CURRENT ARCHAEOLOGICAL RESEARCH IN KENTUCKY

VOLUME TEN

Edited By

Vanessa N. Hanvey
Nicole Konkol
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Cover Photo: Mr. William A. (Bill) Huser volunteering his time to help University of Kentucky graduate student Ms. Karen Stevens excavate a shell midden in Henderson County, Kentucky, in 2018. (Photo Courtesy of Karen Stevens)

PREFACE

Since its creation in 1966, the Kentucky Heritage Council has taken the lead in preserving and protecting Kentucky's cultural resources. To accomplish its legislative charge, the Kentucky Heritage Council maintains three program areas: Site Development, Site Identification, and Site Protection. Site Development administers the state and federal Main Street programs, providing technical assistance in downtown revitalization to communities throughout the state. It also runs the Certified Local Government, Investment Tax Credit, and Restoration Grants-in-Aid programs.

The Site Identification staff maintain the inventory of historic buildings and are responsible for working with a Review Board, composed of professional historians, historic architects, archaeologists, and others interested in historic preservation, to nominate sites to the National Register of Historic Places. This program also is actively working to promote rural preservation and to protect Civil War sites.

The Site Protection Program staff work with a variety of federal and state agencies, local governments, and individuals to assist in their compliance with Section 106 of the National Historic Preservation Act of 1966 and to ensure that potential impacts to significant cultural resources are adequately addressed prior to the implementation of federally funded or licensed projects. The staff are responsible for administering the Kentucky Heritage Council's archaeological programs; organizing the annual archaeological conference, including the editing and publication of selected papers; and the dissemination of educational materials. On occasion, the Site Protection staff undertake field and research projects.

This volume contains papers presented at the 20th, 22^{nd,} and 35th Annual Kentucky Heritage Council Archaeological Conference as well as contributed papers. The 20th conference was held in Louisville, Kentucky, in 2003. The 22nd conference was held at the University of Kentucky in Lexington, Kentucky, in 2005. The 35th Annual Archaeological Conference was held at Kentucky Dam Village SRP, Kentucky, in 2018, and was co-sponsored by Wickliffe Mounds State Park, Land between the Lakes National Recreation Area, Tennessee Valley Authority, the Kentucky Archaeology Survey and the Kentucky Organization of Professional Archaeologists. The efforts of those in charge of conference organization and details are greatly appreciated.

As in years past, the papers presented in this volume provide a cross-section of archaeological research conducted in Kentucky. Figure 1 illustrates the general locations of major sites and project areas discussed in this volume.

I would like to thank everyone that has participated in the Kentucky Heritage Council Archaeological Conferences. Without your support, these conferences would not have been as successful as they have been. Finally, I would like to thank the many editors that made the publication of this volume possible.

Vanessa N. Hanvey
Kentucky Heritage Council

We dedicate this volume to Mr. William A. (Bill) Huser who was a devoted friend, colleague, and Kentucky archaeologist. We think of and miss him every day.

Figure 1. Approximate Location of Sites Discussed in this Volume: 1) Hedden, Site 15McN81; 2) Fort Campbell, KY-TN; 3) Gladie Creek, Site 15Mf410; 4) Omer Adams, Site 15Hy25; 5) Constant's Station, Site 15Ck461; 6) Armstrong Farmstead, Site 15Fa185; and 7) Allen Brick Yard, Site 15McN115.

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THE OMER ADAMS SITE (15HY25): EARLY HISTORIC SALT MAKING AT DRENNON SPRINGS, HENRY COUNTY, KENTUCKY

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ABSTRACT

An adequate supply of salt was critical to the settlement of the Ohio River valley. Local salt was obtained by precipitating it from the waters of mineral springs. Salt making developed into an early commercial industry that historians recognize as a distinct influence on early Ohio Valley settlement. Archaeological investigations of saltworks, however, have been rare. Fieldwork at Drennon Springs in 1995 provided a first detailed look at the remains of some Kentucky saltworks and are herein described. To put them into context, springs and the technology of precipitating salt from their waters is described and the history of salt making at Drennon Springs and elsewhere is briefly recounted.

INTRODUCTION

Currently, few archaeological excavations of historic-period salt making facilities in the eastern United States have been conducted. Well-known saltworks, such as the mid-18th to early 19th century one at St. Genevieve, Missouri (Trimble et al. 1991) and the early 19th century "United States Salines" in Gallatin County, Illinois (Herdrich 1985) have been investigated. A smaller operation at Boone's Lick, Missouri, in operation from 1805 to 1833, has also been sampled (Bray 1986, 1987; Yelton and Bray 1992). Additionally, several descriptions of saltworks have been produced from initial and evaluation-level archaeological studies. Boisvert (1984) produced a general overview of Kentucky salines but he did not describe any saltworks examined during the investigations. Dickinson and Edwardson (1984) described Civil War Confederate coastal saltworks in northwest Florida. Prentice (1994) described one of the several Beatty Saltworks in Tennessee, which operated from ca. 1820 to ca. 1877. Anslinger et al. (1996)

described the evidence for ca. 1850's saltworks in the Kanawha River valley of West Virginia, while Updike (2001) reported the data recovery of the coal-fired furnace at Marmet, West Virginia.

In late 1995, archaeologists from the Kentucky Transportation Cabinet, Division of Environmental Analysis, Frankfort, and Wilbur Smith Associates, Lexington, conducted extensive National Register eligibility testing of the Omer Adams Site (15Hy25) at Drennon Springs in north-central Kentucky. Mechanical excavation of the site within a proposed right-of-way for the KY 1360 bridge over Drennon Creek revealed a concentration of features associated with Euro-American salt making ca. 1785-1815. In this paper, the Omer Adams Site and its archaeology are described, and salt making in this frontier setting is interpreted within the context of the larger role salt played in early Ohio Valley settlement.

SALT AND COLONIAL NORTH AMERICA

Salt was indispensable in the life ways of the European colonists of North America as it was used in abundance for the preservation of meat, fish, hides, and furs. It also was used in leather tanning, fabric dyeing, ceramic glazing, and in lesser quantities for medicinal purposes, and for cooking and dining. An ample supply of salt was therefore essential for domestic life and commercial endeavors. Salt was understandably an important article of commerce and one of the earliest products manufactured by the English in colonial North America (Weiss and Weiss 1959:12)

In 17th century Europe, two techniques of evaporation of saline waters, solar and direct heat application, were widely used to obtain salt. In coastal areas, where fuel was scarce, solar evaporation of seawater was typically practiced, sometimes augmented by the direct application of heat through the burning of peat. Inland, where sufficient wood fuel existed, the waters of mineral springs were boiled to obtain salt and direct heat evaporation was the norm. These basic techniques of solar and applied heat evaporation of saline waters diffused to North America with European colonists.

In the English colonies, the first attempt at salt making occurred at Jamestown before 1620, using seawater (Bishop 1868:274). The encouragement and regulation of domestic salt making enterprises by governmental authorities date to 1662 Virginia (Bishop 1868:286). Before the Revolutionary War however, local production of salt in the colonies could not meet demand and salt was primarily imported. Coarse salt, employed in the fisheries industry and the fur trade, was supplied by ships that arrived from Europe, the Azores, and the Caribbean. Culinary salt was supplied from England and commanded a higher sale price (Bishop 1868:288; Weiss and Weiss 1959:12).

As Europeans penetrated the interior of eastern North America, they were on the fringes of the international salt trade. The high demand for salt, concomitant with the costs of production and transportation, made salt a precious and expensive commodity on the frontier. To obtain an adequate supply of salt, the colonists exploited the waters of local mineral springs. As salt making developed into an industry in the Ohio Valley, it provided employment, furnished a medium of exchange, effected land value, influenced settlement patterning, spurred road development, encouraged other industries, and inspired legislation (Jakle 1969).

SALT AND OHIO VALLEY SETTLEMENT

Mineral springs occur in abundance throughout the Ohio Valley. An inland sea-covered portion of the Ohio Valley as late as the Tertiary period deposited sands and mud up to several thousand feet thick trapping seawater between the mineral grains as these deposits solidified into rock. This water and lesser quantities of meteoric solutions are the sources of the region's spring brines. The brine varies in strength due to physical and chemical changes that have occurred through time but are on average stronger than seawater. The springs of highest salinity in the Ohio Valley occur in the strata of the Pennsylvanian-age Pottsville series (Jakle 1969:689).

From the start, mineral springs played a central role in Euro-American settlement of the Ohio Valley. The earliest explorers of the region were hunters, trappers, and traders who quickly learned that animals were attracted to the springs or "licks" by the presence of the salt that impregnated the earth there. These animals included the buffalo, from the western plains, which were present in the eastern woodlands in small herds. The seasonal migrations of the buffalo between prairie grasslands and salt licks throughout the Ohio Valley had, through years of repetitious movement along specific routes, created a system of well-defined paths that connected larger springs. In some locales these buffalo "traces" were the only clear overland routes. Often buffalo traces evolved into roads that exist to the present, and initial settlement in Kentucky was largely concentrated at the locations of springs and along traces (Clark 1938:42; Jakle 1969:689-691).

By 1737, the French had found springs of high salinity in the Middle Mississippi River valley near Ste. Genevieve, Missouri. There, they 1750, they established the first viable commercial saltworks in the interior of eastern North America (Bishop 1868:294; Bray 1986:9; Trimble et al. 1991:171). Ste. Genevieve salt sustained both the French in the Illinois Country and the small population of English inhabitants in the Ohio Valley until 1763, the end of the French and Indian War (Jakle 1969:692).

When France relinquished to England all of her lands east of the Mississippi, and Spain took control of the Upper Louisiana salt springs, the English in the Ohio Valley essentially lost their access to salt. The Proclamation of 1763 forbade English settlement west of the Appalachian Mountains, and Native American hostility made settlement a perilous act. Even so, small parties of English hunters, the "Long Hunters" roamed the Ohio Valley on extended, wide-ranging trips during the years leading up to the American Revolution. The hunters boiled the waters of mineral springs to obtain salt for expedient use and by that gained knowledge about the relative salinity of the various springs of the region (Clark 1938). Yet, there was no steady local supply of salt, in quantity, available. Thus, in 1766, English traders began to import West Indies' salt into the Illinois Country by transporting it overland from Philadelphia and Baltimore to Fort Pitt and then shipping it down the Ohio River (Jakle 1969:692).

SALT AND EARLY KENTUCKY SETTLEMENT

Early Anglo-American explorers and settlers got to Kentucky by traveling down the Ohio River or by land over the Appalachian Mountains. The river route brought them to locations where buffalo traces intersected the river, locations, which grew into early urban centers of travel and commerce, such as Maysville, Covington, and Louisville. Meanwhile, many of those who came through the Appalachians passed through Cumberland Gap, a buffalo trace well known to Native Americans and a few European explorers by 1750. These travelers were familiar with the valleys of eastern Kentucky, which contained salt springs and abundant game. However, it was the level lands and mineral springs of the Bluegrass Region of north-central Kentucky that first attracted permanent settlement starting in 1774-1775 with fortified stations at Harrodstown (Harrodsburg) and Boonesborough (Clark 1938:43). Settlement in the Bluegrass was preceded by land surveys, including a 1773 survey expedition led by Virginian Thomas Bullitt, during which land close to Drennon Springs was first surveyed (Woods 1905:434).

The outbreak of the American Revolution in 1775 delayed permanent settlement in Kentucky but encouraged the manufacture of salt there. The British naval blockade and military occupation of the Middle Atlantic colonies eliminated the supply of imported salt and drove up the price. In 1775, the price of salt on the coast increased from 15 shillings to between 5 and 19 pounds sterling per bushel (Jakle 1969:697). In reaction, the Continental Congress attempted to stimulate domestic salt production. Congress reprinted and distributed in 1776, an extract from William Brownrigg's, an M.D. 1748 article entitled "The Art of Making Common Salt as now practiced in most parts of the World" (Multhaulf 1978:36; Weiss and Weiss 1959:13) This pamphlet described salt making by solar evaporation. Additionally, the Continental Congress passed resolutions to alleviate the salt shortage. In May of 1776, Virginia, and later Kentucky, addressed the scarcity of salt in an ordinance that encouraged the construction and operation of saltworks in the colony (Henning 1821:122-126). During May 1777, Virginia offered bounties for the private manufacture of salt (Henning 1969 [1821]:311-312).

Virginia's 1776 Ordinance, with its subsequent revision in 1777, and a Congressional committee's report of 1777, stimulated speculative developments of the saline springs in western Virginia and Kentucky, although Native American hostility made salt manufacture a risky undertaking. For example, in February 1778, Native Americans briefly captured Daniel Boone and a small party while making salt at Blue Licks, Kentucky.

Nevertheless, the tide of settlers was unstoppable and after the Revolutionary War ended, Americans surged into Kentucky. Kentucky's population in 1790 was recorded as 73,677 people, including 12,430 slaves and 114 free African-Americans (Heinemann 1992:1-2). Statehood followed in 1792. As the population-increased, salt making quickly grew from a low-level activity intended to supply local needs to an intensive, capitalistic industrial venture designed to supply domestic and commercial regional needs,. Jakle (1969:696) points out that the commercial raising of livestock was equal in importance to agriculture on the Ohio Valley frontier, and livestock could neither be raised nor slaughtered without an adequate supply of salt. The early Kentucky iron industry was also stimulated by the growth of salt making, as kettles used to boil brine, was one of the main products of the early iron furnaces. The Bourbon Furnace, in present-day Bath County, Kentucky, dates to 1791 and is believed to have been the first iron works west of the Appalachian Mountains (Jakle 1969:701-702).

Kentucky was a major producer of Ohio Valley salt between 1780 and 1800, commercial manufacture having begun at all of the larger springs by 1790. These springs, found primarily in the Bluegrass region (Figure 1), were the Big Bone, Bullitt's, Drennon's, Goose Creek, Little Sandy, Lower Blue, Mann's, May's, and Ohio licks. The Bullitt saltworks, in operation by 1779, were the earliest and became the largest and most advanced operation (Jakle 1969:699; McDowell 1956:241). Entrepreneurs sought to control the salt supply for personal gain. In 1783, General James Wilkinson moved to Kentucky from Pennsylvania to engage in business, and by 1785 had achieved a monopoly on salt in the Lexington area, and on salt produced by the Mann and Bullitt saltworks (Clark 1938:44; Jakle 1969:701). In 1787, Wilkinson negotiated a trade agreement with the Spanish Governor of Louisiana under which Kentucky goods could be sold in New Orleans. Commodities shipped south-included tons of pork, bacon, dried beef, butter, and biscuits, which all required quantities of salt in preparation for market. Attainment of a southern market also stimulated Bluegrass tobacco production (Clark 1938:45; Jakle 1969:701).

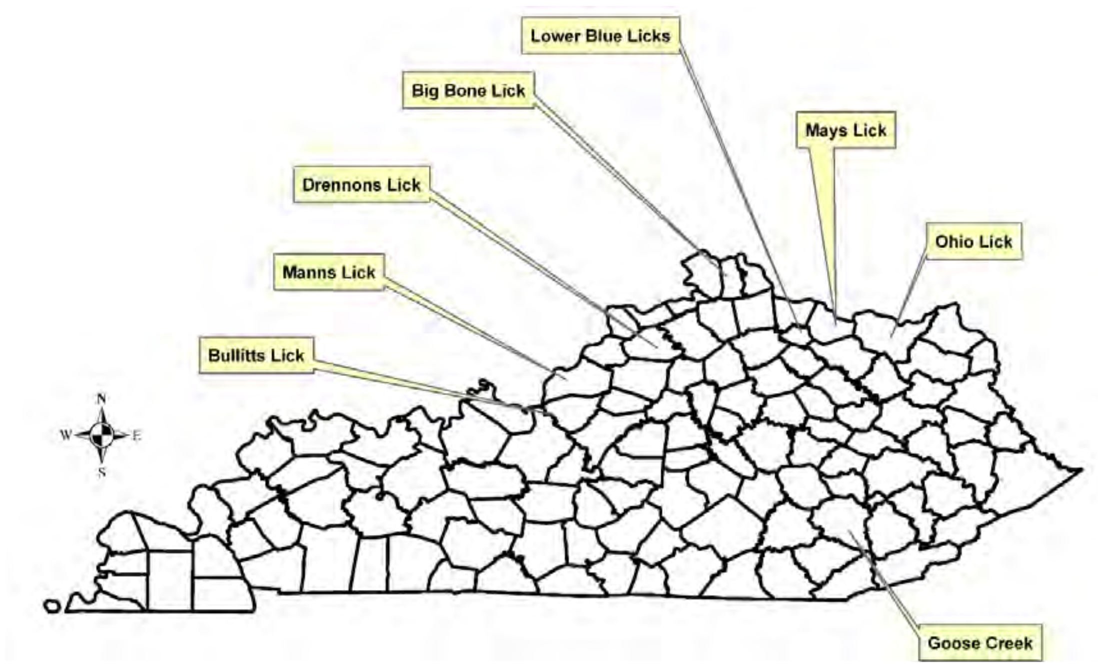

Figure 1. Lick locations within the Commonwealth of Kentucky.

DRENNON SPRINGS SALT MAKING

Drennon Springs is a cluster of mineral springs in the Drennon Creek Valley, in Henry County, in north central Kentucky (Figure 1). This area is part of the Hills of the Bluegrass Physiographic Region, an area of steep, rough, and hilly topography that has been highly dissected by streams (Whitaker and Eigel 1992:4). The area is underlain by Late Ordovician limestone. Drennon Creek is an entrenched minor tributary of the lower Kentucky River, with a watershed of 60,000 acres, most of which is upstream from the Omer Adams Site. The creek's flood plain is about 2,000 feet wide close to the site. A vein containing galena and barite, minerals important in lead production, outcrop in the Drennon Creek bedrock (Fohs 1913:507). The mapped soils overlying the bedrock are deep silt loam of moderate permeability. Jillson (1967: 123) observed four mineral springs on Drennon Creek in 1923.

Among Thomas Bullitt's 1773 party of surveyors was Jacob Drennon, who visited the Drennon Creek valley and subsequently tried without success, to patent 400 acres surrounding the saline springs found there (Hammon 1978:149; LaRoche 1980a:4; Woods 1905:433). Although Drennon's name became permanently associated with the locale, extensive documentary research has identified the Hite family of Virginia as the group most closely associated with salt making at Drennon Springs.

Isaac Hite, of Dutch descent, was another member of Bullitt's party (Hammon 1978:149; Rice 1993:49-51). Isaac's grandfather, Joist Hite, was a land speculator said to have aided in settling 100 members of the Dutch Reform Church in the Shenandoah Valley (Brookes-Smith 1976:iv). Isaac's father, Abraham Hite, Sr. was a land speculator and member of the Virginia Legislature, who immigrated to Jefferson County, Kentucky, ca. 1787. Revolutionary War hero George Rogers Clark also claimed Drennon Springs. Research, however, has failed to produce evidence that Clark was significantly involved in salt making at Drennon Springs, or the outcome of the 1784 pending a lawsuit.

In 1774, Isaac Hite returned to Kentucky and made a private survey of 16,000 acres in the Little Kentucky River and Drennon Creek drainages for Hite, Bowman and Company. This was a co-partnership consisting of Isaac Hite (son of Joist Hite) and Abraham, John, and Joseph Bowman, all Hite’s relatives by marriage. Hence, a pattern of acquisition and ownership began in the Drennon Creek drainage by the Kentucky Hite family. By 1797, this co-partnership of individuals had accumulated some 11,000 acres there (Kentucky Secretary of State, Land Office).

In the summer of 1775, Isaac Hite, Abraham Hite, Jr. and others made a survey and an entry of 1,000 acres in Kentucky, including Drennon Springs, under a military warrant assigned to Colonel William Preston. Nicholas Cresswell, an English traveler who visited Drennon Springs in June 1775 may have observed Isaac and Abraham, Jr. there as he wrote that:

> This is the largest lick I ever saw. I suppose here is 50 acres of land trodden by buffaloes, but there is not a blade of grass upon it... Here is a number of salt and Brackish springs in a small compass, some of them so strong of the brine that the sun forms the salt round the edge of the Springs. Here were two Dutchmen, sent by the proprietors to make an experiment on the water of the strongest spring. They had made about a pint of salt from sixteen Gallons of water (Cresswell 1968:85-86).

In April, 1776, Abraham Hite, Sr. agreed to be partners with Peter Hogg in a saltworks at Drennon Springs (Hite et al. 1820:424-425). Hogg, a Scottish immigrant, settled in Virginia ca. 1745. He was a noted lawyer in the Shenandoah Valley and a member of the Virginia Legislature (Waddell 1886:63). Salt making at Drennon Springs was not feasible in 1776. That year, James McDaniel (or McDonald) was killed by Native Americans (Mason 1951:144) while attempting to manufacture salt.

The 1,000 acre tract surveyed in 1775 was a military grant, assigned by Colonel Preston to Abraham Hite, Sr. and Peter Hogg in 1780. The same year the survey was entered by the Virginia Land Office (Fincastle County 1775; Brookes-Smith 1976:177). In 1780 Hogg received a 400-acre settlement grant and a 1000-acre preemption next to the Drennon Springs military survey, also called the Lick Survey (Kentucky Historical Society 1992: 204). That same year a party supervised by Joseph Hite, a son of Abraham Hite, Sr., attempted to build a saltworks at Drennon Springs but was driven off by Native Americans. Moreover, in 1781 a group from the Falls of the Ohio attempted to go to Drennon Springs to make salt. Several male and one female member of the group were killed, while three African-American slaves owned by Squire Boone were captured (O'Malley 1996:5).

Documentary evidence places the first operational saltworks at Drennon Springs during the winter of 1785. Shane (1841a:108, 1841b:247-251) states that Archie Dickinson was employed to hunt game for the workers, and it apparently was Dickinson who discovered galena on Isaac Hite's property. In 1787, a small fort or "station" was built to protect the Drennon Springs workers. On December 9, 1787, the station was overrun by Native Americans resulting in the death of two of the four occupants and the capture of a third, with the fourth escaping because he was out hunting (Bradford 1787:1-3).

A 1795 a Native American attack on a fortified station at the mouth of the Kentucky River prompted Richard Turner to write to Governor Shelby requesting the militia to be stationed at Drennon Springs to protect settlers and salt workers (Jillson 1950:9). In 1799 and 1800, the Henry County Judge Executive ordered several studies of existing and proposed roads connecting Drennon Springs with various other locations. The firm of Hogg and Hite received permission to construct and operate an inspection station for tobacco, hemp and flour at the confluence of Drennon Creek and the Kentucky River in 1800 (Littell 1810:384). We have been unable to find any record of the station's existence before 1817 (Hite et al. 1820:466-467). Between 1808 and 1811, Abraham Hite, Jr. initiated several lawsuits to evict tenants and squatters on Hite land at Drennon Springs. Although these lawsuits illustrated land improvements, as well as the residents near the springs, there was no description of the saltworks or lead mine.

In 1810, single operation at Drennon Springs produced 800 bushels of salt per year (Coxe 1814:121-128). No saltworks in Henry County were recorded in the Third Federal Census of 1820. By 1840, Bluegrass salt making had ended, probably falling victim to competition from more productive saltworks elsewhere, monopolistic practices, and improvements in the brine reduction process.

DESCRIPTION OF A HYPOTHETICAL KENTUCKY SALTWORKS

A commercial-scale saltworks would first require a well to serve as the brine supply. Well depths were recorded as being 12 (3.66 m) to 15 ft (4.57 m) at the Ohio Saltworks, 22 ft (6.71 m) at Knob Lick (Shaw 1939 [1807]: 190, 195), 35 ft (10.68 m) at Mann's Lick (Toulmin 1948: 104-106), and 70 ft (21.34 m) at Mann's Lick (NAUS 1965: 117). Wells were initially hand excavated and early ones were lined with a large, hollow tree trunk, probably a sycamore (Buford 1837:116;

Hildreth 1833:54-56). Later wells became larger in circumference and may have required a log crib frame with the interior sheathed in tongue and groove planks.

The most common method for removing and elevating brine water from a well was the sweep (Toulmin 1948:104). This mechanism consisted of a bucket that probably held 5 gallons (0.019 m^3) or more, a pole, pivot and a person to operate it. The bucket was suspended from one end of a pole, 25 (7.62 m) to 30 ft (9.14 m) long and with a counter balance weight on the opposite end. The pole was mounted on a pivot or swivel post. Brine could be hand-carried in buckets to the furnaces, but was also conducted from an elevated wooden cistern to the furnaces by a gravity-fed network of wooden aqueducts or pipes made of bored logs (Smith 1927:138). It was considered more economical to place a furnace near a fuel source (wood or coal), and pipe water to it, than to haul wood to the furnace (Toulmin 1948:106). Pipelines sometimes extended for several miles to connect wells to distant furnaces (Bartlett 1911:77-78; Collot 1909:290).

Alternatives to the sweep device include a reel, or windlass, in which a bucket of brine was hand-cranked up to the surface (Cummings 1904:164). The use of draft animals to operate a windless consisted of the power being transferred to the windless by a system of gears and drive shafts with ratchets running overhead. Inclined horse and human tread mills were sometimes used (Bray 1987; Hildreth 1833:54-56; Yelton and Bray 1992), as was a force pump, a hollow wooden tube with two or more sets of valves that was similar in design to a present day bicycle pump or bilge pump (Smith 1927:138).

Boiling it in kettles that sat atop wood-fired, semi-subterranean furnaces reduced brine. A furnace trench was excavated on top of a stream terrace, or into the side of an embankment, with the deepest end at the lowest elevation (McDowell 1956:256). The trench had a thermometer-shaped plan view and cross-section. A firebox was located at the deep end of the trench, with a chimney at the opposite end. The trench walls were lined with stone blocks to form an arch on which brine kettles sat (DeWitt 1801:280-282). The rock walls were then plastered with clay. At this juncture, the floor of the trench, which sloped upward to the chimney (Hildreth 1833:54-56), was coated with a layer of lime plaster. Kettles were laid on the arch formed by the walls and gaps between the kettles were filled with rocks or cast iron kettle fragments and mortared with clay to seal the flue (Michaux 1904: 196). The firebox could be covered with metal plates and fed wood through a door (Crammer 1979 [1811]: 119). The chimney was probably of mortared stone; unfortunately, historic descriptions do not describe chimney height. One would expect that a chimney stood well above the kettles to prevent ashes from collecting in the brine solution. At some operations, sheds were built over the furnaces, presumably to prevent dilution of brine by rainwater (Hildreth 1833:54-56).

The brine was placed in kettles and was permitted to boil for approximately 24 hours. During this process, animal blood or lime was added to the solution to precipitate and enable the extraction of impurities such as sulfur and calcium carbonate. The solution was then transferred to a cooling trough. This also potentially served as a settling tank, which produced clear saturated brine. This brine was then drawn off by hand into other "graining" kettles to be boiled again. Once calcium chloride crystals formed and began to settle to the bottom of the kettles the heat was reduced so that the pot would remain at an even simmer. The crystals were removed by dippers and placed in baskets to drain (Fleming 1916:620; Hildreth 1833:54-56; McDowell 1956:256). The excess water removed during this process was retrieved in additional pans and returned to the main kettles, which were never allowed to boil dry. Impurities such as calcium carbonate and sulfur would accumulate in the main boilers during continuous use and required removal. Thus, the kettles and the furnace required frequent cleaning to remove accumulated ash and slag (Smith 1927:138-139).

Kettles were globular or bell-shaped. Kettle capacity stated in documents ranges from 20 [0.076 m^3] (Daniel 1783a) to 90 gallons [0.34 m^3] (Hildreth 1833:54-56), with intermediate capacities of 24 gallons [0.091 m^3] (Toulmin 1948:104-106), 30 [0.11 m^3] (National Archives 1965:117), 35 [0.13 m^3] (Bradford 1794), 40 [0.15 m^3] (Daniel 1873b), and 60 gallons [0.22 m^3] (Hildreth 1833:54-56).

By at least 1796 salt furnace design had evolved from single-trench furnaces with one row of kettles to furnaces with two parallel trenches and rows of kettles (Crammer 1979 [1811]:119; McDermott 1963:23-24). However, a much more efficient method for reducing the brine to salt was available by 1785 which made use of large, shallow metal pans instead of kettles, as was typical in Europe (DeWitt 1801:280-282; Merriwether 1785). Dearinger (1977:19) states that pans were used at the U.S. Salines, but there is no evidence that this system was ever employed in Kentucky, although the primary renters were Lexington, Kentucky residents. By 1810 however, groups of kettles graduated in size were set on the furnace starting at the firebox end with the largest one. The fresh brine was poured into the kettles closest to the heat and evaporated. It was then removed from the heat and permitted to settle and clarify. After the liquid became clear it was placed in smaller kettles toward the chimney end furnace as the liquid evaporated and sodium chloride crystals were removed. The last unit was a large, flat stirring-off pan. The salt then was shoveled on to a large draining board to dry (Dearinger 1977:17). A horse drawn cart or wagon would have been utilized to transport the salt to a storage building to be packed in barrels, then, shipped to market.

OMER ADAMS SITE ARCHAEOLOGY

The Omer Adams Site is located on the Drennon Creek flood plain about 2 km (1.25 mi) northwest of the confluence of Drennon Creek and the Kentucky River. The site is situated on and around a low rise on the northern side of Drennon Creek. Beginning in the early 1980’s, the Kentucky Transportation Cabinet proposed to build causeway approaches across the flood plain for a new KY 1360 highway bridge over Drennon Creek. The Cabinet's Division of Environmental Analysis discovered the Omer Adams Site in 1984 during an archaeological survey of the project area. Named for a local property owner, the site was known in 1985 to have Late Woodland and early historic period components and was included in the Kentucky Heritage Council's nomination of the Drennon Springs Archaeological District to the National Register (Fiegel and Fiegel 1990).

The route of the KY 1386 bridge approach on the north side of Drennon Creek crossed the western end of the Omer Adams Site, and the Division of Environmental Analysis acted to assess the site's significance. In 1991, the Division excavated three 2 m^2 (21.53 ft^2) units. The material recovered by these excavations was meager. It was concluded that the examination of the highway right of way utilizing this method was not cost effective. In 1994, the exposure of two 10 m (32.8 ft) long by 3 m (9.84 m) wide areas along the eastern edge of the right of way at the top of the rise exposed a pit feature (Feature 1), and a burned trench feature (Feature 2). In early 1995 hand excavation revealed that Feature 1 (Figure 2) was a shallow pit with horizontal dimensions of 1.9 m (6.23 ft) N-S by 1.7 m (5.58 ft) E-W and a maximum depth of 26 cm (10.27 in). It had well-preserved floral and faunal remains and yielded an undecorated pearlware sherd that indicated a date after 1790 (Noel Hume 1972:232).

Figure 2. 15Hy25 Feature 1 cross-section.

More-extensive testing of the site was conducted after the property was acquired between late July and early November 1995. During this period of fieldwork, over 3,000 square meters (32,291.73 square feet) of surface area on the top and western slope of the rise and the flood plain to the south of the rise were stripped mechanically (Figure 3). Stripping revealed that the flood plain and slope were covered by as much as 1.5 m (4.91 ft) of alluvium deposited by flood water after the site had been abandoned, as determined by soil scientists Greta Steverson and Steve Jacobs through an examination of profile walls (Ms. on file, Kentucky Transportation Cabinet, Frankfort). The damming of the Kentucky River downstream from Drennon Creek in the 1830's dramatically increased the amount of backwater standing in the Drennon Creek valley. Flooding is likely to have greatly accelerated the rate of sedimentation, resulting in a blanket of soil being deposited over the lower portion of the valley. Logging and agricultural activities within the valley during the historic period also likely contributed to increased sedimentation.

Beneath the alluvium, sheet midden composed mainly of compact wood ash and silt, was found to extend over at least 228 m^2 square meters (2,454.17 ft^2) of surface area on the western slope of the rise and the flood plain to the west and south of it. The large quantities of ash created as a waste product during salt making were periodically removed from furnaces and apparently were dumped on the ground in the immediate vicinity. The midden on the slope and western flood plain was sampled by unit excavation. A third midden, located on the flood plain south of Features 24-27 at 2 m (6.56 ft) below surface, was exposed in a backhoe trench but was not sampled further as it was completely saturated with groundwater. Its extent appears to encompass the entire lower terrace.

The midden on the rise covered at least 18 m^2 (59.06 ft^2) of surface area and was 30 cm (.98 ft) thick. Investigated by block excavation, it yielded 38 historic artifacts, the most temporally diagnostic ones being three pearlware sherds. The midden also yielded four creamware, two redware sherds and 18 kettle fragments. Additionally, one stoneware, and one porcelain sherd, a redware tobacco pipe fragment, a cut nail, a blond gunflint, were recovered.

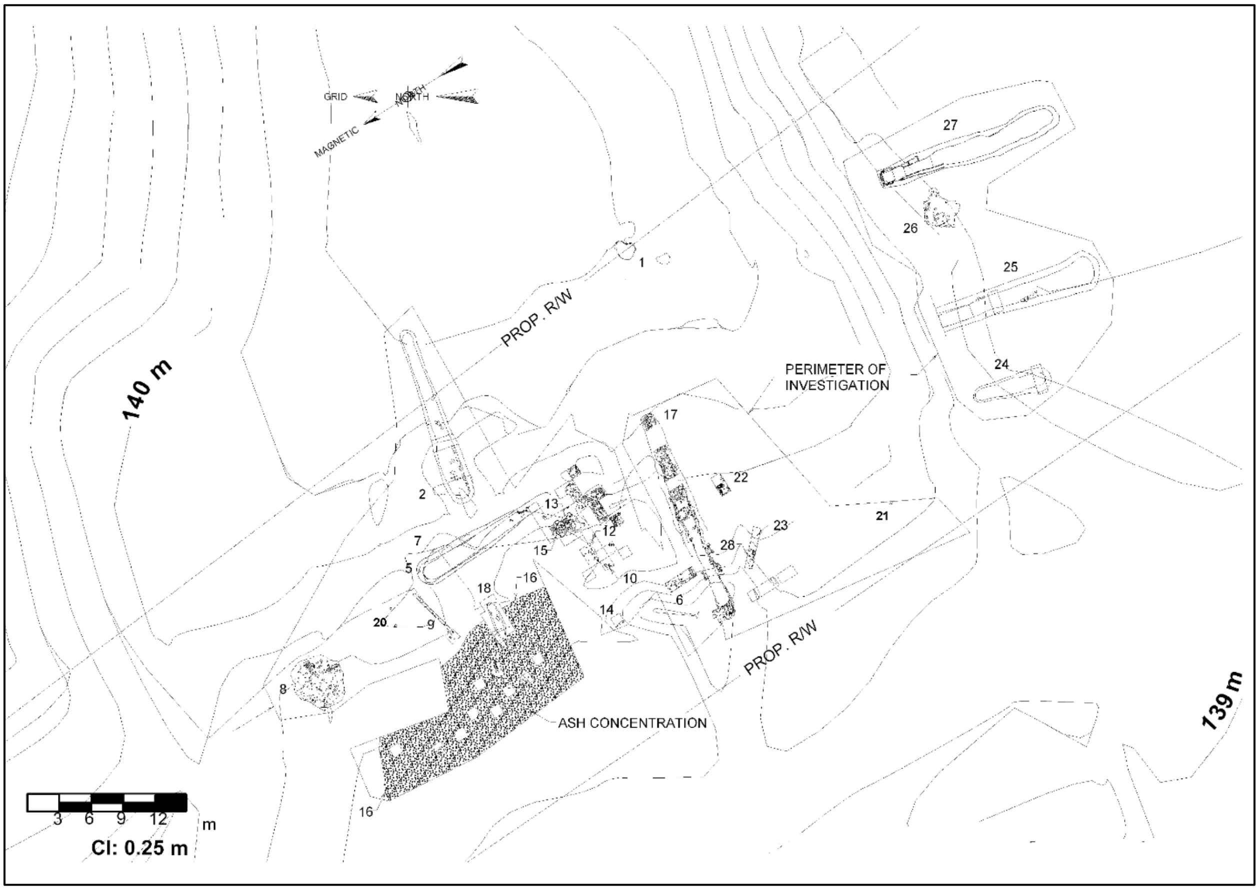

Figure 3. Planview of the Omer Adams Site excavation.

The top of the yellowish-brown soil layer (Zone II) beneath the ash was the ground surface during the salt making period. It was littered with chunks of limestone and numerous animal bones. The artifacts dispersed throughout the zone included two pearlware sherds. However, Feature 13, an erosional gully intrusive into Zone II, yielded three undecorated whiteware sherds that date to 1800 or later, and as the ash midden overlay Feature 13 the midden can be assigned a more accurate date of the early 19th century date.

The ash midden in a low area west of the rise was designated Feature 16. It covered at least 210 square meters (688.97 square feet) of surface area and was overlain by up to 1.2 m (3.94 ft) of alluvium. The excavation of 11 1X1 m^2 (3.28 ft^2) units, several of which ended in standing groundwater, sampled it. The midden contained 33 historic artifacts including one sherd each of creamware and redware, two container glass fragments, three cut nail fragments, two copper or brass buttons, and twelve kettle fragments, plus numerous animal bones. Intermixed were 110 prehistoric artifacts including cord-marked, limestone tempered ceramic sherds. This midden was assigned a date of 1790-1800 based on the artifacts it contained. Beneath the ash, Zone II contained only six historic artifacts whereas it yielded 161 prehistoric artifacts including ceramic sherds with limestone and shell tempering. No prehistoric or historic features were found, and given the flood plain context, it is possible that all of the archaeological materials at this locale were redeposited by water and were in secondary context.

No well was identified on the site although Feature 8 was extremely circular in plan, had a maximum diameter of 5 m, and may have been a well or cistern (Figure 4). It was excavated by hand to 1.35 m (4.43 ft) below its surface. Zone I, the uppermost 44 cm (1.44 ft) of the feature, was completely excavated. It consisted of very compact wood ash and charcoal furnace debris that had been dumped into a basin-shaped pit intrusive into Zone II. Artifacts were scattered randomly throughout Zone I; the most diagnostic of which was an overglaze painted pearlware sherd (post-1795) and a one piece round metal button, similar to South (1964) Type 8 button. Also present were one sherd each of redware and stoneware, an olive-green container glass fragment of undetermined manufacture, an ash-encrusted stub-stem pipe, three corroded cut nails, an animal shoe fragment, and 14 kettle fragments, as well as numerous animal bones, chunks of fired clay, and blocks of limestone. Beneath Zone I the feature boundaries were vague. The excavation of six square meters (18.68 square feet) sampled Zones II and III. Zone II consisted of 20 cm (7.87 in) of yellowish brown alluvium that yielded 5 kettle fragments, animal bone, prehistoric artifacts, and limestone. Zone III consisted of laminated silt 75 cm (2.46 ft) thick, from which a chert flake and small amounts of bone and fired soil were recovered. Below Zone III, mechanical excavation to 3 m (9.82 ft) below present ground surface failed to detect the feature.

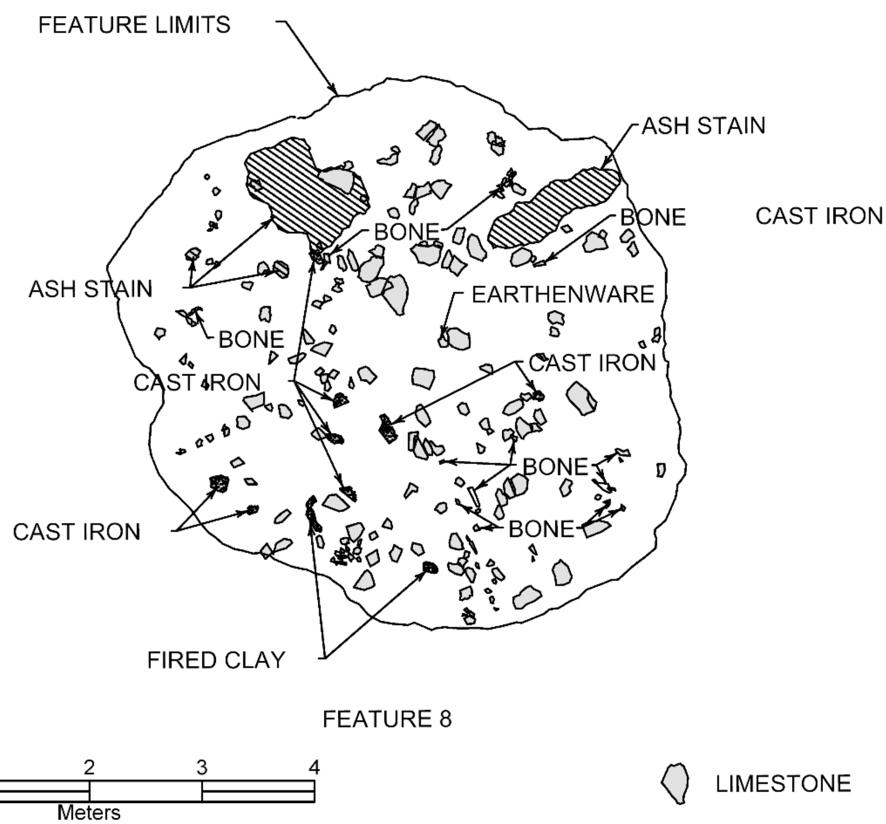

Figure 4. 15Hy25 Feature 8 planview.

Ten furnaces were excavated wholly or in part (Features 2, 5, 6, 17, 18, 23, 24, 25, 27, 28). Some furnaces were oriented north-south, south-north or west-east to take advantage of the prevailing winds. They were present on top of the rise, on its western slope, and on the flood plain to the south. Feature 5, the only furnace completely excavated, was located just west of the top of the rise. Its firing chamber was 14.5-m long, averaged 1.5 m (4.29 ft) in width, and had a maximum depth of 2.25 m [7.38 ft] (Figure 5). The southern, chimney end was in the plowzone and had been destroyed. Profiles of the firing chamber fill showed that the uppermost fill was laminated gray silt that contained abundant limestone blocks, a few animal bones, and the majority of a large kettle. Beneath this was a layer of blended ash, silt, and fired soil, interpreted to be evidence of gradual filling by flooding and wall erosion after furnace abandonment. The basal deposit consisted of dark ash and limestone blocks. The sloping floor of the firing chamber was coated with lime that may have made a smooth surface to facilitate ash removal. Feature 5 was one of three furnaces in which no intact stone lining was present. The linings of these furnaces may have been robbed for use elsewhere after their abandonment. The only diagnostic artifact in Feature 5 was one undecorated creamware sherd.

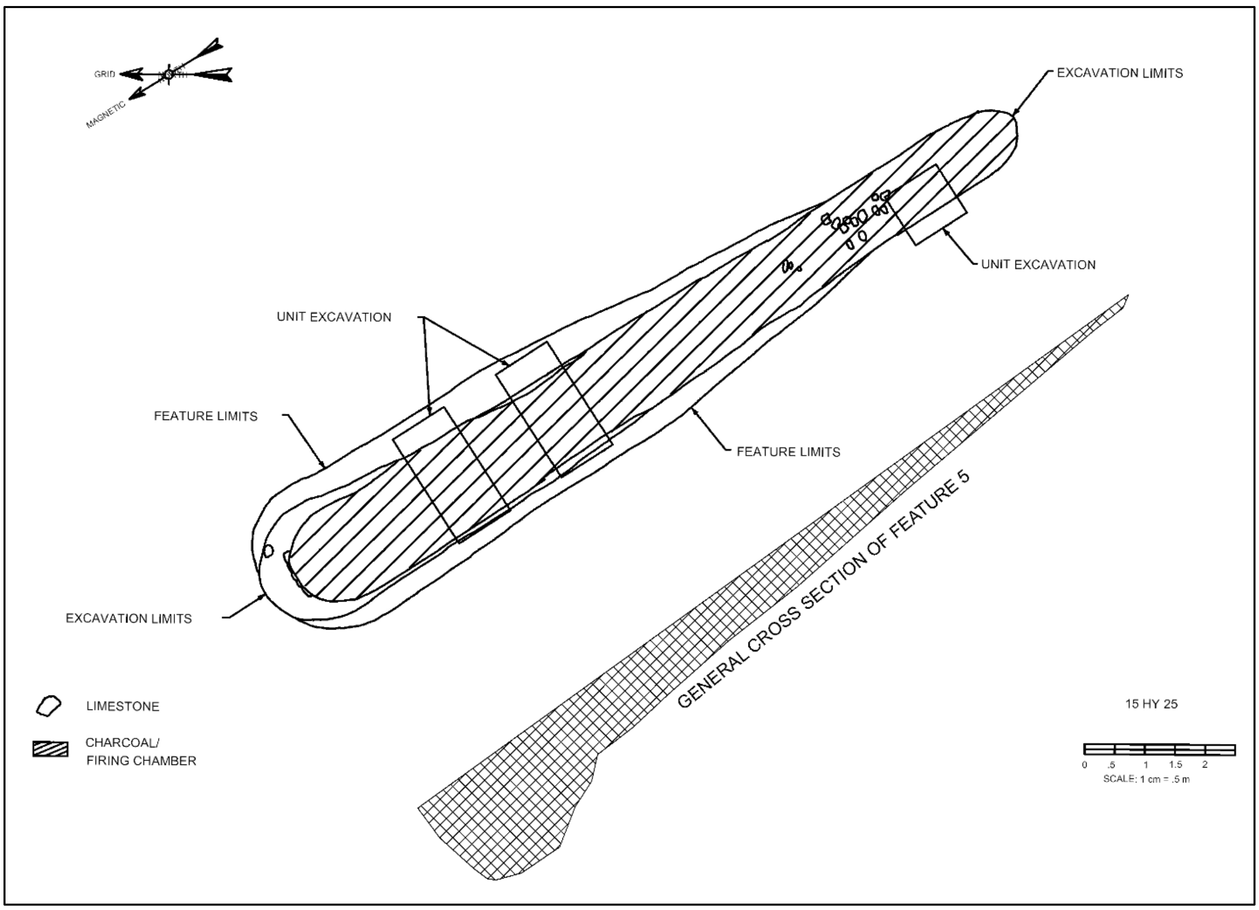

Figure 5. General cross-section and planview of Feature 5.

Feature 17, set into the western slope of the rise, was the largest furnace found, being 20.5 m (67.26 ft) in length with a firing chamber 1.5 m (4.82 ft) in width on average (Figure 6). In total, 17.5 linear meters (57.41 ft) of the firing chamber were excavated. The eastern, chimney end of the furnace was in the plowzone and was a jumble of rocks. However, the furnace's stone lining was intact for the majority of the length of the chamber. At the western, firebox end of the furnace the lining was two courses thick. A broken kettle had been incorporated into the wall of the stone lining on the northern edge of the firebox and a second broken kettle was recovered from the firing chamber. The deepest part of the firing chamber was not completely excavated due to persistent groundwater flooding. Two stoneware sherds with an Albany slipped interior recovered from Feature 17 indicate that the feature was filled ca. 1800 or later.

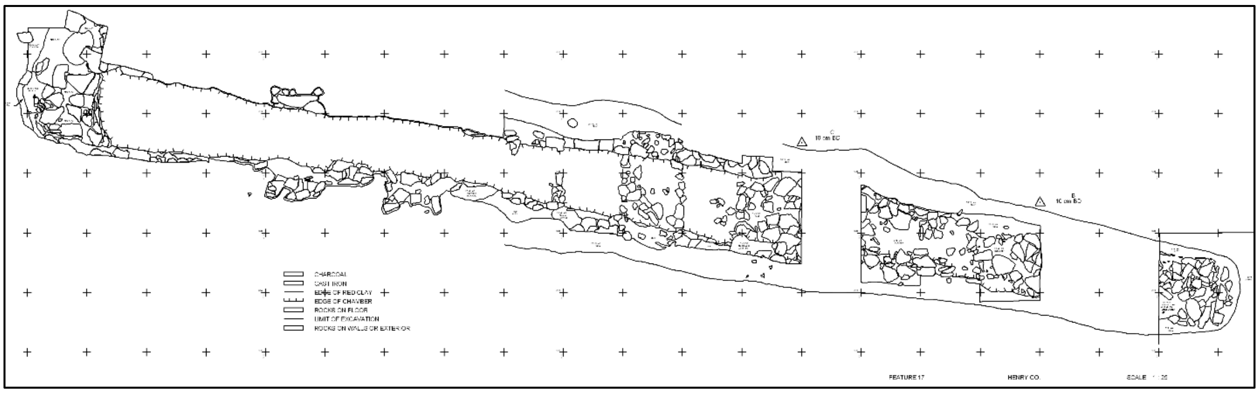

Figure 6. Planview of Feature 17.

The smallest furnace found (Feature 18) was sealed beneath the Feature 16, an ash midden. Feature 18 had a length of 4 m (13.12 ft), a width of 1 m (3.28 ft), and ranged in depth from 10 (3.94 in) to 20 cm (9.45 in). It was unlined and was filled with alluvium and a few blocks of limestone. This may have been a smaller, graining furnace used in the final boiling of brine as the salt precipitated out, or perhaps was one of the earlier furnaces on the site. The only diagnostic artifact present was one undecorated creamware sherd.

Feature 27, on the flood plain south of the rise, contained an excellently preserved chimney end (Figure 7). Feature 2; on top of the rise, contained large quantities of lime that was used to coat furnace floors and was added to brine to precipitate impurities such as sulfur.

In addition to the ash midden described above, other deposits of furnace debris were identified: Feature 26 was a discreet deposit of fired soil, ash, charcoal, and limestone blocks located between two furnaces on the flood plain south of the rise. Feature 26 had dimensions of 3.5 m (11.48 ft) by 4 m (13.12 ft) and had a maximum thickness of 24 cm (9.45 in). The single diagnostic artifact present was a sherd of under glaze blue painted pearlware dating to after 1780 (Miller 1980, 1991). Feature 15, located on the rise, was a debris pile that consisted mainly of limestone blocks. It had horizontal dimensions of 1.5 m (4.91 ft) by 2 m (6.56 ft) and was 33 cm (12.99 in) thick. The Feature 15 debris was deposited in a shallow basin-shaped hole, which was perhaps a puddle. Part of Feature 15 overlay Feature 11, a shallow basin 22 cm (8.66 in) deep, that contained some limestone chunks, a few animal bones, and a sherd of annular banded pearlware that indicated a date of 1790 or later for the two features.

Two features interpreted to be water-related (Features 13 and 9) were found. Feature 13, mentioned above; apparently was an erosional gully that trended east west for at least six m down the western slope of the rise. Feature 13 ranged from one to two and one-half m (3.28-8.2 ft) in width and had an average depth of 15 cm (5.9 in). The feature was filled with a dense cluster of limestone chunks, numerous animal bones, and occasional artifacts including a few small whiteware, creamware stoneware and redware sherds, a harness buckle, kettle fragments, and a small piece of barite.

Figure 7. Feature 27 chimney base.

Feature 9 was a curious, hand-dug channel oriented east west on the western slope of the rise. The feature, perhaps a drain, was 5.5 m long, 25 cm wide, and 19 cm deep. The flat floor declined 2.5 m in elevation over its length and terminated to the west in a fan-shaped deposit of ash and silt. The feature fill consisted of black ash in which were chunks of charcoal, lime, and fired soil, with lenses of white ash. This fill had settled or been dumped into the channel as the feature matrix was not fire-reddened. The fill contained a few kettle fragments and animal bones, including a mussel shell with a button blank cut out of it. Toward the eastern end of the feature, a circular posthole (Feature 9a) was centered in the channel. Feature 9a had a diameter of 31 cm and extended down 38 cm below the base of Feature 9. The fill of Feature 9a was the same dark ash of Feature 9. No post mold was discerned. The only diagnostic artifact present was a small sherd of plain pearlware.

Five other postholes (Features 7, 12, 19, 20, 21) were found. Feature 12 contained a distinct post mold. Features 19 and 21 were interpreted to be the filled voids of pulled posts due to the homogeneity of their fill. Feature 20 contained an un-decayed cedar post and was of recent age. None of these five features contained diagnostic artifacts. Another probable recent posthole (Feature 4) was destroyed during site stripping in 1995.

Between 1991 and 1995, 657 historic artifacts were recovered from contexts sealed beneath 19th century flood-deposited alluvium (i.e. Zones I and II and Features 1-28). These artifacts were in the least-disturbed contexts investigated during testing and are the only ones discussed here. Zone I (including Feature 16 ash midden) yielded 73 specimens (11.1% of total), Zone II yielded 123 specimens (18.7% of total), and the features yielded 461 specimens (70.2% of total). After South (1977), the artifacts pertain to the functional groups of Kitchen (N = 116), Architecture (N = 18), Arms (N = 2), Clothing (N = 9), and Activities (N = 512). No artifacts pertaining to South's Furniture Group or Personal Group were found.

The Kitchen Group (17.7% of assemblage) is made up of 96 ceramic sherds and 21 fragments of glass. Of the ceramic sherds, 68 (70.8%) are of refined and 28 (29.2%) are of unrefined wares. The refined specimens consist of 45 creamware, 15 pearlware, three whiteware, three indeterminate refined, and two porcelain sherds. The creamware sherds are the lighter yellow variety first produced in 1775 (Miller 1991:5). All are undecorated. The pearlware sherds include examples with annular banded, shell edge, and monochrome and polychrome under glaze painted decoration. The whiteware sherds, found in Feature 13, are undecorated. The porcelain sherds are of the hard paste, Chinese Export variety imported into the United States mainly from ca. 1784-1830 (Palmer 1983:16). One porcelain sherd, from Zone I, lacks decoration; one from Feature 28 has red overglaze painted decoration in geometric motif.

The unrefined ceramic specimens consist of 21 redware (75%) and seven stoneware (25%) sherds. The redware sherds include unglazed, clear- and brown-tinted lead glazed, and white slipped examples. Lead-glazed vessels include ones glazed only on the interior as well as ones glazed interior and exterior. One clear lead glazed sherd from Zone II has incised geometric decoration, the remaining are undecorated. All of the stoneware sherds are salt glazed. There are four decorated and three undecorated specimens. Incising, in geometric motif, is the only decoration type represented. Feature 17 yielded a conjoining rim and body sherd of a pitcher that has a salt glazed exterior and an Albany slipped interior, indicative of a date of ca. 1800 or later (Phillippe 1990:80). Feature 8, Zone I, contained two conjoining sherds of a large vessel, probably a bulbous jug, with salt glaze exterior and a green slip interior. Both the pitcher and the jug have incised exterior decoration, as does a sherd from Zone I that has an unglazed exterior and an Albany slipped interior.

The ceramic sherds clearly indicate a late 18th to early 19th century date for the saltworks. Creamware, the most popular ware type on the American market at the end of the 18th century (Miller 1991:5), is the most common ware type in the assemblage. Creamware is three times as abundant as pearlware, the second most common type. Pearlware replaced creamware as the most common tableware in the United States ca. 1810 (Majewski and O'Brien 1987:118-119). Whiteware, first produced ca. 1800 and popular by 1820, is poorly represented (Hume 1978:130-131; Miller 1980:16-17). No mean ceramic date was calculated for the assemblage, however. Small sample size and the inability to precisely determine the number, form, and size of vessels due to small sherd size (less than one square cm, on average) make date calculation an exercise of questionable accuracy. Inexpensive, undecorated and minimally decorated vessels, as might be expected on an industrial site (Miller 1991) dominate the assemblage.

The 21 glass fragments in the assemblage consist of 13 bottle fragments and seven fragments of undetermined function. The glass fragments, like the ceramic sherds, were quite small on average. Their age is consistent with but does little to refine the date of site occupation indicated by the ceramics. Of the 13 bottle fragments, eight were found in features, five in Zone II. There are seven olive green, two clear, two light green, one light aqua, and one green fragment present, in the form of eleven body two basal fragments. These represent a minimum of five bottles, based on form, method of manufacture, and/or color. Two conjoining basal fragments from Zone II are from a clear, leaded, square bottle made in a dip mold and finished using an unimproved pontil. A second vessel, from Feature 9, is a light aqua bottle, possibly a flask, which was mold blown. Liquor flasks were introduced ca. 1810 and had become very popular by 1830 (Deiss 1981:62). Fragments of a third vessel type, an olive green square bottle, possibly a case bottle, were found in Feature 8 and in Zone II of the site.

Of the seven glass fragments not attributable to a container or other object type, five were found in features, two in Zone I. They consisted of three clear leaded, three clear unleaded, and one light green specimen, all of which are small body fragments. The presence of unleaded clear specimens raises to six the minimum number of glass vessels present in the assemblage.

Architecture Group building materials (2.7% of assemblage) were rare. Eight cut nail fragments, seven unidentified nail fragments, two probable fence staples, one complete handmade 5:1 brick and a fragment of mortar were recovered. Seven of these artifacts were found in Zone I, three in Zone II, and nine in features. The nail fragments were too corroded to identify more precisely. The scarcity of building materials other than limestone blocks on this industrial site is in sharp contrast to their abundance on domestic sites.

The Arms Group (0.3% of assemblage) is limited to two artifacts, a fragment of a "blond" or "honey-colored" gun flint of a size appropriate for a pistol, from Zone I, and a piece of lead sprue, debris from lead ball molding, from Zone II. In total only five arms-related artifacts were found in 1994-1995, and the rarity of objects of this category at this early frontier site is striking.

The Clothing Group (1.4% of assemblage) consists of eight buttons and one small eyelet/grommet, the latter probably from a shoe. Three clothing items each were found in Zone I, Zone II, and in features. They are all made of metal. One button or sleeve link is octagonal in shape and is stamped with a design. The other seven buttons are circular and lack decoration. Two are copper/brass, one-piece buttons similar to South's Type 8 (South 1964). Two, copper/brass, two-piece buttons are similar to South's Types 9 and 18. One two-piece steel button is similar to South's Type 10. One copper/brass specimen is probably a button back.

Two hundred-ninety-three kettle fragments, 207 small metal unidentified objects, dominate the Activities Group (77.6% of assemblage). The other objects in the category includes one buckle, one animal shoe, four small specimens of barite, (locally-occurring lead-bearing rock), two stub-stem pipes and four small pieces of coal, the last two of which are included in this group as they are at least manuports. Forty-six Activities items were found in Zone I, 85 in Zone II, and 379 in features. One stub-stem pipe specimen is a brown-glazed redware bowl fragment from Zone I at terminus of Feature 5. The other, from Feature 8, is apparently a complete pipe although little more can be said about it as it is completely encrusted with wood ash, perhaps the result of super-heating in a salt furnace.

Sixty-two archaeobotanical samples totaling 776 liters of feature soil were processed by water flotation and analyzed. The recovered specimens are overwhelmingly of wood charcoal (2,347 g) with minute amounts of two cultigens (corn and gourd), five species of nutshell, and seeds of berries, fruits, and weeds. Rossen (1998) notes that some of the wood charcoal is salt encrusted and may have been construction material. The most common charcoal is from the white oak group, followed by black locust, ash, hickory, red oak group, and black walnut, all highly desirable woods for fuel. Less-desirable fuel woods present in minor amounts include eastern red cedar, soft maple, sycamore, yellow poplar, honey locust, American chestnut, and hackberry. Fifty-two recovered nutshell specimens include acorn, black walnut, hickory, and single specimens of hazelnut and butternut. Squash rind was present in Feature 1. Gourd rind was present in two locations, corn in three. Of the edible fruit or berries represented, blackberry/raspberry is the most common, followed by trace amounts of grape, peach, persimmon, ground cherry, small-seeded nightshade, and sumac, the last three being common field weeds, edible but likely to have been naturally deposited. Other weeds present were large-seeded nightshade or buffalo burr, common on historic sites but rare on prehistoric ones, and trace amounts of chenopod, black nightshade, knotweed, and grass. In sum, the archaeobotanical remains reflect the heavy consumption of wood for fuel that occurred on the site. Various species of trees present in proximity to the saltworks are identified. Selection for slow-burning hardwoods was evident. Food plant remains were rare on the site and were distinguished by the scarcity of cultigens (Rossen 1998).

Animal bones were abundant and ubiquitous on the site. Testing resulted in the recovery of 4,314 bones and shell. Species identified are bison, cow, white-tailed deer, dog, pig, sheep/goat, fox species, chicken, turkey, mallard duck, goose species, pigeon, catfish species, gar species, soft-shell turtle, turtle species, buckhorn, mucket, and brown wood snail. Mammal bones make up 90 percent of the collection. As ranked by minimum number of individuals pig (11) is the primary species, followed by deer (6), cow (5), sheep/goat (2), bison (2), dog (1), and fox (1). Warner notes that while a large number of deer elements are present, there is also a distinct lack of diversity of wild species in the collection. He suggests that the pattern of exploitation may indicate that the feeding of salt workers was a well-organized affair in which procurement was concentrated on large species that would feed a group of people, meals were prepared by someone specifically assigned the task, and were eaten communally. Warner discerned that cows and pigs were slaughtered at optimum ages for meat yield and were processed at the Omer Adams Site. (Curiously, no evidence of rats or mice was recovered despite the quantities of offal, which must have been present.) The small quantities of bird, fish, turtle, and mussel remains present offered only scant evidence of dietary diversity. The mussels may have been gathered for button making rather than for food. Wood snails recovered almost certainly occurred naturally (Warner 1998).

CONCLUSION

While the Drennon Springs saltworks was one of the less-productive operations in Kentucky, considerable effort and energy was expended in that remote location to produce that valuable product. The documentary evidence of the involvement of the Hite and Hogg families of Virginia in salt making underscores the idea, that while participating in an agrarian economy, some of the earliest American settlers of the Ohio Valley came not to farm but to practice industry. The archaeological evidence of salt making at the Omer Adams Site agreed well with historic descriptions of the components of saltworks. Excavation revealed that massive, well-preserved features lay sealed beneath deposits of alluvium, and that the topography of the Drennon Creek valley was altered by human activity after the salt-making period, principally by the damming of the Kentucky River. Analysis of archaeobotanical samples identified some of the species of trees making up the forest in proximity to the site, and has demonstrated a predictable pattern of exploitation of hardwoods for their superior heat yield. Other plants present, including cultigens, were also identified. Analysis of faunal remains indicated a concentration on large, domesticated species as well as animal processing on-site. The associated artifacts, the small amounts of kitchen refuse, clothing and personal items present, comprise scant evidence of the lives of the anonymous laborers who occupied the site, but support the documentary evidence of an occupation date of ca. 1785-1815.

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