operators from 1889–1957 from the sources cited in Figure 2. No rock asphalt was produced in Kentucky during 1896 (Parker, 1898) or 1957 (Creason, 1957). Estimated annual production after 1933 was calculated from the average change in production of the U.S. rock-asphalt industry given in the sources cited in Figure 2 applied to the production from the prior year.

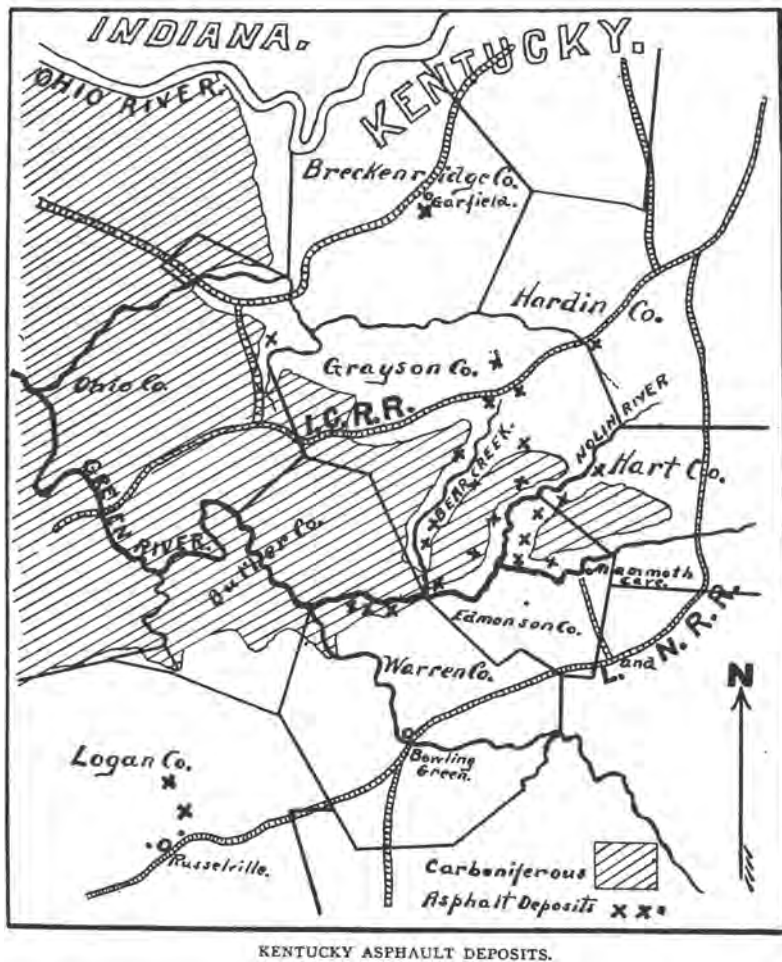


Figure 4. Locations of rock-asphalt deposits and mines from Burk (1903). The developed areas would not change much over the period of Kentucky rock-asphalt production (see Fig. 1A).

sistant to the stresses of modern heavy-weight trucks, and the inability of Kentucky rock asphalt to compete in the market with petroleum-bitumen road products, brought an end to the industry in 1957 (Creason, 1957) (Fig. 3). Total Kentucky rock-asphalt production from 1889 to 1957 is estimated to be 6.04 million tons from all Kentucky rock-asphalt production containing 2.33 million barrels of bitumen, assuming an average commercial bitumen content of 7 percent by weight (Weller, 1927) and an average volume of 5.5 barrels per ton of bitumen (U.S. Energy Information Administration, 2015). Although the volume of produced bitumen sounds like a lot, it was less than 0.1 percent of the estimated bitumen resources in the Big Clifty and Caseyville (Bowersox, 2014).

History of the Operating Companies, 1889–1957

American Bituminous Rock Co. (1889–95) and Federal Asphalt Co. (1901–04)

Kentucky rock asphalt was noted early on as being essentially the same product as the popular California product (Parker, 1892), if not better (Mathewson, 1890). With a comparable cost at the mines in Grayson and Hardin Counties as at the mines in California (Parker, 1892), it was an attractive product awaiting development. California rock asphalt was distant from the eastern United States cities, and the difficulty and expense of transporting it from California kept it out of the eastern market (Parker, 1893a). The American Bituminous Rock Co. (Fig. 1A, location 1; Fig. 2) developed its rock-asphalt deposit by underground mining the Big Clifty Sandstone (Jillson, 1927a) in a steep-sided canyon near Tar Hill, Grayson County (Eldridge, 1901). It produced 112 tons of rock asphalt, the first commercial production from Kentucky, in 1889 (Orton, 1891; Parker, 1892). This is likely the material used to pave parts of two streets in Brooklyn, N.Y., in 1889 (Tillson, 1900). The successful test in

Brooklyn was followed by a second test in Louisville in 1890 (Tillson, 1900), and subsequent installations of rock-asphalt pavements throughout the Midwest, eastern United States, and Ontario, Canada (Moore, 1899; Tillson, 1900; Crump, 1913). American Bituminous Rock Co. incorporated Buffalo Paving Co. in New York in June 1890 (*Buffalo Morning Express*, 1890b) to promote and construct roads, primarily in Buffalo, with Kentucky rock asphalt (*Buffalo Evening News*, 1890; *Buffalo Morning Express*, 1890a). A lengthy description of Buffalo Paving Co.'s new plant and rock-asphalt processing capabilities was described in an article appearing in the *Buffalo Courier* newspaper (*Buffalo Courier*, 1890). Parker (1893b) listed Buffalo Paving Co. with Schillinger Brothers as rock-asphalt produc-

ers in Kentucky during 1892. Buffalo Paving Co., however successful, would remain in operation less than 5 years. The American Bituminous Rock Co. remained in operation until at least April 1895 (*Paving and Municipal Engineering*, 1895a), but was closed by 1896 (Eldridge, 1901). With the closure of American Bituminous Rock Co.'s mine in Grayson County, Buffalo Paving Co. was sold to Standard Paving Co. of Buffalo in March 1896 (*Buffalo Evening News*, 1896). The assets of the American Bituminous Rock Co., including its mine and mill, were sold to the Federal Asphalt Co. of Chicago (*Age of Steel*, 1901).

Federal Asphalt Co. (Fig. 2) was incorporated in West Virginia on Sept. 5, 1901, with property holdings totaling 25,000 acres in Grayson, Hardin, Hart, Warren, and Edmonson Counties (*Indianapolis Journal*, 1901). It briefly reopened the idled American Bituminous Rock Co. mine and processing plant in Grayson County, the only developed property, in 1901. The company had earlier acquired the mine and processing plant of the American Bituminous Rock Co. from W.L. Breyfogle on July 15, 1901 (Court of Appeals of Kentucky, 1929). It had an initial capitalization exceeding \$3.5 million (*Age of Steel*, 1901) and control of 23,000 acres in 96 tracts of land in Hardin, Grayson, Edmonson, Hart, and Warren Counties (*The Sun*, 1901; *Municipal Engineering*, 1903a), but operational and product-quality issues would lead to its closure in 1904. The company's mill and equipment were destroyed in a fire on its first day of operation (Burk, 1903), apparently before Eldridge's (1901) visit to the site, which he described as "gone to ruin." A new processing plant was constructed in 1902 (*Municipal Engineering*, 1903a; Nall, 1903) and a few railcar-loads of rock asphalt were shipped that year (Burk, 1903). The company was paving roads by year end of 1902, but there were quality issues with its product from the new mill causing rapid deterioration of the installed road surfaces, requiring extensive repairs (*Indianapolis Journal*, 1903; *True Republican*, 1903a, b; Supreme Court of Indiana, 1908). By 1903, Federal Asphalt Co. was at its peak production and employing 200 to 300 people in Grayson County (Nall, 1903) (Figs. 5–7) and pursuing paving contracts in the Midwest (*Buffalo Courier*, 1903) and Northeast (Fig. 8). By the end of 1903, however, Federal Asphalt Co. was in

financial trouble (*Municipal Engineering*, 1904a) and forced to borrow funds in January 1904 to continue its operations (*Breckinridge News*, 1904; *Municipal Engineering*, 1904b). The creditors petitioned the federal bankruptcy court in Chicago to have a receiver appointed for the company on Feb. 4, 1904, citing poor management (*Municipal Engineering*, 1904c; *The Sun*, 1904a), and Federal Asphalt Co. entered bankruptcy in Chicago on Feb. 18 (*Indianapolis Journal*, 1904; *Post Standard*, 1904). The bankruptcy proceedings were extended to its Kentucky properties on Feb. 20 (*The Sun*, 1904b). The company's financial condition worsened through 1904 because of irregular transactions by its president, Frank V.E. Bardol, involving the disposition of corporate assets (*Buffalo Courier*, 1904a, b). The receiver operated Federal Asphalt Co. through early 1905, then petitioned the court and sold its assets, mostly 66 tracts of property with rock-asphalt deposits, on June 29, 1905 (Court of Appeals of Kentucky, 1929). Decades of litigation followed (Court of Appeals of Kentucky, 1929), and what happened to the mill and equipment that was still on site in 1908 when the City of Louisville considered acquiring the property to secure a source of cheap asphalt is unclear (*Municipal Journal and Engineer*, 1908). The mine in Grayson County was reopened about 1927 by United Rock Asphalt Co. (Jillson, 1926b, 1927a).

Breckinridge Asphalt Co. (1890–1901), Garfield Rock Asphalt Co. (1925–28), and Gar-Rock Asphalt Co. (1929–1930's)

Breckinridge Rock Asphalt Co. (Fig. 1A, location 2; Fig. 2) quickly began production from two quarries near Garfield in Breckinridge County (Eldridge, 1901) and was paving streets in Buffalo, N.Y., by the end of 1890 (Burk, 1903), although not without controversy regarding its materials quality and surface durability (*Paving and Municipal Engineering*, 1895b; *San Francisco Call*, 1895, p. 257; *Municipal Engineering*, 1897a). Breckinridge Asphalt Co.'s problem was that commercial-grade rock asphalt was specified as having a bitumen content of 7 percent by weight (Crump, 1913), and the rock in its quarry varied from less than 6 to 10 percent bitumen content by weight, without a clear demarcation in the quarry between acceptable and second-grade rock, which was less than 7 percent bitumen by weight (Eldridge, 1901). Con-

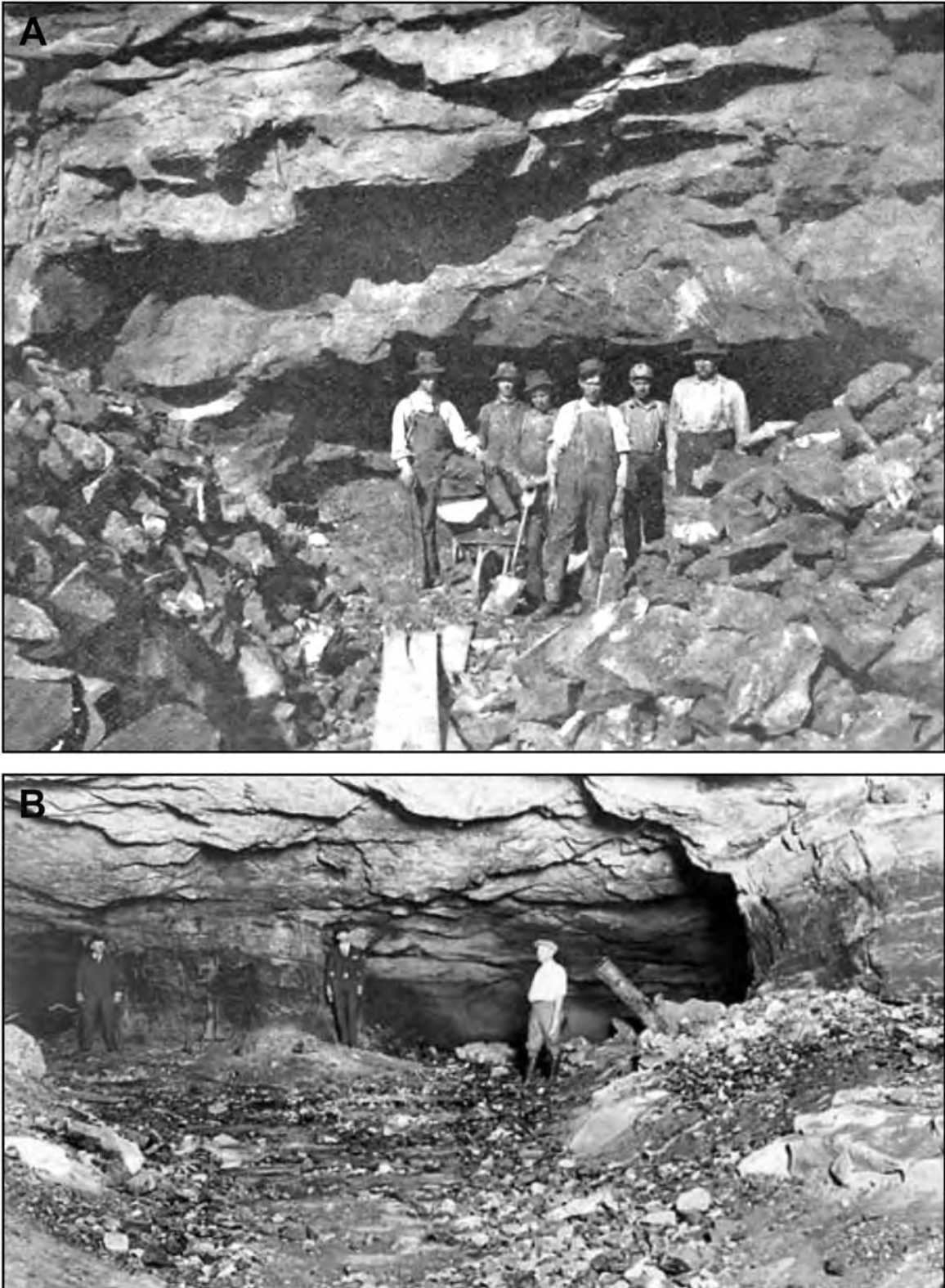


Figure 5. Federal Asphalt Co. acquired the assets of the American Bituminous Rock Co. in July 1901 and failed less than 3 years later. (A) Entrance to a Federal Asphalt Co. mine (probably 3L; Figs. 6A, B), Grayson County, at its peak production in 1903. This mine is developed in a thick section of bitumen-saturated Big Clifty Sandstone. Photo from *Municipal Engineering* (1903c). (B) Interior of one of the Federal Asphalt Co.'s abandoned mines in about 1923 (Jillson, 1924).

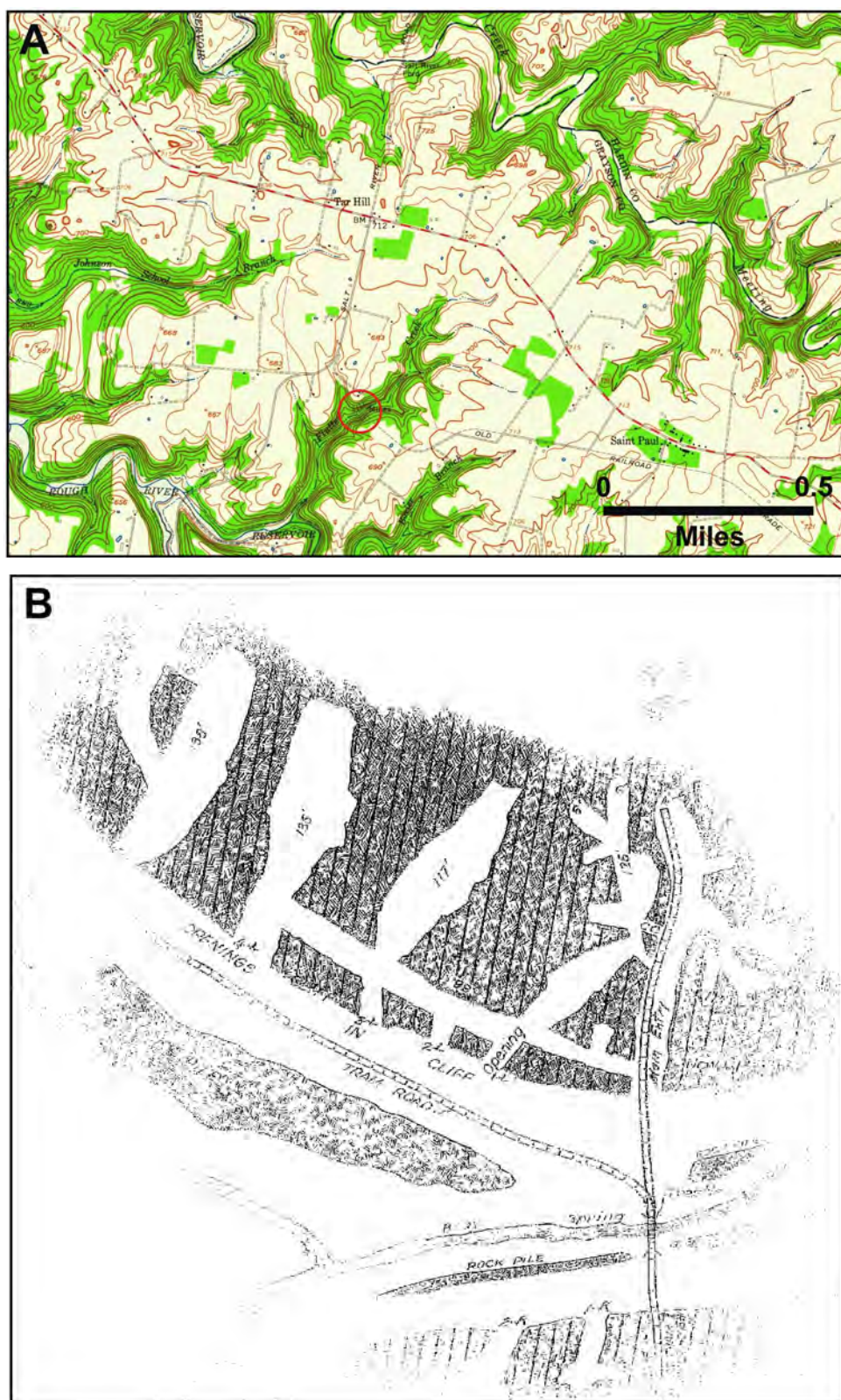


Figure 6. Location and mine plan of the Federal Asphalt Co. operation. (A) Location of the Federal Asphalt Co. mines is about 0.9 mile south of Tar Hill in northern Grayson County (U.S. Geological Survey, 1960). (B) Plan of the Federal Asphalt Co. mines. From Jillson (1926b). These mines were briefly reopened in the late 1920's by the Continental Rock Asphalt Co.

FEDERAL ASPHALT CO

171-173 LA SALLE STREET CHICAGO, ILL.

PRODUCERS OF

FEDERAL ASPHALT PAVING MATERIAL

MADE OF

KENTUCKY ASPHALT ROCK

No Gas Tar. No Soluble Salts. No Petroleum Oils

NATURE'S OWN MIXTURE. DURABILITY UNEQUALED

In use in various cities for ten years or more and has always remained in good condition under the heaviest traffic

In the city of Buffalo, after an experience of 12 years with both materials, the cost for repairs of Trinidad asphalt was found to be more than six times the cost for repairs of

KENTUCKY ASPHALT ROCK

Prepared at the Company's mills in Kentucky
Ready for Warming and Laying

Figure 7. Federal Asphalt Co. trade-journal advertisement from *Municipal Engineering* (1903a).

sequently, by late 1898 the City of Louisville would no longer accept bids for road paving from Breckinridge Asphalt Co. (*Breckinridge News*, 1898a, b; Moore, 1899), and the company eventually closed in 1901 (Ball, 1951). The properties remained idle (Foerste, 1910) while tied up in litigation (Richardson, 1924), and no rock-asphalt production can be documented from Breckinridge County until 1925 (Northrop, 1917, 1920; Osborn, 1921; Cottrell, 1922, 1923, 1924, 1926, 1927), except during 1916 (Northrop, 1919). The Breckinridge County asphalt quarries were reopened by Garfield Asphalt Co. (Fig. 2) and in production from 1925 to 1927 (Hopkins and Coons, 1928, 1930; Hopkins, 1929). There was no production by Garfield Asphalt Co. after 1927, but an evaluation of its properties and mill

How Asphalt was Found in Logan County.

It was about ten years ago that asphalt was first found in Logan county. The discovery was made by a young son of Mr. D. D. Duncan, near the point where the present quarry is being worked. The boy picked up several pieces of what he thought coal, sticking from the side of a small hill, and carried them home. Mr. Duncan, who owned the property, thought he had a coal mine, and was jubilant. Samples were sent to Russellville and Louisville, and simple tests demonstrated that the material was a fine quality of rock asphalt. The owner of the property sold the mineral rights on the land to a party of gentlemen in Nashville, who organized the Kentucky Asphalt Company, but they lacked capital to develop the property. There were one or two other transfers, the last previous to that to the present owners being to the Logan County Asphalt Company. This company, formed principally of Russellville people, purchased the lands as well as the mineral rights and started in to develop the property on a large scale. It required more capital than the company could command, so finally, in September, 1899, the Logan county company sold out or transferred its holdings to the American Standard Asphalt Company.

Figure 8. *Hartford Herald* [Ky.] story explaining the early, and only, development of rock asphalt in Logan County (*Hartford Herald*, 1903).

in February 1928 showed it to be in good operating condition, though apparently in need of financing to resume production (Jillson, 1928). It was ultimately purchased by an unnamed buyer in 1929 for \$80,000 (*Kentucky Progress Magazine*, 1929). The buyer was the Gar-Rock Asphalt Co. (Fig. 2), incorporated in April 1929 (Amos, 1976; Kentucky Secretary of State, 2014) as Gar Rock Mine, but there are no records available of its years in operation or rock-asphalt production. Ball (1951) gave 1930 as its last year of operation, although it may have been operated sporadically during the 1930's (Abraham, 1938). Both Garfield Rock Asphalt Co. and Gar-Rock Asphalt Co. are still listed as inactive Kentucky corporations as of October 2014 (Kentucky Secretary of State, 2014).

Schillinger Brothers (1892)

Before 1900, additional operators quarried rock asphalt in Kentucky. The Schillinger Brothers, Toledo, Ohio, opened two quarries near Leitchfield, Grayson County, by 1892 (Parker, 1893b; Eldridge, 1901) (Fig. 1A, location 3; Fig. 2). The Schillinger Brothers, roofing, flooring, and paving contractors, were ephemeral. They are credited with production from Kentucky only in 1892 (Parker, 1893b). Eldridge (1901) described their No. 1 quarry as having “only 3 feet ... sufficiently rich to be worked” and their No. 2 quarry as “hardly more than a prospect in a depression in the hills.” The Kentucky quarries may have been, in fact, only prospects because the Schillinger Brothers were only advertising mines in Oklahoma in 1890 (Detroit Architectural Club, 1890) and built a large manufacturing plant there in 1897 (*Municipal Engineering*, 1897c).

American Standard Asphalt Co. (1897–1914)

American Standard Asphalt Co. (Fig. 1A, location 4; Fig. 2), the Standard Asphalt Co. of some authors (e.g., Eldridge, 1901), opened a quarry near Russellville, Logan County, by 1897 (*Municipal Engineering*, 1897b; Moore, 1897; *Hartford Herald*, 1908). The company (Fig. 1A), successor to the Logan County Asphalt Co. (*Municipal Engineering*, 1897b; *Hartford Herald*, 1908) (Fig. 8), incorporated in Kentucky in September 1899 with capitalization of \$250,000 (*Courier-Journal*, 1899). It quickly developed its quarry property and built a plant in Louisville that prepared rock asphalt for paving material (Burk, 1903). American Standard Asphalt Co., as a demonstration of the quality of its product, finished a paving test in Louisville in October 1900 (*Courier-Journal*, 1900). In 1901 it became the subject of speculation that it was to be acquired by an Eastern railroad syndicate and merged with Green River Asphalt Co., Warren County (*New York Times*, 1901), but this never came about, and in 1903 it was reorganized and recapitalized (*Municipal Engineering*, 1903c). Having a plant in Louisville allowed it to pave many roads in the area from 1903 through 1914 (*Municipal Engineering*, 1903b, 1911, 1913; *The Contractor*, 1914; Crain, 1914a, b), but it appears to have closed by 1915, when Northrop (1917) listed

only one active rock-asphalt quarry in Kentucky, in Edmonson County.

Litigation and labor trouble in Louisville may have hastened closure of the American Standard Asphalt Co. (Crain, 1914b), but Miller (1919) described American Standard Asphalt Co.’s quarry as worked out (Fig. 9), suggesting that they were no longer able to supply rock asphalt. The Kentucky Rock Asphalt Co. acquired the American Standard Asphalt Co. in or before 1921 (Jillson, 1921a), and Ball (1951) showed that the company’s quarry last operated in 1922. Richardson (1924) stated that American Standard Asphalt Co. controlled 577 acres of rock asphalt-bearing land near Homer, Logan County, and were coring the property to determine the deposit’s thickness and economic value. This may be the deposit near Homer mentioned by Eldridge (1901). Although Gilder-sleeve (1966) showed an abandoned rock-asphalt quarry 1.2 miles north of Homer, there is no record of American Standard Asphalt Co., its parent company, Kentucky Rock Asphalt Co., or any other operator developing the tar sands in northern Logan County before the 1980’s.

Green River Asphalt Co. (1900–04)

In 1900 a new and short-lived company, the Green River Asphalt Co. of St. Louis, Mo., opened a quarry on the Cherry property along the Green River at Youngs Ferry, Warren County (Eldridge, 1901) (Fig. 1A, location 5; Fig. 2). This was the first quarry to commercially develop the Caseyville Formation tar-sand deposits (Eldridge, 1901). The company was well capitalized at \$100,000 (*Municipal Journal and Engineer*, 1902), quickly developed its quarry, and built a processing plant in Louisville (*Semi-Weekly Interior Journal*, 1900). It was advertising its product nationally by year end 1900 (*Municipal Engineering*, 1901c) (Fig. 10). Green River Asphalt Co.’s business was as a supplier of processed rock asphalt to municipalities and paving contractors (*Municipal Engineering*, 1901a, b; *Municipal Journal and Engineer*, 1902). The company was so successful, so quickly, that it attracted the attention of the same syndicate that considered acquiring the American Standard Asphalt Co. in Logan County (*New York Times*, 1901). It supplied asphalt, usually to subcontractors, for road paving in many cities, among them Louisville (*Municipal*



Figure 9. The recently abandoned quarry of the American Standard Asphalt Co. north of Russellville, Logan County, in 1919. By this time, Miller (1919) considered the quarry to be worked out, leaving only low-quality Big Clifty rock asphalt. Photo by S.D. Averitt from Miller (1919).

Engineering, 1901c), Mobile, Ala. (*Watertown Daily Times*, 1901), Brooklyn, N.Y. (*New York Times*, 1902), Leavenworth, Kansas (Moore, 1918), Little Rock, Ark. (*Municipal Engineering*, 1907), and Decatur, Ill. (*Daily Review*, 1903). Despite its advertised claims (*Municipal Engineering*, 1902), durability of the rock-asphalt surface was problematic because of its inconsistent bitumen content and properties for road surfacing (Fig. 11). The paving in Little Rock, for example, “began to deteriorate soon after the street was accepted” (*Municipal Engineering*, 1907, p. 402). The cost of resurfacing the failed roads fell upon either the Green River Asphalt Co. or the insurance underwriters it contracted to warrant the work (for example, see *Daily Review*, 1903; *Municipal Engineering*, 1907; Moore, 1918), which consequently led to litigation. By October 1904, the company was short of capital and went to

the bond market for additional funding (*New York Times*, 1904), leading quickly to foreclosure (*Philadelphia Inquirer*, 1904) and sale of its assets to the first mortgage holder (*Hartford Republican*, 1904) for liquidation. Litigation about contract warranties made by Green River Asphalt Co. for road-surface durability, however, would dog the company and its insurance underwriters for more than a decade following its closure (for example, see Rader, 1905; Crawford, 1909; Moore, 1918). Green River Asphalt Co.’s quarry was never reopened, and the rock-asphalt deposit at Youngs Ferry has remained largely undeveloped (Abraham, 1938).

Wadsworth Stone and Paving Co. (1903–17)

Wadsworth Stone and Paving Co. and its successor, the Kentucky Rock Asphalt Co. (Fig. 2, location 6a, b), operated for 54 years, far longer than

Green River Pavements

...OF...

Kentucky Asphaltic Sandstone

WILL NOT SOFTEN, CRACK NOR CREEP

A Natural Mixture of Asphalt with Clean, Sharp Sandstone, which, when Crushed,
Heated and Compressed, Returns to its Original Sandstone Form

Durable Showing Practically No Wear After Five Years' Service

Economical Costing Less for Maintenance than Any Known Pavement

Quiet Avoiding the Noisy Clattering of Stone Pavements

Sanitary Being Impervious to Germs and Readily Cleaned

The Green River Asphalt Co.

NO. 130 CHAMBER OF COMMERCE
St. Louis, Missouri

25

Figure 10. Green River Asphalt Co. trade-journal advertisement from *Municipal Engineering* (1902).

any other rock-asphalt producer. Wadsworth Stone and Paving Co., a Pittsburgh, Pa., construction contractor, incorporated in March 1892 (Pennsylvania Department of State, 2014) and remained in business through at least October 1959 (*Union Sun and Journal*, 1959). Company secretary-treasurer W.C. Thomas began evaluating rock-asphalt deposits about 1901, looking for an economical rock-asphalt source in Kentucky to replace French Seyssel rock asphalt in its products, located a 300-acre tract of fee-simple minerals for development on the north bank of the Green River at Pittsburgh Landing in Edmonson County (*Municipal Journal and Engineer*, 1904; Crump, 1913) (Fig. 1A; Fig. 2, location 6a). The quarry was equipped and in operation quarrying rock asphalt before April 30, 1904, when it dis-

played a product sample at the St. Louis World's Fair (Kentucky Commission, Louisiana Purchase Exposition, 1904; *Municipal Journal and Engineer*, 1904; Weller, 1927). The Pittsburgh Landing rock-asphalt deposits were 5 to 15 feet thick (Crump, 1913), with a bitumen content of 7 to 10 percent (*Municipal Journal and Engineer*, 1904). Crump (1913) gave a detailed description of Wadsworth Stone and Paving Co.'s milling and shipping facilities at Pittsburgh Landing and installation procedure for Kentucky rock-asphalt paving (Fig. 12).

Wadsworth Stone and Paving Co. registered the Kyrock trade name in March 1911 for its Kentucky rock-asphalt product quarried from the Caseyville Formation (*Municipal Journal and Engineer*, 1911), a product that was nationally promoted by the company (Wadsworth Stone and Paving Co., 1912) (Fig. 13). A popular product, Kyrock was used to construct roads throughout the mid-western and mid-Atlantic states (Steele, 1915). The town of Kyrock was established adjacent to the quarries and processing plant on the Nolin River in Edmonson County (Jillson, 1921a), about 1.4 miles northeast of Sweeden, and Kyrock School was built about 0.6 mile north of Sweeden. Wanless (1939) appropriately named the lower conglomerate of the Caseyville Formation the Kyrock Conglomerate, because of its correlation to the rock-asphalt quarries' deposits.

Kentucky Rock Asphalt Co. (1917–57)

Kentucky Rock Asphalt Co. appears to have a curious backstory that initially begins with Andrew F. West, an entrepreneur in Syracuse and Buffalo, N.Y. (*Buffalo Evening News*, 1899), and ends as part of Wadsworth Stone and Paving Co. by 1908 (American Automobile Association, 1908a, b; *Buffalo Courier*, 1908). West had interests in many industries, including road paving (*Buffalo Morning Express*, 1890a), real estate (*Buffalo Courier*, 1894a; *Buffalo Courier-Record*, 1897), building construction (*Buffalo Courier*, 1894b), metal fabrication and manufacturing (*Buffalo Courier*, 1901; *Age of Steel*, 1901), and more (*Illustrated Buffalo Express*, 1893). Kentucky Rock Asphalt Co. was incorporated in New York by West, as its corporate secretary, before July 11, 1889, when he was interviewed by the *Buffalo Courier* newspaper (*Buffalo Courier*, 1899). He outlined an ambitious business plan for build-

BITUMINOUS SAND FROM DEPOSIT OF GREEN RIVER ASPHALT
COMPANY, WARREN COUNTY, KENTUCKY.

Test number.....	61873	27606
Bitumen soluble in CS ₂	6.1%	8.8%
Passing 200-mesh sieve.....	14.9	11.3
" " 100- " "	48.0	10.0
" " 80- " "	19.0	23.0
" " 50- " "	12.0	37.1
" " 40- " "	0.0	8.0
" " 30- " "	0.0	.9
" " 20- " "	0.0	.9
" " 10- " "	0.0	.0
	100.0	100.0
Loss, 212° F., 1 hour.....		1.5%

EXTRACTED BITUMEN.

Penetration at 78° F..... Too soft, pulls to a thread

Fixed carbon. 11.8%

Figure 11. Analysis of rock asphalt from the Green River Asphalt Co. quarry (from Richardson, 1913) does not show the properties of good commercial rock asphalt.

ing a rock-asphalt processing plant in Buffalo so the company could begin paving roads in the area (*Buffalo Courier*, 1899). This suggests that before the

incorporation of the Buffalo Paving Co. in 1890 (*Buffalo Morning Express*, 1890b) he had already made contact with W.L. Breyfogle and the American Bituminous Rock Co. to develop an outlet for rock asphalt being mined in Grayson County. There does not appear, however, to have been a parent company–subsidiary relationship between the American Bituminous Rock Co. and the Kentucky Rock Asphalt Co., as there was between the American Bituminous Rock Co. and the Buffalo Paving Co. (*Buffalo Morning Express*, 1890b).

Whereas the Buffalo Paving Co. was sold in 1896, after the American Bituminous Rock Co. ceased operating its mine in Grayson County (*Buffalo Evening News*, 1896; Eldridge, 1901), what is not clear is whether or not West had sold the Kentucky Rock Asphalt Co. about the same time. West submitted a bid in his own name

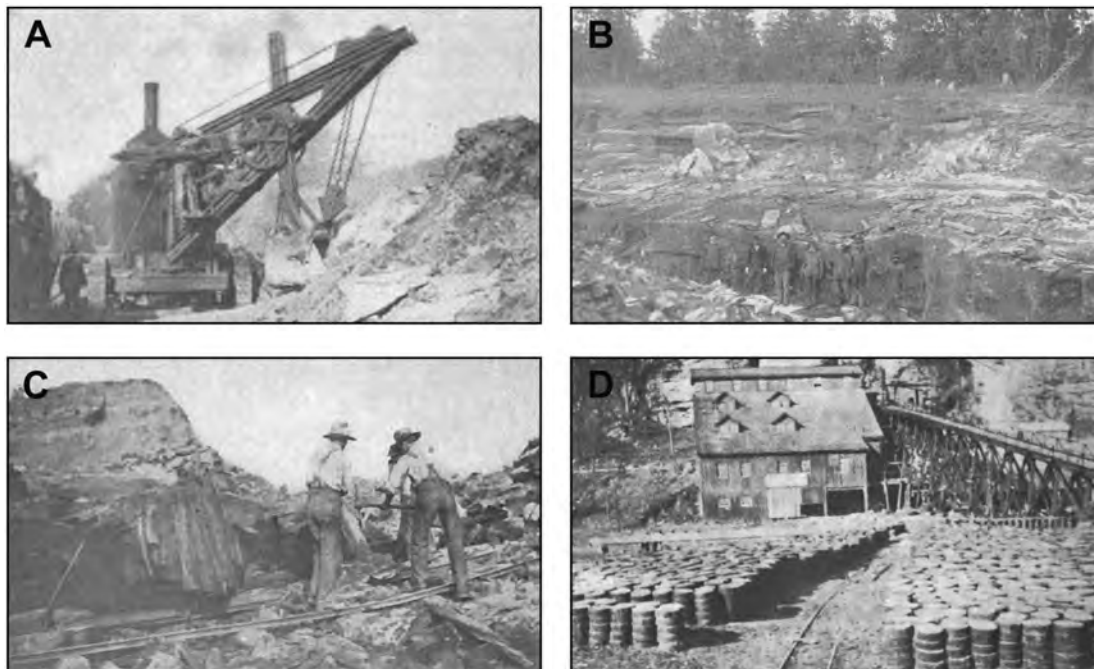


Figure 12. Wadsworth Stone and Paving Co.'s quarry on the Green River, Edmonson County, circa 1914. The quarry was located on a bluff above the Green River at Pittsburgh Landing, where the rock asphalt was quarried, crushed, and shipped (Bryant, 1914). (A) Stripping the overburden (from Steele, 1915). (B) The working quarry face (from Bryant, 1914). (C) Quarrying rock asphalt (from Steele, 1915). (D) The Wadsworth Stone and Paving Co. grinding mill (from Steele, 1915). After the rock asphalt had been ground to commercial specifications, it was loaded onto barges by gravity then towed 27 miles down the Green River to the mouth of the Barren River. From there, the barges were towed 30 miles up the Barren River to a railhead in Bowling Green (Steele, 1915).



Figure 13. Wadsworth Stone and Paving Co. trademarked the Kyrock product name in March 1911 and promoted it nationally in trade journals. This advertisement was published in "The Official Good Roads Year Book of the United States" (Wadsworth Stone and Paving Co., 1912).

to the City of Syracuse in 1894 for vitrified brick paving manufactured by New York Brick & Paving Co. (West Publishing Co., 1897) and was awarded a contract for conventional asphalt paving from the City of Syracuse in January 1895 (*Engineering News*, 1895; *Engineering Record*, 1895). These activities suggest that West no longer had a business relationship with the Kentucky Rock Asphalt Co. by 1894. Kentucky Rock Asphalt Co. had unsuccessfully laid a test road in Rochester, N.Y., several years before 1893 (*Evening Herald*, 1893), although "several years" in this case had to mean less than 4 years, and its processing facility in Brooklyn, N.Y., was described by West as being "now unused" in February 1891 (*Buffalo Express*, 1891). The company had to have remained in business in some form, however, because in 1903 it was a representative for Warren Brothers Paving Co. in Buffalo and adjacent towns (*Niagara Falls Gazette*, 1903).

In August 1902, Kentucky Rock Asphalt Co. acquired a 300-acre tract of land with rock-asphalt deposits in Hardin County, adjacent to the Illinois Central Railroad right-of-way (*Boone County Recorder*, 1902). This tract was probably near the town of Summit, where Ohio Valley Rock Asphalt Co. would later develop the rock-asphalt deposit. Whether this company is the Kentucky Rock Asphalt Co. of New York cannot be determined without a lengthy search of land-title records in

Hardin County. By 1908, however, Kentucky Rock Asphalt Co. of New York had become a subsidiary of Wadsworth Stone and Paving Co. In June 1908, Wadsworth Stone and Paving Co., as the Kentucky Rock Asphalt Co., paved a 1-mile road section in Williamsville, N.Y., with its Kentucky rock-asphalt product as part of a road-building demonstration for the first convention of the American Automobile Association (American Automobile Association, 1908a, b; *Buffalo Courier*, 1908). The Kentucky Rock Asphalt Co. remained in the road-paving business in New York through at least 1913 (*New-York Tribune*, 1913), and was recognized, in fact, as being the Wadsworth Stone and Paving

Co. (*New York Call*, 1913). Kentucky Rock Asphalt Co., New York, was probably closed with the sale of the operations of Wadsworth Stone and Paving Co. in Edmonson County and the Kyrock trade name to the newly chartered in Kentucky, in 1917, Kentucky Rock Asphalt Co. (Weller, 1927; McFerrin, 1938).

The Kentucky Rock Asphalt Co. (Kentucky) became the most successful and most storied of all of Kentucky's rock-asphalt producers by virtue of its 40-year longevity (Havens and Williams, 1956; Creason, 1957) (Fig. 2), ceaseless advertising hyperbole (for an example, see Kentucky Rock Asphalt Co. Inc., 1920; *Boone County Recorder*, 1936), trade-journal articles of thinly veiled promotion by the company (Wiley, 1919, 1920a, b), and in Kentucky Geological Survey publications during the 1920's (for an example, see Jillson, 1921a), and being the object of a shaky financial scheme typical of the mid-1920's that collapsed in the early 1930's (McFerrin, 1938). Its history in Kentucky starts about 1906 when M.M. Logan, Frankfort, began acquiring rock-asphalt leases in Edmonson County (Weller, 1927). By 1914 he had accumulated about 40,000 acres of leases that became the sole asset of Bee Spring Land and Mining Co., by exchanging company stock with landowners for their mineral rights held by the leases (Weller, 1927; *Louisville & Nashville Employees' Magazine*, 1944). On Jan. 1,

1917, Kentucky Rock Asphalt Co. was formed by the merger of Wadsworth Stone and Paving's Kentucky operations with the assets of Bee Spring Land and Mining Co. and \$1.3 million of capital stock (*Cincinnati Enquirer*, 1917; Cossar, 1917). Kentucky Rock Asphalt Co. became the largest rock-asphalt producer in Kentucky (Jillson, 1927a) (Fig. 14), and the only producer from 1917 to 1921 and 1947 to 1957. By the late 1920's, Kentucky Rock Asphalt Co. was operating eight quarries in Edmonson County (Weller, 1929).

Kentucky Rock Asphalt Co. operated the former Wadsworth Stone and Paving's quarry, processing plant, and shipping facilities on the Green River in Edmonson County (Fig. 1A, location 6a) for about a year before moving to Kyrock, on the Nolin River in Edmonson County (Weller, 1927), about 1.4 miles northeast of Sweeden (Fig. 1A, lo-

cation 6b; Fig. 15). Both locations provided river access to ship rock asphalt by barge to the Ohio River (Fig. 15C). The location of the Kyrock quarries 235 feet above the Nolin River, however, allowed movement of ore by small trains from five quarry faces to the processing mill (Fig. 15B) located lower on the slope, then directly onto barges for the 70-mile trip to Bowling Green and further shipment from there by rail (Richardson, 1924; McCormack, 1925; Weller, 1927). The rock-asphalt deposit at Kyrock was 20 to 40 feet thick, requiring quarrying to remove an equal thickness of overburden rock, and with a working face approximately 1 mile long (Richardson, 1924). Bitumen content of the rock asphalt from the quarries varied from 6.2 to 8.2 weight-percent (Jillson, 1921a; Richardson, 1924); commercial finished product had an average 7 percent bitumen content (Hittell, 1922).

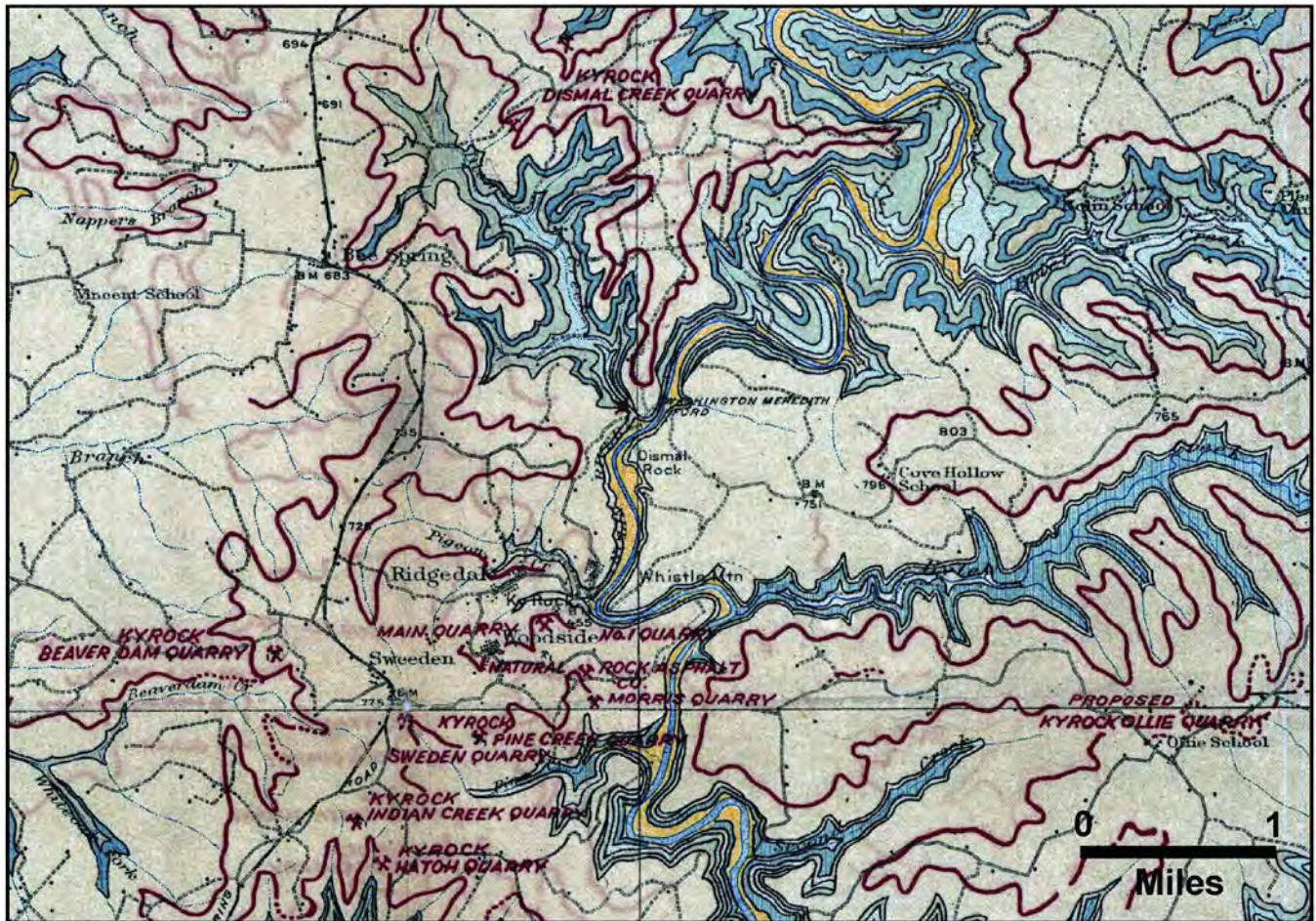


Figure 14. By 1929, the peak year of rock-asphalt production in Kentucky, Kentucky Rock Asphalt Co. had nine operating and one proposed quarry in Edmonson County (from Weller, 1929). The company's Wadsworth Quarry, 7 miles southwest of the Main Quarry at Kyrock, is not shown on this map.

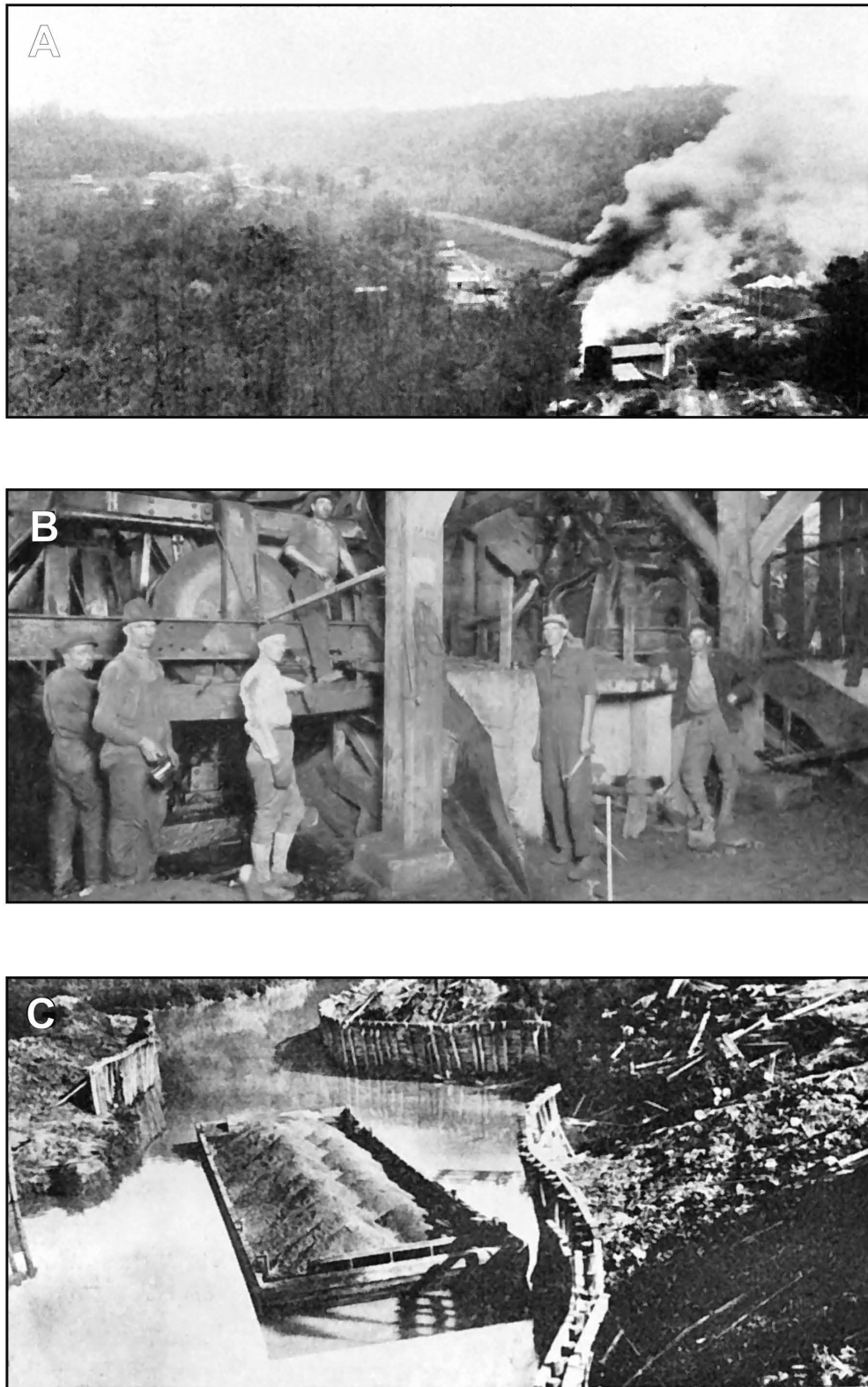


Figure 15. Operations of the Kentucky Rock Asphalt Co. during the early 1920's. (A) Panorama view of the plant site at Kyrock, Edmonson County. (B) Interior of the Kentucky Rock Asphalt Co. mill. This mill was capable of producing about 1,000 tons per day of processed rock asphalt. (C) A loaded barge in the Nolin River leaving the mill site for towing to Bowling Green. Photos (A) and (B) are from Jillson (1921a) and photo (C) is from Richardson (1924).

With a plant capacity of 1,200 tons per day, and an average 83 percent of the quarried rock as waste (Richardson, 1924), Kentucky Rock Asphalt Co. was moving about 7,200 tons of rock each day during its heyday.

An early advantage of Kentucky rock-asphalt roads, after all of its past failures as a road surface, was that it could be laid cold; that is, it required no preheating to prepare it for paving (McCormack, 1925; Mullen, 1925). Kentucky Rock Asphalt Co. heavily advertised this property of its product in municipal trade journals (for example, Kentucky Rock Asphalt Co., 1922a–e). This advantage allowed it to be laid with minimum expense, even during adverse weather (McCormack, 1925). As a consequence, it could also be laid quickly (Jillson, 1921a). Cahill (1922) gave a detailed description of the construction of 11 miles of the Dixie Highway between Louisville and West Point, Ky., and reported that a 16-man crew once laid 1,275 linear feet of roadway with Kentucky rock asphalt in 10 hours. Mullen (1925), however, did not find that being able to lay Kentucky rock asphalt cold was much of an advantage over other rock-asphalt products. After the first Canadian test of Kentucky rock asphalt by the Ontario highway department, Mullen (1925, p. 18) argued that

there is no economic reason for freighting Kentucky sand to Canada, since it is not superior thereto ... The nearest prior art to the cold-laid pavement is ... in the case of Kyrock, the same mixture from some other source.

This is a good argument, and one that was ignored by the Kentucky Rock Asphalt Co. It was then that another property of Kentucky rock asphalt became an important selling point: It protected against skidding, especially when the road surface was wet (Weller, 1927; Havens and Williams, 1956). The anti-skid property derives from Kentucky rock asphalt's mineralogy. The asphalt rock is fundamentally a quartz sandstone that is crushed to coarse bitumen-coated grains for the market (Cahill, 1922; Weller, 1927; *Petroleum Times*, 1928). It is the angularity of the crushed quartz grains that provides a very fine, sandpaper-like, anti-skid surface (Wiley, 1919). It was the nonskid property of Kentucky rock asphalt that brought the Kentucky Rock Asphalt Co. its highest-profile paving contract at the Indianapolis Motor Speedway. Kentucky Rock As-

phalt Co. initially paved the track in four stages, beginning by filling rough sections in the original brick surface in 1936, then paving all four turns in 1937 to improve their safety, and finally paving the whole track, except for the original brick on the front straight, beginning in 1938 and finishing in 1939 (*Cortland Standard*, 1939; *Erie County Independent*, 1939; Pine, 2013). Their final paving contract at the Indianapolis Motor Speedway was finished in 1956 when the entire track was repaved, once again excepting the front-straight brick (*Binghamton Press*, 1955).

By the mid-1920's, Kentucky rock asphalt, from all suppliers, had been used to pave roads in 31 states, Canada, and Cuba (Crump, 1913; *Binghamton Press and Leader*, 1926). By the late 1920's, Kentucky Rock Asphalt Co. was expanding its sales to Brazil (*Elmira Star-Gazette*, 1928). During the early 1920's, Kentucky Rock Asphalt Co. was very successful in capturing a share of the growing road construction in the South (McFerrin, 1938). By the mid-1920's the company was nearly debt free and paying substantial dividends to its shareholders (McFerrin, 1938). For example, in 1924 the company made a 65 percent profit on its rock-asphalt sales, which, in turn, provided its shareholders with earnings of more than \$20 per share, a 23 percent return on their invested capital, and an 8 percent cash dividend (Weller, 1927; McFerrin, 1938). Production and sales reached a new high in 1925, and corporate earnings again exceeded \$20 per share, attracting the attention of Caldwell and Co. of Nashville, Tenn., the largest financial corporation in the South at the time (McFerrin, 1938). A review of Kentucky Rock Asphalt Co. showed the company with net assets valued at \$5.77 million, and Caldwell and Co. made its shareholders a very attractive buyout offer in early 1926 (*Binghamton Press and Leader*, 1926; McFerrin, 1938). After Kentucky Rock Asphalt Co.'s president resigned about March 30, 1926 (*New York Sun*, 1926), the shareholders accepted the offer in May (McFerrin, 1938) and the company was acquired through a syndicate led by Caldwell and Co. and Rogers Caldwell and Co. of New York (*Binghamton Press*, 1926). Kentucky Rock Asphalt Co. was reincorporated in Delaware, and the syndicators began offering debt instruments to the public on June 1, 1926 (*Binghamton Press*, 1926; *Rochester Democrat and Chronicle* and

Rochester Herald, 1926; *Watertown Daily Times*, 1926; McFerrin, 1938) (Fig. 16).

The Kentucky Rock Asphalt Co.'s new shareholders almost immediately, and unwisely, gave up control of the corporation by executing a voting trust agreement with three officers of Caldwell and Co. in which they became the sole voting trustees for 10 years (McFerrin, 1938). The new company had been saddled with substantial debt obligations, about 40 times that held in 1925 (*Binghamton Press*, 1926; McFerrin, 1938), requiring the equivalent of 88 percent of its prior earnings to service it (McFerrin, 1938). The Kentucky Rock Asphalt Co.'s paving business was good through the end of the 1920's and into 1930 (*Philadelphia Inquirer*, 1927; *New York Evening Post*, 1930; McFerrin, 1938), however, in large part because it was able to bypass competitive bidding for work in Tennessee through a cozy relationship between Caldwell and Co. and Tennessee's governor, Henry Horton, and its commissioner of Highways and Public Works, Harry Berry (McFerrin, 1938), so servicing the debt and paying dividends to the shareholders were achievable. Because of these relationships, Kentucky Rock Asphalt Co. managed to weather the early part of the Great Depression, paying dividends to its shareholders through October 1930 (McFerrin, 1938).

Despite a prediction that "this high-grade road-surfacing material will find a permanently expanding market" (*Petroleum Times*, 1928), production of Kentucky rock asphalt had peaked from 1926 to 1930 at an average of 326,000 tons per year from seven operating quarries (McFarlan, 1943), then quickly crashed to less than 45,000 tons per year in the early years of the Great Depression of the 1930's (Fig. 3). Only the Kentucky Rock Asphalt Co. and its Ohio Valley Rock Asphalt Co. subsidiary (discussed below) continued in operation after 1931. Predictably, however, the onset of the Great Depression and consequent bank failures led to Caldwell and Co. collapsing quicker than a poorly laid Kentucky rock-asphalt road. Rogers Caldwell, founder of Caldwell and Co. in 1917, in turn founded the Bank of Tennessee in 1919 (Colvin, 2009). By 1930, Caldwell and Co. had acquired controlling interests in four additional banks in Nashville and Knoxville, Tenn., and Louisville, and created a financial structure controlling banks and insurance

companies with combined assets represented to be \$615 million (*Buffalo Courier-Express*, 1930; Central Press, 1931; McFerrin, 1938; Colvin, 2009). This financial structure proved to be a house of cards that came crashing down on Nov. 5, 1930, after Tennessee state examiners audited the Bank of Tennessee and declared it insolvent, beginning runs on other Caldwell and Co.-controlled banks in Tennessee (*Banking Law Journal*, 2000; Colvin, 2009). Caldwell and Co. went into bankruptcy receivership on Nov. 14, 1930 (Colvin, 2009), which precipitated the collapse of 247 other banks in Kentucky, Tennessee, Arkansas, and North Carolina (*Cortland Standard*, 1939). Lawsuits to recover substantial funds deposited in Caldwell and Co.-controlled banks began in December 1930 (*New York Evening Post*, 1930), and criminal indictments followed in 1931 in Tennessee and Kentucky (*Buffalo Courier-Express*, 1931; *Cortland Standard*, 1939).

Loss of the Tennessee market and bankruptcy of Caldwell and Co. cut Kentucky Rock Asphalt Co.'s production in 1931 to about 45 percent of its 1930 level, and the company entered a 4-year period of financial losses (*New York Sun*, 1934; McFerrin, 1938). Kentucky Rock Asphalt Co. was delisted from trading by the New York Curb Exchange (the American Stock Exchange from 1953 to 2008; *New York Times*, 2010) in June 1933 (*New York Sun*, 1933). A bondholders' protective committee was formed in early June 1935, and Kentucky Rock Asphalt Co. was forced into bankruptcy, followed by a drastic reorganization plan on June 29, 1935 (McFerrin, 1938). The reorganization reduced the debt load, although it was nowhere near what it had been before recapitalization by Caldwell and Co., and issued new shares equally to former shareholders and bondholders (McFerrin, 1938). During reorganization, Kentucky Rock Asphalt Co. suspended operations until mid-May 1936 (*Waterville Times*, 1936), and missed about a year of production when sales by rock-asphalt producers increased by about 20 percent in an otherwise poor road-construction market (Redfield, 1936). The market for road asphalt of all kinds is seasonal, however (Redfield, 1935), and Kentucky Rock Asphalt Co. was closed for the peak paving months in 1935. Suspending operations for 5 months in 1936 did not hurt the company's earnings, however (*Philadelphia Inquirer*, 1938), although the improved earnings in 1936

New Issue

\$1,500,000

Kentucky Rock Asphalt Company

First Mortgage 6½% Ten-Year Sinking Fund Gold Bonds

(WITH STOCK PURCHASE WARRANTS)

Dated June 1, 1926 Due June 1, 1936

Interest payable June 1 and December 1 at the office of Trustee in New York City without deduction for normal Federal income tax not exceeding 2% per annum. The Company will agree to refund, upon timely application as provided in the mortgage, the usual Kentucky and District of Columbia taxes not in excess of 5 mills per annum, the Maryland Securities Tax not in excess of 4½ mills per annum, the California, Pennsylvania and Connecticut taxes not in excess of 4 mills per annum and the Massachusetts income tax on the interest not in excess of 6% per annum. Coupon bonds in interchangeable denominations of \$1,000 and \$500 registerable as to principal only. Redeemable as a whole or in part on any interest date, upon thirty days' notice at 105% and accrued interest. The Chemical National Bank of New York, Trustee.

Stock Purchase Warrants

Each Bond will bear a detachable warrant entitling the holder thereof to purchase Common Stock of the Company, at \$15 per share, at any time prior to June 1, 1936, in the ratio of 25 shares for \$1,000 principal amount of Bonds.

Mr. W. H. Tarvin, President of the Company, summarizes his letter as follows:

Business: Kentucky Rock Asphalt Company owns and operates the business formerly conducted by Kentucky Rock Asphalt Company of Kentucky and is engaged in the quarrying, crushing and marketing of natural rock asphalt.

The Company's product, sold under the well-known trade-name of "Kyrock," is extensively used in surfacing streets, highways, bridges, railroad-station platforms, factory floors, etc. "Kyrock" has been approved as a standard road-surfacing material by the Federal Highway Commission and by state, county or city authorities in 31 states.

Properties: The Company owns in fee or has mineral rights on approximately 40,000 acres of land in Kentucky, containing extensive deposits of natural rock asphalt. Reports indicate that the properties contain an actually proven supply sufficient for over ten years' operation and that unproven reserves are sufficient to last many years beyond the life of these bonds.

The Company owns a modern crushing plant with a present annual capacity of approximately 250,000 tons. The present financing program provides for additions to the Company's plant and equipment sufficient to increase the annual capacity to 350,000 tons.

Security: These bonds are a direct obligation of the Company and in opinion of counsel are secured by a first mortgage on all of its Fixed Assets now owned or hereafter acquired.

The sound value of the plant, together with the proposed additions, and commercial value of the mineral rights, as appraised by Ford, Bacon & Davis, Inc., as of May 11, 1926, total \$5,196,231, equivalent to approximately \$3,500 for each \$1,000 Bond of this issue.

Assets: The Balance Sheet of the Company as of March 31, 1926, after giving effect to the financing and completion of additions to plant as certified by Messrs. Humphrey Robinson and Company, shows Total Net Assets of \$5,773,922, equivalent to over \$3,800 for each \$1,000 Bond of this issue presently to be outstanding. The same Balance Sheet shows Current Assets of \$518,720 as compared with Current Liabilities of \$116,983 or a ratio of better than 4.4 to 1.

Earnings: For the three-year period ended December 31, 1925, Net Earnings of the predecessor company available for interest charges, depreciation and Federal Taxes, as certified to by Messrs. Humphrey Robinson and Company, were \$1,244,826 or an annual average of \$414,942. This is approximately 4¼ times maximum annual interest charges on the first mortgage bonds presently to be outstanding. During the calendar year of 1925 such earnings were over 4¼ times such maximum annual interest charges.

Ford, Bacon & Davis, Inc., estimate that, as a result of the proposed increase in the Company's annual production and sales to 350,000 tons, Net Earnings available for bond interest, depreciation and Federal Taxes will be in excess of \$800,000 per annum.

Sinking Fund: It is estimated that the sinking fund will retire all the bonds of this issue prior to maturity.

We offer these bonds for delivery when, as and if issued and accepted by us, subject to the approval of counsel. All legal details will be passed upon for the Company by Mr. H. N. Lukins of Louisville, Kentucky, and by Mr. W. E. Norvell, Jr., of Nashville, Tennessee, for the bankers. All audits were made by Messrs. Humphrey Robinson & Company, Louisville, Kentucky, and appraisals by Ford, Bacon & Davis, Inc., New York, N. Y.

Price 100 and interest to yield 6½%

Rogers Caldwell & Co., Inc.
150 Broadway
New York City

J. A. Ritchie & Co., Inc.
Resident Representative—Binghamton
Alexander Grossman, 63 Lathrop Ave.
Telephone 2094

All statements and figures contained herein, although not guaranteed, have been obtained from sources which we believe to be reliable.

Figure 16. Kentucky Rock Asphalt Co. was purchased in a highly leveraged buyout by a syndicate led by Caldwell and Co. and Rogers Caldwell and Co. of New York (*Binghamton Press*, 1926). In this advertisement published in the *Binghamton Press* (1926), the Caldwells are offering \$1.5 million of 10-year gold bonds secured by all current and future fixed assets—the properties, processing plant, buildings, and equipment—of the company.

stemmed from a strong upturn in road construction beginning in 1936 (Redfield, 1937). Demand for rock-asphalt products increased almost every year thereafter from 1937 to 1942 (Redfield, 1938, 1939, 1941, 1943a, b) (Fig. 3).

After a 10 percent dip in sales during 1943 (Redfield, 1945), production and sales of Kentucky rock asphalt rebounded during the late years of World War II to 141,208 tons in 1944, valued at \$978,279, and 152,047 tons in 1945, valued at \$1,037,068 (Redfield, 1946, 1947; Meyer, 1947). The progressive increase in rock-asphalt sales in the United States generally continued through the post-war years of 1946 to 1952, with a small dip in sales during 1948, a large drop in sales in 1950, and another small dip in 1953 (Redfield, 1948, 1949; Redfield and Spencer, 1949, 1951; Redfield and Sims, 1953; Redfield and Granacher, 1954; Coumbe, 1955; Coumbe and Avery, 1956) (Fig. 3). Kentucky Rock Asphalt Co. consolidated its operations in 1946 by moving its processing from its original site at Kyrock to Sweeden in 1946 (Creason, 1957). It was not the production volume by the Kentucky Rock Asphalt Co., however, that led to its closure in 1957, but a combination of three factors (Creason, 1957): the higher cost of Kentucky rock asphalt was not competitive with the cost of petroleum asphalt, the poor durability of Kentucky rock-asphalt road surfaces under the weight of modern “boxcar-size” trucks, and the illness of their longtime president. Production in 1956 was about 67 percent of that in 1949; however, income was only about 25 percent of 1949’s (Creason, 1957). The company discontinued production in 1956, with the commonwealth of Kentucky likely its last purchaser that year (Havens, 1964; Florence, 1966), and shareholders voted on June 14, 1957, to dissolve the corporation and liquidate its assets (Creason, 1957). The assets of the company were purchased by W.G. Reynolds and Associates during 1957–58 (Laughlin, 1962) and the Kentucky Department of Highways purchased the last of the

processed rock asphalt in stock during 1958 (Havens, 1964). Kentucky Rock Asphalt Co. is registered with the Delaware Department of State, Division of Corporations (2014a).

**Natural Rock Asphalt Corp.
(1922–27) and Standard
Rock Asphalt Co. (1928–35)**

Natural Rock Asphalt Corp. (Fig. 1A, location 7) was organized in 1922 (Cottrell, 1925; Weller, 1927) and quarried rock asphalt from the Caseyville Formation on 2,000 acres of land along Bear Creek in west-central Edmonson County (Richardson, 1924; Jillson, 1927a) (Fig. 17). At the time it was the only other rock-asphalt company operating in Kentucky besides the Kentucky Rock Asphalt Co. (Cottrell, 1925) (Fig. 2). The company was acquired

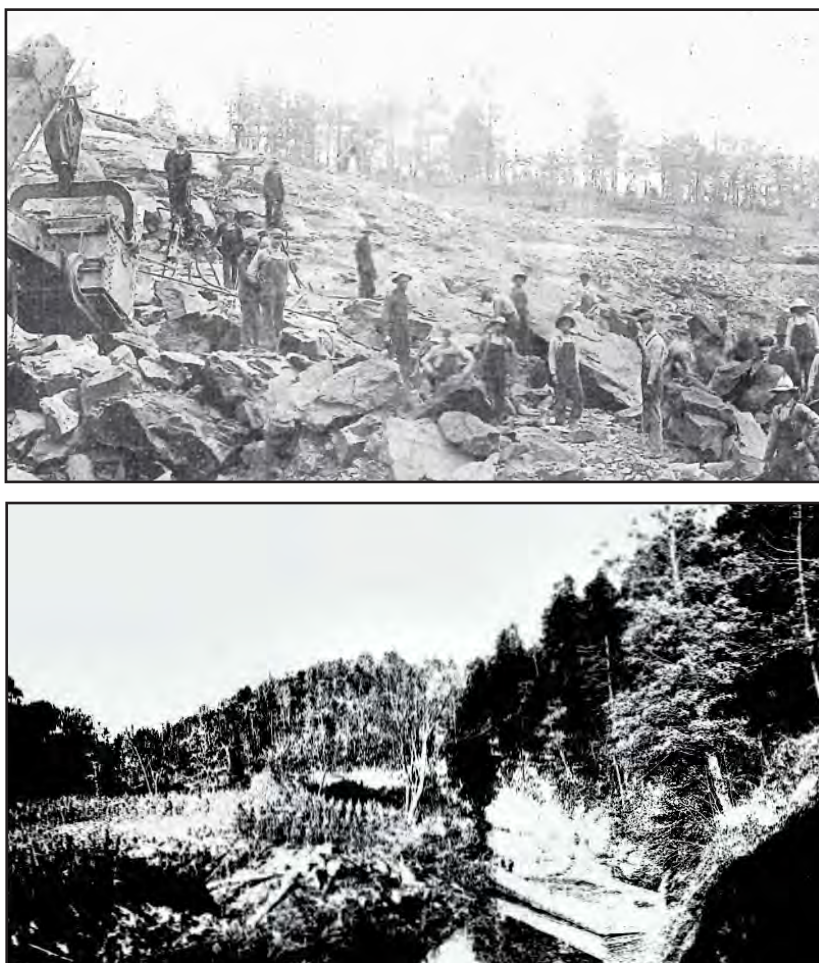


Figure 17. The Natural Rock Asphalt Corp. operations in west-central Edmonson County. (A) A view of the Natural Rock Asphalt Corp. quarry in Gulf Hollow (Jillson, 1926c). (B) A barge loading processed rock asphalt at the Natural Rock Asphalt Corp.’s landing on Bear Creek (Jillson, 1922b).

by a holding company, Standard Rock Asphalt Co., in January 1928 (*New York Sun*, 1928), but continued to operate as the Natural Rock Asphalt Corp. through at least 1931 (Cottrell, 1926, 1927; Hopkins and Coons, 1928, 1930; Hopkins, 1929; Burroughs, 1930; Redfield, 1930, 1932a, b, 1933) (Fig. 2). Standard Rock Asphalt Co. was chartered in Delaware on Nov. 3, 1925, with a capitalization of \$1.5 million (*New York Times*, 1925) and incorporated on March 1, 1927. Natural Rock Asphalt Corp. evaluated its property by drilling coreholes on 25-foot centers well ahead of quarrying, and operated an open-pit mine and a mill with a production capacity of 250 tons of rock asphalt per day (Richardson, 1924; *Pit and Quarry*, 1926). Evaluations of coreholes on nearby properties held by Standard Rock Asphalt Co. showed an average rock-asphalt thickness of 7 to 34 feet and average bitumen content of 6.35 to 8.97 percent (Jillson, 1925b, 1927c). The Natural Rock Asphalt Corp. discontinued its quarry operations in 1935 (Havens and Williams, 1956), and by late 1935 Standard Rock Asphalt Co.'s stock had fallen to 50 cents per share (*New York Sun*, 1935), from \$12 per share at its formation (Supreme Court of New York, 1931). Standard Rock Asphalt Co. is still listed in Delaware as an inactive corporation as of October 2014 (Delaware Department of State, Division of Corporations, 2014b).

Rock Asphalt Co. of America (1922–27), United Rock Asphalt Co. (1927–about 1930), and Diamond Rock Asphalt Co. (about 1932–40)

Rock Asphalt Co. of America (American Rock Asphalt Co. of Ball [1951]) (Havens and Williams, 1956) (Fig. 1A, location 8; Fig. 2) was organized in Louisville prior to October 1922 when Jillson (1922b) evaluated undeveloped properties in Edmonson County. The properties totaled 2,026 acres as two tracts on the Green River west of Brownsville, Edmonson County, the largest tract being about 1,479 acres (Jillson, 1922a). Jillson found that the rock-asphalt deposit varied from 11 to 23 feet thick, and that the single sample analyzed had a bitumen content of 10.7 percent by weight, a very rich sample (Jillson, 1922a). When Rock Asphalt Co. of America began its operations on the Green River properties in Edmonson County is uncertain. Richardson (1924) gave a summary of Jillson's (1922a)

property evaluation without mentioning quarrying or milling the rock asphalt. A newspaper account has Rock Asphalt Co. of America contracting for equipment to be shipped to its new plant on the Green River in mid-August 1924 (*Park City Daily News*, 1959). The company was not listed as a rock-asphalt producer until 1926 (Hopkins, 1929); however, it was likely in production by then (Fig. 18).

In March 1927, the Rock Asphalt Co. of America was merged into United Rock Asphalt Co. (*Burlington Times*, 1927) (Fig. 2), a Delaware corporation (U.S. Circuit Court of Appeals, Sixth Circuit, 1932) with Southern Rock Asphalt Co. of Louisville, whose operations were at Decatur, Ala. (Clark, 1925). The combined operations had a contemplated combined capacity of 3,000 tons per day, including the 2,000-tons-per-day Southern Rock Asphalt Co. plant in Edmonson County (Fig. 1A, location 8), a plant at Black Rock, Grayson County, and a plant in Decatur, Ala. At the time of the merger, Rock Asphalt Co. of America's properties were valued at \$1 million and the Black Rock and Southern Rock Asphalt Co. properties at \$350,000 (*Burlington Times*, 1927) (Fig. 19). At that time, mineral speculators Overall and Owens, Bowling Green, Ky., also contributed 3,000 acres of rock-asphalt leases to the venture (Weller, 1927), possibly including the 1,800 acres lying on Bear Creek in Edmonson County evaluated by Jillson (1922b). Financing for the new company was secured by bond sales during the second half of 1927 (*Altoona Tribune*, 1927). Jillson (1926b) had earlier evaluated three mineral tracts for United Rock Asphalt Co. in March 1926: a 75-acre tract in southern Hardin County about 1.5 miles northwest of Tar Hill, northern Grayson County, a 575-acre tract of fee-simple and leased lands immediately south of Tar Hill, and a 2,000-acre lease in Logan County about 5 miles northeast of Russellville adjacent to the properties once held by American Standard Asphalt Co. Although Jillson (1926b) described United Rock Asphalt Co. as operating a mill at Big Clifty and quarry about 3.5 miles northwest of there (Jillson, 1926a), the company is listed as a rock-asphalt operator in Kentucky during 1926 (Burroughs, 1930) but as a producer only in 1927 (Hopkins and Coons, 1930) and later, after the merger. The Kentucky Geological Survey holds 23 original records of coreholes drilled by Hoffman Brothers, contractors of Punx-

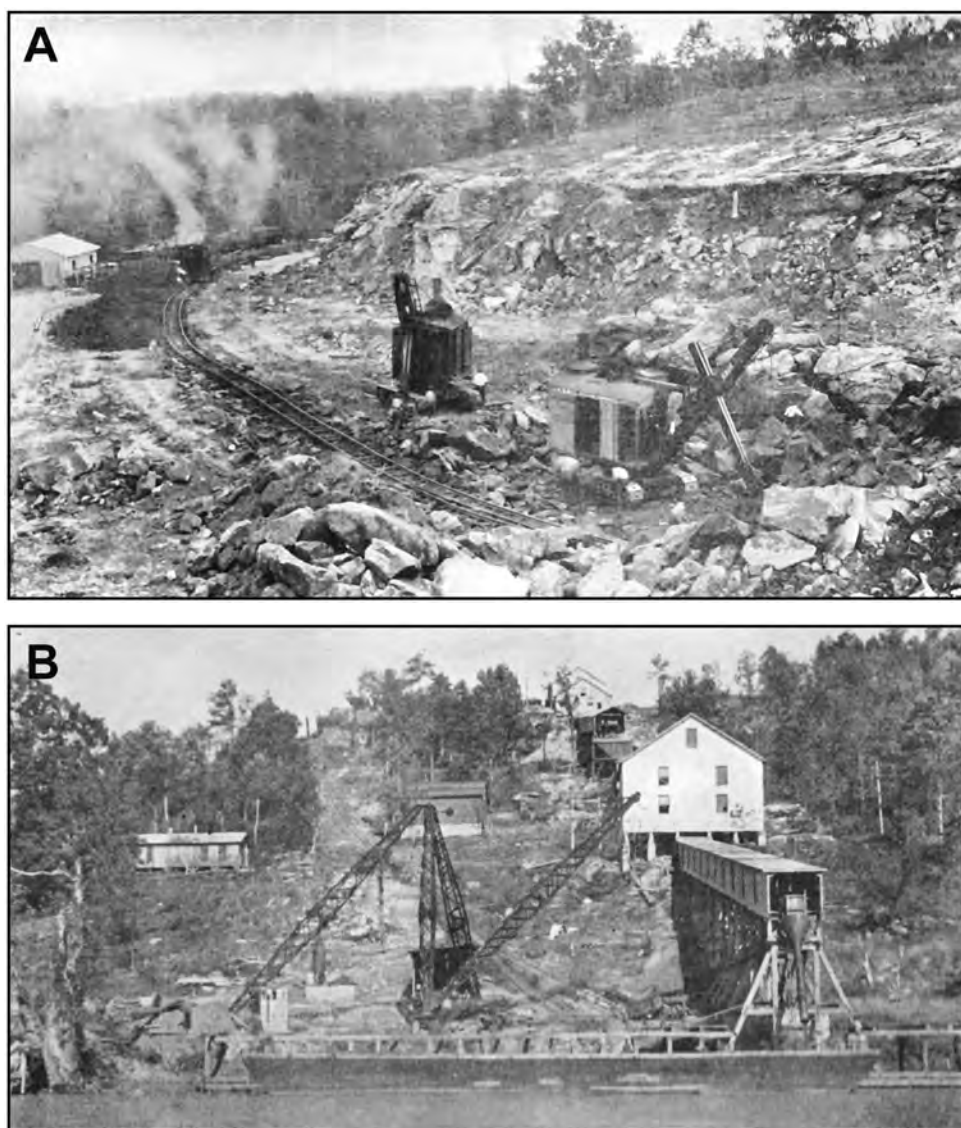


Figure 18. Rock Asphalt Co. of America developed a quarry and built a plant and barge-loading terminal on the Green River near the abandoned Wadsworth Stone and Paving Co.'s site. (A) A view of the Rock Asphalt Co. of America quarry about 1925. (B) Mill and barge terminal on the Green River. Photos are from Weller (1927).

sutawney, Pa., in United Rock Asphalt Co.'s properties near Asphalt, Edmonson County, during May and June 1927.

In February 1928, United Rock Asphalt Co. received a contract to provide Kentucky rock asphalt to the County of Pinellas, Florida (*Evening Independent*, 1928); however, this is the only record available of product sales. The company entered receivership after January 1929 (Redfield, 1932a; U.S. Circuit Court of Appeals, Sixth Circuit, 1932), probably in 1930 when it was not listed as a rock-asphalt producer by Redfield (1932b). Its Kentucky properties and mill were subsequently sold to Di-

amond Rock Asphalt Co. (Havens and Williams, 1956) about 1932 (Fig. 2), because Diamond Rock Asphalt Co. is not listed as a producer in 1931 (Redfield, 1933), and before November 1936 when Diamond Rock Asphalt Co. became insolvent (Court of Appeals of Kentucky, 1950). Diamond Rock Asphalt Co. continued to operate the properties and mill until 1940, when they were sold to Ohio Valley Rock Asphalt Co. (Havens and Williams, 1956). United Rock Asphalt Co. of Louisville is still listed as an existing foreign corporation in Alabama as of October 2014 (Alabama Secretary of State, 2014).

We Recommend

United Rock Asphalt Co.

First Mortgage Sinking Fund Gold Bonds

Dated June 1, 1927

Due June 1, 1942

DENOMINATIONS \$500 . . . \$1,000

Callable prior to December 31, 1931 on 30 days' notice at 105 and interest; thereafter up to and including December 31, 1936 at 102½ and interest, and thereafter to and including December 31, 1941 at 101½ and interest, and on June 1, 1942 at 100 and interest. Trustee—Pennsylvania Company for Insurances on Lives and Granting Annuities. Company pays normal Federal income tax 2 per cent. Pennsylvania four mills tax refunded.

Natural Rock Asphalt has been approved as a STANDARD ROAD SURFACING MATERIAL by the FEDERAL HIGHWAY COMMISSION and by State, County and City authorities IN MORE THAN THIRTY STATES.

The United Rock Asphalt Company controls three producing properties, two in Kentucky and one in northern Alabama. At EACH PROPERTY there is a Complete and MODERN PLANT for PROPERLY preparing the material for market—these plants have an aggregate productive capacity in excess of 300,000 TONS OF "UNIROK" PER YEAR.

Considering only the tonnage classified by Ford, Bacon & Davis, Inc., as proven, the operation of the Sinking Fund will, it is estimated, retire the present bond issue by the time approximately 20 per cent of the proven tonnage has been sold.

UPON COMPLETION OF PRESENT FINANCING, NET TANGIBLE ASSETS WILL BE IN EXCESS OF \$3.100 PER \$1,000 bond.

Sinking Fund of fifteen cents per ton of "Unirok" produced and sold, will retire this issue by maturity. Payments are to be made to the Trustee monthly and are to be used as provided in the mortgage for the purchase and cancellation of bonds.

The estimated earnings are in excess of 9 TIMES INTEREST CHARGES, thus indicating approximately \$1.00 per share earned on the Company's Common Stock.

The purchaser of each \$1,000 Bond will receive 10 shares of Common Stock, and the purchaser of each \$500 Bond, 5 shares of Common Stock, upon delivery of the Definition Bonds.

**Circular
Sent on
Request**

The United States spent \$1,500,000,000 for roads in 1921.
These roads must be kept up and new roads must be built.

**Price 98—To Yield 6.70%
When, As and If Issued**

Calahan & Co., Inc.

Third Floor, Penn Central Building . . . Phone 5126

The above information has been obtained from sources we believe to be reliable, but in no event are any statements herein to be considered representations by us.

Figure 19. United Rock Asphalt Co. sold gold bonds in mid-1927 to finance the expansion of its operations in Kentucky and Alabama (*Altoona Tribune*, 1927). Despite this financing measure, the company failed 2 years later.

Ohio Valley Rock Asphalt Co. (1922–46)

Ohio Valley Rock Asphalt Co. (Fig. 1A, location 9) was organized in 1922 (U.S. Court of Appeals for the District of Columbia, 1937; Havens and Williams, 1956) (Fig. 2) and acquired leases in Hardin, Hart, Grayson, Breckinridge, and Logan Counties (Jillson, 1924; U.S. Court of Appeals for the District of Columbia, 1937). The company began operations at Summit, Hardin County, in 1923 (Cottrell, 1926) and was operating a plant at Summit capable of processing 1,000 tons per day of rock asphalt quarried from the Big Clifty Sandstone by 1924 (Jillson, 1924) (Fig. 20). The company's trademarked rock-asphalt product was marketed as Bituroc (Fig. 21). Although it had plans to expand its operations to Garfield, Breckinridge County, and near Russellville, Logan County (Jillson, 1924), Ohio Valley Rock Asphalt Co. never operated beyond Summit (U.S. Court of Appeals for the District of Columbia, 1937). The company was operated from its founding as a subsidiary of Kentucky Rock Asphalt Co. (*Kentucky Progress Magazine*, 1929), although this cannot be verified from other sources. Ohio Valley Rock Asphalt Co. acquired the land, mineral rights, and equipment of the Diamond Rock Asphalt Co. in 1940, at which time its operations were moved to Black Rock, Grayson County (Havens and Williams, 1956). The company subsequently closed its business in 1946 (Ball, 1951; Havens and Williams, 1956).

Continental Rock Asphalt Co. (1923–24) and Crown Rock Asphalt Co. (1925–40)

Continental Rock Asphalt Co. of Kansas City, Mo., was incorporated in Kentucky in October 1921 (*Rock Products*, 1925), and produced rock asphalt from Grayson County in 1923 and 1924 (Fig. 2) from mines at Tar Hill (Fig. 1A, location 10) and a 500-ton-capacity mill at Big Clifty (Jillson, 1923a, 1924; Richardson, 1924; Cottrell, 1926, 1927; Havens and Williams, 1956) (Fig. 22). The rock asphalt they mined was good commercial quality, about 7 to 8 percent bitumen by weight, but only 4 to 5 feet thick (Richardson, 1924). The company failed in 1924 (*Rock Products*, 1925) and its operations were acquired by Crown Rock Asphalt Co. of Cincinnati, Ohio (Clark, 1925; Hopkins and Coons, 1928; Havens and Williams, 1956) (Fig. 2). Crown Rock Asphalt Co. replaced the existing mill at Big

Clifty in 1925 (*Engineering News Record*, 1925) to process lean rock asphalt (with a bitumen content less than 7 percent by weight) to produce a product meeting commercial quality (Havens and Williams, 1956). The company was listed as a Kentucky rock-asphalt producer from 1924 to 1928 and 1930 to 1931 (Cottrell, 1926, 1927; Hopkins and Coons, 1928, 1930; Hopkins, 1929; Burroughs, 1930; Redfield, 1930, 1932a, b, 1933), then sporadically until closing in 1940 (Havens and Williams, 1956).

Black Rock Asphalt Co. (1925–38)

Black Rock Asphalt Co. (as Black Rock Asphalt Corp. of Kentucky) (Fig. 2) was incorporated in Delaware on June 13, 1925, with an initial capitalization of \$200,000 (*New York Times*, 1925), although it was soliciting investors as early as March (*Union-Sun and Journal*, 1925a) (Fig. 23). Earlier in the year it advertised that it had acquired a rock-asphalt property in Kentucky (*Union-Sun and Journal*, 1925b, p. 6):

The Rock Asphalt itself has been found in its natural state in Kentucky but until recently there has been no extensive exploitation of this highly desirable commercial product. ... The Black Rock Asphalt Co. has purchased one of the richest sources of the material and it is purposed to start production very soon. In fact orders and inquiries as to where Rock Asphalt may be obtained, are being received without solicitation.

The company goes on to advertise that it was “organized to quarry, mill, and market natural Kentucky rock asphalt,” with properties at Russellville, Logan County (*Buffalo Morning Express*, 1925) (Fig. 24). The location of the quarry cannot be accurately placed. Outcrops of Big Clifty Sandstone nearest Russellville are found about 2 miles to the north (Gildersleeve, 1966; Miller, 1968), close to the American Standard Asphalt Co. quarry. It is unlikely that Black Rock Asphalt Corp. acquired the American Standard Asphalt Co. quarry from Kentucky Rock Asphalt Co. in 1925, because Miller (1919) described it as worked out. In Jillson's (1926b) evaluation of a 2,000-acre leasehold of United Rock Asphalt Co., adjacent to the abandoned American Standard Asphalt Co., no nearby operations are mentioned. Thus, the “contemplated commercial operations ... near Russellville” mentioned by Jillson (1927a) likely refer to the United Rock Asphalt Co. properties evaluated in his 1926 report.

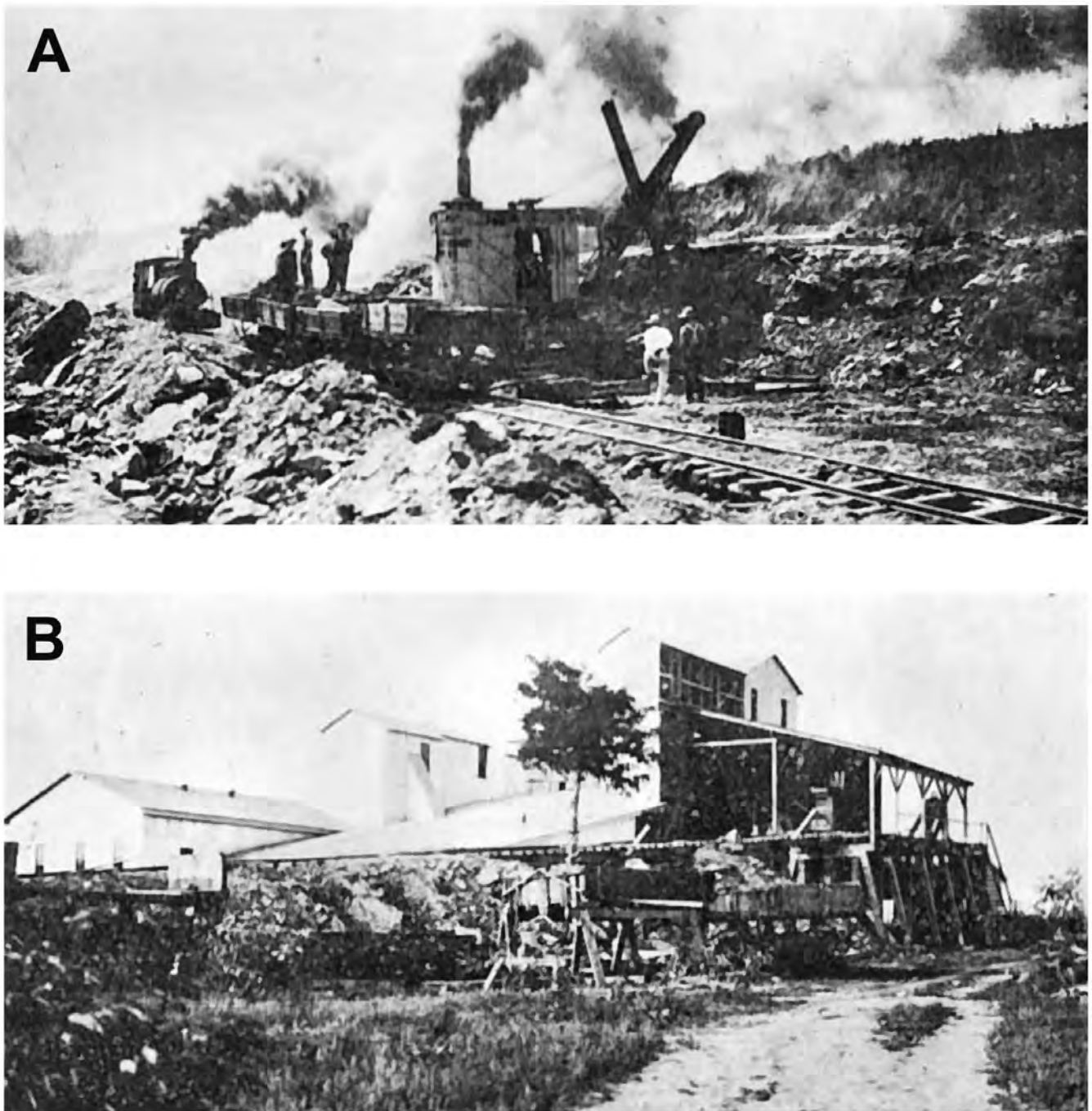


Figure 20. The Ohio Valley Rock Asphalt Co.'s quarry and mill were adjacent to the railroad tracks at Summit in Hardin County, from 1922–46. (A) The company's mill about 1926. Remains of the mill's foundation are still visible on the site. (B) The Ohio Valley Rock Asphalt Co.'s quarry about 1926. Photos are from Jillson (1927a).

The Logan County properties must not have been developed, because Richardson (1924) had Black Rock Asphalt Co. evaluating 2,222 acres of rock-asphalt properties in Grayson County, near Church, about 3 miles southeast of the town of Black Rock at that time (Fig. 1A, location 11). Core

drilling on the properties showed 9 feet of rock asphalt with an average bitumen content of 7.11 percent (Richardson, 1924); however, Black Rock Asphalt Co. was not listed as a rock-asphalt operator in 1926 (Burroughs, 1930). Gildersleeve (1978) showed two abandoned rock-asphalt quarries,



Figure 21. Most of the rock-asphalt companies had a proprietary trademarked name for their products. The Ohio Valley Rock Asphalt Co.'s product, processed Big Clifty Sandstone, was called Bituroc.

developed in the Caseyville Formation, at Church on land where the mineral rights were owned by Black Rock in 1974 (Morgan, 1974). Jillson (1927a) mentioned that "other operations are contemplated near Black Rock post-office, a few miles southwest of Leitchfield." This is consistent with Richardson (1924). Because Black Rock Asphalt Co. submitted bids for street paving in Buffalo, N.Y., in June 1928 (*Buffalo Evening News*, 1928), its operations must have commenced in late 1927 or early 1928. The company may also have been the operator that quarried rock asphalt from the Caseyville Formation near the railroad tracks at Black Rock, about 1.2 miles north of the Church quarries (Ball and Associates Ltd., 1965, and sources cited therein; pits shown by Gildersleeve, 1978). It continued in operation, probably sporadically, until 1938, but ultimately failed because the material did not meet road-paving specifications (Havens and Williams, 1956).

Other Operators and Land Speculators

Besides those companies discussed above, several other operators are mentioned in the literature who were in business only a very short time or never succeeded in commencing operations. The Ohio Bituminous Rock Co. paved a street in Cincinnati with "improved natural asphalt" before May 1894 (*Cincinnati Enquirer*, 1894), but had surface-quality issues. It was listed with a quarry near Big

Clifty, Grayson County, by 1897 (Mine and Quarry News Bureau, 1897), but was not mentioned by Eldridge (1901) or any subsequent author. Havens and Williams (1956) noted Pioneer Asphalt Co. as a rock-asphalt producer near Russellville, Logan County, from 1894 to 1905. Sicilian Asphalt Co., New York, held a prospect by 1901 adjacent to that of the Green River Asphalt Co. (Eldridge, 1901), but the property was never developed beyond trial shipments of a few tons of rock (Eldridge, 1901; Abraham, 1938; Ball, 1951). Crump (1913) stated that more than 100 rock-asphalt mines and quarries had been opened in Grayson and Edmonson Counties by that time. Nolin Asphalt, Coal and Navigation Co. of Staunton, Va., was chartered in West Virginia on May 20, 1905, first "to buy, sell, deal in or with asphalt, asphalt rock, asphaltic products, by-products and compounds ... and to mine, quarry, excavate, dig or procure by any operation or manipulation the same ..." along with similar endeavors in oil and gas and other mining industries (West Virginia Secretary of State, 1907). There are no records demonstrating that Nolin Asphalt, Coal and Navigation Co. mined or sold any product other than coal in West Virginia (*Black Diamond*, 1922), although it exhibited rock asphalt from Edmonson County, as did Wadsworth Stone and Paving Co., at the Jamestown Ter-Centennial Exposition in 1907 (Ousley, 1907). A Mr. Hatch opened a quarry on Indian Creek in Edmonson County in 1907 that operated for about 18 months, selling its product to Barber Asphalt Co. in St. Louis (Bryant, 1914; Weller, 1927). This is the Hatch Quarry later worked by Kentucky Rock Asphalt Co. (Weller, 1929), but may also include its Indian Creek Quarry discussed in May and others (2007). Richardson (1924) discussed properties at Meredith Hill in southern Grayson County, including one at which 40 to 50 tons of rock asphalt had been quarried but not shipped, without giving an operator. Overall and Owens were former oil operators that became large land speculators, assembling 18,000 acres of leases in Edmonson County (Jillson, 1925a; Weller, 1927), of which 3,000 acres were sold to Rock Asphalt Co. of America (Weller, 1927). Silica Asphalt Co. had plans to open a rock-asphalt quarry in south-central Grayson County (Richardson, 1924; Jillson, 1927a; Ball, 1951), although there is no record of the company reaching production (Havens

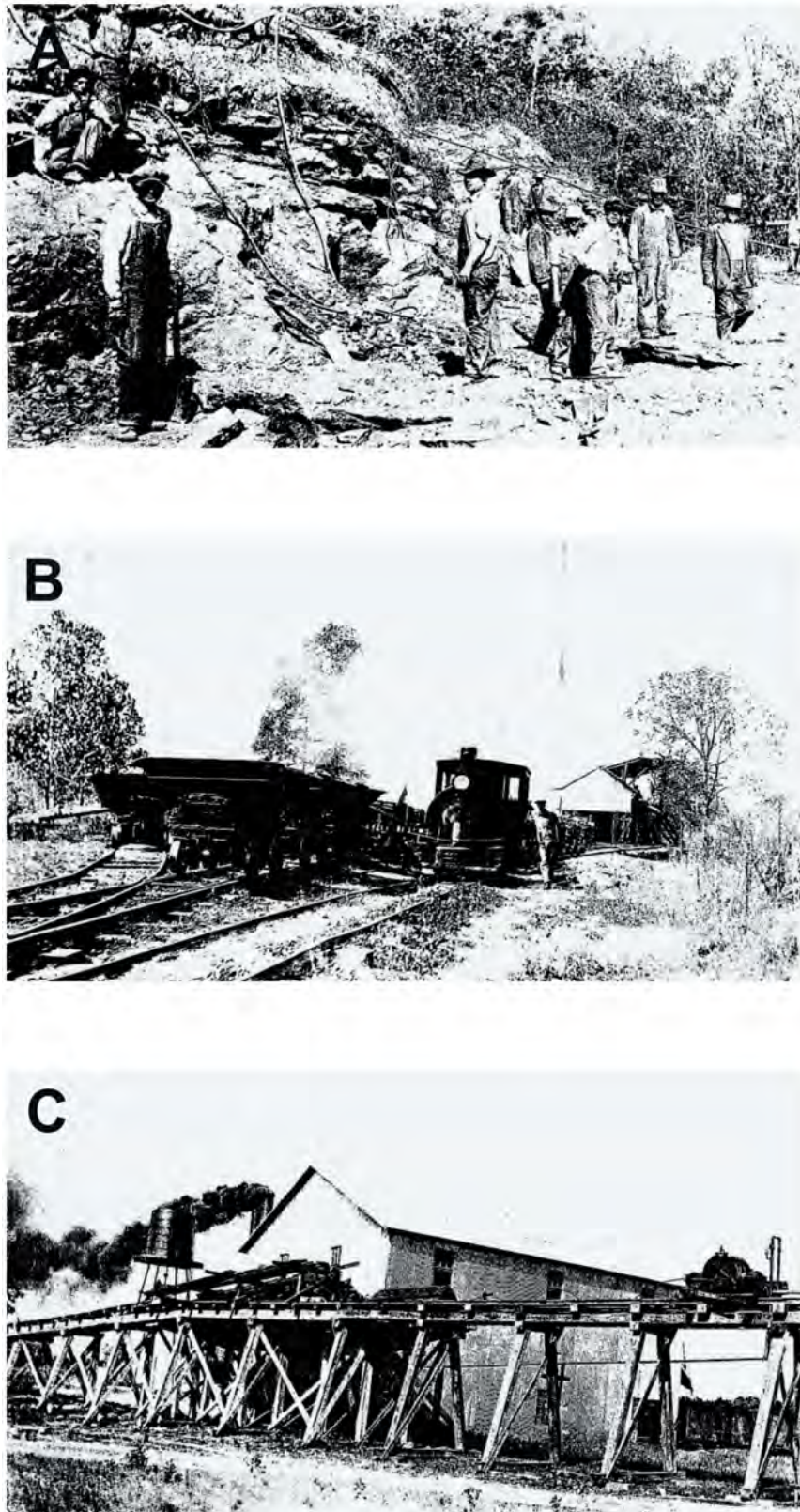


Figure 22. Continental Rock Asphalt Co. operated a quarry near Tar Hill, Grayson County, with its mill and loading facilities in Big Clifty. (A) Continental Rock Asphalt Co. quarry. (B) A load of rock asphalt being pulled by a dinky train on its way from the quarry to the mill. (C) The Continental Rock Asphalt Co. mill at Big Clifty. All photos from Jillson (1923b).

**Looking Forward
To Better Roads**

Black Rock Asphalt is formed and ready mixed by nature. It is not subject to damage by the elements either in shipment or storage. It is shipped ready to lay cold and on any standard base. No equipment other than shovels, rakes and roller is needed to lay it. The finished pavement is smooth, noiseless, dustless and resilient. It does not crack, roll, buckle or run. No other pavement can be so easily and inexpensively maintained.

THE OLD ADAGE

"The Early Bird Gets the Worm" still holds true and the early investor with the Black Rock Asphalt Company gets in on the ground floor. A limited number of shares are offered at \$10.00 (par) to increase our working capital. Full particulars will be cheerfully given at 215 Hodge Building or call 957.

The Black Rock Asphalt Company Inc.

HARRY E. WHITNEY, PRESIDENT, LOCKPORT, N. Y.

Figure 23. Black Rock Asphalt Co. advertised heavily in north-eastern newspapers after its formation. This advertisement, touting the advantages of Kentucky rock asphalt as a road-surfacing material, also solicits additional investors in the company (*Union-Sun and Journal*, 1925a).

and Williams, 1956). Havens and Williams (1956) noted that Church Asphalt Co. produced a small amount of rock asphalt from a quarry in Grayson County about 5 miles north of Shrewsbury in 1926 and 1927, and a Mr. Fowler operated a small crushing plant at Leitchfield and produced and sold rock asphalt from 1937 to 1940.

Every resource play attracts land speculators, and the western Kentucky rock-asphalt development was no exception. At least 16 of these individuals and companies are known from publications of the Kentucky Geological Survey. Aside from Overall and Owen (Richardson, 1924; Jillson, 1925a), two other land speculators in Edmonson County were mentioned by Richardson (1924). Weller (1927) discussed seven rock-asphalt land speculators and their lease holdings in Edmonson County, as well as M.M. Logan, who had contributed property to the founding of the Kentucky Rock Asphalt Co. in 1926. Jillson (1923a, b, 1925c, 1927b, d, 1928, 1929) completed rock-asphalt re-

**NATURAL—
KENTUCKY ROCK ASPHALT**

—THE IDEAL ROAD SURFACING MATERIAL
—LOWEST IN COST OF MAINTENANCE
—HIGHEST FROM STANDPOINT OF DURABILITY

BLACK ROCK ASPHALT CO.

ORGANIZED TO QUARRY, MILL AND MARKET
NATURAL KENTUCKY ROCK ASPHALT

<p>OFFICES:</p> <p>1001 BRAMSON BLDG. BUFFALO, N. Y.</p> <p>215 HODGE BLDG. LOCKPORT, N. Y.</p>	<p>PROPERTIES:</p> <p>RUSSELLVILLE LOGAN COUNTY, KENTUCKY</p>
---	---

Figure 24. This advertisement from June 1925 states that the newly incorporated Black Rock Asphalt Co. was "organized to quarry ... natural Kentucky rock asphalt" and held properties near Russellville in Logan County (*Buffalo Morning Express*, 1925). Nothing in the advertisement states, however, that rock asphalt would be quarried in Logan County. All other evidence suggests that their operations were in Grayson County near Black Rock (Havens and Williams, 1956).

source evaluations of properties held by seven additional land speculators in Edmonson, Grayson, Hardin, and Hart Counties. Doubtless the names of additional land speculators may be found in the archives of Jillson's papers at the University of Louisville, University Archives and Records Center, Louisville, and Berea College, Special Collections and Archives, Berea, Ky.

Kentucky Rock-Asphalt Industry's Legacy on the Landscape

It is impossible to remove as much rock as was mined and quarried by the Kentucky rock-asphalt industry without leaving visible evidence of its activities (Fig. 25). Although this damage can be mitigated, during the period of rock-asphalt production, mine-site reclamation and surface recontouring were not required, as is mandated by current regulations. Consequently, even though the last active rock-asphalt quarry, Kentucky Rock Asphalt Co.'s Sweeden Quarry in Edmonson County (Fig. 25B), closed in 1957 (Creason, 1957), scars of this and the other Kentucky Rock Asphalt Co. quarries in Edmonson County are easily discovered by aerial and satellite photography. Figure 25 shows LiDAR (light detection and ranging), an aerial pulsed-laser method for imaging the earth's surface, served by KGS's Kentucky Geologic Map Information Service (kgs.uky.edu/)

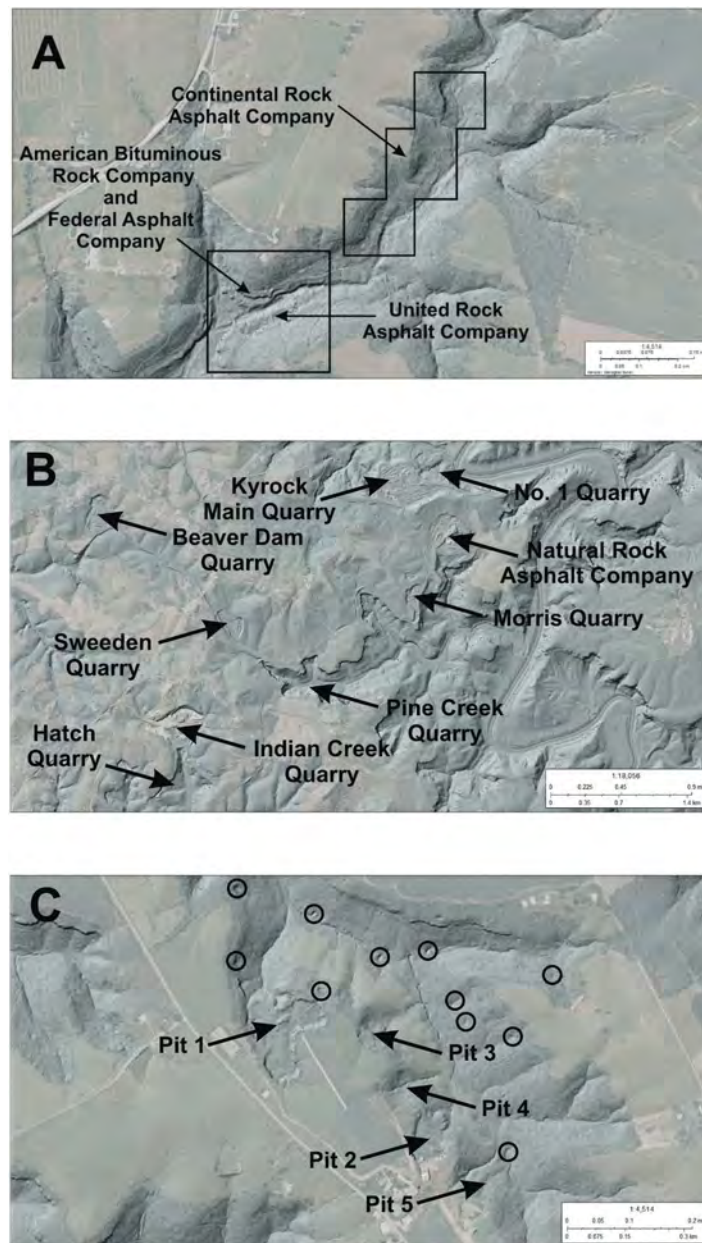


Figure 25. The Kentucky rock-asphalt industry left a substantial surface impact in western Kentucky in the form of abandoned mines and quarries. These sites are visible on aerial and satellite photographs, where not obscured by vegetation, and LiDAR images. (A) Three mines operated in Flutter Creek, about 2.4 miles south of Tar Hill, Grayson County, between 1889 and about 1930. Mine adits left by the American Bituminous Rock Co. and Federal Asphalt Co. are visible as six to eight black spots above a ledge along the canyon wall. United Rock Asphalt Co. quarried rock asphalt in Flutter Creek across from the Federal Asphalt Co. mine. A large spoil pile is visible adjacent to the quarry site in the southwest corner of the box. Rock asphalt was briefly quarried from the Big Clifty by Continental Rock Asphalt Co. in three pits in Flutter Creek, upstream of the sites of the Federal Asphalt Co. and United Rock Asphalt Co. operations. (B) Kentucky Rock Asphalt Co. operated eight quarries in central Edmonson County, excluding the former Wadsworth Stone and Paving quarry, between 1917 and 1957. The Sweeden Quarry was the last to operate. The largest operation was at the Main Quarry (Fig. 15A). Natural Rock Asphalt Co. and its successor, Standard Rock Asphalt Co., operated one quarry between Kentucky Rock Asphalt Co.'s No. 1 and Morris Quarries for about 13 years. (C) American Standard Asphalt Co. was the third rock asphalt company to open a commercial quarry. Their quarry, about 4.4 miles northeast of Russellville in Logan County, although closed over 100 years ago, is still the only commercial rock-asphalt venture to operate in Logan County. Five quarry pits (see, e.g., Fig. 9) were operated by the company. American Standard Asphalt Co., or successor interests, also dug 11 prospect pits (circled) northeast of the quarry site to evaluate the commercial extent of the rock-asphalt deposits.

kgsmap/kgsgeoserver/viewer.asp). Abandoned rock-asphalt mines and quarries in Grayson County (Fig. 25A), Edmonson County (Fig. 25B) and Logan County (Fig. 25C) left clear imprints of surface damage caused by moving and removing overburden and rock asphalt. Pits and mine-spoil piles are visible (Fig. 25A, C), as well as prospect pits that were dug to evaluate rock-asphalt resources near the quarry site in Logan County (Fig. 25C). Although the rock-asphalt industry did not leave a moonscape of abandoned quarries, there was a substantial surface impact.

Contamination of surface and groundwater by hydrocarbons leaching from the mined areas and spoil piles would be a reasonable concern for residents near abandoned quarry sites. Western Kentucky's rock-asphalt deposits have been exposed in surface outcrops since the Late Cretaceous (Bowersox, in press), or a period of about 95 million years (Cohen and others, 2013). Any mobile hydrocarbons in these outcrops should have long since been volatilized or degraded. What remains are solid to semi-solid bitumen in rock-asphalt outcrops and sparse natural seeps of heavy oil. The possibility of hydrocarbons leaching from Caseyville rock-asphalt mine spoil in Edmonson County was tested by Kasulavada (2013). He tested six samples by circulating synthetic rainwater with a pH range of 3 to 9 through them and found hydrocarbons leached only by water with a pH of 3. Natural rainwater in western Kentucky has a higher pH of about 5.5 because of gases dissolved in it (Merideth, 2009), so, although the unreclaimed mine and quarry sites may be unsightly where not covered by vegetation, it is unlikely that hydrocarbons are being leached from abandoned rock-asphalt mine and quarry sites or mine-spoil piles and contaminating surface- or groundwater resources.

Summary and Conclusions

The Kentucky rock-asphalt industry had a rich history of visionary entrepreneurs (see Orton, 1891), businessmen (see *Municipal Journal and Engineer*, 1904), engineers and geologists (American Society of Civil Engineers, 1890; *Municipal Engineering*, 1903a), more than 200 hard-working miners and mill workers in the largest quarries (for example, see Creason, 1957), promoters (*Buffalo Evening News*, 1899), land speculators (Richardson, 1924;

Jillson, 1925a; Weller, 1927), and crooked financiers and corrupt politicians (see McFerrin, 1938). From its inception in 1889 with W.L. Breyfogle's American Bituminous Rock Co., only 19 companies can be documented as having produced rock asphalt in western Kentucky (Fig. 2). Fewer than half of these, including the American Bituminous Rock Co., operated for more than 6 years (Fig. 2). Even during the peak producing years of 1923 to 1931, there were never more than eight active rock-asphalt operators documented, with an average of seven operators active in western Kentucky during this time (Fig. 3). Average rock-asphalt production for this period was about 246,000 tons per year (Fig. 3), or an average of about 35,000 tons per year per operator. Peak annual production of 344,220 tons occurred in 1927 by eight operators (Fig. 3), although with eight active quarries (Fig. 14), Kentucky Rock Asphalt Co. produced most of this. The Great Depression progressively reduced the number of operators to two by 1940: the Kentucky Rock Asphalt Co. and its Ohio Valley Rock Asphalt Co. subsidiary. When the Ohio Valley Rock Asphalt Co. folded in 1946, Kentucky Rock Asphalt Co. remained the sole surviving rock-asphalt producer.

There had always been issues with the durability of rock-asphalt road surfaces, and, in the end, the development of modern petroleum-bitumen road products resistant to the stresses of the modern heavyweight trucks, beginning production after World War II, brought an end to the legacy rock-asphalt industry of western Kentucky. Kentucky Rock Asphalt Co. could not compete in a market dominated by asphalt and road oil produced from petroleum refineries distributed throughout the United States. For example, 11.9 million tons of asphalt and road oil was produced by refineries in 1950 alone (Redfield and Sims, 1953). Kentucky rock asphalt was finally limited to an ever-declining niche market as an anti-skid product with a sales region of only about 300 to 400 miles from the mine and mill (Creason, 1957). Closure of the company followed in 1957, and the end of the Kentucky rock-asphalt industry (Creason, 1957) (Fig. 3). The Kyrock area was designated as Kentucky Society of Professional Geologists Distinguished Geologic Site 4 in 2007 (Andrews, 2007). There are, however, enormous bitumen and heavy, tarry oil resources remaining in the Big Clifty Sandstone

and Caseyville Formation at the surface and in the shallow subsurface of western Kentucky that lack a commercial process to begin development (Bowersox, 2014, in press). It is the development of these resources that will likely become the new rock-asphalt industry.

Sources

Kentucky Digital Library (kdl.kyvl.org)

Library of Congress, Chronicling America, Historic American Newspapers (chroniclingamerica.loc.gov)

Old Fulton NY Post Cards (fultonhistory.com)

Google Books (books.google.com)

Newspapers.com (www.newspapers.com)

Kentucky Transportation Center, Archived Research Reports (www.ktc.uky.edu/publications/reports/archived-research-reports)

References Cited

- Abraham, H., 1938, *Asphalts and allied substances* [4th ed.]: New York, D. Van Nostrand Co. Inc., 1491 p.
- Alabama Secretary of State, 2014, United Rock Asphalt Company: Entity ID 806-113, arc-sos.state.al.us/cgi/corpnnumber.mbr/input [accessed 10/30/2014].
- Age of Steel*, 1901, *Machinery*: v. 91, no. 21, p. 30–32.
- Altoona Tribune*, 1927, United Rock Asphalt Co. [advertisement]: Altoona, Pa., Sept. 1, 1927, p. 5.
- American Automobile Association, 1908a, Report of the Committee on Practical Demonstrations: American Automobile Association, Proceedings of the First Annual Good Roads and Legislative Convention, Buffalo, N.Y., p. 139–142.
- American Automobile Association, 1908b, Road making demonstrations: American Automobile Association, Proceedings of the First Annual Good Roads and Legislative Convention, Buffalo, N.Y., p. 286–290.
- American Society of Civil Engineers, 1890, Constitution and list of members: American Society of Civil Engineers, 122 p.
- Amos, D.H., 1976, Geologic map of the Garfield quadrangle, Breckinridge County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1278, scale 1:24,000.
- Andrews, W.M., Jr., 2007, Nomination and designation of the Kyrock area as KSPG Distinguished Geologic Site #4, in May, M.T., Kuehn, K.W., and Schoefernacker, S., eds., *Geology of the Mammoth Cave and Nolin River Gorge region with emphasis on hydrocarbon and karst resources*: American Association of Petroleum Geologists–Eastern Section and Kentucky Society of Professional Geologists, p. 7.
- Asphalt Associates, 2014, Trinidad lake asphalt: www.asphaltassociates.com/html/products/tla.html [accessed 09/26/2014].
- Ball, M.W., 1951, The synthetic liquid fuel potential of Kentucky, oil impregnated strippable deposits: New York, Ford, Davis and Bacon Inc., 347 p.
- Ball and Associates Ltd., 1965, Surface and shallow oil-impregnated rocks and shallow oil fields in the United States: U.S. Bureau of Mines Monograph 12, 375 p.
- Banking Law Journal*, 2000, Bank deposit not created without right of control by depositor: Buffalo, N.Y., William S. Hein & Co. Inc., v. 57, p. 339–343.
- Binghamton Press*, 1926, Kentucky Rock Asphalt Co. offers issue of first mortgage bonds: Binghamton, N.Y., June 30, 1926, p. 26.
- Binghamton Press*, 1955, Untitled article: Binghamton, N.Y., Sept. 9, 1955, v. 22, no. 128, p. 20.
- Binghamton Press and Leader*, 1926, Kentucky Rock Asphalt Co [advertisement]: Binghamton, N.Y., June 30, 1926, v. 48, no. 68, p. 28.
- Black Diamond*, 1922, New coal companies: v. 69, no. 6, p. 168.
- Boone County Recorder*, 1902, Asphalt lands sold: Burlington, Ky., Aug. 13, 1902, v. 27, no. 43, p. 7.
- Boone County Recorder*, 1936, Announcement: Burlington, Ky., Oct. 3, 1936, v. 61, no. 22, p. 1.
- Boorman, T.H., 1908, *Asphalts, their sources and utilizations*: New York, William T. Comstock, 168 p.
- Bowersox, J.R., 2014, Evaluation of western Kentucky's heavy oil and bitumen resources [abs.]: Eastern Unconventional Oil and Gas Symposium 2014, www.euogs.org, [5 p.] [accessed 01/29/2016].
- Bowersox, J.R., in press, Heavy oil and bitumen resources of the western Kentucky tar sands: Kentucky Geological Survey, ser. 12, Report of Investigations 36.
- Breckinridge News*, 1898a, A patriotic body: Cloverport, Ky., Oct. 5, 1898, v. 23, no. 12, p. 2.
- Breckinridge News*, 1898b, To the merchants of Louisville: Cloverport, Ky., Nov. 9, 1898, v. 23, no. 17, p. 2.
- Breckinridge News*, 1904, To operate asphalt lands: Cloverport, Ky., Jan. 27, 1904, v. 28, no. 28, p. 2.
- Bryant, J.O., 1914, The economic geology of a portion of Edmonson and Grayson Counties: Kentucky Geological Survey, ser. 4, v. 2, pt. 1, p. 155–218.

- Buffalo Courier*, 1890, Rock asphalt. Operations and plant of the new Buffalo Paving Company: Buffalo, N.Y., Nov. 9, 1890, v. 55, no. 313, p. 6.
- Buffalo Courier*, 1894a, A new corporation: Buffalo, N.Y., Oct. 12, 1894, v. 59, no. 285, p. 6.
- Buffalo Courier*, 1894b, Local gleanings: Buffalo, N.Y., Nov. 3, 1894, v. 59, no. 307, p. 7.
- Buffalo Courier*, 1899, Asphalt competition: The Kentucky Rock Company has bought a site for a plant: Buffalo, N.Y., July 11, 1889, v. 55, no. 192, p. 5.
- Buffalo Courier*, 1901, New stamping company: Buffalo, N.Y., April 3, 1901, v. 64, no. 93, p. 8.
- Buffalo Courier*, 1903, Impressed by local streets: Buffalo, N.Y., July 26, 1903, v. 68, no. 207, p. 3.
- Buffalo Courier*, 1904a, Are mixed up over rollers: Buffalo, N.Y., Oct. 18, 1904, v. 69, no. 292, p. 3.
- Buffalo Courier*, 1904b, Files petition in bankruptcy: Commercial National Bank of Chicago vs. Eastern Construction Company: Buffalo, N.Y., June 20, 1904, v. 69, no. 180, p. 2.
- Buffalo Courier*, 1908, Automobilists will see how roads are built: Buffalo, N.Y., June 30, 1908, v. 73, no. 182, p. 7.
- Buffalo Courier-Express*, 1930, Southern banking houses are linked in big deal: Buffalo, N.Y., June 6, 1930, v. 95, no. 157, p. 24.
- Buffalo Courier-Express*, 1931, Louisville jury indicts former finance chiefs: Buffalo, N.Y., June 26, 1931, v. 96, no. 177, p. 12.
- Buffalo Courier-Record*, 1897, It was a bitter pill. Council had to vote to pay appraisers of grade crossings land—Mr. Adam's speech: Buffalo, N.Y., Dec. 2, 1897, v. 62, no. 336, p. 7.
- Buffalo Evening News*, 1890, A new paving company: Buffalo, N.Y., v. 20, no. 58, p. 1.
- Buffalo Evening News*, 1896, It's Standard now: Buffalo, N.Y., v. 32, no. 15, p. 8.
- Buffalo Evening News*, 1899, For exchange: Buffalo, N.Y., July 25, 1899, v. 38, no. 88, p. 8.
- Buffalo Evening News*, 1928, Paving bills are opened: Buffalo, N.Y., v. 96, no. 53, p. 3.
- Buffalo Express*, 1891, They have seen. Aldermanic party returns from Brooklyn: Buffalo, N.Y., Feb. 14, 1891, p. 5.
- Buffalo Morning Express*, 1890a, A new paving company organized by men of means: Buffalo, N.Y., June 17, 1890, p. 5.
- Buffalo Morning Express*, 1890b, Untitled article: Buffalo, N.Y., July 20, 1890, p. 3.
- Buffalo Morning Express*, 1925, Natural Kentucky rock asphalt [advertisement]: Buffalo, N.Y., June 1, 1925, p. 2.
- Burk, W.E., 1903, Asphalt rock in Kentucky: *Engineering and Mining Journal*, v. 75, no. 26, p. 969.
- Burlington Times*, 1927, Big asphalt firms in merger: Burlington, N.C., March 25, 1927, p. 13.
- Burroughs, W.G., 1930, Directory of Kentucky mineral operators: *Kentucky Geological Survey*, ser. 6, v. 32, 186 p.
- Cahill, J.H., 1922, Constructing Kentucky rock asphalt pavement on Dixie Highway between Louisville and West Point, Kentucky: *Municipal and County Engineering*, v. 62, no. 1, p. 12-15.
- Central Press, 1931, South awaits climax in first trials of once ace banker: Cortland, N.Y., *Cortland Standard*, July 23, 1931, p. 10.
- Cincinnati Enquirer*, 1894, So the B. of A. decides in the matter of Kentucky asphalt: Cincinnati, Ohio, May 1, 1894, v. 11, no. 121, p. 12.
- Cincinnati Enquirer*, 1917, Consolidation effected: Cincinnati, Ohio, Jan. 2, 1917, v. 34, no. 2, p. 2.
- Clark, G.H., 1925, Rock asphalts of Alabama and their use in paving: *Geological Survey of Alabama Special Report* 13, 97 p.
- Clark, L.D., and Crittenden, J.D., Jr., 1965, Geology of the Mattingly quadrangle, Kentucky-Indiana: U.S. Geological Survey Geologic Quadrangle Map GQ-361, scale 1:24,000.
- Cohen, K.M., Finney, S.C., Gibbard, P.L., and Fan, J.-X., 2013, Updated, the ICS international chronostratigraphic chart: *Episodes*, v. 36, p. 199-204; www.stratigraphy.org/ICSchart/ChronostratChart2015-01.pdf [accessed 02/16/2016].
- Collins, M.B., 1981, The use of petroleum by Late Archaic and Early Woodland peoples in Jefferson County, Kentucky: *Journal of Field Archaeology*, v. 8, p. 55-64.

- Colvin, F., 2009, Caldwell and Company: Tennessee Encyclopedia of History and Culture, version 2.0, tennesseeencyclopedia.net/entry.php?rec=171 [accessed 12/12/2014].
- The Contractor*, 1914, Classified news of construction work: v. 20, no. 5, p. 49–66.
- Cortland Standard*, 1939, Advance sale opens for auto grind: Cortland, N.Y., Jan. 24, 1939, p. 7.
- Cossar, A., 1917, News and gossip by local correspondents: *The Contractor*, v. 24, no. 2, p. 49.
- Cottrell, K.W., 1922, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1919, pt. II—Nonmetals, p. 279–297.
- Cottrell, K.W., 1923, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1920, pt. II—Nonmetals, p. 45–53.
- Cottrell, K.W., 1924, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1921, pt. II—Nonmetals, p. 69–75.
- Cottrell, K.W., 1925, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1922, pt. II—Nonmetals, p. 7–13.
- Cottrell, K.W., 1926, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1923, pt. II—Nonmetals, p. 135–142.
- Cottrell, K.W., 1927, Asphalt and related bitumens: U.S. Geological Survey Mineral Resources of the United States 1924, pt. II—Nonmetals, p. 161–169.
- Coumbe, A.T., 1955, Asphalt and related bitumens: U.S. Bureau of Mines Minerals Yearbook, Fuels, 1952, v. 2, pt. B, p. 260–267.
- Coumbe, A.T., and Avery, I.F., 1956, Asphalt and related bitumens: U.S. Bureau of Mines Minerals Yearbook, Fuels, 1953, v. 2, pt. B, p. 297–302.
- Courier-Journal*, 1899, September 9, 1899: Louisville, Ky., v. 93, New Series No. 11,222, p. 9.
- Courier-Journal*, 1900, Home asphalt company recognition by its exceptional mines: Louisville, Ky., v. 95, New Series No. 11,617, p. 14.
- Court of Appeals of Kentucky, 1929, Dugan v. Logan et al.; Same v. Natural Rock Asphalt Corporation: Lexis-Nexis, 229 Ky. 5; 16 S.W.2d 763; 1929 Ky. LEXIS 690, www.lexisnexis.com [accessed 10/10/2014].
- Court of Appeals of Kentucky, 1950, Potter-Matlock Trust et al. v. Myers et al.: Lexis-Nexis, 239 S.W.2d 949; 1950 Ky. LEXIS 1107, www.lexisnexis.com [accessed 10/30/2014].
- Crain, G.D., 1914a, Louisville correspondence: *The Contractor*, v. 20, no. 6, p. 40–41.
- Crain, G.D., 1914b, Louisville correspondence: *The Contractor*, v. 20, no. 9, p. 40–41.
- Crawford, T.D., 1909, Aetna Indemnity Company v. Little Rock: State of Arkansas, Arkansas Reports, v. 89, p. 95–103.
- Creason, J., 1957, Exit Kyrock: Louisville, Ky., *Courier-Journal*, v. 205, June 23, 1957, section 5, p. 1.
- Crump, M.H., 1913, Kentucky rock asphalt: Kentucky Geological Survey, ser. 4, v. 1, pt. 2, p. 1053–1065.
- Daily Review*, 1903, Not heard from: Decatur, Ill., June 6, 1903, no. 157, p. 4.
- Day, D.T., 1890, Asphaltum: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1888, p. 513–514.
- Day, D.T., 1911a, Asphalt: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1909, pt. II—Nonmetals, p. 731–733.
- Day, D.T., 1911b, Asphalt: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1910, pt. II—Nonmetals, p. 833–839.
- Day, D.T., 1912, Asphalt: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1911, pt. II—Nonmetals, p. 1003–1021.
- Day, D.T., 1913, Asphalt: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1912, pt. II—Nonmetals, p. 997–1006.
- Day, D.T., 1914, Asphalt: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1913, pt. II—Nonmetals, p. 537–544.
- Delaware Department of State, Division of Corporations, 2014a, Kentucky Rock Asphalt Company: delecorp.delaware.gov/tin/controller [accessed 11/19/2014].

- Delaware Department of State, Division of Corporations, 2014b, Standard Rock Asphalt Corporation: delecorp.delaware.gov/tin/controller [accessed 10/23/2014].
- Detroit Architectural Club, 1890, Catalogue of the first annual exhibition of the Detroit Architectural Club, in the Galleries of the Detroit Museum of Art, Jefferson Avenue, from April twenty eighth to May twelfth, MDCCCC: Detroit, Mich., Detroit Architectural Club, 217 p.
- Dickey, P.A., 1959, The first oil well; SPE 1195-G: *Journal of Petroleum Geology*, v. 11, no. 1, p. 14–26.
- Eldridge, G.H., 1901, The asphalt and bituminous rock deposits of the United States: U.S. Geological Survey, 22nd annual report of the United States Geological Survey to the Secretary of the Interior 1900-01, Part I—Director's report and a paper on asphalt and bituminous rock deposits, p. 209–452.
- Elmira Star-Gazette*, 1928, Many prominent persons listed among Vestris victims: *Elmira*, N.Y., Nov. 14, 1928, v. 22, no. 115, p. 1.
- Engineering News*, 1895, Contract prices: Supplement—Feb. 7, 1895, v. 33, no. 6, p. 47.
- Engineering News Record*, 1925, Crown Rock Asphalt Company [advertisement]: v. 94, p. 110, 190.
- Engineering Record*, 1895, New street work and paving: v. 31, no. 10, p. 178.
- Erie County Independent*, 1939, Drivers prepare for 500 mile race, Hamburg, N.Y., April 20, 1939, v. 65, no. 26, p. 7.
- Evening Herald*, 1893, Destructive to pavement. Breaks and holes in the James Street asphalt: Syracuse, N.Y., April 17, 1893, v. 17, no. 4,990, p. 4.
- Evening Independent*, 1928, County asphalt contract given: St. Petersburg, Fla., Feb. 8, 1928, v. 82, p. 3A.
- Florence, R.L., 1966, Kentucky rock asphalt bases and hot-mix surfaces; experimental construction: Kentucky Department of Highways, Interim Report KYHPR-64-10; HPR-1 (1), 61 p., www.ktc.uky.edu/files/2012/09/1966-Kentucky-Rock-Asphalt-Bases-and-Hot-Mix-Surfaces-Experimental-Construction-KYHPR-64-10.pdf [accessed 09/26/2014].
- Foerste, A.F., 1910, Oil, gas, and asphalt rock in Meade and Breckinridge Counties: Kentucky Geological Survey, ser. II, Report on the progress of the Survey for the years 1908 and 1909, p. 69–85.
- Gildersleeve, B., 1966, Geologic map of the Homer quadrangle, Logan County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-548, scale 1:24,000.
- Gildersleeve, B., 1978, Geologic map of the Leitchfield quadrangle, Grayson County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-1316, scale 1:24,000.
- Hartford Herald*, 1903, How asphalt was found in Logan County: Hartford, Ky., Jan. 7, 1903, v. 29, no. 1, p. 1.
- Hartford Herald*, 1908, How asphalt was found in Logan County: Hartford, Ky., Jan. 7, 1908, v. 29, no. 1, p. 1.
- Hartford Republican*, 1904, Untitled article: Hartford, Ky., Dec. 30, 1904, v. 17, no. 24, p. 1.
- Havens, J.H., 1964, Research report on use of Kentucky rock asphalt for de-slicking purposes; Ref: Your memorandum dated October 15, 1964, and Commissioner Ward's memo dated October 13, 1964: Kentucky Department of Highways, Memorandum H.1.64.10, 8 p., unknowledge.uky.edu/cgi/viewcontent.cgi?article=2181&context=ktc_researchreports [accessed 10/20/2014].
- Havens, J.H., and Williams, E.G., 1956, Report No. 2: A study of the properties and performance of Kentucky (natural sandstone) rock asphalt: Kentucky Transportation Center Research Reports, Paper 1250, 56 p., unknowledge.uky.edu/ktc_researchreports/1250 [accessed 10/20/2014].
- Hittell, J.B., 1922, Asphalt: Occurrence, production and preparation for use in highway construction: *Journal of the Western Society of Engineers*, v. 27, no. 11, p. 340–350.
- Hopkins, G.R., 1929, Asphalt and related bitumens: U.S. Bureau of Mines, Mineral Resources of the United States 1926, pt. II—Nonmetals, p. 51–69.

- Hopkins, G.R., and Coons, A.B., 1928, Asphalt and related bitumens: U.S. Bureau of Mines, Mineral Resources of the United States 1925, pt. II—Nonmetals, p. 29–37.
- Hopkins, G.R., and Coons, A.B., 1930, Asphalt and related bitumens: U.S. Bureau of Mines, Mineral Resources of the United States 1927, pt. II—Nonmetals, p. 67–80.
- Hovey, E.O., 1904, Asphaltum and bituminous rock: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1903, p. 745–754.
- Hovey, E.O., 1905, Asphaltum and bituminous rock: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1904, p. 789–799.
- Hovey, E.O., 1906, Asphaltum and bituminous rock: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1905, p. 1161–1169.
- Illustrated Buffalo Express*, 1893, Boughton's telephotos: Buffalo, N.Y., Sept. 24, 1893, p. 15.
- Indiana Society of Civil Engineers and Surveyors, 1889, Proceedings of the Indiana Society of Civil Engineers and Surveyors of the state of Indiana at its ninth annual meeting held at Indianapolis, Jan. 15, 16 and 17, 1889, together with the constitution, by-laws and other valuable matter: Logansport, Ind., Wilson, Humphreys & Co., 159 p.
- Indianapolis Journal*, 1901, Asphalt in Kentucky; beds in four counties to be worked by stock company: Indianapolis, Ind., v. 51, no. 219, p. 2.
- Indianapolis Journal*, 1903, Worthless asphalt used: Indianapolis, Ind., Jan. 21, 1903, v. 53, no. 21, p. 7.
- Indianapolis Journal*, 1904, Contract money is tied up by Council; bankrupt Federal Asphalt Company has \$40,000 invested in Wabash Street paving: Indianapolis, Ind., Feb. 21, 1904, v. 54, no. 52, p. 3.
- Jillson, W.R., 1921a, Kentucky rock asphalt—The ideal road surface: Kentucky Geological Survey, ser. 6, v. 2, p. 39–57.
- Jillson, W.R., 1921b, Recent mineral production in Kentucky, in Jillson, W.R., The Sixth Geological Survey: Kentucky Geological Survey, ser. 6, v. 6, p. 261–267.
- Jillson, W.R., 1922a, Geological reconnaissance of the properties of the Rock Asphalt Company of America, located in Edmonson County, Kentucky: Frankfort, Ky., Willard Rouse Jillson, 13 p.
- Jillson, W.R., 1922b, Geological report on 1810 acres of rock asphalt properties located on Bear Creek, Edmonson County, Kentucky: Frankfort, Ky., Willard Rouse Jillson, 8 p., kgs.uky.edu/kgsweb/olops/pub/kgs/JillsonTarSandsReport01.pdf [accessed 01/31/2014].
- Jillson, W.R., 1923a, Report of geologic reconnaissance, state of Kentucky, county of Edmonson, waters of Green River: Property examined owned by W. Kirkpatrick, Bowling Green, Kentucky: Report prepared for C.D. Eaton, 165 Broadway, New York City: Dated May 24, 1923: Frankfort, Ky., Willard Rouse Jillson, 7 p., kgs.uky.edu/kgsweb/olops/pub/kgs/JillsonTarSandsReport08.pdf [accessed 02/12/2014].
- Jillson, W.R., 1923b, Report of geologic reconnaissance, state of Kentucky, county of Grayson and Hardin, waters of Big Clifty and Big Meeting Creek: Property examined owned by Continental Rock Asphalt Co.: Report prepared for Continental Rock Asphalt Co., Big Clifty, Ky.: Dated Oct. 13, 1923: Frankfort, Ky., Willard Rouse Jillson, 21 p., kgs.uky.edu/kgsweb/olops/pub/kgs/JillsonTarSandsReport15.pdf [accessed 01/30/2014].
- Jillson, W.R., 1924, Kentucky rock asphalt: Pan-American Geologist, v. 41, p. 251–258.
- Jillson, W.R., 1925a, Report of geologic reconnaissance, state of Kentucky, county of Edmonson, waters of Green River: Property examined owned by Overall and Owen, Bowling Green, Ky.: Report prepared for Overall and Owen, St. James Apartments, Chestnut Street, Bowling Green, Ky.: Dated Jan. 15, 1925: Frankfort, Ky., Willard Rouse Jillson, 10 p., kgs.uky.edu/kgsweb/olops/pub/kgs/JillsonTarSandsReport11.pdf [accessed 02/04/2014].
- Jillson, W.R., 1925b, Report of geologic reconnaissance, state of Kentucky, county of Edmonson, waters of Nolin River: Property examined

- owned by Standard Rock Asphalt Company: Report prepared for C.K. Jones, Standard R. A. CO., 11 S. 54th Ave., Duluth, Minn.: Dated Oct. 12, 1925: Frankfort, Ky., Willard Rouse Jillson, 10 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport12.pdf [accessed 02/04/2014].
- Jillson, W.R., 1925c, Report of geologic reconnaissance, state of Kentucky, county of Grayson and Hardin, waters of Green River: Property examined owned by W.H. Giltner, Trustees, Louisville, Kentucky: Report prepared for Curtis C. Webb, 1505 Rosewood Ave., and William Crawford, Intersouthern Bldg., Louisville: Dated Dec. 24, 1925: Frankfort, Ky., Willard Rouse Jillson, 19 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport04.pdf [accessed 02/10/2014].
- Jillson, W.R., 1926a, Map of Grayson County, Kentucky, showing approximate distribution of bituminous sandstone outcrops, fault pattern, and oil and gas wells: Kentucky Geological Survey, ser. 6, scale 1 in. = 1 mi.
- Jillson, W.R., 1926b, Report of geologic reconnaissance, state of Kentucky, county of Grayson and Logan, waters of Ohio and Green Rivers: Property examined owned by United Rock Asphalt Company, Republic Building, Louisville, Ky.: Report prepared for United Rock Asphalt Company, E.J. Bigley, P.O.B. 54, Altoona, Pa.: Dated March 13, 1926: Frankfort, Ky., Willard Rouse Jillson, 12 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport07.pdf [accessed 02/04/2014].
- Jillson, W.R., 1926c, Résumé of Kentucky's mineral resources: Kentucky Geological Survey, ser. 6, Pamphlet 7, 11 p.
- Jillson, W.R., 1927a, Kentucky rock asphalt: Kentucky Geological Survey, ser. 6, v. 30, p. 95–103.
- Jillson, W.R., 1927b, Report of geologic reconnaissance, state of Kentucky, county of Edmonson, waters of Nolin River: Property examined owned by Dr. E. Bryant Crump, Winchester, Ky., and Mammoth Cave Rock Asphalt Company: Report prepared for Mammoth Cave Rock Asphalt Company, Lexington, Ky.: Dated April 22, 1927: Frankfort, Ky., Willard Rouse Jillson, 18 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport06.pdf [accessed 02/11/2014].
- Jillson, W.R., 1927c, Report of geologic reconnaissance, state of Kentucky, county of Edmonson, waters of Nolin River: Property examined owned by Standard Rock Asphalt Company: Report prepared for Standard Rock Asphalt Company, 111 S. 54th Avenue, East Duluth, Minn.: Dated Feb. 19, 1927: Frankfort, Ky., Willard Rouse Jillson, 8 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport14.pdf [accessed 02/04/2014].
- Jillson, W.R., 1927d, Report of geologic reconnaissance, state of Kentucky, county of Hart, waters of Nolin River: Property examined owned by John Rock Asphalt Company, Detroit, Michigan: Report prepared for M.C. John, 1507 Monterey Ave., Detroit, Michigan: Dated November 26, 1927: Frankfort, Ky., Willard Rouse Jillson, 12 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport03.pdf [accessed 02/07/2014].
- Jillson, W.R., 1928, Report of geologic reconnaissance, state of Kentucky, county of Hart and Edmonson, waters of Nolin and Green Rivers: Property examined owned by Pure Rock Asphalt Co., 309 Urban Bldg., 122 South Fourth St., Louisville, Ky.: Report prepared for Pure Rock Asphalt Co., Fred G.B. Metzner, Pres., J.L.H. Harper, Mgr., Louisville, Kentucky: Dated Feb. 16, 1928: Frankfort, Ky., Willard Rouse Jillson, 17 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport10.pdf [accessed 02/04/2014].
- Jillson, W.R., 1929, Report of geologic reconnaissance, state of Kentucky, county of Grayson, waters of Nolin River: Property examined owned by M.C. John, 1507 Monterey Ave., Detroit, Mich.: Report prepared for M.C. John, 1507 Monterey Ave., Detroit, Mich.: Dated June 3, 1929: Frankfort, Ky., Willard Rouse Jillson, 15 p., kgs.uky.edu/kgswweb/olops/pub/kgs/JillsonTarSandsReport02.pdf [accessed 02/06/2014].
- Kasulavada, S.K., 2013, Analysis of Kyrock for leaching of impurities in synthetic rainwater: Bowling Green, Ky., Western Kentucky Uni-

- versity, master's thesis, 46 p., digitalcommons.wku.edu/theses/1276 [accessed 01/07/2016].
- Kentucky Commission, Louisiana Purchase Exposition, 1904, Kentucky at the World's Fair, St. Louis, 1904, being a report of the commission authorized by an act of the General Assembly to the governor of the commonwealth: Frankfort, Ky., 142 p., nyx.uky.edu/dips/xt7jh98z9d6b/data/mets.xml [accessed 03/06/2013].
- Kentucky Progress Magazine*, 1929, Ohio Valley Rock Asphalt Company: v. 3, no. 2, p. 42–43.
- Kentucky Rock Asphalt Co., 1920, Mineral aggregate and perfect mixture make Kentucky rock a super-asphalt [advertisement]: Road-Maker, Excavator, and Grader, v. 14, no. 4, p. 63.
- Kentucky Rock Asphalt Co., 1922a, Kentucky rock asphalt [advertisement]: Municipal and County Engineering, v. 62, no. 5, p. 26.
- Kentucky Rock Asphalt Co., 1922b, Solving the problem of street [advertisement]: Municipal and County Engineering, v. 62, no. 3, p. 4.
- Kentucky Rock Asphalt Co., 1922c, Striking recognition of merit [advertisement]: Municipal and County Engineering, v. 62, no. 2, p. 26.
- Kentucky Rock Asphalt Co., 1922d, That old road has a big cash value. Why destroy it? [advertisement]: Municipal and County Engineering, v. 62, no. 1, p. 4–5.
- Kentucky Rock Asphalt Co., 1922e, Why road builders prefer Kentucky rock asphalt [advertisement]: Municipal and County Engineering, v. 62, no. 4, p. 24.
- Kentucky Secretary of State, 2014, Gar-Rock Asphalt Company: Kentucky Secretary of State, apps.sos.ky.gov/ftsearch [accessed 10/21/2014].
- Laughlin, G.R., 1962, Construction report on experimental use of natural, bituminous, quartz sandstone (Kentucky rock asphalt) as a traffic-bound aggregate: Lexington, Ky., Highway Materials Research Laboratory, 20 p.
- Louisville & Nashville Employees' Magazine*, 1944, Kentucky Rock Asphalt Company: v. 20, p. 11.
- Mathewson, L.W., 1890, City streets—How to build them and why: Eleventh annual report of the Ohio Society of Surveyors and Civil Engineers, being the transactions of the society at its eleventh annual meeting held in Columbus, Ohio, January 21, 22, and 23, 1890, p. 95–117.
- May, M.T., Kuehn, K.W., and Schoefernacker, S., 2007, Geology of the Mammoth Cave and Nolin River Gorge region with emphasis on hydrocarbon and karst resources: Part II: Rock asphalt redux and paleovalleys anew: American Association of Petroleum Geologists–Eastern Section and Kentucky Society of Professional Geologists, 25 p.
- McCarthy, W.D., 2008, Seneca oil and Devil's tar: Salt drillers, medicine men, and the pioneer oil industry of south-central Kentucky: Oil-Industry History, v. 9, no. 1, p. 163–172.
- McCormack, C.P., 1925, The Kentucky rock asphalts—Their character and utilization: National Petroleum News, v. 17, no. 6, p. 41–42.
- McFarlan, A.C., 1943, Geology of Kentucky: Lexington, Ky., University of Kentucky, 531 p.
- McFerrin, J.B., 1938, The Kentucky Rock Asphalt Company: Southern Economic Journal, v. 4, p. 455–465.
- McGrain, P., 1976, Tar sands (rock asphalt) of Kentucky—A review: Kentucky Geological Survey, ser. 10, Report of Investigations 19, 16 p.
- Merideth, J., 2009, Vadose zone hydrology near the vicinity of Edna's Dome, Mammoth Cave, Kentucky: Bowling Green, Ky., Western Kentucky University, master's thesis, 46 p., digitalcommons.wku.edu/theses/65 [accessed 01/07/2016].
- Meyer, M.A., 1947, Statistical summary of mineral production: U.S. Geological Survey, Minerals Yearbook 1945, p. 27–84.
- Miller, A.M., 1919, The geology of Kentucky: Kentucky Department of Geology and Forestry, ser. 5, Bulletin 2, 392 p.
- Miller, R.C., 1968, Geologic map of the Russellville quadrangle, Logan County, Kentucky: U.S. Geological Survey Geologic Quadrangle Map GQ-714, scale 1:24,000.
- Mine and Quarry News Bureau, 1897, Alphabetical list of mining and quarrying companies and operators: The mine, quarry, and metallurgical record of the United States, Canada, and Mexico: Chicago, 702 p.

- Moore, C.B., 1916, Some aboriginal sites on Green River, Kentucky. Certain aboriginal sites on lower Ohio River. Additional investigations on Mississippi River: *Journal of the Academy of Natural Sciences of Philadelphia*, v. 16, p. 431-511.
- Moore, L., 1897, Twelfth biennial report of the Bureau of Agriculture, Labor, and Statistics of the state of Kentucky: Louisville, Ky., The Geo. G. Fetter Printing Co., 622 p.
- Moore, L., 1899, Thirteenth biennial report of the Bureau of Agriculture, Labor, and Statistics of the state of Kentucky: Louisville, Ky., The Geo. G. Fetter Printing Co., 601 p.
- Moore, O.L., 1918, No. 20,770: The City of Leavenworth, appellee, v. Green River Asphalt Company, et al. (The United States Fidelity and Guaranty Company, appellant): Topeka, Kansas, State of Kansas, Reports of Cases Argued and Determined in the Supreme Court of the State of Kansas, v. 101, p. 82-86.
- Morgan, H.M., 1974, Western Kentucky farm map: Rectangle No. 2, Leitchfield quadrangle: Utica, Ky.: Henry M. Morgan, scale 1:24,000.
- Mote, R.H., and Kaufman, A., 1955, The mineral industry of Kentucky: U.S. Geological Survey Minerals Yearbook, Area Reports, v. III, 1952, p. 387-406.
- Mote, R.H., and Kaufman, A., 1956, The mineral industry of Kentucky: U.S. Geological Survey Minerals Yearbook, Area Reports, v. III, 1953, p. 439-456.
- Mullen, C.A., 1925, Proprietary asphalt pavements covered by trade names and patents: *Engineering Journal* (the *Journal of the Engineering Institute of Canada*), v. 8, no. 1, p. 15-18.
- Municipal Engineering*, 1897a, Improvement and contracting news: v. 13, no. 1, p. 51-66.
- Municipal Engineering*, 1897b, Trade notes: v. 12, no. 6, p. 388-390.
- Municipal Engineering*, 1897c, Trade notes: v. 13, no. 4, p. 243-244.
- Municipal Engineering*, 1901a, Current information: v. 20, no. 3, p. 161-177.
- Municipal Engineering*, 1901b, Green River Asphalt Company [advertisement]: v. 20, no. 1, p. 46.
- Municipal Engineering*, 1901c, Improvements and contracting news: v. 20, no. 5, p. 309-321.
- Municipal Engineering*, 1902, Green River Asphalt Company [advertisement]: Dec. 2, 1902, advertising supplement, v. 23, no. 6, p. 6.
- Municipal Engineering*, 1903a, American asphalt rock for pavements: v. 24, no. 3, p. 212-214.
- Municipal Engineering*, 1903b, Improvement and contracting news: v. 24, no. 3, p. 241-246.
- Municipal Engineering*, 1903c, Machinery and trade: v. 25, no. 4, p. 286-293.
- Municipal Engineering*, 1904a, Machinery and trade: v. 26, no. 1, p. 64-70.
- Municipal Engineering*, 1904b, Machinery and trade: v. 26, no. 2, p. 134-153.
- Municipal Engineering*, 1904c, Machinery and trade: v. 26, no. 3, p. 205-216.
- Municipal Engineering*, 1907, Paving: v. 32, no. 6, p. 402-403.
- Municipal Engineering*, 1911, Improvement and contracting news: v. 41, no. 2, p. 161-172.
- Municipal Engineering*, 1913, Paving conditions in southern cities: v. 44, no. 2, p. 73-78.
- Municipal Journal and Engineer*, 1902, Merits of rock asphalt: v. 12, no. 2, p. 86.
- Municipal Journal and Engineer*, 1904, Kentucky rock asphalt: v. 17, no. 6, p. 283.
- Municipal Journal and Engineer*, 1908, News of the municipalities: v. 25, no. 22, p. 747.
- Municipal Journal and Engineer*, 1911, Kyrock: v. 30, no. 11, p. 400.
- Nall, I.B., 1903, Fifteenth biennial report of the Bureau of Agriculture, Labor and Statistics of the state of Kentucky: Louisville, Ky., The Geo. G. Fetter Printing Co., 741 p.
- New Albany Evening Tribune*, 1903, Groom's illness hastened marriage of well known residents: *New Albany, Ind.*, v. 15, no. 261, p. 4.
- New York Call*, 1913, Admits he offered to get state work: *New York*, Nov. 22, 1913, v. 6, no. 326, p. 1-2.
- New York Evening Post*, 1930, Kentucky Rock Asphalt Company: v. 128, no. 14, p. 25.
- New York Sun*, 1926, Form new company: *New York*, April 1, 1926, v. 93, no. 179, p. 36.

- New York Sun*, 1928, Capitalists buy control of Natural Rock Asphalt: New York, Jan. 4, 1928, v. 95, no. 104, p. 44.
- New York Sun*, 1933, Curb removes many securities from trading: New York, June 12, 1933, v. 100, no. 239, p. 32.
- New York Sun*, 1934, Corporate reports: New York, March 26, 1934, v. 101, no. 173, p. 37.
- New York Sun*, 1935, Securities at auction: New York, Oct. 16, 1935, v. 103, no. 38, p. 43.
- New York Times*, 1901, Kentucky asphalt lands: New York, v. 50, no. 16,055, p. 1.
- New York Times*, 1902, Low bids for asphalt work: New York, v. 51, no. 16,377, p. 2.
- New York Times*, 1904, Securities at auction: New York, v. 54, no. 17,097, p. 13.
- New York Times*, 1925, New incorporations [in Delaware]: New York, April 14, 1925, v. 74, no. 24,552, p. 34.
- New York Times*, 2010, When stocks came in from the cold: New York, Sept. 30, 2010, www.nytimes.com/2010/10/03/realestate/03scapes.html [accessed 12/15/2014].
- New-York Tribune*, 1913, James K. McGuire may be indicted: Nov. 24, 1913, v. 73, no. 24,280, p. 1.
- Niagara Falls Gazette*, 1903, Just as he predicted. F.G. Graham of the Barber Asphalt Paving Co. has something to say regarding the paving bids let last night: Niagara Falls, N.Y., March 7, 1903, v. 10, no. 303, p. 1.
- Northrop, J.D., 1916, Asphalt: U.S. Geological Survey, Mineral Resources of the United States 1914, pt. II—Nonmetals, p. 347–362.
- Northrop, J.D., 1917, Asphalt: U.S. Geological Survey, Mineral Resources of the United States 1915, pt. II—Nonmetals, p. 135–150.
- Northrop, J.D., 1919, Asphalt: U.S. Geological Survey, Mineral Resources of the United States 1916, pt. II—Nonmetals, p. 263–281.
- Northrop, J.D., 1920, Asphalt: U.S. Geological Survey, Mineral Resources of the United States 1917, pt. II—Nonmetals, p. 233–251.
- Orton, E., 1891, Report on the occurrence of petroleum, natural gas, and rock asphalt in western Kentucky, based on examinations made in 1888 and 1889: Kentucky Geological Survey, ser. II, v. E—Oil and gas, 233 p.
- Osborn, C.C., 1921, Asphalt: U.S. Geological Survey, Mineral Resources of the United States 1918, pt. II—Nonmetals, p. 447–494.
- Ousley, C.C., 1907, Kentucky at the Jamestown Ter-Centennial Exposition, April 26 to November 30, 1907: Kentucky Jamestown Exposition Commission, 77 p.
- Owen, D.D., 1856, Chapter I. General report, in Report of the geological survey in Kentucky, made during the years 1854 and 1855: Frankfort, Ky., A.G. Hodges State Printer, p. 15–248.
- Owen, D.D., 1857, First part of the second geological report of Kentucky, in Second report of the geological survey in Kentucky, made during the years 1856 and 1857: Frankfort, Ky., A.G. Hodges, State Printer, p. 9–114.
- Park City Daily News*, 1959, 35 years ago last week: Bowling Green, Ky., Aug. 23, 1959, p. 13.
- Parker, E.W., 1892, Asphaltum, in Day, D.T., Report of the mineral industries of the United States at the Eleventh Census: 1890: U.S. Department of the Interior, Census Office, p. 581–587.
- Parker, E.W., 1893a, Asphaltum: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1891, p. 452–455.
- Parker, E.W., 1893b, Asphaltum: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1892, p. 699–703.
- Parker, E.W., 1895, Asphaltum: U.S. Geological Survey, Sixteenth Annual Report of the United States Geological Survey, Part IV, Mineral Resources of the United States, 1894, Nonmetallic Products, p. 430–435.
- Parker, E.W., 1896, Asphaltum: U.S. Geological Survey, Seventeenth Annual Report of the United States Geological Survey, Part III, Mineral Resources of the United States, 1895, Metallic Products and Coal, p. 751–758.
- Parker, E.W., 1897, Asphaltum: U.S. Geological Survey, Eighteenth Annual Report of the United States Geological Survey to the Secretary of the Interior 1896–97, Part V, Mineral Resources of the United States, 1896, Nonmetallic Products Except Coal, p. 919–947.

- Parker, E.W., 1898, Asphaltum: U.S. Geological Survey, Nineteenth Annual Report of the United States Geological Survey, Part VI, Mineral Resources of the United States, 1897, Nonmetallic Products Except Coal and Coke, p. 187–204.
- Parker, E.W., 1899, Asphaltum and bituminous rock: U.S. Geological Survey, Twentieth Annual Report of the United States Geological Survey, Part VI, Mineral Resources of the United States, 1898, Nonmetallic Products, Except Coal and Coke, p. 251–268.
- Parker, E.W., 1901, Asphaltum and bituminous rock: U.S. Geological Survey, Twenty-first Annual Report of the United States Geological Survey, Part VI, Mineral Resources of the United States, 1899, Nonmetallic Products, Except Coal and Coke, p. 319–332.
- Parker, E.W., and Richardson, C., 1894, Asphaltum: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1893, p. 627–669.
- Paving and Municipal Engineering*, 1895a, Current information: v. 8, no. 5, p. 247–255.
- Paving and Municipal Engineering*, 1895b, Improvement and contracting news: v. 9, no. 4, p. 252–261.
- Peckham, S.F., 1884, Production, technology, and uses of petroleum and its products: U.S. Department of the Interior, Census Office, 319 p.
- Pennsylvania Department of State, 2014, Wadsworth Stone and Paving Company: www.corporations.state.pa.us/corp/soskb/csearch.asp [accessed 11/17/2014].
- Petroleum Times*, 1928, The rock asphaltites of Kentucky: v. 126, p. 152.
- Philadelphia Inquirer*, 1904, To foreclose on a [sic] asphalt company: Philadelphia, Pa., Oct. 23, 1904, v. 151, no. 115, p. 2.
- Philadelphia Inquirer*, 1927, Kentucky Rock Asphalt Co. declared: Philadelphia, Pa., Nov. 26, 1927, v. 197, no. 149, p. 28.
- Philadelphia Inquirer*, 1938, Texas Corp. 1937 net \$54,574,319; sets high record: Earns \$5.02 a share as against \$4.10 in previous year: Kentucky Rock Asphalt Co.: Philadelphia, Pa., March 14, 1938, p. 28.
- Pine, W.J., 2013, Asphalt paving of the Indianapolis Motor Speedway – An engineer's perspective [video]: Indianapolis, Ind., 246th American Chemical Society National Meeting and Exposition, presentations.acs.org/common/media-player.aspx/Fall2013/MOTION/MOTION-04/12672 [accessed 09/17/2014].
- Pit and Quarry*, 1926, The Natural Rock Asphalt Corporation exploiting Kentucky hills: v. 12, no. 9, p. 91–92.
- Post-Standard*, 1904, Federal Asphalt Company in hands of receiver: Syracuse, N.Y., Feb. 20, 1904, v. 76, no. 51, p. 1.
- Rader, P.S., 1905, Green River Asphalt Company, appellant, v. City of St. Louis: Columbia, Mo., E.W. Stephens, Reports of Cases Determined in the Supreme Court of the State of Missouri, v. 188, p. 576–580.
- Redfield, A.H., 1930, Asphalt and related bitumens: U.S. Geological Survey, Mineral Resources of the United States 1928, pt. II – Nonmetals, p. 391–421.
- Redfield, A.H., 1932a, Asphalt and related bitumens: U.S. Geological Survey, Mineral Resources of the United States 1929, pt. II – Nonmetals, p. 523–567.
- Redfield, A.H., 1932b, Asphalt and related bitumens: U.S. Geological Survey, Mineral Resources of the United States 1930, pt. II – Nonmetals, p. 205–246.
- Redfield, A.H., 1933, Asphalt and related bitumens: U.S. Geological Survey, Mineral Resources of the United States 1931, pt. II – Nonmetals, p. 215–235.
- Redfield, A.H., 1934, Asphalt and related bitumens: U.S. Geological Survey, Mineral Resources of the United States 1934, pt. II – Nonmetals, p. 765–774.
- Redfield, A.H., 1935, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1935, p. 871–882.
- Redfield, A.H., 1936, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1936, p. 775–778.

- Redfield, A.H., 1937, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1937, p. 1123–1135.
- Redfield, A.H., 1938, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1938, p. 977–988.
- Redfield, A.H., 1939, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1939, p. 1081–1092.
- Redfield, A.H., 1941, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1940, p. 1093–1104.
- Redfield, A.H., 1943a, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1941, p. 1183–1190.
- Redfield, A.H., 1943b, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1942, p. 1185–1191.
- Redfield, A.H., 1945, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1943, p. 1233–1240.
- Redfield, A.H., 1946, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1944, p. 1203–1210.
- Redfield, A.H., 1947, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1945, p. 1212–1220.
- Redfield, A.H., 1948, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1946, pt. 2, p. 152–160.
- Redfield, A.H., 1949, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1947, pt. 2, p. 153–160.
- Redfield, A.H., and Granacher, W.D., 1954, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1951, pt. 2, p. 177–185.
- Redfield, A.H., and Sims, E., 1953, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1950, pt. 2, p. 149–158.
- Redfield, A.H., and Spencer, S.J., 1949, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1948, pt. 2, p. 156–163.
- Redfield, A.H., and Spencer, S.J., 1951, Asphalt and related bitumens: U.S. Bureau of Mines, Minerals Yearbook 1949, pt. 2, p. 149–157.
- Reed, A.H., Jr., and McFarlan, A.C., 1957, The mineral industry of Kentucky: U.S. Geological Survey, Minerals Yearbook, Area Reports, v. III, 1955, p. 459–473.
- Reed, A.H., Jr., and McFarlan, A.C., 1958, The mineral industry of Kentucky: U.S. Geological Survey, Minerals Yearbook, Area Reports, v. III, 1956, p. 493–509.
- Reed, A.H., Jr., McGrain, P., and Rivers, M.E., 1959, The mineral industry of Kentucky: U.S. Geological Survey, Minerals Yearbook, Area Reports, v. III, 1957, p. 463–480.
- Richardson, C.H., 1913, The modern asphalt pavement [2d ed.]: New York, John Wiley & Sons, 629 p.
- Richardson, C.H., 1924, The road materials of Kentucky: Kentucky Geological Survey, ser. 6, v. 22, 206 p.
- Richardson, C., and Parker, E.W., 1894, Asphaltum, in Day, D.T., Mineral resources of the United States, calendar year 1893: U.S. Geological Survey, p. 627–669.
- Rochester Democrat and Chronicle and Rochester Herald*, 1926, Kentucky Rock Asphalt Company [advertisement]: Rochester, N.Y., June 30, 1926, p. 35.
- Rock Products*, 1925, Continental Rock Asphalt Co.: v. 28, p. 64.
- Rose, J.G., 1992, Kentucky rock asphalt (Kyrock) road surfacing material: Preliminary investigation: Kentucky Transportation Center Research Reports, Paper 458, 23 p., uknowledge.uky.edu/ktc_researchreports/458 [accessed 07/15/2014].
- Russell, W.L., 1932, Geology of oil and gas fields of western Kentucky: American Association of Petroleum Geologists Bulletin, v. 16, p. 231–254.
- San Francisco Call*, 1895, For good street work: Asphalt and bituminous rock for use in modern pavement. It must be hard and firm. Bernard Bienenfeld's valuable information about materials and ingredients: San Francisco, Calif., v. 78, no. 27, p. 5.
- Selley, R.C., 1998, Elements of petroleum geology [2d ed.]: San Diego, Calif., Academic Press, 470 p.

- Selsor, K.A., Burky, R.R., Kirner, D.L., Thomas, J.E., Southon, J.R., and Taylor, R.E., 2000, Late Prehistoric petroleum collection in Pennsylvania: Radiocarbon evidence: *American Antiquity*, v. 65, p. 749–755.
- Semi-Weekly Interior Journal*, 1900, News notes: Stanford, Ky., Dec. 25, 1900, v. 28, no. 85, p. 1.
- Simm, C., 2014, The history of the Pitch Lake in Trinidad: traveltips.usatoday.com/history-pitch-lake-trinidad-58120.html [accessed 09/26/2014].
- Steele, G.D., 1915, The mining of Kentucky rock asphalt and the construction of rock asphalt McAdam roadways: *Better Roads and Streets*, v. 5, no. 5, p. 15–17, 60, 62.
- The Sun*, 1901, Federal Asphalt Company formed: New York, Sept. 7, 1901, v. 69, no. 7, p. 9.
- The Sun*, 1904a, Receiver asked for Federal Asphalt: New York, Feb. 5, 1904, v. 71, no. 158, p. 10.
- The Sun*, 1904b, Federal Asphalt receivership extended: New York, Feb. 21, 1904, v. 71, no. 174, p. 10.
- Supreme Court of Indiana, 1908, City of Auburn et al. v. State ex rel. First Nat. Bank of Chicago et al., 1908: *Northeastern Reporter Volume 83*: St. Paul, Minn., West Publishing Co., p. 997–1005.
- Supreme Court of New York, 1931, Kenneth S. Clark, appellant, v. Standard Rock Asphalt Corporation, respondent: Supreme Court of New York, Appellate Division, First Department, 233 A.D. 536 N.Y.S. 730; 1931 N.Y. App. Div. LEXIS 11357, www.lexisnexis.com [accessed 10/23/2014].
- Taff, J.A., 1907, Asphalt and bituminous rock: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1906, p. 1131–1137.
- Taff, J.A., 1908, Asphalt and bituminous rock: U.S. Geological Survey, Mineral Resources of the United States, Calendar Year 1907, pt. II—Non-metallic Products, p. 723–730.
- Thomas, J.E., Kirner, D.L., Burky, R.R., Selsor, K., Taylor, R.E., and Southon, J.R., 2002, Documentary, archaeological, and radiocarbon evidence of prehistoric and protohistoric petroleum production in Pennsylvania: *Oil-Industry History*, v. 3, no. 1, p. 19–33.
- Tillson, G.W., 1900, Street pavements and paving materials: New York, John Wiley & Sons, 532 p.
- True Republican*, 1903a, Asphalt at Belvedere: Bad spots at Elgin and Wabash, Ind., to be repaired: Sycamore, Ill., Dec. 23, 1903, no. 9, p. 1.
- True Republication*, 1903b, He says it is N.G.: Opinion of mayor of Wabash, Ind., as to Kentucky asphalt paving: Sycamore, Ill., Dec. 19, 1903, no. 9, p. 1.
- Union-Sun and Journal*, 1925a, Looking forward to better roads [advertisement]: Lockport, N.Y., March 2, 1925, p. 12.
- Union-Sun and Journal*, 1925b, The story of asphalt—No. 6 [advertisement]: Lockport, N.Y., March 24, 1925, p. 6.
- Union-Sun and Journal*, 1959, Lee A. Wiser, 79, dies in Pittsburgh of heart attack: Lockport, N.Y., Oct. 29, 1959, v. 112, no. 25, p. 22.
- U.S. Circuit Court of Appeals, Sixth Circuit, 1932, Kaye v. MacMillan, 60 F.2d 7 (6th Cir. 1932): casetext.com/case/kaye-v-macmillan [accessed 10/30/2014].
- U.S. Court of Appeals for the District of Columbia, 1937, Ohio Valley Rock Asphalt Company, Inc., v. Helvering, Com'r of Internal Revenue (two cases), No. 6452; No. 6453: U.S. Court of Appeals for the District of Columbia, 95 F.2d 87; 68 App. D.C. 176; 1937 U.S. App. LEXIS 4097; 38-1 U.S. Tax Cas. (CCH) P9016; 20 A.F.T.R. (P-H) 1066, www.lexisnexis.com [accessed 10/22/2014].
- U.S. Energy Information Administration, 2015, International energy statistics—Units: www.eia.gov/cfapps/ipdbproject/docs/unitswithpetro.cfm [accessed 02/22/2015].
- U.S. Geological Survey, 1960, Big Clifty quadrangle, Kentucky: U.S. Geological Survey Topographic Map, scale 1:24,000.
- Wadsworth Stone and Paving Co., 1912, Kyrock [advertisement], in Pennybacker, J.E., ed., The official good roads year book of the United States: American Highway Association, p. 443.

- Wanless, H.R., 1939, Pennsylvanian correlations in the Eastern Interior and Appalachian Coal Fields: Geological Society of America Special Paper 17, 128 p.
- Watertown Daily Times*, 1901, Untitled article: Watertown, N.Y., Dec. 2, 1901, p. 6.
- Watertown Daily Times*, 1926, Kentucky Rock Asphalt Company [advertisement]: Watertown, N.Y., June 30, 1926, v. 66, no. 55, p. 13.
- Waterville Times*, 1936, Department of Commerce weekly business survey: Waterville, N.Y., May 14, 1936, v. 79, no. 25, p. 6.
- Webb, W.S., 1946, Indian Knoll, site Oh2, Ohio County, Kentucky: University of Kentucky Reports in Anthropology and Archaeology, v. 4, no. 3, pt. 1, p. 235-292.
- Weller, J.M., 1927, The geology of Edmonson County, a detailed presentation of the physical, stratigraphic, structural, and economic geology of this district with a description of the methods of cavern formation in the Mammoth Cave region: Kentucky Geological Survey, ser. 6, v. 28, 246 p.
- Weller, J.M., 1929, Geologic map of Edmonson County, Kentucky: Kentucky Geological Survey, ser. 6, scale 1:62,500.
- West Publishing Co., 1897, Smith v. City of Syracuse: New York, New York Supplement, v. 44, p. 852-857.
- West Virginia Secretary of State, 1907, Corporation report of secretary of state, March 4, 1905, to March 11, 1907: Charleston, W.Va., The Crossman Printing Co., 882 p.
- Wiley, J.R., 1919, What Kentucky rock asphalt is: Road Maker, Excavator, and Grader, v. 13, no. 12, p. 29-32.
- Wiley, J.R., 1920a, Kentucky rock asphalt for road and street pavements: Better Roads and Streets, v. 10, no. 3, p. 111-113.
- Wiley, J.R., 1920b, The road to Camp Knox: Road Maker, Excavator, and Grader, v. 14, no. 4, p. 19-21.
- Williams, D.A., Noger, M.C., and Gooding, P., 1982, Investigations of subsurface tar-sand deposits in western Kentucky: A preliminary study of the Big Clifty Sandstone Member of the Golconda Formation (Mississippian) in Butler County and parts of Edmonson, Grayson, Logan, and Warren Counties: Kentucky Geological Survey, ser. 11, Information Circular 7, 25 p.