

**HILLTOWN GLASSHOUSE SITE
[36BU332]**

**HILLTOWN TOWNSHIP, BUCKS COUNTY
PENNSYLVANIA**

**A REPORT ON
RECENT ARCHAEOLOGICAL INVESTIGATIONS**

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ABSTRACT

This paper presents the results of partial archaeological investigations conducted for the Hilltown Historical Society at the Hilltown Glasshouse site [36Bu332]. These investigations were conducted in order to ascertain the presence and integrity of archaeological remains associated with the 18th century glassworks complex on the Clauser property located at 730 Minsi Trail Road in Hilltown Township, Bucks County, Pennsylvania.

Prior to physical excavations background research of the property and a one-day geophysical investigation was conducted north and east of the Clauser house in an attempt to delineate subsurface anomalies possibly related to the Hilltown Township Glasshouse operations. Following the background research and geophysical investigations a two day program of shovel testing was conducted on a ten-foot grid within the areas subjected to geophysical investigations.

A total of 4,664 artifacts were recovered from 39 of the 41 shovel tests excavated with the remains of foundations located in six tests. Amazingly 99% of the artifacts are related to the construction and operation of the 18th-century glasshouse. Less than one percent of the artifacts consist of prehistoric artifacts and more modern items related to the current use of the property. Although the entire property was not tested and the limits of the site have not been firmly established, the site is undoubtedly eligible for listing in the National Register of Historic Places because of its great research potential given the presence of archaeological features and materials (in abundance) related to the rarely studied archaeology of the colonial glass-making industry.

ACKNOWLEDGMENTS

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Overall direction for this project was provided by William B. Liebeknecht and Damon Tvaryanas. Background research for this survey was performed by Nadine Sergejeff under the supervision of Damon Tvaryanas. The archaeological field survey was performed by William B. Liebeknecht, Damon Tvaryanas and Rebecca White. The artifact assemblage was cataloged by Rebecca White under the supervision of William B. Liebeknecht.

I. INTRODUCTION

A. Project Background and Scope of Work

This paper describes the results of an initial program of archaeological investigation conducted by Hunter Research, Inc. at the former Hilltown Glasshouse site [36Bu332] on the Clauser property in Hilltown Township, Bucks County, Pennsylvania. The investigation included a one-day geophysical survey of the property conducted by Geo-Graf, Inc. Geophysical Investigations. The archaeological investigations were performed for the Historical Society of Hilltown Township and funded by a grant from the Goodfellow Fund and the Pennsylvania Historical and Museum Commission. Field investigations were conducted in July 2006 and were undertaken with the specific intention of obtaining information concerning the extent and integrity of any surviving archaeological remains associated with the glassworks complex known to have been located on the property.

The project area is situated on the west side of Minsi Trail (S.R. 4019), east of Morris Run, a tributary of the Perkiomen Creek and south of an unnamed tributary of the Morris Run. The former glassworks property is currently occupied by a one-story ranch-style house (#730 Minsi Trail) owned by the Clauser family. The house is situated on a discernable rise above the confluence of the Morris Run and the unnamed tributary. Although investigations were limited to the Clauser property, additional resources associated with the glasshouse complex likely extend to the east side of Minsi Trail (S.R. 4019) on the upland above the un-named tributary.

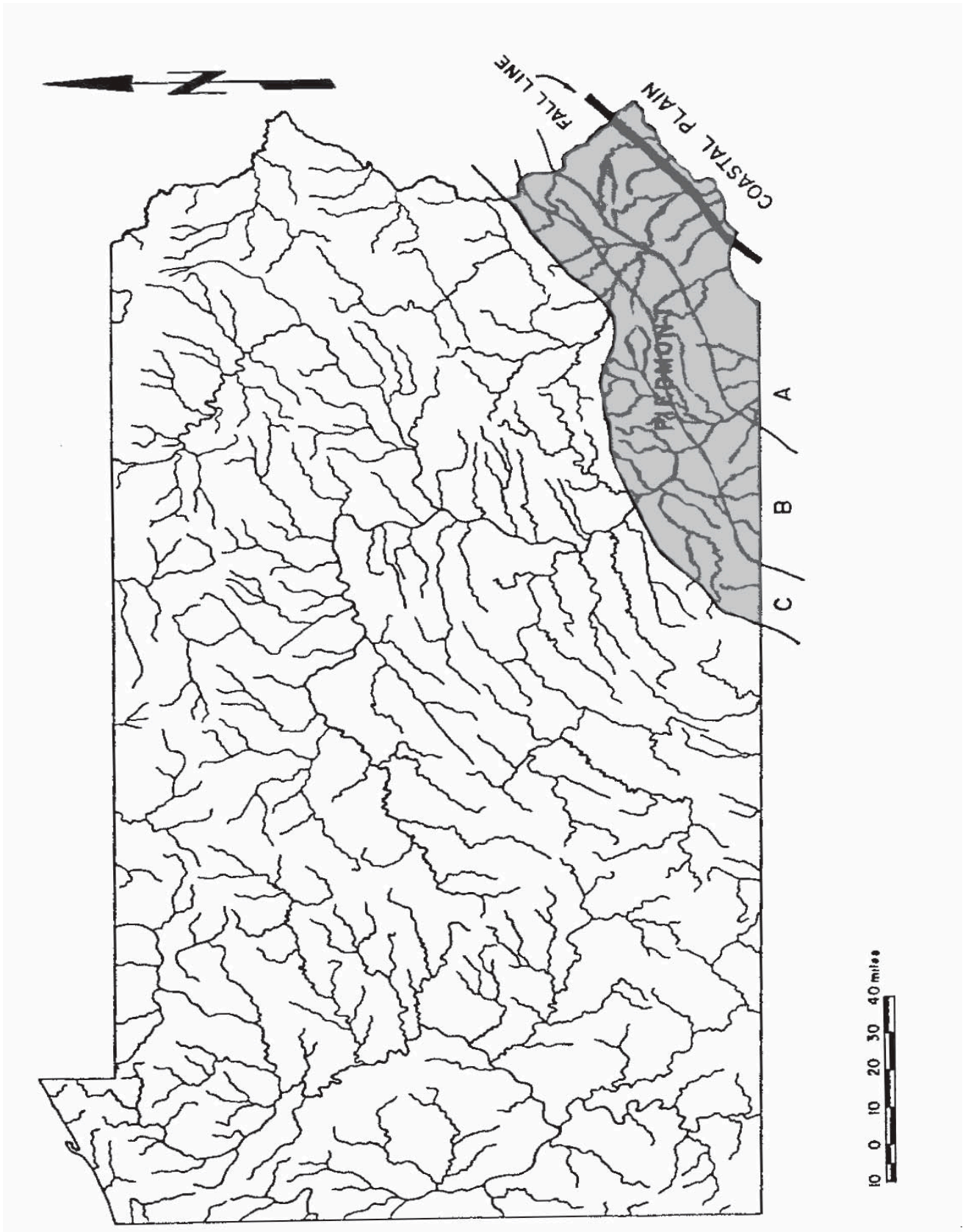


Figure 1

B. Previous Research

Prior to engaging Hunter Research to undertake this investigation, the site of the Hilltown Glasshouse was of interest to Rudolf Hommel, a local antiquarian who surface collected materials from the site in the 1940s. The materials included fragments of mallet bottles, bowls, snuff bottles, creamer handles and sugar bowl finials. Prior to the construction of the present house the late Jack Fox from the Historical Society of Hilltown Township reported that in a day and half of informal digging he uncovered the remains of “at least seven structures” but failed to locate the actual furnace (Archaeological and Historical Consultants, Inc. 2004:50). These buildings were likely part of the Hilltown Glasshouse complex. Unfortunately no records were kept and the only artifact noted was a gold doubloon, which is now missing.

A Phase I and II archaeological survey was conducted for the Pennsylvania Department of Transportation by Archaeological and Historical Consultants along both sides of Minsi Trail from December 2001 to January 2002. This work was performed in advance of the replacement of the bridge that carries Minsi Trail (S.R. 4019) over the unnamed tributary of the Morris Run. Testing south of the stream yielded an impressive 3,000 plus historic artifacts from shallow contexts. This assemblage was unsurprisingly dominated by glass slag and vessel glass from the glasshouse. Low numbers of 18th-century ceramics were also observed including redware, Jackfield, refined redware, and pearlware. The density of artifacts related to the glasshouse was substantially higher on the west side of Minsi Trail suggesting the core of the site lies to the west near the Clauser home. No cultural features were identified. The lack of features and artifacts associated with meaningful contexts lead researchers to conclude the area potential effect for the bridge replacement project lacked the potential to yield further historical information and no further work was recommended.

In 2001 David B. Long recorded the site with the Pennsylvania Archaeological Site Survey, which is administered by the Pennsylvania Historical and Museum Commission, as site 36Bu332. On the site form he roughly delineates the site as encompassing approximately four acres on the west side of Minsi Trail, the site of the glasshouse, and 25 acres on the east side of Minsi Trail, from which waste from the glasshouse has been recovered. Long, a member of the Bucks County Historical Society, arranged for funding of a professional archaeological survey of the Clauser property and engaged Hunter Research, Inc. to conduct this survey.

II. HISTORICAL BACKGROUND

While archaeological investigations have uncovered evidence of a glassworks on within the study area on Minsi Trail (Old Bethlehem Road) in Hilltown Township, Bucks County, Pennsylvania, little documentary evidence relating to the glassworks has been uncovered. What does exist consists of deeds, transcriptions of scattered newspaper advertisements and church records and Bucks County tax records which provide fragmentary clues to the existence and nature of the glassworks at Hilltown.

The three-acre Clauser property on which structural remains of the Hilltown Glasshouse were uncovered, was originally part of William Penn’s 10,000 acre tract known as “Perkasie Manor,” patented in 1702. Upon his death, William Penn willed the entire manor to his son John Penn who subsequently sold a 1,002 ½ acre parcel to William Allen in 1728. Allen was a very prominent and successful politician, merchant and land speculator who also invested in a variety of extractive industries in Pennsylvania and New Jersey. The year before he purchased the 1,002 ½ acre tract, he had invested in the newly created Durham Furnace Company, which put a furnace into operation in Durham Township (approximately 14 miles northeast of the Hilltown glassworks site) that same year. Given Allen’s wealth and history of investment in extractive industries, it is possible that he started the Hilltown glassworks between 1728 and 1739 when he owned the property. However this hypothesis is purely conjecture and is thus far not supported by archaeological or historical evidence (Archaeological and Historical Consultants, Inc. 2004:44-45; Durham Historical Society).

A number of the early landowners were connected socially, politically and in business. In 1739, William Allen sold the tract that includes the site of the glassworks to Jeremiah Langhorne, another early investor in the Durham Furnace Company (Bucks County Deed A3/110; Durham Historical Society; see Table 1). Three years later, Langhorne willed the property to Andrew and James Hamilton, sons of his friend Andrew Hamilton, Sr. (Bucks County Deed 23/203). Though these early owners were investors in common industries and were of similar political and social backgrounds, there is no evidence in the deeds of sale to indicate that any of them operated a glassworks on the property in Hilltown.

Several items in 18th-century Philadelphia newspapers, which were compiled by Rudolph Hommel in an article in the Bucks County Traveller in 1957 and transcribed by the Bucks County Historical Society sometime thereafter, provide circumstantial evidence of the presence of a glasshouse in Hilltown Township. An item printed in 1755 in Christopher Sower's widely-circulated German language newspaper, referred to "Johannes Bohn and George Heyl, at the glass-house" with no indication of its location (Bucks County Historical Society). Only two or three glasshouses are known to have been in operation in America in 1755 – Casper Wistar's glasshouse in Salem County and one or two companies in New York City (McKearin and McKearin 1941:78, 96-97). One can not definitively link the item in Sower's newspaper to a glasshouse in Hilltown, for it could reference any one of these glasshouses or an unidentified operation.

In 1769, the Pennsylvania Chronicle, another Philadelphia newspaper, advertised that Jacob Barge, Jacob Morgan, James White and Jacob Reno were collecting broken flint glass to be worked up at a "new glass house" (Bucks County Historical Society). Again no location is indicated and there is no way to pinpoint this reference to a glasshouse in Hilltown. In fact, in 1763 Henry William Stiegel opened his first glasshouse in Manheim, Pennsylvania and construction on his second Manheim glasshouse began in 1768, the year before the aforesaid item was published in the Pennsylvania Chronicle (McKearin and McKearin 1941:83). While it is not impossible that Barge, Morgan, White and Reno worked in Hilltown, Bucks County, they were more likely collecting flint glass to be worked up at the new Stiegel glassworks in Lancaster County.

While the advertisements in these widely-circulated newspapers may refer to a glass house in Hilltown, a record from the Tohickon Union Reformed Church provides stronger, yet still circumstantial, evidence that a glasshouse was in operation at Hilltown by 1760. The Tohickon Union Reformed Church was founded in the mid-18th century in Bedminster Township, Bucks County – approximately five miles from the site of the Hilltown glassworks. Church records from June 21, 1760 reported the death and burial of "George Musse, the old glass blower" (Bucks County Historical Society; Archaeological and Historical Consultants, Inc. 2004:48). If Musse was employed as a glassblower at the time of his death, as this record indicates, he was likely employed at a local glass works. Musse arrived in Philadelphia from Germany in 1750, thus placing his possible employment at the glass works at some point between 1750 and 1760.

Another important piece of evidence appears in Henrich Miller's Pennsylvanischer Staatsbote, another German language newspaper published in Philadelphia. In 1776, an advertisement reported that German servant Eberhard Meyer had run away from Peter Mason, his master at the glasshouse in Bucks County for the sixth time (Bucks County Historical Society; Archaeological and Historical Consultants, Inc. 2004:49). This single advertisement provides a wealth of information. First, that a glass house was indeed located in Bucks County by 1776 and as Meyer had previously fled a number of times, the glass house was likely in operation prior to that year. Moreover, the advertisement hints at the nature of the glassworks in Bucks County. In 1776, the works was managed by Peter Mason who relied, at least in part, on the labor of German indentured servants. Furthermore, at that time the glassworks was not run by the property owner. Henry Wismer owned the glassworks property from 1775 to 1794 (Bucks County Deed 23/203), so Peter Mason either rented the land from Wismer or conducted the glassworks for him.

This line of evidence fits nicely with Bucks County tax records and the Federal Census of 1790. Tax records list Peter Mason as a resident of Hilltown Township in 1779 and from 1781 to 1784. In 1779, Peter Mason owned six horses, no cattle and no land while Henry Wismer owned 190 acres. Though Mason's occupation is not listed, the fact that he owned no land would fit with the hypothesis that he was conducting the glassworks on Wismer's property (Egle 1897:62). The tax list from 1781 is the most revealing. Peter Mason still owned no land, but he is listed as "Peter Mason, glass works" (Egle 1897:187). Mason is also

listed on Hilltown Township tax lists from 1782, 1783 and 1784 with no occupation indicated (Egle 1897:253, 378, 447). Peter Mason left Hilltown Township sometime in 1784 or 1785. He is not listed on Hilltown Township tax records after 1784 and by the time the Federal Census was taken in 1790, he had relocated to Springfield Township, Delaware County (United States Census 1790).

Although documentary evidence is fragmentary, it suggests that a glasshouse may have been in operation at Hilltown as early as 1760 when Musse the “old glass blower” was buried in Bedminster. The idea that a glassworks was in place at Hilltown prior to that date is not unthinkable, but such a hypothesis is based on tenuous and circumstantial evidence at best. A glassworks was certainly in operation in Bucks County by 1776, as Miller’s newspaper indicated that Peter Mason was at a Bucks County glasshouse in that year. The assumption that this glasshouse was indeed in Hilltown Township is supported by Hilltown Township tax records from the 1780s.

There is no documentary evidence that indicates the presence of a glasshouse on the property after Peter Mason left Hilltown Township in 1784 or 1785. Henry Wismer sold the property to Christian Kern in 1794 and the deed of sale makes no mention of a glasshouse (Bucks County Deed 24/446). Christian Kern sold the land to his son John Adam Kern the following year and the deed of transfer described the property as a “homestead farm” with no indication that buildings of the former glassworks remained (Archaeological and Historical Consultants, Inc. 2004:49). The site of the Hilltown glasshouse remained agricultural through the early 20th century and owners of the field recalled finding artifacts from the glassworks. Samuel Berger, who owned the property from 1903 to 1919, recalled finding pieces of glass as he plowed his fields and in the 1950s, dairy farmers James and Josephine Kyler also found pieces of slag and green glass in their field (Bucks County Historical Society). Today the core of the Hilltown glassworks site is located on a small three-acre lot that Russell and Emma Bennett sold to Edward and Grace Bennett in 1964 (Bucks County Deed 1764/1086). The Bennetts likely constructed the ranch house that is located on the property today in the mid 1960s around the time of this sale.

III. FIELD INVESTIGATIONS

A. Results of Geophysical Investigations

Prior to physical excavations within the project area a one-day geophysical investigation was conducted on May 4, 2006 north and east of the Clauser house in an attempt to delineate subsurface anomalies possibly related to the Hilltown Glasshouse. Similar testing was conducted at the Wistarburgh Glassworks site in Alloway Township, New Jersey prior to archaeological testing with positive results. The geophysical investigations were conducted using a ten-foot grid and consisted chiefly of ground penetrating radar (GPR), supplemented with electromagnetic, radio frequency and magnetic instrumentation to produce a surface anomaly map (SAM).

Three types of anomalies were encountered on the Clauser property: possible near-surface rock, subsurface anomalies and subsurface targets. All of these anomaly types require subsurface excavation to determine their origin and character. Possible near surface rock targets are interpreted as consolidated rock likely to be natural outcrops less than four feet below the ground. However, these may also be man-made features such as stone foundations. Subsurface anomalies are areas where the subsoil has been disturbed in the past by some type of excavation or could indicate an area of buried debris. Subsurface targets are larger more well-defined objects such as foundation walls or a dense concentration of debris. Subsurface targets normally have the highest probability of being significant subsurface features and are specifically targeted for excavation.

B. Results of Archaeological Investigations

Archaeological shovel testing was limited to within the areas subjected to geophysical investigations (Figure 4). Using the ten-foot grid employed by the geophysical investigation, the front or east yard and the side or north yard was tested. This grid was

supplemented with additional tests to specifically target subsurface anomalies and subsurface targets of interest. The Phase I investigations were conducted on June 12 and July 19, 2006.

All shovel tests were recorded using the context system. Under this methodology, each discrete human action recognizable in the site stratigraphy – be it an act of construction or demolition, a cumulative deposit, or the cut of a pit or trench – is assigned its individual context number through which it (and any associate cultural materials) can be distinguished in all excavation and recording activity undertaken by the archaeologist. Similarly each natural soil layer, and each arbitrary unit or level employed in the excavation of cultural and natural deposits, is assigned its own separate context number. In the post-excavation analysis and interpretation of an archaeological site, the context numbering system is then used to form the basis of a site wide matrix through which cultural and natural stratigraphy can be reconstructed and sorted into a meaningful sequence of events (e.g., Biddle and Biddle; Harris 1975; Barker 1977).

All soils were sifted through ¼-inch-mesh hardware cloth. Artifacts were bagged according to the context from which they were recovered and inventoried. Obvious modern (mid-20th century or later) artifacts such as plastic rubber and glass were discarded either in the field or in the laboratory. General field operations were recorded through digital photography. Notes on daily field activities and the evolving interpretation of the site were kept in a site notebook by the Principal Investigator.

Geophysical investigations identified three possible near-surface rock targets, two in the northern side yard and one under the existing driveway under the asphalt. The survey also identified six subsurface anomalies, one large rectangular-shaped target north of the house and five irregular shaped targets across the front yard. Finally and most importantly three subsurface targets were identified in the shape of an “L” interpreted as the possible corner of a former building.

Shovel testing was employed on the ten-foot grid to test the anomalies with additional tests deployed in the exact locations of subsurface targets thought to be foundations. On June 12 a total of 21 shovel tests (Shovel Tests 1 through 21) were excavated in the front (east) yard. Structural features were encountered in four, possibly five, shovel tests. The first shovel test (Shovel Test 1) located ten feet east of the northeast corner of the Clauser house encountered a probable stone foundation wall. The stone was rounded unlike the underlying red shale observed outcropping along the east side of Minsi Trail. Shovel Test 12, located 20 feet east of the center of the Clauser house, uncovered a definite stone (local shale) foundation wall (three courses were observed) running north-south. Shovel Tests 13 and 21 came down on a possible foundation also constructed of local shale, unfortunately the extent and orientation were unclear. Shovel Tests 14 and 17 located 15 and 20 feet east of the northeast corner of the Clauser house encountered a burnt brick surface thought to be the floor of the glasshouse furnace. All five structural features are situated on a slight rise. The rise may represent the limits of the former furnace building.

On July 19 an additional 19 shovel tests (Shovel Tests 22 through 40) were excavated in the side (north) yard. Only one shovel test (Shovel Test 33) encountered structural evidence in the form of a trimmed shale foundation wall. Once again the orientation of the wall was unclear.

Artifact densities were greatest within 20 feet of the house. Shovel Test 36 contained large pieces of glass slag and furnace shelving. Shovel Test 40 was located along the northern extent of the project area within a GPR target exhibiting a near-surface rock signature. Soil recovered from this test proved to be sterile alluvial deposits. An obvious sharp down-sloping line in the yard suggests soil has been removed 55 feet north of the house, possibly removing cultural evidence of the glasshouse complex.

C. Analysis of Material Culture

A total of 4,664 artifacts were recovered from 39 (out of 41) shovel tests and from exposed surfaces within the Clauser property.

1. Prehistoric Artifacts

A total of nine prehistoric artifacts were recovered from the Hilltown Glasshouse site. There were several other items cataloged as “indeterminate lithics” which in most cases refer to thin naturally and locally occurring fragments of argillite/shale which could be the result of prehistoric tool production or trimming of historic building materials. Of the nine artifacts cataloged as prehistoric seven were classified as debitage or flakes resulting from the production or curation of stone tools on site (Plate 6). Five flakes were made from jasper, with one each of chert and argillite. Argillite is locally available outcropping in numerous places in the vicinity while jasper and chert likely originate from prehistoric quarries located in northern Bucks and southern Northampton Counties. A jasper drill and an argillite narrow-bladed stemmed projectile point dating to the Late Archaic period (circa 4,000 to 1,000 B.C.) were also recovered, suggesting the site may have served as a short-term Native American camp.

2. Historic Artifacts

Only 31 artifacts recovered during the present investigation are not specifically related to the manufacture of glass or the associated glass manufacturing buildings. Artifacts with more of a domestic association and dating to the period of the Hilltown Glasshouse consist of an iron kettle fragment and ceramic sherds; two white salt-glazed stoneware sherds, circa 1720-1805 and eight lead/manganese-glazed redware sherds dating to the mid-18th century through the late 19th century. These artifacts may have been brought to the glasshouse to prepare and consume meals. Artifacts not considered related to manufacturing and dating later in time consist of a single yellowware sherd, circa 1830-1940, 15 pieces of coal and four small pieces of unidentified bone. These artifacts are likely the result of fertilizing activities associated with farming activities on the property prior to the construction of the Clauser house.

3. Historic Artifacts Related to Glass Production

The majority, 99.4% of artifacts can be directly related to the production of glass at the Hilltown Glasshouse site. Just over half, 50.6% of the artifacts are related to the manufacturing process, which includes glass slag (1,376), crucibles (417) refractory shelf fragments (20), cullet (721), drips of glass (180) and threads (46). A total of 275 artifacts have been classified as fragments of former buildings, such as stone and brick. Last but certainly not least was the recovery of 22 pieces of charcoal. Wood was an important source of fuel needed to fire the furnaces; therefore the presence of charcoal is not unexpected. The charcoal may also have been the result of a building fire, common at glass furnaces, as there are no indications that the glasshouse buildings were present in tax records dating to 1798.

Glass slag, a byproduct of glass manufacturing was dominant across the site with 1,376 fragments recovered. Glass slag is a mixture of impurities resulting from the necessary raw ingredients and glass. Slag is removed from the top of the molten glass batch prior to production. As expected at a glass manufacturing site, glass cullet or waste was plentiful, represented by 721 pieces. Cullet is waste or broken glass used as an additive to the raw batch of glass. Cullet can originate from a foreign or outside source (used bottles) or could originate from within the works as cut scraps, vessels broken during production or vessels simply not suitable for sale. Foreign cullet presents a particular problem when attempting to establish what was actually produced at the site.

One hundred and eighty items cataloged as glass drips, also known as drops, likely occurred when the molten batch was gathered onto the iron blow pipes or rods from the crucible in the furnace. A drop of molten glass was purposely allowed to drip allowing the glassblower to assess whether the batch had reached the proper temperature and viscosity for blowing. Drips may also have occurred as spillage while removing the crucible from the furnace or if a crucible cracked as a result of over use in the furnace.

Items described as crack-offs are globular pieces of glass which are the result of transferring molten pieces of nearly complete vessels from one iron blowpipe to another. A blob of molten glass is used to facilitate the transfer so that the top of the vessel can be finished. When the lip or closure has been finished the vessel is removed from the rod and the blob is removed or cracked off when cooled. Cataloged examples exhibit iron adhering to the interior surface of the cracked off pieces.

A total of 417 thick-bodied, flat-sided pot or crucible fragments were recovered from excavations. The number of broken crucible fragments may reflect vessels which were deliberately broken up to extract the remaining usable glass. Some of the vessels would then be ground up and used as a tempering agent. After repeated uses crucibles also frequently became fused to the benches inside the furnace and had to be broken to remove them. The vessels recovered from the Hilltown Glasshouse site consist of a kaolin-like coarse white and pink body with grog temper (crushed crucibles). The interior and exterior surfaces are "glazed" as a result of extremely high temperatures achieved in the furnace. Colors range from black to brown and green. The method of construction appears to be by connecting slabs in a wooden mold. This method did not require a skilled potter suggesting crucibles could have been made on site. Clays from northern Delaware may have been exploited for making crucibles at the Hilltown Glasshouse (Glenn:1900:179). Palmer reports John Frederick Amelung from Maryland used clays from New Castle, Delaware to make crucibles at the New Bremen Glass Manufactory (Arlene Palmer personal communication, February 7, 2003). This area of northern Delaware is known for its vast sources of high quality kaolin clays, which could be fired to high temperatures (Lake 1997).

Some pot fragments found at Amelung's glassworks were flat-sided, possibly octagonal or hexagonal in form (Lanmon et.al. 1990:184). Images of glass pots from a Bristol, England glassworks (1753-1755) depicts both cylindrical and flat-sided or paneled pots (Angerstein 2001:131).

Insufficient data exists from the sherd to reconstruct a full profile and project the capacity of the crucibles at Hilltown. Reconstructed vessels from John Baker's late 17th-century glasshouse at Vauhall, England held up to 30 gallons which would make approximately 300 wine bottles (Tyler and Willmott 2005:44-45). No lid fragments were recovered from the excavations suggesting the vessels were open. Open crucibles are indicative of green potash glass production thus the green glaze/residue observed on the interior reported above.

Fifteen refractory shelf/bench fragments are represented in the assemblage. These coarse earthenware tabular fragments exhibit a layer of glaze-like glass on one side. The glass layer or surface varies from fragment to fragment exhibiting a mottled mixture of colors, resulting from continued use in the furnace. These fragments may also represent large crucible base fragments.

Vessel glass fragments recovered from the site were mostly pale green, forest green and dark green ("black glass"), with lesser amounts of amber, clear/uncolored and blue. Interpretation of the glass assemblage is complicated by the fact that the majority of finished products would have been removed from the site to be sold at market, while defective products would have been recycled within the factory as cullet. Numerous pieces of clear or colorless glass exhibited a light purplish blue color when exposed to the black light indicating the presence of lead. The ingredient used in making the forest green is not known. Forest green is not unique, but it is distinctive and should be viewed as a possible hallmark for the site.

The presence of dark green, nearly black glass raises an issue currently debated by scholars. Earlier researchers have assumed the dark green or "black" glass was brought to 18th-century glassworks sites as cullet, resulting from European bottles. It has been assumed by many researchers that historically "black" or dark olive glass could only be produced by coal-fired furnaces, but recent research by Willy Van den Bossche has shown this is not the case. Van den Bossche documented the excavation of dark olive green glass and a broken part of a glass melting pot containing dark metal from the site of an early 17th-century glasshouse (1600-1640) at Savenel, Nethen, Belgium where Jean Colinet and his sons were making glassware of all types. Van den Bassche explains;

At that time Colinet used beechwood fuel to melt a mixture of yellowish sand, limestone and unwashed ash from burned beeches which produced the natural dark olive green colour of his bottles termed

‘black glass’ (verre noir). Coal firing is not a must for producing ‘black glass’. The reducing atmosphere of coal firing in the glass-melting furnace darkens more molten glass than the oxidizing atmosphere of wood-firing for glass of the same composition. Depending on the quantity of impurities such as iron present in the sand and/or in the other glassmaking ingredients, final natural glass colour as a result of wood-firing may also be olive amber or brownish amber known as ‘black glass’ (Van den Bossche 2001:52).

Van den Bossche also states the process of making black glass was “sometimes adapted for use with blast furnace slag” (Van den Bossche 2001:392). R. R. Angerstein’s *Illustrated Travel Diary, 1753-1755: Industry in England and Wales from a Swedish Perspective* contains a recipe for making glass bottles which consists of the normal ingredients with the addition of “Shrope”, which is a bluish iron slag (Angerstein 2001:129). Iron slag would have been easily obtained in this iron-rich area of Pennsylvania. It should be noted that William Allen, Jeremiah Langhorne and James Hamilton who successively owned the property from 1728 to 1774, owned shares in the Durham Iron Works (located within 15 miles of the Hilltown Glasshouse site) where iron slag would have been readily available (Archaeological and Historical Consultants, Inc. 2004:44-46). When glassgall-furnace slag is used in the batch a turquoise blue color can result. This opaque turquoise blue color is a product of sulphate salt of sodium (Van den Bossche 2001:394). In the 1940s when Hommel surface collected the Hilltown Glasshouse site he specifically noted gall or scum formed on melting glass in colors ranging from opaque white to turquoise (Archaeological and Historical Consultants, Inc. 2004:50). Identical opaque turquoise slag was recovered from the Wistarburgh site in Salem County, New Jersey, where “black glass” was almost certainly produced. A curious note worth mentioning is that the Wistars owned shares in the Abbetinkton iron furnace in Pennsylvania (Plamer 1973:12-13). Henry William Stiegel another prominent owner of an 18th-century Pennsylvania glassworks also owned shares in the Elizabeth furnace (Hunter 1950:22-29). Whether or not iron slag was introduced to the batch at the Hilltown Glasshouse is uncertain at this time, but it might be resolved by chemical analysis of the recovered samples.

Numerous artifacts within the assemblage could represent rectangular case or snuff bottles. Without the full profile positive identification is not possible. Fragments associated with case or snuff bottles include dark green flat glass not thought to be window glass, angled shoulder and short rounded neck fragments. Snuff and case bottle fragments are present in the Bucks County Historical Society collections (#27163). Hommel noted that none of the examples he collected had applied lips like those depicted in McKearin and McKearin’s *classic American Glass* (McKearin and McKearin 1941: Plate 223, Nos. 4 and 7). The lips on examples he collected were sheared off and curved outward which he interpreted as a trait unique to the Hilltown Glasshouse. Outward curving lips on case and snuff bottles have been documented from both domestic and foreign 18th-century glassworks and do not represent a signature unique to the site (Palmer 1993: 347; Van den Bossche 2001:254-260). Sheared off lips would have been typically covered with a metal, often pewter, screw closure (Van den Bossche 2001:288). A snuff bottle on display at the Independence Living History Center Archaeology Laboratory excavated in Philadelphia from the James Dexter site circa 1760-1770 has characteristics identical to fragments excavated from the Hilltown Glasshouse (ANCS 66817, FS 2443,2458 Feature 209), including the unique forest green color with multiple air bubbles and the unrefined base.

Two mending olive green fragments form a paneled vessel suggesting flat or “round” octagonal bottles or flasks were either produced at the site or had been brought in as cullet. The color of the paneled vessel fragments suggests it was produced at the Hilltown Glasshouse. Other curved dark green vessel fragments could represent body fragments from chestnut bottles as examples are also present in the Bucks County Historical Society collections (#27163). Chestnut bottles would have been a likely product of the Hilltown Glasshouse as it was for other 18th-century glassworks such as Wistarburgh and the Germantown Glassworks in Braintree, Massachusetts, who were predominately producing dark green vessels (Morcom 2003:14-15).

A minimum of four glass tube fragments were present in the assemblage, varying in size from 4 to 17 millimeters in diameter and ranging in color from green to pale green to colorless (Plate 12). Similar tubes were found at the New England glassworks, which was in operation from 1780 to 1782 in Temple, New Hampshire (Starbuck 1986:51-53). Palmer suggests the small glass tubes were used in scientific experiments (Palmer 1973:152). The Wistarburgh glassworks located in Salem County New

Jersey produced receivers and retorts for the Pennsylvania Hospital. A retort is a vessel used for distilling or decomposing substances by heat, while a receiver is a vessel used to receive and contain gases. Some of the tubular fragments may represent the restricted ends of retorts or small funnels (Palmer 1976:89). A single rim from a colorless wineglass or tumbler was cataloged from the site. The rim fragment may have been produced at the Hilltown Glasshouse or come to the site as cullet. The wineglass or tumbler may have also been used by one of the workers.

Decorative elements observed within the assemblage consist of threading and rigaree. Threading is a thin rib of glass applied or trailed around a vessel, common on pitchers, jugs, creamers and mugs. Threading is also sometimes found on decanters. Rigaree is a narrow ribbon of glass applied to fancier forms using a tool to form a ladder-rung like ornamentation usually associated with flasks, gimmel, scent or perfume bottles.

A total of 419 or 8.98% of the assemblage from the Hilltown Glasshouse has been confidently identified as flat glass. The flat glass is mostly pale green or colorless, confirming that this material is most likely window glass rather than small fragments of case or snuff bottles. All of the flat glass fragments recovered during the excavations are small but of even thickness, suggesting they were manufactured using the cylinder method. Cylinder glass was also referred to as broad, or sheet glass. Cylinder glass was more economical in that it made more efficient use of the glass. The drawbacks were that it was thinner and more brittle with more streaks and waves than crown glass (Wilson 1969:27-28). In this technique, the cylinders were cut, flattened and then divided by a glasscutter into individual panes. The presence of window glass dictates there must have been a flattening oven at the glassworks. Diderot refers to broad or cylinder glass as “German sheet” as this method was used to produce window glass in Bohemia and Germany (Gillisipie 1987:Plate 249; Charleston et al. 1975:4). The production of cylinder or broad window glass in the American colonies can be traced back to a window glass factory located in the Northern Liberties area of Philadelphia as early as 1683 (McKearin and McKearin 1941:77; Wilson 1976: 155; Palmer 1973:22).

The quantity of flat glass window pane or light fragments from the Hilltown Glasshouse site suggests the location of the glass cutting house is likely nearby. A couple of pieces appear to be trim scraps and exhibit scoring and cut marks. Four pieces exhibit rounded edges that were formed when the cylinders were initially cut and flattened in the oven. Four curved edge fragments have projected diameters ranging between six and nine inches. These fragments may represent portions of un-flattened cylinders. The cylinder diameters are consistent with glass cylinders produced at the Wistarburgh Glassworks, which were between five and seven inches in diameter (Hunter Research, Inc. 2004:4-17). It should be cautioned that the fragment used to project the diameters was small and may not be entirely accurate. As reconstruction of the cylinders was not possible, the length of the cylinders could not be determined.

IV. CONCLUSIONS AND RECOMMENDATIONS

Results from the two-day shovel testing program suggest structural remains of the glasshouse complex are located immediately north and east of the Clauser house. This area is denoted by a slight knoll in the front yard. Plotting shovel tests which yielded glass manufacturing remains also suggests structural remains were formerly located under the northern end of the Clauser house. Details of what these structural features specifically in relation to the glassmaking activities on site can not be ascertained at this level of investigation. Review of the Phase I and II archaeological survey report (Archaeological and Historical Consultants, Inc. 2004) suggests the site may have extended east across Minsi Trail, an area which has been only partially tested.

This investigation has merely scratched the surface, confirming the presence of a very important 18th-century industrial site. We recommend the following actions be taken towards the further understanding and preservation of the site:

- 1). Additional testing should be carried out to fill out the grid across the front (east), side (north) and back yard (west) of the Clauser property as well as the adjacent property on the east side of Minsi Trail to establish the horizontal boundaries of the Hilltown Glasshouse site. In addition to shovel testing the grid, open-area excavations in the areas where the remains of

foundations were encountered is highly recommended. Opening these area will reveal more about the layout of the factory operations and will certainly produce a wealth of important material culture, expanding the known and suspected products of the glasshouse. Non-glass artifacts may also help narrow down the dates of operation. Open area excavations would also undoubtedly attract the public's attention and shed light on this important, inadequately studied 18th-century industry.

2). Chemical analysis of slag, vessel and window glass fragments should be considered so that a chemical signature can be established. This record could then be compared to other 18th-century glasshouses and vessels suspected of being manufactured at the Hilltown Glasshouse site.

3). Last, and certainly not least, the Hilltown Glasshouse site [36Bu332] is undoubtedly eligible for listing in the National Register of Historic Places. In this regard we recommend preparing a formal nomination. Listing in the National Register would confer some measure of protection on the site from Federally- and State-funded projects in the future.

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