# *Dendrochronological Analyses*

## *of the*

# *Glen-Sanders Mansion Scotia/Glenville, NY*

## *and*

# *David DeFreest House North Greenbush, NY*

**By**

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## Introduction

This is the final report on the dendrochronological analyses of the Glen-Sanders Mansion, located in Scotia/Glenville, NY, and the David DeFreest House located in North Greenbush, NY. This work has been done under contract with Mr. Walter Wheeler of Hartgen Archeological Associates, Inc., Rensselaer, NY.

Mr. Bill Callahan visited the Glen-Sanders Mansion on May 10-11 and June 8, 2004 to collect wood core samples from selected timbers throughout the building for dendrochronological analysis. In all, he collected 20 tree-ring samples from locations that ought to have covered much of the construction history of the mansion. Also during the May 10-11 visit, Bill visited the David DeFreest House and collected 8 samples from that building for additional dendrochronological analysis.

In the case of both buildings, the sampled timbers were from conifer species, with the large majority being hard or yellow pine (most likely Pitch Pine). In contrast, two samples from the 'Kitchen Passage' of the Glen-Sanders Mansion proved to be eastern hemlock. When sampling, Bill always attempted to locate wany or bark edges on the timbers in order to obtain cutting dates. Such dates will ordinarily be close to the actual construction date of the building. This of course assumes that the timbers were not stockpiled for some appreciable period of time prior to construction or were not from older recycled building material. These latter possibilities are outside the context of the dendrochronological dating results reported here.

Even when wany edges were found, it was not always possible to preserve the outermost rings because the timber surface was in a degraded or "punky" state. This is a common problem in old houses, especially in sub-surface rooms such as cellars that tend to be damp. For the Glen-Sanders Mansion and David DeFreest House, Bill always put a pink chalk coating on the surface where he cored each timber. Cores with pink chalk on the outermost end are, therefore, the ones most likely to have had their wany edges preserved. When pink chalk was not present on the end of the recovered core sample, this indicated that some outer rings were lost. As will be seen, this was a problem with several of the sampled timbers from the Glen-Sanders Mansion.

## Dendrochronological Analyses

Dendrochronology is the science of dating and analyzing annual growth rings in trees. Its first significant application was in the archaeological dating of the ancient Indian pueblos of the southwestern United States (Douglass 1921, 1929). Andrew E. Douglass is considered the "father" of dendrochronology, and his numerous early publications concentrated on the application of tree-ring data for archaeological dating. Douglass established the connection between annual ring width variability and annual climate variability, which is responsible for the establishment of precisely dated wood material (Douglass 1909, 1920, 1928; Stokes and Smiley 1968; Fritts 1976; Cook and Kariukstis 1990). Since 1921, dendrochronological methods, first developed by Douglass, have been perfected and employed throughout North America, Europe, and much of the temperate forest zones of the globe (Edwards 1982; Heikkenen and Edwards 1983; Holmes 1983; Stahle and Wolfman 1985; Krusic and Cook 2001). In Europe, where the dating of buildings and artifacts is as much a profession as a science, the history of tree-ring dating is tremendous (Baillie 1982; Eckstein 1978; Eckstein 1984).

The wood core samples collected from the Glen-Sanders Mansion and the David DeFreest House were processed following well-established methods of dendrochronology. They were taken to our Tree-Ring Lab where they were carefully glued onto grooved mounting sticks. The wood cores were then sanded to a high polish to reveal the annual tree rings clearly. The rings were then measured to a precision of ±0.001 mm. The actual

cross-dating procedure involved the use of a computer program called COFECHA (Holmes 1983), which uses a sliding correlation method to identify probable cross-dates between tree-ring series. Experience has shown that this method of cross-dating is superior to that based on the skeleton plot method (Stokes and Smiley 1968) for oaks growing in the northeastern United States. It is also very similar to the highly successful CROS program used by Irish dendrochronologists to cross-date European oak tree-ring series (Baillie 1982).

We use COFECHA to first establish internal or relative cross-dating amongst the house timbers. This step is critically important because it locks in the relative positions of the timbers with each other and indicates whether or not the dates of those specimens with outer bark rings are consistent. Having done this, we compared the internally cross-dated series with independently established tree-ring chronologies from old living trees and historical tree-ring material. All of these "dating masters" are based on completely independent tree-ring samples.

## Results and Conclusions

## A. Glen-Sanders Mansion

The results of the dendrochronological dating of the Glen-Sanders Mansion timbers are summarized in **Table 1** and **Figures 1** and **2**. A total of 20 samples were analyzed, with 13 of the 18 pine samples providing firm dendrochronological dates and both hemlock samples doing so as well. The five samples that did not date were either very short (e.g., GSHNY03) or aberrant for unknown reasons. The strength of cross-dating within the pine and hemlock groups is indicated by the far right column of **Table 1** by the Spearman rank correlations. These correlations, produced by the COFECHA program, indicate how well each sample cross-dates with the mean of the others in the group. These correlations vary a bit, but all are in the range that one expects for correctly cross-dated timbers from buildings in the eastern US.

Based on the results of this dendrochronological analysis, the Glen-Sanders Mansion was probably constructed in three phases. Historical information indicates that the earliest phase was built in 1713. From **Table 1**, the earliest dated samples all pre-date that date (1689 is the most recent tree-ring date), but none of those samples had recoverable wany edges. Therefore, the 1713 date cannot be refuted by dendrochronological analysis of the sampled timbers and is clearly plausible.

The second phase of construction has a tightly clustered series of outer dates (1769, 1770, and 1771), all associated with wany edges. Although these dates do not agree exactly, it is possible that the outermost rings were not present on those samples for reasons other than sample quality. In any case, it would appear from the tree-ring evidence that the section of the mansion from where these samples were taken was probably built shortly after 1771.

The third phase of construction is based on dates from two eastern hemlock joists in the "kitchen passage", each with fully recovered wany edges. The outer date for each is 1802, which establishes the construction of this portion of the mansion probably shortly after that date.

The reliability of these dates is succinctly illustrated in **Figures 1** and **2**. **Figure 1** shows the mean pine chronology developed from the Glen-Sanders Mansion timbers compared against the best regional dated pine master developed from timbers of buildings on the Deerfield Academy, Deerfield, MA. The t-statistic associated with the correlation between these two series ($r=0.35$) is highly significant ($p<0.001$) with a 216 year overlap. Figure 2 shows that the hemlock samples from the mansion likewise cross-date with a hemlock dating master from southern Vermont ($r=0.41$) with an equivalently high degree of significance. There is no doubt that the dates as presented here are correct. How they are interpreted is up to others.

**Table 1. Dendrochronological dating results for all samples taken from the Glen-Sanders Mansion. For WANY, +BE means the bark edge was present and recovered and –BE means that bark edge was either not present or not recoverable. All correlations are Spearman rank correlations of each series against the mean of all of the others of the same species (pine or hemlock).**

| ID | SPECIES | DESCRIPTION | WANY | RINGS | DATING | CORREL |
|---|---|---|---|---|---|---|
| GSHNY01 | PINE | joist, room adjoining "accounting room", southerly joist, 1st from north room partition | -BE | 116 | 1651 1766 | 0.56 |
| GSHNY02 | PINE | joist, "accounting room", 2nd joist from north wall/door | -BE | 120 | 1649 1768 | 0.47 |
| GSHNY03 | PINE | joist, "accounting room", 6th joist from north wall/door | +BE | 51 | NO DATE | -.-- |
| GSHNY04 | PINE | joist, "bridal room", 2nd joist from west wall | +BE | 214 | 1556 1769 | 0.33 |
| GSHNY05 | PINE | joist, "bedroom" east side 2nd floor, 2nd joist from north wall | +BE | 103 | 1669 1771 | 0.45 |
| GSHNY06 | PINE | joist, "bedroom" on east side 2nd floor, 5th joist from north wall, nearest fireplace | +BE | 115 | 1656 1770 | 0.59 |
| GSHNY07 | PINE | joist, "bedroom" west side 2nd floor, 1st joist from west wall, nearest fireplace | -BE | 149 | 1603 1751 | 0.36 |
| GSHNY08 | PINE | joist, "bar lounge" cellar, 5th joist from south wall (fireplace) | -BE | 145 | 1603 1747 | 0.33 |
| GSHNY09 | PINE | joist, "bar lounge" cellar, 7th joist from south wall (fireplace) | -BE | 88 | 1591 1678 | 0.35 |
| GSHNY10 | PINE | joist, "wine cellar", 4th joist from east wall | -BE | 112 | NO DATE | -.-- |
| GSHNY11 | PINE | joist "wine cellar", 3rd joist from east wall (towards "lounge" side) | -BE | 87 | 1600 1686 | 0.57 |
| GSHNY12 | HEMLOCK | joist, "kitchen passage", 2nd joist from west wall/partition | +BE | 149 | 1654 1802 | 0.37 |
| GSHNY13 | HEMLOCK | joist "kitchen passage", 1st joist from west wall/partition | +BE | 180 | 1623 1802 | 0.37 |
| GSHNY14 | PINE | rafter, under roof, north side in "closet off of bridal room" | -BE | 78 | NO DATE | -.-- |
| GSHNY15 | PINE | joist, 2nd from west wall in "wine cellar", immediately east of fireplace | -BE | 64 | NO DATE | -.-- |
| GSHNY16 | PINE | joist, 3rd from west wall in "wine cellar" | -BE | 72 | 1591 1662 | 0.49 |
| GSHNY17 | PINE | re-core of GSHNY10 | -BE | 93 | 1597 1689 | 0.63 |
| GSHNY18 | PINE | re-core of GSHNY11 | -BE | 105 | 1580 1684 | 0.34 |
| GSHNY19 | PINE | joist, 6th from west wall in "wine cellar" just east of stairway | -BE | 75 | 1588 1662 | 0.60 |
| GSHNY20 | PINE | joist, 7th from west wall nearest wall entrance to "bar longue" | -BE | 73 | NO DATE | -.-- |

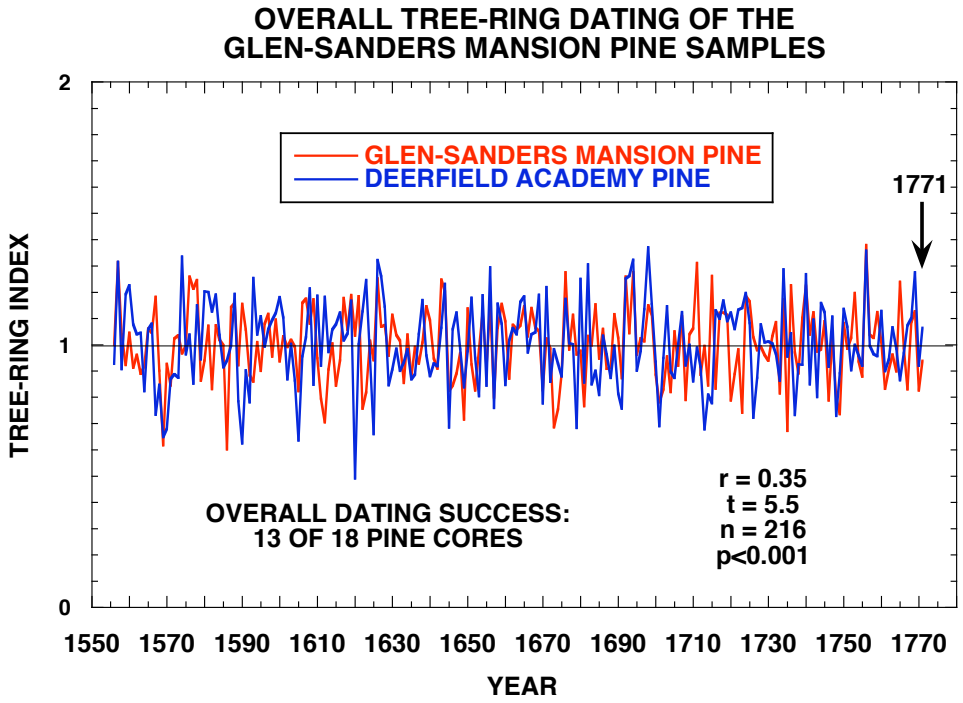


Figure 1. Comparison of the Glen-Sanders Mansion cross-dated pine master chronology with the best regional dated pine master developed from buildings at the Deerfield Academy, Deerfield, Massachusetts. The correlation between the series (r=0.35) is highly significant (p<0.001) with an overlap of 216 years.

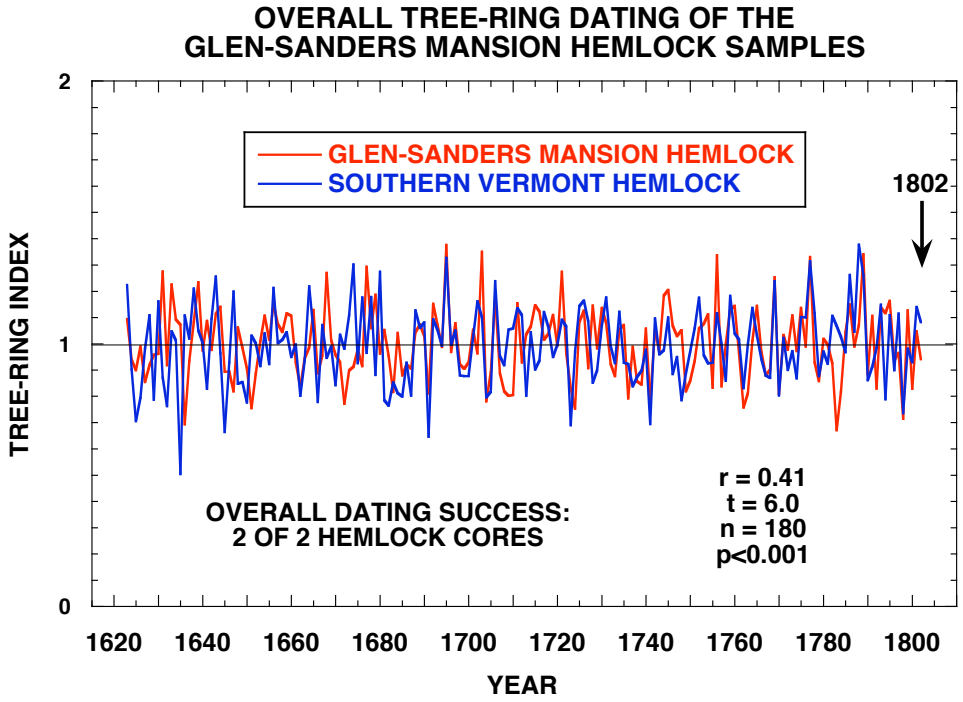


Figure 2. Comparison of the Glen-Sanders Mansion cross-dated hemlock master chronology with the best regional dated hemlock master developed from southern Vermont. The correlation between the series (r=0.41) is highly significant (p<0.001) with an overlap of 180 years.

## B. David DeFreest House

The results of the dendrochronological analysis of the David DeFreest House timbers are summarized in **Table 2** and **Figure 3**. A total of 8 pine samples were collected from the cellar and analyzed, with 5 of the 8 samples dating out extremely well. The three samples that did not date were all very short. As before, the strength of cross-dating within the pines is indicated by the far right column of **Table 2** by the Spearman rank correlations. These correlations are again in the range that one expects for correctly cross-dated timbers from buildings in the eastern US.

Four of the five dated samples have produced the same 1771 cutting date, with the remaining one having an outer date of 1765. These are all from the west wing of the cellar. Therefore, that part of the David DeFreest House was probably constructed shortly after 1771. The three undated samples all come from the east wing of the cellar. The fact that the timbers had far fewer rings suggests a different source of wood and *perhaps* a different construction date. However, it is impossible to provide any more useful information beyond this conjecture. Additional samples from the east wing of the cellar might help in this regard.

**Table 2. Dendrochronological dating results for all samples taken from the David De Freest House. For WANY, +BE means the bark edge present and recovered and –BE means that bark edge was either not present or not recoverable. All correlations are Spearman rank correlations of each series against the mean of all of the others of the same species.**

| ID | SPECIES | DESCRIPTION | WANY | RINGS | DATING | CORREL |
|---|---|---|---|---|---|---|
| DDEFH01 | PINE | joist, west wing of cellar, 2nd joist from partition wall to center section | +BE | 152 | 1620 1771 | 0.36 |
| DDEFH02 | PINE | joist, west wing of cellar, 1st joist from partition wall to center section | +BE | 143 | 1627 1771 | 0.49 |
| DDEFH03 | PINE | beam over partition between west wing of cellar & center cellar section | +BE | 165 | 1607 1771 | 0.40 |
| DDEFH04 | PINE | joist, center cellar section, 1st joist from partition/door to west wing | +BE | 133 | 1639 1771 | 0.46 |
| DDEFH05 | PINE | joist, center cellar section, 2nd joist from partition/door to west wing | +BE | 145 | 1619 1765 | 0.50 |
| DDEFH06 | PINE | joist, east wing of cellar, 4th joist from west wall/door to center section | +BE | 59 | NO DATE | -.-- |
| DDEFH07 | PINE | joist, east wing of cellar, 3rd joist from west wall/door to center section | +BE | 34 | NO DATE | -.-- |
| DDEFH08 | PINE | joist, east wing of cellar, 7th joist from west wall/door to center section | +BE | 53 | NO DATE | -.-- |

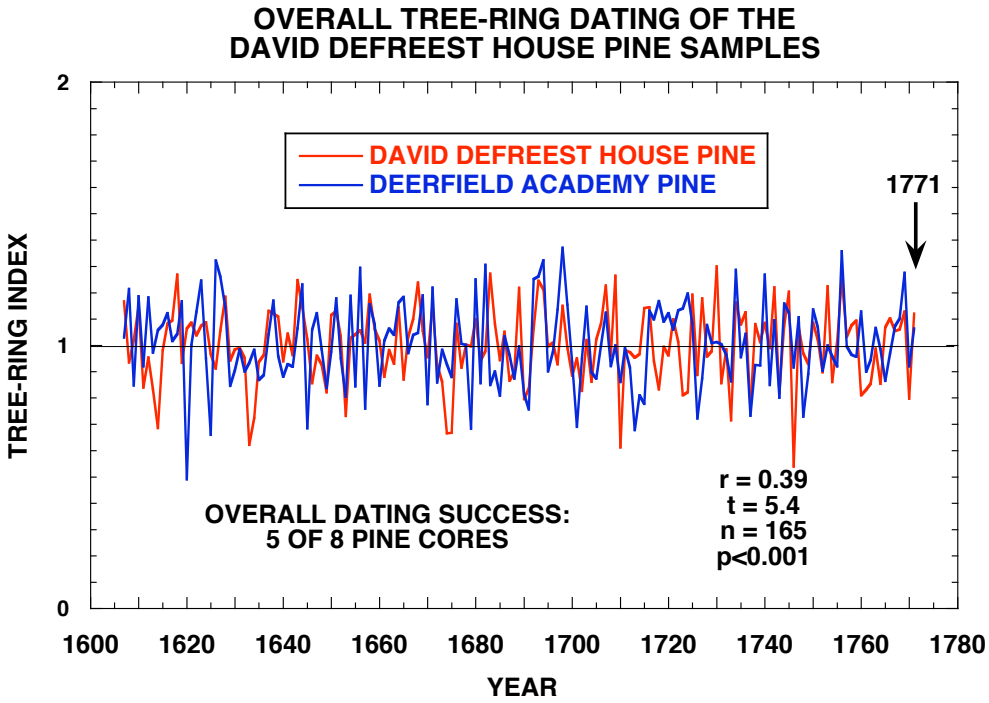


Figure 3. Comparison of the David DeFreest cross-dated pine master chronology with the best regional dated pine master developed from buildings at the Deerfield Academy, Deerfield, Massachusetts. The correlation between the series (r=0.39) is highly significant (p<0.001) with an overlap of 165 years.

## C. Conclusions

The dendrochronological analyses of the Glen-Sanders Mansion and David DeFreest House have been highly successful. Each has yielded useful dates for the likely construction histories of those buildings. The pine master chronologies that have been developed will be extremely useful in dating other buildings in the Albany area that used local yellow pine for construction. The Glen-Sanders Mansion and David DeFreest House pine masters also cross-date with each other very well, with a t-value of 6.3 (p<0.001) based on a correlation of 0.44 and an overlap of 165 years. This match is higher than that for either chronology against the Deerfield Academy master, which means that the development of a local pine dating master will result in better dating potential in the Albany area in the future. Combining the Glen-Sanders and David DeFreest samples into one historical pine master also results in a better match with the Deerfield Academy master (t=6.2, r=0.39). This result strongly validates the cross-dates shown in **Figs. 1** and **3**. It also illustrates the way in which the quality of the dendrochronological dating master improves with the addition of new samples.

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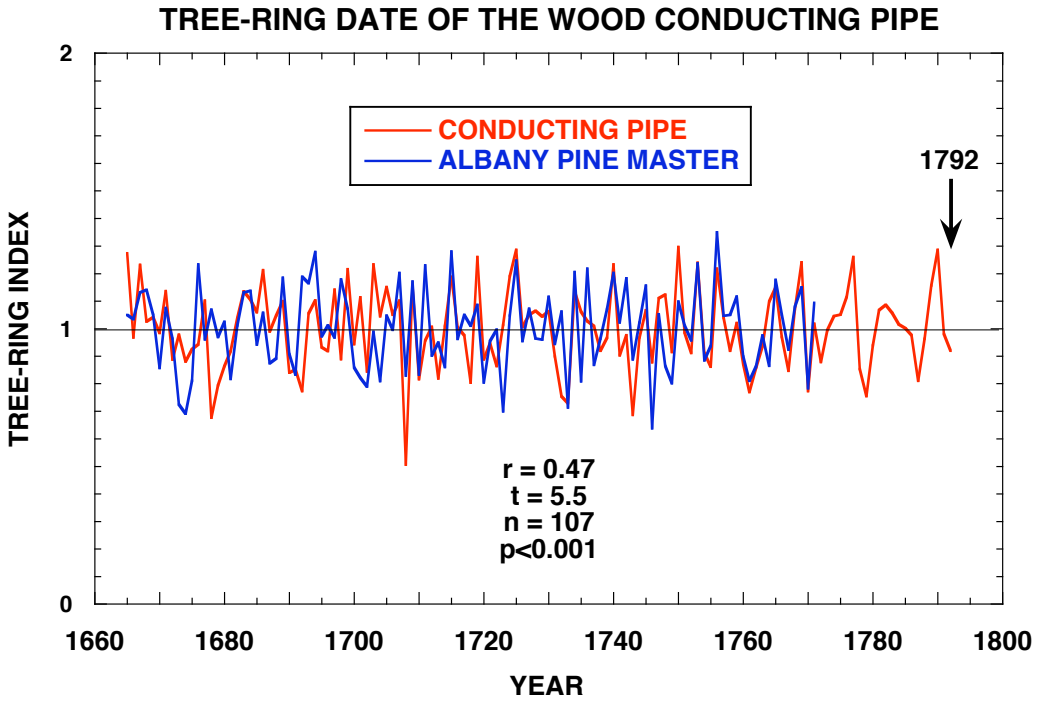
# Addendum

While the dendrochronological analyses of the Glen-Sanders Mansion and David DeFreest House were being carried out, Mr. Walter Wheeler sent Dr. Edward Cook a cross-section sample of a wood conducting pipe obtained from a site in the vicinity of Albany. The conducting pipe was made from a complete pine log approximately 14 inches in diameter, with a 3 inch conducting hole bored through the center of it. Even with the center gone from the cross-section, there were still 128 annual rings left for tree-ring dating. The outermost surface of the pipe also appears to be a bark surface, with what appears to be insect (bark beetle?) galleries on it. The existence of these galleries suggests that the tree may have been near death or already dead when felled for use.

The ring widths along two radii were measured on the conducting pipe cross-section. These ring-width series were run through COFECHA to determine the degree of internal cross-dating. In so doing, the radii were found to correlate very well (Spearman r=0.51). Consequently, they were averaged together into a conducting pipe pine master and dated with the Albany pine master based on the combined Glen-Sanders and David DeFreest dated tree-ring samples. The result is shown below in **Addendum Figure 1**. The wood conducting pipe cross-dates very well with the Albany pine dating master (r=0.47, t=5.5, p<0.001) and has an outer date of 1792.

The 1792 date is probably very close to the felling date of the tree, but as conjectured above, it is possible that the tree was already dead. However, the presence of sapwood and a bark surface means that the death date of the tree must have been very close to the year it was felled, if not in 1792 itself. Therefore, 1792 should be accepted as the best estimate of the date when the tree was felled for use as a conducting pipe.




**Addendum Figure 1.** Comparison of the wood conducting pipe chronology with the Albany pine master based on cross-dated pine samples from the Glen-Sanders Mansion and David DeFreest House. The correlation between the series over the 1665-1771 period in common (r=0.47) is highly significant (p<0.001). The continuation of the conducting pipe series past 1771 leads to an outer date of 1792.