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Uncovering a Mid-Nineteenth Century Maple Sugar Camp and Stone Furnace at the Petticrew-Taylor Farmstead in Southwest Ohio

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Abstract During the middle of the nineteenth century, maple sugar production reached its peak in the United States. Although forgotten today, during the eighteenth and late into the nineteenth century, maple sugar served as the primary sweetener used by American families in food preparation, particularly in the northern half of the country. Maple sugar processing became an integral part of farmstead operations in the Midwest, Northeast, and Great Lakes regions during this period. Sugar's value extended beyond a farm family's subsistence needs, because as a craft product it provided extra income during the off-season. While some historical accounts of maple sugar and syrup production in America exist, little if any physical remains of these early sugar furnaces and/or camps are documented. The results of the excavations at the Petticrew-Taylor farmstead (33MY819) fill this information gap for a maple sugar camp and stone furnace dating to the 1840s to the 1860s in southwest Ohio. They provide important new details on artifacts associated with this site type, perspective on the spatial use of the landscape, and the layout and physical attributes of an early furnace style that represented the experimental and transitional phase to the modern day evaporator.

Maple sugar production in the United States began in the eighteenth century and lasted until the early 1900s, whereupon it was essentially replaced by syrup (molasses) production. During this period of time maple sugar was primarily produced by farmers in 28 states located in the Great Lakes, Midwest, and Northeast regions of the United States (DeBow 1853;

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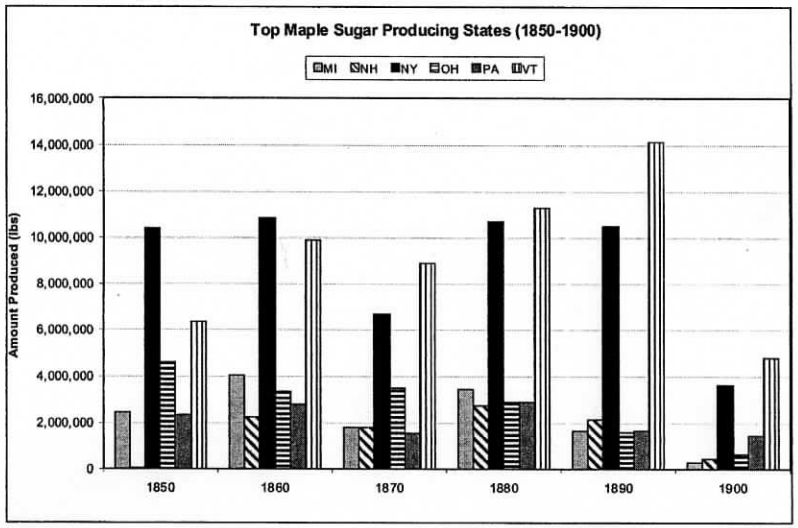

Figure 1. Annual production of top maple sugar producing states between 1850–1900.

Kennedy 1864; Merriam 1902; Porter 1895; United States Department of State [USDS] 1841; Walker 1872, 1883). The leading maple sugar producing states were Vermont, New York, Ohio, Michigan, Pennsylvania, and New Hampshire. Figure 1 shows the annual production of the top producers between 1850 and 1900. These primary states were making 76 to 96 percent of the recorded maple sugar in the mid-to-late nineteenth century. New York and Vermont were consistently the top producers, while Ohio and Michigan tended to rotate at the third position. During the peak production years of 1850 to 1890, the top states were producing, on average, 34,500,000 pounds of sugar a year before the market fell precipitously and sugar making was replaced by syrup production.

The range of the sugar maple tree *(Acer saccharum)* extends from the north across southern Ontario and Quebec in Canada and throughout the Great Lakes, Midwest, and Northeast regions of the United States (Little 1993). Northern farmers used maple sugar tree groves as supplementary income during the off-season. Manufacture of maple sugar was conducted in an individualistic manner with each farmstead processing its own sugar (McMurry 2001). This contrasts with sugar production in the southern states, which used sorghum and cane, and often had processing centers used by numerous families in a community or region (Hemmerly 1983; Wigginton 1975). Consequently, in the Great Lakes, Midwest, and Northeast,

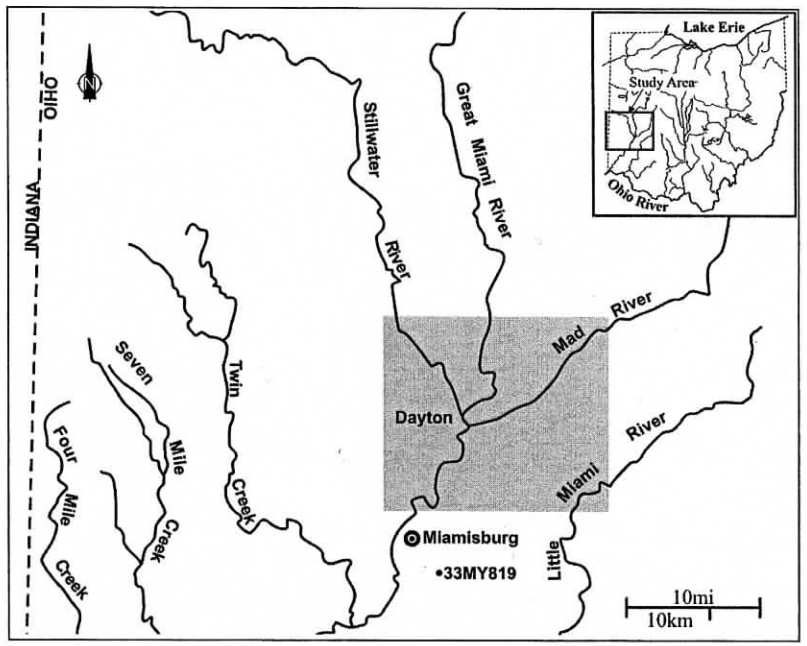

Figure 2. Regional map showing the general location of the Petticrew-Taylor site in southwest Ohio.

there should be archaeological evidence of maple sugar production at many nineteenth century farmsteads.

Prior to conducting fieldwork at the Petticrew Taylor site (33MY819), a mid-nineteenth century maple sugar camp containing a stone furnace located in southwest Ohio (figure 2), researchers sought previously published archaeological research on maple sugar camps in the Midwest, Great Lakes and Northeast to help establish some expectation of what might be found at such a site. It rapidly became clear that very little archaeological research had been published. Most of the available literature involved research on the possibility of prehistoric Native American production of maple sugar and/or more recent Historic Period production by upper Great Lakes tribes (e.g. Chippewa, Potawatomie, etc.) (Holman 1984, 1986; Loftus 1977; Mason 1985, 1986; Mason and Holman 2000; Thomas and Silbernagel 2003).

Thomas and Silbernagel's (2003) work on maple sugar camps on Grand Island in Michigan is a notable exception as their archaeological research focuses on nineteenth to early twentieth century Euroamerican sugar camps.

Their investigation provides details and landscape information on several abandoned early to mid-twentieth century sugar camps. Some history of the development of sugar making is provided, particularly for the Grand Island area, but it is not regional in depth. Their focus was on camp layouts, buildings, and equipment associated with the early twentieth century. A number of camps and sugar house photographs are provided in their article and there are invaluable descriptions of evaporators and brick furnaces that are described as located inside a sugar house. No actual excavations were performed.

The authors lamented the fact that so little archaeological research had been conducted on maple sugar camps in the Great Lakes region, few had been recorded, and many were ignored by governmental agencies and/or Cultural Resource Management (CRM) related surveys. Those that were recorded were, in their opinion, typically "written off" with no additional excavations/research, or any justification as to why they were insignificant (Thomas and Silbernagel 2003: 138).

The same holds true for Ohio, which also has few recorded sites or camp related structures (e.g. sugar houses, etc.). An examination of the Ohio Archaeological Inventory (OAI) Ohio Historic Inventory (OHI) records maintained by the Ohio Historic Preservation Office yielded minimal results. The OHI contained just two recorded early twentieth century sugar houses while documentation in the OAI included seven recorded maple sugar sites in Portage and Geauga counties of northeastern Ohio. Four of these sites were recently examined with a reconnaissance level CRM investigation that involved surface inspection and some shovel testing (Biehl and Pecora 2008).

Of particular interest to our research at the Petticrew-Taylor site were the findings of foundation debris piles at two Geauga County sites, 33GE33 and 33GE34. Both sites contained two rectangular or square fieldstone piles, and scattered handmade brick debris (scattered brick was also noted at the Petticrew-Taylor site). The debris piles were interpreted as possible "hearth platforms" for boiling syrup. At 33GE33 it was indicated that the debris piles were no more than 25 cm (9.8 in) in height. The general dimensions of these debris piles ranged from 3 m to 5 m (9.8 ft by 16.4 ft) in width to 4 m to 6 m (13.1 ft to 19.6 ft) in length. This was similar to the dimensions of the debris pile associated with the Petticrew Taylor site, which was 5 m by 7 m (16.4 ft by 23 ft). Both 33GE33 and 33GE34 were located 30 m (100 ft) from a small stream, again, like the Petticrew Taylor site. The Biehl and Pecora (2008) survey found no artifacts at the sites or any associated historical information. No excavations of the debris piles were conducted.

The state records demonstrated a noticeable lack of archaeological information on maple sugar camps in Ohio for an industry that was very important and common to the rural agricultural landscape of the state during the nineteenth century. The absence of any established in-depth archaeological study for maple sugar sites in Ohio or for that matter the greater Great Lakes region provided an opportunity for the intensive investigation at the Petticrew Taylor site to establish a comparative data base and investigative approach that could be drawn upon by future researchers. An exhaustive study of CRM or unpublished conference literature outside of Ohio was not conducted, so information from these resources may exist for other regions.

The Petticrew Taylor site

The Petticrew-Taylor site was originally identified in 2004 for an Ohio Department of Transportation (ODOT) road realignment of Byers Road in Miami Township, Montgomery County, Ohio (Sewell and Hampton 2008) (Figure 2). The site is located in a wood lot on the western edge of the acreage of a former farmstead and is bordered by agricultural fields to the east and south. Modern housing developments lie adjacent to the west and north of the wood lot. The local area, once dominated by farms and woodland, is now rapidly becoming urbanized with the expansion of the cities of Miamisburg and Dayton to the north.

The Petticrew-Taylor site was initially described as containing several surface scatters of redware and a partially exposed limestone foundation (a .9 m long section) on a small rise containing brick fragments and fill dirt. The scattered redware was mainly represented by heavy rimmed crock debris, while the foundation was situated approximately 30 m from a small stream. Due to the isolated nature of the foundation and the lack of any artifacts reflective of a residential midden, the site was interpreted as a nineteenth century maple sugar camp. The redware crock scatters were interpreted as possible "sugar crocks" associated with a sugar house foundation (Sewell and Hampton 2008). Additional assessment of the Petticrew-Taylor site in late 2008 (Keener et al. 2008) involved more intensive archaeological excavation and historical research with the goal of verifying whether the surface scatters and foundation were indeed a maple sugar camp.

The following text provides a historical context for the history of maple sugar processing which acted as a guide to defining the type of landscape features and artifacts that are likely to be encountered at this particular site type during an archaeological investigation.

Historical Context and Evolution of Maple Sugar Processing

Pancakes and maple syrup represent one of the modern day iconic staples of the breakfast menu for a typical American. Yet most American consumers probably do not realize that maple syrup was originally a secondary product of the sap processed from maple trees. During the colonial period and up to the late nineteenth century, production of maple sugar was the primary goal. Throughout this period, maple sugar, not cane sugar, was the mainstay sweetener for the American population in the northern half of the United States. In the south, sorghum and cane sugar became predominant by the mid-nineteenth century (Hemmerly 1983; Wigginton 1975). An early advocate of maple sugar was Thomas Jefferson (Jefferson 1895; Stanton 1990), who wanted America to become self sufficient and also envisioned that maple sugar could replace cane sugar and consequently end the need for slavery in the West Indies.

In general, historical records attribute the invention of processing maple sugar to Native Americans, (McMurry 2001) although there is some debate in archaeology as to when Native American tribes began using maple sap (Holman 1984, 1986; Loftus 1977; Mason 1985, 1986; Mason and Holman 2000). In any case, the early method of making maple sugar (by Native Americans and early settlers) involved the use of a hatchet cut or gash into a sugar maple tree and the placement of bark containers or wooden troughs at the base of the tree to collect the sap. The wooden trough was then used to hold the sap into which heated stones were placed to bring the liquid to a boil and evaporate the water content. The sap was stirred and continually heated until sugar was made (McMurry 2001). Sugar was then sold as "grained" a coarse granulated sugar similar to brown sugar, or poured into wooden molds at the end of the heating process and allowed to harden into "cakes" or "blocks" (Jefferson 1895; McMurry 2001; Massachusetts Maple Producers Association [MMPA] 1999).

Site selection for the boiling down process remained constant through time. Camp sites were placed near a water source such as a small stream, which was used to clean the sap collectors (troughs, buckets, etc.) and boiling hardware (e.g. buckets, pans, etc.) through scalding. Elevated well-drained rises were also selected for the burn area as wet conditions were a concern during the late winter when the sap begins to run in the trees. The sap runs when temperatures alternate from freezing to thawing sometime between late February to early April varying by region and season (Hills 1907). It takes approximately 35 gallons of sap to make one gallon of syrup or eight pounds of sugar (Perrin 1980; Wieland 2004).

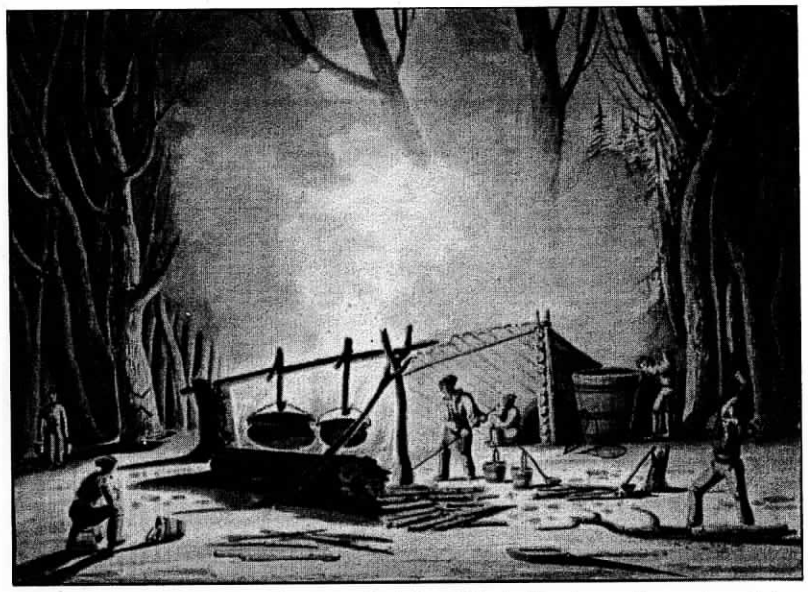

Figure 3. Historical nineteenth century depiction of the boiling down of syrup through the use of kettles (courtesy of the Federation of Quebec Maple Syrup Producers).

By the mid to late eighteenth century, Euroamerican settlers were carving out or hand drilling half-inch holes into trees, into which they placed wooden spiles (often made from pawpaw or sumac branches) from which the sap would better drip into the wooden troughs or bark containers. Sap was then carried to a large iron kettle set over an open fire where it was boiled down to syrup and then finally into sugar (Chamberlain 1907; Hills 1907; McMurry 2001; Ohio Cultivator [OC], 15 March 1847:43). Figure 3 shows the kettle method, which continues to be used to the present day by small scale producers.

In the late seventeenth century to the mid-nineteenth century, Native American tribes and early settlers used maple sugar as a valuable trade item. As Euroamericans pushed into the Ohio region, maple sugar processing became an important part of the American farmstead and sugar bushes (groves) were incorporated into overall management. McMurry (2001:83) indicates that the "woodlot and sugar camp occupied the outer periphery" of the typical Pennsylvania farm. Often viewed as solely producing firewood or lumber, wood lots produced sugar and potash (wood ash used for potash, lye, and soap making) (Paynter 2002). Making sugar enabled farmers to

become self-sufficient and to produce an additional income during months of low productivity over the late winter. During the early to mid-nineteenth century these sugar operations appear to be focused around individual farmsteads, with families making as much sugar as their groves and labor could produce in a season. In 1818, maple sugar was half the cost of cane sugar and with a small population America was able to supply the needs of the burgeoning early nineteenth century nation (MMPA 1999).

New production techniques continued to be developed. By the early nineteenth century, multiple kettles (typically three) were being used to boil down the sap (Chamberlain 1907). This quickened the evaporation process. Collection techniques also became more refined. Wooden buckets and eventually metal buckets began to be used and the spile was replaced with the metal spout from which the bucket could be hung (Chamberlain 1907).

At the Petticrew-Taylor site, and within the southwest Ohio area, redware appears to have been locally popular and wooden spiles continued to be utilized. A number of redware potteries in nearby Warren County, Ohio (just southeast of the site location) produced notable amounts of "sugar crocks," two of which are on display at the Warren County Historical Society (WCHS) (Figure 4). The WCHS display notes that the Merrittstown pottery in Warren County produced 10,000 redware sugar crocks for sap collection (Western Star [WS], 10 January 1845). Greg Shooner (personal communication 2008), a local expert on Warren County redware, found one other published reference to advertised sugar crock sales at the Merrittstown pottery in 1843 (WS, 1 December 1843). The primary literature on maple sugar/syrup production (e.g. Chamberlain 1907; Hills 1907; McMurry 2001; Thomas and Silbernagel 2003; Ware 1993) and various secondary sources (e.g. MMPA 1999; Wieland 2004) does not list any type of earthenware containers used as sap collection hardware but rather exclusively bark containers, wooden troughs (keelers), and wooden and metal buckets. However, in addition to the nineteenth century advertisements, three other local references describe the use of earthenware crocks in the southwest Ohio area (Bogan 1993, 1996; Charlotte's Web of Illusion 2008). One reference is to the recollections of Laban Becker Harley presented on a family web page (Charlotte's Web of Illusion 2008). Laban was born in 1859 in the town of Union, just north of Dayton. He describes to his grandchildren how maple sugar was made in the late 1870s. In reference to crocks he indicated that:

> We kept a couple hundred two gallon crocks in the attic of the old wash house between seasons and in the spring when the season came in we had to bring these crocks down and wash them. We hauled them to the woods and placed them at the root of the trees. We would often do that when there was still snow on the ground so we could haul them on a large home-made sled to the woods, a distance of a quarter or half mile [Charlotte's Web of Illusion 2008].

Figure 4. Photo of two "sugar crocks" on display at the Warren County Historical Society (courtesy of the Warren County Historical Society).

Another account is an early to mid-nineteenth century description provided by John Quincy Smith on maple sugar making in Clinton County, Ohio.

> After 1830 earthen crocks, costing 6 or 8 cents and holding about two gallons each were used. They were cleaner and better than troughs but if a sudden freeze came when they were full of water, a great many would burst, and nearly every year a new supply of crocks would be purchased to make up the loss from breakage [Bogan 1993:35].

When buckets or crocks were checked and the sap collected, it was dumped into a barrel sometimes referred to as a hogshead, which was placed on a horse drawn sled or wagon (Bogan 1993; Charlotte's Web of Illusion 2008; Thomas and Silbernagel 2003). Two buckets were often easily carried on either end of a shoulder yoke, but crocks most likely had to be carried one at a time (McMurry 2001). Heavier than buckets, and often lacking handles, crocks were more bulky and fragile. The lack of handles allowed for the multiple stacking of these vessels and easier off season storage

(Figure 4). The barrel of sap water was then transported to the kettles for boiling and the process repeated.

Archaeologically, this early stage of maple sugar production (eighteenth to early nineteenth century), has a low visibility, as it relied on boiling sap in kettles over a fire. Much of the sap collection hardware was made of wood, such as the bark or wooden containers and spiles, which are unlikely to have survived to the present day. Evidence of some items, however, such as the metal bindings of buckets and barrels, metal spouts, and kettles can be found scattered across a former grove area if they were left at a site. Redware ceramic debris, although apparently of limited regional use, should have the best chance of being recovered as it does not deteriorate like wood or metal hardware. The burn areas for boiling are not likely evident on the surface, but burnt soils and ash should be present from the intense heating event and can be found with test units or soil probing. Nonetheless, finding a burn area through a standard 15 m (50 ft) test unit grid, as used for reconnaissance level surveys in Ohio, or even a 7.5 m (25 ft) grid is a difficult endeavor. Much of the sap collection debris is likely to be scattered and in the case of metal items, probably badly corroded and unidentifiable. Standard shovel test techniques may easily miss these items or recover a small number of artifacts, which could be misinterpreted as secondary refuse deposits. Evidence of tapped trees for these older sites is also unlikely due to the amount of time that has passed. Trees from this period have been cleared for lumber or have died from natural causes.

In the 1840s maple sugar producers began to experiment with new heating techniques that led to the development of the stone or brick furnace, sometimes called an "arch" or "long furnace" (Bogan 1993, 1996; Chamberlain 1907; Ericksen and Mann 1947; McMurry 2001; MMPA 1999; OC 1847:43; Wieland 2004). The earlier versions of these arches appear to have been made of stone. An "old" stone furnace (arch) from Ohio as depicted by Chamberlain (1907:431) is presented in Figure 5. These furnaces were a substantial improvement over the evaporation process as they could hold between five to 12 kettles "holding ten to fifteen gallons each" (Bogan 1993:35). The kettles were set inside the interior channel of the furnace or straddling the channel. It appears that during this time (the 1840s to 1850s), sugar producers began to add rectangular tin evaporators to the process such as described by Laban Harley (Charlotte's Web of Illusion 2008). Some of these furnaces were protected with a skeletal frame roofing or a shed (early sugar house), but many appear to have been out in the open with no protection. Below is the most detailed physical description of one of these early furnaces of Ohio.

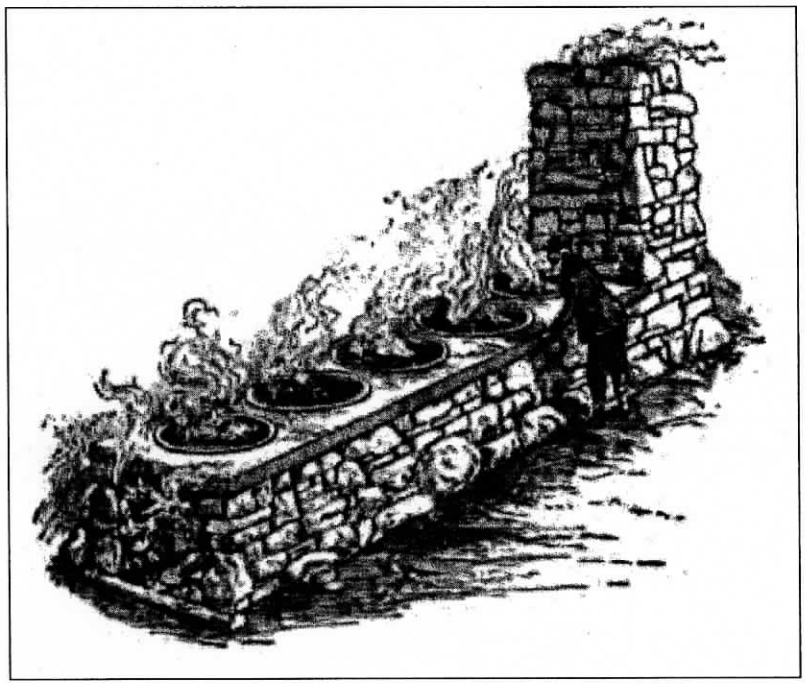

Figure 5. Drawing of a stone furnace "Old-fashioned arch" and "kettles" of the mid-nineteenth century (Chamberlain 1907:431).

Look out some convenient spot, on a gentle rise, where you can make a furnace or flue.....it will draw better if it fronts the prevailing winds.

To construct the flue, commence your ditch for its reception, two or three feet above the foot of the rise, and make it 4 or 5 feet wide at the top, or sufficient to allow of its being two feet wide at the bottom; let the bottom of the ditch (and the flue) slope a little upwards so that you can more closely rake out coals and ashes, and prevent the entrance of water; it will also draw better. Build the walls of brick or stone, 18 or 20 inches high, drawing the sides in a little as they advance to this height; then at about 2 1/2 feet from the mouth lay upon each wall a stone (if you have stone) say 20 inches long, 9 to 12 wide, and as many thick; if you have no stone build abutments of brick of the same dimensions, so that the bottoms of the kettles when set, will be about 16 inches above

the bottom of the flue. Then snugly fit the ear sides of the kettle into the stone or brick so that when the work is finished the run [rim?] of the kettle may be about an inch above the whole work. Put on two more stones, or abutments of brick, so that your second kettle may touch the first and the run [rim?] be half an inch above it; fill in spaces around the kettles snugly with brick, and see that each kettle is set level; go on in this way and set as many kettles as you please; but the number should not exceed seven in so narrow a flue. Cover the whole flue with well tempered clay or lime mortar to within about an inch of the top of the kettles, put a piece of iron across the mouth of the flue-or a good stone will answer; if iron, cover it with stone or brick, and with mortar as before directed. Finish the other end of the flue in the same way; or close by drawing the side walls together, about two feet beyond the last kettle, and there raise a chimney, with a throat 10 or 12 by 18 by 20 inches, and as high as you please. Some who wish to be saving of fuel make the chimney only about a foot high and place a small kettle over the top, but it is disagreeable work to tend it.

When the furnace is finished the top of the kettles should not be more than a few inches higher than the surface of the ground on each side, for convenience of filling and tending them.

Each kettle of 16 to 18 gallons will boil syrup from 140 to 160 gallons of water, [sap] in 34 hours, if well attended with dry wood. Use one of your kettles as a heater and keep the rest boiling all the time.

Two active hands will finish the whole of these preparations in a day, if the material are ready at hand. The furnace should not cost over $1.50 if stone is convenient,.....and will last seven years if properly taken care of [OC 1847:43].

Several other accounts indicate some variations with the stone or brick furnace yet they remained structurally similarly (Chamberlain 1907:431; Charlotte's Web of Illusion 2008; Erickson and Mann 1947:1; McMurry 2001:101; Ohio Farmer [OF], 25 February 1882:129; Wieland 2004). When mentioned, furnace dimensions generally are reported as 4.26 to 4.57 m (14 to 15 ft) long by 1.22 to 1.52 m (4 to 5 ft) wide. The structure contains a long linear double walled foundation with interior flue channel, providing a platform on top of which (or inserted into in some cases) were placed kettles and rectangular tin evaporator pans. In Laban Harley's accounts, they set upon their furnace "a big pan six feet long, three feet wide and ten inches

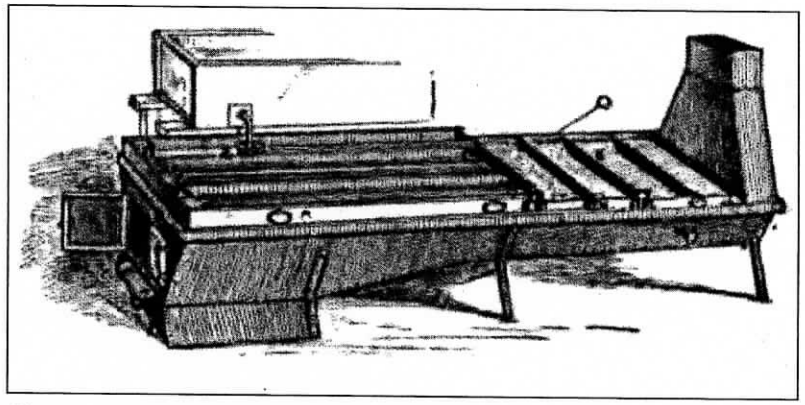

Figure 6. Drawing of an early twentieth century iron evaporator (Chamberlain 1907:431).

high...and one kettle between the pan and the chimney" (Charlotte's Web of Illusion 2008). The furnace foundations were not built too far above the surface of the ground, "were usually located near water, within range of the wood's edge, and frequently at the base of a hill" (McMurry 2001:101). Furnaces could have a protective roof or shed associated with them.

These furnaces represent a substantial improvement on the evaporation process and represent a transitional experimental stage where local sugar processors honed their skills. During the 1840s to the 1860s, maple sugar production increased dramatically with 1860 representing the peak year of maple production in the United States. A total of 40 million pounds of sugar and 1.6 million gallons of syrup were reported (MMPA 1999). In 1860, a tariff on imported sugar is reported by the *Western Star* (1862) as creating an opportunity for local farmers to make maple sugar and sorghum molasses in the upcoming season.

With the increase of maple sugar production it comes as no surprise that the long furnace arch design was patented by D. M. Cook in 1858 and called the Cook's Evaporator (OF, 9 April 1859:116). Figure 6 shows an early twentieth century version of the iron evaporator. Chamberlain (1907) describes these furnaces as measuring 4 by 16 feet (1.2 by 4.9 m), similar in size to the stone furnaces. By 1869, these evaporators were manufactured in large quantities in Cincinnati (OF, 14 June 1865:180; OF, 21 August 1869:542; Rhode 2005).

While this device allowed for the growth and commercialization of maple sugar production, it appears based on historical accounts and landscape evidence that many local farmsteads continued to make their own furnaces

Figure 7. Photograph of an early twentieth century brick arch furnace from Illinois (courtesy of the Catlin Historical Society).

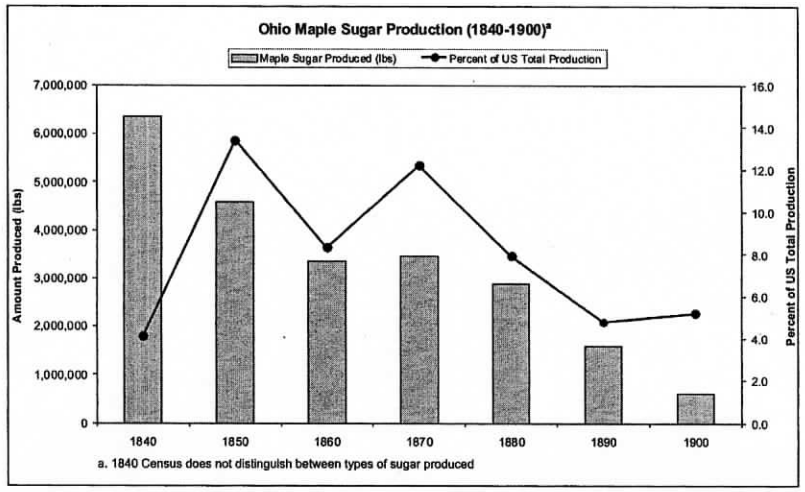

Figure 8. Ohio maple sugar production amounts and percentages between 1840–1900.

out of brick or stone (Charlotte's Web of Illusion 2008; Wieland 2004). Figure 7 shows a family operated brick arch furnace dating to the early twentieth century from Illinois.

The importance of the maple sugar industry in the mid-nineteenth century in Ohio is evident in the US census records for 1840 to 1900 (figure 8) (DeBow 1853; Kennedy 1864; Merriam 1902; Porter 1895; USDS 1841; Walker 1872, 1883). While higher totals appear recorded for 1840, Ohio production appears to stabilize between 1850 and 1880 and represents 8 to 13 percent of the United States' total production of maple sugar over these years. Within Ohio, Montgomery County typically produced only 1.3 to 2 percent of the state's maple sugar production. The amount of sugar produced appears to flatten out between 1850 and 1880 (figure 9). It is evident that sugar was not the only item produced as records were kept on maple molasses (syrup) as well. Molasses appears to be the first reference to actual syrup production. The 1860 United States Agricultural Census, Manuscript Schedules (USAC, MS) noted that 3,090 pounds of maple sugar was produced in Miami Township, and Montgomery County as a whole, led the state in maple molasses production this year and was reported as second in the state in 1870 (Walker 1872). With the increased production and development of new technology it is during the mid-to-late nineteenth century that the sugar house begins to be a common element of the process. The structures were more substantial, fully enclosed, and typically had roof

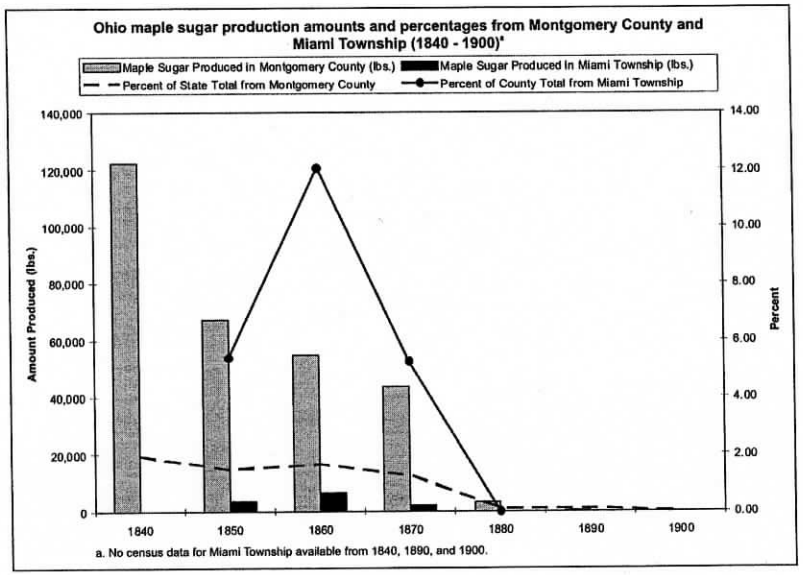

Figure 9. Montgomery County and Miami Township, Ohio maple sugar production amounts and percentages.

cupolas for ventilation as the furnace/evaporators are placed inside, which required a chimney (Thomas and Silbernagel 2003).

The development of the arch furnaces means, archaeologically, there should be better evidence of a mid-to-late nineteenth century maple sugar camp on the ground surface. Based on the *Ohio Cultivator* (1847:43) these structures had a use-life of about seven years. Stone material such as limestone and sandstone begins to degrade or become friable with the continued application of intense heat. Use wear along with exposure to weathering, for those furnaces not roofed, led to their eventual failure with wall or chimney collapse. Material failures could be repaired but once a furnace was abandoned the structure would begin to degrade and collapse.

While intact furnaces for this period could be present on the landscape, it is more likely that most of these sites are evidenced by stone or brick debris piles that represent the collapsed walls of the furnace. It is probable that at most of these debris piles, if excavated, the base of the furnace foundation and portions of the walls are preserved intact. By 1875, metal buckets replaced wooden buckets in sap collection, and consequently, leave additional surface evidence of maple sugar activity. In addition to kettles, the large evaporator pans and later iron furnaces (termed evaporators) suggest that

more metal will potentially be evident on the ground surface, which may be identified during a survey. The sugar house is another element to look for on the landscape, either as a standing structure or as a collapsed ruin (Thomas and Silbernagel 2003).

Even as improvements to furnaces were occurring, the demand for sugar due to increased population growth was outstripping production. Another detriment was the unpredictable element of the weather, which contributed to highly variable annual sap totals. Nationally, maple sugar production appears to have peaked in 1859 when over 40 million pounds were produced, dropping with some fluctuations to a level of 33 million pounds in 1889. Ohio's production trends mirrored the nation, peaking at 8.2 million pounds of maple sugar in 1862, declining to slightly over 2 million pounds by 1873 (Annual Reports of the Secretary of State, Ohio [ARSS] 1873: 239). In 1880, cane sugar and maple sugar were approximately equal in price and by the late 1880s, the import tariff on cane sugar was removed and cane sugar out-sold maple sugar (MMPA 1999). Also related to the decline of maple sugar was the rise in popularity of maple syrup around this same time, which resulted in an increased focus on maple molasses and syrup production. While Ohio was the nation's largest maple syrup producer in 1889, aggregate volume declined during the period from 1860-1890. In 1890, Ohio and seven Midwestern states accounted for 53% of the nation's maple syrup production, but only 11% of the total maple sugar output (ARSS 1873: 239). As a result of these changes, manufacturers began to specialize on maple syrup evaporators such as the G. H. Grimm "Dropped Down Flue Evaporator" (Hudson Historical Archives [HHA] 2006).

In 1882 W. L. Chamberlain, the secretary of the Maple Sugar Maker's Association presented a lecture on "Maple Sirup" and urged farmers to switch from sugar production to syrup production in order to be more profitable. "In simple sugar for sweetening, we can not compete with the cane sugars, and hence, in my own bush I make only sirup" (OF 1882:129).

Chamberlain was right, as the gradual decline in Ohio's aggregate maple sugar output corresponded to increases in cane sugar output, where "highly improved machinery" was accelerating production. In 1890, for example, over 290 million pounds of cane sugar were produced in Louisiana, while Vermont, the nation's largest maple sugar processor, yielded 14 million pounds. Ohio's maple sugar production appears to have peaked at over 8 million pounds in 1862, followed by a steady decline to 1.5 million pounds in 1890. Still, in 1890, with 727,142 gallons yielded, Ohio led the nation in maple syrup production, far more than New York's 457,658 gallons and Vermont's 218, 252 gallons (United States Department of Interior [USDI]

1890: 70, 403, 419). In the 1890s fewer farms in the Great Lakes and Midwest utilized their sugar groves and those that did, focused on syrup making. After the turn of the century, maple sugar became more of a specialty item and maple syrup became the mainstay product of the industry (Merriam 1902; Porter 1895).

Property History of the Petticrew/Taylor Farmstead

The farmstead containing the Petticrew-Taylor site, was owned by the Petticrew and Taylor families during the nineteenth and early twentieth centuries. James Petticrew obtained the land in 1804 (a house is denoted on the property in 1826 [Montgomery County Records Center, Dayton, Ohio (MCRC) 1826: Deed Book (DB) K:488-492]) and he and his heirs owned the farm until 1857. In 1859, the Taylor family acquired and operated the farm until the mid-1940s. Three years (1850, 1860, and 1880) of the United States Agricultural Census Manuscript Schedules (USAC, MS) contained references to the Petticrew or Taylor ownership of the property. The farm appears to be of average size, ranging from 122 to 146 acres in size over the time of ownership of the two families. Both the Petticrew and Taylor families utilized the acreage as a mixed grain-livestock farm. The Petticrews raised cattle and swine while the Taylors focused on swine. None of the reported years indicated maple sugar operations on the farmstead, although this is a limited window of research. The use life of the stone furnaces were rather short as noted earlier (OC 1847:43) and it is probable that the operation of the Petticrew-Taylor site fell in between census publications or simply was unreported. Although agricultural census figures for 1850 and 1860 indicate no maple sugar or syrup production on the Petticrew-Taylor Farm, adjoining farmers did generate substantial quantities. In 1850, for example, adjoining and nearby farmers produced 1,700 pounds of sugar, while in 1860 farmers listed on the same page as the Petticrew-Taylor Farm accounted for nearly 3,100 pounds of sugar and over 550 gallons of syrup (USAC, MS 1850:815; 1860:21). Between 1850 and 1870, Montgomery County farms were annually producing 55,220 pounds of sugar, on average (Walker 1872).

Maple sugar and maple syrup production in Ohio's southwestern counties declined during the last quarter of the 19th century, while production increased in the far northeastern counties. Sugar production peaked in Miami Township in 1860. In 1873, Montgomery County produced 14,321 pounds of sugar and 13,241 gallons of syrup and by 1880 this had dropped precipitously to 3,125 pounds of sugar in the county, with no sugar production reported for Miami Township (Figure 9). In 1890, production declined

to only 200 pounds of sugar and slightly over 5,000 gallons of syrup, demonstrating the shift to syrup production (Figure 9). In 1873, Trumbull and Portage Counties in northeastern Ohio together produced 62,000 gallons of syrup; by 1886 production had jumped to 220,000 gallons. Ashtabula, Geauga, and Portage Counties had over 967,000 trees tapped in 1886, while Montgomery was listed as having 35,460 trees tapped (ARSS 1873: 239-240, 560; 1886). This indicates a shift in the regional output of syrup making showing that northeast Ohio was becoming the focal point of the maple syrup industry within the state. Based on the historical information (the stone furnace, maple sugar and syrup histories, and redware production histories) it is likely that the maple sugar camp and furnace at the Petticrew-Taylor site was in operation sometime between the 1840s to 1860s (MCRC 1826:DB K:488-492; USAC, MS 1850, 1860, 1880).

Fieldwork Investigations and Results

At the start of the field investigations, the foundation at the Petticrew-Taylor site was considered to be a possible sugar house that had a nearby burn area with kettles. Consequently, investigations began with intensive testing around the foundation and the surrounding wood. Initial testing involved a 2.5 m soil probe grid, and a 2 m2 metal detection grid set up on 5 m intervals across much of the site. The goal of this testing was to find any evidence of the presumed burn area (burnt soils or ash) where boiling occurred. The metal detection was used to find possible evidence of metal buckets or kettle fragments. This portion of the investigation failed to find any evidence of burnt soil, and metal detection found no maple sugar related hardware at the site.

An intensive test unit (.25 m2) grid at 5 m intervals was placed around the foundation to obtain a representative artifact sample of this specific area. Again, burnt soils and ash were not detected, but a number of artifacts were collected, primarily represented by limestone foundation fragments and nineteenth century redware fragments. Redware that could be identified to vessel form consisted of storage vessel items (crocks or jars). Figure 10 illustrates the redware counts per test unit.

In addition to the small test unit grid, the wood lot containing the site was visually inspected with pedestrian transects spaced 7.5 m apart. The goal of the pedestrian transects were to find and map any redware or metal sap collection hardware (e.g. bucket, spigots, etc.) that lay on the surface and to record the locations and diameter of sugar maple trees. Surface visibility within this area ranged from 20 to 50 percent with some patchy locations

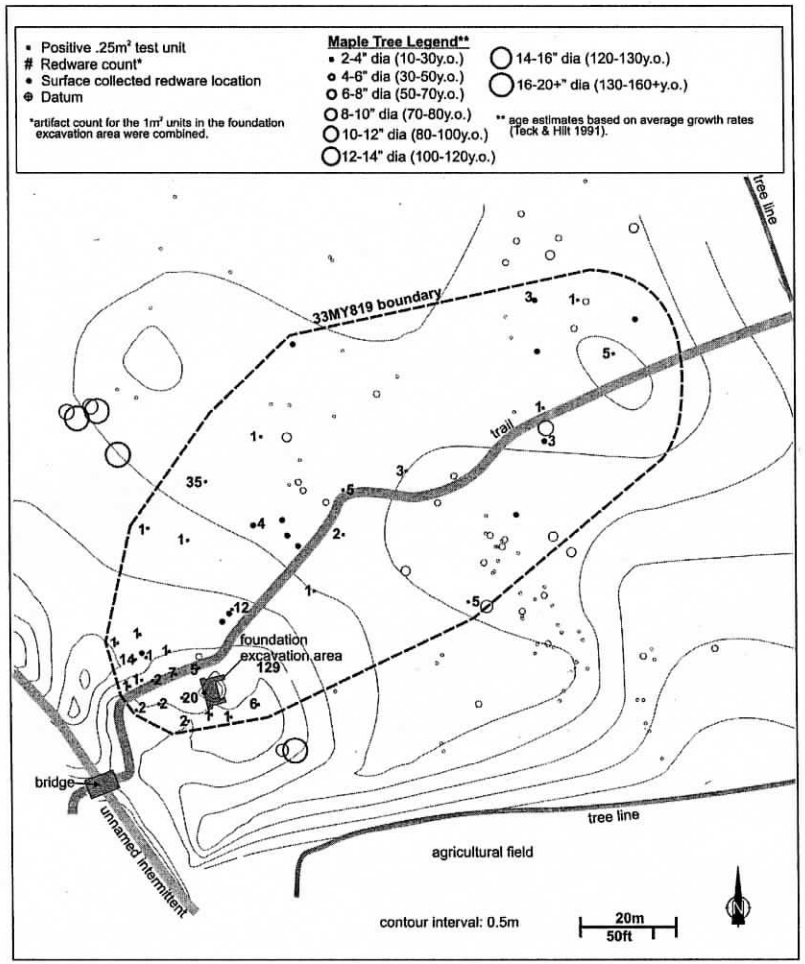

Figure 10. Topographic map showing redware finds (both surface and test unit counts) and maple tree locations.

exhibiting 80 to 100 percent visibility. Maple trees, when identified by their leaves, had their trunk circumference measured and recorded to estimate the age of the trees and to see if any might date to the period of use of site (Teck and Hilt 1991). Small saplings or young trees with circumferences of 5 cm or less were not recorded.

Figure 10 shows both the surface finds and positive test unit locations for redware in conjunction with the current maple tree locations and an old trail that was found to cut through the woods and extend across the front of the foundation. The presence of this trail was important as it was determined it was used to access the furnace and grove area. Relatively few trees (n=6) older than 100 years in age were found. No trees were found to be older than the 130 to 160 year age group. Only two of the trees may have possibly been alive during the operation of the furnace although they would have been saplings. The older trees were situated to the north and south of the site boundaries. Nonetheless, these trees are within 20 m of the site and within 40 m of the access trail. A number of younger trees, particularly trees between 10 to 70 years of age, are located within the central and eastern portions of the site and may represent the remnant ancestors of the nineteenth century grove. Even though no old growth trees that were tapped during the operation of the furnace were noted, the agricultural censuses for 1850, 1860 and 1880 indicated the farm had 66, 55, and 25 acres (26.7, 22.3, 10.1 ha) respectively of undeveloped land represented as woods (USAC, MS 1850, 1860, 1880). The current size of the existing wood lot is 8.6 ha (21.9 acres) which approximates the 1880 total.

Of particular interest is the overall distribution of redware as shown on Figure 10, which also includes totals from the larger test unit excavations at the furnace foundation itself. The redware was highly concentrated in areas beside the old trail (within 30 m of the trail) and at the furnace. Based on these artifact distributions and totals, the trail presumably served as the junction point for sap collection. It is likely that a horse drawn sled traveled along the trail with a large storage barrel (termed a "hogshead") into which sap collected in the redware crocks was poured. Redware is a fragile item and accidents certainly happened between the collection points and trail. A mid-nineteenth century account from Clinton County, Ohio (Bogan 1993:35) indicates that earthenware crocks used to collect sap were prone to "burst" by the freezing of the sap. Consequently, some of the redware concentrations may be indicative of this occurrence. Due to the heavy weight of the crocks and their unwieldy shape (having no handles or a small lug handle), carrying these containers over great distances was likely a hazardous endeavor. The relatively close proximity of redware to the trail supports a targeted strategy where the trail was placed to extend through the heart of the former grove. The location of the furnace appears to be on the western edge of the grove. Its location is strategically associated with advantageous aspects of the landscape such as the small rise and proximity to the stream.

Furnace Excavation

At the presumed sugar house foundation a series of 1 m^2 test units or larger units were excavated to expose the foundation. The excavation was successful in fully exposing a foundation; not from a sugar house, but instead the foundation of a mid-nineteenth century maple sugar furnace. Figures 11 through 15 show various photographs and drawings of the furnace including the interior flue channel. The foundation was L-shaped and composed entirely of dry laid limestone slabs. The use of local limestone was corroborated by another local early nineteenth account (from Warren County, Ohio), which describes a sugar furnace "walled with Clinton limestone...about two feet

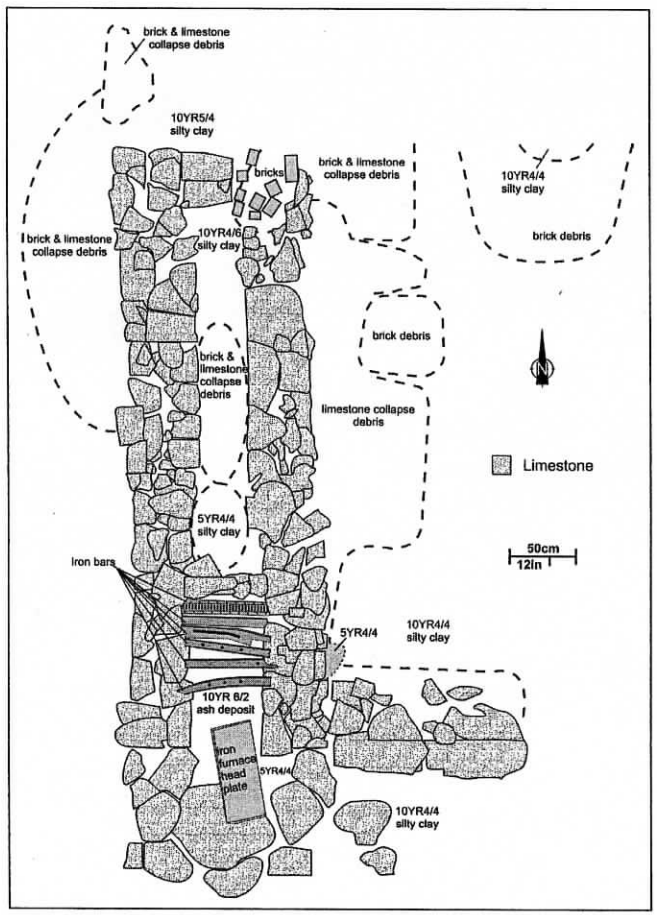

Figure 11. Plan view drawing of furnace foundation and adjacent debris areas.

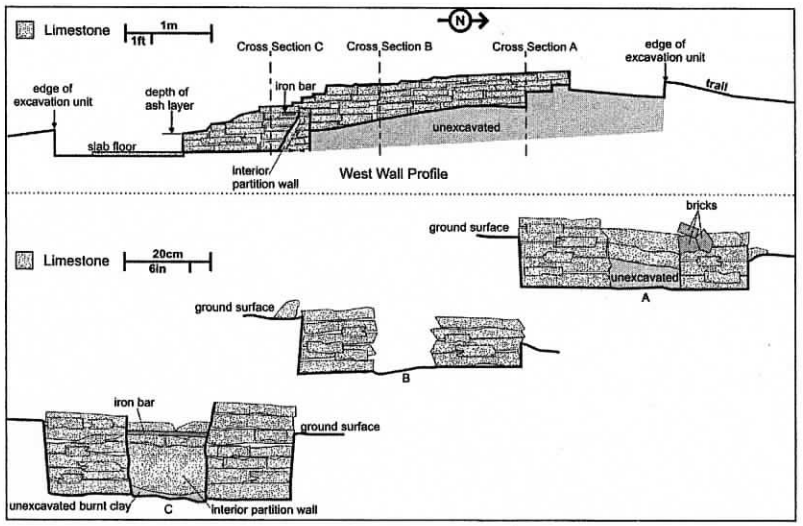

Figure 12. North to south profile drawing of interior channel of furnace and cross-sectional drawings (A–C) of the interior channel.

above the surface of the ground" (Bogan 1996:B1). The main portion of the L, the north to south extending axis, was the actual furnace and was represented by two parallel foundation lines with an interior channel enclosed on the north end, but open on the south end. This configuration is similar to the furnace, depicted in Figure 5, by Chamberlain (1907) and those in other historical references previously presented (e.g. OC 1847:43, etc.).

An interior partition wall that blocked off the southern third of the channel was inside the flue channel, approximately 3.05 m (10 ft) from the north end of the foundation. Just beyond the partition wall were six cast iron bars spanning the channel: two flat and four with I-beam cross section. The northern-most bar was still set in place within the flanking foundation walls. The area in front of the partition wall and lying below the bars contained a distinct ash layer. The south end of the channel was open, although along the base of the entry, there were a number of flat limestone flagstones that formed a square shaped pad area in front of the furnace entrance. Lying on the ash layer partially in the entry was a large metal plate with a molded decorative cornucopia relief (figure 16). This object was interpreted to be the head piece of a cast iron furnace door. The bottom edge of the plate has evidence that a snapped support frame bordered the door. Typically, "the

Figure 13. View of exposed furnace foundation (unexcavated interior channel) from south end, facing north.

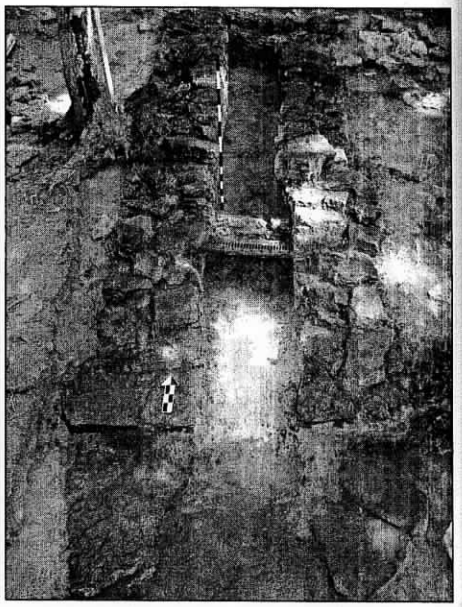

Figure 14. View of furnace foundation from south end after channel excavation (except ash area), facing north.

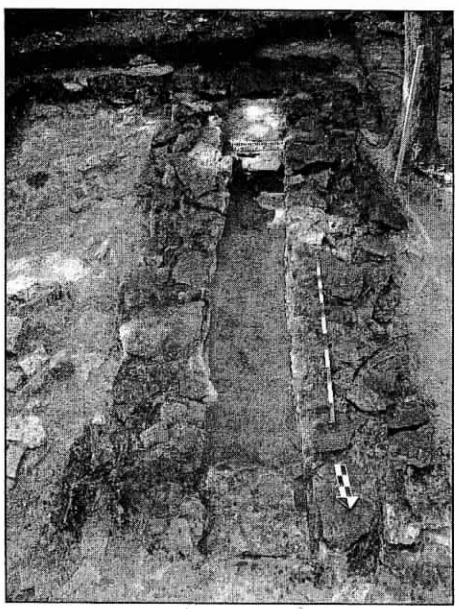

Figure 15. View of foundation from north

mouth of the furnace was closed by a heavy piece of sheet iron for a door" (Bogan 1996:B1).

The main foundation line was 4.43 m (14 ft, 5.25 in) long and the total width is 1.4 m (4.6 ft). The interior channel is approximately 40 cm (15.7 in) in width and ranges in depths of 35 cm to 45 cm (13.7 in to 17.7 in). The shallower feature depths were located north of the partition wall. The foundation ranges from four to five slabs deep to as many as seven overlaying slabs, particularly in the southern half (down slope portion) of the foundation. The subsoil in the interior had been discolored by heat. North of the in-

Figure 16. View of molded relief on stove door head piece.

terior partition, the soils ranged from a yellowish red (Munsell 5YR5/6) to a strong brown (7.5YR5/6) silt clay. In the channel area south of the partition wall, below the ash deposit, the subsoil consisted of a reddish brown (5YR4/4) to yellowish red (5YR4/6) burnt clay. The limestone foundation walls also exhibited heat damage and discoloration, particularly the partition wall and the west and east walls extending south of the partition. The rocks exhibited a yellowish red 5YR4/6 coloration and were very friable.

Based on these findings, the area from the partition wall to the south entry was considered the firebox area where wood was burned to heat the furnace. Wood charcoal was noted in the ash, not coal. It was at first considered odd that no ash piles were noted on the surface or in any of the test units and probes surrounding the foundation. A significant amount of fuel wood is used during the maple sugar or syrup season, and ash piles should be present if ash was thrown away. However, during the early and mid-nineteenth century wood ash was considered a valuable commodity for the production of potash. Farmers, in particular, sold wood ash to local potash works where the ash was converted to potash to be used in soap making. This changed by the late eighteenth century, apparently in relation to the increased maple sugar production.

> Eventually, though, even in high-yield areas settlers stopped selling ashes to British-owned works, for, as a Boston-based potash maker lamented in 1771, "Our [suppliers] have got into the way of

making up their own ashes into salts in the kettles they get to make [maple] sugar in and they find they turn their labor as well as their ashes into money so there is no getting their ashes" [Paynter 2002:1].

By the early nineteenth century, farmers did not have time to turn the ash into potash, and improvements in furnace technology saw potash production turn back again to the small village potash works. Farmers brought their ashes to the local village, selling clean ashes for as much as $.15 per bushel. The United States was the world's leading producer of potash until the 1860s when mined natural deposits in Germany brought the U.S. industry to an end (Paynter 2002).

The cast iron bars that lay across the flue channel served as a platform for split wood. Modern steel evaporators use iron bars as grates to hold wood, allowing the ash to drop below to the bottom of the box. This keeps the fire from being smothered and provides for easy removal of the ash. The area north of the partition wall acted as an open channel in or on top of which kettles or evaporators were placed (Chamberlain 1907; OC 1847:43). Hot air traveled up this channel to the north end where there would have been a brick chimney. The presence of a chimney is surmised from brick debris (mainly whole, hand molded types), which were scattered on either side of the northern half of the foundation and inside the interior channel.

In addition to brick debris, a substantial amount of limestone slab debris was found adjacent to and on top of the foundation area, as well as inside the interior channel. What was exposed of the furnace likely does not represent the original vertical height of the structure. However, historical references indicate that the walls of these furnaces were generally not higher than .5 m (20 in) since the top of the furnace acted as a resting platform for the kettles or evaporators. The resting platform had to be made to a height that provided convenience for the pouring of sap from one container to another. Consequently, knee level or just below was the ideal height to facilitate the lifting of heavy liquids off the platform (what is termed the "arch").

Another interesting aspect of the furnace foundation is that it was placed on the side slope of a small rise with the furnace opening on the down slope end and the chimney on the top of the rise, just as recommended by the historical texts previously cited. Figure 12 shows that the base of the south end of the channel is approximately 85 cm (2.79 ft) lower in elevation than the north end of the foundation. With the heat source on the south end of the furnace, the upslope grade of the foundation drew hot air upward along the channel and increased the air circulation producing hotter temperatures.

The south end of the furnace points southwest toward the prevailing winds. This provided additional air intake and helped insure that smoke from the chimney blew away from and not over the furnace.

Finally, the short leg of the "L" consisted of a single limestone foundation wall that extended 1.65 m (5.4 ft) to the east. It contained two overlaying stone slab layers. It may have contained additional overlying layers as limestone debris was found above the foundation and south of the foundation (representing probable collapse debris). While the exact function of the wall is unknown, it may have served as either a retaining wall or a potential resting platform for kettles or storage items.

Artifact Assemblage

Aside from the limestone and brick fragments (n = 2,982), the two dominant artifact types associated with the operation of the furnace were redware fragments (n= 340) and square cut nails (n=35). The square nails were mainly found at the foundation area and may indicate some kind of wooden platform area for setting crocks or kettles, perhaps along the east "L" foundation. The nails may also be related to other auxiliary wooden features associated with the furnace operation such as a wooden cistern box that allowed fresh sap to be stored next to the furnace and to drip into pans or kettles on the furnace. Nails could also indicate the presence of a "stirring off" trough where thick syrup or molasses was "stirred until it granulated and formed sugar" (Bogan 1996:B1).

The redware assemblage as a whole can be broken down into 267 body sherds, 11 base sherds, 27 rim pieces, and 35 small unidentifiable sherds. A total of 209 of the body sherds, 9 bases, and 15 rim pieces had interior glazing only, one body sherd had no exterior or interior glazing, one rim piece had both interior and exterior glazing, and 73 pieces had exfoliated interiors. Sugar crocks used in sap collection had interior glazing (Greg Shooner, redware specialist of Warren County, Ohio, personal communication 2008), and based on the two examples on display at the WCHS (figure 4), had no exterior glazing. The crocks at WCHS have similar physical attributes that include an orifice diameter of 25 to 27 cm (9.8 to 10.6 in), a vessel height of 21 cm (8.26 in), a 17 to 17.5 cm base diameter (6.7 to 6.9 in) and both hold 7.5 liters (2 gal) in volume.

The redware rim pieces from the Petticrew-Taylor site were represented by two types: a thick/wide single collared rim (n=10 [50 percent]), and a thick/wide double collared rim (n=10 [50 percent]) (figure 17). The remaining rim pieces (n=7) were too exfoliated to classify. The single collared rims

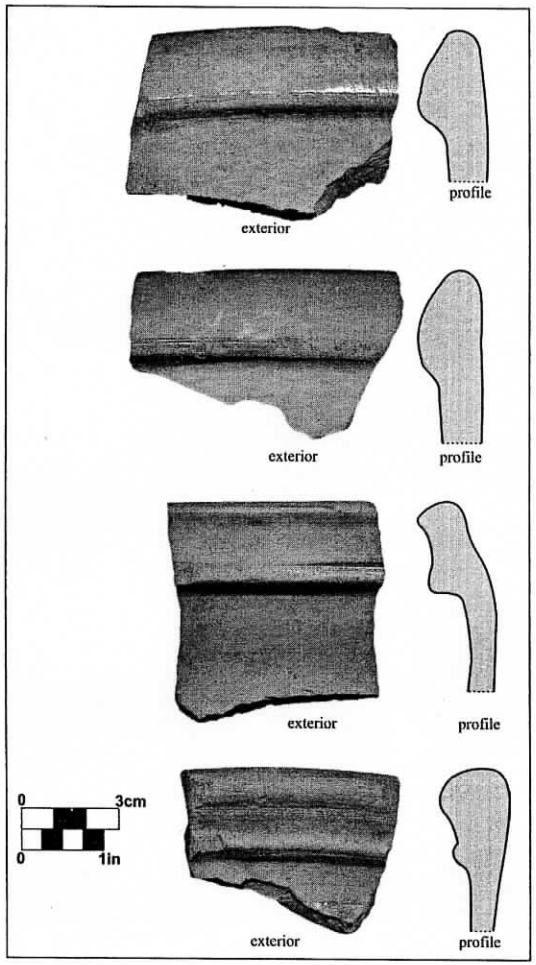

Figure 17. View of dominant redware rim styles found at Petticrew-Taylor site.

represent crocks while the double collared rims appear to be a mixture of crock and jar vessel types. Crocks are defined as having wider orifices and flaring sides as demonstrated by the WCHS exhibits, while jars are more straight sided, sometimes narrowing toward the neck of the vessel and have smaller orifice diameters. Redware jars on display at WCHS had orifice diameters of 20 to 22 cm (7.8 to 8.6).

Shooner was able to view scanned images of a number of the rim pieces. Although he could not conclusively determine the exact function of the vessels, he noted that the heavy collared rims were indicative of the sugar crocks

made by the redware potteries in Warren County. Sugar crocks had wide collared rims and those at the WCHS were both 3.3 cm (1.29 in) in width, which is close to the range of 3.04 to 3.18 cm (1.2 in to 1.25 in) exhibited by the crocks recovered from the Petticrew-Taylor site. The redware pottery industry in Warren County appears to have been a major supplier of sugar crocks to the southwest Ohio region based on the advertisements in the *Western Star* and numerous redware potteries in the county. The redware pottery industry in Warren County began in the late 1790s to early 1800s and lasted to around the 1870s when production ceased (Greg Shooner, personal communication 2008).

Conclusions

The Petticrew-Taylor maple sugar camp contains a representative example of the early stone arch furnaces that appeared just before the invention of the iron evaporator and the eventual decline of the maple sugar industry. This investigation reconstructed in detail the layout of a sugar camp comparable to early historical descriptions as well as more fully documented early twentieth century camps (Thomas and Silbernagel 2003). The maple sugar operation at the site began with the establishment of a trail that apparently extended through the center area of a former maple grove. The building of the furnace took advantage of a small rise near a stream at the southern end of the wood lot. The redware scatters concentrated along the trail represent evidence of sap collection activities associated with former maple tree locations. Local advertisements and references support the use of redware crocks for sap collection, apparently unique to southwestern Ohio and probably tied to the regional redware industry (Bogan 1993, 1996; Charlotte's Web of Illusion 2008; WS 1843, 1845). The use of ceramic collection hardware should be considered during investigations at other suspected maple sugar camps, although the dominant collection devices at most of these sites were probably wooden or metal containers (e.g. buckets). Future archaeological investigations that find concentrations of redware, represented exclusively by crock/jar vessels, in wood lots or former woodlots must consider the possibility that these represent sap collection activities based on the findings at the Petticrew-Taylor site. Even though the metal detection survey yielded no results for this investigation, due to the local emphasis on redware crocks, this testing strategy is likely to be very effective at sugar processing camps where metal buckets or spiles were used.

Significantly, the artifact assemblage associated with the sugar camp was not diverse It was dominated by four artifact types: limestone founda-

tion debris, brick, redware crock and jar fragments, and square nails. This suggests the typical maple sugar camp exhibits limited assemblage diversity, with artifacts mainly representative of the collection process and of the structural feature at a site, whether a stone or brick furnace or a frame sugar house. While archaeological information indicates that early maple sugar camps have a low material visibility, this particular camp produced a moderately large artifact assemblage that would have been larger if surface visibility had been higher at the site. Particularly dense structural debris occurred around the foundation and excavations demonstrated a still intact complete foundation under the debris. These characteristics need to be considered when stone debris piles are found at potential maple sugar camps during archaeological investigations. In addition, the redware scatters clustered within close proximity of the trail and in an area of young maple sugar tree growth demonstrating that artifact distributions and current landscape features still provide evidence of past maple sugar activities.

Compiled historical information illustrates how the maple sugar industry evolved in the Midwest and enables the formulation of archaeological expectations of artifact types, structures, or landscape features that can be found during investigation of maple sugar camps. The work at Petticrew-Taylor site apparently represents the first and oldest maple sugar furnace systematically investigated through archaeological investigations in Ohio. As such, this project establishes important contextual and comparative information for future studies of this site type in the maple sugar producing regions of the United States and Canada. The intensive archaeological and historical research, with full exposure of the furnace foundation, historical documentation explaining redware crock or jar distribution and function, and the comprehensive mapping of the historical landscape, make the Petticrew-Taylor site an excellent "type site" for a mid-nineteenth century (1840s to 1860s) maple sugar camp. This investigation can serve as a planning tool for future research on the number, distribution, and variation in sites of this industry. This research may also provide comparative information for studies on sorghum and cane sugar processing in the south, which was not explored in this study.

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Sourcing Red Pipestone Artifacts from Oneota Villages in the Little Sioux Valley of Northwest Iowa

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Abstract The exchange of some Oneota red pipestone artifacts commonly, but sometimes incorrectly, identified as manufactured from catlinite from southwest Minnesota, likely created fictive kinship alliances between unrelated groups from ca. A.D. 1450 into the early 1700s. Researchers have determined, however, that red pipestone raw material occurs across a wide area within the United States and Canada. Determining the provenance of this red pipestone raw material is thus critical to understanding Oneota trade and alliance building. Using Portable Infrared Mineral Analyzer (PIMA) technology to identify the raw material sources of 84 red pipestone artifacts from seven Oneota villages in the Little Sioux valley of northwest Iowa, we demonstrate that while the local inhabitants had access to the catlinite quarries, they also used a wide range of pipestones from other sources. The possible implications of these multiple source areas are also discussed.

...their greatest wealth is in buffalo hides and red stone calumet pipes

—Father Louis André, 1676 (Wedel 1986)

The first known meeting between the French and the Ioway was recorded by Jesuit Father Louis André at a Winnebago village south of Green Bay in 1676. The above epigraph, translated by Mildred Wedel (1986), stresses the

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