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Archaeological Evidence of Historic Mining at Forestville Saltpeter Cave (15Ht94), Hart County, Kentucky

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Abstract

Forestville Saltpeter Cave is 1.5 km east of Mammoth Cave National Park on the WKU Green River Preserve. Historically, miners removed sediment from the cave to extract saltpeter for the production of gunpowder. Though dozens of peter-mining sites are known in western Kentucky, Forestville Saltpeter Cave is only the third site investigated by archaeologists. Intensive surface survey documented evidence of mining activity in the cave: working bays, rock piles, tally and other marks, tool marks, inscriptions, and lighting material. The mining likely occurred during the early nineteenth century. The operations were extensive throughout all passages and extracted 856 cu m of sediment.

Introduction

Potassium nitrate is a compound used in fertilizer, food additives, and fire suppressants, though it is perhaps best known as an essential component of gunpowder. Potassium nitrate can be manufactured by combining manure or urine with wood ashes or mortar, or it can be extracted from guano deposits. Alternatively, potassium nitrate occurs as nitre, a water-soluble mineral that crystallizes in arid environments such as sandstone caves and rockshelters. The bedrock and sediments of some limestone caves and rockshelters contain a similar water-soluble mineral, calcium nitrate or saltpeter, which can be converted to potassium nitrate through a series of chemical processes and then combined with sulfur and charcoal to produce gunpowder (Faust 1967; George 1986, 2001, 2005).

Nitre/Saltpeter and gunpowder (black powder) were essential commodities on the American frontier. Though Americans imported most of their supplies in the late eighteenth and nineteenth centuries, they were forced to produce them domestically in remote locales and during times of conflict. The era of most intensive domestic

production was in the early 1800s, especially before and during the War of 1812. About 90% of the gunpowder used in the war was produced with nitre/saltpeter from Kentucky. Nitre/Saltpeter mining occurred on various scales in Kentucky, ranging from small-scale family operations or cottage industries to large-scale industrial operations (Faust 1967; George 1986, 2001, 2005; O'Dell 1995).

Despite the key role that Kentucky played in supplying the fledgling nation with nitre/ saltpeter, there have been few archaeological studies of this important industry (O'Dell 1995). In the recently revised Kentucky state archaeology plan, McBride and McBride (2008:988) reported a total of 125 nitre/saltpeter mining sites in Kentucky's caves and rockshelters, and 124 of these are located in the Appalachian cultural landscape of eastern Kentucky. Only one such site, Mammoth Cave (15Ed1), is identified in the Pennyryle cultural landscape of western Kentucky. Not only is the spatial coverage of recorded sites limited; the number of archaeological investigations of these nitre/saltpeter caves and rockshelters is equally limited. In western Kentucky, archaeologists have conducted research at

only two sites: Mammoth Cave (Crothers et al. 2013, Mickelson 2008) and Carpenter Cave (15A122) in Allen County (Henry and Crothers 2007). In eastern Kentucky, Duncan (1995, 1997) studied Saltpeter Cave (15Cr99) in Carter County, and Webb and Funkhouser (1936) and Fig and Knudsen (1984) reported on rockshelter nitre mining sites.

In contrast, speleologists have reported evidence of nitre/saltpeter mining in numerous caves (and some rockshelters) across the Commonwealth. Angelo George, for instance, identified 133 caves and six rockshelters in Kentucky that are known or suspected nitre/saltpeter mines. They are clustered along the western edge of the Cumberland Plateau in eastern Kentucky and in the central part of the Mississippian Plateau in western Kentucky. Of the 139 sites, 56 are located in an 18-county region centered on Mammoth Cave (George 1986a). Further, speleologists have written in detail about the mining industries at a number of nitre/saltpeter mining sites, such as Mammoth Cave (De Paepe 1985; Faust 1967; George 2001, 2005; Hill and De Paepe 1979), Great Saltpeter Cave in Rockcastle County (George 2001), and Dixon Cave (15Ed225) in Edmonson County (George 1986b, 2005).

Given the abundance of nitre/saltpeter mining sites in Kentucky yet the paucity of archaeological documentation and investigations of these sites, especially in western Kentucky, the current research project sought to explore in detail archaeological evidence of saltpeter mining in a Hart County cave. In contrast with nearby Mammoth Cave and its industrial saltpeter manufactory, Forestville Saltpeter Cave affords an opportunity to study smaller-scale nineteenth century saltpeter mining in western Kentucky. The project was guided by three research questions: What is the archaeological evidence of saltpeter extraction in the cave? When did

the mining activity occur? What was the extent of the mining activity? Our field methods involved systematically surveying the ground and rock surfaces within the cave, mapping the mining activities, and verbally and photographically recording evidence of historic mining.

Site Description and Previous Investigations

Forestville Saltpeter Cave (15Ht94) is situated in a very steep cut bank on the north side of Green River in the WKU Green River Preserve in Hart County, about 1.5 km east of the northeastern boundary of Mammoth Cave National Park. The entrance is located at 550 ft amsl, about 130 feet above normal river pool and 250 ft below an unnamed ridgetop (Figure 1).

The horizontal passageways of Forestville Saltpeter Cave formed in the upper Ste. Genevieve limestone formation (Sandberg and Bowles 1965). Based on the original level of the cave sediments, which is indicated by discolorations on the cave walls, the passages were substantially infilled prior to the saltpeter mining. As such, the original ceiling height in the cave was quite low and would have limited movement by the miners.

The large cave entrance measures about 11 m wide and five m high and opens into a similarly sized vestibule. James Borden and Joseph Saunders of the Cave Research Foundation mapped the cave in 1974 (Figure 2). The passages in the single-level cave total 522 m in length. The terminal passage and four side passages end in fill, while a fifth side passage was mapped to the point that the ceiling was too low to pass (Borden and Saunders 1974). During this mapping expedition, Borden and Saunders “found a saltpeter scoop, 1812 vintage, in the cave” (Saunders et al. 1979:5). No other details about the artifact, including its form, discovery context, or current location, are known.

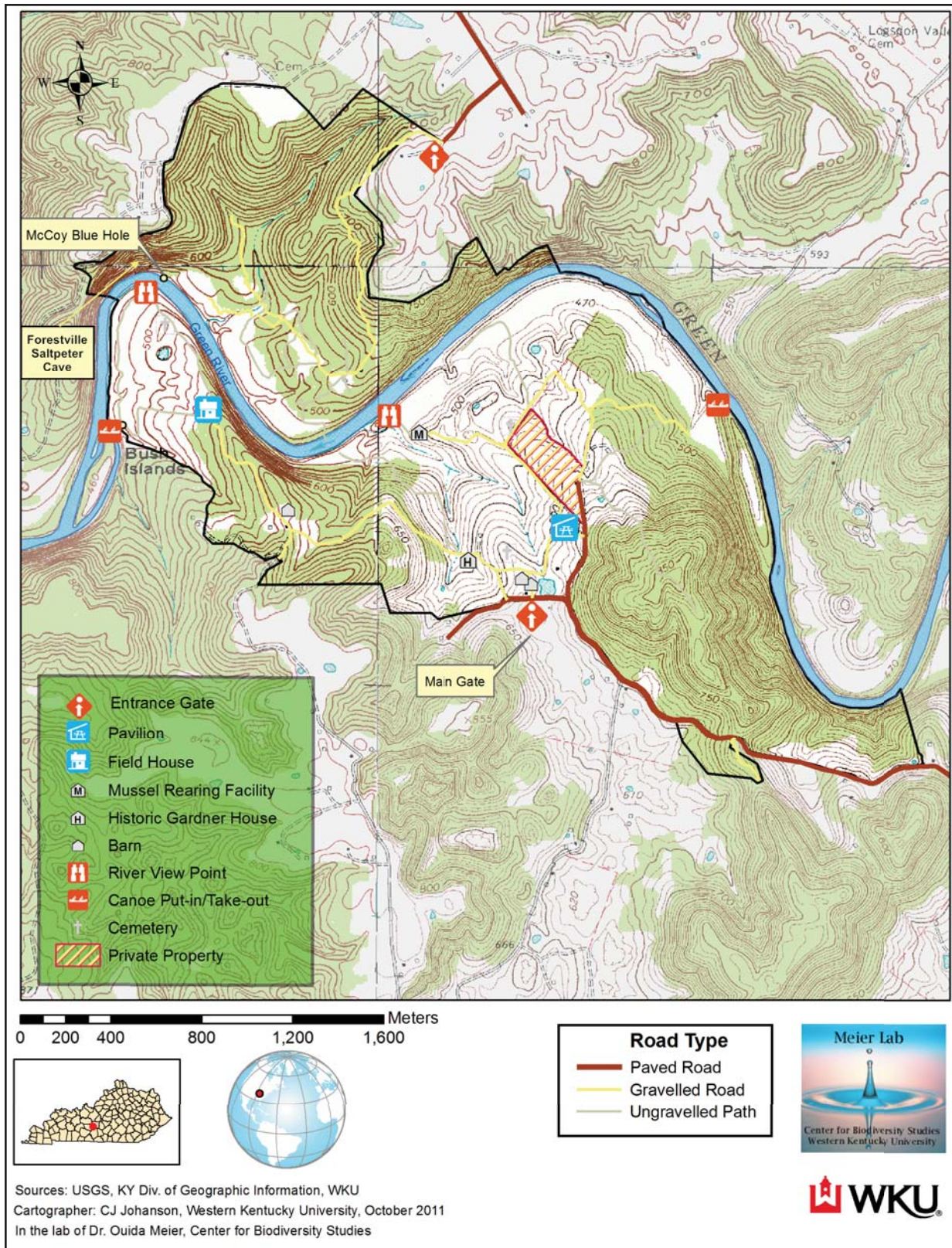


Figure 1: Topographic map composite showing location of Forestville Saltpeter Cave on Cub Run (1979) 7.5-minute quadrangle within the boundary of the WKU Green River Preserve (map courtesy of Dr. Ouida Meier, Western Kentucky University).

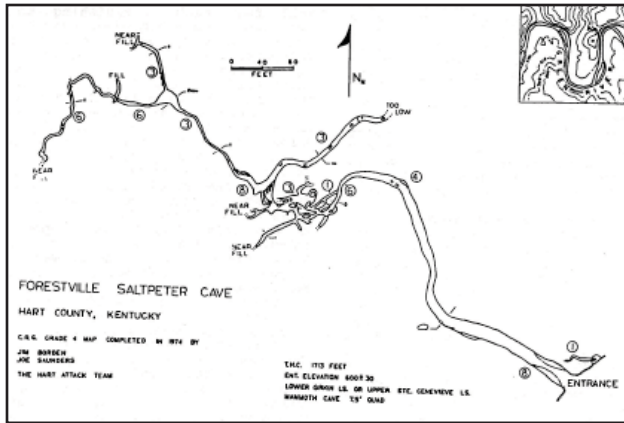


Figure 2: Plan view map of Forestville Saltpeter Cave (Borden and Saunders 1974).

Speleologists Larry McCarty, Pat Stephens, Angelo George, and Charles B. Fort studied the cave on two occasions in 1985. George (1985) wrote a brief description of saltpeter mining at Forestville Saltpeter Cave. He noted excavation trenches, stacked rock piles, wooden torch fragments, lamp seats, linear tally marks, and “exotic” tally marks including an asterisk form (which may be a slave cosmogram [George 2005:18]), circle with cross, and half-circle with radiating tallies. As there currently is no water source in the cave, George hypothesized that the miners used a shoot or a wire line to transfer bags of sediment to the river floodplain for processing. However, he also noted that some maze passages were “backfilled with processed saltpeter earth for re-nitrification to occur” (George 1985:15), which suggests that processed sediment was transported back to the cave and/or some sediment was processed on-site. George (1985:16) concluded that miners preferred Forestville Saltpeter Cave, like other maze-passageway caves, because “the saltpeter content was stronger and probably re-nitrified faster.”

Evidence of Saltpeter Mining

Regarding the first research question, we documented considerable evidence of sediment mining activity at Forestville

Saltpeter Cave. The most obvious evidence is the working bays where the peter-laden soil was mined. A working bay is a “cavity produced by the mining of soil . . . identifiable as a niche in a soil bank bounded on three sides by a high wall excavation face” (George 1986b:96). Working bays are present throughout all passages within the cave, where their dimensions vary depending on the depth of the cave sediments and the size of the cave passage. There was extensive sediment mining in the vestibule of the cave, where a medial trench measures as much as four m wide and three m deep (though it is possible the entire vestibule was mined and the trench represents a trail between lateral piles of re-deposited processed sediment). Midway through the trunk passage the face of the excavated sediment is as much as four m high (Figure 3). The miners also removed sediment from lateral ledges along the trunk passage in the vestibule. The ledges are one-two m above the current cave floor, but they likely were below the floor of the infilled cave prior to mining. As such, the ledges were exposed by the mining and do not represent balcony alcove working bays (c.f., George 1986b).



Figure 3: Vertical face of working bay along north wall at 120 m from cave entrance.

Another indication of the mining activity is rock piles resulting from two mining-related activities. As the miners excavated the cave sediments they encountered rocks that had previously fallen from the cave ceiling. They piled these rocks on ledges and on previously mined surfaces as they worked through the cave passages. The rock piles also resulted from clearing pathways to facilitate the movement of miners and their equipment within the cave. There are 11 major rock piles in the trunk passage and north side passage. They range from 1.2 x 1.0 m to 9.0 x 3.2 m in size.

Tally marks represent a third line of evidence of the mining activities at Forestville Saltpeter Cave (Figure 4). The marks are scratched or incised into the rock of the cave walls. The typical form of the tally marks is vertical lines, which can be long or short, thick or thin, shallow or deep. Some tally marks have horizontal or angled incisions across the vertical lines. There are 66 sets of tally marks, and an additional ten possible sets, throughout all passages of the cave. The number of lines within any one set ranges from 2 to 30. We recorded at least 631 tally marks associated with the mining activity at Forestville Saltpeter Cave.



Figure 4: Set of 15 vertical tally marks in the south wall of the trunk passage at 162.7 m from the cave entrance.

Salt peter miners likely used tally marks as a counting system to track the amount of excavated soil or processed soil (Faust 1955), and Blankenship's (2008) research at Cagle Saltpeter Cave in central Tennessee demonstrated a correlation between tallies and mining rather than tallies and leaching.

We documented 21 directional arrows on cave walls in the trunk, north side, and north terminal passages. Twenty of the arrows are incised, and one is formed by candle marks. The arrows point in the direction of the cave entrance and are found primarily in the deeper maze passages. We propose that most of, if not all, the directional arrows were left by the miners as they explored and mined the cave, so they could find their way out.

In addition to the tally marks and arrows, we found a number of other incised symbols, at least some of which may be associated with record keeping by the miners. Four crosses are incised in the three locations within the north side passage. The trunk and north side passages each contained two incised cross hatches, each of which is formed by two horizontal lines and two vertical lines. Eight incised X marks are located in the trunk, north side, and north terminal passages. Eleven asterisk marks, each of which is formed by four intersecting lines, were found in three places: single asterisk marks in the trunk and north side passages and a series of at least nine superimposed asterisk marks in the north terminal passage. The "asterisk" is the symbol that George (2005:18) suggested may be a slave cosmogram. Other symbols are a sun form (circle with short radiating lines) in the trunk passage and a cross inside a circle and an L form in the north side passage. Other unpatterned incised marks are found in at least 11 places of the trunk, north side, and north terminal passages.

A sixth line of evidence about the historic mining is tool marks. These are impact scars, chips, and wide scratches on rock

surfaces, as well as wide scratches and gouges in the unexcavated cave sediments. Based on the sizes of the tool marks, they likely were made by metal tools, possibly picks, mattocks, shovels, and/or spades. There are hundreds tool marks on the cave walls and sediment faces throughout all passages of the cave. We found no evidence of the use of digging sticks (Faust 1955).

There are five other types of evidence potentially related to mining operations at Forestville Saltpeter Cave, though it is likely that some derive from other cave visitors. There are 102 historic inscriptions on the cave walls and ceiling throughout all passages. Some of the inscriptions are decipherable and many are illegible. The inscriptions include names, initials, dates, and words like "HELP." Name signatures were made by incising with a sharp tool or, more commonly, with charcoal (Figure 5) or candle/torch smoke. Several contemporary signatures are in crayon and chalk. Nine inscriptions are dates or include dates ranging from 1872 to 2004,



Figure 5: Undated charcoal signature of L. F. Philpott on the ceiling of the trunk passage at 90.0 m from the cave entrance. The Philpott family has a connection to property in the vicinity of Forestville Saltpeter Cave. Around the turn of the twentieth century Curtis C. McCoy married Martha E. (Philpott) McCoy and the family resided in the Forestville area until at least the 1930s. In the early twentieth century Curtis McCoy's parents, Washington Alexander and Dilemma (Ewing) McCoy owned the farm on which the cave is located (Applegate 2007).

though one somewhat illegible date may be 1811, 1852, or 1854 and another may be 1860. The inscriptions with the nineteenth century dates are located near the end of the northern terminal passage, in the vicinity of another inscription reading \$40,000.

The other four cultural items that may be mining-related are associated with lighting. A total of 39 isolated candle marks and charcoal/torch marks are found on the cave walls and ceilings throughout all passages, especially the trunk and south terminal passage. The candle marks take the form of small circles, squiggles, and amorphous shapes, and at least some of the charcoal marks appear to be torch stoke marks. A few of the candle and charcoal marks are associated with tally marks. Four possible lamp seats were recorded in the trunk, north side, and north terminal passages. Finally, we documented nine pieces of burned wood on the cave floor, with seven in the trunk passage and one each in the north side and north terminal passages. Most of the burned wood is short or long segments of tree branches that were carbonized at one end, indicating their use as torches for lighting. Several amorphous pieces of burned wood likely fueled small fires in the cave.

In terms of sediment processing, we found no evidence of on-site leaching within the cave or immediately outside the cave entrance. There are no water pipes, vats, or other equipment that would have been used to leach the saltpeter. Further, we currently have no evidence to support George's (1985) hypothesis about floodplain processing, though the changing river levels could have obliterated any such evidence. It is also possible that sediment was loaded onto river flat boats and transported elsewhere for processing.

When the Mining Occurred

Regarding the timing of the mining activity, at this time we lack adequate data to say

with certainty when the mining occurred, over what length of time, and by whom. Unfortunately, the historic inscriptions with dates are non-conclusive, as it is unclear whether they were made by miners or other visitors. Nor did we recover any chronologically diagnostic artifacts from the cave that we could use to date the mining operations, though we may seek radiocarbon dates for the burned wood in the future.

Based on the time period of saltpeter mining at nearby Mammoth Cave, where mining ended in 1815, we propose that the mining at Forestville Saltpeter Cave similarly occurred in the early nineteenth century. The possible incised date of 1811 may support this hypothesis, as would the 1812-vintage saltpeter scoop reported by (Saunders et al. 1979:5). The fact that nitre/saltpeter mining in Kentucky occurred primarily in the late 1700s-early 1800s (De Paepe 1985; Duncan 1995; 1997; Faust 1967; George 2001, 2005; Hill and De Paepe 1979; O'Dell 1995) makes it likely that Forestville Saltpeter Cave was mined during the same time frame. Though some nitre mines resumed operation in eastern Kentucky during the Civil War (McBride and McBride 2008), most researchers (e.g., Tabor 1942, O'Dell 1995) concur that little saltpeter was produced in Kentucky during that conflict.

It is possible that local residents conducted the mining activities at Forestville Saltpeter Cave in order to manufacture their own supplies of gunpowder or to preserve meats. The land south of the cave across Green River was settled as early as 1796 (Applegate 2007), and at that time the inhabitants of this new frontier may have been far enough removed from commercial ties with the East that they could not purchase gunpowder. It is perhaps more likely, however, that the mining operation at Forestville Saltpeter Cave was a commercial venture, given the large amount of sediment that was removed, as described below.

The Extent of Mining Activity

The mining operation at Forestville Saltpeter Cave was quite extensive and occurred along all navigable passages within the cave. Besides removing sediment from the main passage and the smaller side passages, the miners crawled into a number of very low recessed areas off the passages in order to remove sediment. Some of these spaces are so constricted that it is difficult to imagine an adult maneuvering with his tools to excavate the sediment.

We measured the excavated portions of the cave sediments in order to estimate the volume of material removed by the nitre mining operations. The miners excavated at least 856 cu m of soil, which is comparable to almost 24,000 bushels (O'Dell 1995; Duncan 1995; 1997). Assuming that each bushel weighed three-five pounds, this is 72,000 to 120,000 pounds of sediment, all of which apparently was processed somewhere offsite. About 80% derived from the trunk passage and 20% from the side passages. Assuming that each bushel of sediment from Forestville Saltpeter Cave produced at least 10 pounds of saltpeter, a conservative estimate (O'Dell 1995), the cave would have generated at least 2,400 pounds of saltpeter. By comparison, in 1810, a total of 2,250 pounds of saltpeter was produced in all of Hardin County (Coxe 1814), in which Forestville Saltpeter Cave was located at that time.

This estimate is astounding. By comparison, Duncan (1995, 1997) estimated that early nineteenth-century miners excavated about 52,000-86,000 pounds of sediment at Saltpeter Cave, which is considered moderate-sized operation. Our estimate for Forestville Saltpeter Cave exceeds this by 20,000-34,000 pounds. Of course, the mining at Forestville Saltpeter Cave does not approach the scale of that at Mammoth Cave, where about 400,000 pounds of saltpeter was produced during the War of 1812 (De Paepe 1985; Faust 1967; George 2001, 2005). Still, at the

conservative pre-war price of 16.7 cents per pound (Coxe 1814) the operation would have generated about only about \$400 in income. At the war-time high price of 75 cents to one dollar per pound (O'Dell 1995), however, the value could have been as much as \$1,800 to \$2,400.

Conclusion

In conclusion, the archaeological investigations at Forestville Saltpeter Cave documented diverse evidence of extensive mining activities that likely occurred in the nineteenth century. This evidence includes working bays, rock piles, tally and other marks, tool marks, inscriptions, and lighting material. The research is significant because it is the only the third archaeological investigation of saltpeter mining in western Kentucky, and because it indicates an extensive mining operation in cave that is very difficult to access. With many more known saltpeter cave sites in western Kentucky, there is still a great deal to learn about this important early industry in the state.

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