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GEOLOGY AND HISTORY OF CONFEDERATE SALTPETER CAVE OPERATIONS IN WESTERN VIRGINIA

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INTRODUCTION

During the American Civil War, Confederate military forces faced shortages of many critical materials, but gunpowder was rarely among them. Thanks to its abundance of saltpeter caves, the South built a first-rate niter and gunpowder industry almost from the ground up. Even at the end of the war, powder mills were still operating and a supply of gunpowder was on hand. This article, one in a series concerning geology and the Civil War in southwestern Virginia (Whisonant, 1996a; 1996b; 1997; 1998; 2000), looks at the geology of cave niter deposits, and the use of this invaluable strategic material to keep alive the dream of southern independence.

In the 1860s, the principal ingredient of black gunpowder was potassium nitrate, derived from niter or saltpeter as it was called (Figure 1). Each powder grain contained about 75 per cent niter, together with charcoal (15 percent) and sulfur (10 percent). When war began between North and South in April 1861, the Confederacy did not possess an adequate supply of gunpowder. Planned importation of powder could not meet all of the South's needs, as the Union blockade of Confederate ports quickly proved. Thus, the need for a strong, home-based gunpowder supply, and consequently a steady source of niter, became evident. Among the potential providers of niter were the numerous saltpeter caves in the limestone regions of the Southeast. Virginia has an abundance of such caverns in the carbonate rock masses west of the Blue Ridge (Figure 2), and these contributed substantially to the Old Dominion's unsurpassed role in the production of niter. Eventually, Virginia (along with parts of eastern West Virginia) provided more of this strategic resource than any other Confederate state (Schroeder-Lein, 1993a).

But niter was not Virginia's only important mineral contribution to the Confederacy (Boyle, 1936). Besides this most basic necessity for mid-nineteenth century warfare, the Old Dominion provided massive amounts of lead, salt, iron, and coal. Virginia was, in fact, the major mineral-producing state in the South both before and during the Civil War (Dietrich, 1970). Saltpeter manufacture differed significantly from the other principal mined materials in Virginia in that it was highly decentralized (a trait common to niter production throughout the

Figure 1. *The Last Confederate Gun at Gettysburg* (courtesy of the Library of Virginia). This typical smoky battle scene illustrates the importance of gunpowder, and thus the saltpeter from which it was derived, during the Civil War. Southern armies were generally well-supplied with gunpowder throughout the war.

Figure 2. Photograph of the entrance to a niter-producing cave in western Virginia. Caverns such as these produced massive amounts of saltpeter for Confederate military forces. Photograph courtesy of Karen M. Kastning and Ernst H. Kastning, Jr.

Confederacy). For example, the lead and salt came exclusively from Austinville and Saltville respectively, iron mostly from well-defined belts in the Valley and Ridge, and coal nearly entirely from the Richmond coal fields. Virginia's saltpeter caves are scattered over numerous western counties and, like many caverns, not easy to locate. Consequently, the niter cave operations were never the principal target of Union attacks, although several such facilities were threatened and even destroyed from time to time during Federal invasions.

GEOLOGY OF NITER DEPOSITS

The connection between caves and nitrate-rich deposits has been known and exploited for centuries. For most of this time, organic material (primarily bat guano) was assumed to be the source of cave nitrates (Hill, 1981). Hess (1900) challenged this belief and asserted that the saltpeter sediments of Mammoth Cave and other eastern caverns formed through the activities of nitrifying bacteria in surface soils above the caves. There, he suggested, waters percolating through the soils dissolved the nitrate and carried it underground to be reprecipitated where water dripped from cave roofs into floor sediments.

Although not entirely correct, Hess's basic idea of cave saltpeter originating through the interaction of nitrate-rich surface soils, groundwater, and nitrogen-fixing bacteria has drawn strong support (e.g., Hill, 1981, 1992; Hubbard and others, 1986; Hubbard, in review). Hill's (1981) work presents the most detailed model, and is based on a comparative study of southeastern saltpeter caves and western caverns rich in organic bat guano deposits. Her study showed clearly that, although bat guano can enrich cave earth in nitrate, it is not the only source and in the southeastern caves not even a major source. Hill's model begins with nitrifying bacteria in surface soils oxidizing organic nitrogen to nitrate (NO_3^-) which is then dissolved by percolating groundwater and carried downward to anaerobic soils and rock interstices where it is reduced to ammonium (NH_4^+). If caverns are present, the infiltrating waters move toward the caves due to a moisture-density gradient within the bedrock created by evaporation at the cave air-bedrock interface. Upon reaching the cave boundary, the ammonium in solution is oxidized to nitrate with the help of nitrifying bacteria. If porous cave sediment is in contact with the bedrock, seeping groundwater will be drawn to the surface of the sediment where evaporation and bacterial action cause nitrate concentration.

This theory explains a very interesting aspect of cave saltpeter deposits, namely the well-documented observation that nitrate content can be regenerated in very short time scales (within a few years or even much less). For example, saltpeter miners in 1812 evidently shoveled earth leached of nitrate onto the wall ledges of Dixon Cave in Kentucky for the express purpose of regeneration (Hill, 1981). During Civil War times, Craig (1862, cited in Hill, 1981) suggested that dirt be carried into caves so as to become continuously charged with nitrate. Hill's "seeping groundwater" model described an ongoing chemical process wherein saltpeter earth leached of nitrate could be placed back in the cave and new nitrate precipitated.

Hubbard (in review) noted that the question of "what is saltpeter" is confusing. Saltpeter is a synonym of niter, a nitrate mineral containing potassium (KNO_3). Potassium nitrate is the key ingredient of gunpowder, but is far from the only nitrate compound in the cave sediment commonly referred to as saltpeter. Part of the problem of studying the chemistry and mineralogy of saltpeter is that the nitrate minerals contained therein are notoriously deliquescent, meaning they absorb moisture from the air and dissolve. Hence, nitrate compounds such as magnesium nitrate and calcium nitrate may rarely crystallize into their naturally-occurring mineral forms (nitromagnesite and nitrocalcite, respectively) in the humidities found in Virginia and other southeastern caves.

Given the difficulties noted above, Hubbard and others (1986) attempted to shed some light on the mineralogy and chemistry of saltpeter earth in six Virginia caves. They found that the only actual nitrate mineral in these caves was niter, but it occurred in only a few samples. Leachates from the cave samples were rich in calcium and magnesium (as well as nitrate), leading them to conclude that the composition of cave saltpeter in the cases studied can be considered a mixture of nitro-magnesite and probably nitrocalcite with local concentrations of true niter. They also postulated that the nitrate compounds evaporated from cave leachates may occur seasonally in some Virginia caves because of summer-winter variations in cave humidities.

Recent work such as Hill's (1981) and Hubbard and others' (1986) helps to explain why most of the saltpeter caves in the United States are located in the southeast. Theories of origin that involve transportation of surface soil nitrate into caverns by slowly moving groundwater and biochemical precipitation by bacteria require certain conditions of organic content in surface soils, temperature, humidity, cave air circulation, and various aspects of ground- and cave water chemistry and movement. For instance, dripping or flowing water in cave passages is especially detrimental to the formation of saltpeter because such water will leach away the very soluble nitrates. Using these factors, Hill (1981, p. 115) summarized succinctly why American saltpeter caves are located primarily within the boundaries of the Confederate states: "the northward extent of saltpeter caves may be limited by lower temperatures or by the wetness of northern caves; their southward extent may be limited by higher temperatures and less highly organic soil types; their westward extent may be limited by drier climates and nitrogen-retentive soils."

In the 1860s, the southern war machine benefited immeasurably from the conditions of climate, vegetation, and geology that gave it the greatest concentration of saltpeter cave deposits in North America.

HISTORY AND TECHNOLOGY OF NITER PRODUCTION

Knowledge of saltpeter extends back to the earliest times of recorded history (Lewis, 1989). Sumerian writings from about 2200 or 2100 B.C. refer not only to saltpeter but also to black saltpeter, suggesting that refining of this material was already accomplished. Alchemists in Europe knew of saltpeter in the first century B.C.; Chinese workers mixed it with other ingredients to make fireworks in the seventh century C.E. and military explosives in the tenth century. Gunpowder (made from saltpeter, sulfur, and charcoal) appeared on European battlefields for the first time in the battle of Crécy in 1346. The first modern book on mining and metallurgy, *De re metallica*, in 1556 described the extraction and refining of saltpeter in great detail. Apparently, artificial niter beds had been developed by then also. As the gunpowder age continued to develop rapidly in Europe, niter became a crucial resource not only to supply the national armies but also to ensure the survival of colonists in the hostile new world.

As noted by Faust (1964, p. 32), almost from the time of arrival at Jamestown, Virginia settlers were concerned about a reliable source of saltpeter for gunpowder. In 1629-1630, the Virginia colonial government passed an act "for the better furtherance of and advancement of staple commodities, and more especially that of potashes and saltpeeter (sic)... (cited in Faust, 1964, p. 32). This early legislation contained specific directions for the production of saltpeter from wood ashes and plant and animal refuse. In 1745, the Virginia General Assembly passed an act for the encouragement of saltpeter making in which a bounty was offered on the precious material.

As war between England and her colonies loomed in 1775, the Continental Congress advised the Colonists to "collect the saltpeter and sulfur in their respective colonies...to be manufactured, as soon as possible, into gunpowder... (cited in Faust, 1964, p. 33). A national Committee on Saltpeter was formed, and Richard Henry Lee represented Virginia on this body. Production records from the Revolutionary War period are poor, but western Virginia caverns, which had been producing niter for several decades prior to the conflict, likely produced a considerable amount of this strategic material.

Following the surrender of Cornwallis, the demand for saltpeter did not abate; indeed, frontier fighting, hunting, government military uses, and the expanding use of black powder blasting in mining and construction drove the need upward (Faust, 1964). The War of 1812 only exacerbated this trend. During the early 1800s, caves in western Virginia (which then included present-day West Virginia) contributed substantially to the young nation's saltpeter supply. Faust (1964, p. 36) provides an interesting statistic in this regard. "The 1810 (3rd Federal Census) reported that 447,174 pounds of saltpeter valued at $80,434.00 – of which Virginia provided 59,175 pounds, valued at $16,243.88 – were produced during this report period. Virginia's share of this came from Bath, Botetourt, Lee, Montgomery, Pendleton, Russell, and Tazewell counties." Another feature of these times was the Old Virginia Saltpeter Route, a network of at least 12 caves in western Virginia. This route wound from Pendleton County, West Virginia, through Highland, Bath, and Alleghany Counties, Virginia, ending in Monroe County, West Virginia. At the same time, other niter caverns were active farther south, including Buchanan Cave in Smyth County. Here, saltpeter production can be traced back to about 1750, making it one of the oldest niter producers in North America. Thus, by the mid-1800s, the caves of western Virginia had established a long history of niter production and stood ready to supply the Confederacy with this crucial resource in the coming struggle.

The actual production of niter from cave earth was a relatively simple process that could be done on a small scale using fairly common implements (Faust, 1964; DePaepe, 1981; Powers, 1981). Workmen (sometimes called "peter monkeys") excavated the nitrate-bearing earth ("peter dirt") using various tools such as shovels, mattocks, wooden scraping paddles, hoe-like scrapers, and chisel-shaped bars, the latter needed to obtain material from ledges and cracks and to serve as pry bars. Faust (1964, p. 44) described excavations of 16-20 feet depth in one of Virginia's large saltpeter caves in Bath County. Miners constructed footpaths, stone steps, ladders, and sometimes tramways or bridges to transport peter dirt from the dig site to the leaching hoppers (DePaepe, 1981). In large operations, mules, donkeys, or oxen carried cave earth from excavations to the processing sites, which were commonly located in the caves. Cave illumination was very important, and light sources included iron lard-oil lamps, candles, and (most commonly) faggot and bark torches. Tally marks, essentially vertical scratches on the cave walls, were extremely common features in saltpeter caves; however, the purpose of the tally record is not clear (Figure 3). The marks may have been a record of the number of days worked or one man's production in bags of peter dirt (Faust, 1964).

Leaching the peter dirt to concentrate the nitrates was the major processing procedure. Cave earth was placed in vats or barrels containing fresh water (Figure 4). Commonly, three barrels were used, and water leached from the first barrel was poured into the second and then into the third (Powers, 1981). The nitrate-rich leach water was treated with potassium salts which had been produced usually by leaching wood ashes. This removed undesirable magnesium and calcium ions, replacing them with potassium. Next, the leachate was strained through cheesecloth and then boiled in open iron kettles. Evaporation of the water left behind crystals of potassium nitrate (niter), and the used water was recycled back to the first leaching vat. Using this technology, three men in Civil War times could produce 100 to 200 pounds of saltpeter in three days (Powers, 1981).

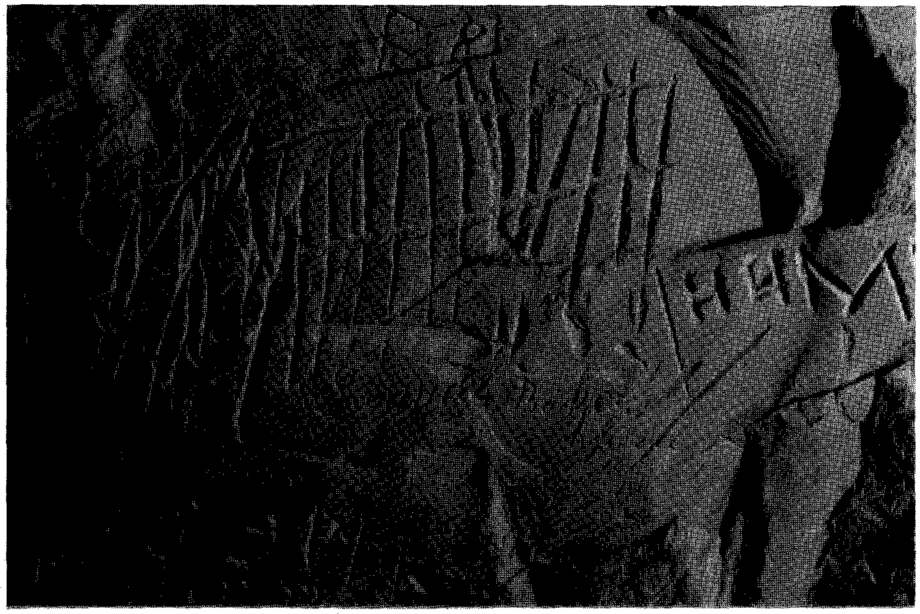

Figure 3. Tally marks are found in many of the caves worked for saltpeter in Virginia and elsewhere. These marks are from a cave in the Shenandoah Valley. Notice the name and date (Samuel Baker, 1862) inscribed on the cave wall. Photograph courtesy of Karen M. Kastning and Ernst H. Kastning, Jr.

The ultimate destination of the niter was the gunpowder mill. Here, the saltpeter was further refined by additional leaching, and the resulting solution boiled down. Sulfur and charcoal were added to the purified niter, at which point the mixture became highly explosive. At the Confederacy's largest powder works in Augusta, GA, powder was mixed in 60 pound batches according to this recipe: 45 pounds saltpeter, nine pounds charcoal, and six pounds sulfur (Melton, 1973). This mixture was dampened and pressed into solid cakes, which were then cooled and broken up into grains. Vibrating wire screens separated the grains into different sizes – smaller ones for rifles and smoothbores, larger ones for cannons.

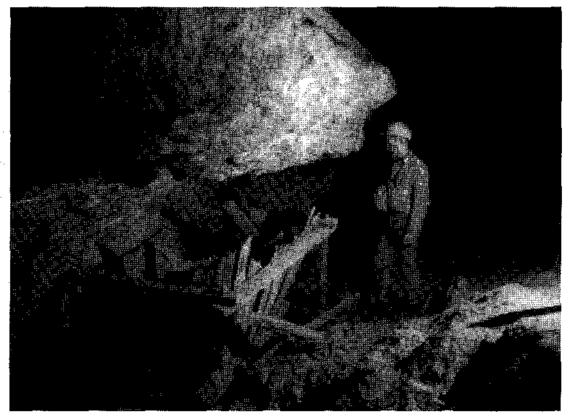

Figure 4. Photograph of remains of a typical leaching vat used to extract saltpeter from cave "peter dirt." In some instances, a series of such vats was used to progressively concentrate the leached saltpeter. Photograph courtesy of Ernst H. Kastning, Jr.

NITER AND THE CONFEDERATE WAR EFFORT

Despite the niter industry's early development in the southern states, the Confederacy did not possess an adequate supply of saltpeter at the outbreak of hostilities (Powers, 1981). The long years of antebellum peace and emphasis on agriculture at the expense of industrial development left the South with reduced niter operations and few gunpowder-making facilities. At the time of secession in 1861, the new nation possessed barely a month's supply of powder. For the rest of that year, importation provided most of the niter consumed by domestic powder mills.

In addition to importation, the South possessed three major sources of niter. First, as noted above, numerous saltpeter caverns had long supported gunpowder manufacture in the eastern part of the country. In the 1860s, the states of Virginia, Tennessee, Georgia, Alabama, and Arkansas became the most important cave niter producers for the Confederacy. Second, niter could be recovered from dirt under houses and outbuildings. Many private individuals entered into contracts with the government to provide niter from these sources. Third, niter could be produced in "nitriaries" or artificial niter beds. In these operations, heaps of various kinds of plant, animal, and human waste were set up, especially near large cities, and niter eventually extracted. According to Schroeder-Lein (1993a, p. 1147), at least 13 "nitriaries" were established in the eastern Confederacy, including some near Richmond. Most of these did not come on line with significant niter production prior to the war's end in 1865.

Realizing that imported niter sources could not be relied upon, the Confederate Congress acted in 1862 to ensure an adequate domestic niter supply (Schroeder-Lein, 1993a, 1993b). Legislation passed in April created a niter corps within the Ordnance Department. The main function of the corps personnel was to obtain niter to feed the South's rapidly growing gunpowder industry. A year later, the Congress made the niter corps an independent agency and renamed it the Niter and Mining Bureau. The new Bureau was given a larger staff and responsibility not only for acquiring niter, but also for procuring iron, copper, lead, coal, and zinc for use by the military. June 1864 legislation added more staff, including a maximum of six chemists and six professional assistants to aid in the scientific aspects of mineral collection. Among the employees of the Bureau were John and Joseph LeConte, and Nathaniel Pratt who produced geological maps as part of their work.

The Confederate government's operation of the niter and gunpowder industry was very successful, thanks in no small part to the selection of extremely able leaders. Chief of the Niter Corps was George W. Rains, a West Point graduate and experienced administrator, who moved quickly to exploit the South's abundant niter caves and other nitrate sources. Rains brought on line many of the South's powder mills, but his masterpiece was the giant Augusta Powder Works, a technologically advanced operation that produced high-quality gunpowder until war's end. Another important individual was Isaac M. St. John, a civil engineer chosen to head the Niter and Mining Bureau in 1863. Under men like St. John and Rains, Confederate niter (and gunpowder) produced expanded enormously during much of the war. The success of the Confederate munitions industry stands out in glaring contrast to the general inadequacy of the Confederate supply system (Powers, 1981).

Over the course of the conflict, the Confederacy was divided into 14 niter and mining districts, most of which were east of the Mississippi. Districts One, Two, Three, Four, and Four and a Half were in Virginia, and included the niter producing counties in present-day eastern West Virginia. Surviving records suggest that Confederate niter production to September 1864 was 1,735,531.75 pounds domestically and 1,720,072.00 by importation (Schroeder-Lein, 1993a). Of the domestic production, the five districts in Virginia accounted for 505,584.25 pounds (about 29 per cent), making the Commonwealth the leading niter producer among all Confederate states.

One very interesting aspect of the Confederate niter story is the connection between the geography of the saltpeter cave regions and the political temperament of the people who lived there (Schroeder-Lein, 1993a). Most of the niter caves occurred in the Paleozoic carbonate belts in mountainous areas. The high-relief topography of these regions had given rise to a small farm, non-slave holding economic system that contrasted sharply with the much larger plantation operations in the low-relief Piedmont and Coastal Plain provinces found in most of the South. Thus, the mountain folk tended to have very different political and social outlooks, rendering many of them only marginally loyal to the Confederacy, if not outright Unionists. This resulted in a notoriously unreliable workforce where absenteeism and desertion were common. Because many of the other major mineral industries were in the same mountainous areas, these problems plagued Confederate mining operations throughout the war.

CIVIL WAR CAVE NITER OPERATIONS IN WESTERN VIRGINIA

No one knows precisely how many western Virginia caves were active niter producers during the Civil War. Records were lost or poorly kept (if at all), especially by the scattered private contractors who sold directly to the government. Another major problem is that cave names have changed, or several local names have been used for the same site over the years. Approximately 100 Virginia caves have been worked for saltpeter at one time or another (Hubbard, oral commun., 2000), and a considerable portion of these must have been active in 1861-1865. Powers (1981, p. 25) stated that 25 caves in Virginia produced saltpeter during the war. Faust (1964, p. 47) quoted a July 1, 1863, Niter and Mining Bureau report concerning active operations in western Virginia as follows: "...one large cave in Tazewell, one in Giles, and six small caves in Wythe, Smythe (sic), Pulaski, and Montgomery. These caves are in good working condition and are beginning to yield..." Examples of specific Civil War saltpeter cave operations in Virginia are given in Faust (1964), Hauer (1968a, 1968b, 1968c, 1970a, 1970b, 1970c, 1971), Holsinger (1975), Powers (1981), Smith (1987), Hubbard (1996), and Hubbard (in review).

What were the day-to-day activities like at a wartime saltpeter cave in western Virginia? Much is known generally from the tools and other artifacts left behind by the peter monkeys, but detailed descriptions of the daily activities are not abundant. Of the latter, two excellent portraits are provided by Faust (1964) for Buchanan Saltpeter Cave in Smyth County and Smith (1987) for Horner's and Heaton's niter works in Bath County. The following material is taken largely from these works.

Buchanan Saltpeter Cave is located in the valley of the North Holston River in northern Smyth County. Geologically, the formation containing the cave is the Beekmantown, an Ordovician limestone and dolomite unit that occurs virtually throughout the entire Valley and Ridge province in western Virginia. These caverns are particularly interesting because they have an extraordinarily long history of saltpeter production that includes connections to another famous mineral resource in the region, the salt operations at Saltville.

In 1748, John Buchanan belonged to a party of men surveying property along the North Holston River for a real estate development company. This group included Charles Campbell, who recognized the value of the salt deposits in the region and settled the site that became Saltville. Buchanan surveyed and claimed large holdings in the nearby Rich Valley area, then established his home there and began farming.

A large cave existed on Buchanan's property, which he investigated and found to contain significant deposits of cave earth rich in saltpeter. Large boiling kettles were frequently used in the production of saltpeter to concentrate the solutions, and Campbell was using these very same kinds of kettles to make his salt. Thus, the two operations very likely cooperated. Faust (1964, p. 49) quotes nineteenth century writer J. Leander Bishop accordingly: "Salt was made by boiling at Campbell's Salines...and in 1795, several tons of saltpeter, collected from the nitrous caves in the county, (and processed at the salt works) were sent to the Atlantic market." Because Buchanan's cave was the only major source of cave peter dirt in the county, it is most probably the main source of the Saltville niter.

Buchanan Cave was one of the largest western Virginia cave saltpeter sources during the Civil War; it was part of the Niter and Mining Bureau's District 7, headquartered in Wytheville. John Buchanan and his two brothers were active in the wartime operations at the cave. John, also a professor at Emory College in Abingdon, was consultant and evidently the local representative to the Niter and Mining Bureau. The niter works at Buchanan Cave were never raided or captured by Union forces in the war years; however, work was suspended during the Battle of Saltville in 1864.

The niter operations at the cave were extensive and efficient. Faust (1964, p. 50) described a very clever "cascade system" of leaching vats arranged so that the leach water from one vat would drain into the next lower one. This had a number of advantages over single vat operations, including less water needed, improved leach-brine concentrations, and reduced amounts of fuel (and the labor to provide it) needed to evaporate the leach brine from the boiling kettles. No information is available concerning the amount of saltpeter produced at Buchanan Cave, but evidence indicates that it was a considerable quantity.

Smith's (1987) exhaustive research provides many details of daily activities at two wartime saltpeter cave operations in Bath County. Horner's and Heaton's niter works were located in Niter and Mining Bureau District 4 °, headquartered in Staunton. There were at least five government operations within the bounds of this district, four of which were in caves (including Horner's and Heaton's). Individual citizens were also contracted to produce niter, which many did from dirt beneath houses and outbuildings; a few probably mined cave earth also. Contractors in District 4 ° were paid $1.00 to $1.50 per pound for niter. Workers in the operations were exempted from military duty (this being about the only to keep them), but were subject to military discipline and could be used to repel Union incursions.

Horner's works were located at Douglas Cave, a name not currently used for any Bath County cave. Faust (1964, p. 45) and Hubbard (1996, p. 4) believed that the cave associated with Horner's works was Clark's Cave, but Smith (1987, p. 22) contended that Williams Cave, less than a mile from Clark's Cave, or perhaps a combination of the two, was the niter source. Clark's Cave is developed primarily in the Licking Creek Limestone, a Devonian carbonate common in this part of western Virginia (Hubbard, 1996).

According to Smith (1987, p. 17), 70 different individuals are listed as employees of Horner's works between November 1862 and July 1864. On a month-to-month basis, workers varied from 45 in January 1863 to 18 in October 1864. The pay per day was 60 cents, and desertions, sometimes called "French leave," were common. Evidently, there was some makeshift housing available to the laborers, and flour, beef, and bacon were purchased to feed them. At least two horses and one or more wagons were used for daily work.

The total of saltpeter produced at Horner's works is not known, but some figures are available. The niter refinery in Lynchburg, in a second quarter report of 1864, credited the operation with 89,724 pounds of saltpeter. The same refinery noted 2,160 pounds received for October 1864.

A second major Bath County niter operation, called Heaton's works, existed at a cave known as Kirkpatrick's during the war. Smith (1987, p. 22) believed this to be present-day Mountain Grove Cave, but Faust (1964, p. 45) identified it as Starr Chapel Cave. Hubbard (in review) noted the presence of plentiful evidence of saltpeter mining in Starr Chapel Cave, including many names dated from the Civil War era. This cave is also formed primarily in the Licking Creek Limestone.

Working conditions and the labor force were much like those at Horner's operation (Smith, 1987). At Heaton's works, 60 different men were on the payroll from April-June 1863 to October 1864. During this time, the number of free laborers ranged from 35 to 17; slave labor was used also. Desertions at Heaton's works were less frequent than at Horner's, but other aspects of daily life seem very similar. Sources concerning saltpeter production mention about 50 pounds daily for May 1863, 3,019 pounds for the second quarter of 1864, and 1866 pounds in October 1864.

The niter works in Bath and nearby counties were disturbed at least four times by threatened or actual Federal raids. General William Averell accounted for three of these occasions in August, November, and December 1863; General David Hunter's major campaign in June 1864 constituted the fourth. Workmen apparently were able to repair any damage and restored the niter works to production after each of these invasions.

EPILOGUE

Beyond any doubt, the saltpeter caverns of western Virginia and the other Paleozoic carbonate belts of the South contributed mightily to the Confederacy's amazingly successful niter and gunpowder industries. Indeed, as noted by Powers (1981, p. 94), had the majority of the nation's saltpeter caves been located north of the Mason-Dixon Line rather than south, the war would certainly have ended much sooner. In addition to quantity, the quality of southern niter was exceedingly high, and western Virginia's cave production ranked with the very best. The head of the Confederate Niter and Mining Bureau, Col. Isaac M. St. John, reported during the war that niter from caves in southwestern Virginia was of superior quality and could be quickly refined (Powers, 1981). Consequently, the gunpowder made from such high-grade domestic saltpeter was also quite good, equal in quality to any that could be imported from abroad.

During most of the war, Confederate niter production expanded and kept pace with the growing demands of the military. The dispersed nature of the cave sources and their location in remote mountainous regions kept them relatively safe from disruption. By 1864, as cave areas were increasingly lost to the Union, production from other sources at last exceeded that from caverns (Powers, 1981). Eventually, in 1865 total niter production declined, but even at war's end, the Augusta, GA, powder factory had 70,000 pounds on hand.

Today, the contributions of the western Virginia saltpeter miners (as well as those in the rest of the Confederacy) are little remembered. They worked obscurely in remote areas, and few records or personal writings remain to mark their efforts. Even the artifacts left behind in the caverns where they labored have been largely destroyed by time and vandalism, despite state and federal laws designed to protect caves and artifacts found in them. But history is steeped in irony, and the niter miners of southwestern Virginia added one last footnote to the Civil War story (Faust, 1960; Hauer, 1970a).

On March 15, 1959, Confederate veteran John Salling died in Slant, Virginia, his lifelong home in Scott County (Figure 5). Nearby is Lawson's Saltpeter Cave in Copper Ridge where Salling and his fellow miners worked the precious niter deposits. Salling is commemorated only by a small monument on the Slant road placed there by the United daughters of the Confederacy. At the age of 112 years, Private John Salling, Company B, 25th Virginia regiment, Niter Corps of the Confederate Army, became the last saltpeter miner, the last Confederate veteran, and perhaps the last Civil War soldier to die. The sturdy old peter monkey had outlived them all.

Figure 5. Photograph of John Salling at the age of 108 years on his birthday May 15, 1954. According to some, John Salling was the last "peter monkey" and the last Civil War veteran to die. Photograph by G. Alex Robertson, from the Clay Perry Collection, courtesy of the National Speleological Society.

* The identity of the last surviving Confederate veteran is a hotly disputed topic. Marvel (1991) contended that Salling was an "imposter" for this title because census records indicate that he was only two years old in 1860. Many other sources, notably the United States Department of Veteran's Affairs in Washington, DC, call Salling the last Confederate veteran.

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