

THE HISTORY OF SALTPETRE MINING IN MAMMOTH CAVE, KENTUCKY*

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Part V WHO MINED SALTPETRE IN MAMMOTH CAVE?

MANAGERS AND OPERATORS OF SALTPETRE PRODUCTION

There have been many attempts to establish the date when saltpetre mining was first started at Mammoth Cave, but most of them lack a ring of authenticity. The great number of travelogue writers who roamed the country during the middle quarters of the 1800's and glamorized their experiences for the home-folk, had little but folktales and hearsay reports far removed in time from the actual mining operations, upon which to base their writings and conclusions.

During the years of 1769-1771, James Knox and his Long Hunters (so-called because they were gone from home a long time) explored and hunted in the valleys of the Green and Cumberland rivers. One of these Hunters is reported to have said, "I learned every twist and turn of it [The Green River], all of its deep places and its shallows, the cliffs and the caves it cuts out of the hills."¹

Substantially all the Long Hunters had lived most of their lives in those sections of the county in which the procedure of how to collect saltpetre from a cave, recover and refine it, and then blend it with the other ingredients: sulphur and algremore (finely divided charcoal), to make gunpowder, was generally known. Therefore, it seems entirely reasonable to assume that some of these Hunters had the knowledge and skills necessary to procure saltpetre from the caves and prepare gunpowder. For at least two reasons, it does not appear likely that they carried a three-years' supply of gunpowder with them: first, to transport such an amount would have been a difficult problem; and second, the danger of spoilage by rain or river water was too great to justify the effort. It is well known that guides and explorers sent men back to Virginia to "fetch" gunpowder. However, in spite of the presumption that the Long Hunters procured saltpetre from

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Mammoth Cave, or any other Kentucky cave, no proofs or authentic records of such activities are presently known.

The actual number of gunpowder factories in operation in America during the Revolutionary Period is not presently known. There were such factories in Massachusetts, New York, Philadelphia, Wilmington, Richmond, and several other places. By the early 1800's the gunpowder factories in the United States were almost legion. The United States Census Reports for 1810, which was the first time information relative the amounts, kinds, types, sources, and values of national commodity productions, was given, show that there were 208 such establishments in this country. Of this number 63 were in Kentucky, five of which were in Lexington, and reported a total production of 115,716 pounds of gunpowder.

Michaux² who traveled thru Kentucky in 1802 reports that there was an operating mill in Lexington. Collins (*History of Kentucky*, Vol. II, p. 397) states that "Major Anderson Miller, in 1805, made a large lot of gunpowder at his father's residence in the northern part of Jessamine County, hauled it by wagon to Louisville, bought a flat-boat and shipped it to New Orleans." Collins also states (Vol. II, p. 334): "On Linn Camp Creek [in Hart County], near the line of Green County, was an extensive powder mill which during the War of 1812, and for a number of years thereafter, provided large quantities of powder." Gorin makes the following report: "In 1813 a powder mill was erected on Coon Creek, south of Skaggs Creek, not far from the State Road, where powder was made during the War of 1812-1815." There were others, but these illustrate the fact that this activity was widespread even at this early date.

There are some observations which may be made relative to the figures given in this 3rd (1810) census. Of the states in which saltpetre was produced, Kentucky, with its reported 202,957 pounds, heads the list. Since it is not known that there were any artificial niteraries within the state, it must be concluded that the entire output came from the caves. Had all the saltpetre produced within the state been processed into gunpowder, well over a quarter of a million pounds could have been manufactured. Only about 87,000 pounds of the amount produced were actually needed to make the 115,716 pounds of gunpowder reported. This left about 116,000 pounds available for export from the area.

This considerable production of saltpetre and the wide-spread distribution of gunpowder factories indicate that, for a number of years, the people had been active in the production of this commodity. Even tho these amounts were small in comparison with later production, it is clearly evident that, before 1810, the manufacture of gunpowder and

the production of saltpetre were important industries with a sizeable economic worth. It seems reasonable that, for a considerable number of years, Mammoth Cave played a major role in these industries.

Even tho there is no known evidence that the Long Hunters or any other early explorers or settlers procured saltpetre from Mammoth Cave, there is persuasive circumstantial evidence that Valentine Simmons, whose name first appears in the ownership records of the Cave in 1797, either produced or allowed others to mine saltpetre from this cave. This date may be questionable since September 14, 1798, is the date on the Land Certificate to Simmons. If it had not been known that this mineral was present in the cave, and the only way in which it could become known was thru mining operations, the mention of the saltpetre caves in the description of this property would have no significance.

The previously-mentioned Dr. Samuel Brown lived in Lexington; considered one of the leading authorities on saltpetre production, he gave encouragement to the development of this natural resource, as well as to the promotion of gunpowder factories. He reported, in 1806, that he had visited a number of saltpetre caves in Kentucky, and had been told of "many others in various parts of the state." Even tho he is silent on this point, it seems reasonable that he knew Mammoth Cave as a source of saltpetre.

Charles Wilkins, a member of a prominent family in Pittsburgh, migrated to Lexington sometime previous to 1806. There, in all probability, he met Dr. Brown and became interested in the procurement and sale of saltpetre. He and Brown might have become business partners, since both had a common interest in this much-needed mineral.

Even tho Charles Wilkins and Fleming Gatewood of Warren County, Kentucky, on July 9, 1812, purchased 156 acres of the original 200 acre survey of the Mammoth Cave property from the McLean brothers for \$3000 cash, this was not Wilkins' first involvement with the procurement and sale of saltpetre. Among the earliest known documentary evidence that Charles Wilkins was a saltpetre dealer for a considerable period of time previous to his purchase of Mammoth Cave is a letter, dated November 1, 1808, from Archibald McCall, a saltpetre dealer in Philadelphia,^a to the du Pont Company in Wilmington, Delaware, in which it is stated, "I have received a letter from Kentucky announcing the purchase of all the Salt Peter then in the market—3 to 4000 (lbs) . . . Mr. Wilkins has engaged all that should be received during the month of October, at the same price (16 2/3 cts. per lb.), but says the quantity to be procured cannot be calculated with any degree of certainty."³ Also in this same letter and

presumably based on information received from Kentucky, McCall also states: "The Salt Peter is made in the interior & brought down in small quantities, which makes it very troublesome for one person to get a large quantity."

McCall again wrote on November 14, 1808,⁴ "I have heard again from Mr. Wilkins in Kentucky, he has made further purchases of Salt Peter, & has drawn another bill on me at 60 days for \$850 which I have accepted. He had determined to close his purchases on the 10th of this month, at which time he did not expect to be able to collect more than 10,000 lbs., perhaps not so much. He was fearful of going beyond that time, lest the ice might prevent the Salt Peter from being sent on (to Pittsburgh). When he receives my letter directing him to collect all he could during the winter, he will of course resume his purchases. The navigation *down* the Ohio & Mississippi will continue open to New Orleans, long after it is closed in the direction of Pittsburgh. Would it not be better to order the Salt Peter which may be collected during the winter to be shipped to New Orleans & insured?" McCall further states: "He (Mr. Wilkins) is very active & attentive & no doubt will procure all that is to be had. . . . He has written & circulated hand bills in every direction to encourage the making but the time is short to get a great deal on this fall."

Wilkins evidently was far from idle during the winter months, probably as a result of a suggestion that he might ship via New Orleans. On May 31, 1809, du Pont wrote: "The person (Charles Wilkins) in Lexington who was hired to buy saltpetre for us has supplied us with as much of it in the last fifteen days as in the month of October last."⁵

The Embargo Act of 1807, which sometimes was called the Non-Intercourse Act, even tho it was designed to prohibit all trade between America and foreign ports and became abandoned in 1809, was only partly effective in the accomplishment of the original intent. However, it did add to the difficulties involved in the procurement of saltpetre since it stopped virtually all imports of this commodity from European ports and did cause a considerable increase in its cost. It also made the gunpowder manufacturers more conscious of the potential sources of saltpetre in Kentucky. That these manufacturers, along the Eastern Seaboard, were aware of these situations is illustrated in a letter, dated April 17, 1808, which du Pont wrote to Anthony J. Cazenova, a saltpetre dealer in Alexandria, Virginia, in which is stated: "It appears very certain by the last news from Europe that the orders from France will permit this country to maintain its embargo; consequently more saltpetre neither from India or England. If you could then procure for us saltpetre from Virginia and from Kentucky, the quality of which

you will guarantee, we would take whatever quantity could be furnished us."⁶ In another letter dated August 31, 1809,⁷ which du Pont wrote saltpetre-dealer Archibald McCall in Philadelphia, is found: "We beg you to write M. Wilkins and order him the purchase of fifteen thousand weight of saltpetre. . . ." Then again on November 17, 1809,⁸ du Pont wrote McCall and stated: "We are of the opinion that it would be advantageous to give a new order for 30,000 weight of saltpetre, requesting him [Wilkins] to ship by New Orleans."

The du Pont factory, which started to manufacture gunpowder in 1804, was only one of a number of such establishments along the Eastern Seaboard.

There always have been, during every war, unscrupulous persons who, tempted by the promise of easy money, sought to profiteer in the sales of materials for which there was an expanded demand and a general increase in prices. To conceal rocks in barrels of sugar and to substitute paper for leather in shoes were not uncommon practices. Even tho all reports indicate that Wilkins furnished a good quality of saltpetre which had low contents of sea-salt, organic matter, and other impurities, he was occasionally a victim of unscrupulous practices. This probably was due to the fact that it was physically impossible for him to inspect every shipment and that he placed too much trust and confidence in some of his saltpetre field-purchasers. In his August 31, 1809, letter,⁷ du Pont said: "We wish that he [Wilkins] should be more particular in the inspection as there was a great quantity of white gravel in some of the barrels particularly in the best of the crude saltpetre." The removal of the gravel during the refinement operation was no great problem. The useless labor involved and the added cost of transportation of such worthless material were undesirable and unnecessary expenses. Thus it only seems reasonable that the purchaser would be aggravated by the presence of such impurities.

None of the records or reports inspected definitely establish that Charles Wilkins had any direct connection with the production of saltpetre at Mammoth Cave before July 9, 1812, at which time he became part owner of the cave. It appears that even before 1808 Wilkins, who had lived in Lexington since about 1806, was a well known saltpetre merchant and in all probability the largest supplier of this commodity from the Kentucky area. It is known that he bought saltpetre which had been collected at widely separated locations within the state. Therefore, it is reasonable to assume he was well aware of the fact that Mammoth Cave was an important source of saltpetre.

Apparently Wilkins was not interested in the cave beyond the saltpetre deposits locations. He stated in a letter dated October 2, 1817, "I have explored so little of it [Mammoth Cave] myself, that I am un-

able to give a general description of it with accuracy."⁹ Wilkins, who was an astute businessman, no doubt made, with the assistance of trusted personal representatives, a thorough and expert investigation of the saltpetre deposits in the cave, the potential production possibilities, and the mechanical and engineering problems in the promotion and development of the project before he invested any money in the deal. While no evidence has been discovered to support the idea, it seems reasonable to assume that Dr. Samuel Brown was a consultant in this survey. Marginal notes on the Eye-Draught map of the cave give information relative the extent and richness of the cave earth deposits.

Hyman Gratz, a wealthy man whose home was in Philadelphia, on August 25, 1812, purchased Fleming Gatewood's half-interest in the cave for \$10,000 cash. The ownership of the 156-acre tract was now in the hands of Wilkins and Gratz. The new partners apparently did not consider the leaching and other processing equipment in use adequate for the planned increased output. Therefore, production was halted shortly after the date of purchase. This situation is reported by Archibald McCall, in a letter to du Pont dated November 30, 1812, in which McCall quotes from a letter he had recently received from Wilkins, "I received an answer to my letter to Mr. Charles Wilkins of Lexington, in which he mentions, that having been obliged to repair the works he had made very little Salt Peter this season."¹⁰ In light of the extensive remains of leaching equipment still in the cave, a reasonable assumption from this report is that the works were not only repaired but enlarged and expanded as well.

Ebenezer Miriam, who was at the cave during part of the time when it was in production, states, "The cave was extensively worked for Saltpetre from 1810 to 1814." Since these dates cover two years before Wilkins and Gratz became partners in the ownership of the property it is even more conclusive that these men had definite and accurate information relative the value of the cave as a source of saltpetre.

Miriam continues his description of the mining operation as follows, "The Saltpetre hoppers are placed at a distance from the mouth of the cave. . . . The Saltpetre hoppers are constructed in the same manner as ash leaches are made, and the earth is lixiviated with water precisely in the same way that ashes are leached to make pot and pearl ash. . . . The dirt yields from 3 to 5 lbs. of nitrate of lime to the bushel, requiring a large proportion of fixed alkali to produce the required crystallization, and when left in the cave becomes reimpregnated in three years. . . . Oxen were used in the cave for transporting the earth to the Hoppers for lixiviation."

Miriam also reports that while he was at the cave, "At that time I furnished the carbonated alkalies (pot and pearl ash or fixed alkalies)

with which the Saltpetre fluids were crystallized. . . . An idea may be formed of the great extent of the manufacture of Saltpetre at this cave, from the fact that the contract for this supply of fixed alkali alone for this cave, for the year 1814, was twenty thousand dollars."

It is difficult, if not almost impossible, in view of the meager reports available, to determine exactly how much alkali this \$20,000 provided. The 1810 Census Reports show that the cost of "pot and pearl ashes" in the Northeastern states was approximately \$15 to \$16 per hundred-weight. With an allowance of 20 to 25 per cent increase in the market price of this chemical, between 1810 and 1814, a conservative estimate would be \$20 per hundred-weight. At this rate Miriam would have furnished approximately 100,000 pounds of alkali. Since each 175 pounds of alkali will convert about 200 pounds of calcium nitrate (cave saltpetre) to potash nitrate (gunpowder saltpetre) this would indicate a production of about 115,000 pounds of commercial saltpetre during the year 1814. Thus it appears that the production from Mammoth Cave alone, during the year of 1814, was nearly five times as much as the total produced in Warren County and reported in the 1810 Census.

Miriam is silent, in the report of his activities in Kentucky, relative the source from whence he obtained the alkali supplied for the saltpetre recovery operations at Mammoth Cave. Since leached wood-ashes was practically the only source of fixed alkali it appears safe to conclude that substantially all of it was obtained in this manner. As ashes could be transported with much less labor than logs the wood was generally burned close to where the trees had been felled. In addition to the wood cutters and burners it was necessary to have ash haulers. These men would collect the ashes and haul them to the ash leaching vats, sometimes several miles away. Even tho nothing is known to support the idea, no doubt the wood-ashes were leached reasonably close to the boiling kettles. Thus the pot-ash leach water would be readily accessible for use in the conversion operation.

Since Miriam had a crew of wood-cutters as well as teams and wagons, he may well have provided the wood burned in the boiling furnaces. Whether or not he collected and leached the ashes from the boiling furnaces is not known. The fire-tenders may have leached these ashes for the alkali they contained. If so, the actual supply of fixed alkali would have been greater than the amount Miriam supplied. Thus the production of saltpetre would have been greater than the estimated 115,000 pounds for 1814.

Due to the fact that large quantities of wood were needed to construct the leaching and other equipment, to provide fuel for the boiling furnaces, and to furnish the fixed alkali, trees were cut

from many acres of land. Miriam and Blane both report that the timber in the Kentucky Barrens was small and stunted. No doubt, Miriam found it necessary to go many miles to procure a sufficiency of timber to meet the demands of the "great extent" of the Mammoth Cave operation. Such practices have denuded the hills and mountains of substantially all timber in the vicinity of every saltpetre cave which the author has visited and studied.

According to local historical accounts the original forest trees—largely sugar maple, hickory, walnut, and different varieties of oak—were cut over almost the entire length of Jack Mountain in Virginia and West Virginia (which sheltered or was close to seven saltpetre caves), the eastern slopes of the Alleghenies, and the valley of the North Holston River as well as along Patterson Creek in West Virginia, for use in the production of saltpetre.

It is rather a sad commentary that apparently substantially nothing has been done in any of the cut-over areas to reforest the denuded land. This has been true not only in this country but in Southern France as well. Interestingly, there has been one historical exception to this situation. On August 29, 1779, Don Martin de Mayorga was made the 46th Viceroy of Mexico and continued as such until April 29, 1783. The production of saltpetre and the manufacture of gunpowder were natural concerns of the government. During his administration Martin issued a number of edicts which governed the practices and procedures of the saltpetre collectors and refiners. On September 11, 1782, he issued an order in which the procurement of wood was controlled. In essence, this order prohibited the cutting of any fruit or ornamental trees and directed that for each tree cut four must be planted. This type of conservation makes good sense. Imagine what the tree stand would be today had all authorities enforced such a practice.

Miriam's remarks relative the labor used in the cave in the collection and leaching operations provide some interesting sidelights on the personnel involved and the working conditions when he states: "The workmen employed in the cave were blacks, and were sometimes to the number of 70. They worked by artificial light from iron lamps, in which lard [probably lard-oil] was burned. The stranger-visitor, on passing up the cave and coming in sight of this sable group with their burning lamps, displaying their white shining ivory teeth and gleaming eyes, would feel a sensation that the reader can as easily imagine as I can describe. During the whole time this cave was wrought in for saltpetre there was no case of sickness among the numerous workmen. They all enjoyed excellent and uninterrupted health, and preferred this employment to that of labor outside."

There is no question that, due to the size of the passageways, the gentleness in the slope of the cave floor, and the absence of great heaps of breakdown on the floor in the vicinity of the petre-dirt deposits, Mammoth Cave was a much more pleasant place to work than many other saltpetre caves in which the passages were too small and too tortuous to permit the use of draft animals and carts.

Apparently no person took the trouble to leave or preserve much information, in the form of authentic records, relative the extent and kinds of equipment used in the processing operations beyond the leaching step. The present writer has made a careful inspection of the grounds above and around the cave entrance. However, there have been so many changes made in the area that nothing at all remains of a once great activity which was of prime importance in the history of our country. Consequently, it is necessary to base any conclusions, relative the above-ground activities, solely upon a few scattered fragments of meager information. However, these scraps when taken together support the fact that, as Miriam stated, the operation was of "great extent."

Here Miriam again enters the picture with a quotation, which he holds to be "very accurate," from an article published in Vol. 2, No. 15, p. 2, dated September 30, 1834, of the *Lexington Kentucky Intelligencer*, which reads, "A narrow winding foot-path conducted us to the mouth of the Cave, near which are the ruins of several furnaces, constructed many years since, and employed in the manufacture of Saltpetre, and about fifty iron kettles, used for the same purpose." Further confirmation of the location of the boiling furnaces is found in a statement in an article by Robert M. Bird, published in the May 1837 issue of the *American Monthly*, of the presence of " . . . two tottering chimneys of stone, behind the cottonwood tree on the right, the ruins of [the] old saltpetre works." These chimneys are clearly shown in the picture labeled "Entrance to Mammoth Cave" and printed in the January 1967 issue of *The Filson Club Quarterly*. A single sentence, in a description of the path from the hotel to the cave, published in Ballou's *Pictorial Drawing Room Companion*, dated May 19, 1855, states that: "There rise heaps of ashes on the right." These statements all confirm the fact that an extensive installation of boiling furnaces was located along the path which led to the cave.

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NOTES

a. During the first years of the 1800's the number of saltpetre dealers in the United States is quite amazing. While the following list of such merchants is not complete, it does indicate that the distribution of such was wide spread, for the conditions which existed in a young, growing, and developing frontier nation. They did not deal exclusively in cave saltpetre. Probably, except during the years of the War of 1812, they all handled saltpetre from India which was imported from England and France.

1. Archibald McCall, Philadelphia, Penn.,
2. John Hancock, Boston, Mass.,
3. Anthony J. Cazenova, Alexandria, Va.,
4. William Lorman, Baltimore, Md.,
5. Charles Wilkins, Lexington, Ky.

In addition there were such dealers in New York, New Orleans, Pittsburgh, Richmond, Va. and several other cities.

Part VI
AFTER 1815

It is virtually impossible to make even an approximate estimate of the amount of saltpetre recovered from Mammoth Cave. Information relative such production is not only sketchy, and incomplete, but widely scattered as well. One report gives upward of 400,000 pounds as the annual Kentucky production during the war years. Since there were many sources of this material, within the state, this figure does not give any information of the production at Mammoth Cave. Another report gives the production of saltpetre in Warren County for the March to September 1812 period as 22,850 pounds. While Mammoth Cave in this period of its history was within Warren County this figure does not show the cave-by-cave production. Another report states that a contract for the purchase of \$20,000 worth of saltpetre from Mammoth Cave was made for the year of 1812. Since the 1812 price on saltpetre ranged for 55¢ to 83¢ per pound this figure represents less than 10,000 pounds. These are typical of such reports. Thus it becomes evident why any estimate would be merely a guess. Whatever the production was, reports appear to indicate that, during the period of the Embargo and the War of 1812 years, the saltpetre which came from the caves of Kentucky, Tennessee, Virginia, and Missouri had a very stabilizing effect on the market prices of this commodity. In fact, the production was so great and from so many caves that some of the gunpowder manufacturers were beginning to become apprehensive that the supply would be exhausted before the war demands could be met. When the war actually did end there was an almost audible sigh of relief that the crisis was past.

Even tho the treaty, which ended the war between Great Britain and the United States, was signed at Ghent on December 24, 1814, due to the slowness of communications word of this action did not reach this country until February 1815. In the meantime, active fighting continued and the Battle of New Orleans was fought on January 8, 1815.

There is no way to know how long, after the news of the official signing of the treaty reached Washington, it took for this information to reach Mammoth Cave. In all probability, when the news reached them, the surface workmen quit their various jobs and the miners rushed out of the cave. The termination of the war, of course, ended the urgent need for gunpowder which in turn caused the market demand for saltpetre to virtually disappear. The loss of this eastern market for saltpetre, no doubt, prompted Wilkins and Gratz to close their mining operations at Mammoth Cave, exactly when is not

known. However, it appears reasonable that this recovery operation was closed during the early spring of 1815. No further saltpetre mining activities have ever been conducted at Mammoth Cave, at least on a commercial scale. There is no evidence that, during either the Mexican or Civil wars, any saltpetre was mined at this cave.

After the close of the War of 1812 world travel became increasingly popular. It sometimes appears that nearly everyone who could find an excuse to visit America made the journey, and it became almost an obsession to visit Mammoth Cave. Evidently these travelers considered themselves duty-bound to write a travelogue report of the cave and the general area for the benefit of those who had to stay home. None of them related any new or significant facts about the mining equipment or activities, over that of earlier authentic reports. In fact, they only casually mentioned what they had been told about a once great industrial project and which at the same time contributed much to the preservation of our country. From these writings, it appears that the mining equipment left in the cave was regarded, not only by the visitors but the guides as well, as more of a nuisance or inconvenience, and a source of amusement and merriment, rather than an example of technical development of historical significance.

One of the best descriptive articles on Mammoth Cave was written by Robert M. Bird, and published in 1837. While Bird wrote in a very flowery descriptive style and was somewhat redundant, he presented undisputable facts. His article is one of the best and most sympathetic and understanding reports ever published. With regard to the above rather reprehensible attitude he makes the following interesting comments: "In the Grand Gallery are the ruins of the old nitre-works—leaching-vats, pump frames, and lines of wooden pipes. Of the last there are two different ranges, one of which was formerly used for bringing fresh water from the dripping-spring to the vats; the other for forcing it, when saturated with the salt, back to the furnaces at the mouth of the cave. These pipes, now mouldering with dry-rot, serve at present no other purpose than to amuse visitors; they are acoustical telegraphs, through which the visitor who has penetrated so far, can transmit to his more timid friend at the entrance an assurance that as yet he is in safety. A whisper bears the intelligence: even a sigh, breathed into the tube, falls distinctly on the ear a half a mile off as if the friend who breathed it were reclining at the listener's elbow."

There were other groups of visitors who, in considerable numbers after the close of the war, invaded the "strygian darkness" of the cave. Ever since the first discovery, in the early 1880's, of a desiccated mummy (this mummy rode to Lexington reposing on a wagon load of

saltpetre) archeologists, ethnologists, explorers, and just plain curiosity and thrill seekers were cave visitors. Some of these worked diligently to collect information about the early aborigines who had entered the cave many years ahead of the white man. Others entered only to plunder and destroy and to take anything they found which they thought might be of use or value to them. Others were primarily interested in exploration, to learn the extent of the cave and to see what was beyond the next turn, in a passageway. A few of these persons have left records of significant importance. However, there is one common factor absent in all the writings and reports of the time: there is no mention of any active saltpetre mining.

Even a brief and superficial review of national and domestic conditions in the United States indicates that there was considerable unrest in the country. Shortly after the War of 1812, a great influx of foreign visitors, migration of residents, Indian fighting, buffalo hunting, gold rushes, state's rights questions, troubles with raiding bandits, arguments over free or slave states, President Jackson's threat of armed action against South Carolina over a Tariff question, the Missouri Compromise, and the acquisition of property from Spain were among the activities and problems which involved the people of this country.

These conditions pose some rather provocative questions. Why was it considered necessary or desirable to have, in 1835, as complete and accurate a record of the extent of Mammoth Cave as the Lee map provided? Was the three- to four-month survey and the preparation of this map inspired by an investigation of the amounts and extent of the saltpetre deposits and the possibility of reactivating the mining operation? Who ordered the survey? Who paid for it? Or, were there other reasons? Anything which might be said to explain the decision to have this instrument survey made would be largely conjectural. However, it might be of passing interest to speculate on some possible reasons, since there were several factors which, even tho largely hypothetical, may have contributed to this decision.

After Wilkins' death his executors sold, on June 28, 1828, the estate's one-half interest to Hyman Gratz for \$200 cash. There is a strong possibility that Benjamin Gratz, brother of Hyman, an attorney who lived in the Lexington area, promoted the purchase. It seems reasonable to assume that there was more than an imaginary possibility that the gunpowder manufacturers, in the midst of the developing unrest with Mexico particularly if Great Britain should side with Mexico, wished to have accurate information of potential sources of saltpetre. They could have, with Gratz's cooperation, provided the money to employ Lee to make an extensive survey and prepare a detailed map. While neither the map nor Lee's notes provide any significant, addi-

tional, or new information relative the location or extent of the saltpetre beds or deposits, there is no way to know whether or not a private report on these points was submitted to the gunpowder manufacturers or Gratz.

Harold Meloy, an attorney in Shelbyville, Indiana, and a top authority on the general history of Mammoth Cave, in personal correspondence offered the following alternate reasons for such a survey: " (1) To possibly develop it as a tourist attraction; and (2) To enhance its apparent present or future value in the event he found an interested purchaser, or in event he wanted to use it as security for a loan. There is a considerable amount of evidence to support either view."

By the time of the Mexican War, 1846-1848, commerce between the United States and the rest of the world was in a rather healthy condition. Since Great Britain did not side with Mexico, the gunpowder manufacturers were able to import ample supplies of India saltpetre from Europe and it was not necessary to tap domestic sources. So the saltpetre recovery operation at Mammoth Cave was not reactivated.

It is not the intent or purpose of this study to review the many events which transpired in west-central Kentucky during the early years of the Civil War. However, there are a few general observations about certain events which may serve as hints in the possible explanation of why the saltpetre mining activity was not reactivated at Mammoth Cave during this period.

Since Kentucky was one of the key border states between the North and the South it was subject to invasion by military troops of both sides. A small group of secessionists in south-west Kentucky organized a government, joined the Confederacy, and established a seat of government at Bowling Green. However, this was a short-lived movement and any direct affiliation with the South soon disappeared. General Kirby Smith is reported to have said, "The Kentuckians are slow and backward in rallying to our standard. Their hearts are evidently with us but their blue grass and fat cattle are against us." In any event Kentucky ceased to try to officially maintain a neutral position and in September 1862 is reported to have reluctantly joined the Federals.

The reactivation of the saltpetre recovery operation at Mammoth Cave by the Confederates would have been quickly spotted by the Federals and raids mounted against the installation. There is no known instance that the Federals, at any time, attempted to operate any cave saltpetre recovery operation, even those captured from the Confederates. All this in spite of the fact that on a number of occasions, the North had substantially as great a problem in the procurement of saltpetre

as did the South. The North seemed to evidence only destructive action toward such installations rather than a recognition and utilization of a valuable source of raw material. In addition, the Confederates had been able to develop many other saltpetre caves in other parts of the mountainous regions. Consequently, they were not particularly interested in Mammoth Cave since they knew the dangers which enemy raids would bring.

Meloy offers the following thoughts on this point. "The Mammoth Cave leasee at the time, E. K. Owsley, was a Unionist. He had his money and time tied-up in a five-year lease, and he had made expenditures for furniture, wine, etc., at the hotel. Had he permitted the North to mine Mammoth Cave, there were too many Southern troops too close for comfort and he would have been ruined. John Croghan, the owner of the Cave, died in 1849, and left the property in trust for his heirs, the last one of which died in 1926. During the Civil War period, Senator Joseph R. Underwood, of Bowling Green was the trustee of the property. Underwood would not have had the authority to permit mining because the will did not give the trustee such authority; and because the premises were already leased to Owsley, pursuant to the authority of the testamentary trust."

Thus it becomes apparent that there were good and acceptable reasons why the saltpetre mining operation was not reactivated at Mammoth Cave during the Civil War. It was logistically impractical and unnecessary, as well as legally impossible.

Part VII

THE BORRESEN REPORTS

The story of saltpetre mining in Mammoth Cave would not be complete without a rather comprehensive review of the findings, suggestions, and recommendations which resulted from an intensive and extensive study of the mining artifacts as they existed in the cave during 1940-1941.

These findings have been presented in the form of two typescripts. One is entitled, *Report on the Remains of the Old Saltpetre Works, Within Mammoth Cave, Kentucky*, dated 1941. The second is entitled *Report on the Present Condition of the Leaching Vats, Saltpetre Works, Mammoth Cave National Park, Kentucky*, dated 1942. The studies were made by Associate Historical Technician Ralston B. Latimore (presently Superintendent of Fort Pulaski National Monument, Savannah Beach, Georgia, and Assistant Historical Technician Thor

Borresen (now deceased). While Borresen authored the reports he gave full credit to his associate Lattimore. These reports have been made available to the present writer through the courtesy of National Parks officials who have graciously granted permission to use material from them.

On November 11-13, 1940, Lattimore and Borresen visited Mammoth Cave, "... for the purpose of examining the remains of the Old Saltpetre works within the cave, and if possible, to suggest a method of preserving them and to prevent further deterioration." The following review of this first paper, which is interspersed with remarks by the present author, is presented to illustrate the scope of this investigation.

Borresen presented only a short review of the history of Mammoth Cave. This he based largely on a paper entitled "A Short Legal History of Mammoth Cave," presented by John B. Rodes, at a meeting of the Kentucky Bar Association, on April 9, 1929. He reports the famous Houchen's Wounded Bear story of the discovery of the cave in 1809, but treats the alleged event with considerable skepticism. He further suggests that the mining activities of Valentine Simmons, who is purported to have been the first owner of the cave in 1795, should be further investigated. However to date no new information relative to Simmons has been discovered.

As an explanation of how saltpetre gets into a cave Borresen gives the following: "Caves are favorite places for azotized earth, not only because of its contents of animal droppings, from birds and bats, but because the limestone contained decomposed animal matters." This statement appears to have been taken from some badly misinformed writer and indicates only superficial ideas which do not find persuasive support in theory, analyses of cave earths, or in the practice which has been followed for hundreds of years by the saltpetre miners, to return the earth to the cave where it would become revitalized in a few years.

Borresen draws upon and quotes from a book entitled *The Private Soldier Under Washington*, written by Charles Knowles Bolton, for a description of the process of making saltpetre. Bolton in essence states "... take the earth from under old barns, houses, etc., put it lightly into a hogshead barrel and fill it with water, which immediately forms a lye. This lye is then put into an ashes leach which has all the goodness extracted before, this being only a strainer. After it runs through the ashes, boil the lye so clarified to a certain consistency and then put it to cool, when the saltpetre forms."

Since this is substantially all that Bolton offers on the processes of procurement of saltpetre it is clearly evident that he has omitted the step necessary to convert the cave saltpetre to gunpowder saltpetre.

All the "goodness" had been "extracted before" so there is no potash to convert the chemical change necessary to provide the proper kind of saltpetre.

Borresen states, "... we find that there is no difference in the principles of extracting the nitre from the earth here than in the method, explained in the Bolton volume, used during the Revolutionary War, except of course here it was done on a much larger scale." The weakness in this statement will be obvious to one who has read the description of the process of recovery of saltpetre from petre-dirt, as outlined in a previous portion of this study. This statement clearly fails to consider the necessity and use of the conversion step. Since this investigation was to study remains and not the processes utilized, the fact that some incompletenesses have been introduced in any such explanation is of no particular importance.

However, Borresen is at his best in his description of the physical condition of the equipment which remains in the cave. He also offers a number of excellent suggestions for its preservation. He states, "Much of the original works are missing, some by natural decay and deterioration, but there is much which has been lost due to carelessness and abuse."

This carelessness and abuse on the part of many visitors leaves a condition which has been observed by every speleologist who has visited a saltpetre cave. It sometimes seems that the ubiquitous vandal is always there ahead of the person who wishes to make a serious study of such artifacts of historic value. An attitude of indifference and lack of appreciation of values on the part of many owners of caves which shelter historic artifacts of many kinds, lack of respect for personal property rights, faulty education, and incomplete understanding, all seem to contribute to foster carelessness and abuse on the part of many visitors to such caves. Borresen comments, "However, there still remains sufficient material which will permit us to tell an interesting story of the early methods of manufacturing nitre and saltpetre. No time should be lost for setting up a project for its protection. Much of the wood is in a good state of preservation. Yet there is much which needs immediate attention, if we are to arrest the inroads of decay which have already commenced."

The conservation characteristic of the men who made this investigation is evidenced in the following: "The first step should be to instruct the guides to prevent the visiting public walking over the old timbers or any other parts of the present remains. This habit was particularly apparent in the entry into the cave, where some of the old pipes lie partly buried in the clay of the cave bottom, also behind the filtering vats in the inner cave. Many of the wooden pipes have

been thrown aside so as to permit school children, clubs, and societies to construct cairns or other monuments along the footpaths in the cave. We were informed that the custom of building these monuments had been discouraged but that it had not been altogether suppressed. This should be effectively prohibited." The apparent policy of the management of the cave seems to have been to adopt this suggestion and so instruct the guides.

Borresen expresses the opinion that: "I do not think any large scale restoration should take place. There should be no attempt to restore the entire works, yet some restoration will be necessary, because there are many wooden pipes that have been thrown to one side and these pipes should be put back in their original location. There are also other small items which could and should be replaced, parts of which still remain in the cave. It is surprising how well preserved many of the timbers appear to be. However, their condition runs from one extreme to the other, with the largest share in excellent condition. There are some whose exterior appears to be sound, but under closer examination prove to be completely decayed due to dry rot."

Borresen makes an almost impassioned plea for the protection, preservation, and restoration of the badly deteriorated and vandalized saltpetre works in the cave. He states, "Few of the people visiting the Mammoth Cave have realized the real part played by the cave and the old saltpetre works in national defense in the early part of our country's struggle for existence. Nitre played an important part in the daily operations of our Army and Navy. Without it the armed forces could only have carried out a warfare similar to our native Indians with a bow and arrow, plus sabers, axes, knives, and pikes. Fire arms, such as muskets, cannon, or any other weapon requiring powder would have been useless."

Borresen continues, "We are preserving many of our national battlefields, yet very few of the original sites where sources of material were secured which made possible the battles, have been preserved. They have been destroyed or lost, except through contemporary accounts, or other documented sources. Perhaps without these sources, or the knowledge of developing them, there might have been no United States of America."

The investigators offer the suggestion that one of the regular cave trips " . . . be converted into a historic tour by changing the present guide system, and having some guides qualified in historical interpretation. The history is there and is quite obvious. A brief but accurate history of the part nitre played in national defense, the method of extraction, the crude and hard labor necessary in order to supply the nation with these small minute crystals of salt would be interesting.

If one compares it with our modern almost effortless scientific method for producing the salt [saltpetre] crystals today, it will be found that there is no comparison, because the difference is too great to be realized. Only those who may visit the cave and may see those huge piles of rock can realize the immense amount of labor required to produce the raw material only. Every one of the stones had to be handled individually by hand; the tons of earth, brushed and scraped off each stone, had to then be collected and carried or carted to the vats. Later, after the leaching process, the earth had to be carried and dumped along the narrow passages of the cave. The evidence of this vast expenditure of labor must be seen in order to understand. Here, nationalism, commercialism, profit, and human misery worked hand in hand."

These quoted statements are so true, so pertinent, and so clearly in line with ideas expressed by the present writer that no further argument to support the conservation and preservation of valuable, in fact priceless, historical sites and equipment, is considered necessary at this time.

About a year after the first general report was filed on the investigation of the saltpetre works which remained in Mammoth Cave the results of a more detailed study were presented. As was stated in this second report: "The purpose of this examination was to expose sections of the old saltpetre vats covered with earth so that a thorough study could be made of the vats and other remnants relating to them and the saltpetre works in general. From this study plans and drawings have been prepared, together with suggestions for their preservation and stabilization."

In further discussion of the condition of the remaining equipment Borresen reports, "When the works were discontinued no effort was made to remove the earth from the vats. . . . All but one vat are about $3/4$ full of nitrous earth. The one vat which has been emptied is in bad state of repair. The only timber visible in these vats which still contain earth is the outside of the siding and rails and the ends of the bottoms which protrude beyond the sides, where the lye drained into wooden troughs. Several of the wooden pipes leading out to the entrance of the cave are half buried in the earth of the cave floor. The question here arises how much of this can be disturbed, and how much will respond to a preservative treatment. These questions can only be answered by an archeological excavation. I do know that two of the wooden troughs placed in front of the vats appear sound on the surface, but show deterioration on the side next to the earth; however, the condition is not so bad but that they will respond to treatment."

Continuing with Borresen's report, we read: "Of the saltpetre works still within the cave the leaching vats form by far the largest items. There are three leaching vats and one small drain tank in the Rotunda. In Booth's Amphitheatre there are 5 leaching vats in a fair condition and the remains of one vat and one drain tank."

Borresen makes the following interesting observations: "In the Rotunda each vat is about 11' 6" x 11' square and 3' 6" high. Each of the vats rests on a dry laid stone wall that varies from 1' 6" to 2' 6" high, depending on the ground elevation of the bottom of the cave. The vats were originally standing free, that is, they were exposed on all four sides. Later they were completely covered (on three sides) with earth discarded from the leaching vats to the very top of the vat combing, leaving only the front of each vat exposed. Just why this earth was piled around the vats until they were completely covered on three sides there is at present no way of telling. . . . The nearest that I can come to explaining it is based on evidence found during excavation. Each one of the vats contained about ten tons of earth. Fear that this weight might force the sides apart as the vats became older prompted them to pile the discarded earth around them. This would, of course, act as a reinforcement. The earth as removed from the vats, was very wet. Its consistency was very much like paste. Due to its softness and its weight it would squeeze into any crevice and around any projection so that when dry all the space between the vats and back of them would have a solid support similar to an adobe or cement wall. Today where any part of the vats have been destroyed accurate measurements of the exterior of the wall can still be gotten from the impression in the clay." This was not an uncommon practice at many saltpetre caves where the leaching vats were inside the cave. There are at least two other reasons for this practice; one, the piled dirt formed ramps which provided convenient access to the vats, and two, the workmen were prone to get the leached dirt out of their way with as little labor as possible.

Since the system by which water was supplied to the vats and the leach water returned to the surface has been discussed earlier in this paper, only Borresen's statements about the remains will be given. "Of the wooden pipes still remaining within the cave, there are about 57 sections. They vary in length from 26' to broken pieces 8 to 19 feet long. Some are in a very well preserved condition, and others are very much decayed with dry rot."

Borresen makes some statements which provide further light on the structure of these artifacts. "All timbers such as frames, sills, and coamings are of oak hewn out by hand. The poplar siding and flooring were ripped out by hand using the old whip or pit saw. On the

vats in the Rotunda the inside of the siding was hand dressed. In Booth's Amphitheatre the inside of the siding and the flooring was dressed. All siding on all vats was tongued and grooved. On the outside of all the vats the siding is rough and the marks of the old whip saw are amply indicated and easily identified. All the nailing studs measured from $3\frac{1}{2}$ " to $4\frac{1}{2}$ " in width, and from $4\frac{1}{2}$ " to $5\frac{1}{2}$ " in thickness. Some of the studs are hewn on all four sides. Others are partly hewn and partly sawed. The top whaling or coaming timber is a piece $3\frac{1}{2}$ " by $5\frac{1}{2}$ " of hewn oak. The bottom frame timbers, to which the floor joists were mortised and tenoned, were hewn out of one triangular piece. The inside triangular groove was cut deep and wide enough so that the firstboard of the siding as well as the bottom board would partly overlap within the groove or rabbet. The sill frame on which the vat rested was hewn on the top and two sides only. The bottom remained in the natural shape of the log. The stone walls on which the entire wooden construction rested was laid dry. There were three longitudinal walls and one front and back wall. [This was the supporting foundation structure.] In thickness they vary from 16 to 20 inches. The height depending on the bottom of the cave. [That portion of the cave floor on which the vats were located.] They [the heights] vary from 18" to 2' 6". The air chamber that was formed between the bottom of the vats and the stone fill on the bottom of the cave was for drying out the under sides of the vats. This same space was also used for placing of supports if the bottoms of the vats became weakened. There are several thus repaired or reinforced."

In regard to the pumping equipment Borresen states: "None of the pumping platforms remain intact. Hence, we do not know their original heights. The drain tank in Booth's Amphitheatre was from all indications destroyed by fire. However, along the trail or footpath behind the vats are a number of squared timbers about 6" x 7" and about 18' long, of hand hewn white oak. They contain many mortises, both at right angles and on the oblique, indicating the possibility that they are the original timbers of the scaffold. If so, they must have been removed before the fire as none of them show any evidence of being burned. Perhaps the high platform ruined the appearance of the large room and for this reason removed and made into a hand rail."

"Although very little remains of the drain tank, accurate measurements were easily obtained because the wet earth, previously piled around the vat, plus the few remaining parts of the wood which permitted us to get accurate dimensions of most of the lumber used. The drain tank in the Amphitheatre was much larger than the one in the Rotunda, indicating that if any delay occurred in the flow of water it

was held back and stored in the Amphitheatre. The tank itself was built identical with those used for leaching, except that it did not contain a false bottom or any drain outlets."

"The drain tank in the Rotunda . . . with the exception of the front board which is missing . . . is intact. . . . The timber lying on the ground, left of center, is the old wooden pump. With the exception of the handle and the pump rod the pump is in good condition." Fortunately this situation still prevails. "According to Mr. John Nelson, the pumping platform in the Rotunda was set on fire by one of the torches thrown by a guide. This happened about 1903. Mr. Nelson was one of men carrying water into the cave in order to put out the fire."

Samples of the wood were sent to the U. S. Department of Agriculture, Forest Products Laboratory, at Madison, Wisconsin, for study. While the laboratory report contains a certain amount of technical data, Borresen states: "They, however, could give us little information."

These reports indicate that Borresen and Lattimore made a very careful and painstaking, as well as sympathetic investigation of the saltpetre mining equipment left in Mammoth Cave. They offer some excellent suggestions on the methods and means which could be used to preserve, protect, and restore at least some of these priceless artifacts, which are illustrations of elements of national historical significance. No attempt was made to belittle or minimize the work and care, to say nothing of the expense involved, in such a project. However, very little appears to have been done to the present time to preserve and refurbish this lamentably small part of the equipment used in an activity which contributed so much to our American Heritage.

Conclusion

Questions such as the exact date upon which the production of saltpetre at Mammoth Cave was terminated, the total number of pounds produced, the amount of income received by the owners, the number of men employed, the amount of wages paid, and the men who provided transportation, haulage, and other services must go largely unanswered until someone is fortunate enough to locate some long forgotten records stored in an old trunk or box hidden in an attic which could be many miles from the scene of this important activity.

In spite of superstitions and folklore, indifference toward, aversion for, and even fear of caves there is no question but that the raw ma-

terials obtained from caves which include lead, iron ore, saltpetre, travertine, calcite, and some other minerals in minor quantities, have contributed a great deal toward the development of our country.

The "petre monkey" and the gunpowder maker have gone the way of the grist mill operator, the mint distiller, the home soap maker, the salt boiler, and other similar crafts. Likewise, the indigo vat, the pit or whip saw, the tread mill, and the horse-drawn sleigh have all disappeared from our daily life. However, it does seem fitting that pause be taken to pay a small tribute to those of our ancestors who were involved in the early industrial activities in the development of our country.

(The End)

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The writer has tried to tell a substantial portion of the role which saltpetre mining in Mammoth Cave played in the post-Colonial period in the history of the United States. A sincere attempt has been made to present as accurate and complete a history as possible in which primarily only original source material has been used. Secondary sources have been used very sparingly and then only after critical inspection and study indicated them to be of acceptable authenticity.

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