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A Preliminary Examination of Settlement Spread at Camden (38KE1)

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A PRELIMINARY EXAMINATION OF SETTLEMENT SPREAD AT CAMDEN (38KE1)

by

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INTRODUCTION

The fieldwork upon which this study is based was conducted as a part of a landscaping program carried out by the Camden Historical Commission in March 1977. This landscaping consisted of the planting of pine seedlings along a line parallel to the 1780-81 town wall of Camden which had been previously located by archeological investigations in 1975 (Lewis 1976). The pines were planted to outline the old historic town wall as an interpretive device for site visitors. The writer, under the direction of Dr. Kenneth Lewis, was hired to work with the tree planters for two purposes: (a) to avoid damaging the actual wall trench of 1780-81 as well as other archeological remains and (b) to ascertain the extent of occupation outside the immediate perimeter of the old town wall.

The Camden Historical Commission is to be commended for this concern with the archeological data and the protection of the archeological record in the ground. Simple planting of a line of seedlings might seem of minimal impact on the archeological record but if those seedlings had been planted on archeological features such as the town wall, the entire wall trench could well have been destroyed.

The present study has developed from this field work and is designed to identify, if possible, certain supposed demographic shifts of the town of Camden following the Revolutionary War. The present town of Camden lies well to the north of the site of the 18th Century town and the assumption is that it gradually diffused northward from the older location (Schulz 1972: 56; Lewis 1976: 25, 43). As a problem in demographic distribution one may wonder, in the light of known historic events, whether this was actually a gradual northward diffusion or not. It may have been that the center of activity of the town was abruptly moved from the eighteenth century location to the twentieth century location and then spread slowly in all directions including southward to encroach upon the site of the older town.

The data from the landscaping work of March 1977 would seem to provide information on this question and is the basis for the present study. This study draws upon the archeological investigations at Camden conducted by Dr. Lewis, in which the area within the 1780-81 town wall was studied (Lewis 1976). Dr. Lewis' investigation provides the comparative material from within the wall while the 1977 investigation provides material from outside the town wall. Together, the two sets of data are used to identify the nature of the demographic shift to the north and to specify whether that shift was a gradual diffusion over space or an abrupt movement to a new location.

NATURAL SETTING

The site of the eighteenth century town of Camden is located in the southern part of the present city of Camden, in Kershaw County, South Carolina (Fig. 1). Camden lies on the Fall Line at the interface of the Coastal Plain and the Piedmont. This area is one of transition between the older metamorphic and igneous rocks of the Piedmont and the unconsolidated elements of the Coastal Plain. The soils in Camden are of the Wickham-Altavista-Roanoke soil association, consisting of brownish-grey loams underlain by sandy, mottled clays. The soils in the surrounding area are sandy, well drained, and usually are suitable for cultivation. Swamps and other poorly drained areas are found in floodplains, especially below the Fall Line. The major river system in the area is the Wateree, which drains most of east-central South Carolina (Frothingham and Nelson 1944: 5; Hunt 1967: 145; Craddock and Ellerbe 1966).

Camden lies within the Southern Temperate Deciduous Forest biome. The predominant forest type in this region is the longleaf pine forest, and consequently, this community is characterized mainly by longleaf pine (Pinus palustris). Other trees that appear in quantity, includes scrub oaks, turkey oak (Quercus laevis, willow oak (Q. cinerea) and blackjack oak (Q. Mailandica) (Braun 1950: 285; Frothingham and Nelson 1944: 5; Shelford 1963: 56).

A second forest community characterized by the loblolly pine (Pinus taeda), also occurs in this area. Several species of hardwoods are also found in this forest, including black gum (Nyssa sylvatica), sweet gum (Liquidambar styraciflua) and scrub oaks. Longleaf pine, shortleaf pine (Pinus echinata) and pond pine (P. rigida) occupy the drier areas of this forest community. Due to its ability to invade abandoned fields, loblolly pine has greatly increased during historic times in areas that would formerly have supported mixed forest (Frothingham and Nelson 1944: 19-20; Braun 1950: 286; Spring, Brewer, Brown and Fanning 1974: 2). At the time of European contact the forest in the Camden area was apparently approaching a deciduous oak-hickory climax. The disruptive nature of land clearing and cultivation resulted, however, in the predominance of softwoods and the oak-hickory forests disappeared (Shelford 1963: 88).

Animal species associated with this ecotone include white-tailed deer, gray fox, fox squirrel, eastern cottontail, gray wolf, mountain lion, timber rattlesnake, wild turkey, quail and gopher tortoise. All of these species were present during the early period of European occupation (Shelford 1963: 88; Mills 1972: 100-103).

The climate of the area is temperate with an average annual temperature of 62.0°F. The warmest month, July, averages 80.0°F. and the coldest month, December, averages 44.5°F. Average annual rainfall for the area is 49.1 inches. Minor droughts occur approximately once every seven years, with major ones occurring less frequently (Rogers 1973: 124).

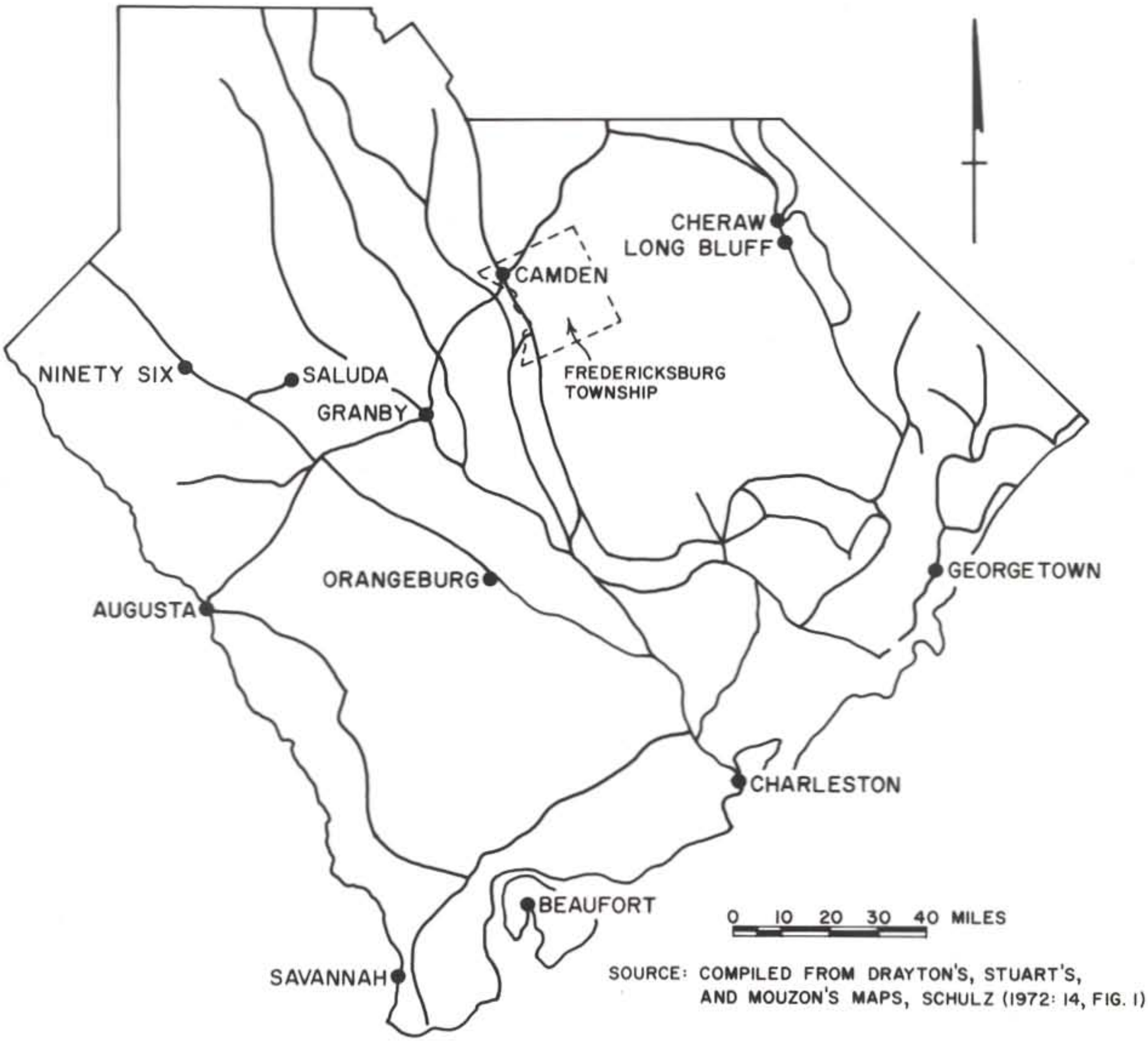
CHERAW
LONG BLUFF
CAMDEN
FREDERICKSBURG TOWNSHIP
NINETY SIX
SALUDA
GRANBY
GEORGETOWN
ORANGEBURG
AUGUSTA
CHARLESTON
BEAUFORT
SAVANNAH
0 10 20 30 40 MILES
SOURCE: COMPILED FROM DRAYTON'S, STUART'S, AND MOUZON'S MAPS, SCHULZ (1972: 14, FIG. 1)

FIGURE 1.

HISTORICAL BACKGROUND

The eighteenth century town of Camden lay within the boundaries of Fredericksburg Township (Fig. 1), which was part of Craven County. The Camden area was first settled in the 1740's by Irish Quakers, and by the 1750's the settlement had grown and assumed the name of Pine Tree Hill. Its importance during the 1750's increased as it became a major transshipment point for goods moving from the coastal areas to the frontier (Kirkland and Kennedy 1905: 9-10; Mills 1972: 586; Ernst and Merrens 1973: 561-562).

Pine Tree Hill continued to grow in importance during the 1760's. It not only remained a break-in-bulk point, but also became the location of small scale industries. In 1769, with the establishment of the circuit court system, Pine Tree Hill became the seat of the Camden district, a position of considerable importance. At this time the old name, Pine Tree Hill, was dropped and the town's name was changed to Camden (Kirkland and Kennedy 1905: 90-95; Schulz 1972: 23; Mills 1972: 589).

During the Revolutionary War several changes occurred, including the near destruction of Camden by the British forces in 1781. South Carolina, in general, did not play a major role in the Revolutionary War between 1777 and 1780, but when Charleston was taken by the British in 1780, the British set up a chain of fortified posts to secure the interior and to serve as channels of communication and transportation. Camden was one of these posts. It was fortified with a stockade wall surrounding the town, four redoubts, and three other fortified positions outside the stockade wall. These exterior fortifications were arranged so as to protect the approaches to the town from invading American forces (Lee 1969: 163; Ward 1954: 704).

Two military engagements were fought outside of Camden during the Revolutionary War. The first, the Battle of Camden, resulted in a victory for the British. The second, the Battle of Hobkirk Hill, was indecisive. It did, however, cause the British to reconsider their position in the interior of South Carolina, especially when their communication lines to Charleston were shut off. Perceiving that their position was rapidly becoming untenable, the British evacuated Camden on May 8, 1781. Before leaving, they destroyed part of their own supplies and burned the jail, mills, and other buildings in the town (Lewis 1976: 25).

Following the Revolution there was an emphasis in agricultural activity on intensive cultivation of cotton and a corresponding rise in the number of plantations in the Camden area. Moreover, Camden, continued to be a major break-in-bulk point with other diversified activities associated with it. During the first part of the nineteenth century, the town's location shifted to the north and the site of the earlier settlement, which was considered unhealthy, was abandoned (Schulz 1972: 56).

HYPOTHESES AND TEST IMPLICATIONS

The goal of this research is to test the historically documented proposition that the town expanded to the north across the boundary of the 1780-81 town wall during the late eighteenth and early nineteenth centuries (Schulz 1972: 56; Lewis 1976: 25, 43). Since the earlier town was encompassed by the 1780-81 town wall, examination of the area with respect to this feature should aid in determining if the settlement did shift to the north, as indicated by the documents (Lewis 1976: 25, 43).

Although the present town of Camden lies to the north of the eighteenth century town, it should not be assumed that the town arrived at its present location by diffusing north. Although diffusion is indicated by the documents, alternative explanations suggest themselves. One explanation is that a secondary town center developed to the north of the eighteenth century town site, and that later it expanded to form present-day Camden. In this case, individuals from the eighteenth century Camden site could have moved to the new center, which eventually grew to encompass the earlier site of the town. This would result in the same settlement pattern seen in contemporary Camden, yet the process involved in shaping it would not be that implied in documentary sources.

The specific hypotheses to be tested here may be stated as follows: the settlement of Camden spread northward from the eighteenth century town site during the late eighteenth and early nineteenth centuries resulting eventually in the present town of Camden, the center of which lies approximately 1/2 mile north of the eighteenth century town center. The alternate hypothesis is that the settlement pattern of eighteenth century Camden did not spread northward from that town site, hence a process other than northward diffusion accounts for the location of the nineteenth century and modern town.

One test implication follows from each of the hypotheses. If the town spread northward from its eighteenth century boundaries, the area immediately adjacent to the north should exhibit artifact densities equal to or greater than those from the northern border areas within the eighteenth century town. If this spread did not occur from the northern part of the eighteenth century town, then the artifact densities for this area should be less than those from northern border areas within the eighteenth century town.

These hypotheses and test implications should allow for examination of the proposed settlement spread of Camden to the north of the eighteenth century town. In dealing with densities (number per unit volume-- in this case grams per cubic inch and frequency per cubic inch) of artifacts, a basic archeological assumption will be followed: that areas where similar occupations occur (in this case town type occupation) will have similar types of, and relative compositons of, artifacts.

By comparing the values obtained from the sample with those from the interior town occupation, the nature of the settlement outside of the 1780-81 town wall can be ascertained. Through further comparison and statistical analysis it can be ascertained whether the settlement (if there was any) outside of the 1780-81 town wall is of sufficient intensity to adequately resolve the hypotheses posed.

SAMPLING

The first consideration in the field work was to plant the trees in a line parallel to and outside of the 1780-81 town wall. From an interpretive viewpoint, this was to provide visitors with an idea of the approximate size and boundaries of the Revolutionary War period town. From the archeological viewpoint, this would prevent root damage from occurring to the remains of the 1780-81 town wall and to the archeological materials within the eighteenth century town. This linear arrangement does limit the sampling methodology to one of transect sampling; the transects in this case being the lines along which the trees were to be planted. Given the problem under investigation this limitation was not severe, although it was not as ideal for data collecting as would have been the case if the field work had been designed solely for archeological reasons. The transect method does allow coverage outside of and parallel to the perimeter of the 1780-81 town wall, hence it should be sensitive to any sort of spread outward from the 1780-81 town boundaries (Mueller 1975).

The second consideration was with the subsurface sampling units, the nature and size of which were also dictated by non-archeological considerations. The trees had to be planted six feet apart, in a hole the size of the plug of earth taken out in one post hole digger cut. Therefore, a post hole digger plug was to be the subsurface sampling unit (referred to hereinafter as a test pit). The problem with this sampling method is that the results of this sample, in order to be compared with the results of the excavations of the interior, had to be normalized to some relative measurement. Ideally, these units should have been the same size as those used in the previous investigations of the 1780-81 town. The sampling then would have involved the extension of the grid outside, continuing with the stratified systematic unaligned method (Lewis 1976). In this case, however, sponsor needs, financial constraints and time requirements overrode scientific consideration.

This difficulty was not insurmountable. The recovered data could be converted to a density ratio (grams per cubic inch and frequency per cubic inch) and hence be made comparable to the material from previous excavations, once this conversion had also been performed on the previously collected material. These conversions were implemented and used in all aspects of the present study.

Given the fact that a transect sample would be sensitive to the kind of information necessary for this study and that the data could be normalized for comparability, the project, although rigidly structured, could proceed within both the scientific framework and the sponsor's framework. Specific points where the project's restrictions affect the analysis, will be discussed as they arise. Otherwise, given the general focus of the hypothesis, the sponsor's restrictions should not unduly influence the results of this study.

The three sampled transects were oriented parallel to and 12 feet outside the three segments of the 1780-81 town wall (see Fig. 2). The first transect (#1) was approximately 624 feet long and oriented 4° west of north. The second transect (#2) connected with the northern end of the first transect and ran parallel to an angle in the town wall for a distance of 90 feet. This transect was oriented 45° east of north. The third transect (#3) connected with the northeast end of the second transect and ran parallel to the north town wall for a distance of approximately 408 feet. This transect was oriented 86° east of north (Fig. 2).

The sample itself was composed of the contents of systematically aligned plugs of dirt removed with a post hole digger (one per hole), in the process of planting pine seedlings. The plugs were taken out at six foot intervals, yielding 104 plugs for Transect #1, 15 plugs for Transect #2, and 68 plugs for Transect #3. The plugs were then water-screened through 1/4 inch hardware cloth and the cultural material from each was retrieved for further analysis (Appendix A, B).

Prior to analyzing the material, the sample was stratified into three parts for purposes of comparison with material from the previous investigations inside the 1780-81 town wall. This stratification was done to allow areas along the interior perimeter of the town wall, having the same general data values, to be grouped together for purposes of comparison with material from the exterior. Within the exterior sample, the stratification was carried out, so that data from test pits located adjacent to the various perimeter strata would be placed in the appropriate strata for comparison and analysis.

The strata were based on the results of a SYMAP program run on the data from the interior of the 1780-81 town wall. There were three perimeter strata obtained from this program, hence the sample was to be stratified into three parts. The SYMAP was compared to the map of test pits, and lists were made of the test pits that fell opposite each of the three perimeter strata (Appendix C). These lists, then, represented the sample strata by which the material from this project was to be analyzed. In this case, data from the perimeter strata represent the predicted population values (in densities) that a town-type occupation should have. Upon comparison with the values from the sample strata it will be possible to ascertain if the area sampled contains a town-type occupation as well. This will indicate if there was, indeed, a gradual spread of the settlement of Camden to the north.

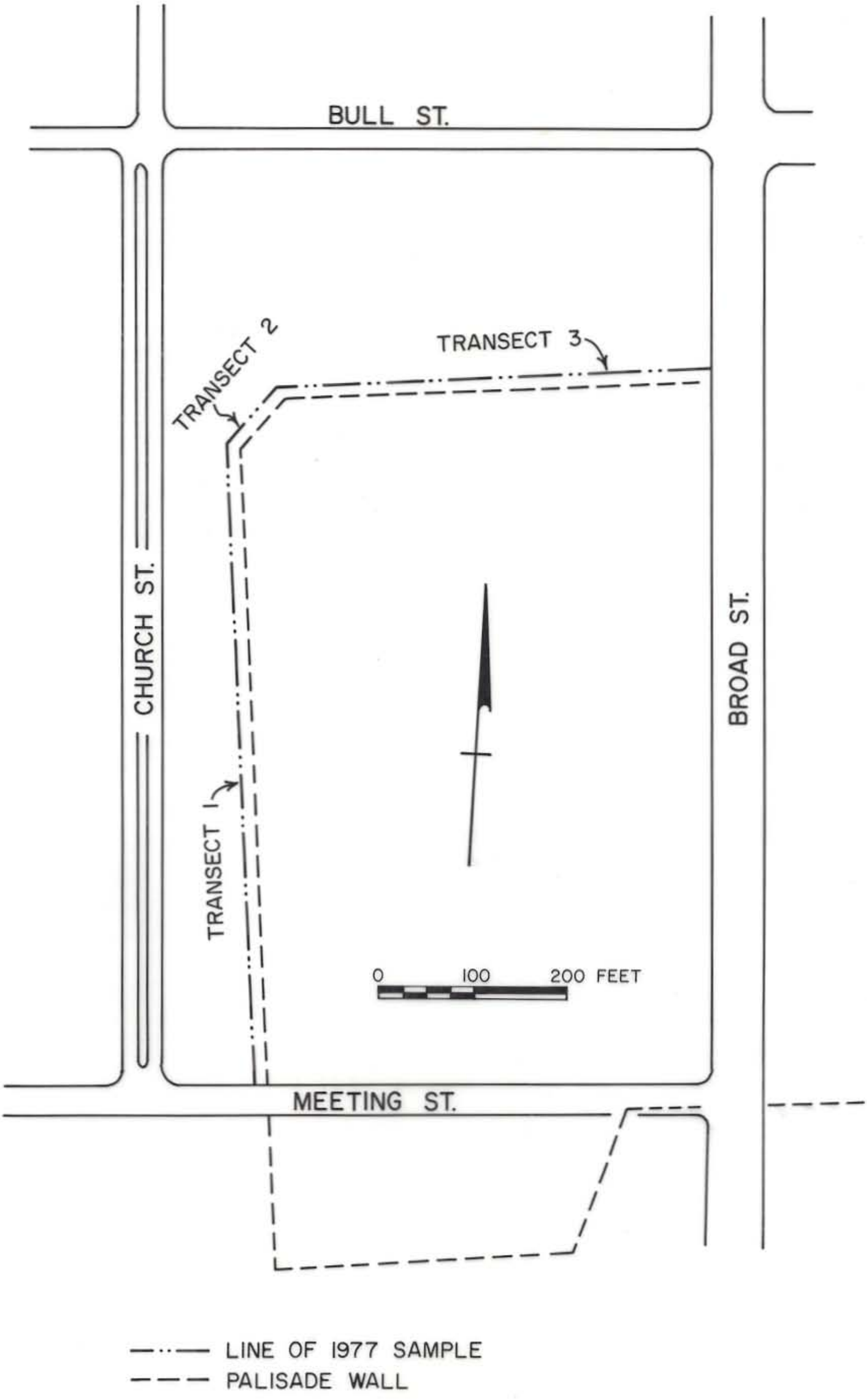
BULL ST.
TRANSECT 2
TRANSECT 3
CHURCH ST.
BROAD ST.
TRANSECT 1
0
100
200 FEET
MEETING ST.
LINE OF 1977 SAMPLE
PALISADE WALL

FIGURE 2.

METHODS OF ANALYSIS

The analytical methods used in this study are essentially descriptive ones, enabling the characteristics of the data from the 1972 sample and from the 1974-75 excavations to be summarized into a form in which they will be comparable. The analysis compares the sample results with the excavation results from the interior of the town. This provides some idea of settlement spread dealing both with directionality and intensity.

Initially it was hoped that a diverse set of data would be recovered, however, during the early stages of laboratory processing, it became apparent that the cultural material from the sample was composed almost exclusively of ceramic fragments and brick fragments. These two variables were therefore the only ones used in this analysis.

The first step in the analysis was to weigh the brick fragments obtained from each of the test pits and record this weight. Next, the volume of each test pit was computed and recorded. A measure of density was then computed using the volume of the test pit and the weight of the brick. This was performed for each pit in each of the three strata. This procedure was also followed in computing values for the base population strata, obtained from the results of the excavations inside the town wall. An identical procedure was followed for the ceramic data, except that the fragments were counted rather than weighed, yielding density as frequency per unit volume (Appendices A, B).

The second step in the analysis was to compute artifact densities for each of the sample strata for each of the population (interior-perimeter) strata for each sample transect and for each interior transect. With the exception of sample stratum 1 and transect #1, which had a sufficient number of elements, these statistics were computed using small sample techniques (Alder and Roessler 1972: 1-40) (Appendices D, E).

After obtaining the above information, the following procedures were performed:

First, the density values obtained from the individual test pits within each sample stratum were compared with the descriptive statistics of the densities obtained from the corresponding stratum within the town wall. This comparison indicated how each of the sample pits compared with the population values from within the town. This gave some idea of the intensity of occupation and hence its significance as an indicator of the nature of settlement outside the town wall.

Second, the descriptive statistics for each of the sample strata were compared with those from each of the population strata to ascertain the general characteristics of both data sets and how they compare with each other. In addition, these descriptive statistics are necessary for the computation of Student's t-test (Alder and Roessler 1972: 153-160).

Third, Student's t-test was used to examine the possibility that the sample strata are similar to the population strata, upon which they were based. This test was designed to determine whether similar patterning in the archeological record was occurring inside the eighteenth century town and outside the town. These results were used to determine if a similar occupation had occurred both within and outside of the eighteenth century town wall, thereby dealing with the question of whether the settlement had gradually spread outside of its original boundaries or not.

Fourth, the descriptive statistics for each sample transect were compared with the descriptive statistics for each of the interior transects (i.e. data obtained from perimeter squares located along each of the three segments of the 1780-81 town wall). The individual sample pits on each transect were compared with the predicted values obtained from the interior population and the results inspected to ascertain if any areas of significantly higher artifact concentrations existed along the transects. This procedure aided in discerning settlement spread, since it treats the sample along the axes where settlement spread would be noticeable.

Finally, Student's t-test was used to ascertain if the characteristics of the sample transects are the same as those from the population transects. This provided an indication as to whether similar phenomena were occurring outside and inside of the eighteenth century town. Hence, it addresses itself to the problem of directionality of settlement spread along the borders of the eighteenth century town.

The methods outlined above enable this study to adequately address the hypothesis posed for this research. They indicate the nature of and spread of the settlement, without subjecting the data to methods too rigorous for their low level of sophistication.

RESULTS

This section presents the results of this analysis on a step by step basis, dealing with each of the two general problems: the presence of the settlement and the direction of its spread.

The first test was made to compare the results from each sample stratum, with the descriptive statistics generated from the population strata (Appendices B, D).

For the Stratum 1 brick remains, the sample had 100 (66%) units that fell within ± 1s* from the predicted population mean. Twenty-two (12%) units fell between +1s and +2s from the population mean and eight (5%) fell between +2s and +3s from the population mean. Twenty-five (17%) fell greater than +3s from the population mean.

These results indicate that there are similar activities occurring inside and outside of the town along the western wall of the town. This stratum is the zone of least activity inside the wall and upon examination it was found that 48 (31%) of the units in the sample have zero values. This would seem to indicate that the same low level of activity had occurred in both the interior and exterior strata. In addition, a fairly large number of units fell between +2s and +3s from the predicted population mean. This indicates that in part of Stratum 1, more intensive activity was occurring than in other parts, and that this activity was more intense than predicted by the population values.

Ten (63%) of the Stratum 2 brick units fell within ± 1s from the population mean. Five fell between -1s and -2s from the predicted population mean. One (6%) fell greater than +3s from the predicted population mean.

The results from Stratum 2 indicate that, as expected, a large percentage of units fell within ±1s from the predicted population mean. From this, one may conclude that the same or similar phenomena occurred both inside and outside of the town wall in the area along the northwest corner of the town.

None of the Stratum 3 brick units fell within ±1s from the predicted population mean. One (6%) fell between -1s and -2s from the population mean and one (6%) fell between -2s and -3s from the population mean. Five (31%) of the units fell between +2s and +3s from the population mean. Nine (57%) units were greater than +3s from the predicted population mean.

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* s = standard deviation, corrected for small sample size.

The results from this stratum deviate most from the entire sample. None of the sample units fell within ±1s from the predicted population mean. Most (88%) of the sample units fell between +2s and +3s and greater than +3s from the population mean. This indicates that the sample does not conform to the results predicted by the population statistics from inside the town wall. In this case, the results were much greater than those predicted, indicating a more intense occupation in the area than predicted.

Based on the results obtained from an examination of the brick variable it is apparent that there was occupation outside the 1780-81 town wall, at least in those areas corresponding to Strata 2 and 3. Stratum 1, the stratum with lowest density also indicated occupation in some of its units, where the density exceeded +3s from the predicted mean. The fact that Stratum 1 did contain sample units within ±1s from the predicted mean does not mean that the area was occupied. As noted above, many of the values within ±1s from the population mean were zero. To summarize these preliminary indications, there was occupation outside the 1780-81 town wall. Further tests were also used to refine our estimates of this occupation and to ascertain its directionality.

The ceramic evidence from Stratum 1 sheds more light on the somewhat inconclusive results from the brick evidence in Stratum 1. One hundred thirty-six (88%) of the sample units fell between the mean and -1s from the mean. Nineteen (12%) of the sample units were greater than +3s from the predicted mean. However, all the values of the 136 units which fell between the mean and -1s from the mean were zero. Hence there was little evidence of occupation in the areas represented by these sample units. The 19 (12%) units that values greater than +3s from the mean seem to follow a pattern similar to the results of the test on brick. Upon closer inspection, it was ascertained that many of the Stratum 1 sample units with high ceramic densities also had high brick densities. This would seem to indicate that certain areas in Stratum 1 were occupied while others were not occupied at all.

The Stratum 2 ceramic sample had 13 (81%) of its units between -1s and -2s from the predicted population mean. These values, however, were all zeros. Three other values (19%) exceeded +3s from the predicted mean. These results indicate that the majority of the area from which this sample came was not occupied, based on ceramic evidence. It also indicates that some part of the area sampled was more heavily occupied than predicted. This area, however, represents a fairly small portion of the stratum.

The Stratum 3 ceramic sample had six units (37%) between -1s and -2s from the predicted population mean. However, these values were all zeros. Ten (63%) of the sample units from this stratum had values that exceeded +3s from the population mean. These results indicate that part of Stratum 3 was more heavily occupied than anticipated, while the remainder of the stratum was less heavily occupied than predicted.

The results of the ceramic variable tests are similar to those for the brick variable, except in Stratum 2. The Stratum 1 results indicate that the majority of this area was unoccupied, although part of it was heavily occupied. The Stratum 3 results indicate that the occupation of this area was heavier than predicted. Stratum 2 provides an exception. Although the majority of the ceramic values were zero, the brick values behaved as predicted. Therefore, the Stratum 2 area can be said to be occupied, but in a different manner from the areas represented by Strata 1 and 3.

In order to provide a further check on this analysis, a Student's t-test was run, using the descriptive statistics of the predicted population and those of the sample. This testing was run in the same manner as the preceding analysis--stratum by stratum within a variable class. In each t-test the hypothesis that the population mean and the sample mean were approximately equal was tested. This would provide information as to whether the sample and the population were similar and hence had similar activities occurring in both. It should be noted that rejection of this hypothesis does not mean a lack of activity occurred in the sample stratum, but that the activity was not the same as that occurring in the same stratum in the population (Alder and Roessler 1972: 153-160) (Appendix F).

For the brick variable, all three of the t-tests rejected the hypothesis, indicating that different activities were occurring in the sample strata than in the population strata. This tends to confirm the results of the previous examination of the sample units with respect to the characteristics of the sample versus interior population. In the case of Strata 1 and 3, this test confirms the difference, which was apparent upon observation of the large number of zero values and the large number of values exceeding +3s from the predicted mean. The result of the test on the Stratum 2 material is different from the expected, indicating that even though the sample data fall close to the predicted mean, they are, in fact, different. Stratum 2, therefore, continued to produce unexpected results.

When a Student's t-test was run on the ceramic data the hypothesis was rejected only in the case of Stratum 1. This again confirms the results of the preceding t-test and the prior observation of results for Stratum 1. Strata 2 and 3 results indicated that similar phenomena were occurring in the posthole sample as were occurring in the base population.

Based on these results, one may conclude that there was occupation outside the 1780-81 town wall, in the case of all strata, except a portion of Stratum 1. However, only in the case of the Stratum 2 brick distribution and the Strata 2 and 3 ceramic t-tests did this occupation exhibit similarity to that within the wall. In the other instances it was either greater than predicted (+2s or more) or nonexistent. Therefore, when the areas were occupied, an occupation of equal or greater intensity than in the late eighteenth century town took place (Student's t-test).

Having ascertained that there was occupation outside of the 1780-81 town wall (although no temporal parameters can be provided) it is necessary to determine if there was any directionality to this exterior occupation. That is, was one portion of the exterior sample occupied more heavily than another, indicating a shift in the settlement. This would allow the remaining portion of the hypothesis--that dealing with the supposed northward shift of the town settlement--to be investigated.

To investigate this question, the data were organized by the sample transects rather than by strata. The comparative methods and Student's t-test, used previously, were used to examine this aspect of the research, also.

The results for the brick variable in Transect 1 indicate that 81 (78%) of the sample units fall within $\pm 1s$ from the predicted population mean. However, 43 of these values are zero. Ten (10%) of the sample values fall between +2s and +3s from the predicted mean. Thirteen (12%) of the sample values fell further than +3s from the predicted mean. This large number of zero values indicates that a large portion (39%) of the sampled area has no evidence of occupation. An additional 39% was occupied to a similar intensity as that predicted from the interior population. Ten to 22% of the values exceeded an acceptable range around the mean, indicating a more intense occupation than anticipated. The more heavily occupied area fall to the northern part of the transect (Fig. 3).

Transect 2 had only 1 unit from which to derive the interior population values for comparison with those of the sample. Therefore it could not be used in this analysis.

Transect 3 had 31 (49%) of the sample units falling within $\pm 1s$ from the predicted mean. Six (10%) of the sample units fell between -1s and -2s from the predicted mean. These values were all zero. Five (8%) sample values fell between +2s and +3s from the predicted mean. Thirty-one (33%) of the sample units were greater than +3s from the predicted mean. This indicates that an occupation similar to that occurring within the north transect of the town wall occurred in the sample areas. Also, areas of more intensive occupation existed along Transect 3. The histogram of this (Fig. 3) shows a large number of high values occurring all along Transect 3; with the highest values occurring at the east end (Fig. 3).

The Transect 1 ceramic results yielded 91 (87%) of the sample units falling between -1s and -2s from the predicted mean. However, these values were all zero. Thirteen (13%) of the values fell beyond +3s from the predicted mean. These results indicate that only a small portion of this transect was occupied, based on ceramic data. The part that was occupied, however, was occupied at a more intensive level than predicted (Fig. 4).

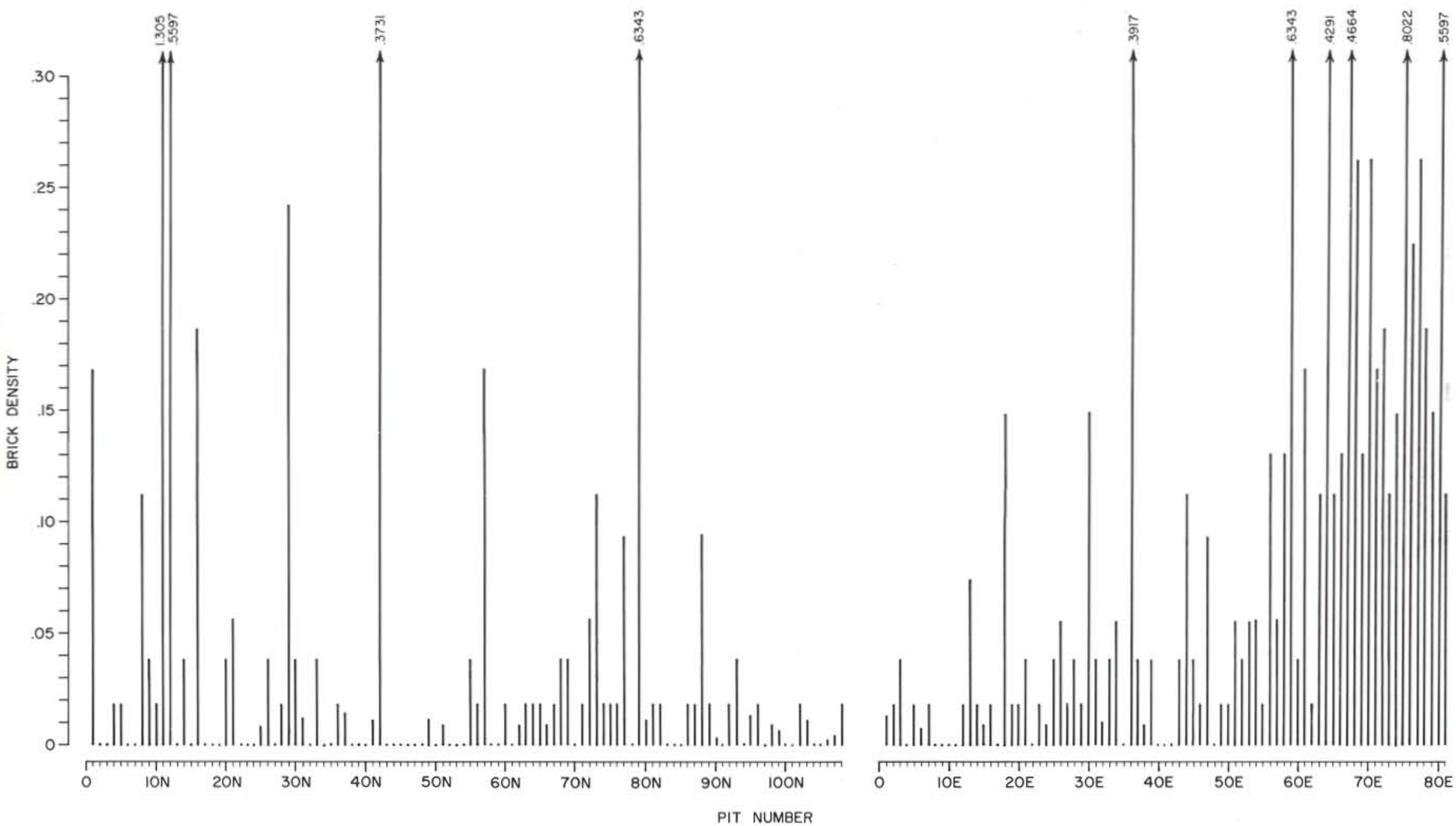

FIGURE 3. Histograms of Brick Data by Test Pits.

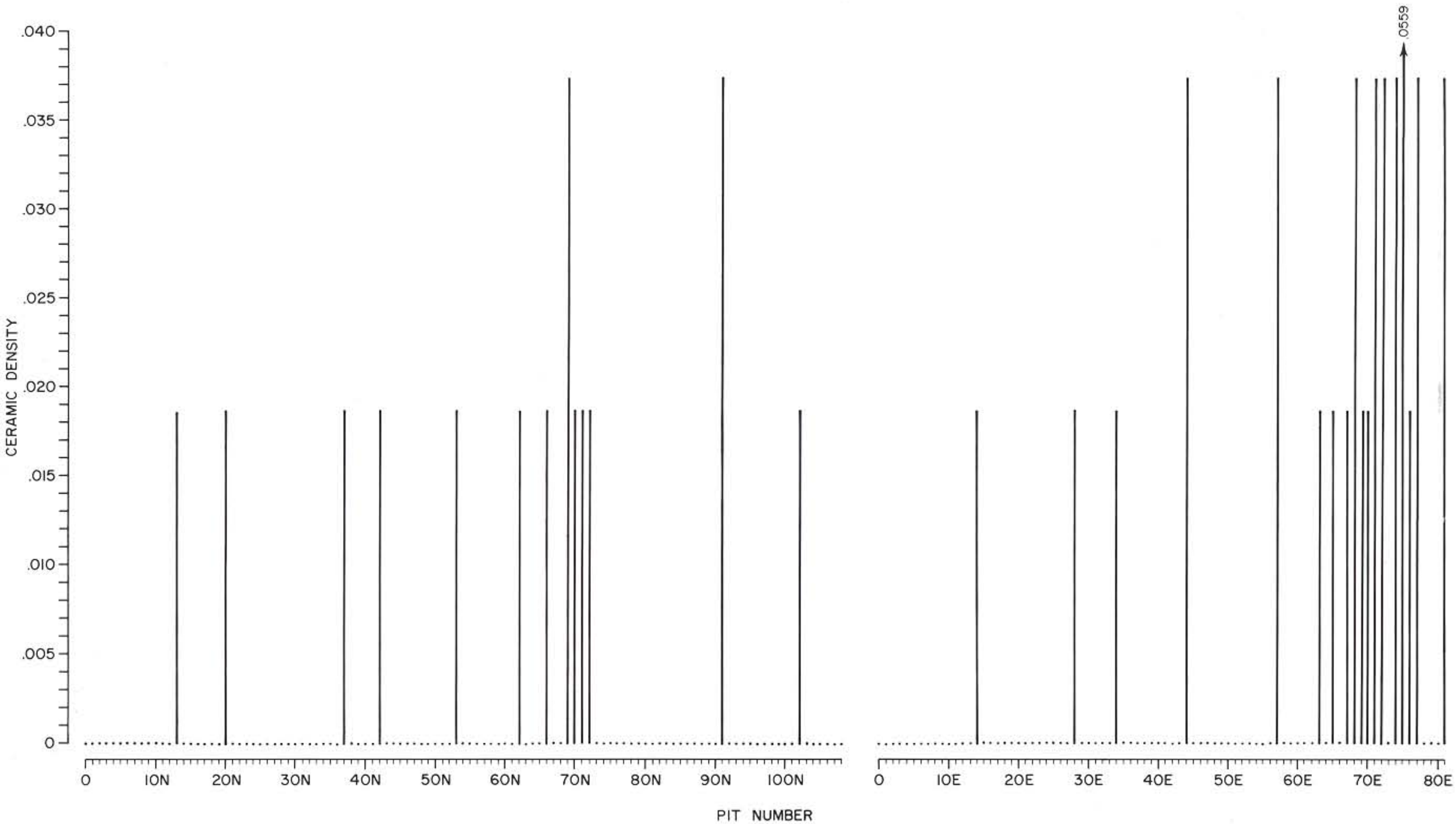

FIGURE 4. Histograms of Ceramic Data by Test Pits.

The results from Transect 3 were split in a manner similar to those in Transect 1. Forty-four (70%) of the sample units fell between ±1s from the predicted mean. These values, however, were all zero. Nineteen (30%) of the sample values fell greater than +3s from the predicted mean. Based on ceramic data, parts of this sample area were unoccupied, while the remainder was occupied to a greater intensity than predicted.

Generally speaking, the ceramic and brick results correspond in their indications of occupation in the sample area. Transect 1 results for both variables indicate a large amount of unoccupied area, as well as areas that are more intensively occupied than predicted. Transect 2 was not examined in either case. The Transect 3 brick and ceramic results are basically similar. Both variables indicated areas of intensive occupation, but the brick data were more evenly distributed than the ceramic data. Other than the intensively occupied areas, all the ceramic values were zero. The brick values varied, including some zero values, but were not limited to these (Figs. 3 & 4).

A Student's t-test was used to ascertain if the sample differed significantly from the predicted population in order to deal with the question of directionality of settlement spread. The hypothesis to be tested by the t-test is that the population mean and the sample mean were approximately equal. This will provide information as to whether similar activities occurred in both the sample and population. From this we can determine the intensity, and to some extent, the directionality of the settlement. Transect 2 will be excluded from this analysis.

The Transect 1 results for both variables indicate that the hypothesis should not be rejected. Hence, one can assume that similar kinds of activity occurred in both the sample and the population. However, based on previously presented data, it can be seen that there was no activity along most of this transect, except toward the northern end. Therefore, although this sample occupation was similar to the population, in absolute terms there was no occupation except toward the northern end of the transect. It seems clear then, that any occupation outside the 1780-81 town wall lies toward the north (Appendix G).

The t-tests results for Transect 3 rejected the test of equality/similarity of means. This coupled with the previously discussed descriptive statistics would seem to indicate that the area to the north of the 1780-81 town wall was inhabited, and inhabited more intensely than predicted (Appendix G).

The overall results of this analysis tend to confirm the hypothesis of northward settlement spread since the occupation to the north was more intense than the population values predicted. This may be taken to indicate a directional shift in settlement as well as the possibility of the occurrence of different activities than those that took place within the 1780-81 town wall.

CONCLUSIONS

The analysis of the archeological data has supported the hypothesis that the occupation of Camden shifted northward, indicating that documentary sources were correct. Although no temporal framework can be assigned, based on archeological evidence, documentary and map evidence indicate that there was no settlement in this area in the pre-Revolutionary and Revolutionary period, or during the early twentieth century. Therefore, any expansion must have taken place during the nineteenth century. Although these results do not eliminate the possibility that the settlement of modern Camden was affected by factors other than diffusion from the eighteenth century town, they do indicate that this diffusion was at least one factor in the development of the modern settlement of Camden.

This study of the spread of Camden has been simplistic in many ways, even though it supports the documentary evidence and points out the various probable loci of intensive settlement outside of the 1780-81 town wall. Given the circumstances, however, it was the most reasonable approach that could have been taken to the archeological aspects of such a landscaping project. This has been a productive approach to take to the dwindling archeological record. With much of the archeological record being destroyed, the archeologist must use wisely the material that is produced by any reasonable project, regardless of its size or the sponsor's goals. In doing so, irreplaceable data will not be wasted and scientific investigations, at various levels of sophistication, can be carried out.

APPENDIX A

DATA FROM POPULATION (INTERIOR TRANSECTS/STRATA)

Square	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Population Stratum	Transect
N5020-E4465	231	10	.0053	.0002	1	1
N5070-E4455	100	9	.0033	.0002	1	1
N5120-E4450	148	5	.0042	.0001	1	1
N5170-E4455	235	19	.0077	.0006	1	1
N5220-E4455	460	26	.0152	.0008	1	1
N5270-E4470	392	27	.0129	.0008	1	1
N5320-E4465	309	22	.0102	.0007	2	1
N5370-E4475	771	34	.0446	.0019	2	1
N5420-E4480	487	26	.0187	.0010	1	1
N5470-E4465	170	21	.0065	.0008	1	1
N5520-E4475	215	5	.0071	.0001	1	1
N5570-E4450	63	10	.0029	.0004	1	1
N5620-E4460	122	19	.0047	.0007	1	1
N5670-E4470 (corner)	206	5	.0059	.0001	1	2
N5690-E4520	53	8	.0015	.0002	1	3
N5685-E4570	210	19	.0054	.0004	1	3
N5665-E4620	154	32	.0035	.0007	1	3
N5675-E4670	1006	57	.0194	.0010	1	3
N5665-E4720	1185	114	.0249	.0023	1	3
N5690-E4770	1570	273	.0519	.0090	3	3
N5695-E4820	1435	63	.0830	.0036	3	3
N5680-E4870	935	30	.0735	.0023	1	3

APPENDIX B

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
1N	9	0	.1679	0	NA	NA
2N	0	0	0	0	NA	NA
3N	0	0	0	0	1	1
4N	1	0	.0186	0	1	1
5N	1	0	.0186	0	1	1
6N	0	0	0	0	1	1
7N	0	0	0	0	1	1
8N	6	0	.1119	0	1	1
9N	2	0	.0373	0	1	1
10N	1	0	.0186	0	1	1
11N	70	0	1.3050	0	1	1
12N	30	0	.5597	0	1	1
13N	0	1	0	.0186	1	1
14N	2	0	.0373	0	1	1
15N	0	0	0	0	1	1
16N	10	0	.1865	0	1	1
17N	0	0	0	0	1	1
18N	0	0	0	0	1	1
19N	0	0	0	0	1	1
20N	2	1	.0373	.0186	1	1
21N	3	0	.0559	0	1	1
22N	0	0	0	0	1	1
23N	0	0	0	0	1	1
24N	0	0	0	0	1	1
25N	.5	0	.0099	0	1	1
26N	2	0	.0373	0	1	1
27N	0	0	0	0	1	1
28N	1	0	.0186	0	1	1
29N	13	0	.2425	0	1	1
30N	2	0	.0373	0	1	1
31N	.6	0	.0111	0	1	1
32N	0	0	0	0	1	1
33N	2	0	.0373	0	1	1
34N	0	0	0	0	1	1
35N	0	0	0	0	1	1

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
36N	1	0	.0186	0	1	1
37N	.7	1	.0130	.0186	1	1
38N	0	0	0	0	1	1
39N	0	0	0	0	1	1
40N	0	0	0	0	1	1
41N	.6	0	.0111	0	1	1
42N	20	1	.3731	.0186	1	1
43N	0	0	0	0	1	1
44N	0	0	0	0	1	1
45N	0	0	0	0	1	1
46N	0	0	0	0	1	1
47N	0	0	0	0	1	1
48N	0	0	0	0	1	1
49N	.6	0	.0111	0	1	1
50N	0	0	0	0	1	1
51N	.5	0	.0099	0	2	1
52N	0	0	0	0	2	1
53N	0	1	0	.0186	2	1
54N	0	0	0	0	2	1
55N	2	0	.0373	0	2	1
56N	1	0	.0186	0	2	1
57N	9	0	.1679	0	2	1
58N	0	0	0	0	2	1
59N	0	0	0	0	2	1
60N	1	0	.0186	0	2	1
61N	0	0	0	0	2	1
62N	.5	1	.0099	.0186	2	1
63N	1	0	.0186	0	2	1
64N	1	0	.0186	0	2	1
65N	1	0	.0186	0	2	1
66N	.5	1	.0099	.0186	2	1
67N	1	0	.0186	0	1	1
68N	2	0	.0373	0	1	1
69N	2	2	.0373	.0373	1	1
70N	0	1	0	.0186	1	1

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
71N	1	1	.0186	.0186	1	1
72N	3	1	.0559	.0186	1	1
73N	6	0	.1119	0	1	1
74N	1	0	.0186	0	1	1
75N	1	0	.0186	0	1	1
76N	1	0	.0186	0	1	1
77N	5	0	.0932	0	1	1
78N	0	0	0	0	1	1
79N	34	0	.6343	0	1	1
80N	.6	0	.0111	0	1	1
81N	1	0	.0186	0	1	1
82N	1	0	.0186	0	1	1
83N	0	0	0	0	1	1
84N	0	0	0	0	1	1
85N	0	0	0	0	1	1
86N	1	0	.0186	0	1	1
87N	1	0	.0186	0	1	1
88N	5	0	.0932	0	1	1
89N	1	0	.0186	0	1	1
90N	.2	0	.0037	0	1	1
91N	0	2	0	.0373	1	1
92N	1	0	.0186	0	1	1
93N	2	0	.0373	0	1	1
94N	0	0	0	0	1	1
95N	.7	0	.0130	0	1	1
96N	1	0	.0186	0	1	1
97N	0	0	0	0	1	1
98N	.5	0	.0099	0	1	1
99N	.4	0	.0074	0	1	1
100N	0	0	0	0	1	1
101N	0	0	0	0	1	1
102N	1	1	.0186	.0186	1	1
103N	.6	0	.0111	0	1	1
104N	0	0	0	0	1	1
105N	0	0	0	0	1	1
106N	.1	0	.0018	0	1	1
107N	.2	0	.0037	0	1	2
108N	1	0	.0186	0	1	2

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
1E	.7	0	.0130	0	1	2
2E	1	0	.0186	0	1	2
3E	2	0	.0373	0	1	2
4E	0	0	0	0	1	2
5E	1	0	.0186	0	1	2
6E	.4	0	.0074	0	1	2
7E	1	0	.0186	0	1	2
8E	0	0	0	0	1	2
9E	0	0	0	0	1	2
10E	0	0	0	0	1	2
11E	0	0	0	0	1	2
12E	1	0	.0186	0	1	2
13E	4	0	.0746	0	1	2
14E	1	0	.0186	0	1	2
15E	.5	0	.0099	0	1	2
16E	1	0	.0186	0	1	2
17E	0	0	0	0	1	2
18E	8	0	.1492	0	1	2
19E	1	1	.0186	.0186	1	3
20E	1	0	.0186	0	1	3
21E	2	0	.0373	0	1	3
22E	0	0	0	0	1	3
23E	1	0	.0186	0	1	3
24E	.5	0	.0099	0	1	3
25E	2	0	.0373	0	1	3
26E	3	0	.0559	0	1	3
27E	1	0	.0186	0	1	3
28E	2	1	.0373	.0186	1	3
29E	1	0	.0186	0	1	3
30E	8	0	.1492	0	1	3
31E	2	0	.0373	0	1	3
32E	.5	0	.0099	0	1	3
33E	2	0	.0373	0	1	3
34E	3	1	.0559	.0186	1	3
35E	0	0	0	0	1	3

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
36E	21	0	.3917	0	1	3
37E	1	0	.0186	0	1	3
38E	.5	0	.0099	0	1	3
39E	2	0	.0373	0	1	3
40E	0	0	0	0	1	3
41E	0	0	0	0	1	3
42E	0	0	0	0	1	3
43E	2	0	.0373	0	1	3
44E	6	2	.1119	.0373	1	3
45E	2	0	.0373	0	1	3
46E	1	0	.0186	0	1	3
47E	5	0	.0932	0	1	3
48E	0	0	0	0	1	3
49E	1	0	.0186	0	1	3
50E	1	0	.0186	0	1	3
51E	3	0	.0559	0	1	3
52E	2	0	.0373	0	1	3
53E	3	0	.0559	0	1	3
54E	3	0	.0559	0	1	3
55E	1	0	.0186	0	1	3
56E	7	0	.1305	0	1	3
57E	3	2	.0559	.0373	1	3
58E	7	0	.1305	0	1	3
59E	34	0	.6343	0	3	3
60E	2	0	.0373	0	3	3
61E	9	0	.1679	0	3	3
62E	1	0	.0186	0	3	3
63E	6	1	.1119	.0186	3	3
64E	23	0	.4291	0	3	3
65E	6	1	.1119	.0186	3	3
66E	7	2	.1305	.0373	3	3
67E	25	1	.4664	.0186	3	3
68E	14	2	.2611	.0373	3	3
69E	7	1	.1305	.0186	3	3
70E	14	1	.2611	.0186	3	3

DATA FROM SAMPLE (EXTERIOR TRANSECT/STRATA)

Pit	Brick Weight (gms.)	Ceramic Frequency	Brick Weight per Unit Volume	Ceramic Frequency per Unit Volume	SYMAP Sample Stratum	Transect
71E	9	2	.1679	.0373	3	3
72E	10	2	.1865	.0373	3	3
73E	6	0	.1119	0	3	3
74E	8	2	.1492	.0373	3	3
75E	43	3	.8022	.0559	1	3
76E	12	1	.2238	.0186	1	3
77E	14	2	.2611	.0373	1	3
78E	10	0	.1865	0	1	3
79E	8	0	.1492	0	1	3
80E	30	0	.5579	0	1	3
81E	6	2	.1119	.0373	1	3

APPENDIX C

PIT ALIGNMENT WITH SQUARES

Square	Pit	Stratum	Transect
Off Grid	1N, 2N	N/A	N/A
N5020-E4465	3N-10N	1	1
N5070-E4455	11N-18N	1	1
N5120-E4450	19N-26N	1	1
N5170-E4455	27N-34N	1	1
N5220-E4455	35N-42N	1	1
N5270-E4470	43N-50N	1	1
N5320-E4465	51N-58N	2	1
N5370-E4475	59N-66N	2	1
N5420-E4480	67N-74N	1	1
N5470-E4465	75N-82N	1	1
N5520-E4475	83N-90N	1	1
N5570-E4450	91N-98N	1	1
N5620-E4460	99N-106N	1	1
N5670-E4470	107N-108N,1E-18E	1	2
N5690-E4520	19E-26E	1	3
N5685-E4570	27E-34E	1	3
N5665-E4620	35E-42E	1	3
N5675-E4670	43E-50E	1	3
N5665-E4720	51E-58E	1	3
N5690-E4770	59E-66E	3	3
N5695-E4820	67E-74E	3	3
N5680-E4870	75E-81E	1	3

APPENDIX D

SYMAP STRATIFICATION

PREDICTED VALUES - SAMPLE VALUES[a]

Brick Weight Per Unit Volume

Stratum 1

Population (interior transect)		Sample
N=18		n=155
m=.0123		$\bar{X}$=.0594
s=.0165		$\hat{s}$=.1526
Range=.0015-.0735		Range=0-1.305
Deviations	Results[c]	Deviations
-.0042 (m±1s) .0288[b]	(102/66%)	-.0932 ($\bar{X}\pm1\hat{s}$) .2120[b]
-.0207 (m±2s) .0453[b]	(19/12%)	-.2458 ($\bar{X}\pm2\hat{s}$) .3646[b]
-.0368 (m±3s) .0618[b]	(7/5%)	-.3984 ($\bar{X}\pm3\hat{s}$) .5172[b]
Greater than +3s	(27/17%)	

Stratum 2

N=2		n=16
m=.0274		$\bar{X}$=.0216
s=.0241		s=.0055
Range=.0102-.0446		Range=0-.1679
Deviations	Results[c]	Deviations
.0033 (m±1s) .0515[b]	(10/63%)	.0161 ($\bar{X}$±1s) .0271
-.0208 (m±2s) .0756[b]	(5/31%)	.0106 ($\bar{X}$±2s) .0326
-.0449 (m±3s) .0997[b]	(0/0)	.0051 ($\bar{X}$±3s) .0381
Greater than +3s	(1/6%)	

Stratum 3

N=2		n=16
m=.0674		$\bar{X}$=.2110
s=.0219		s=.1662
Range=.0519-.0830		Range=.0186-.6343
Deviations	Results[c]	Deviations
.0455 (m±1s) .0893[b]	(0/0)	.0448 ($\bar{X}$±1s) .3772
.0236 (m±2s) .1112[b]	(1/6%)	-.1214 ($\bar{X}$±2s) .5434[b]
.0017 (m±3s) .1331[b]	(6/38%)	-.2876 ($\bar{X}$±3s) .7096[b]
	(9/56%)	

SYMAP STRATIFICATION

PREDICTED VALUES - SAMPLE VALUES[a]

Ceramic Frequency Per Unit Volume

Stratum 1

Population

N=18
m=.0007
s=.0005
Range=.0001-.0023

Deviations
.0002 $(m\pm1s)$ .0012
-.0003 $(m\pm2s)$ .0017[b]
-.0008 $(m\pm3s)$ .0022[b]
Greater than +3s

Results[c]
(0/0)
(136/88%)
(0/0)
(19/12%)

Sample

n=155
$\bar{X}$=.0032
$\hat{s}$=.0094
Range=0-.0559

Deviations
-.0062 $(\bar{X}\pm1s)$ .0126[b]
-.0156 $(\bar{X}\pm2s)$ .0220[b]
-.0250 $(\bar{X}\pm3s)$ .0314[b]

Stratum 2

Population

N=2
m=.0013
s=.0007
Range=.0007-.0019

Deviations
.0006 $(m\pm1s)$ .0020
-.0001 $(m\pm2s)$ .0135[b]
-.0008 $(m\pm3s)$ .0171[b]
Greater than +3s

Results[c]
(0/0)
(13/81%)
(0/0)
(3/19%)

Sample

n=16
$\bar{X}$=.0034
s=.0074
Range=0-.0186

Deviations
-.0040 $(\bar{X}\pm1s)$ .0108[b]
-.0114 $(\bar{X}\pm2s)$ .0182[b]
-.0188 $(\bar{X}\pm3s)$ .0256[b]

Stratum 3

Population

N=2
m=.0013
s=.0036
Range=.0036-.0090

Deviations
.0026 $(m\pm1s)$ .0099[b]
-.0009 $(m\pm2s)$ .0135[b]
-.0045 $(m\pm3s)$ .0171[b]
Greater than +3s

Results[c]
(0/0)
(6/37%)
(0/0)
(10/63%)

Sample

n=16
$\bar{X}$=.0174
s=.0159
Range=0-.0373

Deviations
.0015 $(\bar{X}\pm1s)$ .0333
-.0144 $(\bar{X}\pm2s)$ .0492[b]
-.0303 $(\bar{X}\pm3s)$ .0651[b]

[a] Using standard statistical nomenclature
N=number of variates in the population
n=number of variates in the sample
m=population mean
$\bar{X}$=sample mean
$\hat{s}$=sample standard deviation
s=sample/population standard deviation, adjusted for small samples
Range=range within which all the variates fall

SYMAP STRATIFICATION

PREDICTED VALUES - SAMPLE VALUES[a]

[b] One or both of these values exceeds the population/sample range.

[c] Given the normal distribution, percentages of variates should fall accordingly within standard deviations

66% of variates = $(m \pm 1s)$
95% of variates = $(m \pm 2s)$
99% of variates = $(m \pm 3s)$

The actual results of the sample compared with the predicted population values are given in parenthesis according to the following format:

(number of varieties/percentage of total sample)

APPENDIX E

TRANSECTS

PREDICTED VALUES - SAMPLE VALUES[a]

Brick Per Unit Volume

Transect 1

Population	Results	Sample
N=13		n=104
m=.0110		$\bar{X}$=.0490
s=.0111		$\hat{s}$=.1560
Range=.0029-.0446		Range=0-1.305
Deviations	Results	Deviations
-.0001 ($m\pm1s$) .0221[b]	(81/78%)	-.1070 ($X\pm1\hat{s}$) .2050[b]
-.0112 ($m\pm2s$) .0332[b]	(0/0)	-.2630 ($X\pm2\hat{s}$) .3610[b]
-.0223 ($m\pm3s$) .0443[b]	(10/10%)	-.4191 ($X\pm3\hat{s}$) .5171[b]
Greater than +3s	(13/12%)	

Transect 2[d]

Sample
n=20
X=.0212
s=.0011
Range=0-.1492
Deviations
.0201 ($\bar{X}\pm1s$) .0223
.0190 ($\bar{X}\pm2s$) .0234
.0179 ($\bar{X}\pm3s$) .0245

Transect 3

Population	Results	Sample
N=8		n=63
m=.0328		$\bar{X}$=.1144
s=.0324		$\hat{s}$=.1607
Range=.0015-.0830		Range=0-.8022
Deviations	Results	Deviations
.0003 ($m\pm1s$) .0652	(31/49%)	-.0463 ($\bar{X}\pm1\hat{s}$) .2751[b]
-.0321 ($m\pm2s$) .0977[b]	(6/10%)	-.2071 ($\bar{X}\pm2\hat{s}$) .4359[b]
-.0645 ($m\pm3s$) .1301[b]	(5/8%)	-.3678 ($\bar{X}\pm3\hat{s}$) .5966[b]
Greater than +3s	(21/33%)	

TRANSECTS

PREDICTED VALUES - SAMPLE VALUES[a]

Ceramics Per Unit Volume

Transect 1

N=13
m=.0006
s=.0003
Range=.0001-.0019

n=104
$\overline{X}$=.0023
$\hat{s}$=.0074
Range=0-.0373

Deviations	Results	Deviations
.0003 (m±1s) .0009[b]	(0/0%)	-.0051 ($\overline{X}\pm1\hat{s}$) .0097[b]
0 (m±2s) .0012[b]	(91/87%)	-.0126 ($\overline{X}\pm2\hat{s}$) .0172[b]
-.0003 (m±3s) .0015[b]	(0/0%)	-.0201 ($\overline{X}\pm3\hat{s}$) .0247[b]
	(13/13%)	

Transect 2[d]

n=20
$\overline{X}$=N/A
s=N/A
Range=No Ceramics Recovered

Transect 3

N=8
m=.0024
s=.0028
Range=.0002-.0090

n=63
$\overline{X}$=.0088
$\hat{s}$=.0147
Range=0-.0559

Deviations	Results	Deviations
-.0004 (m±1s) .0052[b]	(44/70%)	-.0052 (X±1s) .0235[6]
-.0033 (m±2s) .0081[b]	(0/0%)	-.0707 (X±2s) .0383[b]
-.0062 (m±3s) .0110[b]	(0/0%)	-.0355 (X±3s) .0531[b]
Greater than +3s	(13/13%)	

a Using standard statistical nomenclature
N=number of variates in the population
n=number of variates in the sample
m=population mean
$\overline{X}$=sample mean
$\hat{s}$=sample standard deviation
s=sample/population standard deviation, adjusted for small samples
Range=range within which all the variates fall

b One or both of these values exceeds the population/sample range.

c Given the normal distribution, percentages of variates should fall accordingly within standard deviations

66% of variates = $(m \pm 1s)$
95% of variates = $(m \pm 2s)$
99% of variates = $(m \pm 3s)$

The actual results of the sample compared with the predicted population values are given in parenthesis according to the following format:

(number of varieties/percentage of total sample)

d None computed for the population since N=1.

APPENDIX F

STUDENT'S T-TEST

SAMPLE VERSUS POPULATION BY SYMAP STRATA[a]

Stratum 1

Brick Data

df=154
n=155
s=.1526
$s\bar{X}$=.0122
m=.0123
$\bar{X}$=.0594
t=3.8606

$t=3.8606 > t_{A=.01}=2.576$

$\therefore$ Reject H_1

Ceramic Data

df=154
n=155
s=.0094
$s\bar{X}$=.0007
m=.0032
$\bar{X}$=.0007
t=3.571

$t=3.571 > t_{A=.01}=2.576$

$\therefore$ Reject H_1

Stratum 2

Brick Data

df=15
n=16
s=.0055
$s\bar{X}$=.0013
m=.0274
$\bar{X}$=.0216
t=4.4615

$t=4.4615 > t_{A=.-1}=2.947$

$\therefore$ Reject H_1

Ceramic Data

df=15
n=16
s=.0074
$s\bar{X}$=.0018
m=.0013
$\bar{X}$=.0034
t=1.166

$t=1.166 < t_{A=.01}=2.947$

$\therefore$ Do Not Reject H_1

Stratum 3

Brick Data

df=15
n=16
s=.1662
$s\bar{X}$=.0415
m=.0674
$\bar{X}$=.2110
t=3.4602

$t=3.4602 > t_{A=.01}=2.947$

$\therefore$ Reject H_1

Ceramic Data

df=15
n=16
s=.0159
$s\bar{X}$=.0034
m=.0063
$\bar{X}$=.0174
t=2.8461

$t=2.8461 < t_{A=.01}=2.947$

$\therefore$ Do Not Reject H_1

STUDENT'S T-TEST

SAMPLE VERSUS POPULATION BY SYMAP STRATA[a]

[a] Student's t-test Nomenclature and Procedure
df=degrees of freedom (n-1)
n=number of variates in the sample
s=standard deviation of sample
$s\overline{X}$=best estimate of standard deviation
m=population mean
$\overline{X}$=sample mean
t=student's t
t_A=.01=critical value for student's t to the .01 level of probability
H=in all test is that the population mean, m, is the best estimate for both the sample and the population distribution.

Computational Procedures

1) $s_{\overline{X}} \doteq \frac{s}{\sqrt{n}}$

2) $t = \frac{\overline{X} - m}{s_{\overline{X}}}$

3) t = ___

APPENDIX G

STUDENT'S T-TEST

SAMPLE VERSUS POPULATION BY TRANSECT[a]

Transect 1

Brick Data

$df=103$
$n=104$
$\underline{s}=.1560$
$s\bar{X}=.0153$
$\underline{m}=.0110$
$\bar{X}=.0490$
$t=2.483$

$t=2.483<t_{A=.01}=2.660$

$\therefore$ Do Not Reject H_1

Ceramic Data

$df=103$
$n=104$
$\underline{s}=.0074$
$s\bar{X}=.0007$
$\underline{m}=.0006$
$\bar{X}=.0023$
$t=2.428$

$t=2.428<t_{A=.01}=2.660$

$\therefore$ Do Not Reject H_1

Transect 2[b]

Brick Data

N/A

Ceramic Data

N/A

Transect 3

Brick Data

$df=62$
$n=63$
$s=.1607$
$s\bar{X}=.0202$
$\underline{m}=.0328$
$\bar{X}=.1144$
$t=4.039$

$t=4.039>t_{A=.01}=2.660$

Reject H_1

Ceramic Data

$df=62$
$\underline{n}=63$
$\bar{X}=.0147$
$s\bar{X}=.0018$
$\underline{m}=.0024$
$\bar{X}=.0088$
$t=3.\overline{555}$

$t=3.\overline{555}>t_{A=.01}=2.660$

$\therefore$ Reject H_1

[a] Students t-test Nomenclature and Procedure
df=degrees of freedom (n-1)
n=number of variates in the sample
$\underline{s}$=standard deviation of sample
$s\bar{X}$=best estimate of standard deviation
$\underline{m}$=population mean
$\bar{X}$=sample mean
t=student's t
$t_{A=.01}$ = critical value for student's t to the .01 level of probability
H_1=in all test is that the population mean, m, is the best estimate for both the sample and population distribution.

STUDENT'S T-TEST

SAMPLE VERSUS POPULATION BY TRANSECT

Computational Procedures

1) $s_{\overline{X}} = \frac{s}{\sqrt{n}}$

2) $t = \frac{\overline{X} - m}{s_{\overline{X}}}$

3) t = ______

b Not applicable, since N=1.

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