American millstones similar to the French burr: 19th-century attempts to find substitutes

Charles D. Hockensmith

Abstract: During the early to mid 19th century, attempts were made in the United States to locate local sources of stone that were comparable in texture or appearance to that of the well known French burr millstone. These searches were primarily motivated by economic reasons. The early literature mentions local stone sources in several states that was described as similar in appearance or quality to the French burr. This paper compiles information on local millstones comparable to the French burr in the states of Alabama, Arkansas, Georgia, Illinois, Indiana, Kentucky, Missouri, North Carolina, Ohio, South Carolina, Tennessee, and Virginia. Most of these ventures had limited success on the local level. However, in Georgia, Ohio, and Kentucky the millstones were manufactured in larger quantities and distributed over larger geographical areas. Despite the effort expended in these pursuits, these local millstones proved inferior to the French burr which retained its high status among American millers.

Keywords: millstones, American millstones, flint millstones, French Burr millstones, Georgia Burr millstones, Flint Ridge millstones, Raccoon Creek millstones, millstone substitutes

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Introduction

American millers preferred French burr millstones for grinding wheat while millstones made from local stones were used for grinding corn. Because of their popularity and shipping costs, the French burr millstones were very expensive. Economic considerations encouraged some American millers to look for substitutes.

Davis (1990, 6) noted that 'the United States had a French burr crisis during the War of 1812 (1812-1815) when trade was cut off with France'. The War of 1812 provided incentives for Americans to search for local sources of stone suitable for millstones. The quest for American substitutes for the French burr continued until the mid-19th century.

By the early 19th century, stone was discovered in several states within the eastern United States that was described as similar in appearance or quality to the French burr. Some of this stone, especially flints in Georgia and Ohio, was commercially exploited for millstones. To a lesser extent, stones similar to the French burr were either used locally or mentioned as having potential for use as millstones.

Terms used historically for these raw materials included flint, 'buhrstone', 'burr stone', 'silicified shell beds', 'porous quartz', etc. The terms 'chert' and 'flint' are used interchangeably in this study. This paper compiles information from early geological reports and other sources in order to piece together a brief summary of these American substitutes for the French burr. Previously, the author has dealt with flint millstones in overviews of the millstone industry in the United States (Hockensmith 1993; 2006a; 2009a, 60-77, 2011), a compilation of early millstone sources (Hockensmith 2004a), as

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well as in other millstone studies for Alabama (Hockensmith 2005), Georgia (Hockensmith 2004b), Kentucky (Hockensmith 2003a, 2008a, 2009b, 11-12, 17), Missouri (Hockensmith 2004d, 2006b), North Carolina (Hockensmith 2004e), Ohio (Hockensmith 2003b, 2007, 2008b, Hockensmith 2009a, 71-76), and Tennessee (Ball and Hockensmith 2005, 2007; Hockensmith 2004c). It is the goal of this study to make the reader aware of those American stones utilized for millstones with properties similar to the French burr.

While not an exhaustive survey, this literature review provides an extensive overview (Fig. 1). A more comprehensive review of the American literature for chert millstones would require a thorough search of numerous early geological reports for many states and hundreds of local history books covering the eastern United States. This would be a very time consuming and expensive undertaking. A series of early quotes by 19th and 20th century researchers are included in this study to describe these millstones. It is felt that these quotes give the reader the flavor of the original literature and provides useful information for millstone scholars.

Initially, a brief discussion of the French burr millstones is provided. Next, some general quotes about the American burr stones are included. The main body of the paper presents information on American burr millstones alphabetically by state. The study concludes with some summary remarks and suggestions for future research.

The French Burr millstones

Generations of American millers considered the French burr (Fig. 2) to be the best millstones ever produced. As early as the 15th century, the French millstone quarries were renowned and the quarries continued in operation until the mid-20th century (Ward 1982a, 205). After the mid-1800s the burr stones were removed from the French quarries and taken to larger workshops where the burrs were carefully shaped to form composite millstones (Ward 1982a, 207). Most of these stones were quarried at La Ferté-sous-Jouarre east of Paris (Ward 1982a). Similar millstones were quarried at Epernon, 67 kilometers west of Paris (Duc 2005; Tucker 1982; Ward 1986, 12).

Apling (1984, 14) provided the following information on the distribution of these quarries:

The finest burrs for millstones-the hardest and least porous-came from a bed called 'Calcaire de

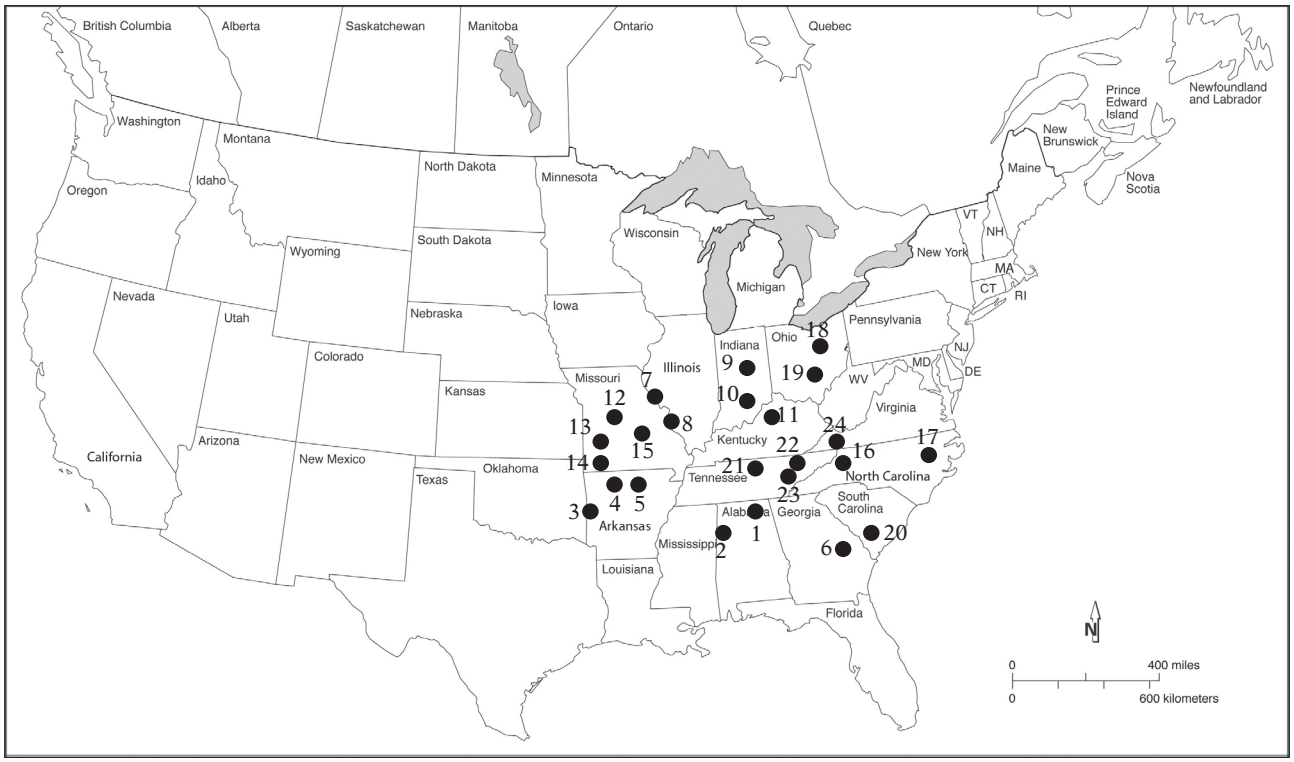


Fig. 1: Map of the United States showing the approximate locations of the flint millstone quarries mentioned. Listed alphabetically by state. Alabama (1: Jackson County, 2: Winston County), Arkansas (3: Polk County, 4: Izard County, 5: Lawrence County), Georgia (6: Burke and Jefferson Counties), Illinois (7: junction of the Illinois and Mississippi Rivers, 8: Union County), Indiana (9: Jennings County, 10: Harrison County), Kentucky (11: Anderson and Woodford Counties), Missouri (12: vicinity of Maries, Moniteau, Osage and Pulaski Counties, 13: Webster and Wright Counties, 14: Ozark County, 15: Madison and Washington Counties), North Carolina (16: Madison County, 17: Jones County), Ohio (18: Flint Ridge quarries in Licking and Muskingum Counties, 19: Raccoon Creek quarries in Athens and Vinton Counties), South Carolina (20: Barnwell and Orangeburg Counties), Tennessee (21: Sumner County, 22: Claiborne County, 23: Jefferson and Knox Counties), and Virginia (24: Floyd County). Base map courtesy of the Ohio Division of the Geological Survey.

Fig. 2: Composite French Burr Millstone in a wall in front of the Weisenberger home site (mill owners) in Woodford County, Kentucky. November 1, 2013. The millstone is 1.06 m in diameter (photograph by C. D. Hockensmith).

Brie', which stretches from Vernon, between Paris and Rouen, to Rheims. The principal quarries were those of Bois de la Barre and La Justice du Nord at La Ferté sous Jouarre on the River Marne about 60 km. east of Paris. There were also quarries further east along the river at Épernay.

Other sources of burr stone were in the Departments of Vienne and Sarthe, at Tours and at Bergerac in the Dordogne east of Boreaux. However, stones from La Ferté were regarded as being of the finest quality for millstones, with the others being softer and more porous, requiring to be dressed more frequently and not lasting so long.

Ward (1982, 36) described the French burrstone as

...a chalcedonic hornstone or fresh water quartz found among beds of fresh water limestone that lie above the chalk and filled with ... irregularly large and small cavities which... forms a kind of network or skeleton.

Apling (1984:14) referred to the stone as

... a decalcified siliceo-calcareous rock, a freshwater flinty limestone now a freshwater form of secondary silica, but not just plain 'freshwater quartz'.

Prior to 1836, monolithic French burrstones were common but were being rapidly replaced by composite millstones comprised of carefully shaped blocks cemented together (Ward 1982).

The most comprehensive English language publication on the French millstone quarries at La Ferté-sous-Jouarre is Owen Ward's (1993) *French Millstones: Notes on the Millstone Industry at La Ferté-sous-Jouarre.* This excellent book discusses the early references to these millstones and then discusses the quarries and their locations. Next, the monolithic millstones and the composite burr stones are described in detail. Ward also discusses the extraction and the steps in constructing the burrstones. Finally, the last part of the book deals with the evolution of the industry through time. The magnitude of the industry is demonstrated by Ward's (1993, 18-23) listing of millstone quarries which include 27 quarries to the southeast, seven to the north, and 14 quarries south of La Ferté-sous-Jouarre.

American flint and burrstone quarries

Flint and other 'burrstone' was utilized as a raw material for millstones in Alabama, Arkansas, Georgia, Illinois, Indiana, Kentucky, Missouri, North Carolina,

Ohio, South Carolina, Tennessee, and Virginia. The terms 'buhr stone' or 'burr stone' were often used for these millstones. Silicified shells beds were also classified as burr stones. Both stones contain silica. American burr stones were often compared to the famous 'French burr' imports. This type of millstone was discussed in the May 2, 1857 edition of *Scientific American* (1857, 268):

Burr Stone

This is a quartz rock containing cells. It is as hard as rock crystal; and its peculiar value for grinding is owing to its hardness and cellular texture, which gives a rough surface. In the best stones the solid and cellular parts occupy about equal spaces. The 'French burr stones' are obtained near Paris from the tertiary formation. To make millstones the rocks are cut in wedge-shaped panes, which are cemented and bound together with iron hoops. A cement for the purpose consist of about one part, by measure, of calcined alum ground into powder, mixed with twenty parts of plaster of Paris, by measure, made into a proper consistency with water.

Good burr stone is found in Ohio, Georgia, and Arkansas. In Ohio, at Hopewell, Richland, Elk, and Clinton, the manufacture of burr stones is carried on to a considerable extent.

A mid-19th century geology text book by St. John (1854, 274-275) included the following comments:

Buhrstone, used almost exclusively for millstones, is a cellular variety of quartz, and owes its value for this purpose to the hardness and sharpness of the inequalities of its surfaces. The finest stones have usually been imported from France where they were found in the Tertiary of the Paris basin, but stones of excellent quality are obtained in Muskingum county and other localities in Ohio, where it is associated with carboniferous sandstones. As some of the cavities contain lime, it is conjectured that removal of that substance by solution has produced the cells. It is found also in Georgia and in Arkansas.

The September 2, 1868 issue of *Scientific American* (1868, 151) included the following contribution entitled 'Answers to Correspondents':

P. J. P., of Ohio.- The French buhr stone used for millstones is simply a variety of quartz, but it is in part composed of pure silex or flint. We have before us now a piece chipped from a rough millstone which is pure semi-transparent flint, of a yellowish, creamy color, honey-combed with holes in which were imbedded minute specimens of marine shells. A substitute for the French stone is found in the bituminous coal measures of northwestern Pennsylvania and eastern Ohio, but the French product is preferred. It is filled with the remains of minute fossil shells.

The 1872 version of Chamber's Encyclopaedia noted that:

... the most important substitute for the French B. in the United States is the B. rock of the bituminous coal measures of North-western Pennsylvania and Eastern Ohio (Chambers 1872, 415).

The following paragraphs discuss American burr millstones by state.

Alabama

Flint was one of several stone types used in making millstones in Alabama (Hockensmith 2005:3). In Jackson County, Alabama, Michael Tuomey (Dean 1995, 19; Tuomey 1848) made the following observations during 1848:

The mountains bordering the valley on the right are composed for the greater part of beds of limestone, and siliceous strata of chert and hornstone; ...North of Sauta Creek, a ridge of hornstone occurs ten or twelve miles in length. Judging from the porous structure of this rock, I am inclined to think that a substitute for burr-millstones may be found here. It must be borne in mind that French burrs are not composed of a single piece, but often ten or twenty, cemented together.

McCalley (1886, 77) mentioned a Millstone Mountain in Winston County, North Carolina which

…is a ridge some three-fourths of a mile long and is much higher than the surrounding country.

McCalley also provided the following information about the stone at Millstone Mountain and its use (1886, 78):

Millstone Rock; forms a prominent ledge around the ridge. It is very hard and compact, siliceous rock, resembling a good deal in looks the knox chert of North Alabama and the burhstone of South Alabama… Much of this rock has been made into millstones, and hence the name Millstone Mountain has been given to the mountain; it doubtless makes excellent millstones, especially for grinding of small grain. The ledge on the outcrop is about….1 ft. 6 in.

Dean (1996) observed that

... a siliceous rock, the 'Tallahata burstone' was quarried in several south Alabama counties for use as a burrstone.

Arkansas

Burrstone has been noted in several counties within Arkansas. In Izard County, Arkansas, burr stone suitable for millstones was present. Owen (1858, 44-45) provided the following information:

There are very fine burr millstone rocks in the ridges of the North Fork not far from Ware's mill, but on the opposite side of the river, according to J. E. Ware...

Lower down, on the same branch, are extensive beds of buhr millstone in 'Camp creek hollow,' some of which are of excellent texture and hardness for grinding corn, while other varieties are equally good for wheat. This buhrstone lies some 200 feet below the level of the ridge over which the Yellville road runs, above the Camp spring...

J. E. Ware is of the opinion, that the best quality of buhrstones, of any required dimensions, can be obtained either in Camp creek hollow or the ridges opposite his flouring mill, on the North Fork, equal in quality to the French buhr.

In Lawrence County, Arkansas, Owen (1858, 213-214) gave the following description of a cellar quartzose rock used for millstones:

On Big creek, a branch of Strawberry, there is a white cellular quartzose rock found in abundance, intercalated amongst the sandstones of the section of this county, which may afford good millstones; indeed, millstones have been made out of it for some of the mills in the vicinity. A pair of stones made from this rock, may be seen running in Jone's mill on Big creek, six miles from the mouth, and have proved of excellent quality for corn.

In his report for field work conducted in 1859 and 1860, Owen (1860, 96) provided the following information for Polk County, Arkansas:

There is one porous variety of silicious rock found in the vicinity of the Gap Springs, which might afford tolerable burr millstones.

Dana (1857, 360) also noted that buhrstone occurs *'…in Arkansas, near the Cove of Wachitta.'*

Georgia

The millstone industry in Georgia has been discussed previously by Davis (1990) and Hockensmith (2004b). Davis (1990, 6) noted that the Georgia burr declined after the War of 1812 when the French burr was again available. Several early sources mention that burr millstones were made in Georgia. McGrain (1991) cites a February 8, 1812 report in the Niles Register that mentioned suitable stone was in Georgia.

A very early ad concerning a millstone quarry in Burke County, Georgia was published in the August 15, 1792 issue of The Augusta Chronicle and State Messenger (Hemphill 1999):

> *The subscriber has for sale, at his Quarry in Burke County, Mill Stones Of the best quality, and on the most Reasonable terms. The stone is composed of seasheils turned into flint, very open and rough, and allowed by good judges to be equal to the best French burr. By adding the expense of carriage, they will be delivered at Mr. McFarland's store in Augusta, where application may be made by those that want to purchase, or to myself at the Quarry, 5 miles above Louiseville [sic], between Rockey Comfort and Ogeehee.*
>
> *JOHN MURRAY*
> *August 1, 1792*

Hemphill (1999) noted that:

John Murray's quarry was forty miles from Augusta as it is five miles north of Louisville which is 45 miles from Augusta. Louisville is now in Jefferson Co. which was cut off the old Burke Co.'

By the mid-19th century the Georgia burr made a comeback (Davis 1990, 6):

By 1849 Georgia buhr had a major comeback, this time on Patrick B. Connally's 17,000-acre plantation near the Central of Georgia Railroad in Burke County. Rock from Connally's plantation was made into stones by S. & H. Hoyt's La Fayette Burr Stone Company of Savannah for sale in Georgia and through A. B. Allen & Co. of New York City. Georgia buhrs were made 15 inches to seven feet in diameter.

The August 18, 1849 edition of Scientific American contained an excellent article entitled the 'Georgia Burr Mill Stone' (1849, 380):

The stone most commonly used for grinding wheat, is known by the name of 'French Burr,' because they are imported from that country. This species of stone is a porous silicious mineral, so very hard, that a pair of millstones will last quite a number of years without being worn out. The French burr stones, owing to their great price, has from time to time stimulated both the Americans and the English, to many efforts to supersede them. During the last war between France and England, when it was impossible to get burr stones; … In our country a substitute for it has long been a desideratum. This has now been obtained. In Burke County, in the state of Georgia, a large quarry embracing an area of 17,000 acres has been discovered; and a Company named the LaFayette Burr Mill Stone Co., has been formed to work it and furnish American Millstones equal to the French Burr. The principle office of this Company is in Savannah. About 1,000 sets of stones have already been put up, and are now in operation, and some of them alongside of the French, where in every instance they have equalled- and a little more, the very best French Burrs. Samples of this stone have been in our office for some time. We have contrasted them in every way with the French burrs, from which without knowing that the one came from France and the other from Georgia, no person could point out a difference. Those who have used the Georgia stone, prefer it for a more enduring fine sharpness, and in that case, it is more economical to use. From what we have seen of the Georgia stone, and heard about it from the most respectable sources, respecting its practical results, we are confident that the quarry must be of immense value.

The Georgia Burr millstone was mentioned in Scientific American in the April 27, 1850 issue 1850, 253):

Georgia Burr Versus French Burr Stones

The Schooner Hartford arrived at this port a few days since from Savannah with a lot of 5 ½ feet Georgia burr mill stones, to be used in the mills of Hackshall, Bro. & Co., at Richmond City, Va. It may somewhat astonish importers of the French burr to learn the fact, that the South will not only in the future quarry their own mill stones, but it will not be a year hence before they will be furnished for

all new flouring mills that may be erected in this or the Western states. The Georgia stone, we have been informed by a manufacturer of this city, fully equals the best French; and he says, although he is engaged in the importation of the French burr, that the Georgia stone will inevitably take the place of the French in this country.

The *Wilmington Journal* newspaper of Wilmington, North Carolina carried an article on the 'Georgia Burr Millstones' in the May 9, 1851 issue (1851, 3). Extracts from comments by Solon Robinson of Macon, Georgia are quoted below:

While at Savannah the other day, I sought the opportunity of examining this Georgia product, at the store of Messrs. Hoyt, agents of an association recently formed, called the 'Lafayette Burr-Millstone Manufacturing Company,' who now have some 20 or 30 hands employed, and will soon increase the number to meet the demand. The quarry is 100 miles from Savannah, and six miles from the Macon Railroad, upon the plantation of P. B. Connelly, extending over a tract of about 1,700 acres, near the line of Jefferson and Burke counties. Previous to the time the present proprietors commenced in 1849, about a thousand pair of millstones had been made, and although many of them in a rough manner, and the blocks not so carefully selected as at present, yet, not one has ever been known to be discarded, and generally they have been highly approved. Still, as the opinion has prevailed that nothing but French burr would make good wheat flour, this invaluable quarry has laid almost idle and worthless to the past year or two. the quantity is inexhaustible. It is generally near the surface, but the ground is considerably broken by creeks and ravines, and the veins of grit are from six to twenty feet thick. There are excellent sites for mills, where the power of water might be used for shaping the blocks with machinery lately invented for cutting stone.

The face of the blocks, when dressed, shows a surface quite as open as French burr, free from all loose pebbles, sand, iron nodules, and veins. In fact, the cavities when examined with a powerful magnifying glass, appear as though they were coated with an enamel of pure quartz, and present an immense number of fine, sharp-cutting edges. Years of exposure to the atmosphere present no appearance of change, and I am assured that the blocks stand fire perfectly, and that there is no difficulty in selecting them so as to form the whole stone of exactly the same quality and of equal goodness throughout the whole thickness.

The present price of millstones is about the same as French burr, but the great abundance of material and the constant increasing demand, will enable the company to supply stones or blocks at a price so much below those imported, that every American farmer has a direct interest in this American quarry. So far as my own opinion is worth in promotion of this new branch of home production, I give it most freely in favor of the Georgia burr over any other in the world. I saw many letters from millers to corroborate this opinion. I recommend the proprietors to take immediate measures to introduce these stone into all the northern states. They should establish an agency at once in New York City, not only for the sale of manufactured millstones, but the blocks, also, so that these now manufacturing millstones from imported blocks may obtain a full supply of an article not only superior in quality, but less in price--one of the products of the teeming soil of America.

In his *Agricultural Resources of Georgia,* Jones (1861, 12) noted that:

... here, are also found inexhaustible quarries of the finest burr-stone, which has upon trial proved equal and in some respects superior to the French burr mill stones.

Five years later, Bishop (1866, 149) provided the following comments on the Georgia burr:

In the last-mentioned State, there is one of the few localities in the Union, if not the only one, that furnishes Burr millstones, identical, in composition and geological position, with the French burrs. The manufacture of these was carried on about fifty years ago near Philadelphia, by Oliver Evans, and extensively at the present time in Savannah.

A story appearing in the April 1876 edition of *Manufacturer and Builder,* provided a more honest and balanced assessment of the Georgia burr millstone:

A quarry was discovered in Georgia a few years since, but so inferior in quality to the French stone, that it is now entirely abandoned.

The stone is generally shipped in pieces varying in size from 1 to 2 feet in length and about 1 foot in width, and after being dressed to the required shape, -are placed in circular form, the cavities and joints filled with a patent cement made of refuse ground burr stone, calcined magnesite and chlorid of magnesium, and then backed by plaster of Paris, making it present the appearance of a whole stone, and if properly finished, will last, with constant use, for twenty years. This cement is also used in repairing old stones, and if applied with care, it nearly equals the stone itself, and bears the pick almost as well as the burr. For grinding coarse grain, a millstone dressed from one burr stone is preferred.

When taking into consideration the scarcity and rarity of the burr quarries, and the labor expended on the stone, the price seems nominal compared with its indispensable value, a perfect stone, 4 feet in diameter, selling for only $250.

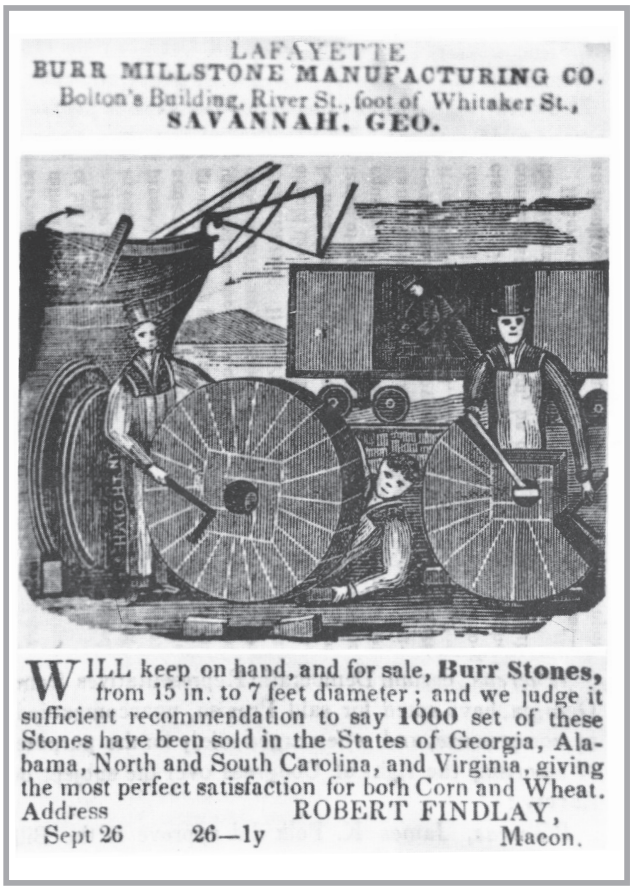
Davis (1990, 6) provided the following information about the Georgia Buhrs:

Christopher Fitzsimons, Irish-born resident of Charleston, SC, was a successful merchant and pioneer American industrialist, owning manufacturies, ships, warehouses and plantations. He acquired the Old Town Plantation, near Louisville, GA, in 1809, and beneath the soil there had been found buhr stone. On June 8, 1810, he sent a 'Georgia buhr' to Philadelphia to Oliver Evans for comparison with the French buhrs. Evans must have been impressed, for northern workmen from Evans and Morton, under a Mr. Maskel, were

in Georgia by January 1811 to acquire more stones. Some of the Georgia buhr stones were sent to flour mills at Brandywine, Pennsylvania. Evans' workmen were quoted as saying that the Georgia buhrs were as good or better than the French, a boast repeated many times in the years that followed...

More information is not available on Fitzsimons' and Evans' work with the Georgia buhrs. However, more than 1,000 buhr stones were reported taken from the Georgia quarries for sale in Georgia, Alabama, the Carolinas, and Virginia. Not all of them came from the Old Town Plantation. Jeremiah Miller and George Poythress in neighboring Burke County were quarrying buhrs by 1815. Miller brought workmen from New York to cut his stone.

An advertisement from an 18th-century Georgia newspaper (Fig. 3), reproduced by Davis (1990, 6), indicates that the Georgia burr was a composite millstone. The drawing of the millstone revealed a rectangular center (constructed from four blocks) with the eye formed by these blocks. The same drawing showed 22 wedge-shaped blocks or panes arranged around the rectangular center to form the millstone. The engraving also depicted three workmen constructing two millstones with a ship and railroad boxcar in the background suggesting the transportation modes utilized.


LAFAYETTE
BURR MILLSTONE MANUFACTURING CO.
Bolton's Building, River St., foot of Whitaker St.,
SAVANNAH, GEO.

WILL keep on hand, and for sale, **Burr Stones,** from 15 in. to 7 feet diameter; and we judge it sufficient recommendation to say **1000** set of these Stones have been sold in the States of Georgia, Alabama, North and South Carolina, and Virginia, giving the most perfect satisfaction for both Corn and Wheat.
Address ROBERT FINDLAY,
Sept 26 26—1y Macon.

Fig. 3: Nineteenth century advertisement for the Lafayette Burr Millstone Manufacturing Company in Savannah, Georgia. Reprinted from the Fall 1990 issue of Old Mill News with permission from the Society for the Preservation of Old Mills.

Illinois

Beck (1823, 194) provided the following information for Illinois:

Buhrstone millstones. In Illinois, near the junction of the Illinois river with the Mississippi.'

Another source mentioned flint millstones being made in Union County, Illinois (Anonymous 1905, 198):

To these the late Professor Worthen, for many years State Geologist, added, although with some hesitancy, the black shale formation of Illinois. Although these comprise an aggregate thickness of over 500 feet, their exposure is limited to a few isolated outcroppings along the bluffs of the Illinois, Mississippi and Rock Rivers. The lower division called 'Clear Creek Limestone,' is about 250 feet thick, and is only found in the extreme southern end of the State. It consists of chert, or impure flint, and thin-bedded silico-magnesian limestones, rather compact in texture, and of buff or light gray to nearly white colors. When decomposed by atmospheric influences, it forms a fine white clay, resembling common chalk in appearance. Some of the cherty beds resemble burr stones in porosity, and good mill-stones are made there from in Union County.

Indiana

A geological reconnoissance made for the state of Indiana in 1837 mentioned areas with burr-stones (Owen 1859). For the burr-stone chert layers in Harrison County, Owen (1859, 23) commented that

... the cement of this burr-stone chert has usually too little tenacity to render it useful for millstones.

In Jennings County, Owen (1859, 27) stated that:

Associated with these, at the forks of the Muscatatuk river, near Vernon and on the Big Sandy creek, about eight miles from that place, is a good variety of burr-stone. It is almost entirely made up of the remains of fossil coral-lines, cemented by a siliceous cement, with perhaps, locally, some calacreous matter also. When free from carbonate of lime, this porous, siliceous material affords a good mill-stone; some of our western mills have been supplied with this burr-stone, which makes a pretty good substitute for the French burr; it requires, however, to be more frequently dresses, because the cement is not so tough.

Finally, Owen (1859, 28) observed that:

The burr-stone mentioned in the first part of this report, which is wrought for millstones in Jennings county, is a member of the upper division of the preceding section.

Kentucky

Flint millstones were quarried within the Inner Bluegrass Region of central Kentucky. Quarries were located in Franklin (present day Anderson County) and Woodford Counties (Hockensmith 2003, Hockensmith 2004a, Hockensmith 2009b). These

are adjacent counties bordering the Kentucky River which has entrenched its self and left substantial cliffs of limestone. These limestone cliffs often contain layers and nodules of flint. Four early newspaper ads referring to these quarries are quoted below.

Two millstone quarries were mentioned in Franklin County during 1820 and 1821. Jeremiah Buckley advertised his flint millstones in two separate ads. On November 23, 1820, *The Argus of Western America* carried Jeremiah Buckley's first millstone ad:

MILL-STONE QUARRY

BLACK & GRAY flint, south of the Kentucky river, near Buckley's Ferry, where the subscriber will keep on hand Mill-Stones of an excellent quality; thought to be equal if not superior to any in the western country. The experiment has been made by gentlemen of respectability whose certificates I now hold. All persons wishing to purchase are requested to view for themselves. It is generally thought by men of judgment that the above named Mill-Stones are not to be equaled or surpassed by any in the United States; for either Corn or Wheat, if put in order.

Prices as follows viz:

Feet,	*Inches.*				*$*
4	*6*	*--*	*--*	*--*	*150*
4	*3*	*--*	*--*	*--*	*140*
4	*-*	*--*	*--*	*--*	*125*
3	*9*	*--*	*--*	*--*	*100*
3	*6*	*--*	*--*	*--*	*85*
3	*3*	*--*	*--*	*--*	*75*
3	*-*	*--*	*--*	*--*	*60*
2	*9*	*--*	*--*	*--*	*50*
2	*6*	*--*	*--*	*--*	*40*

JEREMIAH BUCKLEY.
Franklin County.
March 20, 1820.

Nearly a year later, Jeremiah Buckley advertised his flint millstones in the November 8, 1821 edition of *The Argus of Western America*:

Mill Stone Quarry,

AT BUCKLEY'S FERRY, Franklin County. THE subscriber takes this opportunity of informing his friends and the public in general that he has on hand a good assortment of MILL STONES, and intends at all times to meet the calls of gentlemen that wish to get mill stones from him. As flint or grit is thought by the best of judges, to be superior to any other of the kind that has ever been discovered in the United States, for either corn or wheat when put in order, the French Burr not excepted it is hoped and sincerely requested by the subscriber that gentlemen in the west country wanting that article will inform themselves whether superiority of quality belongs to his Quarry or not; and for their information, he will refer them to a number of gentlemen who have his mill stones now in use: Col Robert McAfee, McCoum and Kennedy Vandike and Keller, Robert Neal and Joseph Adams. These gentlemen have eight pair now in use on Salt River. John Buford, Esq of Versailles and Mr. David Rice, on Clear Creek, Woodford county, Mr. James Rucker, of Caldwell county, one pair in use at this time, Mr. Gabriel Stansefer, on Main Elkhorn, has one pair now in use, also General George Baltzell and John Baltzell of this county, each one pair, Matthew Flourney, of Fayette, has also a pair in use. Mr. Flourney, Col McAfee and John Bufford, Esq. are at this time in the Legislature of our state, from whom, gentlemen living at a distance, through the medium of their representatives and others, may easily inform themselves.

The prices of my mill stones are as follows:

For Five Feet	*$180*
Four feet six inches	*150*
Four feet	*125*
Three feet nine inches	*100*
Three feet six inches	*85*
Three feet three inches	*75*
Three feet	*60*
Two feet nine inches	*50*
Two feet six inches	*40*

JEREMIAH BUCKLEY
October 18, 1821

The firm of Miller, Railsback & Miller, also of Franklin County, advertised their flint millstones in the same paper on August 9, 1821.

LOOK HERE !

To Mill- Wrights and Mill- Builders. THOSE who wish to purchase Mill-stones of the flint kind which have been cut for some years by Dudley and lately by Jeremiah Buckley, may now be had in Franklin county, Ky eight miles above Frankfort, on the river, where mill-stones are cut by the undersigned, on the land of Henry Miller, or near the adjoining land of M. Johnston. We have as good rock and as thick as necessary, and will cut as cheap & do our work as good as any. As the quality of these flint rock has been proven to be good for many years, it is not necessary to recommend them. We will deliver millstones any where in this state or in the states adjoining, by the purchaser paying the common cost of carriage and as our rock are not inferior to any of the kind, we are determined the workmanship shall be the same. We wish every one that wishes to purchase rock, to review them for themselves and in particular those who are real judges of quality and workmanship. All millstones proving not good cut by us either shall be cut gratis for the purchaser that are good, and of the same size. All letters to the undersigned will be attended to. They must be directed to Lawrenceburg, Franklin county, Kentucky. The prices of our Mill-stones are annexed, but the purchaser having cash can almost make his own bargains as we intend to work cheap, and are possessed with experience and a mechanical eye.

5 feet	*$150.*
4 feet	*'100.*
3 feet	*' 50.*

And all sizes accordingly.

MILLER, RAILSBACK & MILLER

May 23rd, 1821.

An early flint millstone quarry operated in Woodford County at the beginning of the 19th century. The Frankfort newspaper, *The Palladium,* carried an ad in the February 27, 1800 issue for millstones quarried in Woodford County:

MILL STONES.

A Fair and impartial trial of a pair of millstones cut in my quarry, of flint quality, of four feet in diameter, now running in Colonel Robert Johnson's mill on North Elkhorn Creek, was made with his Burr stones, as stated in his certificate, 330 lb. of wheat being weighed into each mill, and the wheat weighing 59 ½ lb, per bushel, and both mills managed to the best advantage, and the flour bolted his superfine cloth immediately, that ground on the flint stones was first bolted, and made 243 lb. of flour, the Burrs 213 lb. leaving 30 pounds in favor of the flint stones, & of equal quality. I have here the Colonel's certificate for further information:

I HAVE in my mill on North Elkhorn, a pair of French Burr Stones, four feet diameter; also, a pair the same size, which I purchased of Mr. John Tanner, cut in his quarry, in Woodford county. I have made trial of the flint mill stones I purchased of Mr. Tanner, and find them exceedingly good for manufacturing flour; and I further certify, that I am of opinion they are equal to any French Burrs of the same size in this state. Given under my hand, this 15th day of December, 1799.

A true Copy. (Signed)
Robt. Johnson

I Have for Sale, the Quarry out of which the above stones were cut, and five acres of ground including the same; and will make the terms cash to the purchaser, by taking the price in mill stones and the produce of the country. Seven hands unto of whom may be warrent will make the 100£ per month, clear of all expenses, at my usual selling prices, and the probability is, that the stones will bear a higher price than usual, if their value could be generally known, and if a speedy trial could be made of those who incline to purchase of me. I will warrant them to be equal to the Burrs. I have on hand, a few pair, from four feet two inches in diameter to four feet eight inches, which I will warrant as above.

John Tanner,
February 5th, 1800.

The exact beginning, longevity, and distribution of the central Kentucky flint millstones is not currently known. John Tanner's 1800 advertisement cited a December 15, 1799 testimony for his millstones. Thus, we know that these flint millstones were available in 1799 and possibly a few years earlier.

The industry was actively promoted in 1800 as well as during 1820 and 1821. Millstones may have been manufactured several years beyond 1821. The shortest production period for these millstones would have been about 22 years and possibly many more years. In terms of their distribution, the advertisement by Miller, Railsback & Miller suggests that these millstones were shipped throughout Kentucky and adjacent states. Thus, it is possible that flint millstones produced in these central Kentucky quarries could be present at mills in several surrounding states.

These advertisements are very important since these quarries were unknown until the author discovered the advertisements while reading through early Frankfort newspapers. Also, they provide information on the sizes and prices of their products. These quarries escaped the attention of early geologists since they were abandoned nearly 40 years before the Kentucky Geological Survey was active. I have spent time trying to locate the two quarries near former Buckley's Ferry in Anderson County. Adjacent farm land and sections of cliff lines were explored with negative results.

On June 17, 2016, I received an e-mail from Gary A. O'Dell informing him that a Kentucky flint millstone quarry, thought to be the John Tanner quarry, had been located. The discovery was made by geographer Gary A. O'Dell (Morehead State University) and geologist James C. Currens (Kentucky Geological Survey) with the guidance of local citizen Jimmy Ott.

The quarry is located in Woodford County, several miles from the county seat of Versailles. It is situated on a hillside bench above Grier's Creek about 3,100 feet from the Kentucky River (O'Dell 2016, 13). According to the historic newspaper ads appearing above, John Tanner's millstone quarry was in operation by 1799 and continued until at least 1800. It is also possible that other individuals quarried millstones at this location after Tanner left the area (O'Dell 2016, 11). An outcrop of Curdsville limestone containing cherts nodules (Fig. 4) was quarried for millstones (O'Dell 2016, 12). The full extent of the quarry (Fig. 5) is not currently known since the area to the north was covered with dense weeds. O'Dell (2016, 11) observed two nearly complete millstones as well as:

... numerous other moss-covered 'blanks,' representing earlier stages of production where rock slabs had been roughly hewn to an appropriate size and shape...

The larger millstone (Fig. 6) is 63 inches (1.60 m) in diameter, was shaped down 5 inches (12.8 cm) into the parent rock, and had a round eye 10 inches (25.5 cm) in diameter (O'Dell 2016, 11). It appears that this millstone broke in an irregular manner during the shaping process and was ruined.

The second millstone (Fig. 7) measured 51 inches (1.295 m) in diameter, was shaped to 5 inches (12.8 cm) below the surface, and had a round eye 6 inches (15.3 cm) in diameter (O'Dell 2016, 21).

Fig. 4: Close-up view of the Curdsville limestone containing chert nodules at the Tanner Millstone Quarry in Woodford County, Kentucky (photograph by Gary O'Dell).

This millstone apparently broke apart during the shaping process and was abandoned.

It is hoped that permission can be obtained to document this quarry during the coming winter when the vegetation is dead and ground visibility is greatly improved. Anticipated activities include determining the full spatial extent of the Tanner millstone quarry, documenting all the unfinished millstones and other associated quarry remains, and attempting to reconstruct the manufacturing sequence. Ideally, a paper describing this quarry can be published in a volume connected with a future international millstone conference. This will be an important contribution to the literature since we do not currently have any flint millstone quarries documented in the United States.

Fig. 5: View of the northern edge of the Tanner Millstone Quarry in Woodford County, Kentucky facing north-northeast (photograph by Gary O'Dell).

Fig. 6: Unfinished millstone at the Tanner Millstone Quarry in Woodford County measuring 63 inches in diameter. It was discarded during shaping due to irregular breaks (photograph by Gary O'Dell).

Fig. 7: Second unfinished millstone at the Tanner Millstone Quarry in Woodford County, Kentucky. The stone measures 51 inches in diameter and was discarded while being shaped due to irregular breaks. Geologist James C. Currens and geographer Gary A. O'Dell (photograph by Gary O'Dell).

Missouri

Several stones including flint were utilized for millstones in Missouri (Hockensmith 2004d, 29-31). The *Gazetteer of the State of Missouri* (Wetmore 1837) mentioned millstones in Carrol, Madison, Montgomery, and Washington counties. Of these, the rock in Madison County is compared to the French buhr (Wetmore 1837:109):

There is an abundance of limestone and sandstone in this county; and there is likewise a rock of suitable quality for millstones, and which is now in use for that purpose. It is believed that this stone, if properly wrought in the fashion of the French buhrstone, will be a valuable substitute for that costly material, and take place of it to a great extent. The experiments that have been made in grinding with this stone have proved the great value of the material, and placed it on the long list of the resources of Missouri.

Two years later, *The North American Review* published two brief references to millstones (1839, 522). The first stated that:

Buhr stone, said to be equal to the French, is in great abundance on the Osage and Gasconade Rivers.

The second (1839, 521) noted that*:*

... in a single county (Washington) are found... millstones, resembling the French buhr...'.

The First and Second Annual Reports of the Geological Survey of Missouri (Swallow 1855, 111) provided the following information on millstones in Moniteau County:

MILL-STONES

Some of the beds of silicious breccia, previously referred to in the south-eastern corner of the county, I was informed have furnished very good mill-stones. Judging from their extreme hardness, and cellular structure, it seems quite probable they would answer very well for such purpose.

In the monograph, *Reports on Geological Survey of the State of Missouri,* 1855-1871, Broadhead *et al.* (1873,11) provided the following information on buhr-stone occurring in Maries, Osage, and Webster counties:

In Maries and Osage counties, it occurs as a Silicious Buhr-stone in small fragments, and I almost invariably found it on slopes just above the Second Sandstone. Beautiful specimens of this rock are found in Webster county, where some varieties have been used with very good success as a mill-stone.

For Osage County, Broadhead *et al.* (1873, 31) indicated that:

Lying at the base of the Second Magnesian Limestone, and over the Second Sandstone, are found silicious beds, generally cellular, which very much resemble the French Buhr-stone. The cells are somewhat oval or spheroidal in shape, their general size about that of an ordinary bean-some are larger and some much smaller-and, under a magnifier, their interior appears as if studd with minute quartz crystals.

In Ozark County, Missouri, Broadhead *et al.* (1873, 201) shared the following comments on Missouri stone resembling the French Buhr:

MILL-STONES

Large amorphous masses of silex, sometimes brecciated and containing cavities, are quite common on the uplands in different parts of the county, and these will often furnish a good variety of Buhr-stone.

Broadhead *et al.* (1873, 212) also commented on buhr-stone in Wright County:

BUHR-STONE

The large silicious masses which occur frequently on the tops of the high ridges in various parts of the county, often have the cellular and other appearances of a good quality Buhr-stone.

Finally, Broadhead *et al.* (1873, 231) recorded a chert used for millstones in Pulaski County:

A better material is found near the Gasconade, in the vicinity of Bates' mill, examined by Mr. Engelmann. This is a bed of decomposing chert, traversed with seams of quartz, in the Third Magnesian Limestone. Mill-stones were obtained for several mills in the county at this locality, and they are said to answer a very good purpose.

In a discussion of different types of Missouri millstones, Broadhead (1874:55-56) stated that:

Some of the Chert beds have also been used, from rock obtained from interstratified beds of the Second and Third Magnesian Limestone. The Chert occurring among the Lower Carboniferous rocks of South-west Missouri, in outward appearance closely resembles the French Buhr. Beds of this Chert are well exposed in Newton, Jasper, and Cedar counties. Some specimens from the last named county, under a strong magnifier, disclose minute crinoid stems. There would be danger of their breaking and becoming disseminated into flour, rendering it not very palatable.

North Carolina

North Carolina once had a major millstone industry that exploited several types of stones including flint (Hockensmith 2004e, 19-20). Emmons (1856, 218-219), in his Geological Report of the Midland Counties of North Carolina, provided the following discussion on the burrhstone and pseudo-burrhstone:

Burrhstone or Pseudo-burrhstone

This rock, upon its exterior, is exceeding rough and ragged, and as it is an extremely tough siliceous rock, it may probably possess the same valuable properties as the Paris burrhstone. But I do not speak confidently; for the fact can be known only by applying a stone suitably prepared to this use, that of a millstone. The material of the rock is in the required condition at the surface. It consist of a porous chert; or, originally, it was a porphyrized chert, the felspar having disintegrated, leaves rough cavities bounded by a tough sharp edged material, similar to that of the Paris burrhstone. One difficulty may materially interfere with the introduction of this stone for the purpose proposed, viz., the expense of cutting it, in consequence of the toughness of the material; and besides, the stone has not weathered deeply, except when detached from the parent bed. But the formation is extensive, and the varieties or kinds are quite numerous; and hence, it is expected that localities will occur suitable for the purpose I have proposed.

An early account (North Carolina Land Company 1869, 106) noted that:

On Laurel River in Madison is a peculiar cherty splintered whitish quartz rock which Mr. George Gehagan has manufactured into millstones, which are described as nearly equal in performance to the French buhrstone.

Emmons (1858, 90) provided the following information on stone marl used for millstones:

There are two varieties of stone marl, both of which deserve a special notice. The first consist of shells cemented strongly together, and which are usually from one to one and one and a half inches across, and very uniform as to size. They are very firmly cemented by silica, which seems to have penetrated the shells more or less. This rock has been employed for a long period for small millstones. Its valuable qualities consist in being easily wrought when first removed from the quarry, but subsequently becomes very hard and strong. Being made up of shells, it has a rough appearance, even when cut evenly; but this feature constitutes its recommendation.

Emmons (1858, 102) further noted that:

The Eocene is known to exist at Wilmington, at Pollocksville. In Jones county, and underlies the whole country in the vicinity of Newbern, upon Neuse. In this information I include the consolidated beds which have been employed for mill stones, and which consist of a mass of the cast of shells, the most common of which is a small species of clam.

The Report of the Geological Survey of North Carolina (1875, 305) stated that:

... and in the eastern section, the shell rock is often partly or wholly silicified, forming a sort of buhr-stone, as in Georgia, and is well adapted to the same uses.

Ohio

Flint millstones were manufactured at two main localities in Ohio, Flint Ridge and Raccoon Creek (Hockensmith 2003b). At Flint Ridge in Licking and Muskingum Counties, Ohio, millstones were quarried from a flint that was

... very porous and fossiliferous, and very frequently mixed with calcareous or argillaceous material... (Mills 1921, 96).

Samuel Drumm made the first millstones (monolithic) at Flint Ridge and in 1827, Josua Evans & Co. began to manufacture composite millstones similar to French buhrs while Richard Watkins was also making millstones there as well (Garber 1970, 81). In this section, general comments on Ohio buhr stones will be provided first. This will be followed by subsections on Flint Ridge and Raccoon Creek.

Descriptions of Ohio Buhr Stone

In his second Annual Report on the Geological Survey of the State of Ohio, Mather (1838b, 90-91) made the following comments concerning character of the buhr stone:

This is the result of a chemical precipitate-rather than a mechanical deposit-of silex; although we are unacquainted with the process by which it was effected over so large an area. That silex is soluble in boiling water, is evident from the deposits of the geysers of Iceland and Bohemia; nor is a high temperature absolutely necessary, since it enters largely into the composition of most of our canes and rushes.

External Characters.--Greyish or yellowish white- also with a greenish tinge; opaque- sometimes passing into hornstone, when it becomes translucent. It contains numerous cavities- bearing some resemblance to amygdaloidal trap. These cavities, in some cases, are formed by the mold of small infusoria, myriads of which are contained in a cubic foot.

Mineral Contents.--Quartz in beautiful druses, lining the oblique fractures of the buhr- also in six-sided pyramids-occasionally smoky. Chalcedony in a confused aggregation of crystals, in the cavities of the buhr, as though deposited by infiltration before the consolidation of the surrounding mass was complete. Calc spar, in rhombic prisms of pearly lustre-translucent, or nearly transparent. Heavy spar, or sulphate of barytes, is also found.

Concerning the range and extent of the Ohio buhr stone, Mather (1838b, 91) noted:

Beginning about a mile west of Somerset, Perry county, it ranges near the dividing line between Muskingum and Licking, passing through the townships of Hopewell, Hanover, Licking and Jackson, crossing the national road near Gratiot. Its average breath is from 8 to 10 miles. This rock is so liable to disintegration, as to render it difficult to ascertain the line of junction. Its examination, therefore, is attended with some degree of difficulty. To specify all the localities at which it has been observed, would be unnecessary as they are indicated by symbols on the map.

Another early discussion of Ohio buhr stone being utilized for millstones was published by Caleb Atwater (1838, 16):

The burghstone, of which millstones are made, in considerable numbers, in the counties of Muskingum, Hocking, Jackson and Gallia, occurs in amorphous masses, partly compact, but this rock always contains in it, more of less irregular cavities. These holes are occasioned sometimes, by the seashells which originally filled them having fallen out of their places in the rock. The aspect of this millstone is somewhat peculiar, resembling paste, which had been in a state of fermentation, when moist, and warm; but when the heat had ceased to act, the mass became dry, hard and compact, with all the marks of fermentation remaining in it. The cavities are sometimes, filled with crystals of quartz. The fracture of this burghstone is commonly dull, and its colour is whitish or redish brown. Its hardness and cavities, when not too numerous, render it very useful for making millstones, many of which are manufactured, and sent all over this state, and to the western ones generally.

Howe (1851, 586, 1875, 586) also provided the following description of a stone in southern Ohio:

In the 1st Geological Report of Ohio, p. 28, Dr. Hildreth notices the 'calcareo siliceous,' or 'buhr stone rock,' of the coal series of Ohio, which resembles very closely the French buhr, used in this country for mill stones, and imported from France. On Raccoon's creek, and at other places in the south, near the Ohio river, this rock is wrought into mill stones to a considerable extent; but millers, as yet, prefer the foreign buhr, at a considerably higher price.

Flint Ridge Millstones

Garber (1970, 81) reproduced an ad from the May 15, 1827 issue of the Mansfield Gazette newspaper which is quoted below with a different format:

> ***FLINT RIDGE BURR MILL STONES.***
>
> *THE Subscribers inform the public that they have commenced the business of manufacturing Mill Stones of the above description, in Washington township seven mile South of Mansfield, where they have and intend keeping constantly on hand, Stones of various sizes. They have also an establishment at Flint Ridge, in Licking county where Stones of any size will be made on the shortest notice.*
>
> *Persons engaged in the milling business are invited to call and examine for themselves, a the subscribers believe that they can furnish stones of as good a quality, and at as reasonable prices, as any establishment in the western country.*
>
> *JOSHUA EVANS & Co.*
> *Washington, May 15, 1827*

Hildreth (1828, 40) stated that 'at the east end of the ridge, twelve miles from Zanesville, fine mill stones are made of cellular quartz, equal to, or better than French Burr.'

Also in the monograph, the First Annual Report on the Geological Survey of the State of Ohio, Mather (1838a, 33) commented on the manufacture of Flint Ridge millstones:

The manufacture of mill-stones is not confined to the waters of Raccoon, but is also carried on to considerable extent in Hopewell township, Muskingum county. The quality is apparently inexhaustible, and new quarries will be opened, at points where it is not at present looked for, and probably of a more even and compact texture than that now obtained. Few or no quarries have been yet worked by drifting under the sides of the hills, but the rock is generally procured by what is technically called 'stripping,' or excavating the superincumbent earth, near the top of some ridge or hill, where it is easy of access.

Mather (1838b, 91) made the following statements about the use of a buhr stone (2 to 6 feet thick) for millstones at Flint Ridge:

It is quarried and wrought into mill stones. The principal quarries are those of Samuel Drumm and S. Henslee, on sec. 15, Hopewell township, Muskingum county; and Adam Drumm and Joseph Baird, on sec. 11, Hopewell township, Licking county. It is inferior in toughness to the Raccoon buhr, and therefore less valuable for millstones.

Brainard (1854, 12) provided the following statements about Flint Ridge millstones in his book about sandstone conglomerate:

On what is called Flint Ridge, in Ohio, there is a bed of compact quartz, with cavities beautifully studded with crystals. This stratum belongs to the carboniferous formation. It is generally known as the buhrstone of Ohio, and is used to some extent in the manufacture of millstones. Like the buhr stone of France, this has been formed from solution, which fact is most satisfactorily shown by an examination of the specimens.

In an 1874 report on *The Agricultural and Mineral Resources of Muskingum County* (Zanesville, Ohio Board of Trade 1874, 17), the following comments were made concerning the Ohio buhr stone near Flint Ridge:

Buhr.- What is called 'Buhr Stone' is found in the Western section of the County. It exists on both sides of the line dividing Muskingum and Licking Counties, and extends into the North-east corner of Perry County. The stone is a grayish or yellowish white, sometimes passing into hornstone, exist in beds from two to six feet in thickness, is fine grained and compact, and well calculated to give a fine edge to cutting tools or implements. The Indians used the compact hornstone for arrowheads. This Buhr was, years ago, quarried to quite an extent, and made into millstones, but as the material lacked tenacity they were not regarded with equal favor with the 'French Buhr.' Their manufacture has of late been abandoned, and at present the Buhr is not sought.

Millstones were being made to order by Richard Watkins at the quarry in 1841 (Garber 1970, 81). In an 1851 discussion on Muskingum County, Ohio, Howe (1851, 381) noted the presence of a:

... burr-stone or cellular quartz, suitable for mill stones.

Andrews (1870, 102) noted that:

... the flint or buhr stratum, on Flint Ridge [Licking County], *is not found to correspond in stratigraphical position with the other layers of flint found in the district especially examined.'*

Furthermore, he made the following comment about Flint Ridge (Andrews 1870, 102):

The buhr is of a variable thickness, its maximum being perhaps 8 feet. Formerly, mill-stones were made from the rock, but the quarries have been of late years abandoned.

Raccoon Creek Millstones

George Ogden (1823, 77) in his *Letters From the West* provided the following information about the Raccoon Creek millstone quarries:

On Racoon Creek, in Athens county, are extensive quarries of stone, from which burr mill stones are made, equal to the best English burrs; they are so good that all the western states are supplied with them.

In his First Annual Report on the Geological Survey of the State of Ohio, W. W. Mather (1838a, 33) made the following comments concerning the value and importance of the Buhr-stone:

The importance of this article in a commercial and domestic point of view, may in some measure be estimated, when it is stated, by intelligent persons who have been long engaged in the manufacture of mill-stones, that the annual amount of the manufactured article is not less than 20,000 dollars; and that it may be safely calculated at this sum, for twenty years past. When to this, is added, the money saved to mill owners, from the use of the native, instead of the foreign buhr-stone, that amount will be nearly doubled. It came into use about the year 1807; and the first pair of stones constructed of this article, on the waters of Raccoon, was by Abraham Neisby, a native of Germany. He being familiar with the foreign, or French buhr, and seeing this rock so nearly resemble that in composition and aspect, was led to make trial of it. Henry Castle, also began to make them about the same time. Soon after this, our embarrassments with Great Britain, and other commercial difficulties, led the American people to establish manufactories of various articles, heretofore altogether brought from Europe. Amongst other things the enhanced value of the French buhr, led to the search of a material of a similar quality at home, and no doubt brought the domestic article much sooner into general use in the Western States, and especially in Ohio. The early manufactured millstones were made of a single piece; but these often proving to be of unequal density, and not making good flour, were abandoned, and staves constructed of separate blocks, cemented with plaster, and confined together with iron bands. Where these blocks are selected with care, by an experienced workman, the flour is said to be equal in quality to that made by the French stones.

From the 1814 to 1820, the price of a pair of 4 ½ feet stones was $350, and a pair of 7 feet, sold for $500; while the foreign article sold for a still higher sum.

The 4 feet stones now sell for $150. In the townships of Richland, Elk and Clinton, a large number of the inhabitants are engaged in the dressing of blocks, and in the construction of mill-stones. The buhr-rock is a mine of wealth to the inhabitants, and has contributed largely to the prosperity and the independence of this whole region of country.

Mather (1838a: 33-34) described the Raccoon buhr-stone as follows:

The characteristic excellence of the best mill-stone rock consist in its uniform texture; composed of quartz; free from lime and oxyde of iron, which more or less pervade the larger portion of the deposit; color light grey; structure open and full of cells; the fragments giving a clear metalic sound when struck with the hammer. How far this agrees in character with the French buhr will be presently shown. Although an intensely hard rock, yet its structure is similar to that of all other stratified rocks; and it has a regular horizontal division, as well as cross fracture. The bed, or horizontal surface, is the one which contains the most cells, and is selected for the face of the mill-stone. In nearly all the quarries, the rock is found naturally broken into rectangular masses of various dimensions. As the larger portion of the quarries contain more or less of petrified shells, those the most free of foreign matters are considered the best. While the fossils in the French rocks are all of fresh water species, those in the Raccoon buhrs are altogether of marine origin; and as this deposit is a member of the coal series, it is a much older rock than the French, which belongs to the tertiary group.

In the composition and the chemical affinities of the Racoon deposits, there is a close resemblance to those of the Paris basin, as they both abound in calcareous materials, as well as silicious. In several of the Raccoon beds, there is a stratum of lime-stone, two or more feet in thickness, both above and below the buhr-stone. In such quarries, the portion suitable for mill-stones is only from two to four feet in thickness. In others, the quartzy portion is below, and the silicious lime-stone above. The greatest thickness of the deposit in any one bed, is nine feet. In how many points of character the Paris and the Raccoon beds agree, may be seen in the following extracts from 'Cuvier's Essay on the Theory of the Earth.

Bishop (1866:185) made the following comments about the Raccoon Creek burr millstones:

A domestic supply of 'Burr' millstones, for the western country, was opened near the head of Raccoon creek, Athens co., Ohio. It was considered identical in composition with the French curb stone. The first pair were put in the steam flour mill of the Mariette Mill Company, started in January by Messrs. Gilman, Barber, Skinner, Fearing & Putnam, who afterwards added woolen machinery.

A millstone quarry was established in about 1805 by a man named Musselman in Vinton County (Garber 1970, 78). These millstones became known as 'Raccoon buhrs' since the quarry was near Raccoon Creek (Garber 1970, 78). Blocks of stone were quarried and fitted together to form composite millstones (Cinadr and Brose 1978, 59). By 1860 the Raccoon Creek quarry had apparently ceased production (Garber 1970, 78).

In his *The American Miller, and Millwright's Assistant*, Hughes (1869, 73-74), shared the following information about the Raccoon Burr Stone:

ON THE RACCOON BURR STONE

This description of stone is of American production, and its geological nativity is confined to the State of Ohio, not being known elsewhere. Its locality is in Muskingum and adjoining counties, known by the name of the 'Flint Ridge.' This stone is a description of burr, and makes a very good substitute for the imported or French burr. During my residence in the State of Ohio, I was employed by the Messrs. Adams, of Muskingum county, who do a large business in flouring, being the most extensive millers in that part of the State. One of their mills, in which the author was employed, was of six run of stones, all of them of Raccoon burr, and having dressed them, the only conclusions I drew, from the work the stones made, was that they required to be dressed oftener than the generality of the French burr. The reputation of this mill then stood high in New York for making a good article of superfine flour. The difference in the price between the Raccoon and imported being from 35 to 45 per cent cheaper. They are put together in blocks and fitted up as the French burr, and will answer a good purpose for grist mills, or for grinding coarse grains, such as grist grinding generally consist of, for the use of the farmer.

Howe (1888, 427) provided the following information on the Raccoon Creek millstone industry in Vinton County, Ohio:

When we first came here there were perhaps fifty families in and around this settlement, most of them quarrying and making millstones. There was no person making a business of farming. All had their little patches of garden, but making millstones was the principal business. Isaac Pierson, father of Sara Pierson, of Chillicothe, had the principal quarry. Afterward Aaron Lantz and Richard McDougal had large quarries. A man named Musselman first discovered the stone in 1805 and in 1806 employed Isaac Pierson to work for him. This was on section seven. There were no white people here at that time and the two camped out. Musselman quit, but the next year Pierson, finding the business to be very profitable, moved out, built the first cabin and made the first permanent settlement.

He employed hands to help him, and soon the settlement grow. The business was very profitable, and all engaged in it would have become independently rich but for one thing-whiskey! Most of them drank; and nearly every pair of millstones that was sold must bring back a barrel of whiskey, whether it brought flour or not. If the flour was out they could grind corn on their hand-mills but they made it a point never to get out of whiskey.

Fig. 8: Pit at a Raccoon Creek Burr Millstone Quarry in Near McArthur in Vinton County, Ohio. March 25, 2005 (photograph by Steve Parker, Lancaster, Ohio. No scale is available).

Fig. 9: Working debris at a Raccoon Creek Burr Millstone Quarry in Near McArthur in Vinton County, Ohio. March 25, 2005 (photograph by Steve Parker, Lancaster, Ohio. No scale).

Fig. 10: Large chert boulder with tree growing on top of it in a Raccoon Creek Burr Millstone Quarry pit in Near McArthur in Vinton County, Ohio. March 25, 2005 (photograph by Steve Parker, Lancaster, Ohio. No scale).

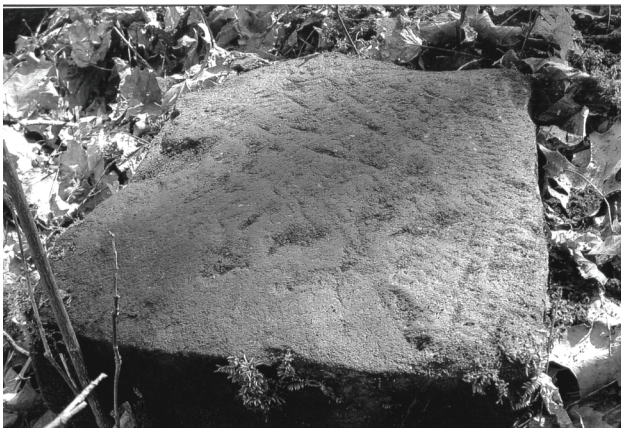


Fig. 11: A stone slab at a Raccoon Creek Burr Millstone Quarry in Near McArthur in Vinton County, Ohio. March 25, 2005. The slab, 12-14 inches across, has numerous tool marks (photograph by Steve Parker, Lancaster, Ohio).

James L. Murphy (2004) shared with the author that he had seen advertisements for the 'Raccoon buhrstones' in early Ohio newspapers. Further, he stated that these millstones were made from the Zaleski flint of Vinton County, Ohio. Murphy (2004) thought that these quarries were located west of McArthur (the county seat of Vinton County) but were destroyed by strip mining.

A 1961 newspaper article by G. E. Sharp appearing in the *Democrat Inquirer* confirmed Murphy's comments and provided additional details. According to Sharp (1961), during the 1950s, he and Leroy Pilcher found an abandoned Raccoon Creek Buhr millstone quarry on the Morley farm while searching for mushrooms in the woods. Sharp and Pilcher examined five or six unfinished millstones, marked the spot, and made plans to preserve the stones in a historic exhibit (Sharp 1961). During the time of the discovery, the McArthur Brick Company was mining clay on the farm containing the quarry (Sharp 1961). The clay miners made numerous promises to bring the unfinished millstones out of the quarry but did not follow through (Sharp 1961). Later, Bert Eberts, who was operating a large strip mine for coal on the Morley farm covered up the millstone quarry but brought one millstone to Sharp's back yard (Sharp 1961).

Steve Parker located one of the Raccoon Creek Buhr millstone quarries near McArthur during March 2005. His field trip revealed 12 quarry pits, piles of flint debris from shaping millstones, and one squared piece of flint (12 to 14 inches across) with tool marks. He shared several photographs with the author including images of quarry pits (Fig. 8), quarry debris (Fig. 9), a large chert boulder (Fig. 10) and a smaller worked stone slab (Fig. 11). Mr. Parker confirmed Sharp and Murphy's report that a larger quarry had been destroyed by strip mining for coal and that several unfinished millstones were reportedly buried under the slag piles (Parker 2005).

A Raccoon Creek Burr millstone is on display in front of the Vinton Courthouse in McArthur, Ohio. The author photographed and measured this millstone on September 13, 2014. It is a monolithic made from a very porous light brown chert (Fig. 12). The cavities in this millstone are rounded to irregular in planview, ranging from 5 mm to 7 cm across, and about 1-5 cm in depth. Its diameter is 1.20-1.22 m with a thickness ranging from 16-24 cm. The round eye is 23 cm in diameter. The exposed surface is relatively flat while the opposite face is irregular. Portions have been broken off the bottom. It is uncertain whether these broken areas are connected with the modern transportation of the millstone or damage that occurred at the quarry. Since the millstone does not appear to have been dressed for grinding grain, it is most likely a specimen retrieved from an abandoned quarry in Vinton County.

There are several documented millstones from the Flint Ridge millstone quarries in Ohio. According to Bradly Lepper (2014), a partial millstone made from Flint Ridge chert is on display at the Flint Ridge State Memorial near Glenford, Ohio. The millstone fragment on display at the Flint Ridge State Memorial is originally from Licking or Muskingum County, Ohio and measures 1.01 m across (Hannibal *et al.* 2013, 751). Hannibal *et al.* (2013, 751) included three other flint millstones in their study thought be from the Flint Ridge area. One of these millstones was used as a grave marker in the Hall Cemetery in Knox County, Ohio (Getz 2012; Hannibal *et al.* 2013, 751). This composite millstone measures 1.07 m in diameter (Hannibal *et al.* 2013, 751). Two large segments of monolithic millstones were documented at Black Hand Gorge Park in Liking County, Ohio measuring 1.175 m and 1.18 m, respectively (Hannibal *et al.* 2013, 751).

Fig. 12: Raccoon Creek Burr Millstone on display in front of the Vinton Courthouse at McArthur, Ohio. September 13, 2014. Millstone diameter: 1.22 m (photograph by C. D. Hockensmith).

South Carolina

Millstones were quarried from a flint-like stone at two locations in South Carolina. The first is near Barnwell in the southwestern portion of the state where *'beds of silicified shells'* were quarried (Tuomey 1848, 290). Tuomey noted that:

... pieces may be found that agree exactly with the French buhrstone, but those who have attempted to procure millstones at this locality, have committed a great mistake in trying to get them in one piece. Everyone knows that French burr mill stones are made up of from 16 to 20 pieces, cemented and bound together with iron hoops.

The second quarry was located in central South Carolina near Orangeburg and millstones were made from '*...a bed of close grained silicious rock...*' (Tuomey 1848, 290). Finally, Foster (1869, 320) noted that:

... and in South Carolina occurs a cellular Buhr-stone, adapted to mill-stones.

Tennessee

Several types of stone were shaped into millstones in Tennessee including flint (Ball and Hockensmith 2005; Hockensmith 2004c, 9-11). The earliest mention of buhrstone millstones in Tennessee is found in Haywood's (1823, 14) *The Natural and Aboriginal History of Tennessee*:

Some of the inner mountains above described; and particularly one lying fifteen miles to the north of Knoxville, are mountains if Buhr stone, which is acknowledged by the best Judges, to exceed all of the like kind in the world.

Safford (1869, 221) provided the following information on flint millstones in his Geology of Tennessee:

The chert so characteristic of the upper part of the Knox Dolomite is manufactured, at several points, into excellent millstones. Layers of it, having a suitable cellular structure, occur in Claiborne, Jefferson, Knox, and other counties. It is generally the weathered outcropping portion of these layers that is used. After getting to a certain depth, the cavities are found to be more or less filled with crystals of dolomite and other matter.

In further discussion of the Knox Dolomite and the flint millstones made from it, Safford (1869, 511) noted that:

This has been made into millstones at a number of points in East Tennessee. At Big Spring, in Claiborne County, Col. Hugh Jones manufactured, during his life time, not many less than 100 pairs of stones from this chert. They were quite in demand, and were considered to be equal to the French buhrstone.

A bed of silicified shells was used for millstones in Sumner County, Tennessee. Safford (1869, 283) described this stone and the millstones made from them as follows:

In Sumner County, a few miles north of Hartsville, immediately below the Black Shale, is a bed, from which millstones were formerly extensively manufactured. This bed is a mass of shells, closely packed, and silicified. The bed is several feet thick, and contains Nashville species.

The shells are so packed as to make the rock, in due degree, cellular. The weathered portions, near the outcrop, are preferred, for the reason that, within, the spaces between the shells are filled with calcareous matter, which, by exposure, is leached out. The millstones manufactured here, were highly esteemed. I do not know that any have been made of late years.

Safford (1869, 511) also reported on some additional chert millstones that he had not personally seen:

Dr. Troost, in his Third Report, speaks of a superior kind of 'siliceous millstone' near Harpeth River. I have not seen this, but suppose it to be some layer of chert, in the Siliceous Group.

Flint millstones were manufactured in Claiborne County, Tennessee at Big Spring (Killebrew 1874, 260). The raw material at this quarry was described as a:

... a flint mass, filled with cellular cavities.

The quarry was in business prior to the Civil War and the millstones were regarded:

... as equal in every particular to the French buhr' (Killebrew 1874, 260).

Presently, there are no documented examples of flint millstones from the Tennessee quarries. Millwright Ben Hassett photographed what he thinks is a flint millstone that may have been manufactured in Tennessee. This millstone is located at the Old Mill of Pigeon Forge at Pigeon Forge, Tennessee (Fig. 13).

Fig. 13: Possible flint millstone at the Old Mill of Pigeon Forge, Tennessee (photograph by Ben Hassett, Lynchburg, Virginia. No scale).

Virginia

Dealing with the period of 1835 to 1841, Rogers (1884, 173) described the Montgomery Buhr deposits in Floyd County in southwest Virginia:

In the same region, and associated with the valley limestone, occurs that interesting and valuable siliceous deposit, the Montgomery Buhr. Varying from a greyish and yellowish white to a deep orange brown, and presenting a cellular texture and great hardness and sharpness of grit, this unique material possesses qualities which admirably adapt it to the formation of mill-stones; and is accordingly, though to a much less extent than could be wished, used for this purpose.

Conclusions

Because of the high cost of acquiring the French burr, there was an interest among some millers and entrepreneurs to find American stones that could serve as a cheaper substitute. The Georgia burr was one of the most successful French burr substitutes on the market. In Ohio, the Flint Ridge and Raccoon Creek burrs were also very popular substitutes for the French burr. To a lesser extent, American millstones compared to the French burr were produced in Alabama, Arkansas, Illinois, Indiana, Kentucky, Missouri, North Carolina, South Carolina, Tennessee, and Virginia. Some of these stones may have physically resembled the French burr because of their porous appearance. Other American millstones may have been compared to the French Burr because of their high quality.

The Georgia burr millstone seems to have enjoyed a degree of popularity among some millers between ca. 1812 and the 1860s. This millstone's greatest appeal was its similarity to the French burr millstone. Initially, the Georgia burr was touted as being equal to the French burr and having the potential of replacing the French stone in America. However, the test of time proved that the Georgia burr was in fact inferior to the French burr. The Georgia burr slipped into obscurity while the French burr maintained its honored position as the world's best millstone. By the 1860s, the Straub Mill Company of Cincinnati, Ohio, was apparently using some of the Georgia burr stones in their portable mills. Undoubtedly, many of the smaller Georgia burrs were used in portable mills shipped throughout the eastern United States. Many of these millstones may be incorrectly identified as French burr stones at mills.

The full spatial extent of the Georgia burr is currently unknown. We know that the stone was shipped to Philadelphia and manufactured into millstones during its early history. One can assume that some were shipped to the states surrounding Georgia. During 1849 and 1850, the literature indicates that some of the Georgia burr millstones were shipped to Savannah (Georgia), Norfolk (Virginia) and Richmond (Virginia). Davis (1990, 6) also mentioned Brandywine (Pennsylvania), Georgia, Alabama, the Carolinas and Virginia. However, much additional

research will have to be undertaken before we can accurately determine how widely these millstones were distributed in the United States.

The complete range of sizes produced for the Georgia burr is not recorded. Davis (1990, 6) reported Georgia millstones ranging from 15 inches (38 cm) to 7 feet (2.13 m). Other sources mention millstone diameters of 4 feet (1.245 m), 4 ½ feet (1.375 m), and 5 ½ feet (1.67 m). A single source mentioned that a 4 foot (1.245 m) millstone was valued at $250.

The add reproduced by (Davis 1990, 6) indicates that the Georgia burr was a composite millstone. The drawing of a complete millstone revealed a rectangular center (constructed from four blocks) with the eye formed by these blocks (*cf.* Fig. 2). The same drawing showed 22 wedge-shaped blocks or panes arranged around the rectangular center to form the millstone. Also, the engraving depicted three workmen constructing two millstones with a ship and railroad boxcar in the background suggesting transportation modes utilized.

The Flint Ridge and Raccoon Creek buhr millstone quarries in Ohio furnished millstones to millers in Ohio and adjacent states between the early and mid-19th century. The Flint Ridge quarries were producing millstones sometime prior to 1827 while the Raccoon Creek millstones were produced by 1805. Millstones were still being manufactured at Flint Ridge in 1841. The Raccoon Creek quarries were still making millstones until about 1860.

At Flint Ridge, millstones were made by Samuel Drumm, Adam Drumm, Joseph Baird, S. Henslee, Joshua Evans & Co., and Richard Watkins. Millstones were manufactured at Raccoon Creek by a Mr. Musselman, Isaac Pierson, Abraham Neisby, Henry Castle, Aaron Lantz, and Richard McDougal. Most of the early families living near the Raccoon Creek quarries in Vinton County were involved in the quarrying and making of millstones (Howe 1888, 427).

It appears that the Flint Ridge and Raccoon Creek millstones shared a lot of properties. Both quarries started out producing monolithic millstones or millstones made from a single stone. Since the raw material was not of a consistent quality, both groups of millstone manufacturers changed their strategy to producing composite millstones. Like the later French burr millstones, these millstones were fashioned from carefully shaped sections of stone that were cemented together and encircled with iron bands. Composite millstones were being produced at Flint Ridge by 1827 and at Raccoon Creek before 1838.

In terms of quality, the Raccoon Creek buhr was more durable and more valuable than the Flint Ridge millstones (Mather 1838b, 91). By 1851, Howe (1851, 586) noted that millers preferred the foreign millstones over the Ohio flint millstones.

Little information is available on the distribution of the Ohio productions. The Flint Ridge millstones were shipped as far west as the Mississippi River and as far east as Pittsburgh, Pennsylvania (Mills 1921, 98). Raccoon Creek millstones were shipped to *'all the western states'* (Ogden (1823, 77).

The range of sizes for these millstones was not recorded. The 1827 advertisement by Joshua Evans & Co. at Flint Ridge mentioned that *'they have and intend keeping constantly on hand, Stones of various sizes'*. Mills (1921, 98) report that the Flint Ridge quarries produced *'small buhr-stones during the early settlement of the country...'*. At the Raccoon Creek quarries between 1814 and 1820, Mather (1838a, 33) noted that a pair of 4 ½ foot (1.375 m) diameter millstones sold for $350 while a pair of 7 foot (2.135 m) diameter millstones sold for $500. By 1838, a pair of 4 ½ foot (1.375 m) diameter millstones sold for $150 (Mather 1838a, 33).

In Kentucky, flint millstones were quarried in Franklin (present day Anderson County) and Woodford counties. Apparently, the millstones makers were quarrying geological strata with flint layers or containing flint inclusions. Unfortunately, we don't know whether these millstones were monolithic or composite. Also, it is not known whether a porous eroded chert deposits (with cavities) was being used or if solid layers of chert were used. Hopefully, once these quarries are located, these and many other questions can be answered.

If the chert exploited at these quarries is porous, these millstones would resemble the French burr stone. The advertisements suggest that these millstones were of high quality since they were compared to the French burrstone and would be replaced if found to contain flaws. However, a recently located flint quarry in Woodford County, Kentucky suggest these millstones probably contained chert nodules rather than a tabular chert.

Flint millstones from the central Kentucky quarries were manufactured in a variety of sizes. The mentioned sizes and corresponding prices were 2.5 feet [76.5 cm] ($40), 2 feet 9 inches [84 cm] ($50), 3 feet [91.5 cm] ($60), 3 feet 3 inches [99 cm] ($50-$75), 3.5 feet [1.07 m] ($85), 3 feet 9 inches [1.145 m] ($100), 4 feet [1.245 m] ($100-$125), 4 feet 2 inches [1.27 m] (no price given), 4.5 feet [1.375 m] ($150), 4 feet 8 inches [1.421 m] (no price given), and 5 feet [1.525 m] ($150-$180).

The exact beginning of the central Kentucky flint millstones industry, its longevity, and its distribution remains obscure. John Tanner's 1800 advertisement quoted a December 15, 1799 testimony for his millstone. Thus, we know that these flint millstones were available in 1799 and possibly a few years earlier. The industry was actively being promoted in 1820 and 1821 and may have continued several years longer. The shortest production period for these millstones would therefore have been at least 22 years.

In terms of their distribution, the advertisement by Miller, Railsback & Miller suggests that these millstones would be shipped anywhere in Kentucky and adjacent states. Thus, it is possible that flint millstones produced in central Kentucky were present in several surrounding states.

The flint millstones quarried in North Carolina were described as being similar to the French burr (Emmons 1856, 218-219) and also similar to the Georgia burr (Emmons 1856, 218-219). These millstones were quarried near Troy in Montgomery County, North Carolina (Emmons 1856, 218-219). Similar porous chert was available at Flat Swamp Mountain in Davidson and Stanly counties but it is not known whether these deposits were used for millstones (Emmons 1856, 218-219). It is possible that many of these local millstones have been misidentified as French burr millstones at mills in North Carolina.

A marl with small fossil claim shells penetrated and cemented with silica was quarried for millstones in Jones County, North Carolina. This rough stone, composed of shells, was noted to be similar to the Georgia buhr millstone (North Carolina State Geologist 1875, 305). Emmons (1858, 90) indicated that this stone served to make small millstones. Similar millstones made from stones with dense shell deposits were reported near Barnwell and Orangeburg, South Carolina in 1848 (Tuomey 1848, 290) and in Sumner County, Tennessee (Safford 1869, 283).

Unfortunately, we know very little about the local millstones produced in the remaining states. For Arkansas, millstones were produced in Izard and Lawrence counties during 1858. Indiana workmen made millstones in Harrison County in 1837 and Jennings County in 1859. Between 1837 and 1874, millstones were quarried in Carrol, Madison, Maries, Moniteau, Montgomery, Osage, Ozark, Pulaski, Washington, Webster, and Wright counties. Tennessee was a producer of millstones between 1823 and 1874 at quarries in Claiborne, Jefferson, Knox, and Sumner counties. Millstones were manufactured in Floyd, Russell, and Smyth counties, Virginia between 1835 and 1884. In most cases, we know little about these millstones beyond the counties where the quarries were located and the types of stone exploited.

A very significant question is 'How successful were the attempts to find American substitutes for the French Burr millstone? The answer varies according the locale. It is suspected that the local chert or burrstone millstones manufactured in Alabama, Arkansas, Illinois, Indiana, Missouri, North Carolina, South Carolina, Tennessee, and Virginia were small scale and perhaps primarily used in local mills. In Georgia, Ohio, and Kentucky the chert millstones were produced in larger quantities and shipped to mills in other states.

Early published accounts suggested that these local millstones were equal to or superior to the French burrs. Mills using these local American chert millstones quickly discovered that these stones were in fact inferior to the French burrs. Efforts to use the native millstones ceased after a few decades of experimentation and the French Burrs retained their status as the favored stones for grinding wheat by American millers. Thus, it must be concluded that the American substitutes for the French Burr millstones only had minor initial success which was very short lived.

Much additional research remains to be undertaken on the American chert millstone industry. An important step is to locate all the surviving quarries in known chert millstone quarrying areas. We desperately need documented specimens of chert millstones from abandoned quarries for comparative purposes. Without samples from each quarry it is impossible to establish a comprehensive data base on chert millstones. Information on these local chert millstones will then be available for comparisons with the French burr. Each millstone quarry needs to be documented in detail in order to determine the extent of quarrying and the nature of the surviving remains. Rejected millstones could be carefully documented to aid in the reconstruction of the manufacturing sequence at each quarry.

Detailed archival research should also be undertaken for the quarries to determine the key people involved, the years of operation, the sizes of millstones produced and other important details. Research conducted on individual quarries should be published to fill voids in the current literature.

One of the most promising avenues of future research is geological studies. Geologist Joe Hannibal (Hannibal *et al.* 2013) at the Cleveland Museum of Natural History is conducting innovative new research on millstones. After selecting a sample of several chert millstones from Ohio and a sample of French burr millstones, Hannibal *et al.* (2013, 741) used hand lenses and binocular field microscopes to identify fossils in each stone. Also, latex rubber was applied in layers on some millstones to obtain a positive mold of a millstone's surface (Hannibal *et al.* 2013, 741). At the close of the study, Hannibal *et al.* (2013, 752) concluded that on the basis of the types of fossils present, they could distinguish between the French burr and Ohio buhrstones.

Undoubtedly, the research initiated by Hannibal has a great potential for chert millstones from other states. Once the fossils are identified in the various chert millstones within the eastern U.S., researchers can hopefully distinguish all the local American cherts from the French burrstone. Also, such research holds the potential for allowing future researchers to determine which local chert quarry produced any millstone.

It is hoped that this overview of American millstones similar to the French burr will stimulate other scholars to undertake future studies on chert millstones and their associated quarries. A excellent partnerships could be formed by archaeologists and geologists teaming up to document the quarries and the fossils present in the millstones. It is the author's hope that American archaeologists will accept the challenge to document the surviving chert millstone quarries. This fieldwork is essential if we are to are develop a greater understanding of the millstone industry which was so essential in supplying stones to American flour and grist mills.

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During the time that I was reviewing the first formatted version of this paper, I was notified that one of the flint millstone quarries (most likely the John Tanner quarry) in Kentucky had been located in Woodford County. Dr. Gary A. O'Dell, geography professor at Morehead State University made the discovery with the assistance of geologist James C. Currens (Kentucky Geological Survey) and Jimmy Ott of Woodford County. I am grateful to Gary for allowing me to use four of his photographs taken at the millstone quarry and permission to quote from his manuscript describing the mills along Grier's Creek and his observations on the quarry. Finally, Gary discovered and shared an ad for Jeremiah Buckley's millstone quarry in Franklin County which appeared in the November 23, 1820 issue of The Argus of Western America.

Finally, I want to express my appreciation to Timothy Anderson for his assistance in the preparation of Figure 1.

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