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Who Needs a Plow-Zone? Using a Common Site Mapping Method in a New Way at the Silvernale Site (21GD03)

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Who Needs a Plow-Zone?

Using a Common Site Mapping Method in a New Way

At the Silvernale Site (21GD03)

By

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This report is submitted as part of the required work in the course Department of Anthropology, ANTH 699, 3.00, Thesis, at Minnesota State University, Mankato, and has been supervised, examined, and accepted by the Professor.

Dr. Ronald C. Schirmer, Chairperson

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This thesis work has been very difficult; at times mind-numbingly boring, and at other times insanely exciting in a way that 'normal' people would never understand. This is a continuation from my undergraduate senior project so I have been working on this since I was an archeological and intellectual peon. I am now proud to say that I am almost a novice! Many people have helped me along the way and I am sorry if I forget to mention any of you (though if you're not mentioned you were probably nearly useless to me).

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I can never give back enough to these people to repay what they have given me in both support and assistance, though all errors are mine alone. I hope that I can make them all proud that they wasted their time on someone like me.

ABSTRACT

WHO NEEDS A PLOW-ZONE? USING A COMMON SITE MAPPING METHOD IN A NEW WAY AT THE SILVERNALE SITE (21GD03)

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Agricultural activities are responsible for extensive disturbance and destruction of archeological sites throughout the region and beyond. Plowing moves the artifacts from their original locations thus making it difficult to tie them back to the contexts in which they belong. It has become a relatively common practice for many archeologists when faced with this problem is to simply blade off the disturbed area of the site, usually the upper 30 to 40 centimeters, so that they can better access undisturbed areas. They do this because they believe that since the artifacts have been moved out of context that they are now useless for interpreting the site. This thesis challenges that assertion by using a common site mapping method, systematic shovel testing, in a new and more innovative way.

Shovel tests were dug in a 5 x 5 meter grid across the Silvernale Site (21GD03), eventually totaling 567 shovel tests. The shovel tests were dug only to the depth of the plow-zone, usually 30-40 centimeters. After cleaning, and cataloguing the artifacts recovered from the shovel tests the data were entered into Microsoft Excel® and subsequently into the GIS Arc Map 10® computer program.

Since the survey was systematically done across the village site it was possible to note concentrations of different classes of artifacts at different points in the village. These concentrations were subjected to a variety of statistical analyses and compared with the results of a geophysical survey along with the results of excavated units at the village.

This method can be used to make use of previously discarded plow-zone materials to predict subsurface features at a site, such as middens, plazas, or even previously lost excavation units. It can also be used to more generally understand site patterning in cases where there are no intact subsurface features. Archeologists using this method will be able to pinpoint areas of the site that will best help them to answer specific research questions without the largely ‘hit or miss’ testing they would normally be subject to. Merely because a site has been cultivated for more than 100 years this does not mean that the surficial deposits lack relevant and reliable data.

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CHAPTER 1: INTRODUCTION

Archeologists are faced with a nearly impossible task: they attempt to understand prehistoric cultures through the study of the very limited amount of material remains that have been left behind by ancient peoples. To compound this problem, many of the sites they study are hundreds or thousands of years old. In that time the material remains have not remained static, they have been constantly disturbed by the effects of various forms of erosion, animal burrows, and human modification of the landscape.

People throughout time have been subject to the same needs from the environment, such as access to water, and this has resulted in the reoccupation of the same sites by various groups of people at different times. In this region farms are often placed on old village sites and plowing fields for crop production is one of the most destructive activities impacting archeological sites. "In eastern North America at least, most archaeological sites are situated in cultivated fields or in formerly cultivated areas." (Shott 1987).

Archeologists rely on finding artifacts *in situ* in order to make reliable interpretations of the artifacts and their associations. Plowing fields causes artifacts to be moved from their original locations and this makes it considerably more difficult, many archeologists would argue impossible, to make reliable interpretations about the materials recovered.

Some archeologists, believing the data to be unreliable, choose to blade off or otherwise remove the plow-zone, the area that has been disturbed by plowing, before beginning their excavations (See examples below). This practice could cause an incalculable loss of data. The data from the plow-zone would of course be lost, but it would also expose the entire undisturbed part of the site to potentially destructive activities such as erosion.

> …approximately 90 upland ridges were surveyed by transect excavation of shallow bulldozer trenches, in conjunction with soil probing to determine the depth of previous plowing. (Green 1987: 68)

> …archaeologists divide the area into a working grid made up of squares two meters on a side. Digging begins with the removal of the uppermost eight to twelve inches of soil, called the plow-zone. Because this layer is likely to have been adulterated by farming or other modern activities, it is not treated as meticulously as the rest of the site. (Mink 1992:).

This thesis proposes an alternate method that would allow us both to utilize the data in the plow-zone and to avoid exposing more of the site than is necessary. The plow zone at the Silvernale site was systematically sampled using a shovel test grid. The purpose of this grid was to attempt to determine site boundaries and to explore internal site patterning. If treated systematically plow zone materials can be used to predict subsurface features such as middens, plazas, or even lost excavation units from previous archeologists. The Silvernale site extends below the plow zone so there are intact features below to study but many sites are shallow or are lacking in intact sub-plow zone features, in those cases this method may be able to give us a general understanding of site patterning not available otherwise.

Shovel tests were dug across the Silvernale site (21GD03) in Red Wing, MN (Figure 4), in a 5 x 5 meter grid, resulting in 567 total shovel tests. The majority of them were dug only to the base of the plow-zone, usually the upper 30-40 centimeters. The recovered artifacts were then cleaned, catalogued, and entered into Microsoft Excel®.

The catalogue was transferred to a Geographical Information System (GIS) where the data were subjected to further spatial analyses. Contour maps were made in the GIS program that showed various concentrations, or lack thereof, of certain artifacts in different areas of the site. Next, various statistical analyses were performed on the data using the GIS program to find distributional patterns in the data as well. This thesis describes and tests the utility of using shovel test samples of plowed sites in order to map concentrations of artifacts and to use that data to explore internal site patterning.

This thesis is organized into 7 chapters. Chapter 1 provides an introduction. Chapter 2 gives the reader the history of the Silvernale site and the project. Chapter 3 delves into the literature on sampling, shovel testing, and the use of plow zone data as they relate to this project. The methods employed in this research are detailed in Chapter 4, including field methods, laboratory methods, and analysis methods. Chapter 5 presents the results and an interpretation of the results. Chapter 6 presents a new model for exploring internal site patterning. Finally since there is always more work to be done in archeology Chapter 7 provides avenues for future research both at Silvernale and at other archeological sites using these methods.

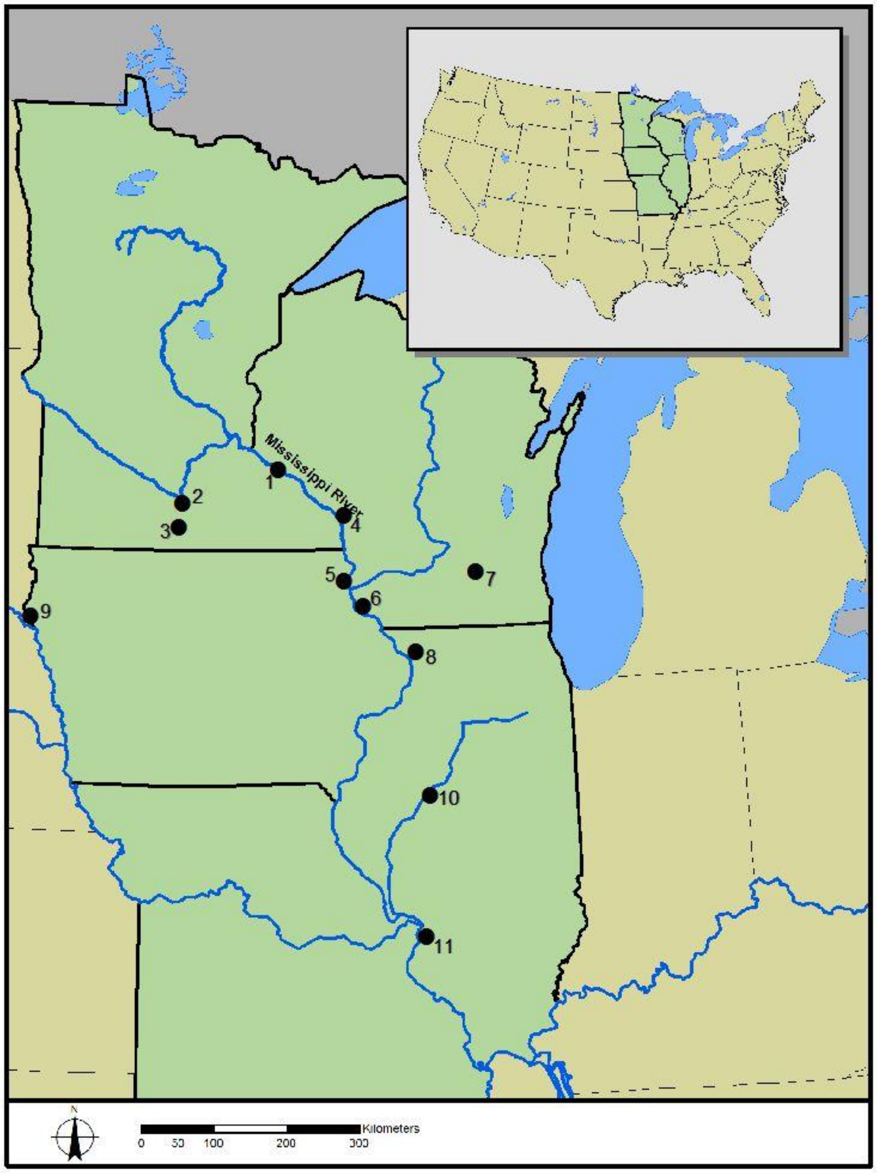


Figure 1 The Red Wing Locality and other Late Precontact complexes in the Upper Midwest.1. Red Wing Locality; 2. Cambria site; 3. Blue Earth valley sites; 4. LaCrosse Locality; 5. HartleyFort; 6. Fred Edwards site; 7. Aztalan; 8. Apple River Locality; 9. Mill Creek sites; 10. Central llinois valley sites; 11. Cahokia and the American Bottom. (after Fleming 2009: 4)

CHAPTER 2: HISTORY

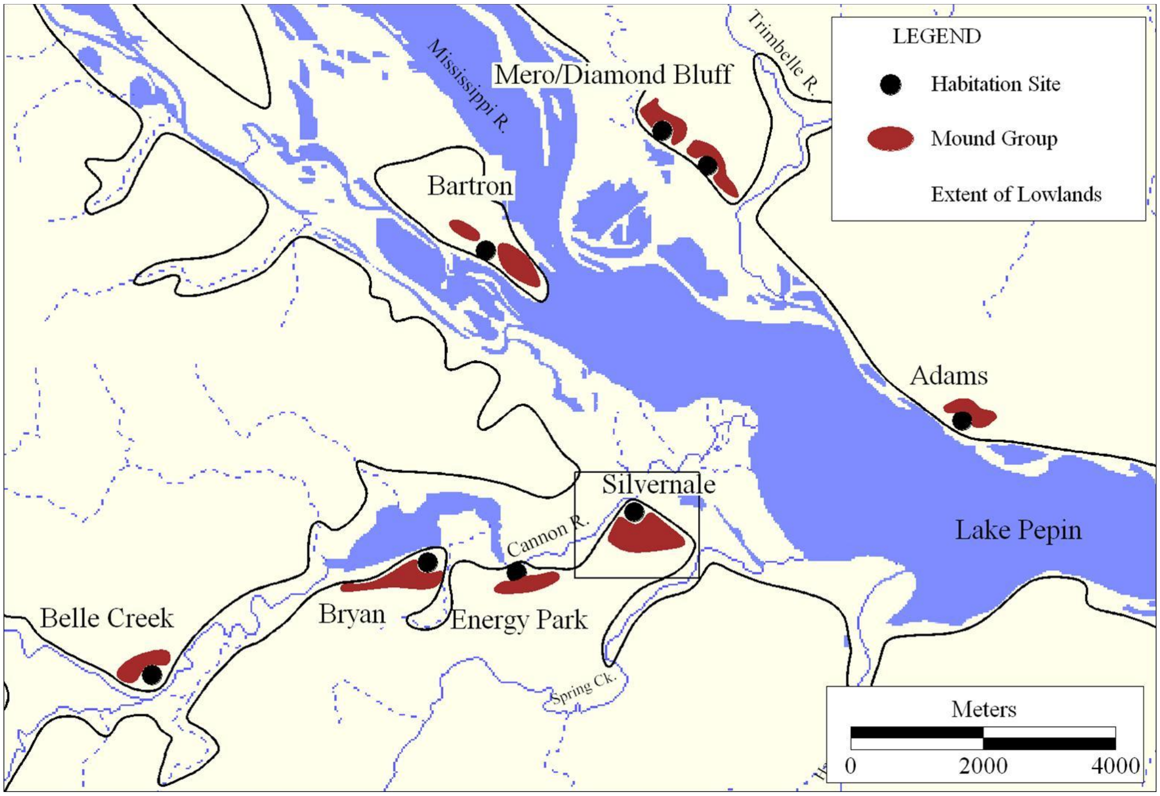


Figure 2 Locations of the seven major villages in the Red Wing Locality. (After Schirmer 2002: 3).

Site History

The Silvernale village site (21GD03) is one of a group of seven large villages in the Red Wing locality (Figure 2). It is located near the junction of the Cannon and Mississippi rivers on a low outwash terrace 20 feet above the Cannon. According to radiocarbon dates the Silvernale village was occupied between A.D. 1000-1300. Like all of the villages in the locality, with the exception of Bartron, Silvernale sits on a terrace that overlooks a river. Also like all of the other villages it is surrounded by an arc of mounds at its landward side (Figure 2). This creates a situation in which the villages can only be approached by river or through the mound group (Dobbs et al. 2003; Fleming 2009; Schirmer n.d.).

Silvernale has been subject to extensive agricultural development- probably being plowed first around the time of the civil war until agriculture ceased here around the mid 1980's (Dobbs et al. 2003). W. W. Sweney noted in 1878 that the entire site area had already been under cultivation for '12-14 years' (Schirmer n.d.). In 1882 the village was cut roughly in half when the Chicago and Great Western Railroad was constructed (Figure 3). They cut a trench through the village that was about 30 meters wide and 700 meters long, destroying or burying a large portion of the village area (Schirmer n.d.). In 1885 T. H. Lewis surveyed the Mound group of the Silvernale site along with many other mound groups in the area. He was primarily interested in the mounds but made note of a habitation area in the section of the site to the north of the railroad. Silvernale has 317 surveyed mounds though many of the mounds at Silvernale have not been mapped. The total mounds associated with the Silvernale site likely goes to over 500. Silvernale is so closely situated to the other nearby villages that the mounds may have once formed a nearly continuous band of mounds (Dobbs et al. 2003; Fleming 2009; Gibbon 1979).

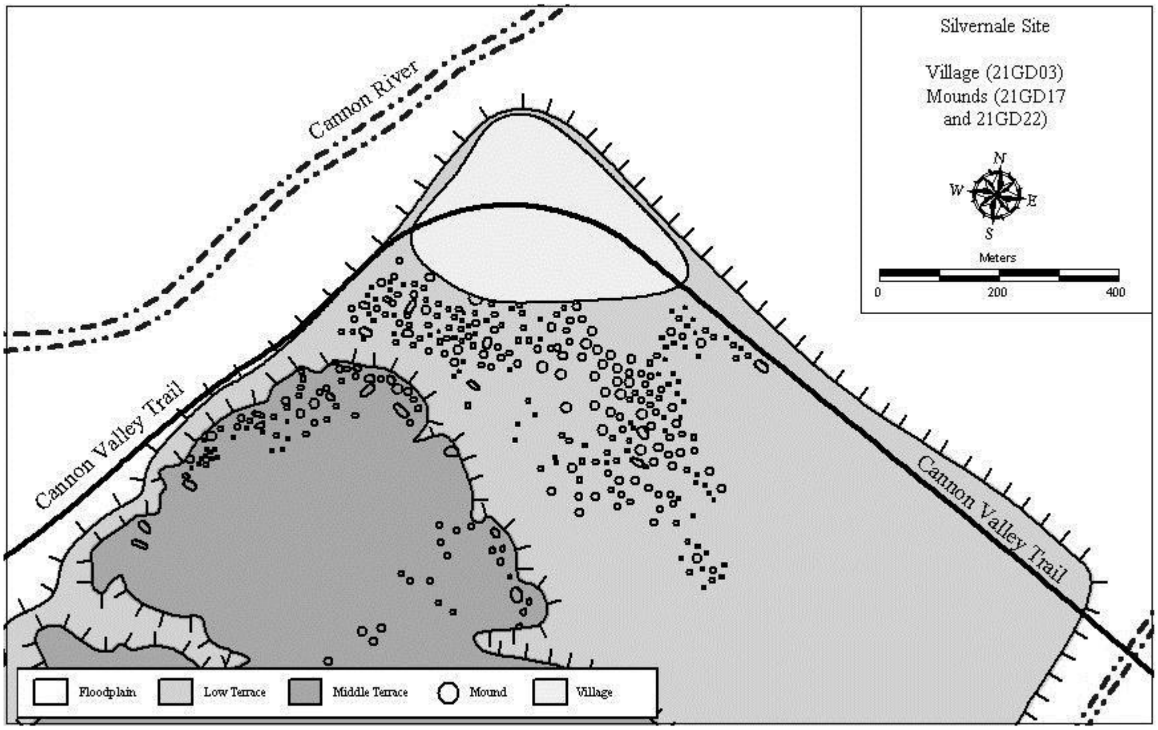


Figure 3 Silvernale Village showing mounds and location of railroad cut. (After Schirmer 2005:29)

In 1947 and 1950 Lloyd Wilford of the University of Minnesota conducted excavations at the site. He excavated two of the mounds and part of the habitation area. In 1947 he excavated in the 'eastern part of the field' and in 1950 he excavated in the 'western part of the field'. He ended up excavating 700 sq. feet of the village area and his comments on the differences between the two areas are part of the impetus for this thesis work (Gibbon 1979; Wilford 1947, 1950). Wilford suggested that the eastern half of the site was older than the western half due to the presence of more rolled rims, a greater presence of grit tempered pottery, and more 'leached out' pottery on the 'eastern side' (Gibbon 1979; Wilford 1947, 1950).

In the 1970's the Red Wing Industrial Park, including the Durkee-Atwood plant was constructed. Many of the remaining mounds and most of the village area that was south of the railroad tracks was affected. Much of this area was likely destroyed, though recent work by Schirmer indicates that even in the middle of the Industrial Park there are intact deposits (Ronald Schirmer, personal communication 2012).

During this time the Minnesota Archaeological Society, Hamline University and the Carleton College Summer Institute jointly conducted salvage excavations under Christina Harrison. They excavated a total of 20 square meters of the northern section of the site from 1974-1977. Until recently, none of the collections had a clear datum point and so locating them and/or comparing them to each other was extremely difficult (Dobbs et al 2003; Fleming 2009). This past summer, Harrison's datum was rediscovered which can aid in comparing collections in the future. The locations of Harrison's units will be discussed later in this thesis.

In the mid 1980's the Cannon Valley Trail (CVT) was created. It is in the location of the old railroad so it now bisects the Silvernale site as well as passing several of the other village sites in the Red Wing locality. In 1999 a private landowner donated the northern remnant portion, 8 acres, of the Silvernale site to the Cannon Valley Trail and it has since been protected from further plowing or other destructive activities (Dobbs et al. 2003; Fleming 2009).

At this point it was commonly believed that the entire Silvernale site was disturbed or destroyed (Dobbs et al. 2003). Clark Dobbs, Ronald Schirmer, and Don Johnson undertook to discover if there were any remaining intact parts of the site. In 2001 the geophysical survey was completed and continuing into 2002 they tried to ground truth hte geophysical survey and a shovel test survey of the site was begun. When they started shovel testing it quickly became apparent that beneath the plow-zone there were in fact intact cultural deposits. The geophysical survey showed anomalies that are likely house floors and more than 75 pit features (Dobbs et al. 2003; Fleming 2009).

A total of five field schools have so far been held at the Silvernale village site by Minnesota State University, Mankato with the digs taking place in 2003, 2004, 2005, 2007, and 2011. The goals of these projects were to complete the geophysical survey of the site, to excavate various anomalies in different parts of the site and to test a new method of site mapping using shovel tests. The latter is, of course, the focus of this thesis (Dobbs et al. 2003; Fleming 2009).

Project History

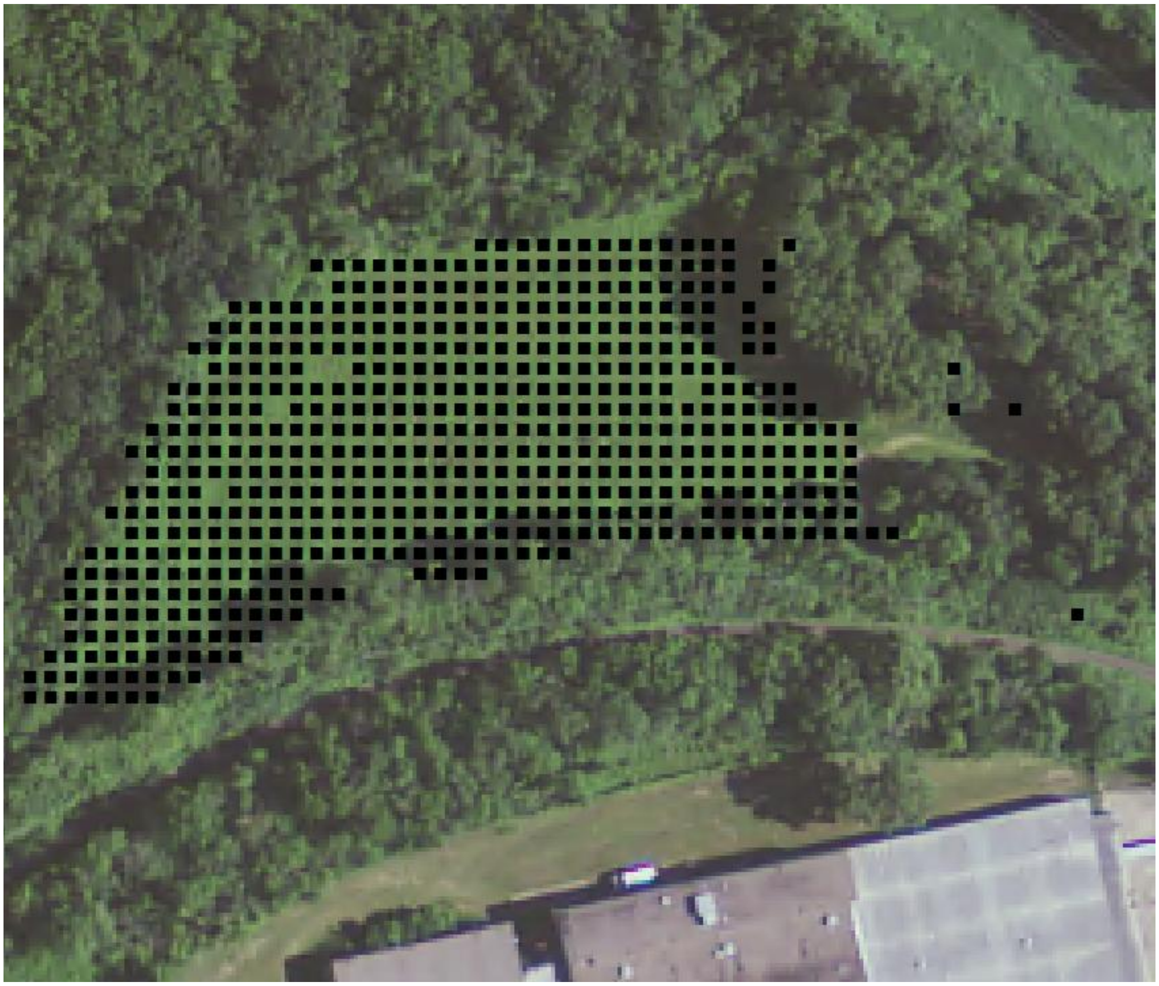


Figure 4 Shovel test grid as shown in GIS. Note: ST's not to scale, enlarged for viewing. Note: Only ST's with positive results in the 0-30cm range are shown.

The current project was first conceptualized by Clark Dobbs and Ronald Schirmer in 2002. When they started working at Silvernale; their primary goals "were to delineate the boundaries of the site, evaluate the integrity of the cultural deposits, and begin to examine artifact distribution and internal site plan." (Dobbs et al. 2003). Shovel testing is often used to do regional surveys designed to discover sites or to determine site boundaries, but it is less often used as an intensive way to explore internal site patterning. Dobbs and Schirmer believed that a systematic shovel test grid could make use of the plow-zone materials to show patterning and concentrations that would otherwise be unavailable (Ronald Schirmer, personal communication, 2011).

To that end Minnesota State University, Mankato, devoted a portion of each of their 5 Silvernale field schools to completing the shovel test grid (Figure 4). In 2005 about half of the shovel tests that were dug to date were catalogued by Minnesota State University, Mankato (MSUM) student Dan Born, though it was left unfinished. In 2008, the project was picked up by two other MSUM students, Ty Warmka and Kyle Harvey. We re-catalogued the materials previously worked on by Dan Born, finding them to be mostly mis-catalogued. We then catalogued the remaining materials dug to date. The work culminated in two senior projects (Harvey 2009; Warmka 2009).

I continued the work for my master's thesis. To that end I had to make some corrections to our previous work. In the summer of 2011we held another field school at Silvernale. There were several goals for this field school. First we had to finish the shovel test grid, which we did. Second we wanted to test some features that were discovered during shovel testing, and were also corroborated by the geophysics.

We ended up placing excavation units in three places across the village remnant. We planned to lay in three 1 x 2 meter blocks, one in the eastern area, one in the west, and one in the center, each centered on likely features discovered during shovel testing. In this endeavor we were victims of our own success, discovering more features than time allowed us to fully remove. (This will be further discussed in Chapter 4 Field Methods, and Chapter 5 Results and Interpretation).

CHAPTER 3: BACKGROUND RESEARCH

Shovel Testing

Shovel testing is often used in archeology, although usually its use is restricted to regional surveys where it is used as a site discovery technique. It is also sometimes used to delineate site boundaries and in at least one instance (Nolan 2010) shovel testing was used as part of a program to attempt to map community structure through internal site patterning.

In Nolan's dissertation he attempted to use a multi-staged approach to help to reconstruct the community structure of the Reinhardt Village (33PI880) in Ohio. He argues that many archeologists rely too heavily upon intensive excavation to investigate prehistoric sites. Excavation is very labor intensive, time consuming, and potentially destructive to sites. It also, unless nearly the whole site is excavated, does not give much information on community organization (Nolan 2010).

> The approach used here begins with a suite of minimally invasive/destructive data-generation techniques (extensive surface survey, intensive surface survey, volumetric shovel testing, gradiometry, magnetic susceptibility, and soil phosphate) supplemented by excavation. (Nolan 2010: ii).

Using these techniques and comparing them to each other, Nolan was able to map the Reinhardt Village, including the central plaza and various activity areas. Some of the villages in this area had been intensively investigated in the past and so Nolan had some general models to compare his data to; making site reconstruction much easier. In the Red Wing area little is known about the community structure of the villages and so it is more difficult to understand site patterning.

The Reinhardt Village site is in a plowed field that is currently still under cultivation. As such, they were able to conduct an intensive surface survey, breaking areas down into grids and colleting the grids as units for comparison with one another. This is similar to the shovel testing method except that it relies only upon the artifacts on the surface and plowing has the greatest displacement effects on materials located on the surface of the ground (Nartov 1979; Lewarch and O'Brien 1981). This method, while potentially effective, could not be used in the current project because the Silvernale site is no longer under cultivation.

Similar to the method used in this thesis, Nolan only dug his ST's to the base of the plow zone. These were laid out in a 10 m x 20 m grid, though he suggests that a finer resolution, 5 m x 5 m grids be used in the future. There were a total of 85 shovel tests dug. He also used several other techniques and each of these together were used to determine the site layout. He argues for this method because it saves time, stating that this method could be used to reconstruct 2-4 community structures per field school, is minimally invasive, and effective, with several different techniques being used to bolster confidence in the results. (Nolan 2010).

Although many archeologists use shovel testing as a site discovery technique, there is very little literature on the efficacy of this technique. Much of the available literature falls into two camps, Michael Shott, James Kracker, and Paul Welch argue that it is too inefficient and misses a large proportion of smaller sites and they call for new techniques, though they allow that in certain circumstances shovel test sampling is currently the best method available (Kracker, Shott, and Welch 1983).

The second camp is that of Kent Lightfoot, Jack Nance, Bruce Ball, and Michael Lynch. Lightfoot argues that shovel testing is the most efficient technique available today for discovering sites (Lightfoot 1986; 1989). The research done by Nance and Ball has shown that shovel test sampling is valid and reliable as long as it is pertaining to larger sites; as the sites get smaller, they say, it becomes less reliable (Nance and Ball 1983). Lynch believes that shovel testing is useful as long as the intervals, depth, and placement are taken into consideration on an individual basis (Lynch 1980).

Each of these camps recognize the need for better methods but have varying views on the use of shovel test sampling in the interim. They each feel strongly and have argued back and forth, commenting on each other's papers and commenting on the comments (Shott 1985, 1989; Nance and Ball 1986, 1989; Lightfoot 1986, 1989).

This thesis however, is not dealing with site discovery, since we already know that the site is there. We are dealing with a large site that is dense with artifacts; each one of the 567 shovel tests in the main part of the field was positive for artifacts. Hopefully this study can open up new areas of study to help expand the shovel test literature.

Plow-Zone

A number of studies have been done on the utility and validity of using plow-zone materials to help interpret sites, as well as using them as a predictive model of the materials below the plow-zone. Despite these efforts many archeologists still choose to blade off or otherwise disregard the plow-zone. Most of these studies involve systematic surface collections or experiments on the movement of artifacts on the surface, but the approach is similar to what we are doing here. In this section we will summarize some of those studies.

The State University of New York, Buffalo, undertook a study of the movement of plow-zone materials at the Claud 1 site in Livingston County (Trubowitz 1981). Their technique was two-fold. The first part of their project was to complete systematic surveys of the Claud 1 site, once a year for 3 years. The site was under cultivation during this time so their goal was to determine 'whether the plowing would significantly alter the configuration of the surface artifact distribution'. The second part of their project involved 'salting the site with objects, washers, bricks and flat ceramic drain tiles, that were similar in size and weight to artifacts to see how they were affected by the plowing (Trubowitz 1981).

They ran statistics on the recovered materials from year to year and analyzed the movement of the salted materials. They determined that-

> Subsurface and surface distributions of cultural material in cultivated fields are directly related, and that plowing does not appear to significantly disturb horizontal cluster relationships...Though plowing disturbed the original provenience of the cultural material… the perimeters of artifact clusters were distributed more widely, but the clusters remained as definable units. (Trubowitz 1981:8)

Lewarch and O'Brien did a similar study. They salted a plowed field with actual artifacts, obtained from the stripping of a plow-zone elsewhere. They put many different kinds of artifacts and placed them in specific patterns to determine movement. They determined that though many individual artifacts were moved large distances-

> Nevertheless, patterns of plowzone materials are not as seriously disrupted as is often assumed… Agricultural engineering research (Nartov 1979) has demonstrated that one-way disk plows have greatest displacement effects

> on materials located on the surface of the ground (Lewarch and O'Brien 1981:12; 45). (Emphasis in original).

This is one of the primary reasons why a shovel test survey has the potential to give much more accurate results than a simple surface survey. This research has shown that systematic surface surveys can reveal useful patterns, relating to the subsurface materials. But the artifacts on the surface are the ones most affected by plowing. This will be corroborated later in the Results section of this thesis.

Many of the experiments done by these authors are somewhat biased towards displacement due to the low number of passes by the plow, usually only being plowed a few times at most before the measurement of artifact displacement. Contrary to what most people believe-"…the short duration of tillage (three passes) tends to present extreme fluctuations of some factors…tillage research has effectively demonstrated that equilibria occur in a number of processes after approximately 10 to 15 equipment passes" (Kouwenhoven and Terpsra 1979; Lewarch and O'Brien 1981).

Several others have done experiments on the effects of tillage on the artifacts in the plow-zone with similar results. Ammerman placed tiles 2 cm below the surface of a field under cultivation and Odell and Cowan buried blue painted lithics 15-20 centimeters below the surface of their site. They then made observations of artifacts found on the surface. They each found that the observed artifacts on the surface had a tendency to spread out, making the sites appear larger (Ammerman 1985; Odell and Cowan 1987; Cowan and Odell 1990).

Both studies tried to avoid the problems faced by the previous authors, primarily the problem of surface artifacts moving more than subsurface artifacts. They did this by burying the artifacts but then they only observed the artifacts that made it to the surface. If they had shovel tested rather than done a surface survey it seems likely that they may have recovered a more accurate sample of all of the artifacts instead of just the ones that made it to the surface. The ones that made it to the surface had already moved since the original sample had buried them so this may have biased the sample. This may have resulted in a less widespread dispersal of their artifacts and in turn a more accurate estimate of site parameters.

Dunnell and Simek did a controlled surface collection of pottery in a cultivated field. Using the data from this study they noted several concentrations of pottery. They tested the reliability of these concentrations by putting in six excavation units over the most concentrated spots. In 2 out of their six units they discovered middens with artifacts corresponding to the concentrations on the surface (i.e. a shell tempered concentration yielded a shell tempered pottery filled midden).

> "The most obvious implication for prospection is that it would be possible, at least under some conditions, to detect the presence of "undisturbed" deposits immediately beneath the plowzone without recourse to expensive, destructive, and largely hit-or-miss "testing". If surface information is acquired systematically and the number of artifacts is sufficiently large, it may even be possible to map the location of such deposits from plowzone data alone" (Dunnell and Simek 1995:307).

If they were successful 2 out of 6 times doing a systematic surface collection then it seems likely that with the added clarity provided by a systematic shovel test grid, such as the one used in this study, we should be able to improve upon the results. Also, as noted by Dunnell and Simek above, with more research into this method it may be possible to map the locations of features without even disturbing the undisturbed soil. This method of surface survey to predict subsurface features was also utilized by

Schirmer at the McClelland site (21GD258) in 2010, though less systematically, resulting in the discovery of several features.

Statistical Analysis

One of the first archeologists to study the spatial distribution of artifacts was Lewis Binford. Binford's study of the Nanumuit group in Alaska (1978a; 1978b) showed how useful this kind of study can be. Since than many archeologists have done spatial analyses though, due to the complexity of studying the large amounts of data from archeological sites, most have not used the more advanced techniques developed by statisticians.

The development of computers and computer programs such as SPSS and GIS has recently made it possible to do just those kinds of analyses. However, since most archeologists are not trained in these techniques few studies have been done. Some recent work by archeologists such as Mills (2009) and Cardinal (2011) have begun to study archeological materials using some of these more advanced techniques. This thesis attempts to add to that literature by utilizing GIS to analyze the materials recovered in the shovel test grid.

> Spatial analysis focuses on the spatial structure of variables to determine the intensity of patterns, thereby obviating them in complex data sets…these patterns can help detect concentrations of artefacts, features and sites, as well as describe, interpret and explain the spatial relationships that exist. (Mills 2009: 6)

Spatial analyses can be done in many ways to benefit archeology. Determining the locations of different types of artifacts and comparing them to each other spatially can help to determine the site layout, including differentiating neighborhoods or separate occupations at the site. Different activity areas such as lithic processing stations or pottery manufacturing sites can also be located in this manner.

CHAPTER 4: METHODS

Field Methods

Beginning in 2001 and 2002, then continuing through the five field schools conducted at the Silvernale site in 2003, 2004, 2005, 2007, and 2011, shovel tests were placed across the remnant of the village. In the far eastern area of the site, shovel tests were placed in a 10 x 15 meter grid. This area was not treated like the rest of the site because the original site surface is now covered with large amounts of fill that was discarded during the construction of the Red Wing Industrial Park. It was tested to determine the extent of the fill and assess the accounts by informants that the fill was mostly derived from the areas in which mounds used to be (Ronald Schirmer, personal communication 2012).

In the village remnant that was not covered with fill, a total of 567 shovel tests were placed in a 5 x 5 meter grid (Shown in figure 4). The grid is consistent across the site except for a few areas, such as in the northeastern section where there is a road cut through the site, as well as a few other potential shovel test locations that were made impossible due to the presence of other obstacles such as brush piles, standing water in ruts, or excavation units (18 total). There are also 5 ST's (ST 8-36 to ST 8-41) which are not included because the depths were not recorded on the bags making it difficult to use for this kind of analysis.

When the first shovel tests were placed at Silvernale, Dobbs and Schirmer were attempting to determine if there were intact features below the plow zone, so they were dug down below the plow zone (12 total ST's dug below the plow-zone). However, it quickly became apparent that there were in fact intact features below the plow zone so the field methods were modified. The remaining shovel tests in the main part of the village were treated as mini-excavation units. They were dug as 30 centimeter squares, and they generally go down in ten centimeter levels to the depth of the plow zone. The exception to this would be if the plow zone in that particular spot was deeper or shallower than 30 centimeters, in which case the shovel tests were truncated at the appropriate level (i.e. 25 cm or 35 cm), (Dobbs et al. 2003). Due to the large number of shovel tests the depths were measured from the surface with a tape measure.

Figure 5 Shovel test 21-16. Intruding black area may be the edge of one of Christina Harrison's old XU's. (Picture taken by Emily Evenson).

Excavation units were also placed during each of the five field schools. There have been a total of 86 units placed, though a few were only partially placed, i.e. ¼ units or ½ units extended to chase a feature, and some like unit 78 were laid out but not dug due to time constraints. The excavation units were laid out as 1 x 1 meter squares and the depths were measured with a line level from the datum point in the southwest corner of the block.

The units and shovel tests were otherwise dug in the same manner. Square shovels were used to bring the levels down and the levels were evened out by hand troweling. All soil removed was screened through ¼ inch mesh screens and the artifacts from each 10 centimeter level were placed in labeled baggies to await further examination. The Munsell Color Chart was used to map the soil colors for both the units and the shovel tests (Dobbs et al. 2003).

In the units, all floor levels that had color variation were mapped. Wall profiles were made once the units reached sterile soil. Any diagnostic or fragile artifacts were given field specimen numbers, their precise coordinates were recorded, and they were placed in separate labeled baggies. Shovel test forms were filled out for each shovel test including the depths of each soil horizon. All units and shovel tests were backfilled at the ends of the respective digs and an old, punctured tarp was usually laid in the bottoms of the excavation units before they were backfilled to facilitate relocation.

To date a total of 26 numbered features have been found in the excavation units. Some were left wholly or partially intact due to time constraints and some were completely removed. Before removal the features were quartered and each quarter was taken out separately, in 5 centimeter levels. The south half was removed first and then a wall profile was made of the cross-section. The soil was removed into air-permeable feature bags to facilitate drying (which improves recovery rates during flotation and prevents molding), they were labeled and set aside for future consideration in the lab. Diagnostic field specimens were noted and removed if necessary (Dobbs et al. 2003). There have also been 48 features indicated in the bottom of shovel tests; some have been excavated while most are marked for later.

During the 2011 field school the shovel test grid was finished. A total of 159 shovel tests were placed in 2011, bringing the total number of shovel tests in the grid up to 567. We originally laid in three 1 x 2 meter blocks across the site. One was placed on the eastern side, one on the west, and one in the center. They were placed to attempt to chase down suspected features either pinpointed using the geophysics or discovered during shovel testing.

In the eastern block, excavation units 82 and 83, two features were discovered, Features 22 and 23. The excavation units landed exactly on the two features, Feature 22 being wholly contained and an extra partial unit, unit 84 was added to the north of the block in order to complete the exposure of Feature 23 (Figure 6).

Figure 6 Dr. Schirmer removing vessel from Feature 23, in foreground, Feature 22 in background. Facing southeast. Picture taken by Mandy Nelson.

A large quantity of field specimens were collected from Features 22 and 23. Of particular note is a 10-15 centimeter level in Feature 22 filled almost entirely with bison bone (a rarity at Red Wing sites, Ronald Schirmer, personal communication) and what was tentatively identified as a large shell cup was found in Feature 23. Each of the features also produced large vessel fragments that were later reconstructed (Figures 7 and 8).

Figure 7 Reconstructed vessel from Feature 22. Picture taken by Jared Langseth, MSUM Archeology lab.

Figure 8 Reconstructed vessel from Feature 23. Picture taken by Jared Langseth, MSUM Archeology lab. (Hole in upper left hand corner is mend-hole, Ronald Schirmer personal communication 2011).

The central block was originally laid out as a 1 x 2 meter block, but due to time constraints only one of the 1 x 1 meter units was excavated. This unit terminated at a feature, Feature 26, which contained large amounts of shell and burned pottery. In order to remove the entire feature we would have had to extend the block both north and east so, again due to time constraints we were forced to mark the feature with a tarp and backfill it without removal.

The location of the western block was selected because according to the geophysics, and corroborated by an artifact concentration in the shovel test map, there was a possible house feature nearby. The possible house was left alone, but a possible feature that we assumed was likely related to the house feature was targeted.

The western block began with units 80 and 81 and eventually contained 3 features. Feature 24 was marked and left for future considerations and we attempted to remove Feature 21. First, what we thought to be the southern half of the feature was excavated; this revealed part of a bison scapula hoe. The rest of the hoe extended into the northern wall so we extended two partial units, half a unit in XU 85 and a quarter unit in XU 86, hoping to expose the entire feature. The feature turned out to be much larger than it had at first appeared and it was oddly shaped, extending even further into both the north and east walls of the enlarged block.

The decision was made to excavate what we had so far uncovered and to mark the rest for later. Since we were now excavating what appeared to be the middle of a large feature it could not be called the northwest or northeast quarters, so the feature was split up into 6 arbitrarily made sections and excavated. While excavating these sections it became apparent that the large feature had another feature, Feature 25, intruding into its most northeast section, section 6. We removed what we had uncovered of Feature 25, which was very ashy, and marked the rest for future excavations (Figure 9).

Figure 9 Andrew Brown and Emily Evenson excavating Feature 21. Picture taken by Mandy Nelson, facing southwest.

Although it was large, Feature 21 was largely devoid of sizeable artifacts. Only the bison scapula hoe and some large lithic materials that may be manos were discovered.

However there was a large profusion of charcoal, charred maize, and what has been tentatively identified as a charred bean.

There were also a separate set of excavations done at this field school. Their goal was to discover likely Woodland components on the lower terraces around Silvernale. There were units placed on the eastern, northern, and western lower terraces around the traditionally defined Silvernale village area. The northern and western terraces were separate from the village as expected but the eastern terrace, according to the artifacts, appears to be a part of the Silvernale village. The far eastern side of the Silvernale village is covered with a large amount of fill from modern activities so it is difficult to gage where the village actually ends and the eastern terrace would start. After excavating what we had presumed to be far outside of the village we discovered a profusion of artifacts that lead us to believe that this is a part of the village. If true, than the undisturbed remnant of the Silvernale village site is far larger than it was previously believed.

A metal detection survey was also carried out at the beginning of this field school that ended up locating the long lost datum point from the digs supervised by Christina Harrison. Now that the materials from those digs can be tied to specific locations they can be used for study and comparison.

Laboratory Methods

There were five years of field schools at Silvernale so a large number of researchers and students worked on various parts of the collection over that time. Parts of the collection were variously cleaned, catalogued, and analyzed; however they all followed the same practices, detailed below (Dobbs et al. 2003). The excavation units that had not been taken care of up to this point were cleaned, catalogued, analyzed, and entered into Microsoft Excel® as a part of the "Making Connections grant to the Minnesota Indian Affairs Council in the spring of 2011. Some of the shovel tests were cleaned and catalogued by Dan Born in 2005, though much of the cataloguing had to be redone in 2008-2009 (Harvey 2009; Warmka 2009).

Beginning in the summer of 2011 and continuing until the end of spring semester 2012, I began to catalogue the materials collected from the 2011 field school at Silvernale. During the field school, on rain days, some of the shovel tests were washed by the field school students at the Anderson Center in Red Wing, MN. Each artifact was removed from its bag and cleaned with a toothbrush and water, then set to dry. Once dry they were placed back in their bags.

Back in the lab at MNSU Mankato I finished washing the dirty artifacts from shovel tests, excavation units, and field specimens from the features. This was done in the same way as described above. Next they were catalogued. The artifacts were separated based on artifact class (i.e. lithic, pottery), name (i.e. debitage, sherd), morphology (i.e. flake, body), raw material (i.e. PdC, GM), heat treatment, size grade, surface (i.e. smooth, cord marked), decoration (i.e. trailed lines), temper (i.e. shell, grit), and if it was a tool then the dimensions were taken. Each section of artifacts was then weighed, counted, recorded and placed into smaller labeled bags before being returned to the original shovel test bag. The catalogues were then entered into Microsoft Excel® so that they could be more easily referenced and sorted. These procedures were established during the first Silvernale work in 2001 and have been adopted for all Red Wing work both for MSUM and the Science Museum of Minnesota (Ronald Schirmer, personal communication).

The bags of feature material were processed in a flotation machine, a Dausmann A-1 Flote-Tec. The volume of each sample was recorded and then they were separately dumped into the flotation machine. The flotation machine was filled with water and then the soil samples were individually added. It agitated the soil samples so that it could separate the soil from the artifacts. The 'heavy fraction' (gravel, large artifacts and faunal remains > 1/8") were separated by the machine from both the soil and the 'light fraction' (mostly botanical remains > .25mm. Each heavy and light fraction was then allowed to dry in a screen. Once the materials dried they were size graded and placed into appropriate bags along with their label tag. The soil samples are not included in this study and they now await further analysis at MNSU Mankato.

Analysis Methods

The artifacts were catalogued on paper so that there is a permanent copy and then the data on the forms were transferred to Microsoft Excel® for analysis. Tables and pie charts were created and the results of the ST data and the XU data were compared. Then because of reasons that will be explained in Chapter 5: Results and Interpretation, the XU data were split into 0-30cm and below 30cm.

Then the individual blocks were split off and compared to the ST's in their general vicinity. The ST's were selected using GIS, using a technique that will be explained in the GIS section below. Then the selected ST's were compared with the individual XU's. The entire blocks, as well as the split blocks (0-30cm and below 30cm) were compared to the ST's using the data functions above, including graph and pie chart making.

GIS Methods

Geographical Information Systems (GIS) is often underutilized in archeology. When GIS is used it is usually only used to visually represent the site or excavation units at the site. In this thesis it is used both to visually represent the site but also as a statistical analysis tool.

There are many different tools that can be used to spatially analyze the data. In this thesis two methods have been selected: Inverse Distance Weighting (IDW), and Kernel Density Estimation. These methods were chosen because they visually represent the data input as well as to attempt to interpret the spaces in between points.

> Inverse Distance Weighting (IDW) is a set of deterministic interpolation techniques that compute the value of a variable at an unsampled location based on the weighted linear average of nearby sample values. The basic principle of IDW is that nearby locations should be considered more important than farther locations. The weight assigned to a specific sample point is inversely proportional to its distance from the point of estimation. (Milillo 2009: 8-9)

$$\hat{v}_1 = \frac{\sum_{i=1}^{n} \frac{1}{d_i^p} v_i}{\sum_{i=1}^{n} \frac{1}{d_i^p}}$$

> The two-dimensional probability density function, the kernel, is placed over these observed points… the relationships between the data points can then be determined and clustered. (Mills 2009: 11)

Kernel density estimation is calculated as

$$\hat{f}(x) = \frac{1}{nh} \sum_{i=1}^{n} K\left(\frac{(x - x_i)}{h}\right),$$

In Arc GIS they are used by first inputting the data set by tying the data set from Microsoft Excel to the Arc GIS. In this case the data set is a systematic survey so the points are evenly spaced and any density anomalies created are likely not an artifact of sampling error. The ‘Toolbox’ function in ArcMap contains many geostatistical functions. So the ‘Toolbox’ was selected and then from inside the ‘Toolbox’ the ‘Tools’ IDW and Kernel Density Estimation were selected each in turn. Once the desired ‘tool’ is selected an option window opens. In the option window the data set desired is then selected (i.e. Grand Meadow or Shell tempered pottery) and placed into the ‘Input point features’ box. The Z value field is next selected (i.e. count or weight). Finally the search radius is selected including both the number of points to be calculated and the maximum distance to be compared. The visual representation of the data is then available and it can be modified (i.e. change colors etc.) The different data sets are then created and compared to each other visually.

In the Arc GIS database created for this project it is possible to look at the data in many different ways. Each shovel test point contains the information that was found in that location. The shovel tests can be selected individually by clicking on them with the mouse and using the ‘Information’ tool. Once selected the data from the individual shovel test are displayed. It is first split up into the different levels of the shovel tests. In this case there are only three levels for each shovel test: 0-10cm, 10-20cm, and 20-30cm. Once the individual level is selected the artifacts in that level become available for viewing and if the individual artifact is selected the complete data for that artifact or group of artifacts is displayed as in Figure 10.

Since the data are tied to the specific shovel tests it is possible to search for specific groups of artifacts (i.e. all of the shovel tests containing Cedar Valley Chert, displayed in Figure 11. This is accomplished using one of the several ‘Select by Attribute’ tools to create a ‘Definition Query’. Depending on which ‘Select by Attribute’ tool is used the screen will display either a highlighted selection of the shovel tests that contain the artifacts desired or it will show only the shovel tests with the artifacts desired, as is shown in Figure 11.

The individual excavation units were compared to the shovel tests in their immediate area. The shovel tests to be used were selected in GIS using the ‘select by rectangle’ function. It was arbitrarily decided that a square was made around the excavation units going two shovel tests in every direction. The data from the nearby shovel tests were compiled and then used to compare with the excavation units in Microsoft Excel.

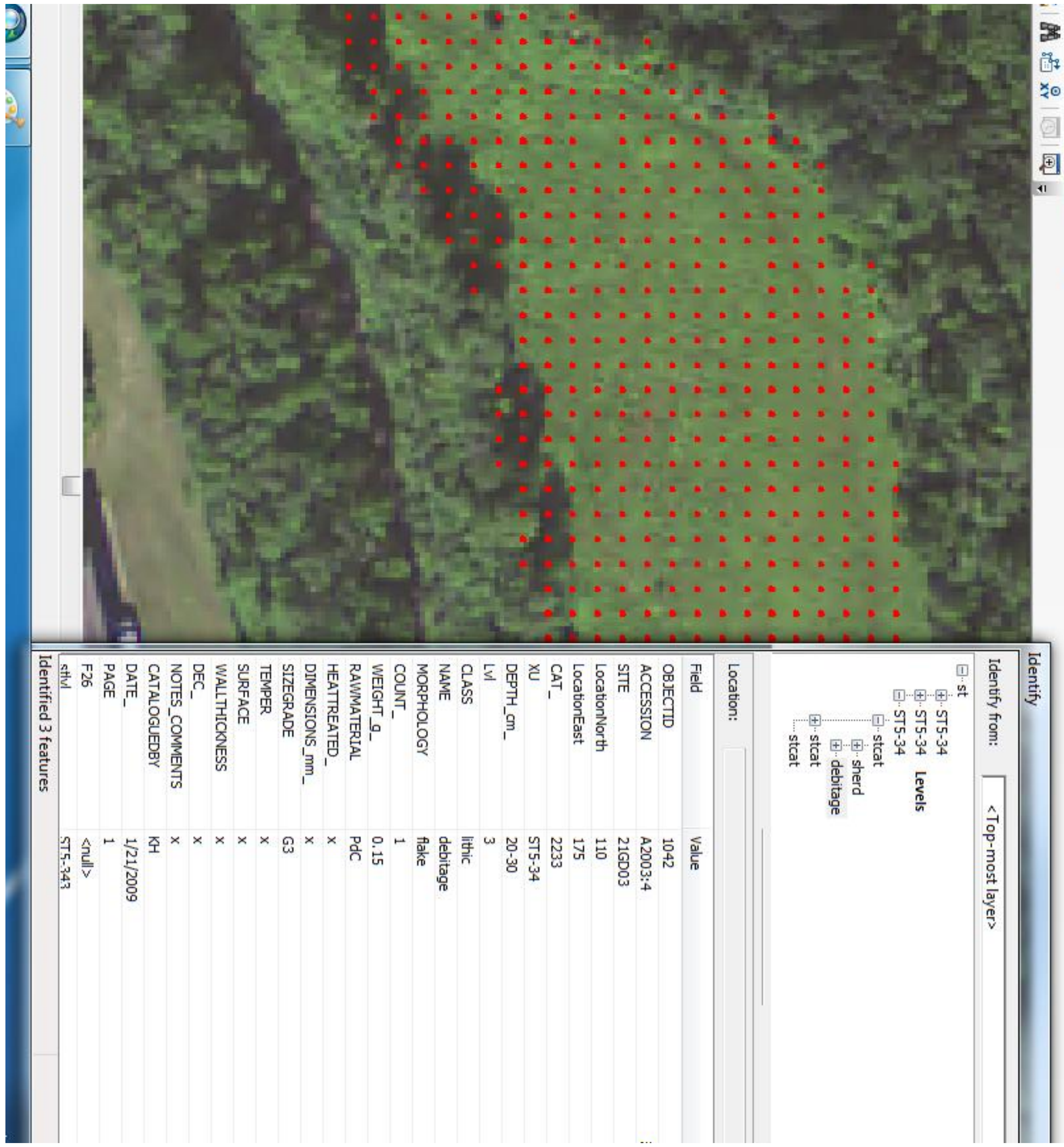


Figure 10 GIS map showing the information displayed for each ST.

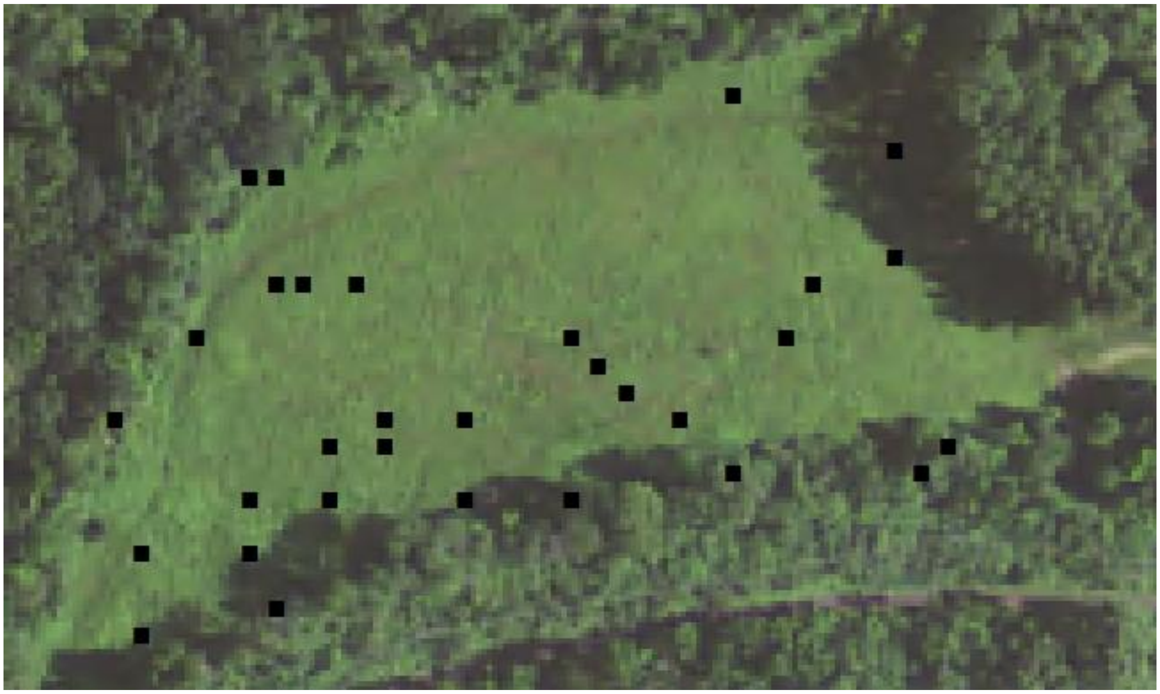


Figure 11 GIS map showing locations of ST's with CVC.

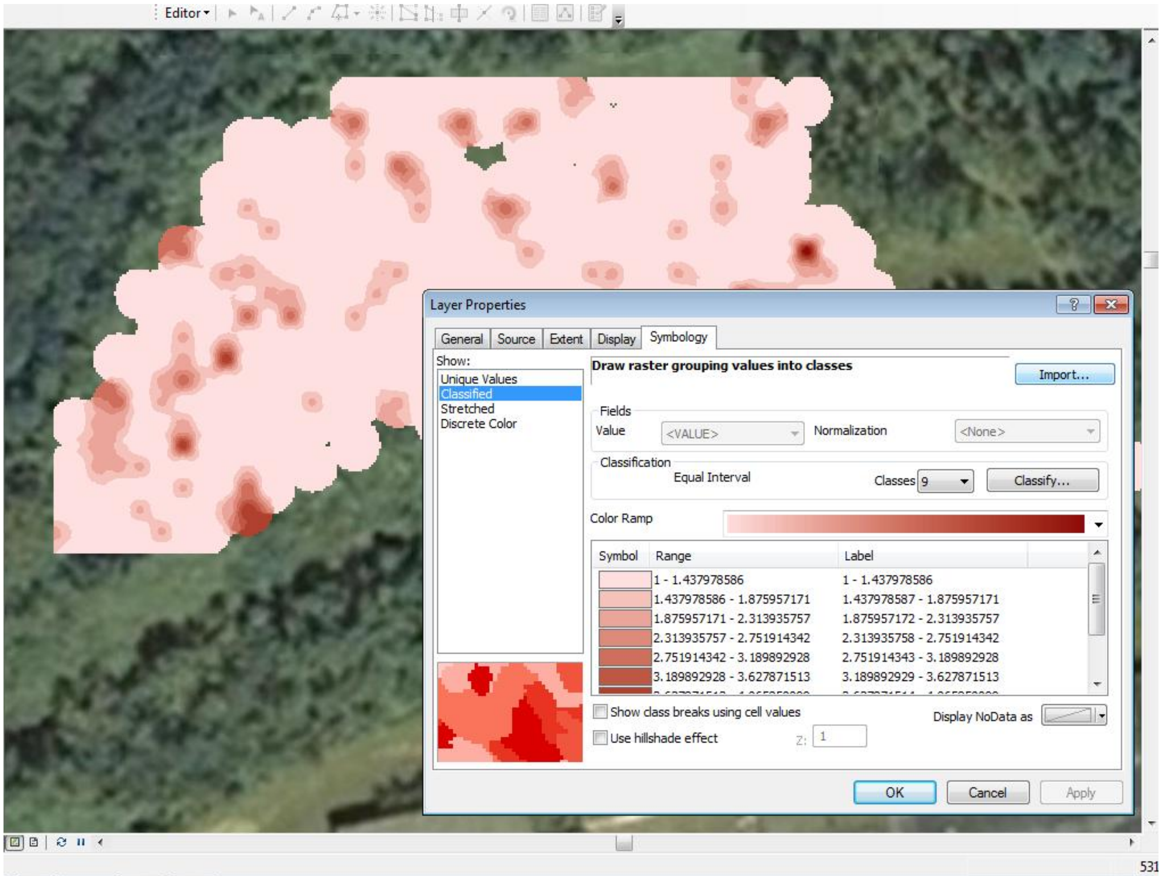


Figure 12 GIS IDW map showing concentrations of Grand Meadow. Also with layer properties tool overlain.

Spatial statistical analyses were also performed using Arc GIS. Several spatial analytical tools were selected from the 'spatial analyst' toolbox. Those selected were IDW and Kernel Density. These tools were used to compare the data spatially. The tools made it possible to use the known locations of artifacts to predict where other artifacts were likely to be found. This had the result of creating concentration peaks in different areas of the site. Figure 12 shows an IDW concentration map of Grand Meadow at the site. The lighter areas show locations where actual and predicted values of Grand Meadow are comparatively low and the darker areas show places where Grand Meadow lithics are found in comparative abundance.

There are many ways in which this data can be modified to show different things. First the user can select the 'search radius' (The distance out from itself from which each point will be compared, each shovel test point is only compared to other shovel tests with the radius selected).This means that the user can either look at small 'bulls-eye' concentrations by setting the search radius at 6 meters, which is done above, or the user can select a wider radius such as 15 meters in order to get a better handle on general site trends, this will create larger blobs of color with bigger spaces between.

Next, the number of classes can be specified. In Figure 12 the number of classes is currently specified at '9'. Each class has a number of artifacts in it. All places, for example, each location where there are from '1-1.437978586' artifacts, will display the same color. This is one class. The class ranges can be split up into any number of ways: the amount of classes can be increased or decreased, thus changing the numbers of colors displayed on the map or the ranges of the specific classes can be changed. Both of these will alter the view of the map and they can give the user the ability to look at the data in nearly infinite different ways, each of which may help to ferret out patterns at the site. There are also a number of other ways to alter the method of what is being shown but those mentioned here are the primary ones used in this thesis.

CHAPTER 5: RESULTS AND INTERPRETATION

Microsoft Excel®

This study contains the results of five field schools at the Silvernale village site (21GD03) in Red Wing, MN. These field schools were led by Ronald Schirmer and took place in 2003, 2004, 2005, 2007, and 2011. This thesis is primarily concerned with the 567 shovel tests placed at Silvernale but it also contains the summarized results of the excavation units placed during this time.

There were 86 numbered excavation units (XU's), however the cataloguing of XU's 66-72 is unfinished and so they are not a part of this study. Also XU's 73-77 and 79 were laid out but not dug due to time limitations. Excavations at Silvernale are not yet completed, in Block 2 for example, few units are down to culturally sterile horizons. Schirmer encountered multiple occupation levels bisected by a house floor and has not yet finished. Plans to finish Block 2 in 2013 are underway (Ronald Schirmer, personal communication).

The shovel tests were supposed to be placed in a continuous 5 x 5 meter grid across the site (Figure 4), however due to obstructions some shovel tests were unable to be dug, leaving gaps in the grid: In a few cases on the east side, the shovel tests would have been in the road, which has eroded to well below the plow zone. In a few cases on the west side, shovel tests were not dug because they were in road ruts that held standing water at the time. Shovel tests were also placed to the east of the traditional village area. They were placed in a 10 x 15 meter grid and due to comparison problems are not included in the general data presented in this section. Also, some of the original shovel tests placed at the village were placed in order to determine if there was undisturbed materials at the site, so they go below the plow zone and those data are not included. The plow zone is deeper or shallower in different spots around the village, varying from 25 to 40 centimeters deep. For comparative purposes the shovel test data below have been truncated at 30 centimeters; that is, the data below are only from 0 to 30 centimeters below the surface. There were also 26 numbered features at the site. Most of these were excavated, however they are not yet fully analyzed and so, with the exception of a few photos and references they are not included in this study.

The results of the shovel test survey will be shown in this section. This will include the counts and weights of various artifact classes, as well as the percentages of each. These results will then be compared and contrasted to the results of the excavation units as a whole. This will help to determine if the shovel test survey method is a useful way of summarizing general site data. That is, if the percentages of artifacts are comparable between the two then it may indicate that a shovel test survey alone could yield a viable yet generalized site profile.

The excavation units are grouped into blocks in different areas of the site and so the individual blocks will be compared with the shovel tests in their immediate vicinity. This will help to determine if the shovel test method can not only give a general site profile but if it can give an accurate profile of individual areas of the site.

Total Assemblage

Archeological assemblages vary by depth so it would not be expected to find a 1 to 1 correlation when comparing data from the plow zone (0-30), and the total assemblage. As noted in Tables 1 and 2 below, there are considerably more artifacts in the XU's than there are in the ST's. The excavation units were placed for various reasons such as searching for specific features so they are not a representative sample of the entire site. Indeed the excavation unit totals are heavily biased towards the larger blocks, 2 and 3. The ST's are focused on plow-zone materials as opposed to the XU's which contain both plow-zone and sub-plow-zone materials. For these reasons the ST's and XU's are not directly comparable but the comparative totals and percentages are nonetheless noted below.

Count	ST's	Percentage ST	XU's	Percentage XU
Total Pottery	4061	46.94%	15176	42.50%
Total Lithics	3944	45.59%	14050	39.40%
Total Faunal	440	5.09%	2793	7.80%
Total FCR	44	0.51%	570	1.60%
Total Floral	157	1.82%	2957	8.29%
Total	**8646**	**99.95%**	**35546**	**99.59%**

Table 1 : Totals of Counts for major artifact assemblages at Silvernale.

Weight	ST's	Percentage ST	XU's	Percentage XU
Total Pottery	1895.351	24.77%	10011	20.38%
Total Lithics	3485.027	45.54%	27763.5	56.52%
Total Faunal	249.004	3.25%	1325.9	2.67%
Total FCR	2009.102	26.25%	9821.3	20.00%
Total Floral	13.97	0.18%	197.3	0.40%
Total	**7652.454***	**99.99%**	**49119***	**99.97%**

Table 2 Totals by Weight for Major Artifact Classes at Silvernale

*Note: 'Total Lithics' section does not contain FCR or Ground Stone Tools on any charts. It should be noted however that almost no Ground Stone Tools were found in the ST's and 8.5% of the original XU artifacts by weight were of Ground Stone Tools.

To make a better comparison between the XU's and the ST's, the XU's have been split into a plow zone section 0-30cm, and a below 30 section.

Count 0-30	ST's	Percentage ST	XU's	Percentage XU
Total Pottery	4061	46.94%	3503	45.18%
Total Lithics	3944	45.59%	3830	49.39%
Total Faunal	440	5.09%	171	2.21%
Total FCR	44	0.51%	141	1.82%
Total Floral	157	1.82%	109	1.41%
Total	**8646**	**99.95%**	**7754**	**100.01%**

Table 3 Totals by Count for Major Artifact Classes at Silvernale. 0-30cm only.

The percentages of pottery and lithics are now, in Table 3, much more similar between the ST's and the XU's than they were in Table 1, where the sub-plow-zone materials were included with the totals.

Weight 0-30	ST's	Percentage ST	XU's	Percentage XU
Total Pottery	1895.351	24.77%	1675.412	13.10%
Total Lithics	3485.027	45.54%	3249.947	25.40%
Total Faunal	249.004	3.25%	89.555	0.70%
Total FCR	2009.102	26.25%	7772.363	60.75%
Total Floral	13.97	0.18%	7.322	0.06%
Total	**7652.454**	**99.99%**	**12794.6**	**100.01%**

Table 4 Totals by Weight for Major Artifact Classes at Silvernale, 0-30cm only.

In Tables 3 and 4, that there is something unusual going on with the FCR in the XU's. It is elucidated below in Table 5.

Column1	Total Weight	Percentage of FCR
FCR 0-30	7772.363	79.14%
FCR 30 and below	2048.937	20.86%
Total	9821.3	100.00%

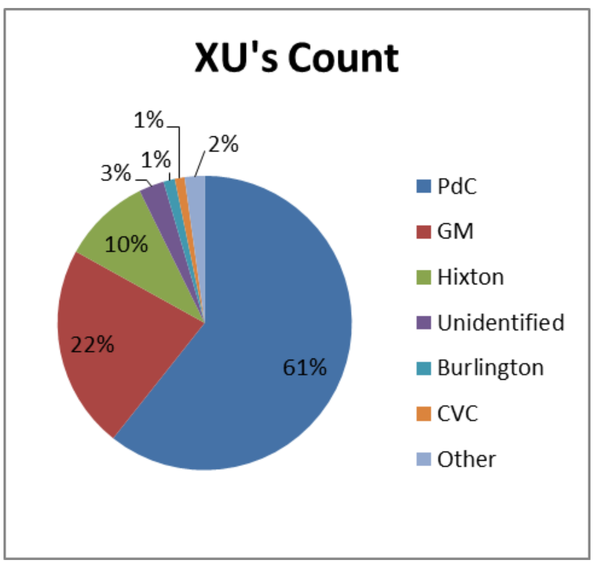
Table 5 FCR in XU's.

In the XU's nearly 80% of the FCR by weight is contained within the plow zone area. This pattern is not repeated in the ST's which are also in the plow zone, nor is it repeated when tabulated by count in the XU's. The reason for this may have to do with the reason that each block was selected. They were selected based on the Geophysics whose data suggested that there were likely features to be found in these areas. This phenomenon will have to be investigated further.

Lithic Assemblage

The following is an accounting of the lithic artifacts in both the ST's and the XU's. The purpose is to compare between the two data sets so there will only be seven categories of lithic named: the five most prevalent types, the unidentified, and the 'other' category which contains, in the XU's 17 different types (Fat Rock Quartz, Galena, Harrison County, Hudson Bay Lowland Chert, Jasper Taconite, Kakabeka, Maynes Creek, Plattsmouth, Porcellinite, Quartz, Quartzite, Rhyolite, Siltstone, Sioux Quartzite, Swan River, Tongue River, and Winterset), and in the ST's eight different types (Galena, Gypsum, Knife River Flint, Quartz, Quartzite, Sioux Quartzite, Swan River, and Wyoming Mud Stone). The Five most prevalent were chosen in order to facilitate comparison. The excavation units contain much more material and they were catalogued by many different people, hence the large array of material types.

Furthermore, due to their large weight, as well as the almost complete lack of them in the shovel test data, ground stone tools have not been included, nor have sandstone shaft abraders and FCR because of their weight. No doubt, however that including them would open up an entirely new and equally important set of data comparisons. There are 3944 lithic pieces in the ST's and 14050 lithic pieces in the XU's so they are shown below is percentages in order to better compare them to each other.



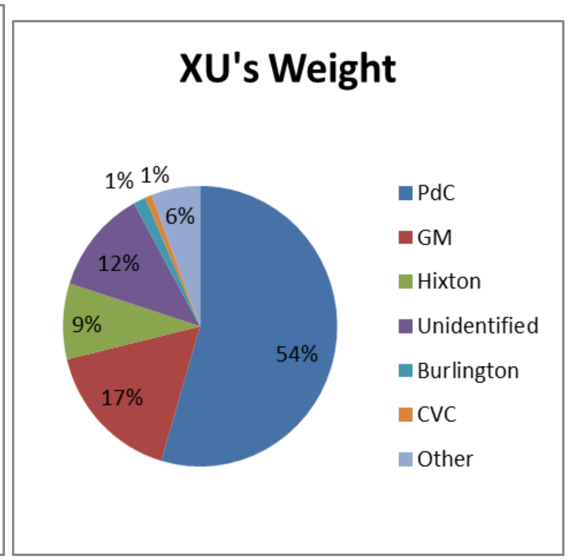
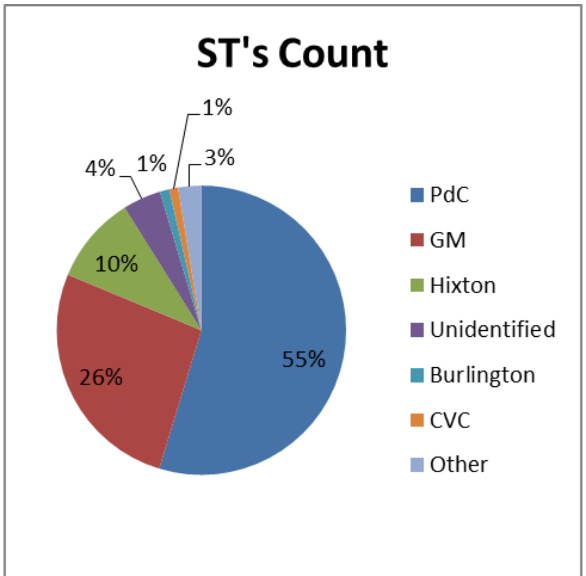


Figure 13 Totals by Count for lithics in XU's

Figure 14 Totals by Weight for lithics in XU's.



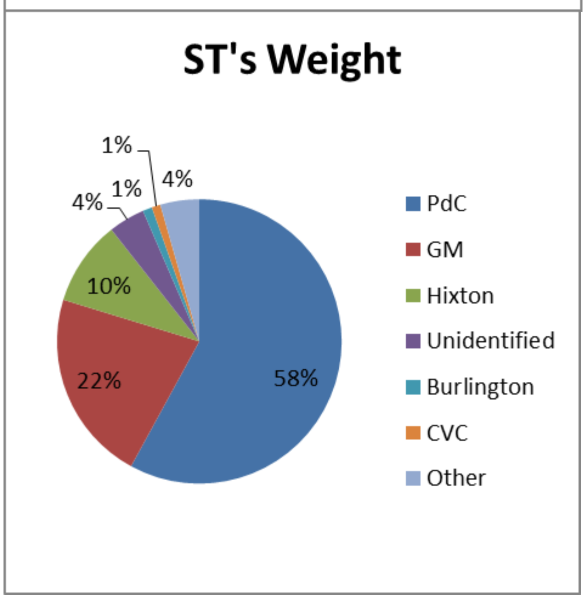
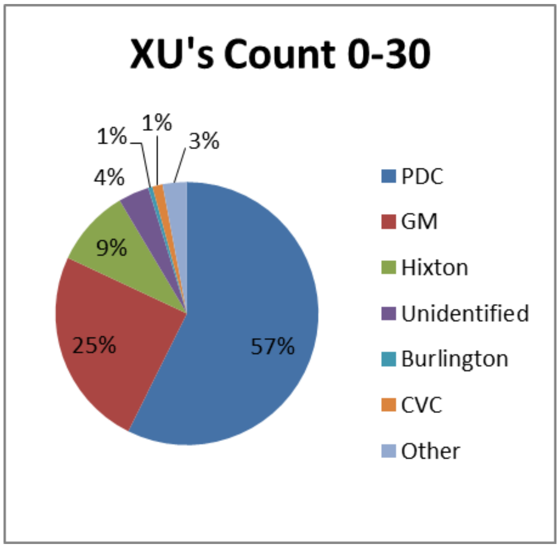


Figure 15 Totals by Count for lithics in ST's

Figure 16 Totals by Weight for lithics in ST's

When comparing Figures 13-16, you can see that the data are already very similar even though the XU data still contains the sub-plow-zone materials.



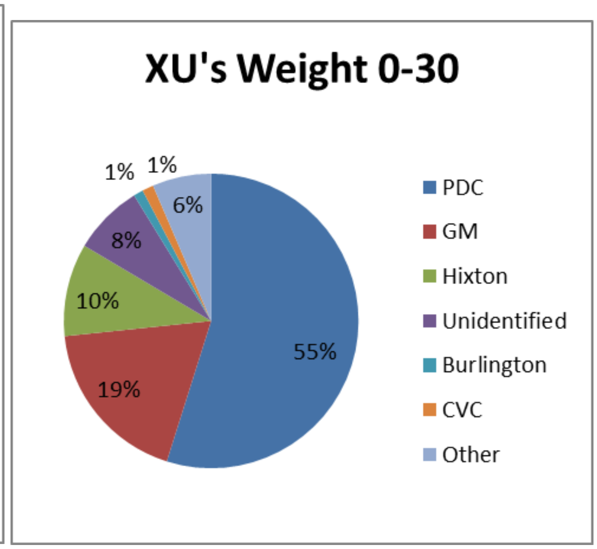
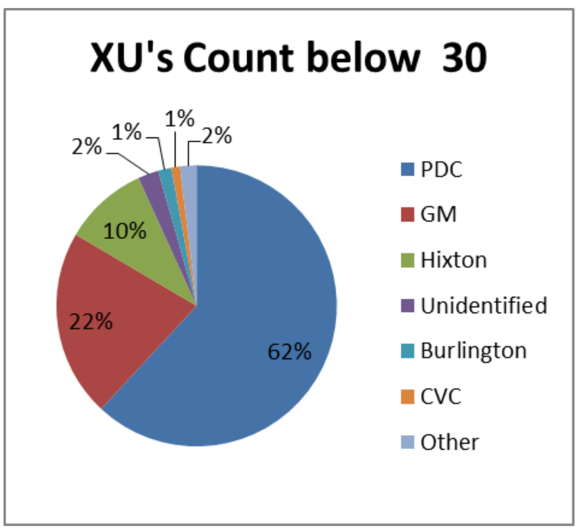


Figure 17 Totals by Count for lithics in XU's

Figure 18 Totals by Weight for lithics in XU's.

In Figures 17 and 18 the data are adjusted for only plow zone materials. Now comparing Figures 13-18 the two data sets are even more similar.



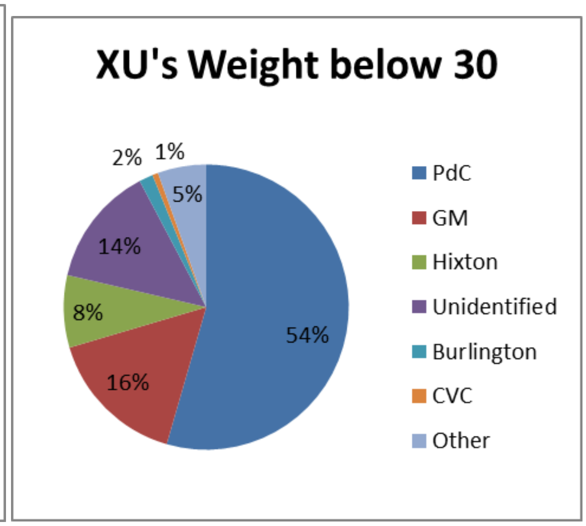


Figure 19 Totals by Count for lithics below 30 in XU's

Figure 20 Totals by Weight for lithics below 30 in XU's.

Plow-zone materials are discarded by many archeologists because they lack context however these data seem to suggest that a representative site profile could be obtained without more extensive excavations. This method certainly appears to give an accurate indication of what is going on in the plow zone, as is shown in Figures 17-20. However it also appears to give a fairly accurate representation of the sub-plow-zone materials. The materials from the ST's appear to differ, as might be expected, from the numbers of the sub-plow-zone materials, but it still appears to be a very good indicator of what is going on below the plow-zone.

In the XU's there are 10,231 lithic artifacts below the plow zone and only 3,819 lithic artifacts above the plow zone. As might be expected it appears by examining Figures 19 and 20 (the sub-plow-zone XU data) and noting their similarity to Figures 13 and 14 (the total XU data) that the sub-plow-zone materials dominate the total XU data assemblage.

Pottery Assemblage

There are 15,176 pottery artifacts in the XU's and only 4,061 pottery artifacts in the ST's so it is necessary for comparison purposes to use percentages. The charts below show the data, they are split up into three categories; Shell, Grit, and Other. The Other category contains pottery of mixed temper, hornblende, or sand tempered.

The large collection analyzed in this thesis has been catalogued by a number of different researchers over several years. This has resulted in data that are not always strictly comparable, but overall that follow a standardized descriptive analysis system. A large proportion of the XU 'Other' category is comprised of the category 'sand temper', whereas in the ST's these pieces would likely have been placed into the grit tempered category. Sand is a form of grit though some researchers have chosen to separate this category which may have as much importance as the distinction between shell and grit tempering.

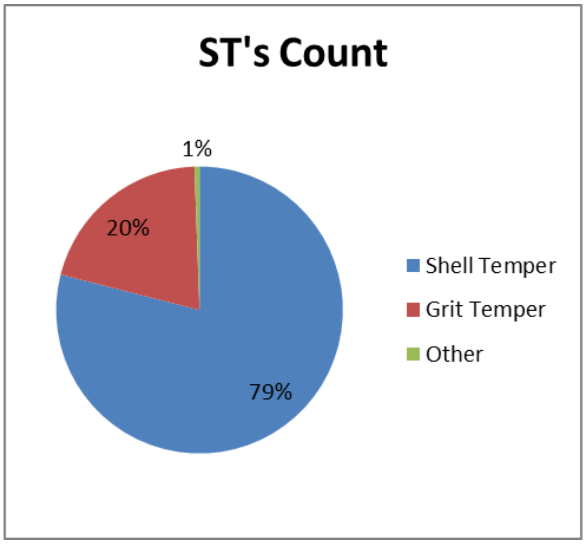


Figure 21 Totals by Count for Pottery in ST's

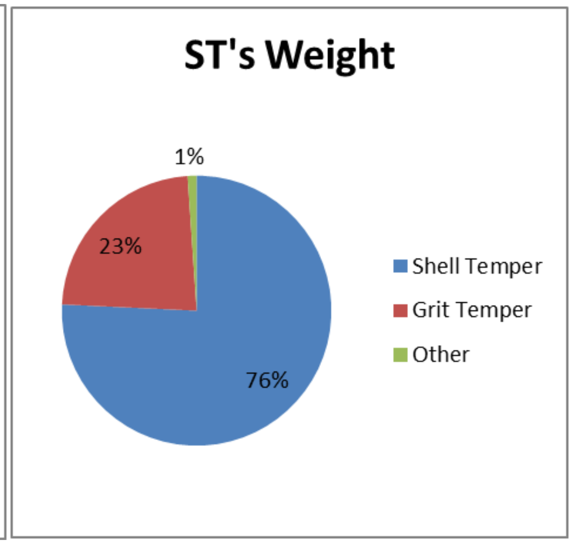


Figure 22 Totals by Weight for Pottery in ST's

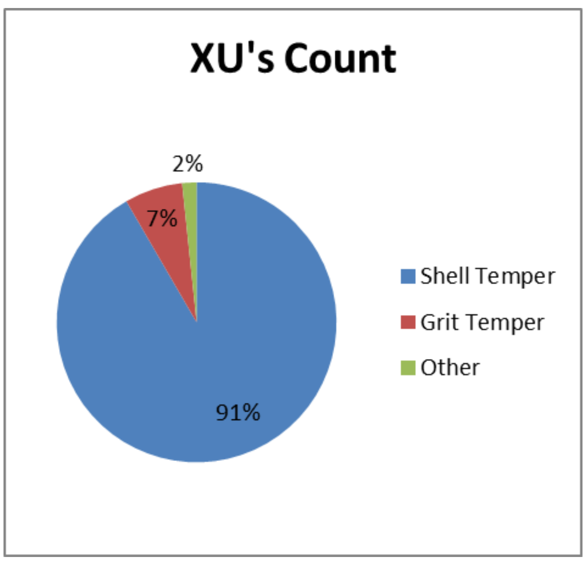


Figure 23 Totals by Count for Pottery in XU's

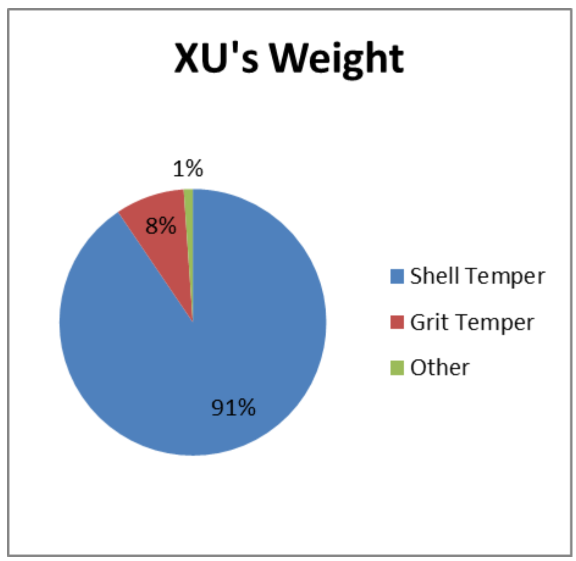
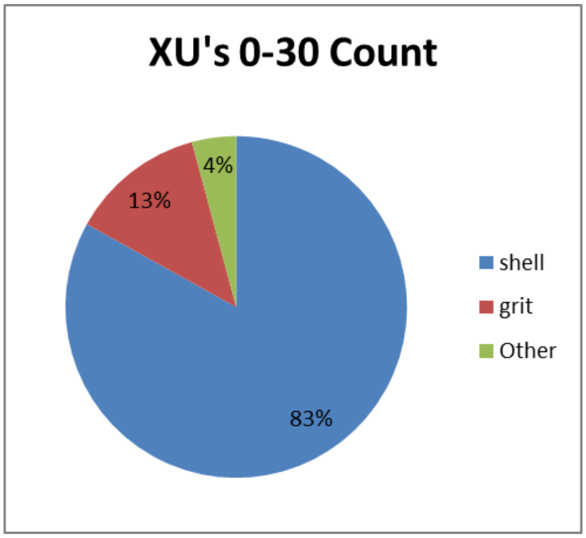


Figure 24 Totals by Weight for Pottery in XU's.

Note: Block 2 is in the berm, so part of the sample is mixed. When Block 2 is removed from the totals, the XU percentages change to 79% shell, 18% grit, and 3% Other.

Much more so than with the lithics the reader can see a dramatic difference between the ST's and the XU's when they examine Figures 21-24. There appears to be nearly triple the numbers, by percentage, of grit tempered pottery in the ST's compared to the XU's. However when we split the XU's up, as is shown below, the difference greatly diminishes.



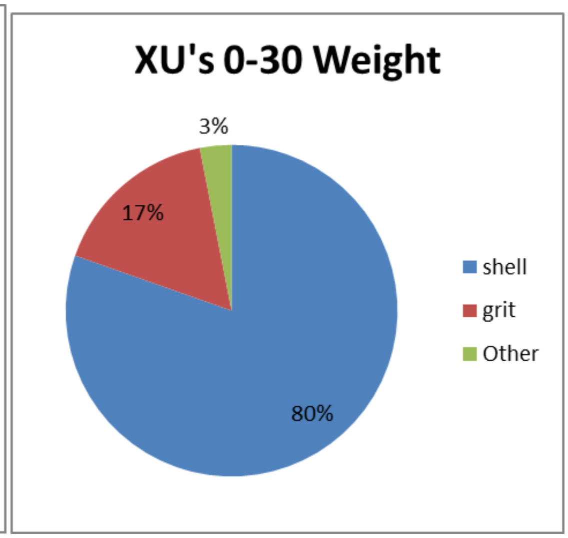


Figure 25 Totals by Count for Pottery in XU's, 0-30Figure 26 Totals by Weight for Pottery in XU's, 0-30.

The data from Figures 21 and 22 (The pottery data from the ST's) compared with, first Figures 23 and 24 (the pottery data from the complete XU's) and then Figures 25 and 26 (the pottery data from 0-30cm only in the XU's) shows that the data from the upper area, 0-30cm, of the XU's has much more similar numbers to the ST's than does the general XU pottery assemblage. Taking the data from both the XU's and the ST's it seems that there are much more pieces of grit tempered pottery in the upper layers of the site. There is also a large increase in the 'Other' category, I suspect that this is because a large percentage, about 1/3 of the 'Other' category in the XU's is labeled 'sand tempered', and as was noted above, this author, who labeled the ST's is more apt to have called the 'sand tempered' wares, 'grit'.

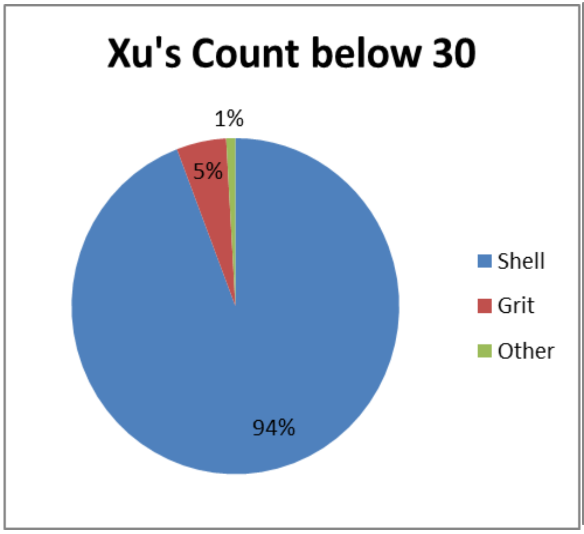
Some explanation of this seemingly counterintuitive pattern can come from the observation that 'Woodland' peoples are more often believed to be less permanent residents in certain areas and live in smaller groups and so are likely to dig smaller, shallower pit features. As noted by Arzigian (2008:12)

> Woodland peoples did not often dig deep storage pit features, in contrast to later Oneota and Plains Village peoples; features such as hearths, basin-shaped pits, or post holes from semi-permanent houses are not common and, when present, are often shallow.

This is in contrast to groups such as the Oneota, and Mississippians, who stayed in one area for longer periods of time, in larger groups, and so have been often noted to be associated with deeper, wider, pit features.

> Storage pits found at Oneota sites include basin, bell, or cylindrical shapes, and include well described examples found at the Sand Lake (47Lc44) and Herbert (47Lc43) sites (Boszhardt 1985), and at the Trane (47Lc447) site (Boszhardt 1992a). They tend to average about 1 meter in width by about 1 to 1-1/2 meters in depth, although larger examples are sometimes found" (Martinek 1998:90)).

These patterns have been observed in the Red Wing area in excavations at the Bartron and Bryan villages. This all likely has the result, when dealing with multi-component sites like Silvernale, of finding a greater abundance of grit tempered pottery and other 'Woodland' associated artifacts nearer the surface and of finding larger amounts of shell tempered pottery and associated artifacts in deeper levels when sites are not subject to processes that result in stratification.



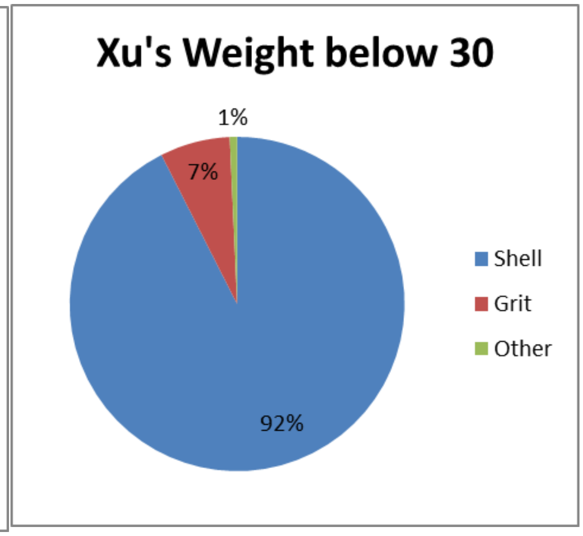


Figure 27 Totals by Count for Pottery in XU's below 30 Figure 28 Totals by Weight for Pottery in XU's below 30

Once again the larger amounts of data from below the plow zone dominate the general XU data, but there is such a propensity in this dataset for grit tempered pottery to be congregated in the upper levels that a difference can still be noted when comparing Figures 23 and 24 (the general pottery data in the XU's) with the sub-plow-zone materials noted in Figures 27 and 28.

BLOCKS

Block 1

Block 1 was dug in 2003 and consisted of 3, 1 x 1 meter units, XU's 1, 2, and 3. It is on the far eastern side of the known village. It contained one feature, Feature 1, which is a deep basin shape. It is an earthen oven that was reused as a refuse pit. It is 50cm deep and .91 x .89 meters wide. The location of Block 1 was selected because ST 6-15 terminated in a feature. Once the excavation began the geophysical data were consulted to determine which direction to add additional XU's. The excavation of Block 1 was terminated due to the discovery of a human tooth. Since than a protocol for the removal of random, non-burial human remains such as teeth has been established with the Office of the State Archaeologist and the Prairie Island Indian Community. In the future the excavation of Block 1 will be finished (Ronald Schirmer, personal communication 2012).

In this section the percentages of various artifact classes in the block are compared to the ST's in the immediate area. Figure 29 shows the placement of Block 1 in the village and the location of the ST's selected to compare it to. The plan for comparison in this thesis is to take all of the ST's within ten meters of each block. Since Block 1 is on the far southeastern edge of the sampled area it is not possible to compare the samples to the east of the block. Out of the 25 ST's that the block should be compared to, only 17 are available.

The excavated portion of Block 1contains a total of 5,264 artifacts, excluding features. In the 17 ST's that it is compared to there are only 329 artifacts. This sample size may be too small to get an accurate comparison; however, the relative percentages are noted below.

Figure 29 GIS map showing the location of Block 1 and surrounding ST's.

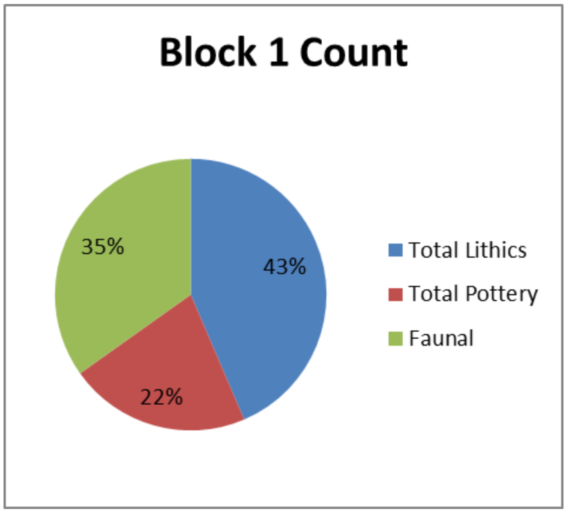


Figure 30 % by Count of Block 1 major artifact classes

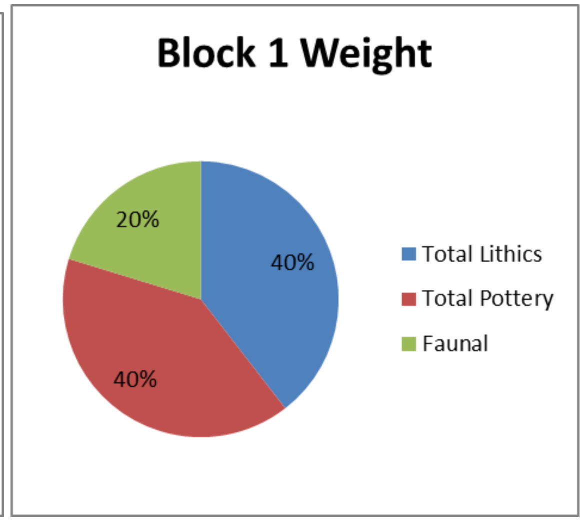


Figure 31 %Weight of Block 1 major artifact classes

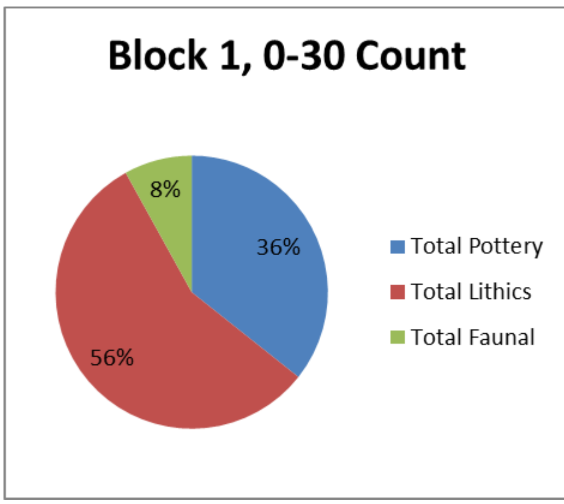


Figure 32 % of Block 1 major artifact classes, 0-30cm

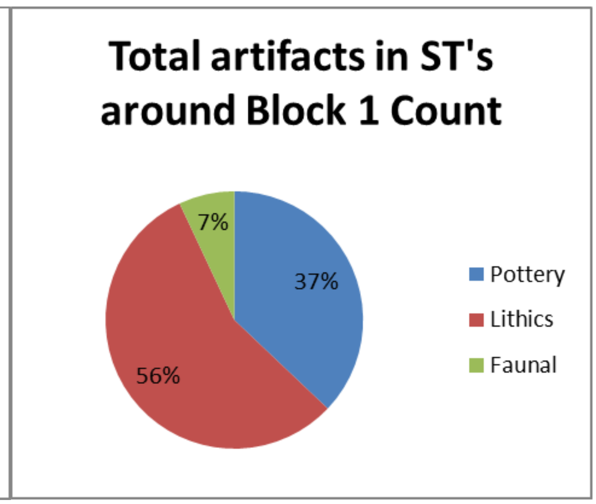
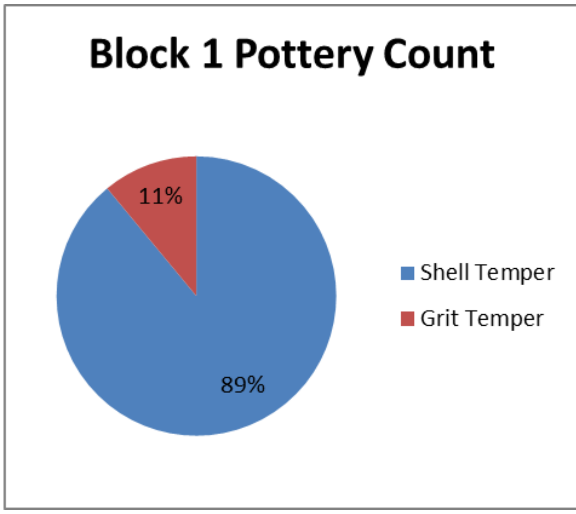


Figure 33 ST’s around Block 1. % Major artifact classes



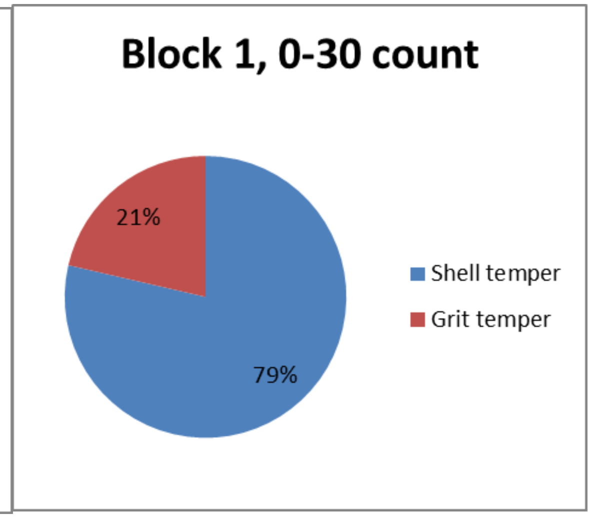


Figure 34 % of Block 1 pottery tempers

Figure 35 % of Block 1 pottery tempers, 0-30cm

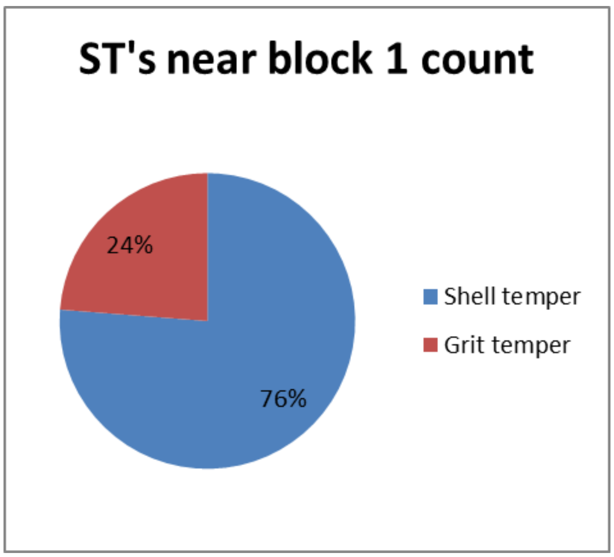
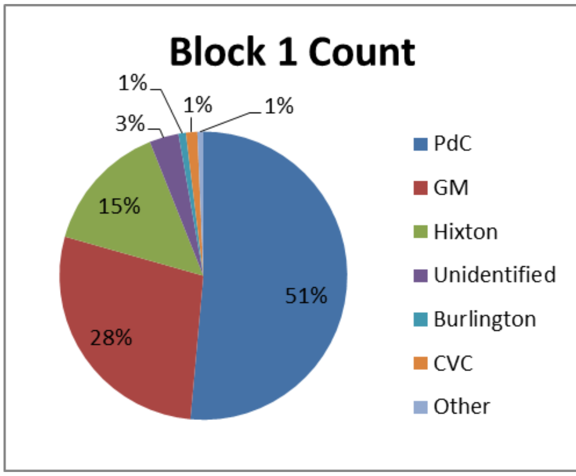


Figure 36 ST's around Block 1, % pottery tempers.

Note: Only grit or shell in Block 1, no sand or mixed tempered pottery.



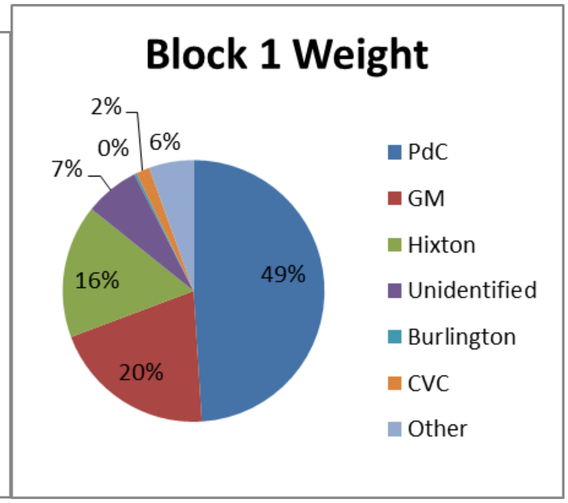
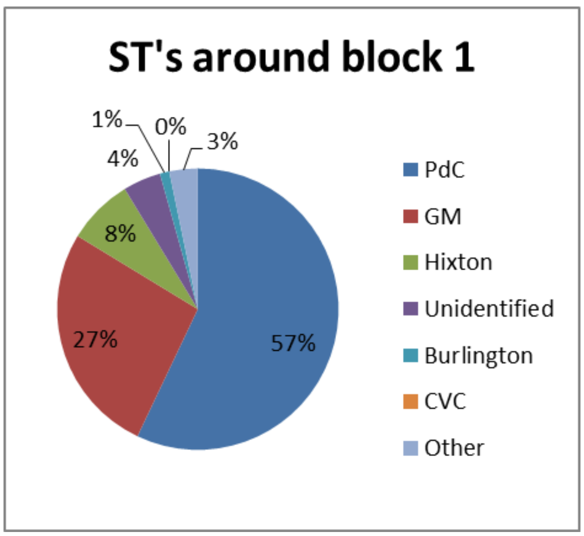


Figure 37 Count by % of Block 1 lithic types

Figure 38 Weight by % of Block 1 lithic types



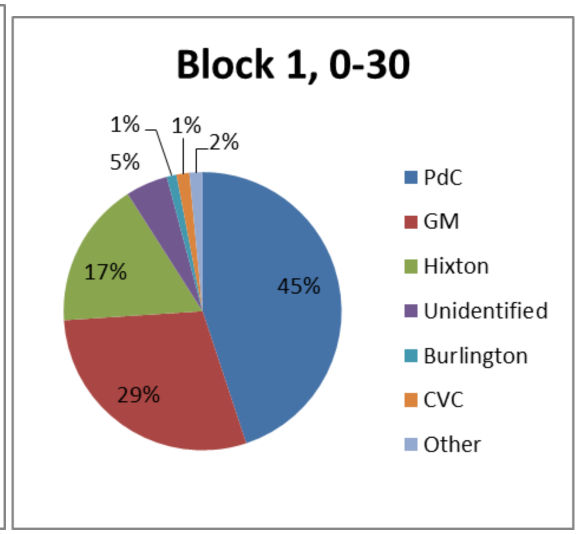


Figure 39 ST's around Block 1, % of lithic types 30cm.

Figure 40 Count by % of Block 1 lithic types, 0-

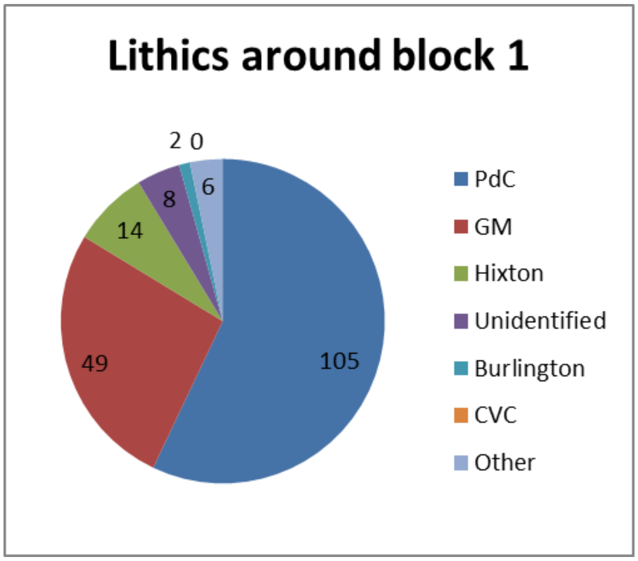


Figure 41 ST's around Block 1, count of lithic types.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

The percentages of major artifact classes in and around Block 1 are compared in Figures 30-33 above. The percentages for Block 1 in Figure 30 are dramatically different from the nearby ST's (Figure 33), especially in reference to lithics and faunal. However if the sub-plow-zone materials are removed from the Block 1 counts, as in Figure 32, then the comparison between the XU's and the ST's are nearly identical.

When the pottery is divided by temper (Figures 34-36) the results follow the same pattern as the major artifact classes. In Block 1 as well as in the nearby ST's there were no artifacts labeled as 'Other'; grit and shell were the only variables. In the ST's there is nearly twice as much grit tempered pottery by percent, as there is in the XU's. However, once the sub-plow-zone is removed the relative percentages become much closer. As noted in previous sections the larger amount of grit tempered pottery in the upper layers is understandable if we accept the premise that Woodland peoples would more likely have dug shallower middens etc.

The lithic comparison between Block 1 and the nearby ST's does not follow the general pattern described above. The percentages are somewhat similar between the XU's and the ST's (Figures 37-41) however, the situation is not improved by removing the sub-plow-zone materials (Figure 40) in fact it is made worse. This may be, in part, due to the small sample size of the ST's (Figure 41). It may also be attributable to unknown factors.

The dramatic difference between plow zone and sub-plow-zone materials in this area may partly be due to sample size, only 3 XU's and 17 ST's, or it may be an indication of cultural activities either at the site as a whole, or simply in this area of the site. This issue will be explored at the end of this section.

Block 2

Block 2 contains 32 excavated units and 5 unexcavated units (XU's 73-77). XU's 66-72 were excavated but the cataloguing is unfinished and so they are not included in this study. Block 2 was dug in 2003, 2004, 2005, and 2007. It is more to the western side of the known village and at the southern edge of the village remnant. This block cuts through the berm thrown up by the former railroad. It was selected for excavation in an attempt to discover if materials below the berm were intact, and if so, how intact. The materials beneath the berm appeared to be very intact and protected underneath the berm. The work was also undertaken so that the Cannon Valley Trail could better manage future work that they may have to undertake (Ronald Schirmer, personal communication).

There were 12 features discovered in Block 2: Features 4, 5, 6, 7, 9, 10, 11, 16, 17, 18, 19, and 20. Features 4, 6, and 7 were post molds and as such not collected for flotation. Feature 5 was a medium basin shaped corn concentration. It is fully excavated by not completely floated and analyzed. It is 42 cm deep and .6 by .6 meters across. Features 9, 10, and 11 were deep basin shaped refuse pits. Their excavations are complete. Features 9 and 10 are completely floated and are currently under study by Travis Hager (Hager 2012). Feature 11 awaits final flotation and analyzation. Feature 9 is 30 cm deep and .9 by .95 meters across. Feature 10 is 25 centimeters deep and 1.06 by .96 meters across. (Features 9 and 10 are right on top of and intruding into one another). Feature 11 is 40 cm deep and .82 by .73 meters across. Features 16 and 17 are unexcavated or fully uncovered, though Feature 16 is intruded upon by Feature 11. Features 18, 19, and 20 are not excavated fully. Feature 18 is 23 cm deep and is .62 by .77 meters across. No information is available for Feature 19. Feature 20 is 23 cm deep and .7 by 1.31 meters across.

Figure 43 shows the placement of Block 2 at the site and the ST's that it is compared to. Similar to Block 1, Block 2's placement makes it difficult to get a representative sample of nearby ST's.; only 14 of the 36 ST's it should have are available. Block 2 is in the southwestern area of the site, and it is mostly placed within the berm from the railroad. The berm area is slightly more difficult to deal with. Some of the materials are intact, and some of them are the product of the soil displaced when the trench was dug for the rail line to go into. At the northern end of the berm there is not one, but two plow zones within this block and due to the difficulty of separating them the block is not broken up into plow zone and sub-plow-zone materials as is done elsewhere.

The excavated and catalogued portion of Block 2 contains 17,251 artifacts, nearly half of the total artifacts in all of the blocks. In the nearby ST's there are only 222 total artifacts and most of them are to the north and northwest of Block 2. There is a smaller sample size for the ST's around this block than there is in others. This is partially because ST's were not dug to the south of Block 2, thus limiting the sample. Useful comparisons can still be made between the ST's and the block but the fact that the ST's only take into account artifacts from the north of Block 2 should be taken into account.

Block 2

	62	56	5	tree	
	61	55	4	63	69
	60	54	35	31	68
77	59	53	34	30	67
76	58	52	33	29	66
75	57	51	32	28	65
74	73	72	71	70	64

Figure 42 XU's for Block 2

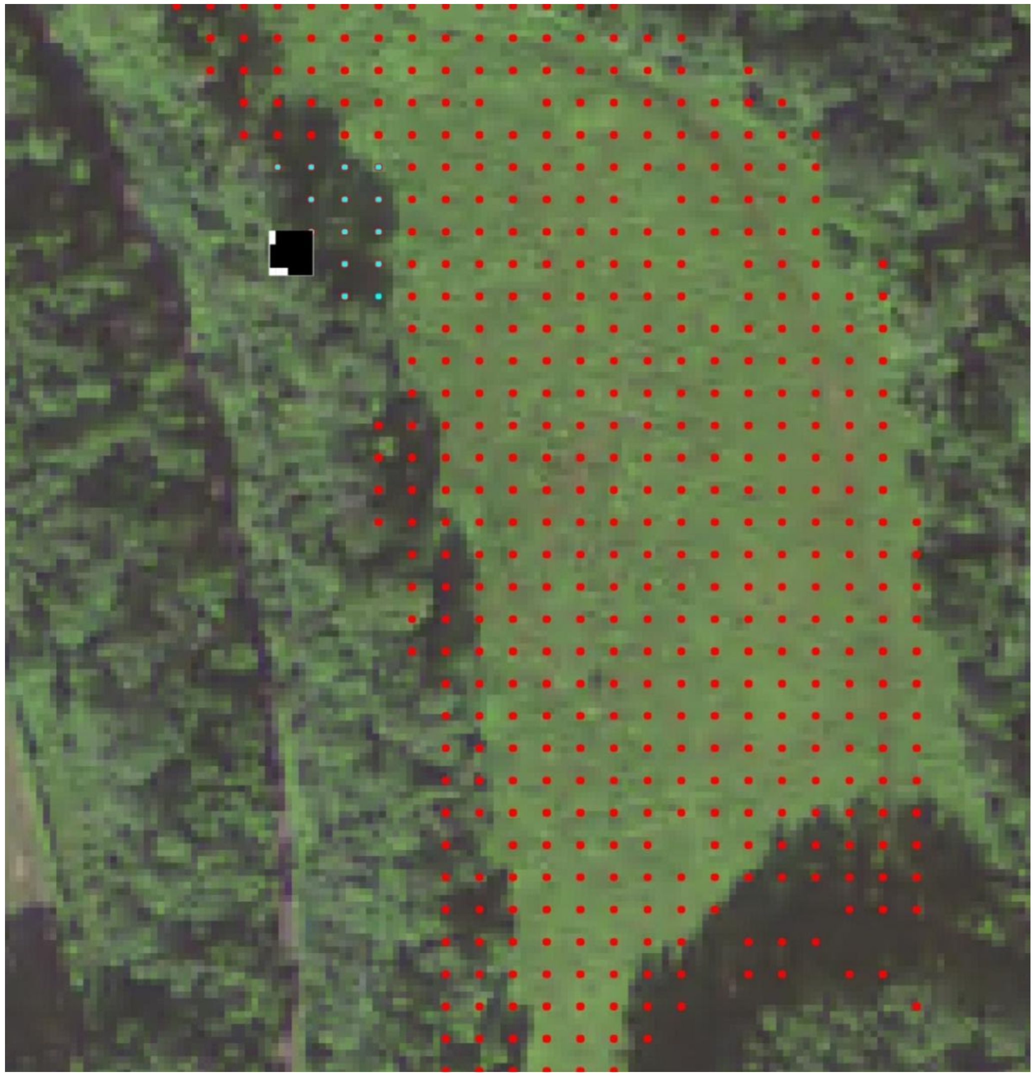
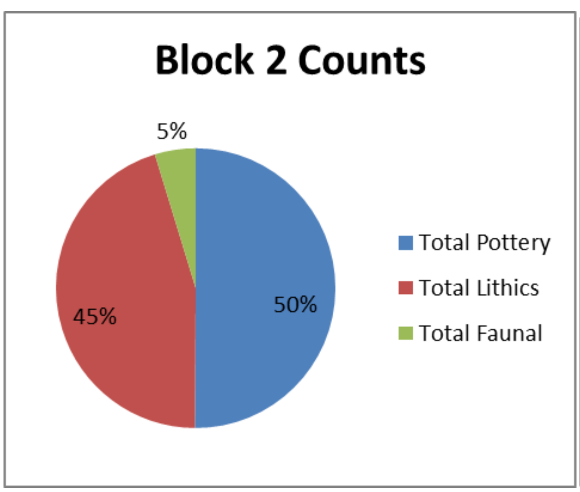


Figure 43 GIS map showing the location of Block 2 and surrounding ST's.



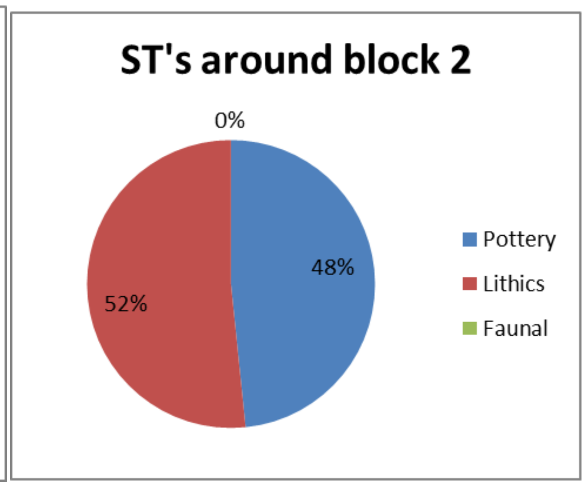


Figure 44 % of Major artifact classes in Block 2.

Figure 45 ST's around block 2, % of pottery temper.

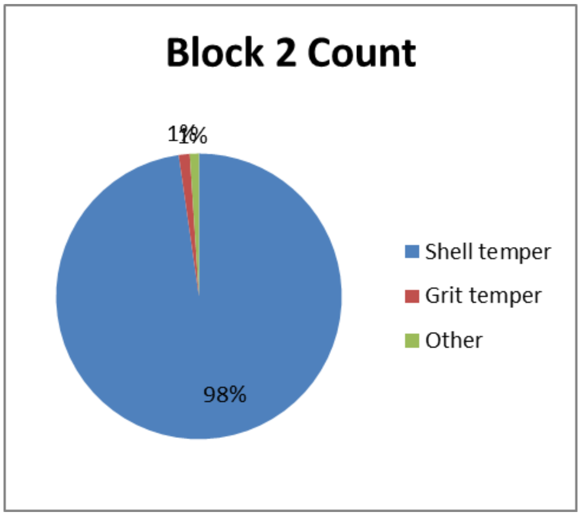


Figure 46 % of pottery tempers in Block 2 temper.

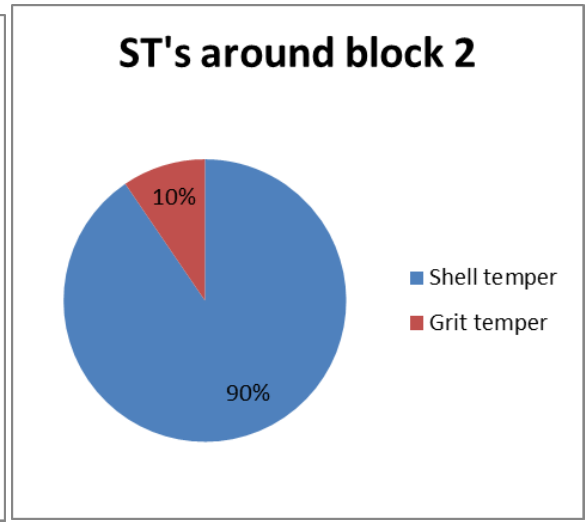


Figure 47 ST's around Block 2, % of pottery

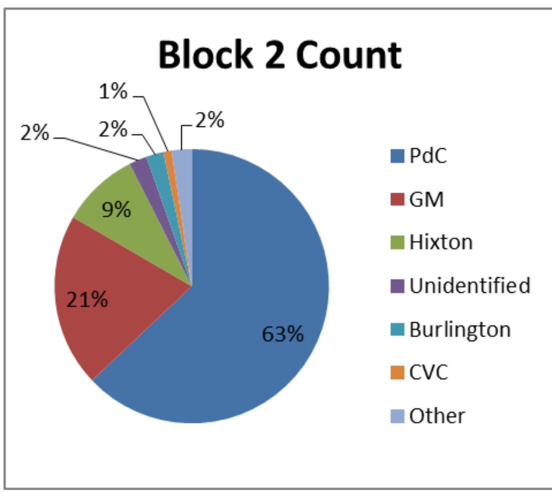


Figure 48 Count by % of Block 2 lithic types

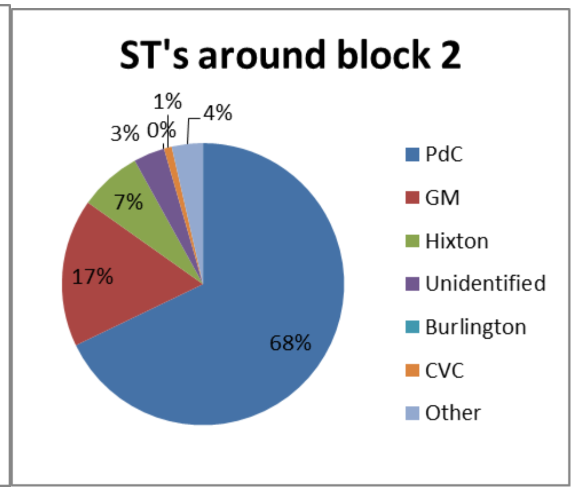


Figure 49 ST's around Block 2, % of lithic types.

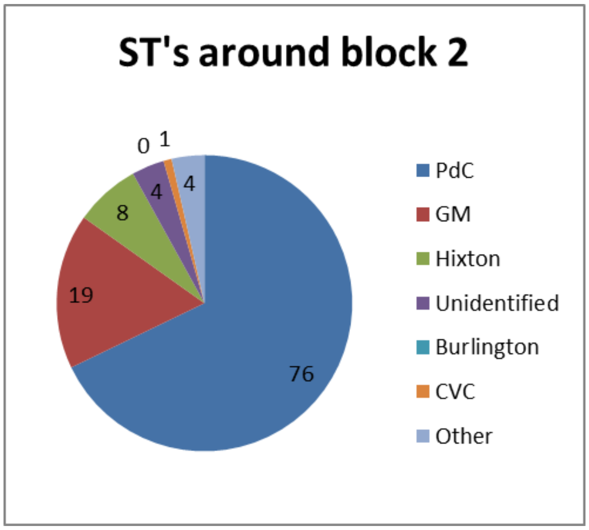


Figure 50 ST's around Block 2, count of lithic types.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

The percentages of major artifact classes in the XU's and ST's are compared in Figures 44 and 45. Despite the small sample size of the ST data, the percentages are fairly close, with the exception of the faunal remains, of which zero were found in the nearby ST's. The percentages of pottery tempers are noted in Figures 46 and 47. There is a larger percentage of grit tempered pottery in the ST's than in Block 2; however the percentage is still much smaller than that of Block 1 on the other side of the field. The percentages of lithic types (Figures 48 and 49) are fairly close. The small count of the nearby ST's (Figure 50) may be the cause of the discrepancies. It is also equally likely, that the percentages of the various artifact classes would be more similar if it were possible to separate the plow-zone from the sub-plow-zone.

Block 3

Block 3 contains 30 excavated units and 4 features, Features 12-15. It was excavated in 2003, 2004, and 2005. It is roughly in the center of the known village. The location was selected based on a geophysical anomaly (Figure 52). It was stopped due to time constraints and may be finished in the future. There were four features discovered in Block 3. Feature 12 was a shallow basin shaped hearth. The excavation and flotation is complete. The bottom of 12 is slightly above Feature 15. Feature 12 is 27 cm deep and .8 by .8 meters across. Feature 13 is a medium basin shaped refuse pit. Excavation and flotation are complete. It is 45 cm deep and .8 by .91 meters across. Feature 14 is a large pit that is not fully revealed or excavated. Feature 15 is a medium basin shaped refuse pit. It is 23 cm deep and .86 by .89 meters across. Excavation is complete by flotation is not.

50	47	44	41	38
49	46	43	40	37
48	45	42	39	36
27	24	21	18	8
26	23	20	17	7
25	22	19	16	6

Figure 51 XU's for Block 3

Figure 53 shows the placement of Block 3 at the site as well as the ST's chosen to compare it to. Block 3 is placed somewhat in the middle of the tested area, though a little more to the south and east of the center. Unlike Blocks 1 and 2, all of the ST's, 36, around Block 3 have been excavated and so are available for comparison.

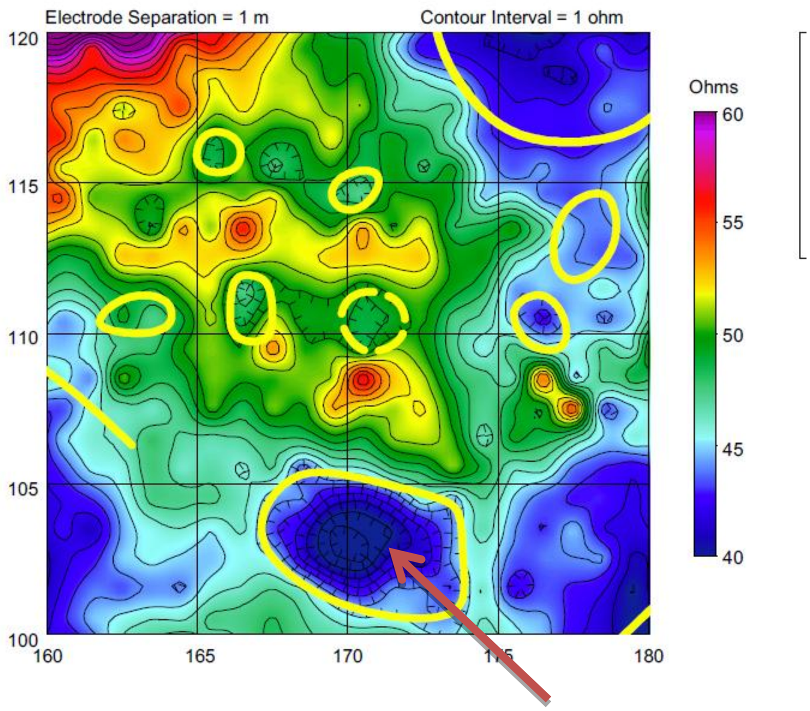


Figure 52 Geophysical interpretation of Grid 12. (after Dobbs et al. 2003:62). Arrow pointing at feature that led to the excavation of Block 3.

There are 8,126 artifacts in Block 3. This is a comparatively small number of artifacts considering that there were 30 XU's in Block 3. As noted above, Block 2 contains over 17,000 artifacts while only 25 of the XU's are catalogued, and even Block 1 with only three XU's has over 5,000 artifacts. The 36 nearby ST's contain only 373 total artifacts for comparison.

Figure 53 GIS map showing the location of Block 3 and surrounding ST's.

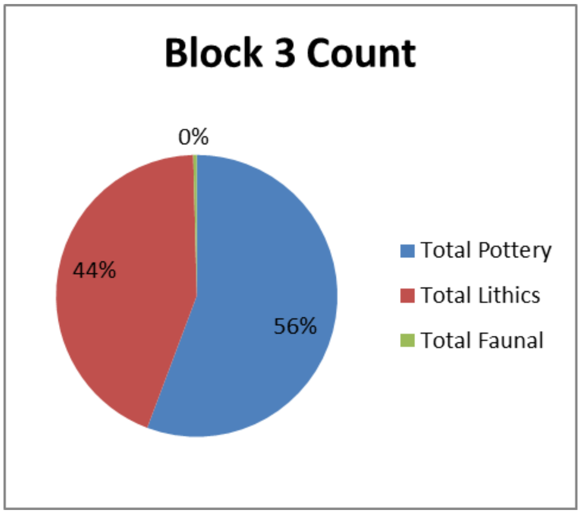


Figure 54 % by Count of Block 3 major artifact classes

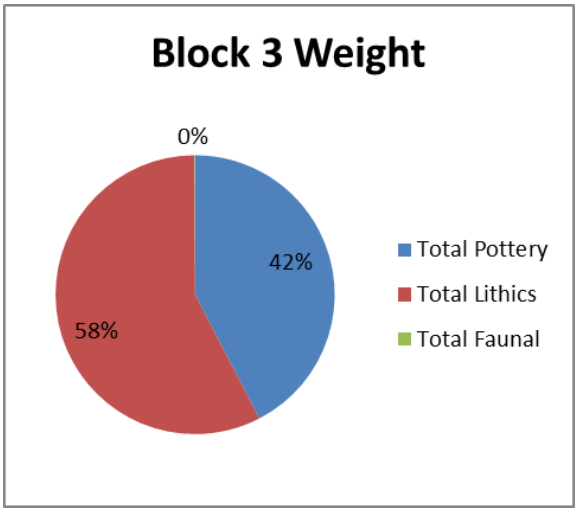
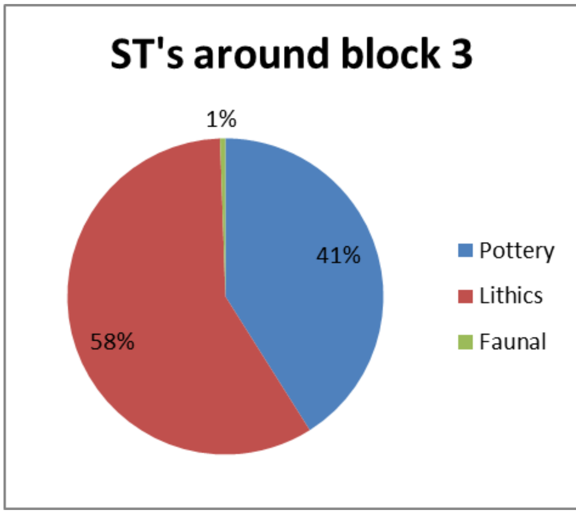


Figure 55 %Weight of Block 3 major artifact classes



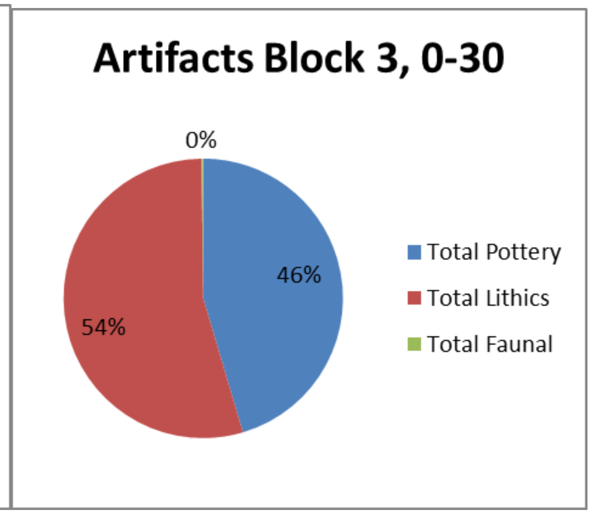


Figure 56 ST's around Block 3, % of Major artifact Classes .Figure 57 % of Block 3 Major artifact classes 0-30.

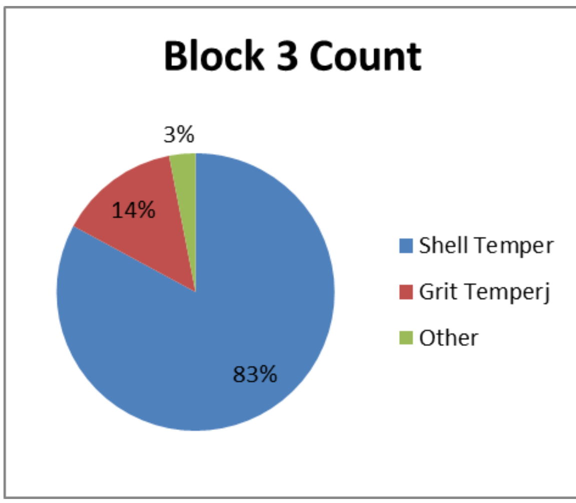


Figure 58 % by Count of Block 3 pottery tempers.

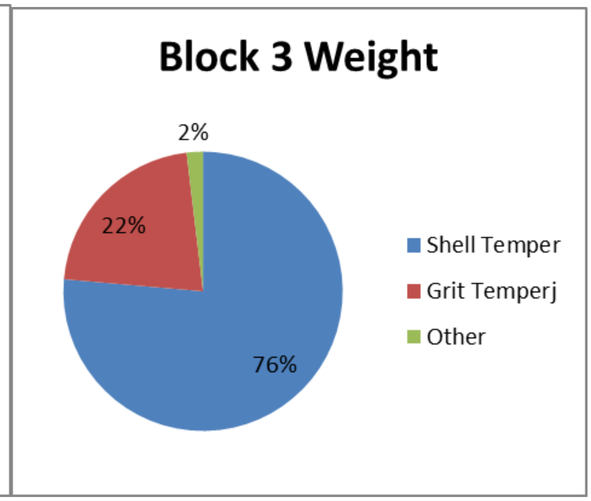


Figure 59 %Weight of Block 3 pottery tempers

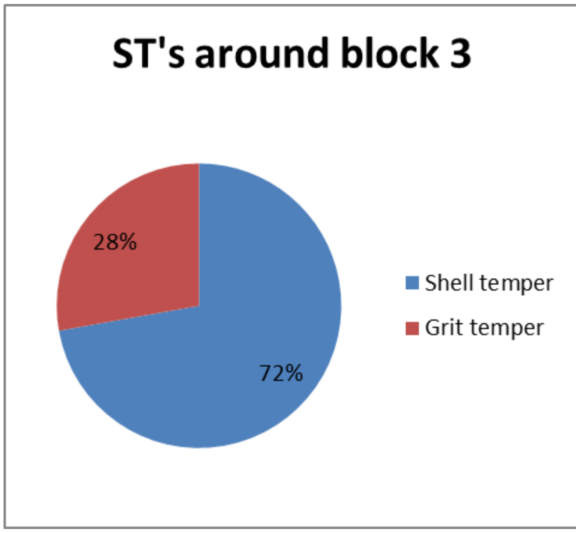


Figure 60 ST’s around Block 3, % of pottery tempers

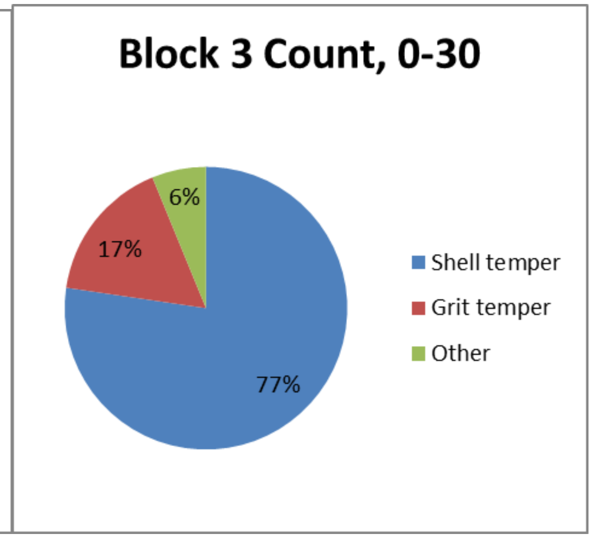


Figure 61 % of Block 3 pottery tempers, 0-30cm.

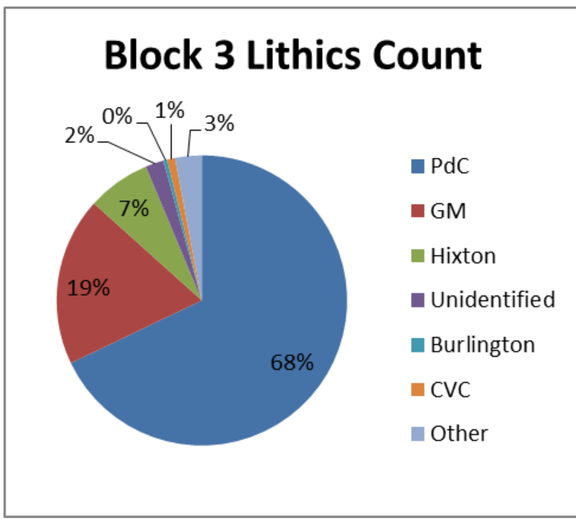


Figure 62 % by Count of Block 3 lithic types

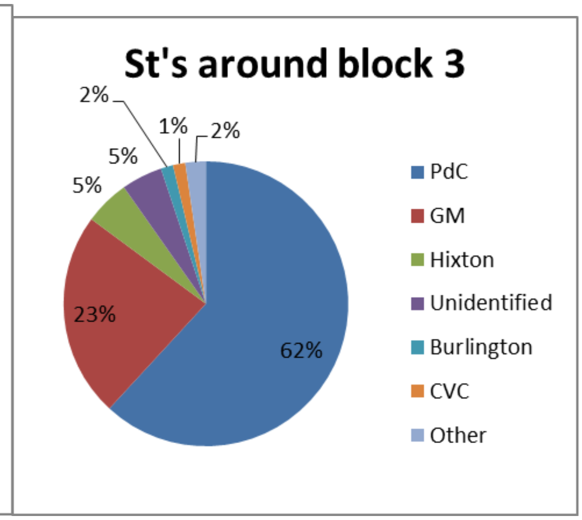


Figure 63 ST’s around Block 3, % of lthic types.

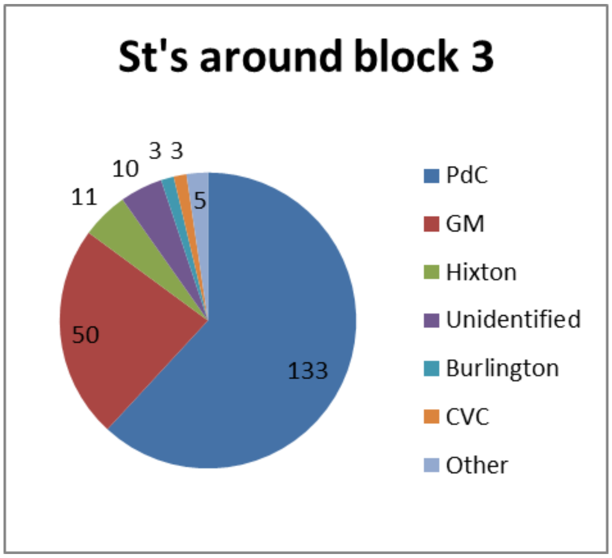


Figure 64 ST's around Block 3, count of lithic types.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

The percentages for major artifact classes in Block 3 and the nearby ST's are displayed in Figures54-57. The percentages of major artifact classes are very different between the total Block 3 count and the ST's, but once the sub-plow-zone materials are removed they become much more similar.

The pottery temper percentages are extremely different between the Block 3 and the nearby ST's. Once the sub-plow-zone materials are removed the totals become closer but are still very different. As discussed earlier a large percentage of the 'Other' category, nearly half, is composed of pottery labeled as 'sand tempered'. This author, who catalogued the ST's was much more likely to catalogue 'sand tempered' materials as 'grit tempered'. If this is the case then the totals become even closer but they are still a good distance away. This is an unusual case, when compared with the other comparative data and it may be a product of either small sample size or quite possibly an artifact of something cultural going on in the area.

The lithic type percentages (Figures 62 and 63) are fairly similar but still a large difference does exist. This may be a product of small sample size (Figure 64) or it could be a product of the same cultural phenomenon that may be affecting the other categories.

Block 4

Block 4 contains 7 excavated units, 9-15, and two features, 2 and 3. It is roughly in the northeast section of the field. It was excavated in 2003. The location was selected based on the results from the geophysical survey. Two features were discovered in Block 4. Feature 2 is an undercut storage/refuse pit. Excavation and flotation is complete. It is 63 cm deep. Feature 3 is a shallow basin shaped hearth. Excavation and flotation is complete. It is 6 cm deep and .71 by >.57 meters across.

Figure 65 shows the placement of Block 4, as well as the ST's chosen to compare it to. Block 4 is in the eastern side of the sampled area. Of the 30 ST's that should be available for comparison, 28 are available. One of them was not dug because of the XU's already there and one in the northeast section is not available due to a road cut that goes through the site.

There are 2,277 artifacts in the excavated part of Block 4 and 481 artifacts in the nearby ST's. There appears to be a fairly low concentration of artifacts per XU in this block while a larger than average number of artifacts per ST. This could be the result of some specific cultural feature, perhaps the feature that led Dr. Schirmer to dig here causes the disparity.

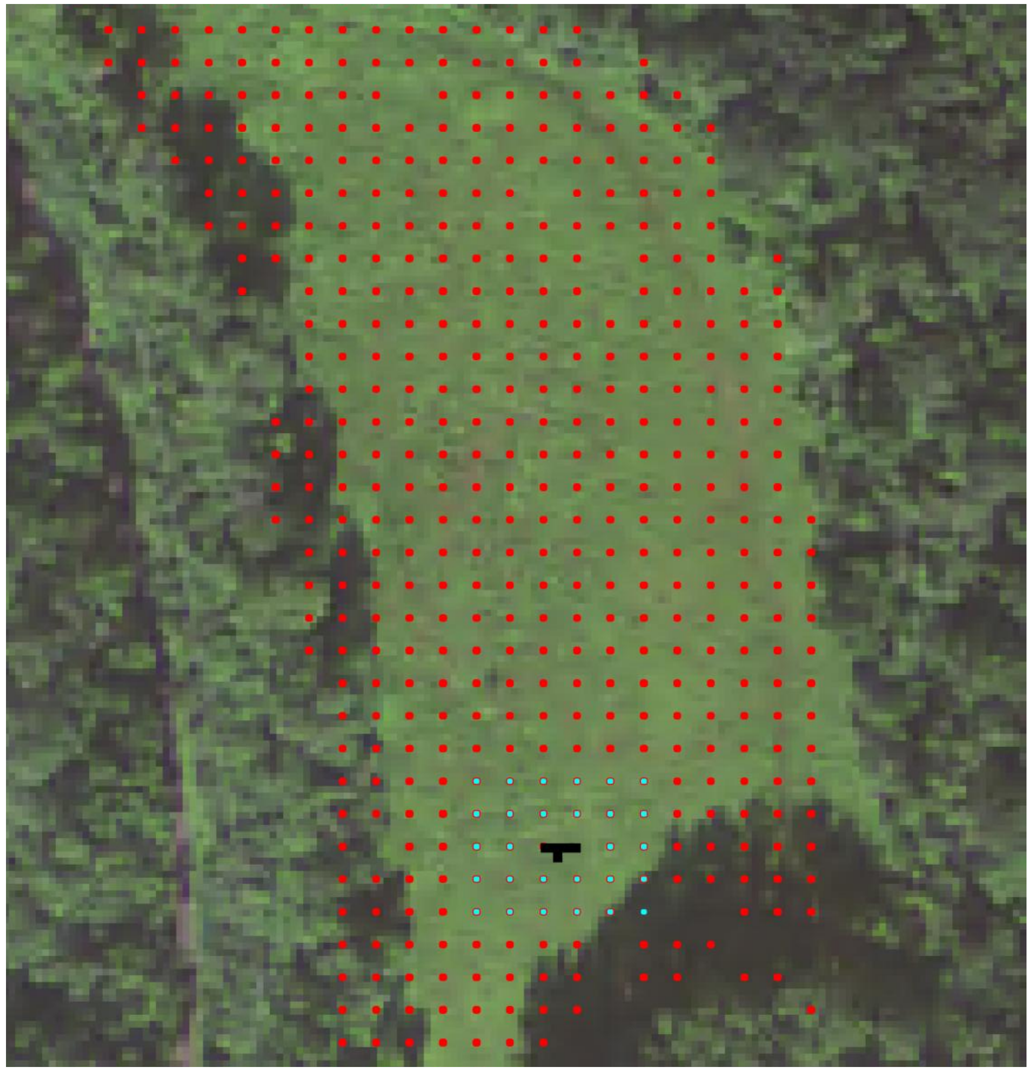


Figure 65 GIS map showing the location of Block 4 and surrounding ST's.

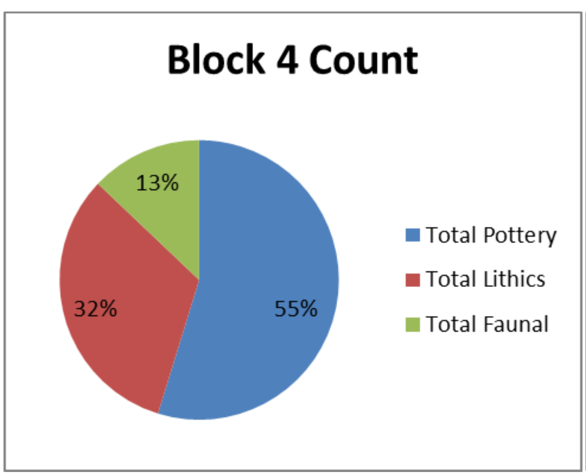


Figure 66 % by Count of Block 4 major artifact classes

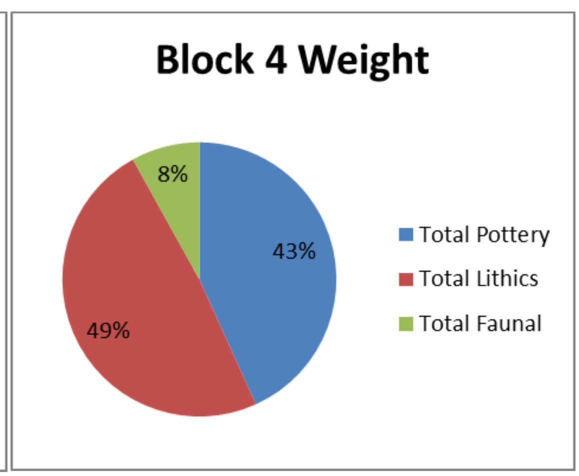
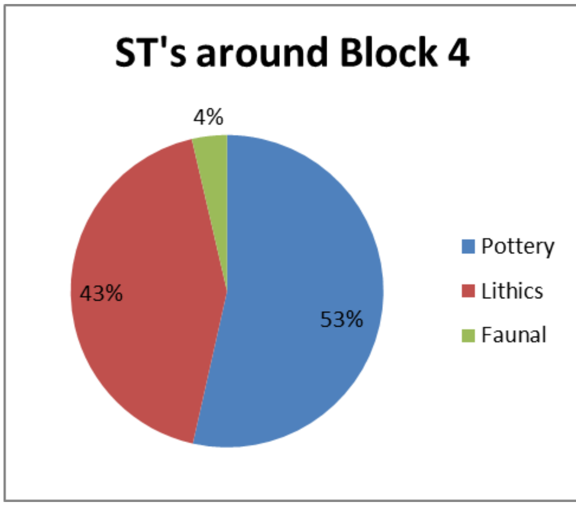


Figure 67 % Weight of Block 4 major artifact classes



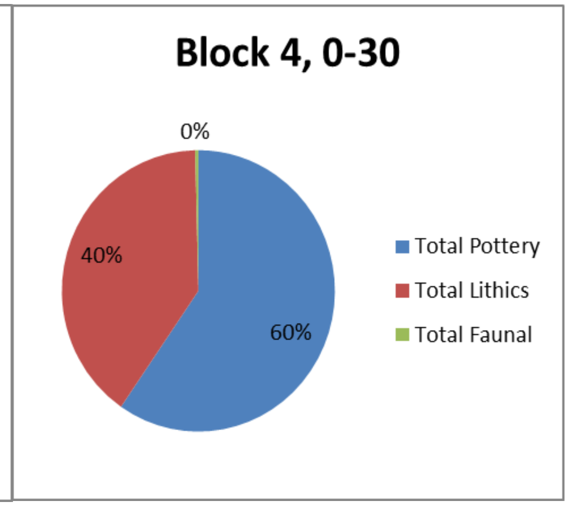
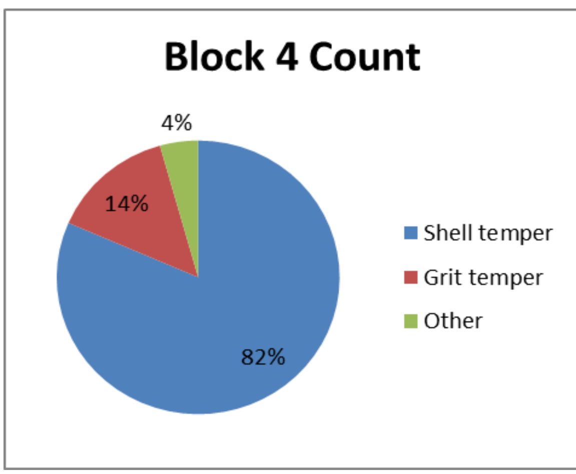


Figure 68 ST's around Block 4, % of Major artifact classes Figure 69 % of Block 4 Major artifact classes, 0-30.

Note: The Major Artifact Classes have a large disparity between the coutn and wieght in this case. The bulk of the difference is due to the presence of one 97 gram Orthoquartzite chopper.



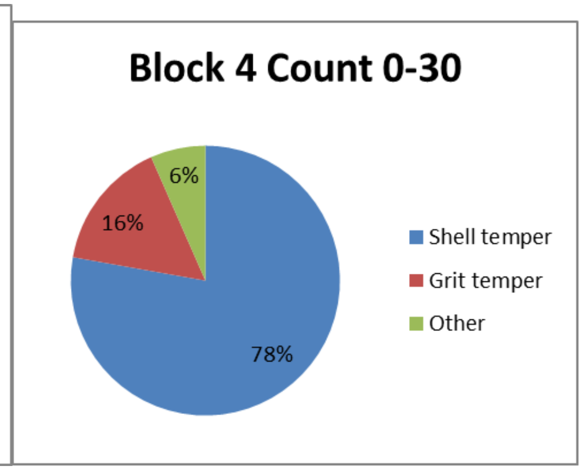


Figure 70 % by Count of Block 4 pottery tempers

Figure 71 % of Block 4 pottery tempers, 0-30cm.

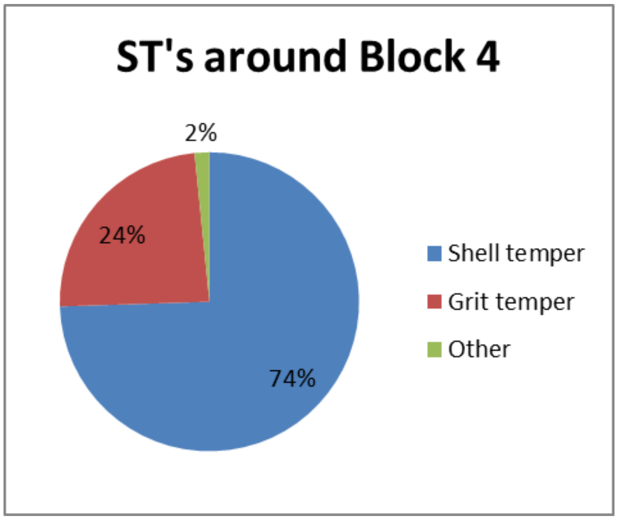
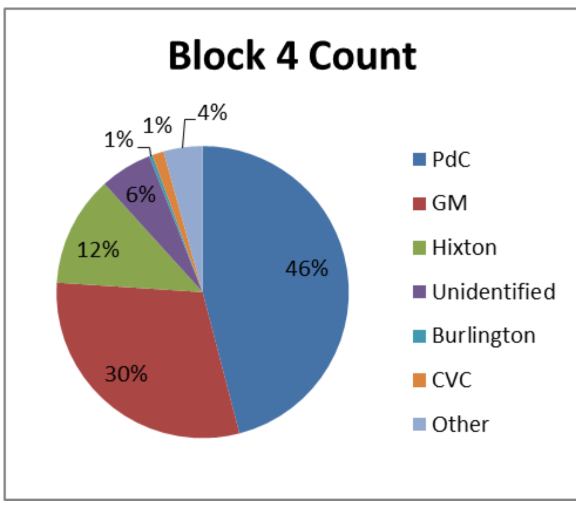


Figure 72 ST’s around Block 4, % of pottery tempers.



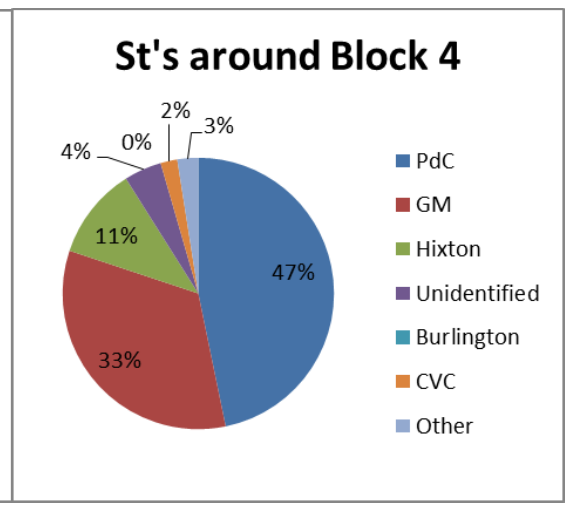


Figure 73 % by Count of Block 4 lithic types

Figure 74 ST’s around Block 4, % of lithic types.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

The percentages for major artifact classes are displayed in Figures 66-68. There appears to be a large difference between the lithic and faunal percentages when comparing the whole block to the local ST’s, however the difference diminishes, while not totally disappearing when looking at Figure 69.

The pottery comparisons in Figures 70-72 show a lot more grit tempered pottery in the ST’s, even when the sub-plow-zone materials are removed. As discussed earlier, if the ‘sand tempered’ pottery were to be counted with the ‘grit’ then the percentages become closer while not exact.

The comparisons of lithic types are very similar between the block and the ST’s (Figures 73 and 74). The plow-zone materials of the block are not shown separately because they do not differ from the total Block 4 count percentages.

Unnamed Block East

This block contains 2, 1 x 1 meter XU’s, 82 and 83, and one 1 x ½ meter XU, 84. Two features were discovered and completely excavated, 22 and 23. It was originally placed, in 2011, because ST 6-23 intruded into what was later discovered to be the northeast quarter of Feature 22. The data from the geophysics helped to determine which way to place the XU’s. ST 6-23 was one of the original ST’s placed at the site, and as such it went below the plow-zone into this feature.

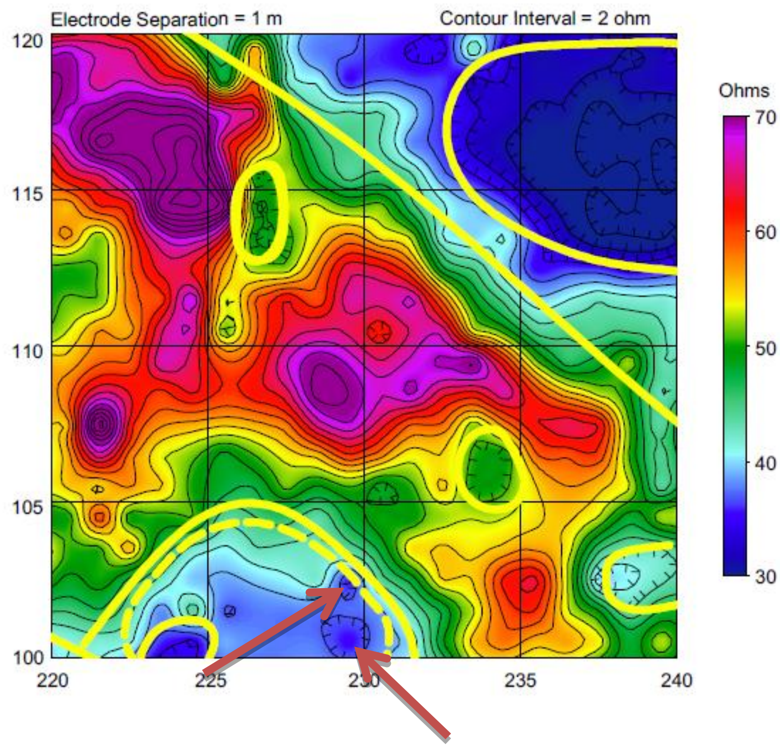


Figure 75 Geophysical interpretation of grid 21. Arrows showing the locations on the geophysics of Feature 22 (southern one) and Feature 23 (northern one). (after Dobbs et al. 2003:71).

XU's 82 and 83 were originally planned and then XU 84 was added to get to the extent of Feature 23. The excavation stopped when the two features were fully excavated and the XU's reached culturally sterile soil. Features 22 and 23 were both large features that were placed a few centimeters apart and they take up nearly all of the space in the XU's (consult Figure 6). Because the features take up so much space in the XU's this may negatively affect the amounts of artifacts reported below. Feature 22, as it was excavated, was 41 cm deep. At its maximum extent it was 105 cm north-south and 100 cm east-west. An old shovel test, ST 6-23, was previously dug in this location and it was relocated inside of the northeast quarter of the feature. Feature 23 was 50 cm deep. At its maximum extent it was 87 cm north-south and 93 cm east-west.

Figure 76 shows the placement of Unnamed Block East as well as the ST's chosen to compare it to. It is in the south eastern section of the sampled area, about 20 meters directly south of Block 4. 24 of the 25 ST's around Unnamed Block East were excavated and are available for comparison. The one ST directly south of the block that is unavailable was not excavated due to the presence of a large brush pile.

Unnamed Block East contains only 779 artifacts, due in part to its small size, only 2.5 XU's and partly to the features that take up so much of its space and the data of which are not available at this time. There are 548 artifacts in the nearby ST's which is the largest amount of artifacts in block neighboring ST's. Since the features make up such a large portion of the XU's in this block it would be useful to redo this analysis when the feature data are available.

Figure 76 GIS map showing the location of Unnamed Block East and surrounding ST's.

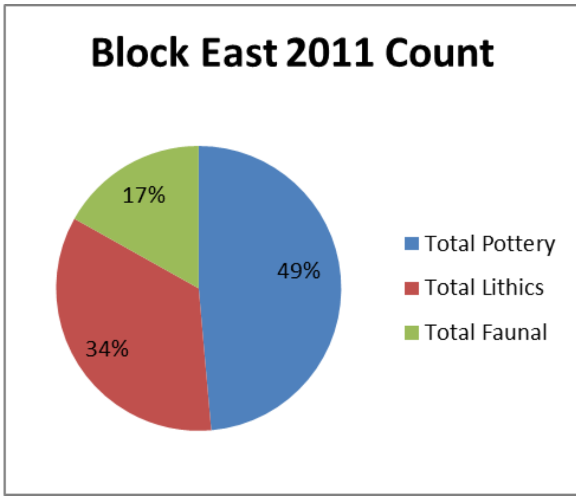


Figure 77 % of Block East major artifact classes

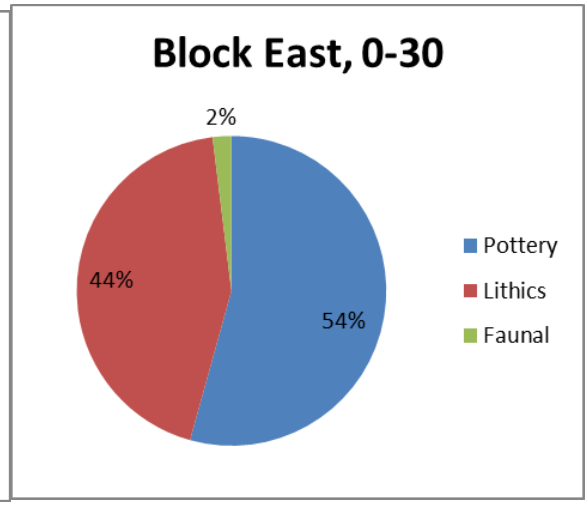


Figure 78 % of Block East major artifact classes, 0-30.

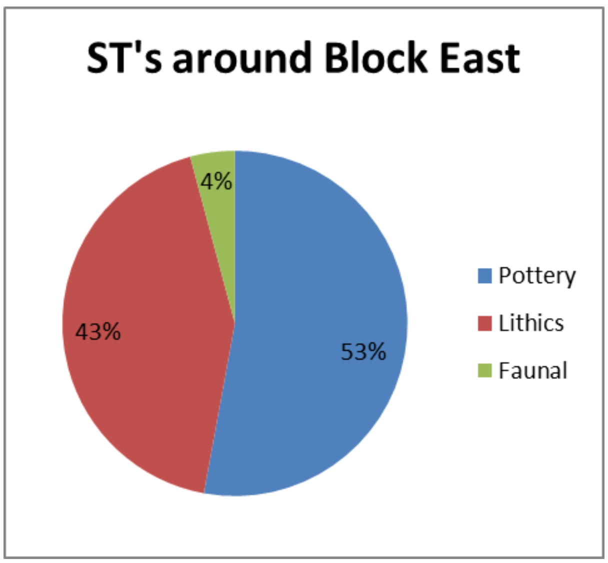


Figure 79 ST's around Block East, % of Major artifact classes.

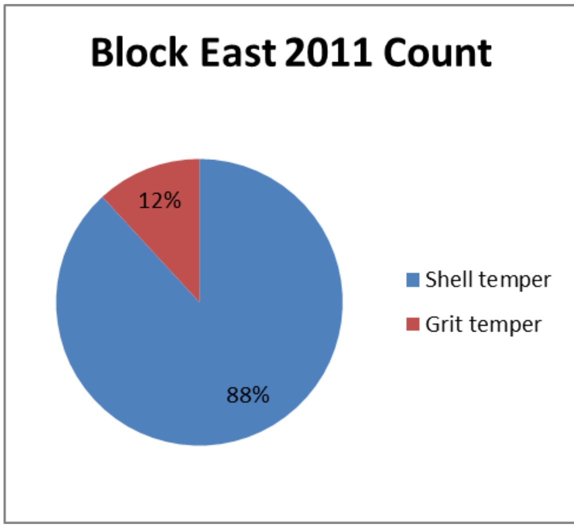


Figure 80 % of Block East pottery tempers tempers

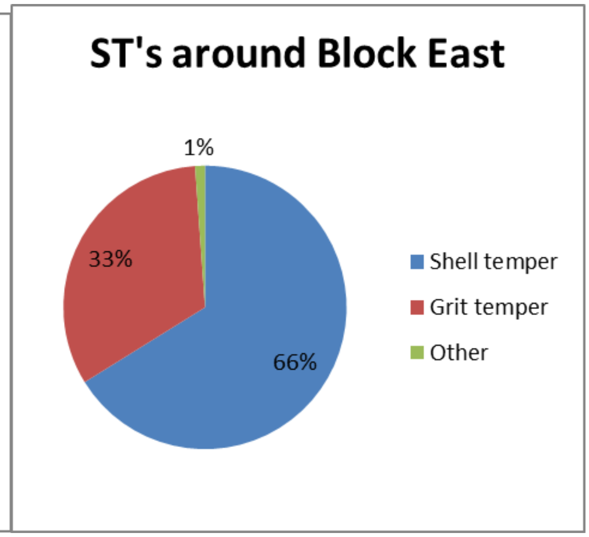


Figure 81 ST's around Block East, % of pottery

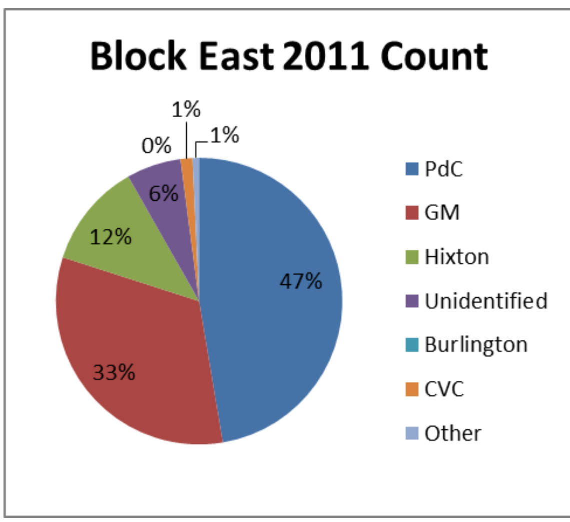


Figure 82 % by Count of Block East lithic types.

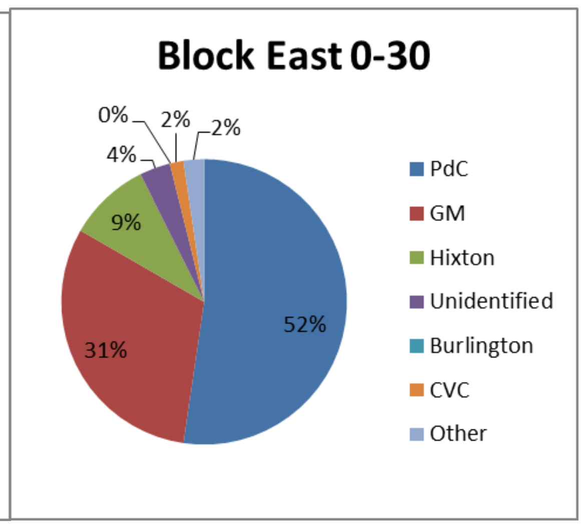


Figure 83 % of Block East lithic types, 0-30cm.

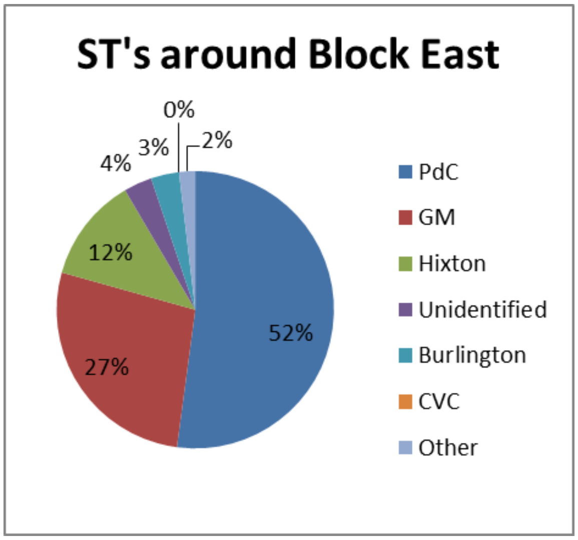


Figure 84 ST's around Block East, % of lithic types.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

The Figures 77-79 show the comparisons of major artifact classes. The difference between the XU's and the ST's is fairly large, however once the sub-plow-zone materials are removed the percentages become nearly identical, with a little more faunal in the ST's.

When comparing the pottery tempers (Figures 80 and 81) the data are very different. There is considerably more, by percent, grit tempered pottery in the nearby ST's than there is in the block. A separated plow-zone section is not shown due to a lack of difference between the entire block percentage and the plow zone materials. This is possibly due to the fact that the XU's do not go very deep before the feature takes over so most of the materials from the XU's are contained in the plow zone. There definitely appear to be some kinds of cultural reasons for the low numbers of grit tempered pottery in these XU's while there are clearly large amounts of grit tempered pottery in the area.

The features contained shell tempered pottery, among other artifacts and they almost entirely take up the XU's so this may be the reason. If the people that used and discarded the grit tempered pottery were contemporaneous with the people that used the shell tempered pottery then this area may have been demarcated for the shell tempered people's use. If the grit tempered wares were deposited earlier than they may have been removed incidentally when the two pits were originally dug. Though plowing should have redistributed the nearby grit tempered pottery. This is an another anomaly that requires further study.

The percentages of lithic types (Figures 82-84) show that the ST's contain somewhat similar numbers when the whole block is counted but they become even more similar when the sub-plow-zone is removed. Why the lithic percentages change with depth in this area and the major artifact classes and pottery tempers do not is a phenomenon that should be investigated more thoroughly. It may be an artifact of the low artifact numbers for both the XU's and ST's in the area.

Unnamed Block Central

This block contains a single 1x 1 meter XU, 78. Originally XU 79 was also laid out but it was abandoned later due to time constraints. It was selected because the bottom of ST ?? came upon the top of Feature 26. This was compared with the geophysics and showed an interesting looking possible feature. XU 78 was also left unfinished because of time constraints. It was brought down to the level of the feature, 35 cm, which extended to the north and east of the XU. The top of the feature, which was unexcavated, contained a large amount of shells and of burnt shell tempered pottery. The other blocks took so much time, because of their large features that we were unable to do much with this block and it was tarped and left for the future. The feature size cannot be ascertained since it extends into the walls.

Figure 85 shows the location of the Unnamed Central Block as well as the nearby ST's chosen for comparison. This block is in the south western area of the site, northeast of Block 2. Since it is on the southern edge, 7 of the 25 potential comparative ST's are unavailable.

Unnamed Block Central contains only 255 total artifacts, however since it is only one XU and it is unfinished this is expected. The nearby ST's actually contains 398 total artifacts which is a fairly large number for the amount of ST's available.

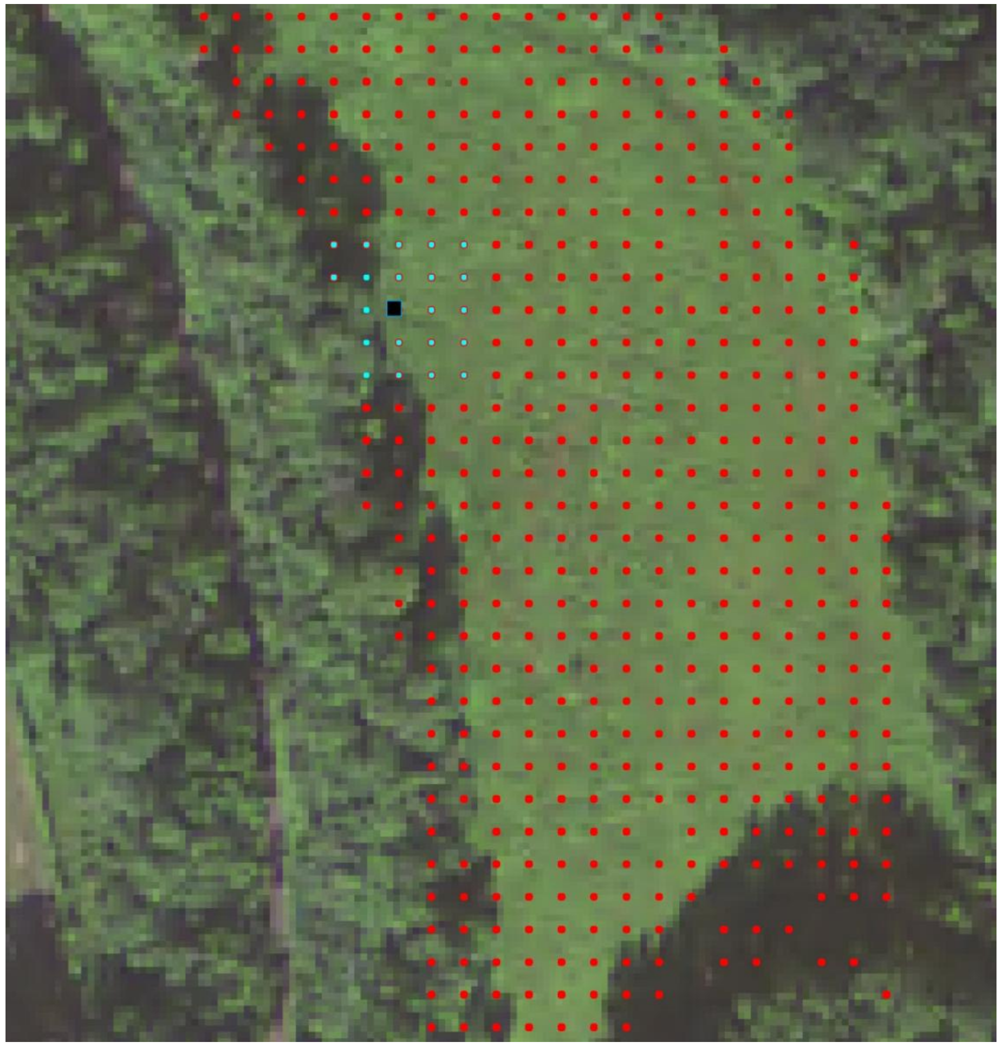
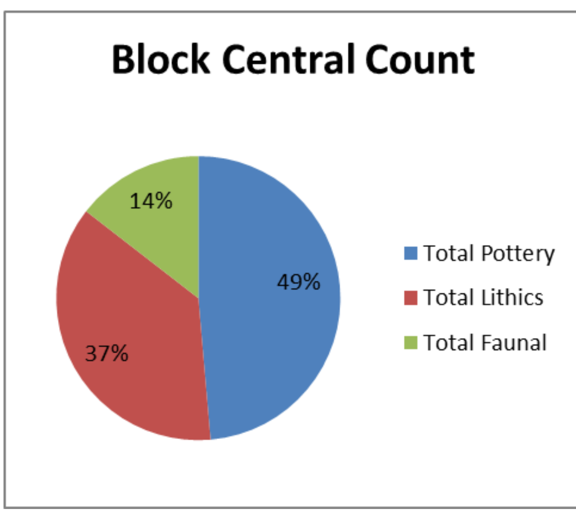


Figure 85 GIS map showing the location of Unnamed Block Central and surrounding ST's.



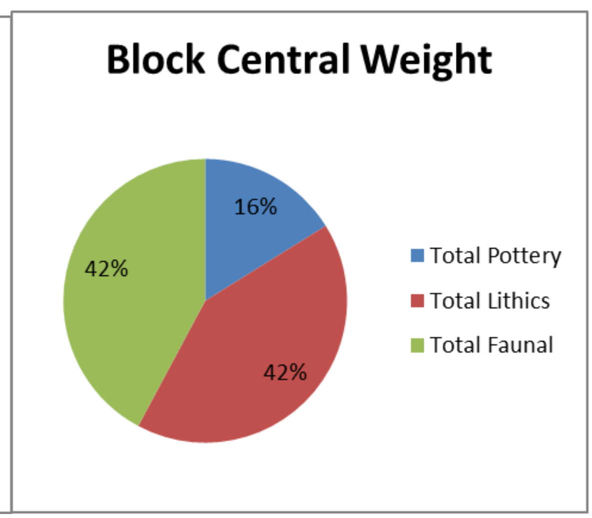


Figure 86 % by Count of Block Central, Major artifact classes Figure 87 % of Block Central, Major artifact classes.

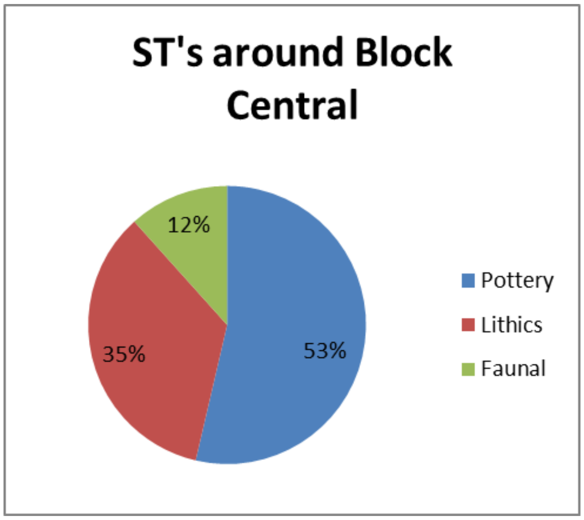
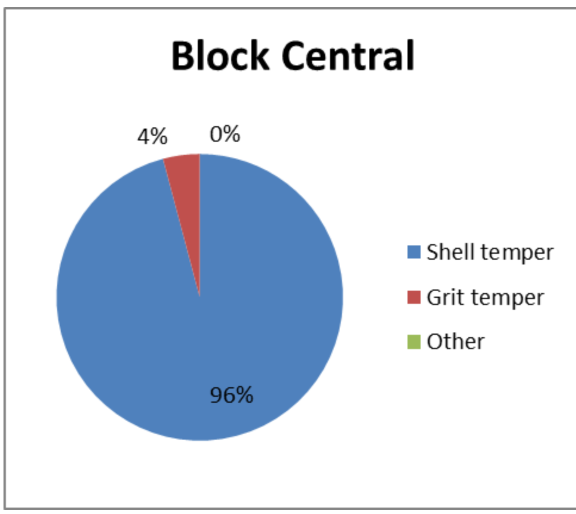


Figure 88 ST's around Block Central, % Major artifact classes.



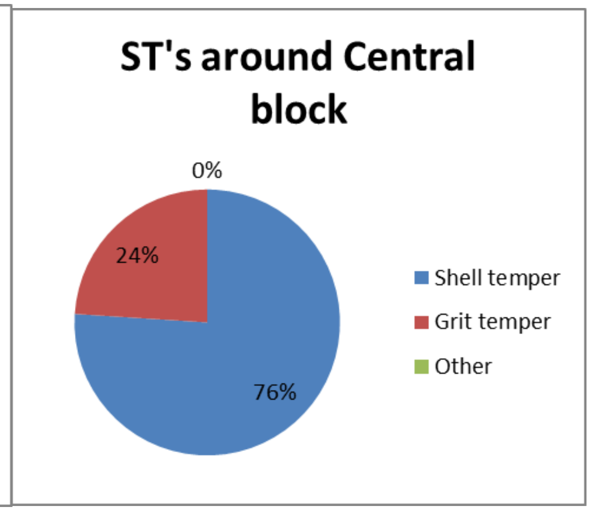
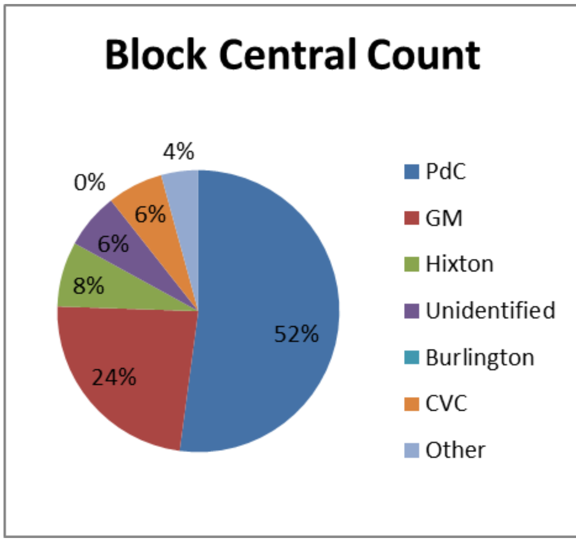


Figure 89 % of Block Central Pottery types tempers.

Figure 90 ST's around Block Central, % pottery



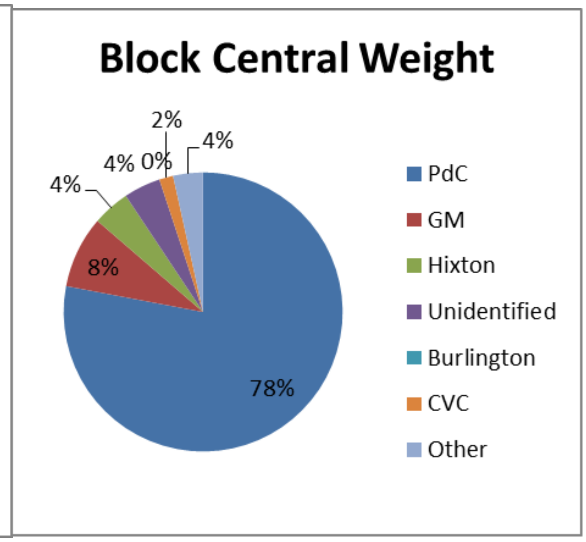
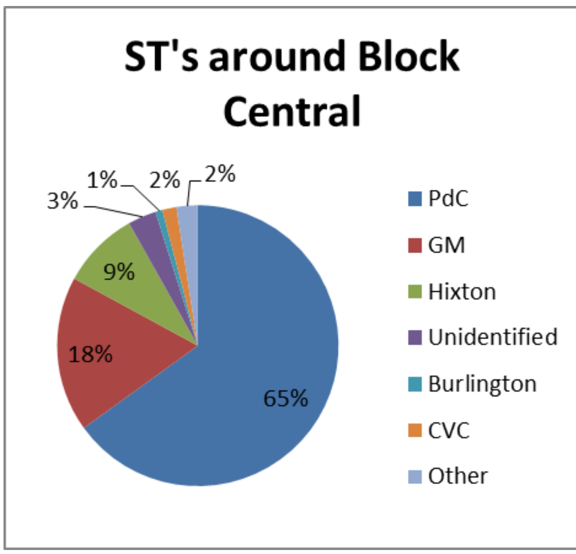


Figure 91 % by Count of Block Central lithic types

Figure 92 % by weight of Block Central lithic types



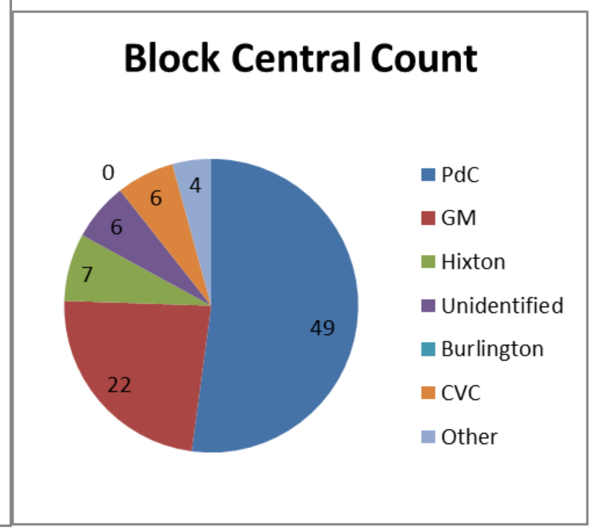


Figure 93 ST's around Block Central, % of lithic types

Figure 94 Count of lithic artifacts in Block Central.

Note: No fcr, ground stone tools, or sandstone abraders included in other totals.

Despite the small sample sizes the percentages for major artifact types are very similar (Figures 86-88). Since the XU was not excavated very deep splitting off the plow zone makes little difference so it is not shown here. The percentages for pottery tempers (Figures 89 and 90) are very different and this may be an effect of small sample size or of something cultural going on in this area. Likewise the lithic counts are different but the sample for the XU is very small (Figure 94) with less than 100 total artifacts.

Unnamed Block West

This block contains 2 excavated, 1 x 1 meter units, 80 and 81. It also contains a 1 x ½ meter unit, XU 85, and a ½ x ¼ meter unit, XU 86. It contains 3 features, 21, 24, and 25. . It was selected because the geophysics indicated that there was a possible house structure to the east of this proposed block. There was also a feature that appeared to be associated with the house, and it was this feature that we tried to focus on Figure 95.

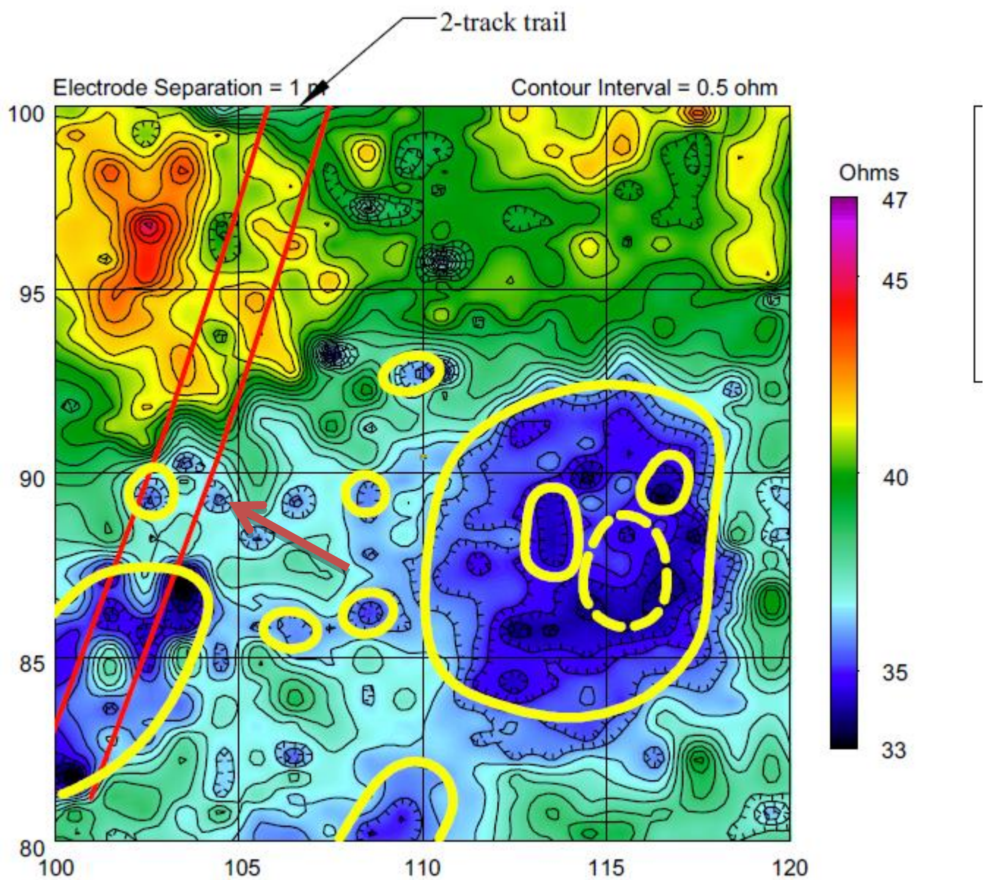


Figure 95 Geophysical interpretation of Grid 1. Arrow showing the locations on the geophysics of Feature 21. (after Dobbs et al. 2003).

Originally two 1 x 1 meter XU's were laid out, 80 and 81. The later XU's were added in order to try and find the extent of Feature 21 that extended outside of our original XU's. When we began to expand the southern portion of the feature made it appear as if it were a large circular feature that could be removed in our time budget. Later we discovered that it is a much larger amorphously shaped feature that still extended north and east of our expanded XU's. We removed what we could of Feature 21 bringing it down to culturally sterile soil. The rest of Feature 21 is marked for future excavation. The excavated portion of Feature 21 at its maximum extent is 35 cm deep, 81 cm across north-south and 150 cm east-west (though it does continue north and east out of the excavated area).Inside of Feature 21 there was a bison scapula hoe and very little other large artifacts. The rest of the materials were consistent with the cleaning out of a house and fire pits etc. There was lots of ash, charcoal, maize, burned pottery, and some manos. The northeastern section of Feature 21 was intruded upon by Feature 25, an even ashier feature that extended into the northeastern walls. The section we had of Feature 25 was removed and the rest marked for future recovery. Another feature, 24, was found in the block but left undisturbed for future excavation.

Unnamed Block West was placed near the far southwestern area of the sampled area of the site (Figure 96). 24 of the 25 nearby ST's were excavated and are available for comparison with the block. The one that is not excavated was left undug because there was standing water in a rut in this area, caused by the two-track trail through the site. There are 1,740 artifacts in this block, though much of the data from the lower levels is not included because they are in feature. The nearby ST's contain 418 total artifacts.

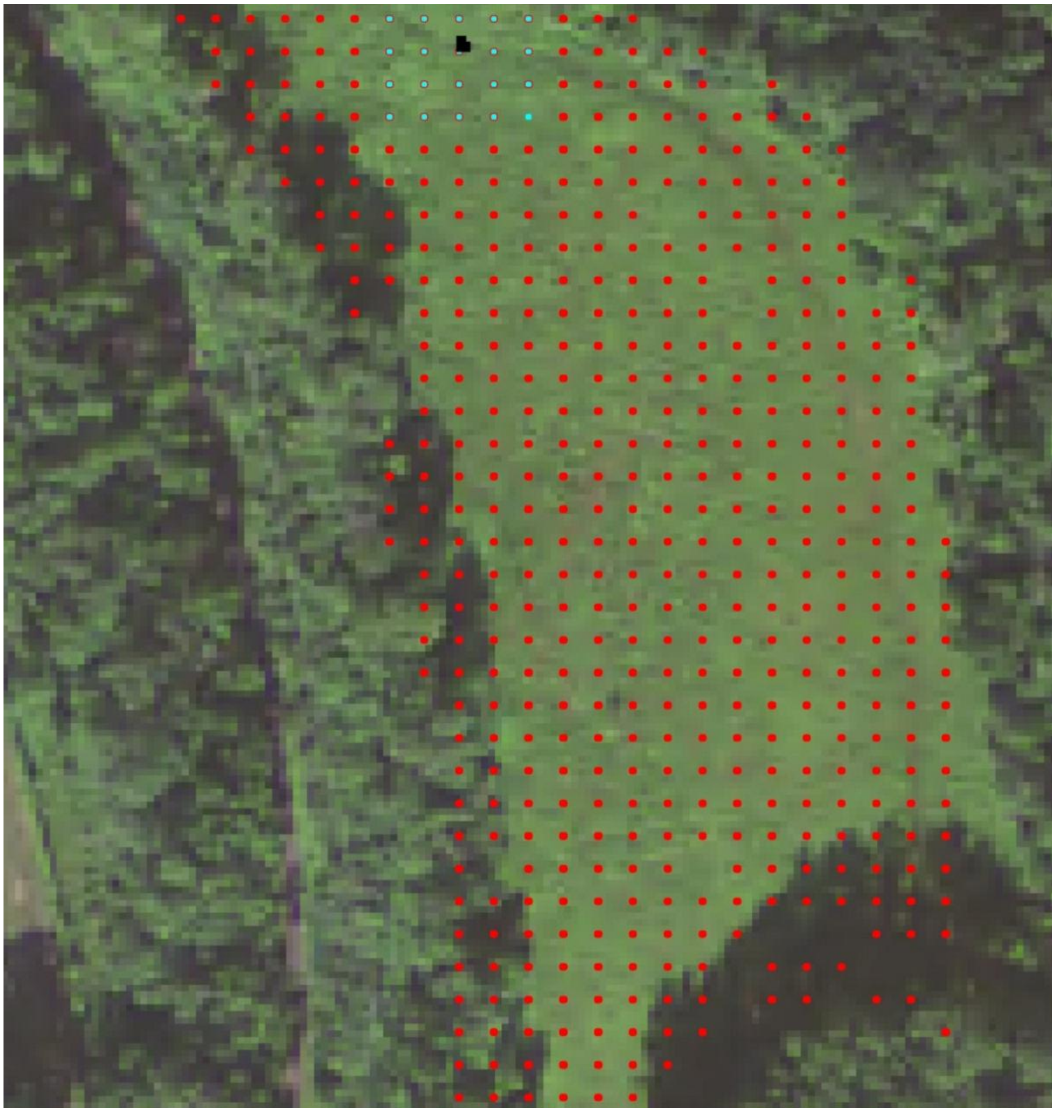
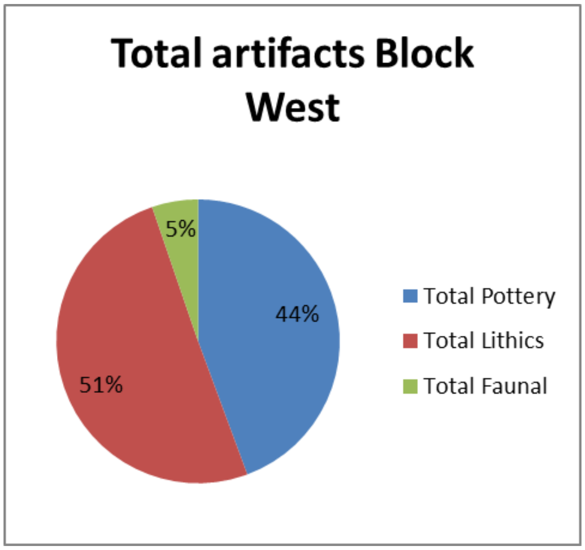


Figure 96 GIS map showing the location of Unnamed Block West and surrounding ST's.



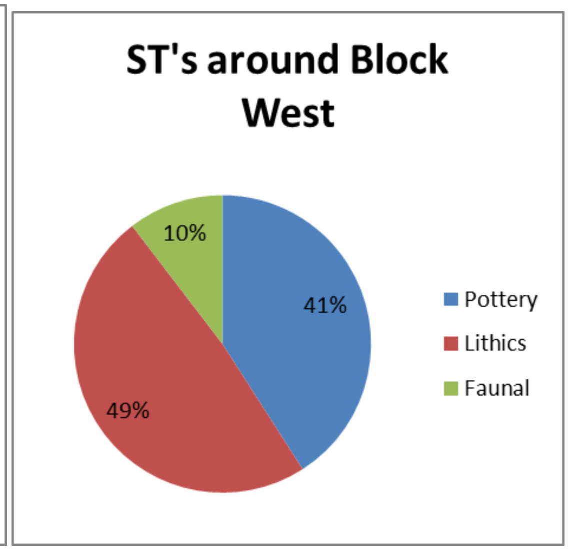
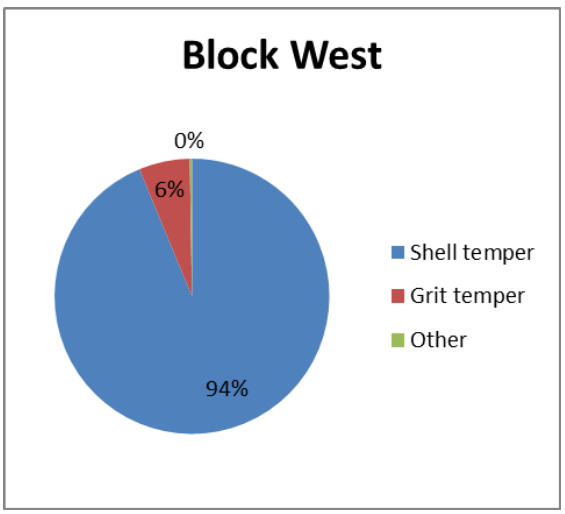


Figure 97 % by Count of Block West, Major artifact classes. Figure 98 ST's around Block West, % of major artifact classes



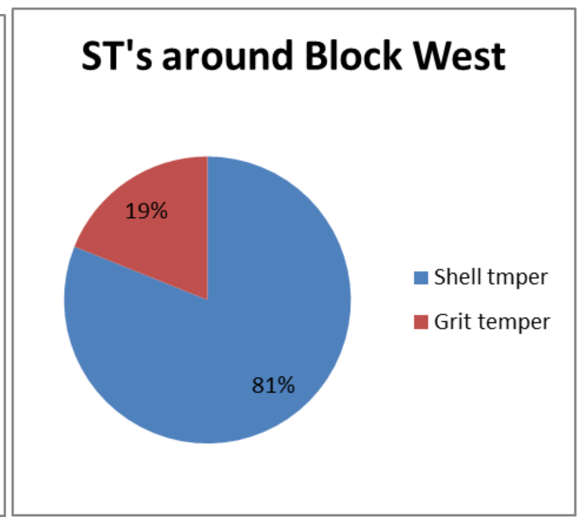
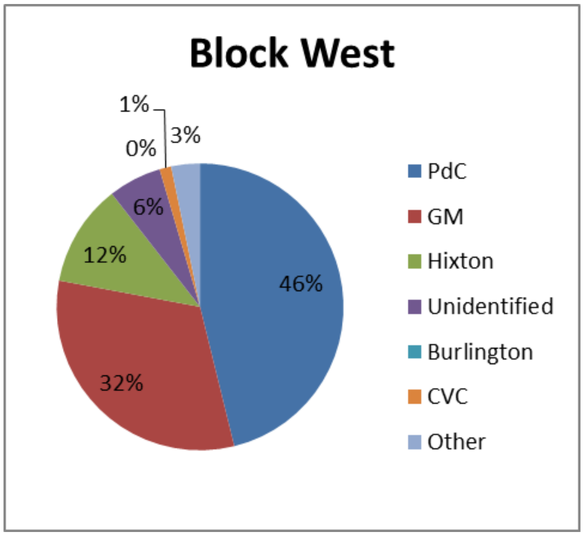


Figure 99 % by Count of Block West pottery tempers Figure 100 ST's around Block West, % of pottery tempers.



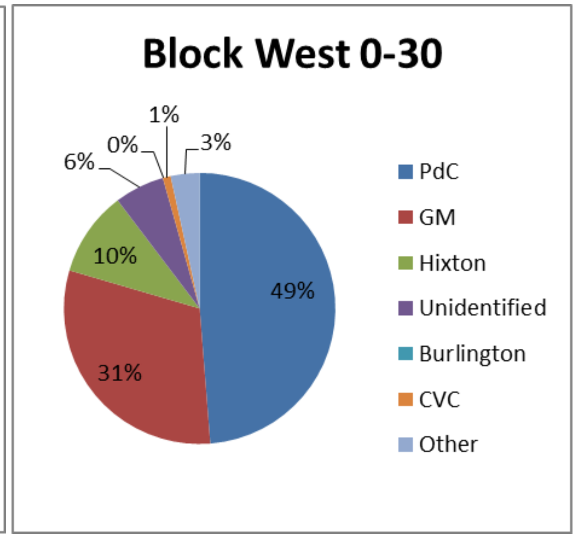


Figure 101 % by Count of Block West lithic types.

Figure 102 %Weight of Block West lithic types, 0-30

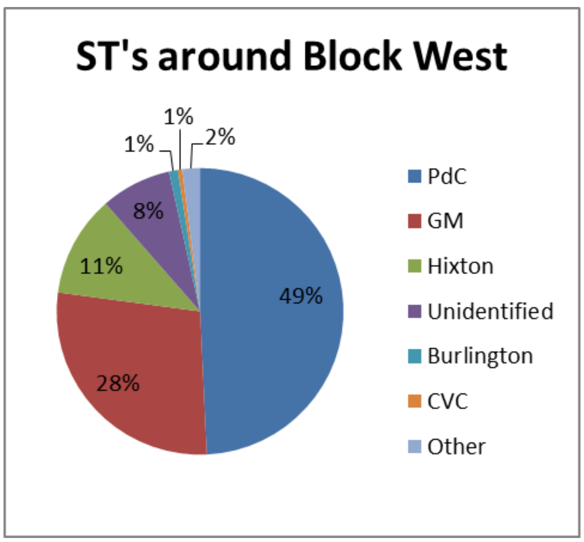


Figure 103 ST's around Block West, % of lithic types.

The major artifact percentages are displayed in Figures 97 and 98. The percentages are fairly similar between the block and the nearby ST's with the exception of a larger amount of faunal in the ST's. The plow zone section shows little difference so it is not included. Figures 99 and 100 show the pottery tempers and there is a much larger amount of grit tempered pottery in the nearby ST's than in the block. The percentages of lithic types (Figures 101-103) are very similar between the XU's and the nearby ST's and they are made more similar by removing the sub-plow-zone materials. The results are not perfect but are very close when the small sample sizes are considered.

Discussion of Blocks and ST's

Figure 104 shows the counts of artifacts per shovel test for the areas around the blocks and Figure 105 shows the counts of artifacts per XU in the different blocks. They are organized west-east. The ST's are comparable to one another because they are all sampled the same way, 30 centimeter cubes. The blocks are not as easily compared since they each have their own unique differences. Some, like the Central Block are not fully excavated or others like the Eastern Block have more features intruding upon them than other blocks. However, there is still useful information.

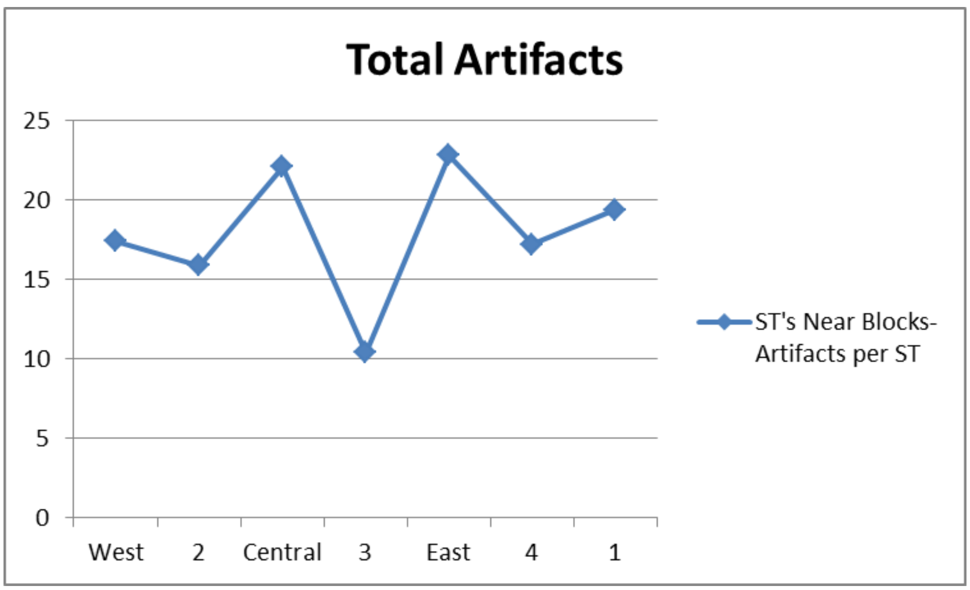


Figure 104 Artifacts per ST in the ST's near the blocks, lined up west to east.

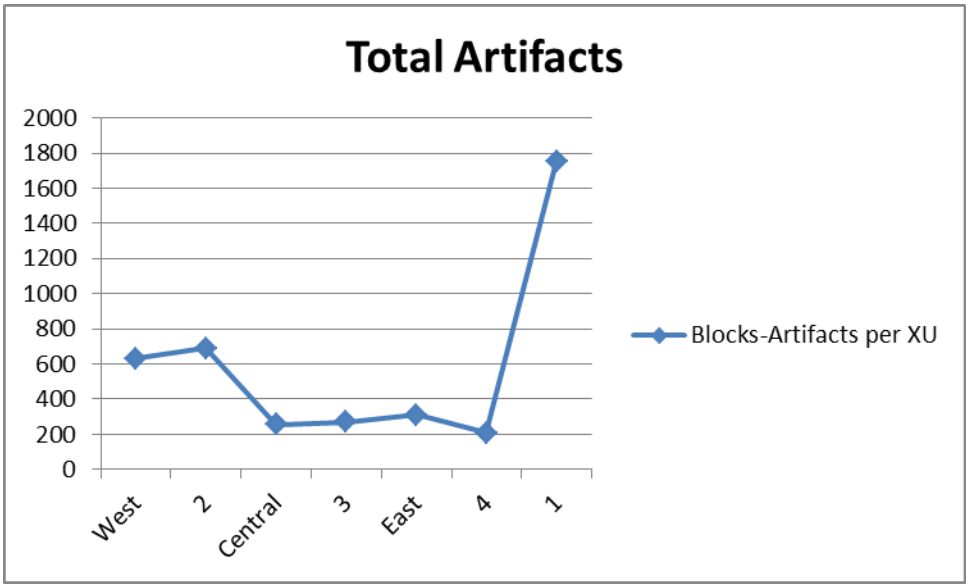


Figure 105 Artifacts per block, lined up west to east.

Looking at the ST's they are all fairly similar, if slightly higher in the eastern areas, with the exception of the ST's around Block 3. These ST's have a dramatic drop in artifact content per ST. This can likely be explained by the placement of Block 3. In the following section it will be proposed, after comparing GIS distributions of different artifacts, that there is likely a communal area in the center of the sampled site. This area is not devoid of artifacts but the amounts of artifacts in this region are markedly lower. Block 3 is placed near the edge of this proposed communal area.

The blocks shown in Figure 105 are less straight forward. Block 1 has more than twice as many artifacts per XU as any other block; indeed it is so large that it makes the differences between the other blocks seem miniscule though they are significant. This could in part be due to its small size, only 3 XU's; it also could be an product of the relative abundance of artifacts in this area. The Central Block is the lowest but it is only one XU and it is not completed, dug to a depth of 35cm. The low count in Block 4 needs to be looked at further, and Block 3, if it is indeed partially in a communal area would make sense as far as the lack of artifact density is concerned.

In the preceding section the percentages of different artifact classes have been compared between the XU's and the ST's and there are several conclusions that can be drawn from this analysis. First, at the Silvernale site there appears to be more grit tempered pottery in the upper levels than in the lower levels. This runs counter to expectations in light of chronology since grit tempered pottery is generally thought of as being earlier in time than shell tempered pottery, and so we would expect the grit tempered pottery to be below the shell tempered pottery. However, if there is not a large time gap or none at all, between the groups of people utilizing different pottery tempers, then it would make some sense. Peoples utilizing grit tempered pottery are known to dig shallow trash pits and other features. If most of the features were less than 30 centimeters deep than many of them would have been disturbed or wholly destroyed by plowing.

Another interesting phenomenon is that there appears to be more grit tempered pottery, by percent, in the ST's surrounding the blocks than in the plow zone materials of the blocks themselves. The possible reason for this is the selection process for our blocks; we have chosen them based upon either the discovery of features from the ST's or by looking for an expected feature based on the geophysics. These, at least so far, have been biased in favor of blocks containing features filled with mostly shell tempered pottery. The features filled with shell tempered pottery may be more visible with these methods or its possible if we follow the premise that grit tempered features would likely have been shallow then it is possible that most of these features filled with grit tempered pottery were largely disturbed or destroyed entirely by the plowing of the soil or other cultural processes. Since we end up focusing on features filled with shell tempered pottery it seems likely that the people who originally used the pit features would have also discarded higher numbers of shell tempered pottery in the immediate area; thus biasing the percentages of Shell-Grit.

In some areas it appears that the lithic type and faunal percentages differ between the XU's and the ST's this may be an artifact of small sample size in the surrounding ST's since the total lithic percentages at the site compare favorably between the ST's and the plow zone materials of the XU's. It may also be a result related to the grit tempered pottery. Regrettably, in this area little work has been done on the lithic preferences of the Woodland peoples. So at this time it is not possible to definitely differentiate the lithics that may have been discarded by different groups of people at the site.

For the site as a whole there is considerably more shell tempered pottery than grit tempered pottery and PdC dominates the lithic assemblage, with Grand Meadow and Hixton also making significant contributions. The data show that this method of systematically shovel testing the plow zone can give accurate information on the materials that were discarded in the plow zone (the ST's and the plow zones of the XU's give nearly identical percentages of artifacts both for the site as a whole and for individual areas of the site. This precludes the possible assumption that the aggregations of artifacts shown in the ST's are a result of random chance).

The shovel test data also compare favorably with the sub-plow zone materials; while not as exact as the plow zone comparisons the comparisons between the ST's and the sub-plow-zone are very similar. However, the predictive power of this method on sub-plow-zone materials should be tested further with excavations.

Artifacts over Features

There are two different ways of comparing the ST's and the XU's. On the one hand we can study the overall composition of the artifact assemblage. This is done above and the assemblages compare well. Another way of looking at it is to compare the shovel test data with the distribution of features. This will attempt to determine if the ST's can not only give a general profile of areas of the site but tell us what was in specific features.

Figure 106 ST's where features were indicated.

While putting in the shovel tests the students sometimes noticed at the bottom of the plow zone what may be 'features'. It is difficult to tell, especially because we do not want to risk digging into the features, since that may disturb them further. These 'features' may be refuse pits, fire pits, or something else cultural. Conversely they may simply be large rodent disturbances, geologic anomalies, or even the remnants of old excavation units etc. The students noted on the forms when they thought that they may have encountered features and Figure 106 shows the distribution of those 'features'.

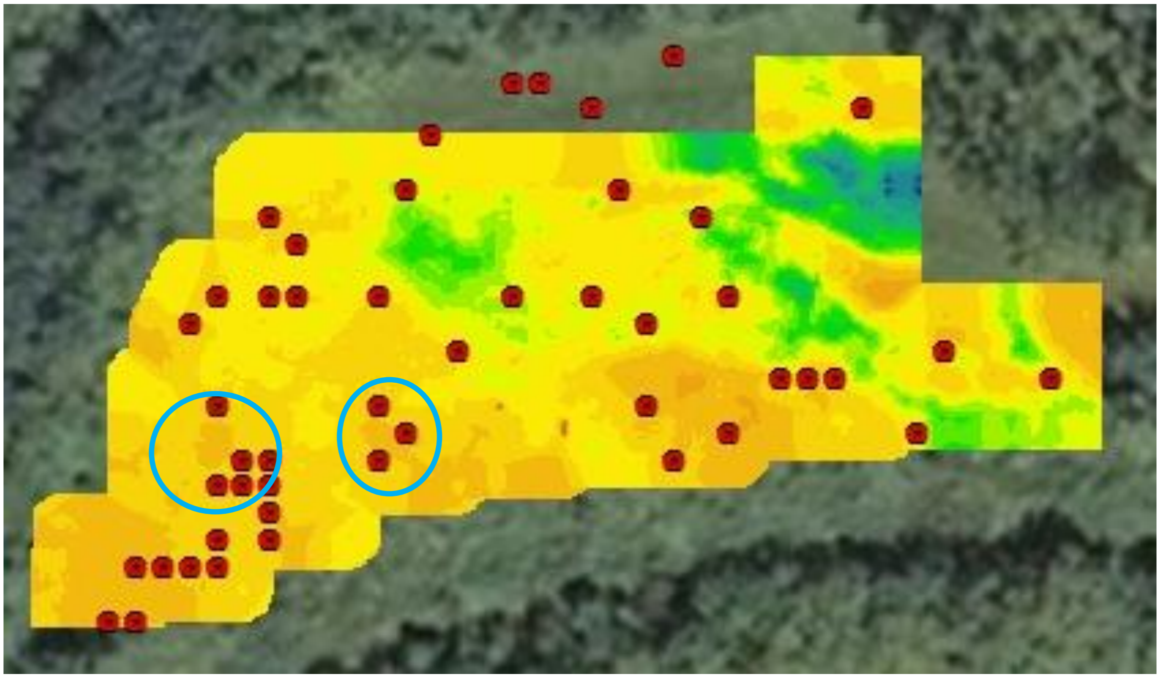


Figure 107 Geophysics map with the ST's where features were indicated map overly. House features circled.

Undoubtedly some of these identified 'features' are cultural and some are not. Knowing this, this data set can still be useful. Figure 107 above shows the 'feature' map overlain upon the results of the geophysics. In the two circled areas it shows 'features' directly around two geophysically interpreted house features. If these features are real they may be showing features that are directly related to the house features they encircle. This data set should not be taken by itself but it can be used in concert with other methods to give more evidence. In the case above, along with the many other methods this can help to give strength to the interpretation of these features as houses. Also the lack of data around other purported house features could serve to weaken the assertions that those features are houses in the same sense as the 'house features' that do contain nearby 'features'.

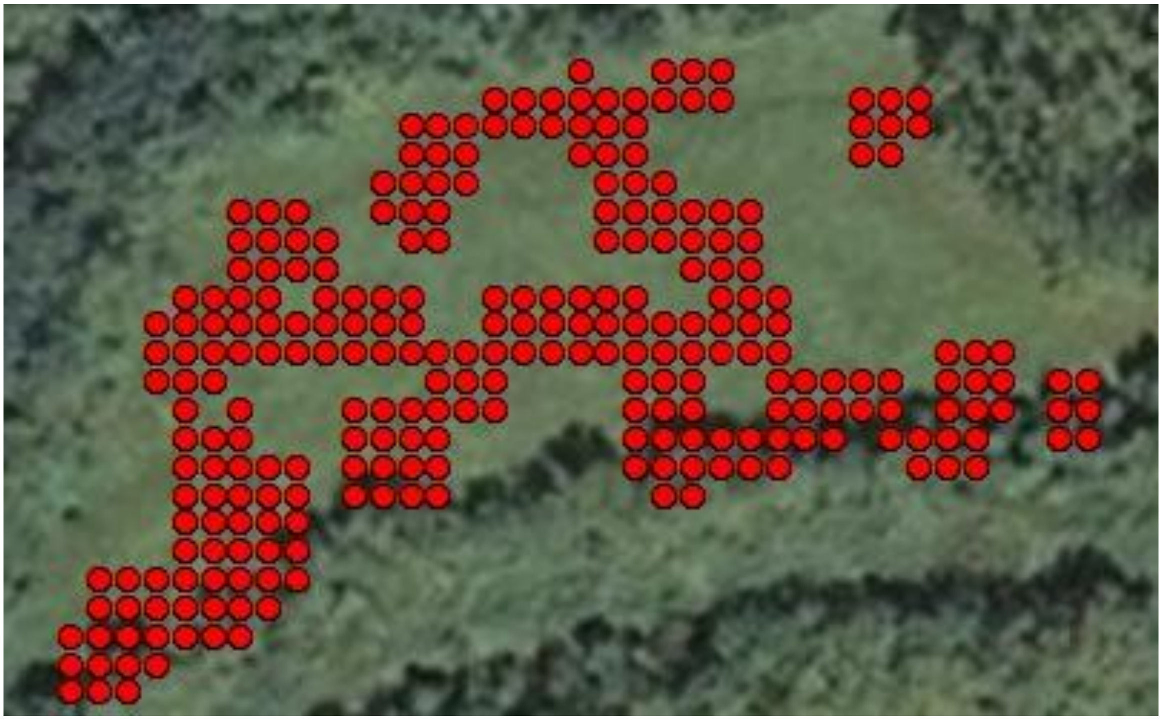
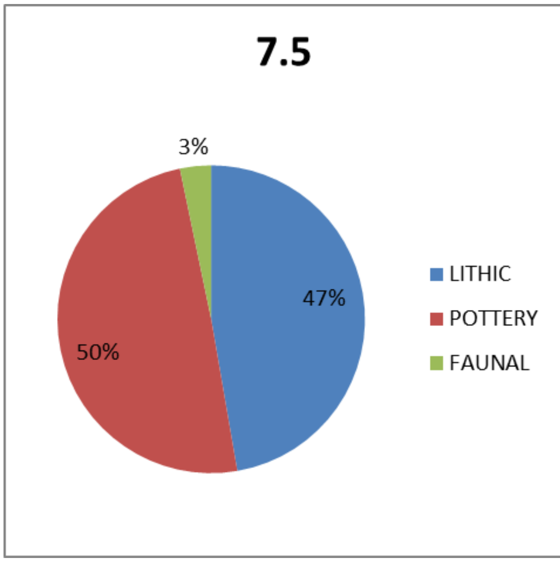


Figure 108 ST's within 7.5 meters of ST's where features are indicated.

Figure 109 ST’s not within 7.5 meters of ST’s where features are indicated.

Some features have been impacted or even truncated by the plow zone. In Figure 108 the ST’s with possible ‘features’ in them have been separated from the rest of the shovel tests. Added to this is all of the nearby shovel tests; every shovel test within 7.5 meters of a shovel test with an interpreted ‘feature’ has been sampled here (this distance has been chosen because it includes all of the ST’s above, below, to the sides of, or at a direct angle to, the ST’s with interpreted features. This was done using the ‘select by distance tool’ in GIS). This has been done in an attempt to determine if the artifacts from those impacted features made enough of a difference in the shovel test data to be visible (i.e. do the ST’s that are near ST’s with interpreted features have a different artifact profile than those that are not near ST’s with interpreted features). Figure 110 shows all of the ST’s that are not within 7.5 meters of an ST with an interpreted feature. These two data sets are compared below to see if they offer a different artifact profile.



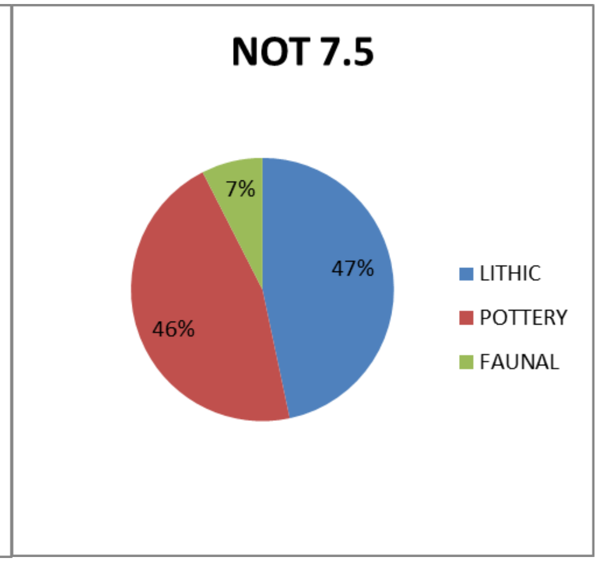
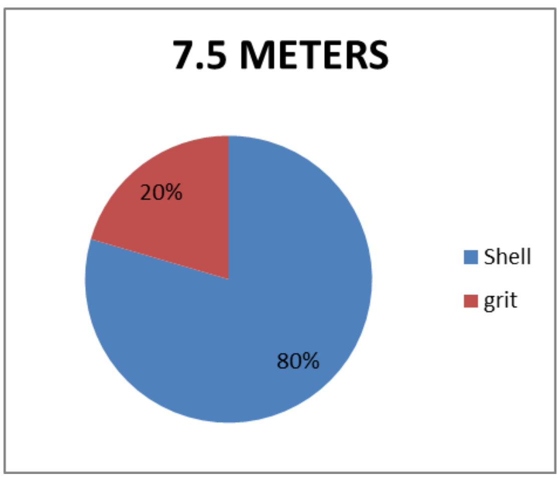


Figure 110 ST's near 'features', major artifact classes.

Figure 111 ST's not near 'features', major artifact classes.



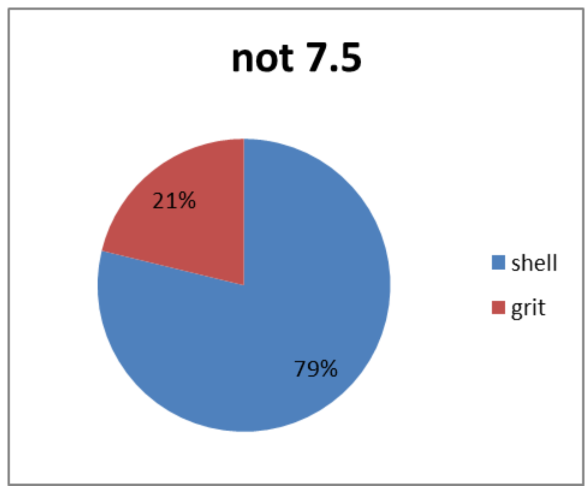
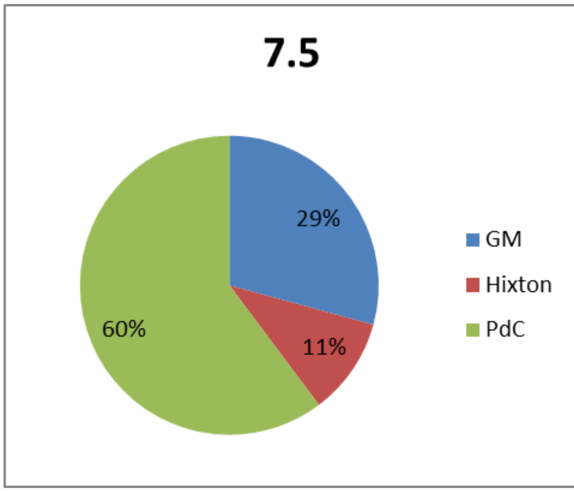


Figure 112 ST's near 'features', pottery

Figure 113 ST's not near 'features', pottery.



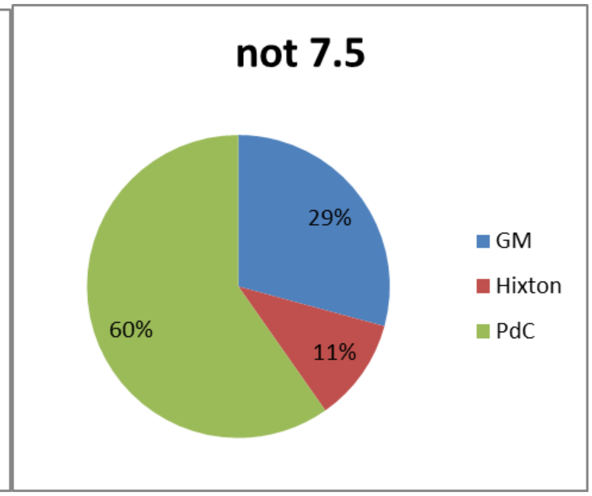


Figure 114 ST's near 'features', major lithics.

Figure 115 ST's not near 'features', major lithics

In the All Artifact pie charts, Figures 110 and 111, there are slightly different percentages, with more faunal materials actually being found in areas where there are no nearby 'features'. In the other pie charts, pottery and lithics (Figures 112-115) the results are almost identical when comparing ST's near 'features' and ST's not near 'features'.

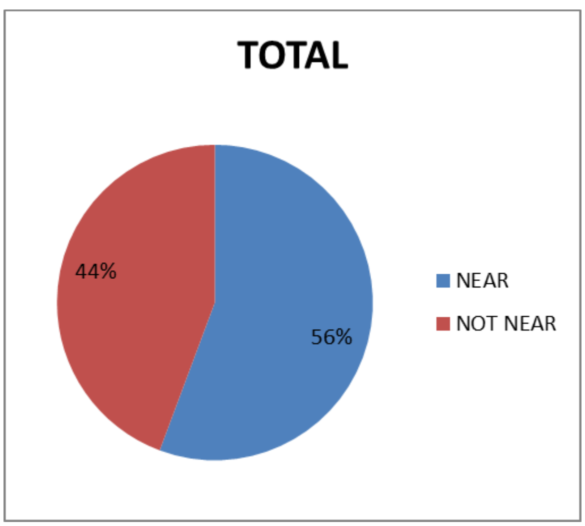
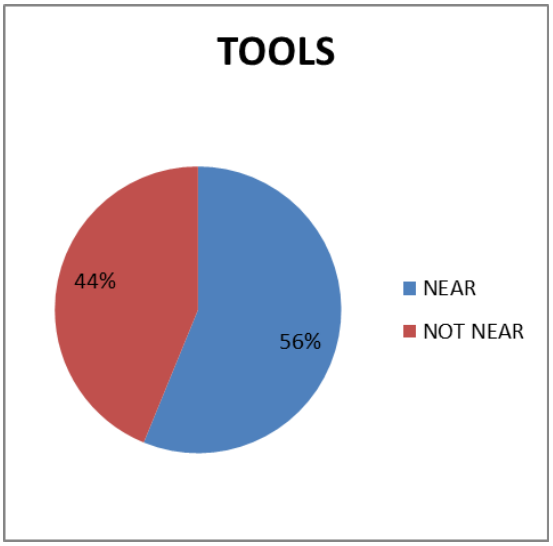


Figure 116 ST's near and not near 'features', % of total artifacts.



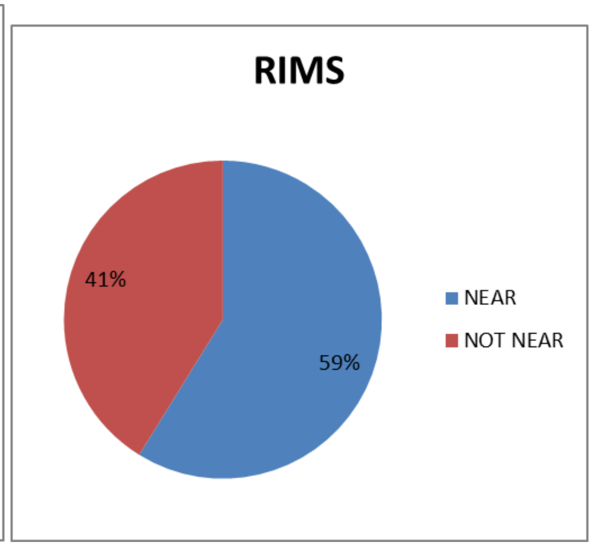


Figure 117 ST's near and not near 'features', Tools.. Figure 118 ST's near and not near 'features', Rims.

Figure 116 shows the artifact percentages of the two data sets. There are more artifacts in the Near ST's with features category, than there are in the Not Near ST's with features category. The above charts show that there is little difference between general artifacts in the two categories. These charts were made, Figures 117 and 118 to determine if there is any difference in the diagnostic artifact assemblages. Figures 116-118 show that tools and rims almost exactly follow the percentage patterns that can be seen between the two groups in general, though there is a 3% difference between the rims found near ST's with 'features'.

Similar charts were made to determine if the distance, 7.5 meters, was too large and thus masking any differences. Maps and charts were made for 5 meters distant (this shows all of the nearby ST's above and below and to either side, but not the crosswise ones). They were also made for simply the ones that were directly above the purported 'features'. The outcomes of both of these variations on the theme above were almost identical and so were not included.

The results of this show that there is little or no difference between the artifact contents of ST's near 'features' and ST's not near 'features'. This can be interpreted in several ways: First it may simply mean that a large amount of the suspected 'features' are not actually cultural features, or that many features were overlooked/ not located. If this is the case then this test should be rerun with only the locations of known features (such as those features either excavated or at least positively identified). Also the individual areas near the features should be tested to determine if they can give us an accurate artifact representation of the specific features.

Secondly, this may mean that the truncated features do not add enough artifacts to make a noticeable difference in the general profile. Thirdly, it may simply mean that we have reached the theoretical limit of what a shovel test grid can tell us. It has been shown above and later in this thesis that a general artifact site profile can be determined and also that profiles of smaller areas of the site can be determined (i.e. in the southwest area of the site there is more shell tempered pottery compared to grit tempered pottery and less rolled rims than in other areas of the site, as well as more Hixton etc.). However, if we assume that the interpreted 'features' found in ST's are an accurate representation of the features at the site then we may have, in fact, reached the theoretical limit of this method. If this is the case then a shovel test grid can tell general trends of certain areas but it is not specific enough to tell us exactly where certain features are, except those directly discovered from the ST's, or what the specific profiles of those features are.

GIS MAPS

Concentration Maps

GIS can help us to look at archeological data in many different ways. Since the data concerned in this thesis are in a systematic grid it is perfect for doing a number of spatial analytical comparisons. There are two different analytical methods shown in this section: Inverse Distance Weighted (IDW) and Kernel Density Estimation.

IDW

The goal of using IDW is to show the relative peaks of different artifact classes. In many of the maps there are a few ‘peaks’ (shown as dark blue or lesser peaks of green and yellow) and there are also large areas of uniformity (the same color shown with no breaks, brownish). This does not mean that there are no artifacts in these areas, on the contrary if it shows any color then there are artifacts in that location (or estimated artifacts based on the shovel test samples). There may even be large amounts of artifacts in the uniform areas but the map shows the places where the highest densities are. In order to better look at the data, subsequent maps will be shown of the same artifact classes with the uniform data removed so that the peaks are more apparent. Later the peaks of the different artifact classes will be shown on the same map for comparative purposes.

PdC

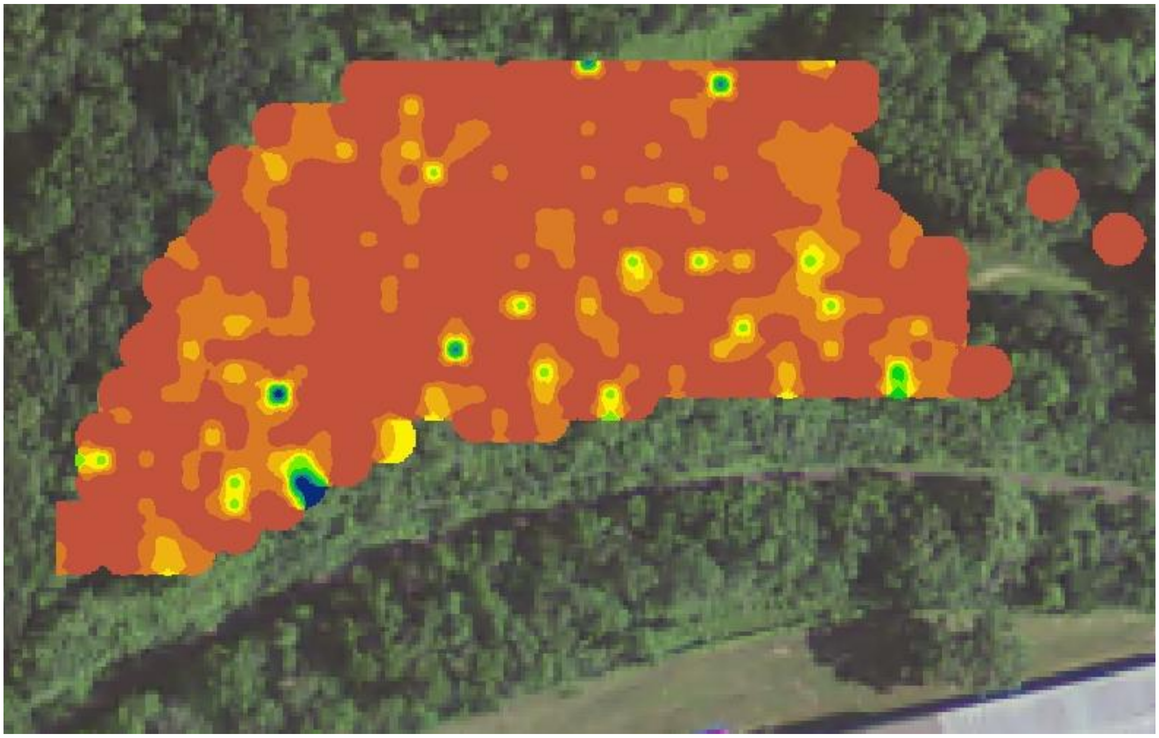


Figure 119 IDW of PdC Count.

Figure 120 IDW of PdC count with all but peaks removed.

Figure 121 IDW of PdC Weight with all but peaks removed.

PdC is the most prevalent lithic type found at Silvernale as well as at the other sites in the area. This is expected since PdC is locally derived and abundant. The maps for PdC (Figures 119-121) show that it is relatively uniformly spread out over the sampled area with only a few large peaks near the bottom of the sample. The map for PdC weight, (Figure 121), shows even less peaks. This is because in the areas of the peaks there are a few large pieces of PdC (50-100 grams) and they swamp out most of the data because most lithic pieces range from less than a gram to a few grams in size. This data set can still be useful because it can help to show the areas where lithic manufacturing may have been going on.

Grand Meadow

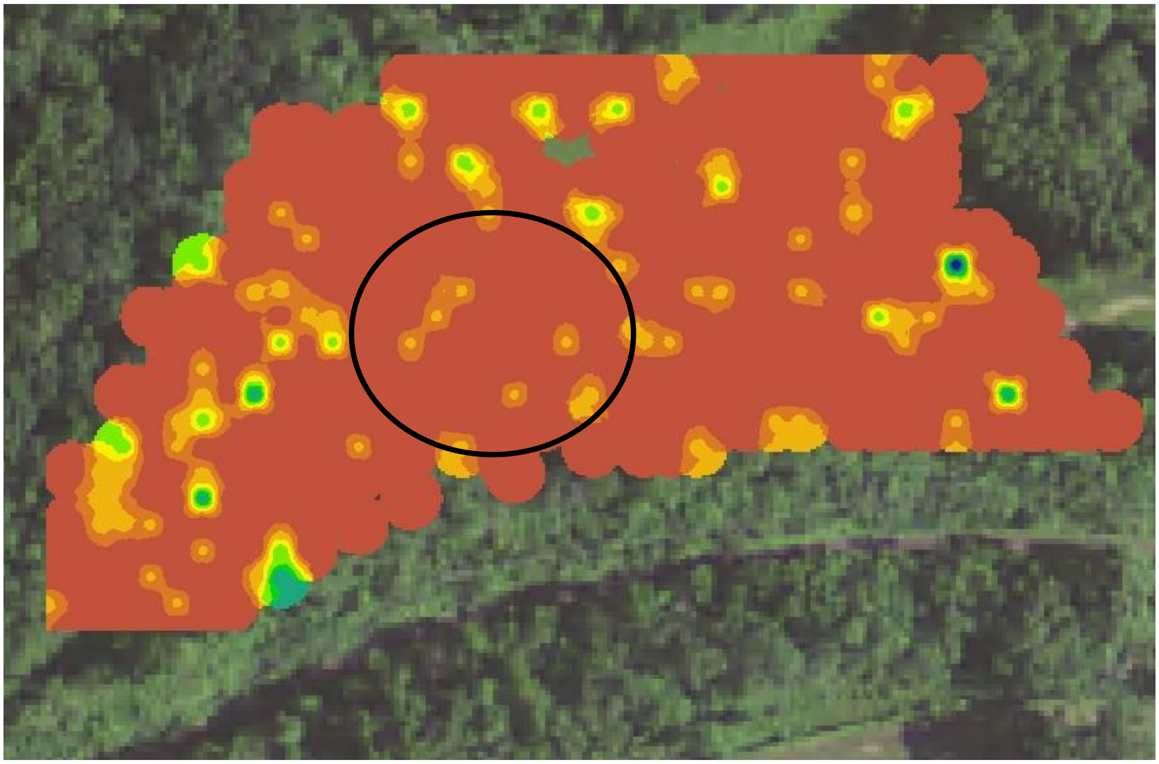


Figure 122 IDW of Grand Meadow count. Communal area circle included.

Figure 123 IDW of Grand Meadow count with all but peaks removed. Communal area circle included.

Figure 124 IDW of Grand Meadow weight with all but peaks removed. Communal area circle included.

Grand Meadow is the second most prevalent lithic type at Silvernale. The maps for GM (Figures 122-124) show a relatively uniform distribution and peaks spread out over the whole site, with the exception of a few notable areas. It is interesting that some of the largest peaks by count of GM are in the southwest area of the site while some of the largest peaks by weight are in the northeastern section. The weight section for GM has fewer peaks than the count section but still a large amount of peaks. That is very different from the PdC weight map where a few peaks swamp out everything. This is likely because GM is not a local material and so it would make sense if smaller pieces were brought to the site, whereas PdC may be found nearby and so transporting it in large chunks would be less of a hardship. There are also large areas with very little Grand Meadow and those have been circled. This area corresponds to areas of lower abundance in most of the other artifact maps as well. The circled areas are slightly different in the different maps but they overlap in a large section.

Hixton

Figure 125 IDW of Hixton count. Communal area circled included.

Figure 126 IDW of Hixton count with all but peaks removed. Communal area circle included.

Though it takes up only 10% of the lithic assemblage at the site, Hixton is the third most prevalent lithic material. The maps for Hixton (Figures 125 and 126) show a much less uniform distribution than either PdC or GM. In fact there are whole sections where there is no Hixton at all. The peaks are located mostly in the southeastern and southwestern areas of the site while the central and northeastern areas contain no peaks at all. The proposed communal area is circled here for comparative purposes, though there are other large sections that are empty of peaks.

Grit tempered pottery

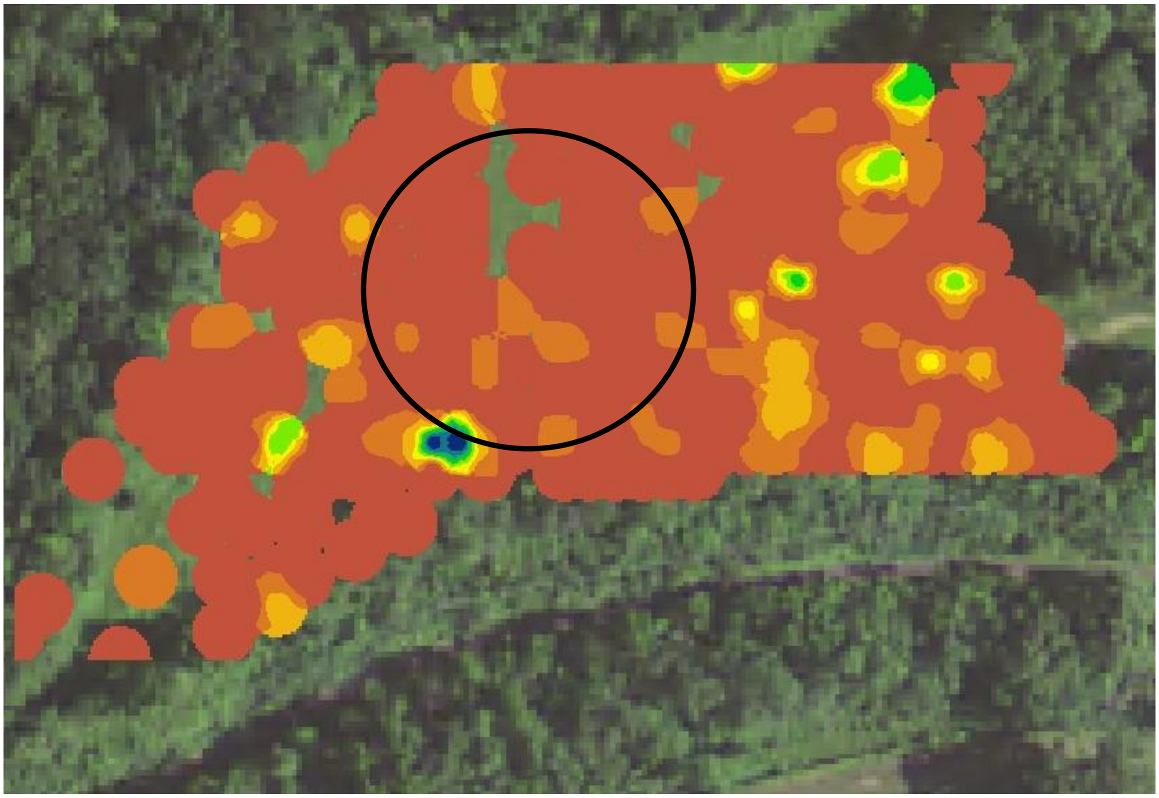


Figure 127 IDW of Grit Tempered Pottery count. Communal area circle included.

Figure 128 IDW of Grit Tempered Pottery count with all but peaks removed. Communal area circle included.

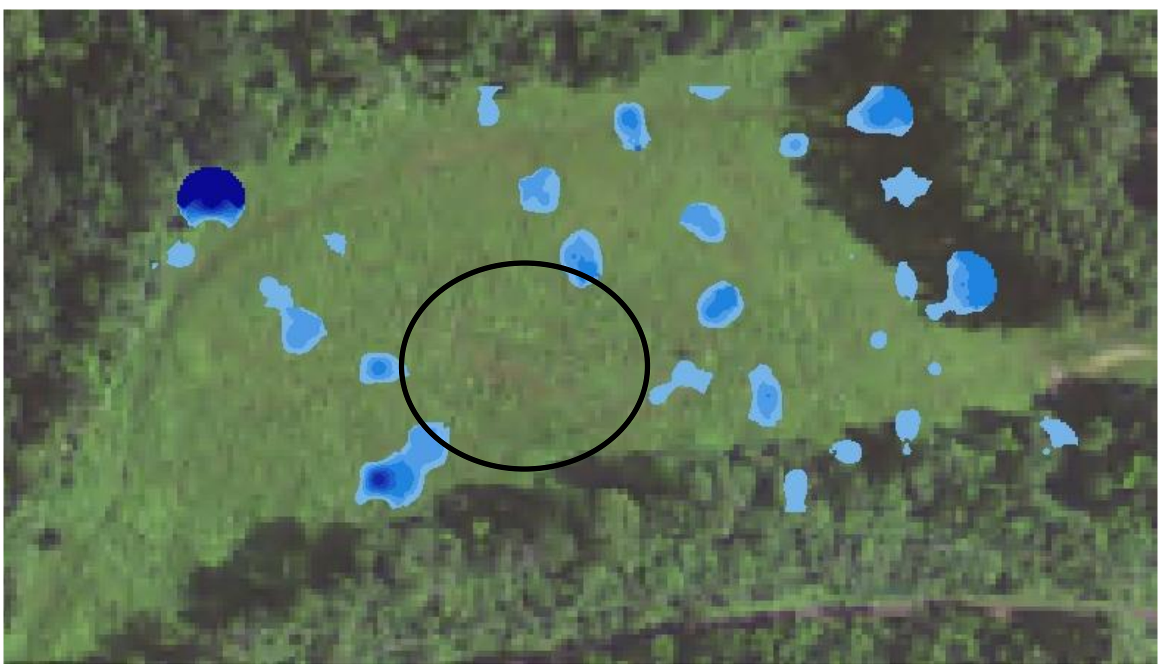


Figure 129 IDW of Grit Tempered Pottery Weight, with all but peaks removed. Communal area circle included.

In the eastern section of the site, grit tempered pottery (Figures 127-129) is very prevalent with large peaks throughout. There is also a concentration in the western area though it is much more scattered with sections of no grit tempered pottery at all and areas, like the peak in the south (shown in blue and green) that are very large. The weight maps show a similar pattern, with the eastern area full and nothing in the west but a strip.

The peoples that deposited the grit tempered pottery appear to have lived in the eastern area of the sampled site, with also a smaller population living in west. This western concentration may in fact represent a separate occupation or group of people; the grit tempered pottery in each area should be compared to determine if it is similar or different to lend evidence to this hypothesis. The central area has gaps of no grit tempered pottery as does the southwestern area of the sampled site. The proposed communal area is circled for comparative purposes.

Shell tempered pottery

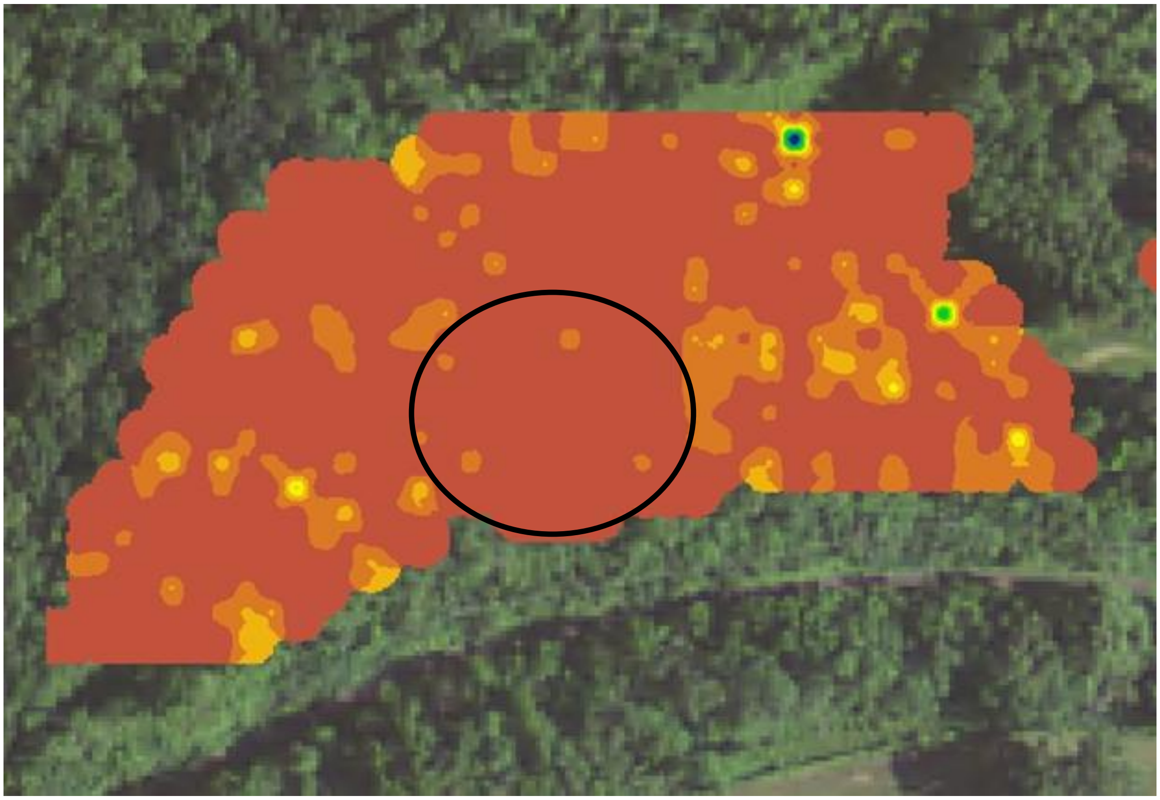


Figure 130 IDW of Shell Tempered Pottery count. Communal area circle included.

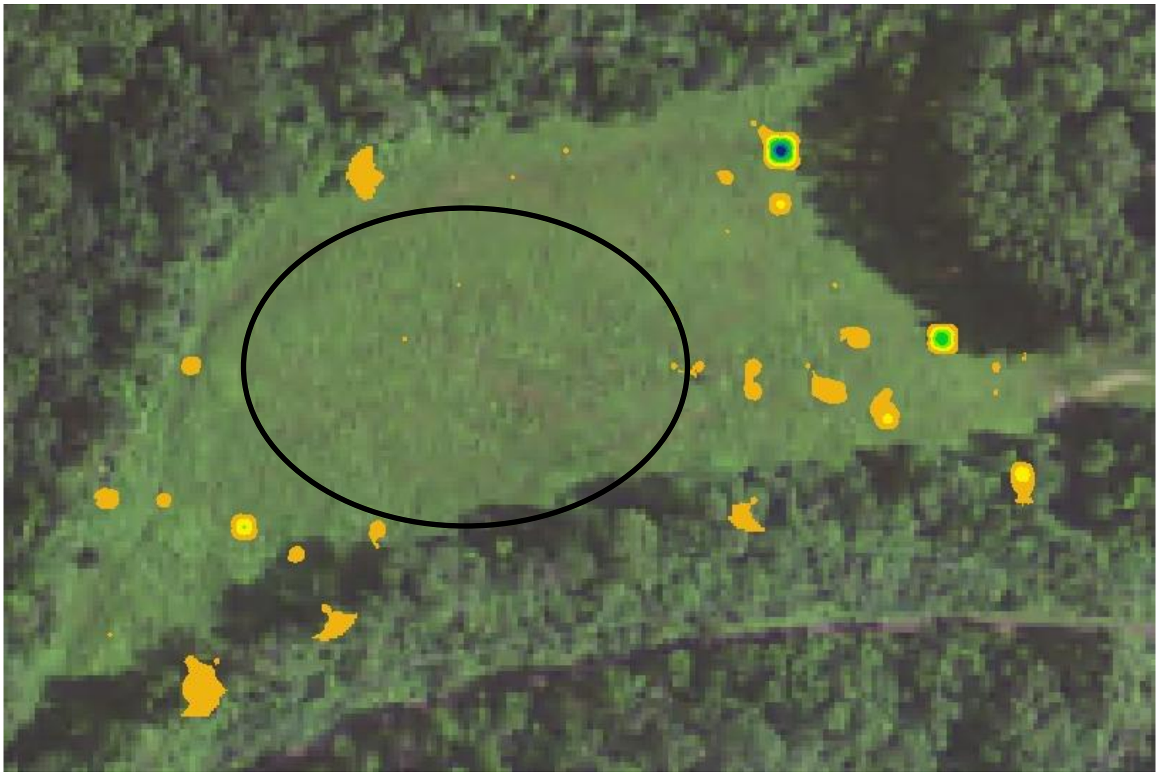


Figure 131 IDW of Shell Tempered Pottery count with all but peaks removed. Communal area circle included.

Figure 132 IDW of Shell Tempered Pottery weight with all but peaks removed. Communal area circle included.

Shell tempered pottery (Figure 130-132) is much more uniformly distributed than is the grit tempered, with no gaps at all in the sampled area. It is also the most prevalent artifact type at the site. Similar to the maps for PdC, this abundance of artifacts causes there to be few peaks. The counts and weights of shell tempered pottery are in agreement about the peaks the map does show; they are in the eastern and southwestern areas of the site with the central area being nearly devoid of artifact peaks (though these areas do still contain significant amounts of shell tempered pottery). The peoples that deposited the shell tempered pottery appear to have lived across the site, while the main occupation likely focused in the east and southwest. The communal area circles are shown, and they are much larger on these maps then they are on other artifact maps due to the large abundance of shell tempered pottery across the site.

Faunal

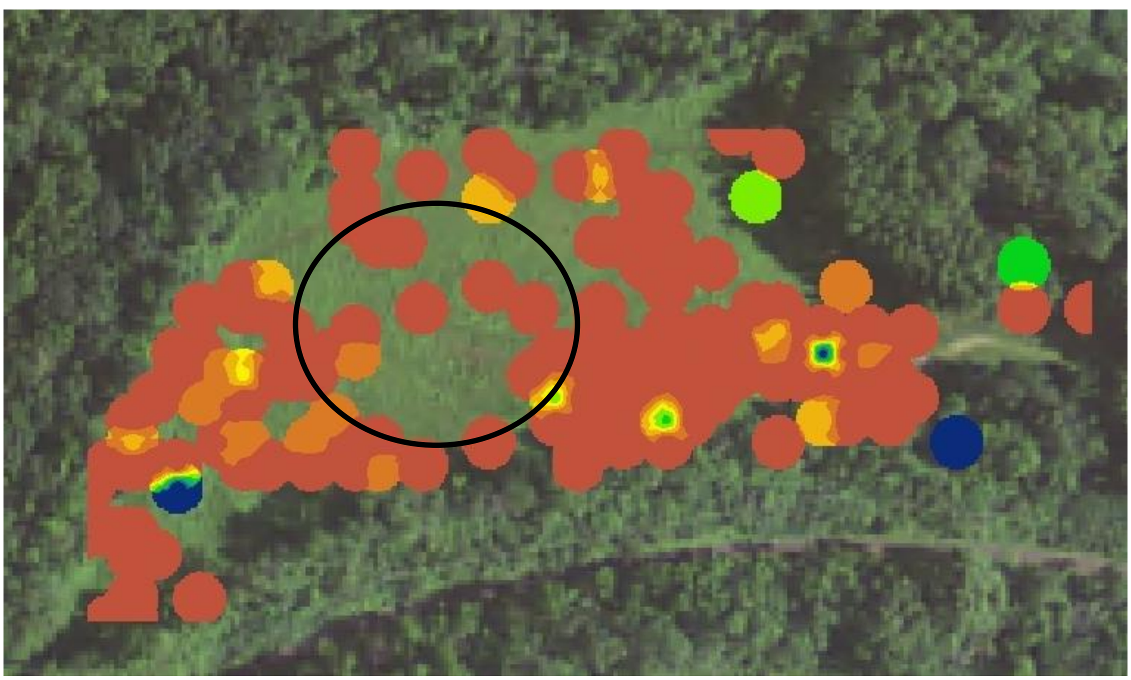


Figure 133 IDW of Faunal count. Communal area circle included.

Figure 134 IDW of Faunal weight. Communal area circle included.

The amounts of faunal materials found at the site are very low, less than 8% of the assemblage by count and less than 3% by weight. The IDW maps show very spotty locations for faunal materials (Figures 133-134); with small concentrations in the southeastern and far western areas of the site. The central area of the site is nearly devoid of faunal materials. When examining the weights of faunal materials there are even fewer peaks apparent. This may mean that the peaks in the counts are related to more broken up faunal materials or it may be different kinds of faunal materials (note that all faunal materials are shown together, including the bones of mammals, birds, fish, and reptiles, as well as shells). The proposed communal area is circled, in this case there are almost no faunal artifacts at all on in this area.

Heat treated lithics

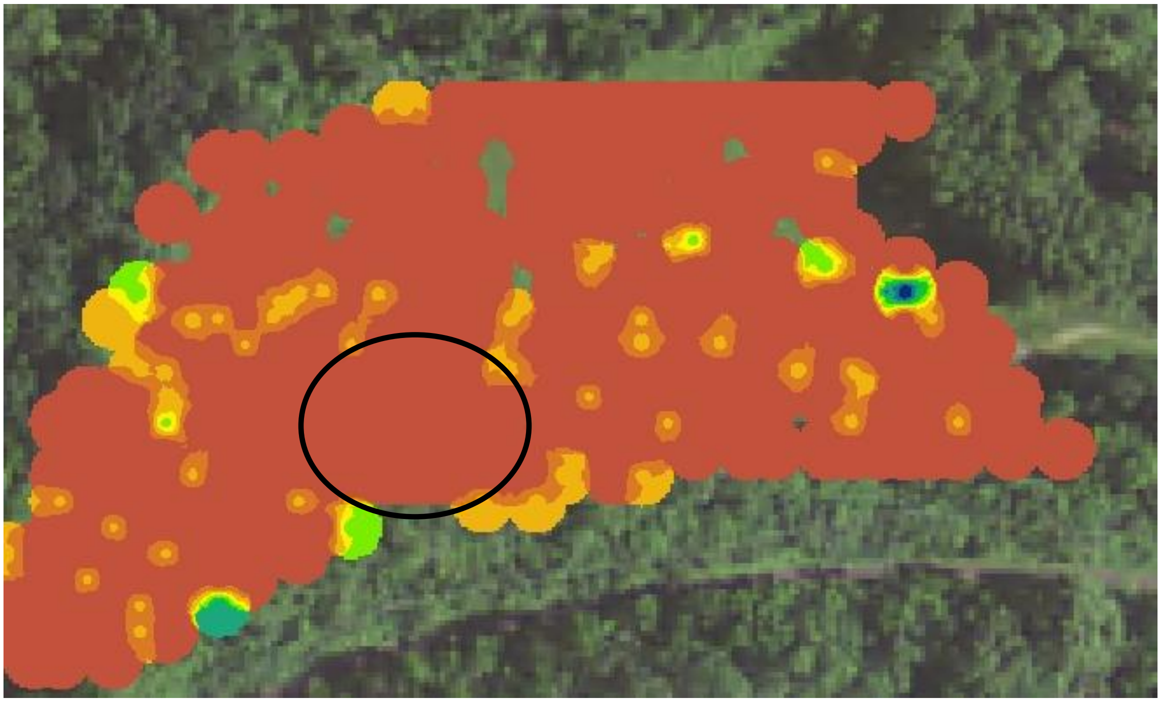


Figure 135 IDW of Heat Treated Lithics count. Communal area circle included.

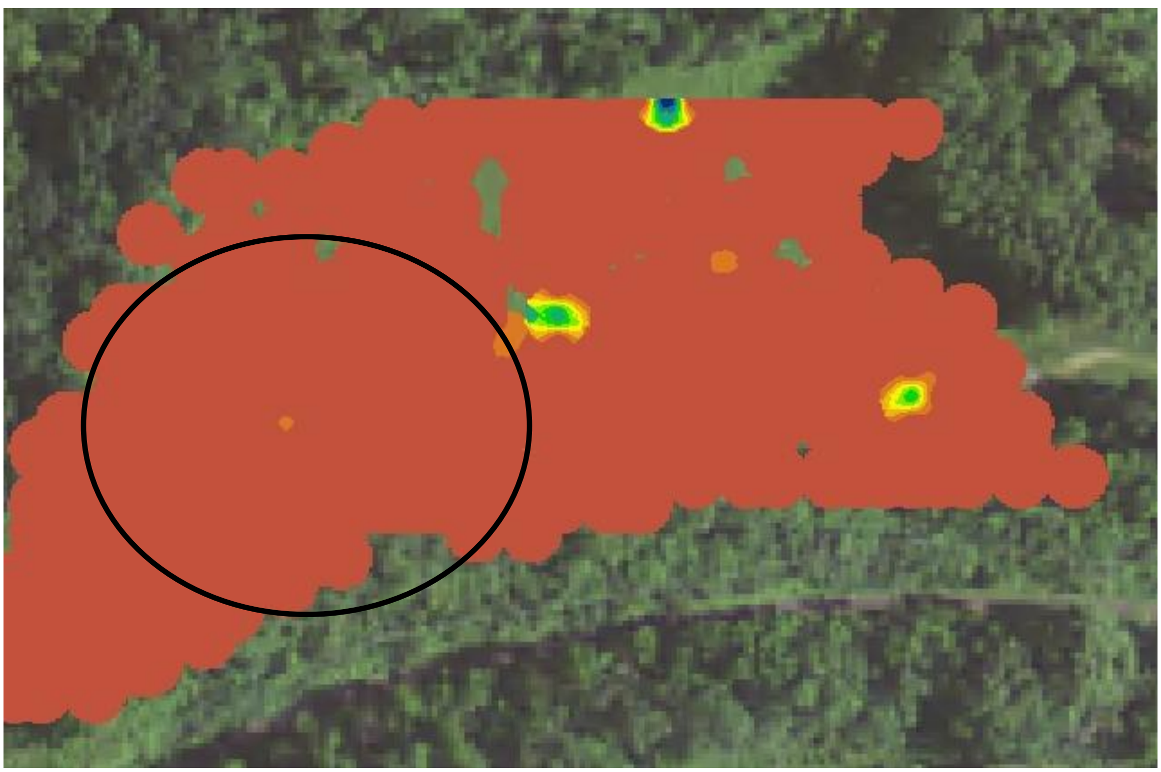


Figure 136 IDW of Heat Treated Lithics weight. Communal area circle included.

Lithic materials are often heat treated to improve the quality of the materials so examining the distribution of heat treated lithics could give us some cultural information possibly related to lithic processing stations or areas where heat treatment is more often used. The IDW heat treated maps show a fairly homogenous distribution across the site with only a few areas in the northern section where they are absent (Figures 135 and 136). The peaks are distributed fairly evenly as well with larger peaks being found in several areas and the relative lack of peaks in the central and northern areas. The heat treatment by weight map shows much more uniformity with only three peaks, it is interesting to note that these peaks are all in different locations than the peaks in the 'count' map. This may relate to differences in the locations of lithic processing at different stages in different areas of the site.

Peaks of all artifacts

Figure 137 IDW of Artifact Density Peaks. (FCR=black; Faunal=purple; Hixton=peach; PdC= green; Grand Meadow= red; Grit tempered pottery= blue; Shell tempered pottery= dark orange with yellow, green and blue centers). Communal area circle included. Other blank space circled as well.

In this map (Figure 137) the peaks of all of the artifacts are shown together to try to compare them and notice patterns (Note the blank areas do contain artifacts, just no peaks of artifacts). The first thing to notice is that the peaks of the various artifact types generally cluster together; the eastern area is clearly the densest, with artifact peaks everywhere overlapping and on top of each other.

Just past the edge of the grid to the east it has been determined that there is more village extending for a good distance. This has been covered up by several feet of fill that was dumped there during the construction of the factories to the south of the sampled area. It would appear when looking at this map that since the densest artifact concentrations are in the far eastern section of the sampled area it is very likely that some of the heaviest occupations took place underneath the fill, to the east of the sampled area. There is a similar pattern with the south, artifact peaks are very dense towards the southern edge and there are likely very dense areas of occupation beneath the railroad berm.

Another thing to notice is the gaps. In the center of the sampled area and in a couple of other spots there are large sections where there are few artifact densities (potential areas outlined in Figure 137). The largest artifact peak free zone, outlined by the large black circle, is suggested here to be a likely communal area.

Many villages have communal areas to visit, trade, play games, perform religious ceremonies, and a number of other activities; though “No central plaza or ordering of structures has been detected at any Red Wing Locality village.” (Fleming 2009: 232).

This proposed communal area is supported by the data from the excavation units and the shovel tests around the excavation units.

Block 3 is located at the southeastern edge of this 'peak free zone' and though it contains artifacts the numbers are considerably less than some of the other blocks. Comparing the separated ST's around blocks with each other there is also a dramatic drop off, less than half in some cases, of artifacts per shovel test (Figure 104) around Block 3. If this 'peak free zone' does, in fact, represent a communal area it appears to be roughly circular. This would be in contrast to typical Middle Mississippian sites where the plazas are more often rectangular and demarcated though, "Mississippian plazas come in a variety of sizes and shapes. Some plazas were square, others rectangular, and still others rounded, and virtually all of them are delimited archaeologically according to the edges of surrounding mounds." (Lewis et. Al 1998).

Geophysics Compared to Shovel Tests

Geophysics were done at the site in 2001 by Don Johnson and during his examination of the results with Ronald Schirmer they postulated several possible houses and over 75 other features from the data, many of which have since been confirmed by excavation (Dobbs et al. 2003). In this section the results of the geophysics will be compared to the shovel test data: individual postulated features from the geophysics will be compared to the artifact density peaks to see if there is any congruity or lack thereof.

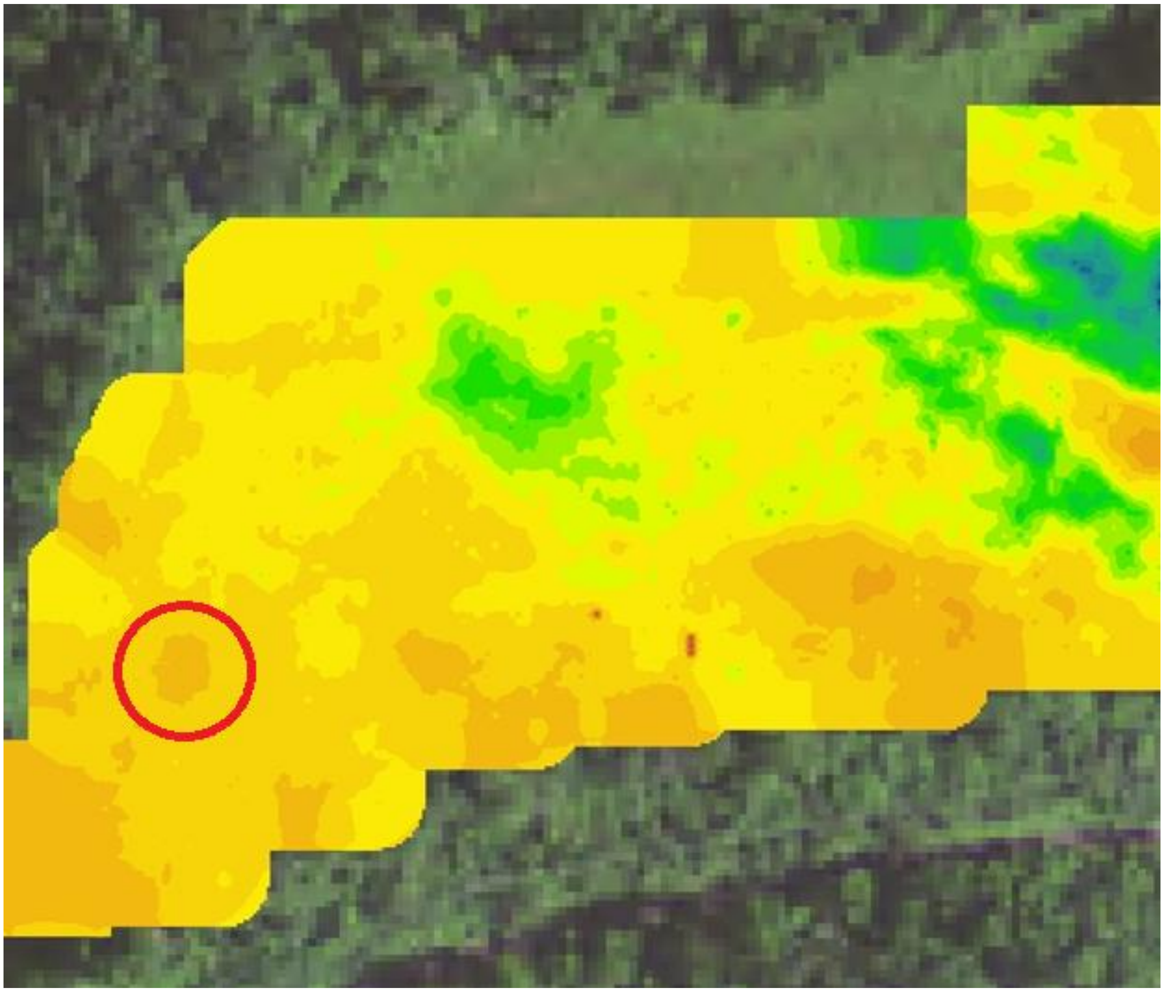


Figure 138 IDW of Geophysics. Proposed house feature circled in red.

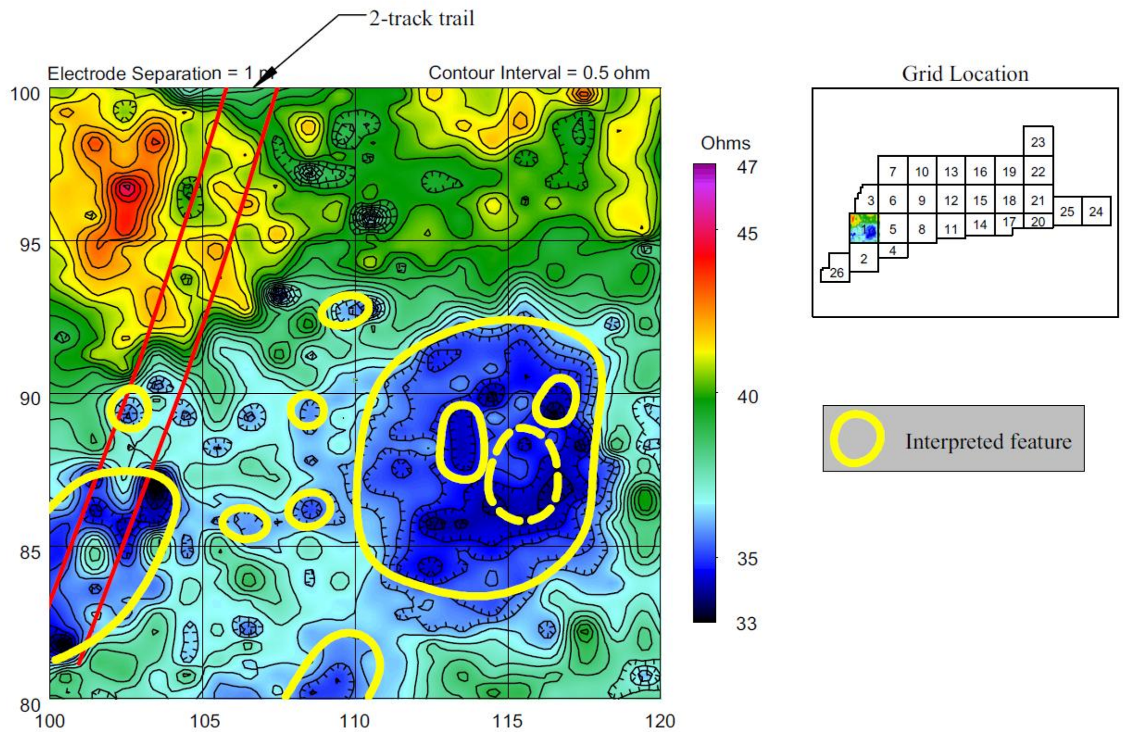


Figure 139 Interpreted house feature, grid 1, from geophysics (Dobbs et al. 2003:51).

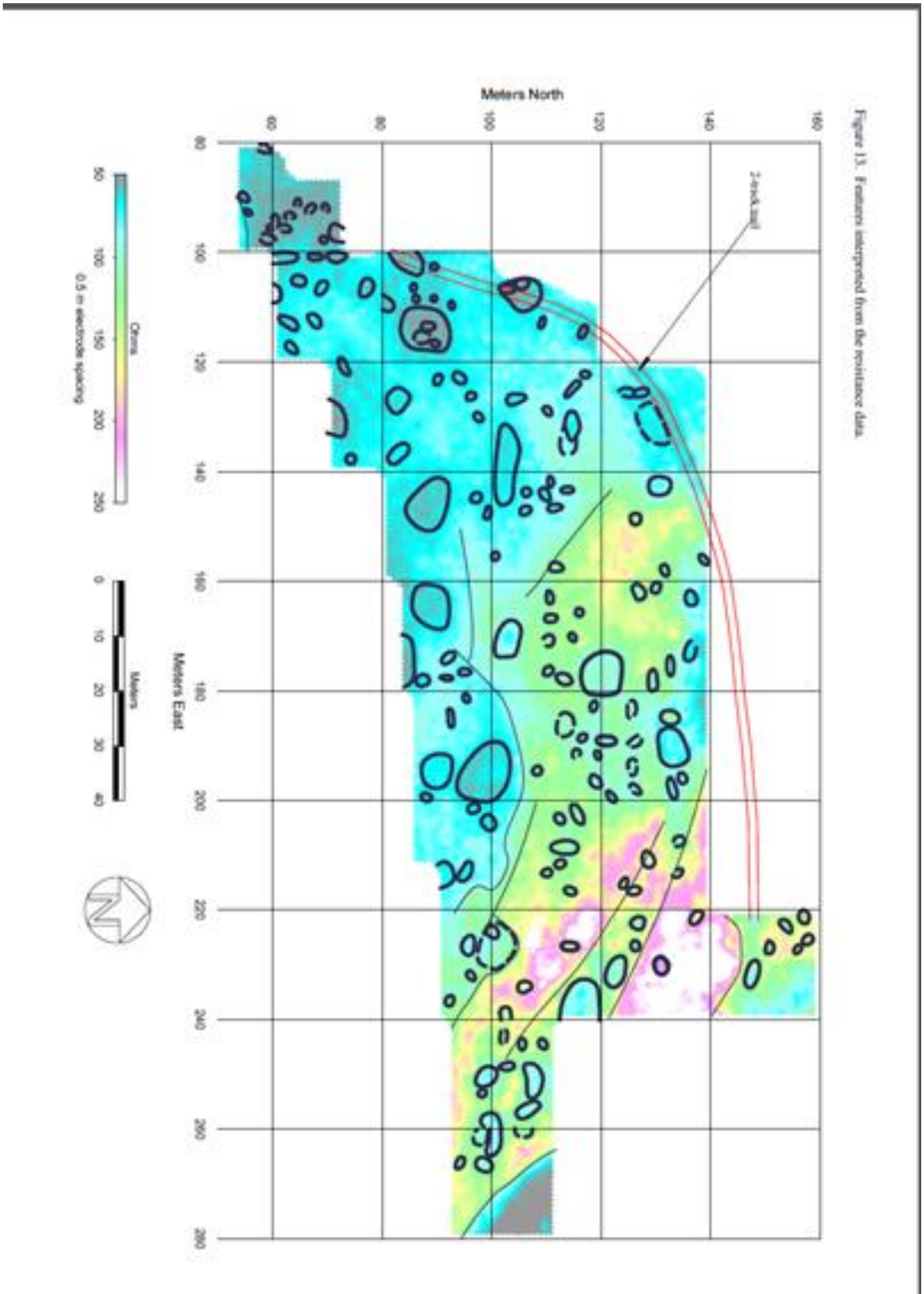


Figure 140 Interpreted features from geophysics (after Dobbs et al. 2003:34).

Figure 138 shows the results of the geophysics as interpreted by the GIS program using IDW. One of the most sharply defined features at the site was what Johnson and Schirmer determined to be a likely house in the western area of the sampled area (The house feature shown in Figure 139, (Dobbs et al. 2003) is the same feature that is circled in red in Figure 138). The excavation of the Unnamed Western Block in 2011 was intended to recover a feature that appeared to be related to this postulated house. The materials discovered in the features were consistent with the refuse removed from a house. Figure 140 shows a site-wide map of anomalies in the geophysics that were interpreted to be likely features (Dobbs et al. 2003).

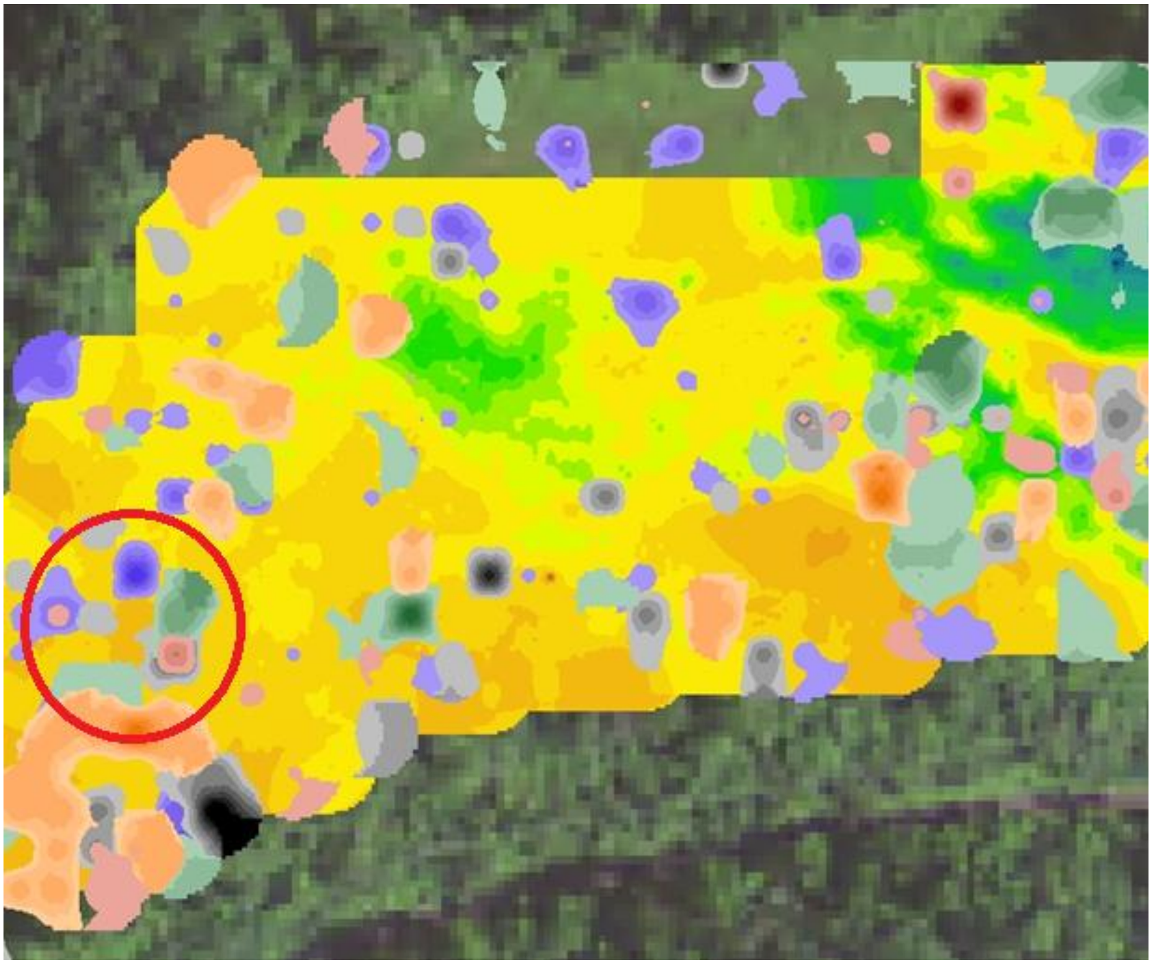


Figure 141 IDW of Geophysics, with Artifact Density Peak map overlay. Proposed house feature circled in red. (Hixton= orange; PdC= black; Shell tempered pottery= red; Grand Meadow= purple; Grit tempered pottery= green).

Figure 141 shows the results of the geophysics with the Artifact Peak Density map overlaid upon it. The area circled in red is the same as in the previous map (Figure 138); it shows the location of the possible house feature with the artifact density peaks that immediately surround it. All of the major artifacts have peaks in the immediate area around this postulated house. This is consistent with an expected house since most materials would be swept out and removed from the house and they would likely be deposited in refuse pits nearby.

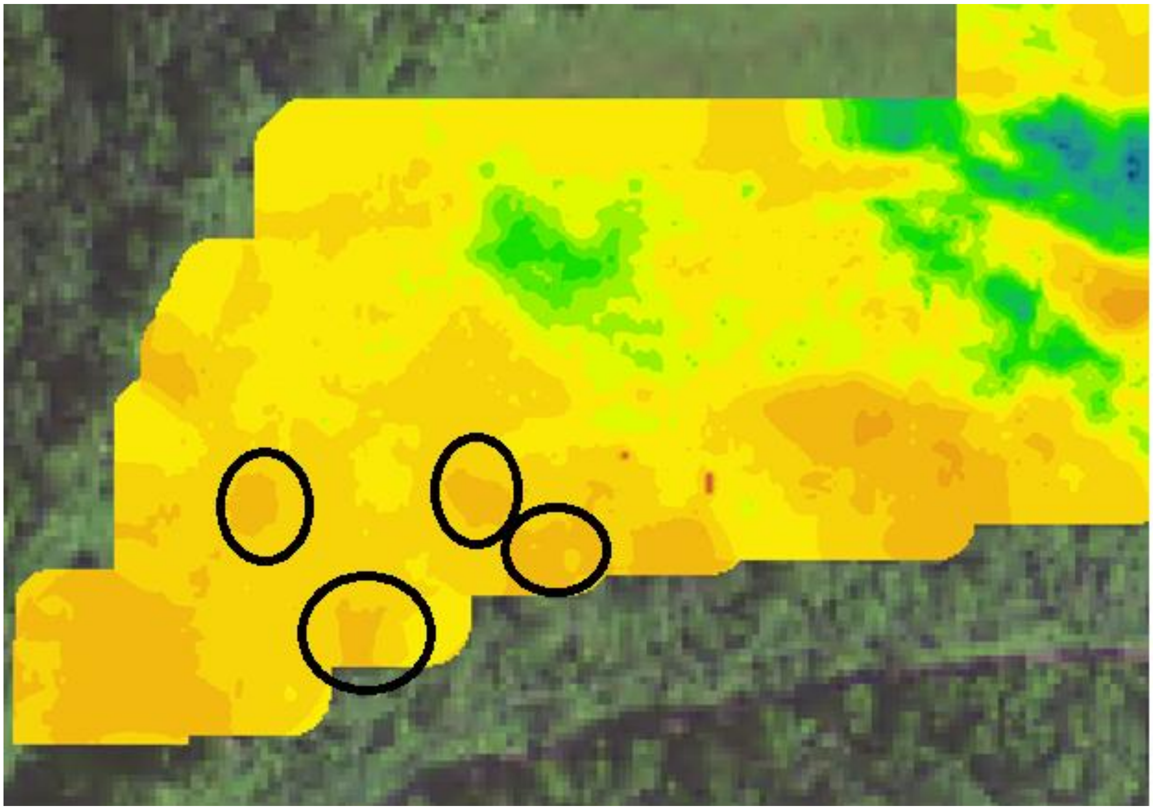


Figure 142 Several interpreted possible house features from geophysics circled in black.

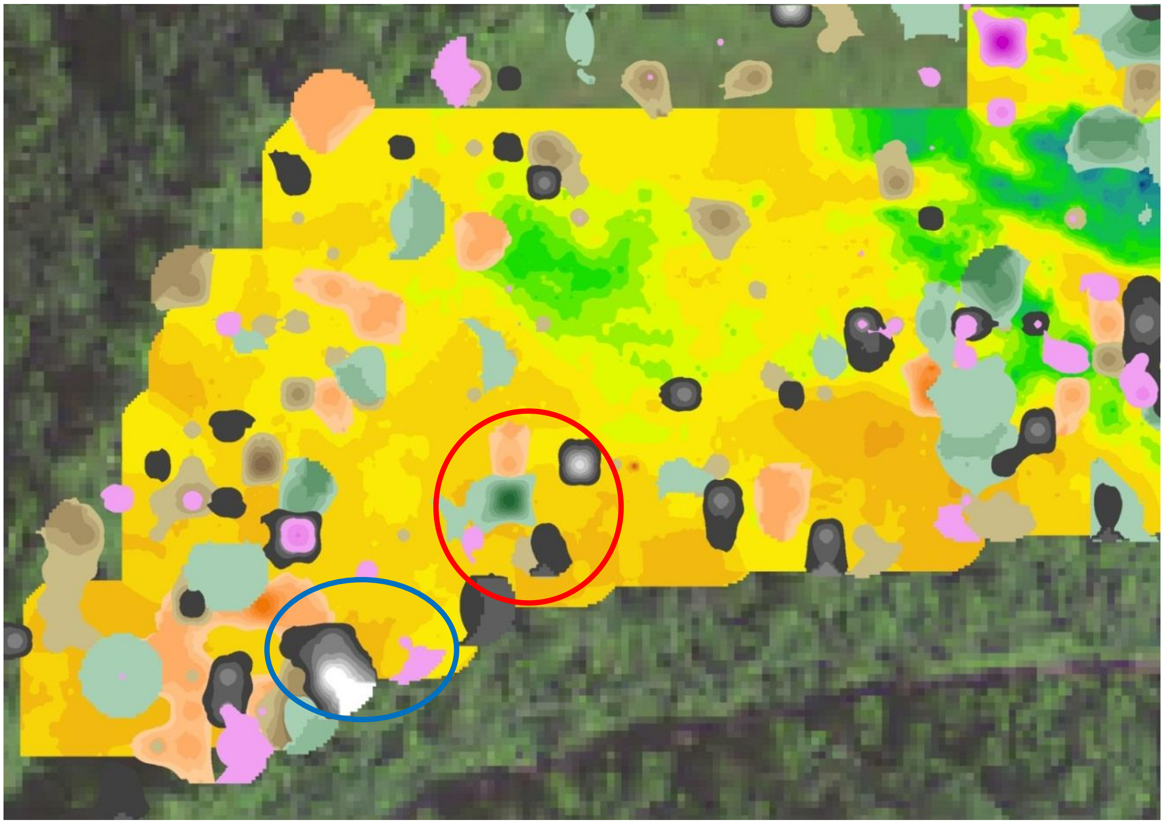


Figure 143 Several interpreted possible house features from geophysics overlaid by shovel test density peaks. (Shell tempered pottery= pink; PdC= black; Grand Meadow= brown; Hixton= orange; Grit tempered pottery= green). Possible house features circled.

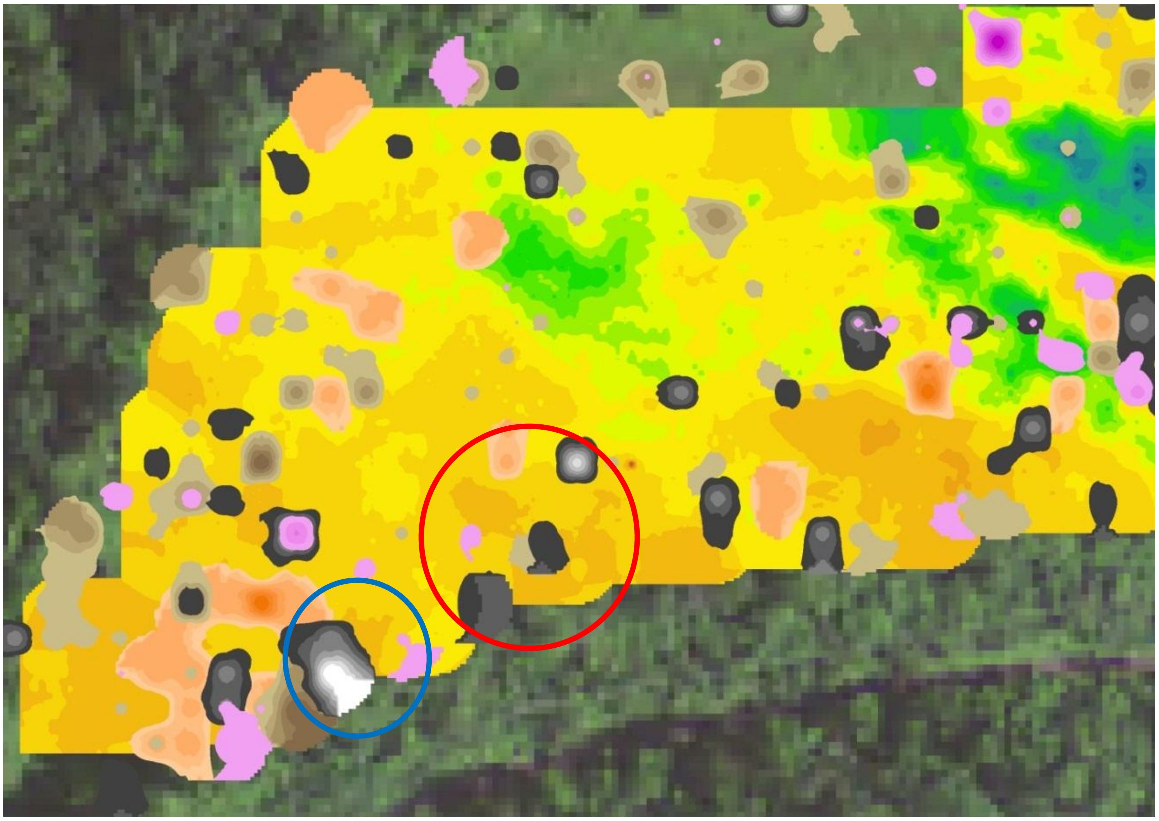


Figure 144 Several interpreted possible house features from geophysics overlaid by shovel test density peaks, excluding grit temper. (Shell tempered pottery= pink; PdC= black; Grand Meadow= brown; Hixton= orange).

Several of the identified possible house features have been circled in Figure 142. One of the circled areas, the farthest to the west, has been discussed above. The other three are jointly shown in Figures143. In these figures two of the features are in the same area and so are shown circled together, in red, along with the artifact density peaks nearby. Figure 143 shows the all of the major artifact peaks and Figure 144 shows the same thing except without the grit tempered pottery peak, which otherwise lands right on top of it. In both of these figures the fourth possible house feature, outlined in blue, is shown, along with the nearby artifact peaks. Note that the artifact peak for PdC partially obscures it.

These possible house features are not as clear as the first example but they still show the geophysical anomalies with artifact densities nearby or sometimes directly on top. If each of these anomalies are, in fact, houses then the less clear results may be a product of the close proximity of the other houses to one another and their associated refuse.

The geophysical IDW maps can be shown in several different levels. The data can be separated into any number of classes and looking at the data in different levels can show or hide different possible features (As is discussed in the Methods section and Figure 12. The data above have been shown separated into 15 different classes. However at that class level some features, as interpreted by Dobbs et. al, cannot be clearly defined. The levels have been changed for the data below to show 20 levels instead of 15 so that some other features are more visible.

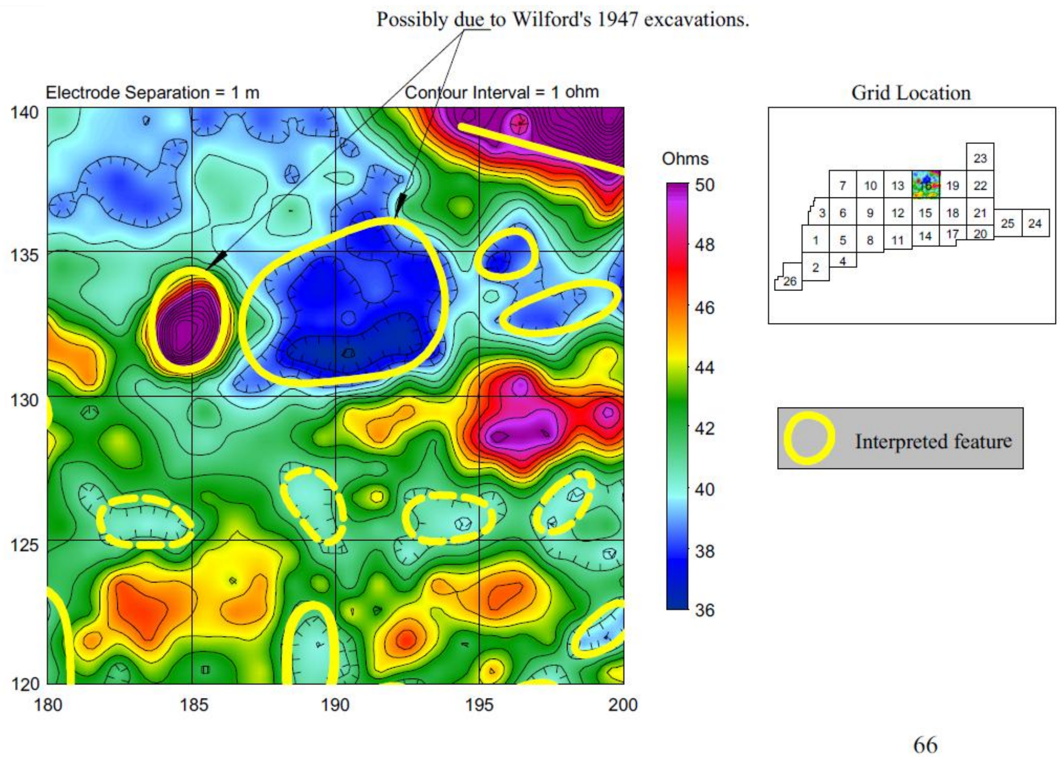


Figure 145 Interpreted features, Grid 16, Wilford's 1947 XU's, from geophysics. (Dobbs et al. 2003:66).

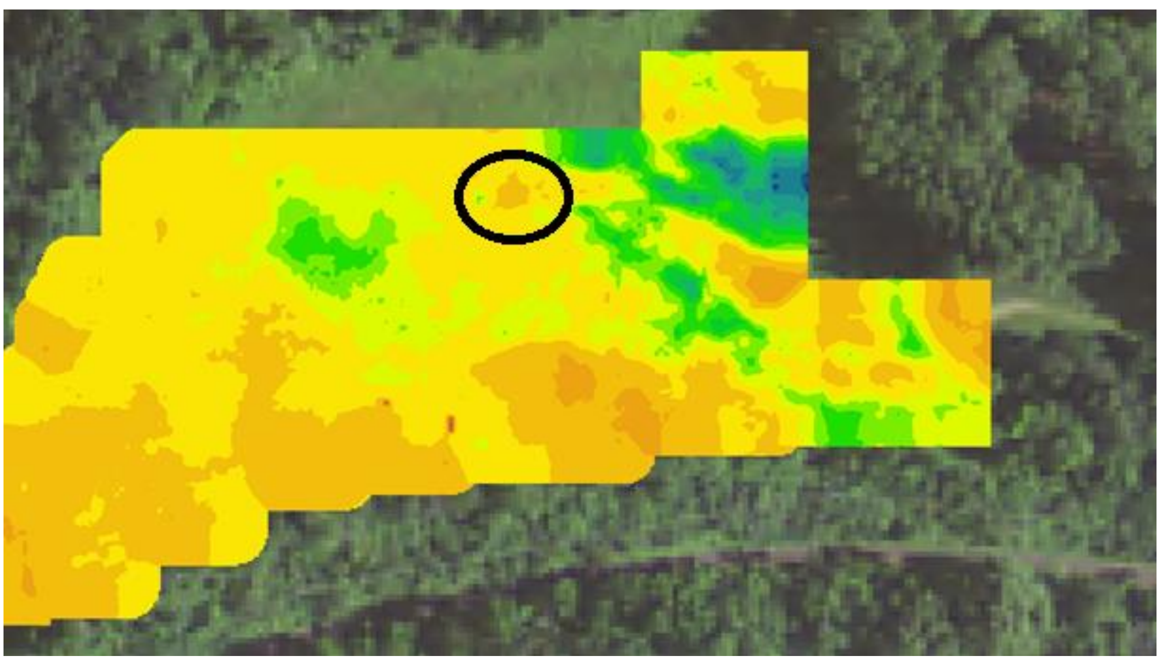


Figure 146 Feature, possibly representing Wilford's XU's, from geophysics, circled in black.

Figure 147 Feature, possibly representing Wilford's XU's, from geophysics overlaid by shovel test density peaks grid 16.

Figure 146 shows a defined view of some anomalies that Johnson and Schirmer interpreted to possibly be due to Wilford's 1947 excavations. Figure 147 shows the same anomalies in IDW showing the whole site view. The features in question are circled in black. Figure 147 shows the anomalies with the artifact density peaks overlaid upon it. There are artifacts in this area but no artifact density peaks. The entire area is low in artifact peaks, part of this could be explained if Wilford's XU's had removed many of the artifacts. The shovel test data do not argue against this hypothesis but it is inconclusive due to low artifact density in this area. This location for his excavation unit is also corroborated by ST 18-31 which lands directly on top of it and was noted by the excavator as possibly being a 'feature'. Another interpretation is that the shovel test simply hit the feature that is interpreted in the geophysics but that the feature may not be one of Wilford's XU's.

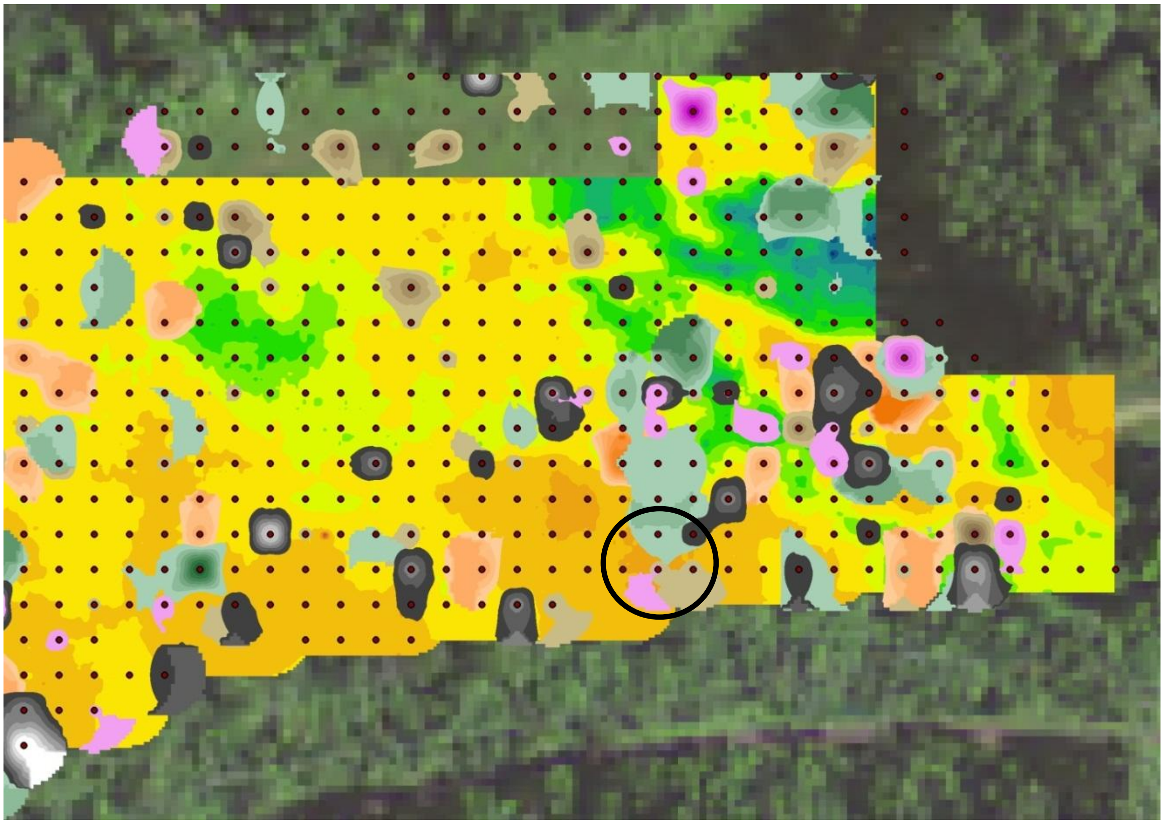


Figure 148 Possible house feature (circled in black) from geophysics overlaid by shovel test density peaks.

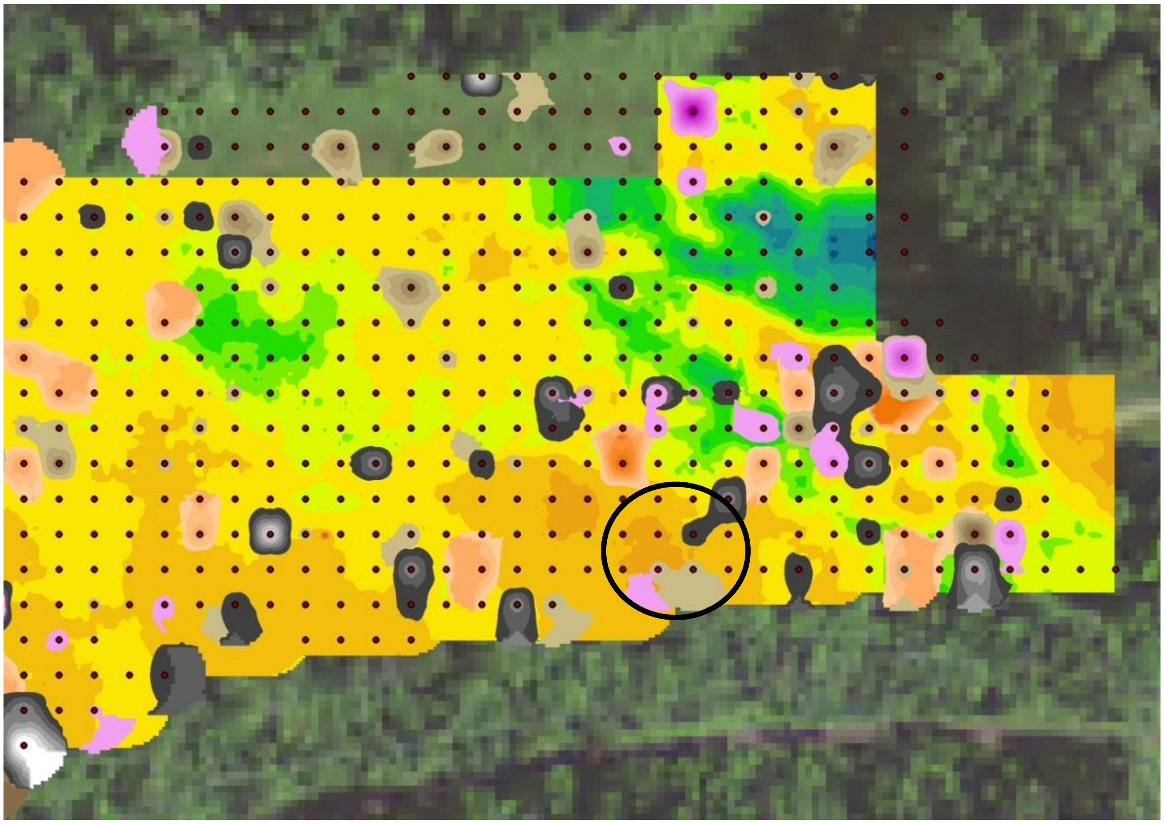


Figure 149 Possible house feature (circled in black) from geophysics overlaid by shovel test density peaks, excluding grit tempered pottery.

The remaining potential house features are all in the eastern area of the village and as such they are more difficult to define due to the enormous quantity of artifact peaks in this area. The potential house feature shown in Figures 146 and 147 is shown circled in black with the artifact density peaks around and on top of it. Figure 146 shows all of the major artifact classes and Figure 147 shows the same except without the grit tempered pottery density peak, which would otherwise lie on top of it.

Much like the previous potential houses, this potential house feature has peaks of every major artifact type in its immediate area and with the exception of grit tempered pottery they all lie just outside of the proposed house. This is the second time so far that a grit tempered pottery peak has been found in exactly the same area as a potential house, but not around it. This could be because the grit tempered pottery was discarded at a different time as the house refuse, before or after.

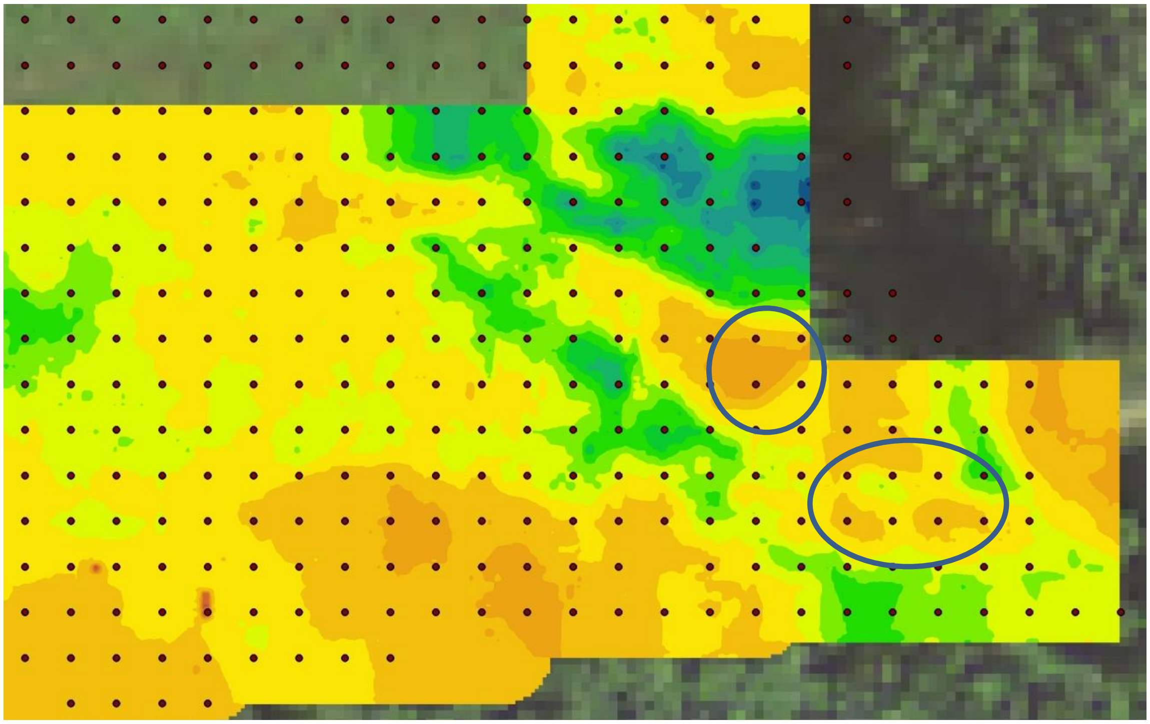


Figure 150 Possible house features, from geophysics, circled in blue.

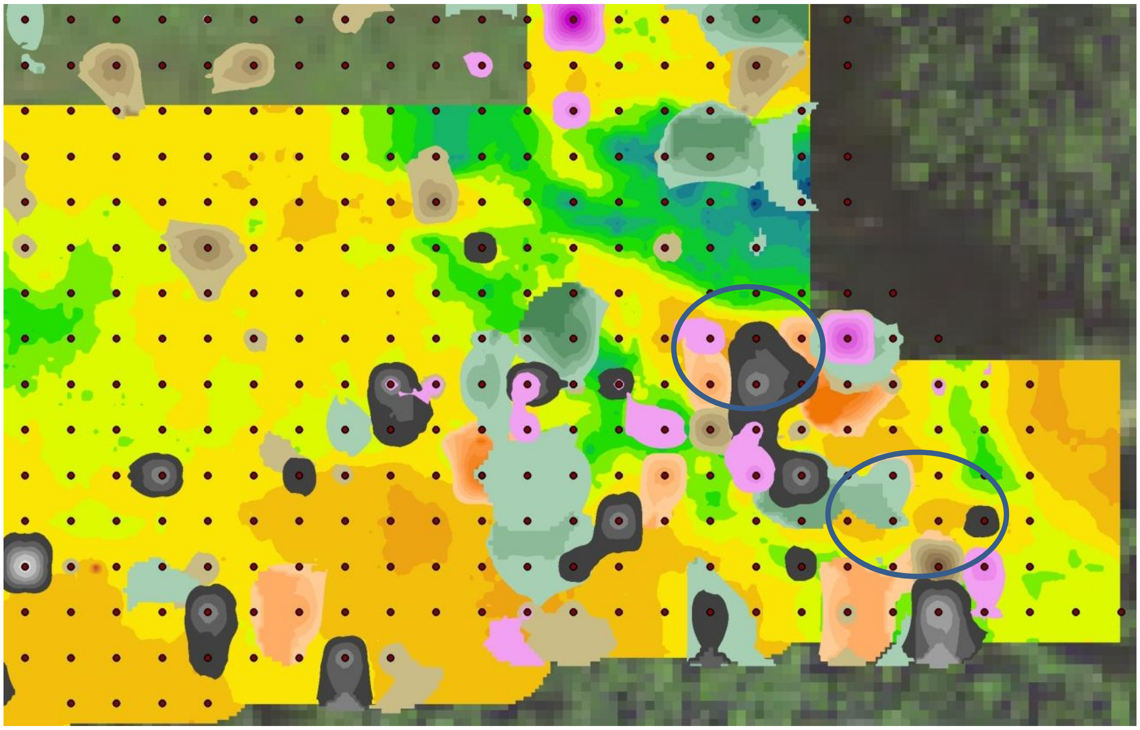


Figure 151 Possible house feature, from geophysics overlaid by shovel test density peaks.

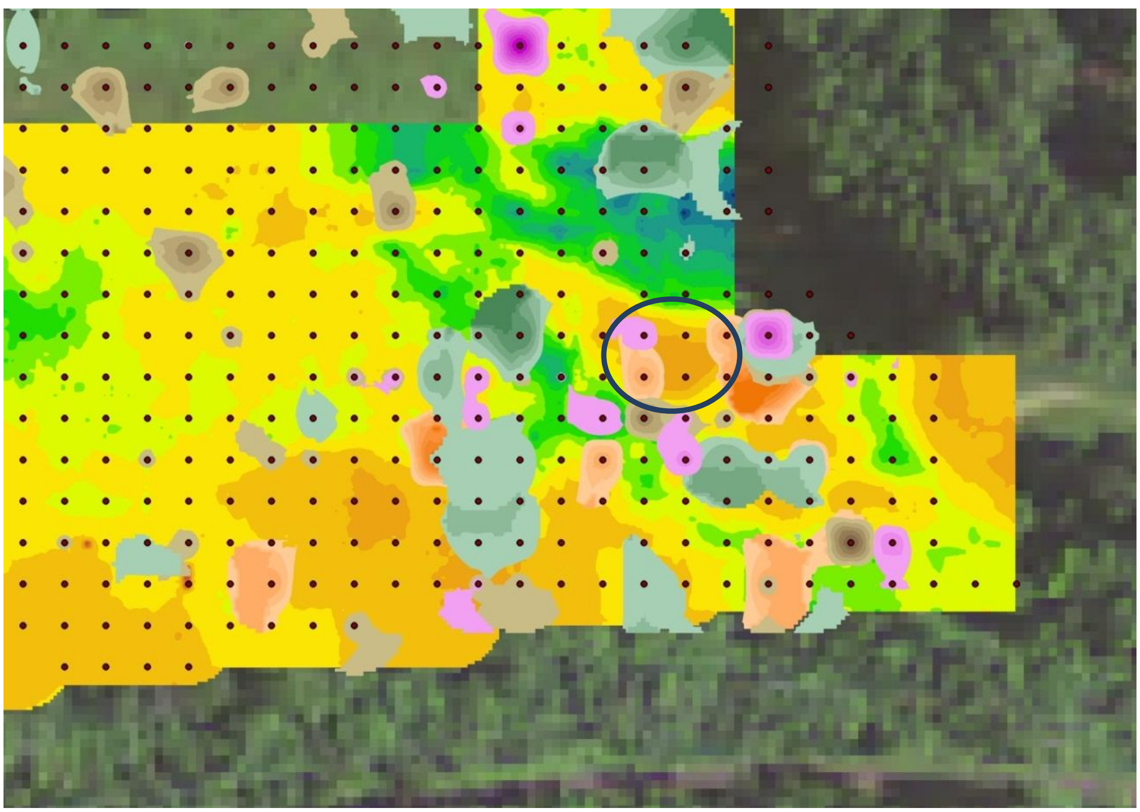


Figure 152 Possible house feature, from geophysics overlaid by shovel test density peaks, exluding pdc

In Figures 150 and 151 several possible house features are shown, circled in blue. In Figure 151 the artifact density peaks are shown on top of the potential house features and the same is shown in Figure 152 with the artifact class ‘PdC’ removed, to help with visibility. In this area there are prodigious numbers of artifact peaks and potential house features. It seems likely that each of these features and their related refuse is blurring the results of its neighbors. There are peaks of every artifact class nearby, however this is somewhat dubious because the entire area is covered with artifact peaks. It seems likely that there are house features in this area but they are difficult to define. The artifact peaks on top of the potential house features may be caused simply by the abundance of activity or by the deposition of refuse, or pits, inside of previously used houses.

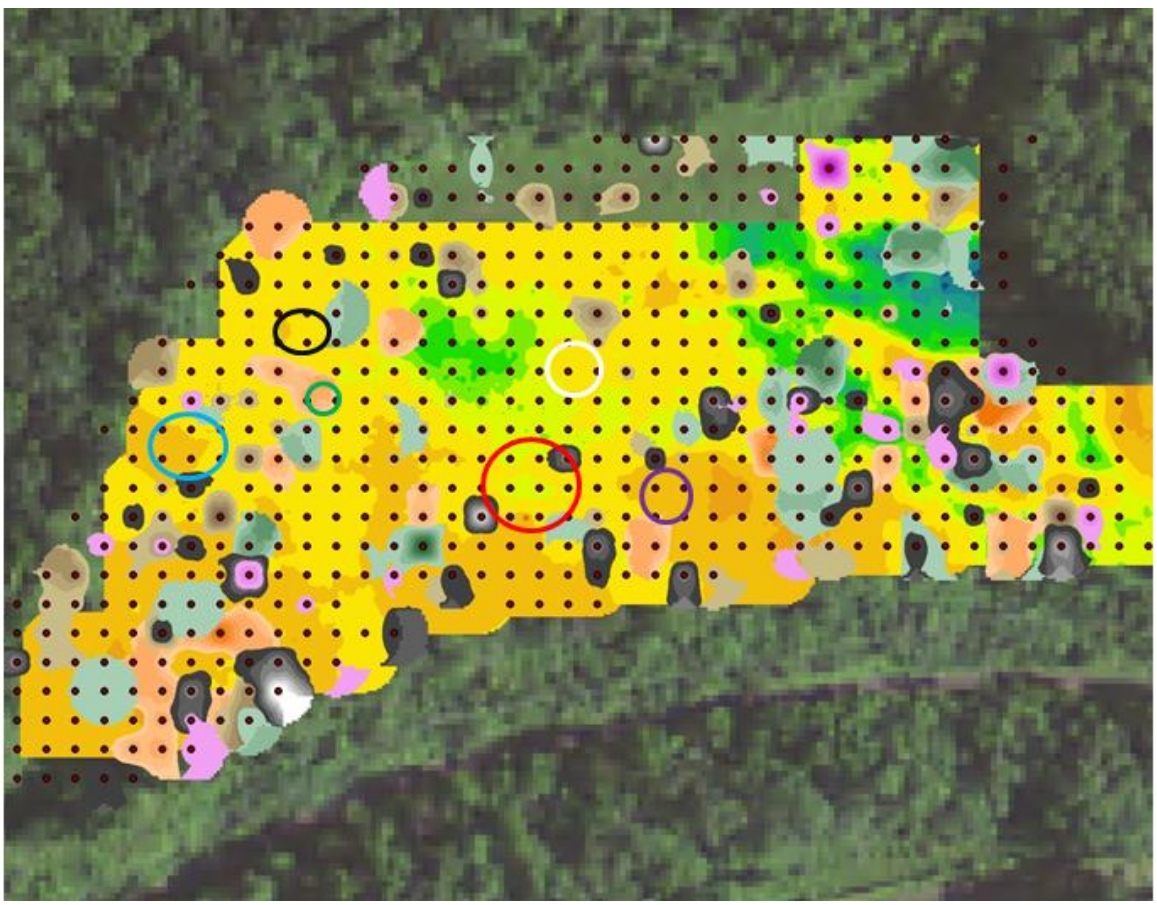


Figure 153 Possible house features from geophysics (circled) with Artifact Peak Density map overlay.

Figure 153 shows six more potential house features, as identified by Dobbs et al. 2003. The feature circled in blue, located on the far eastern edge does have some small nearby artifact clusters. However the proposed geophysical feature and its possibly associated small artifact clusters are suspect because a two-track road goes directly over them and thus somewhat obscures them.

The green circle shows the location that Dobbs et al. 2003 interpreted as possibly being Wilford's 1950 excavations 'in the western part of the field'. The only peak in that area is a small one of Hixton that represents only a small number of flakes. However the lack of very many artifact peaks in this entire area makes it difficult to make a determination. Similar to the other purported Wilford XU, this feature is corroborated by a shovel test that the excavator believed had landed on a 'feature', ST 20-43, though again, this only corroborates that there is in fact a feature there.

The black circled feature has also been disturbed by the two-track trail that runs through the site. There are very few artifact peaks in this area to help us understand the nature of this feature. The purple circled feature may be a house feature and there are several artifact peaks around it. The red and white circled features are in the suspected communal area and thus have very few nearby artifact peaks. The red circled feature was the suspected house feature that prompted the excavation of Block 3. No house was discovered there, though a clay anomaly was found (Ronald Schirmer, personal communication 2012).

The density peaks can be compared to the geophysics as a way to better interpret the features discovered. For example, features such as the house feature pictured in

Figure 141, that have corresponding artifact peaks around it can be more likely termed as 'house features' while a suspected house feature such as the one that led to the excavation of Block 3, which has little or no artifact peaks nearby may be less likely to be a house feature and should be looked at in a different view. It should be noted that this area did contain a few large post-molds, but it remains poorly defined. This idea should be ground-truthed in order to better understand its efficacy.

Kernel Density Estimation

Kernel Density Estimation was also done and it provides similar results though it attempts to predict concentrations more so than does IDW which attempts to more definitely show the data we have. In the IDW maps shown above, each datum point is only being compared to other datum points within 6 meters around its location, this results in precise bull's eye locations of data. In the KDE maps the datum points are being compared to other datum points for 15 meters around; this results in less precise peaks but it may give us a more general understanding of the site. Note that the ranges can be altered for both IDW and KDE; each was tested at many levels and the levels that were eventually selected for each data analyzation technique were chosen because they appear to highlight each technique's individual strengths. In the KDE maps each color represents a different relative amount of artifacts; green is the lowest level and it goes up to yellow, then orange and finally red at the densest locations.

PdC

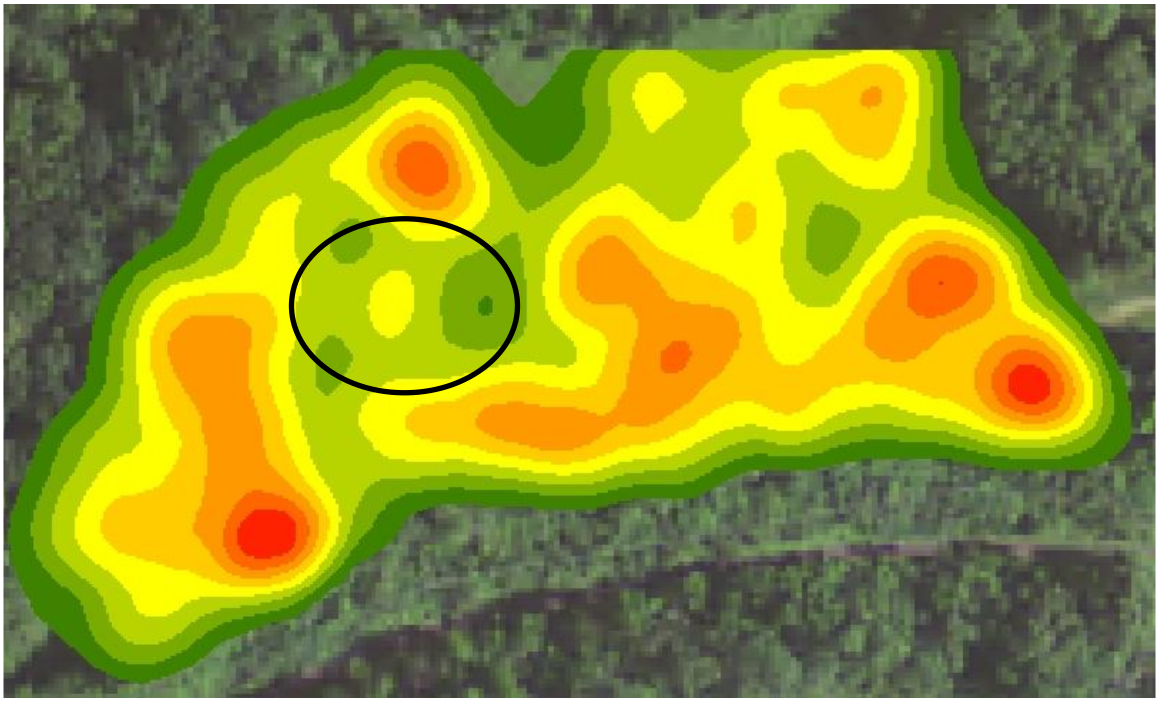


Figure 154 KDE map of PdC count. Communal area circle included.

This technique works well for PdC (Figure 154) since the IDW map shows only a few concentrations. The KDE map shows some large concentrations and gives us an idea of generally where the most PdC is at the site. The southeast and southwest have the largest concentrations with a few spots left with low concentrations; notably the hypothesized communal area circled in black.

Grand Meadow

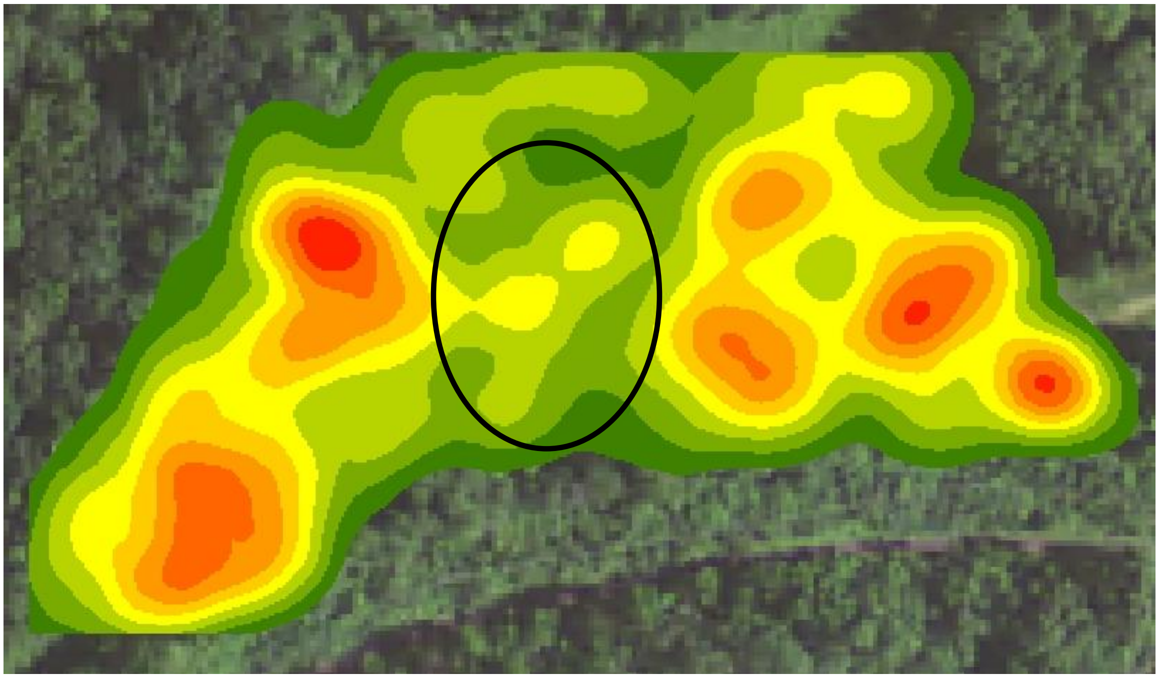


Figure 155 KDE map of Grand Meadow count. Communal area circle included.

The Grand Meadow map (Figure 155) shows concentrations in the east, west, and southwest. The hypothesized communal area is relatively low density and notably the northern section which had several low GM peaks in the IDW map is marked as very low density here.

Hixton

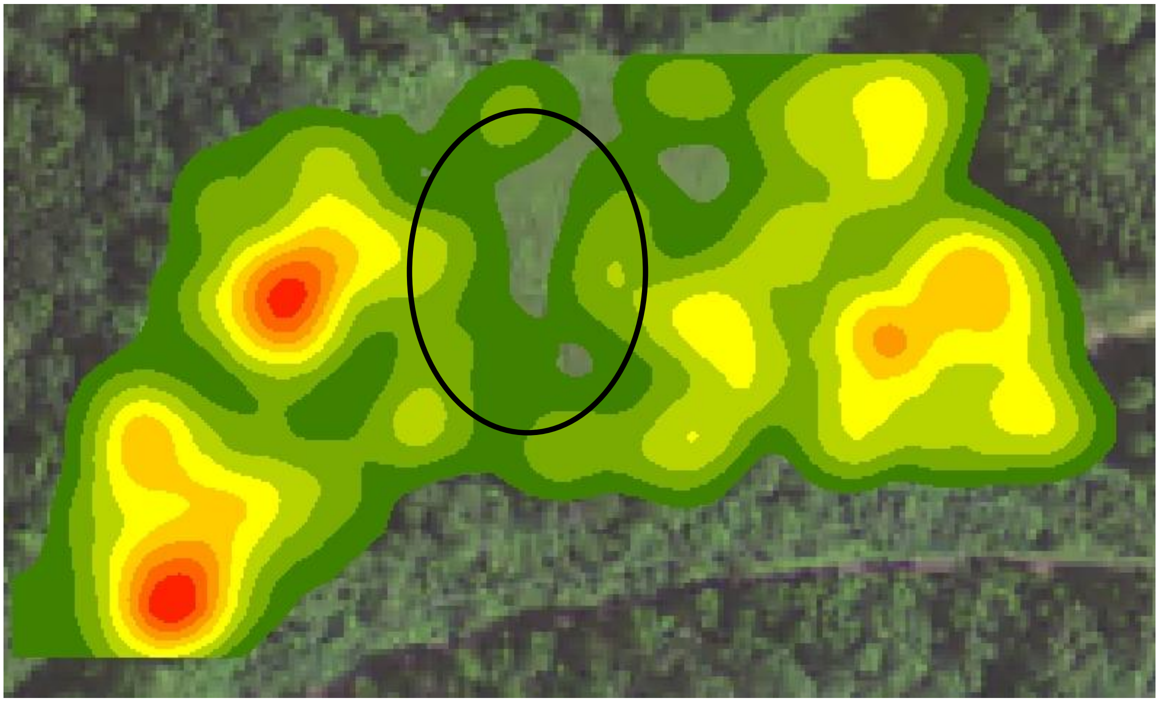


Figure 156 KDE map of Hixton count. Communal area circle included.

The Hixton map (Figure 156) shows the same concentrations as the IDW though it combines the smaller bull’s eyes into larger groupings. There are now two in the east and southeast and a smaller more diffuse one in the east, with no artifacts in the center.

Shell tempered pottery

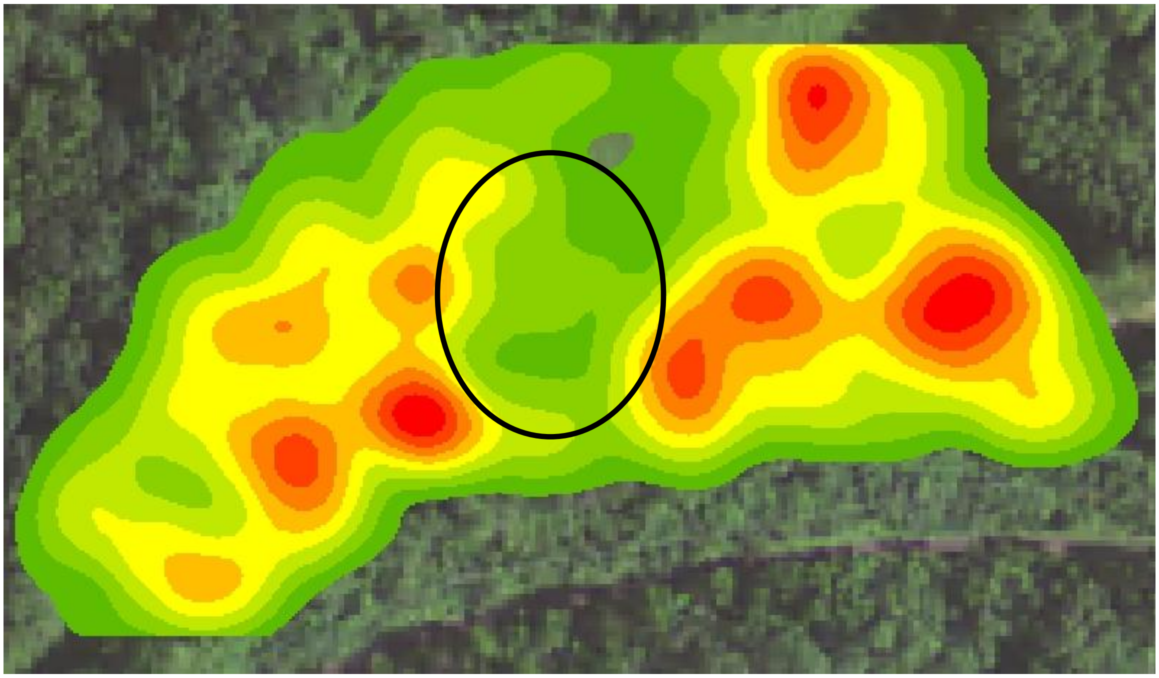


Figure 157 KDE map of Shell Tempered Pottery count. Communal area circle included.

The shell tempered pottery map (Figure 157) shows several large concentrations in the east with a low spot in the middle and a few smaller related concentrations in the west. The central area is left empty of hypothesized peaks. For the most part this follows the pattern shown in the IDW maps yet it makes it clearer, as to the general pattern at the site as a whole.

Grit tempered pottery

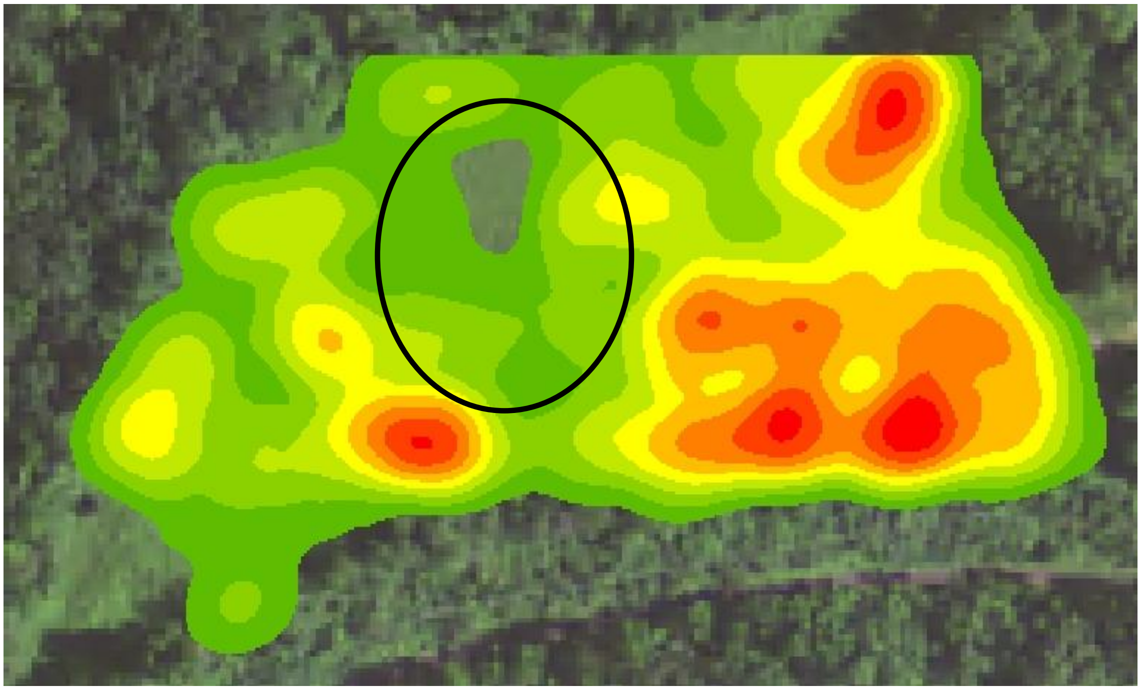


Figure 158 KDE map of Grit Tempered Pottery count. Communal area circle included.

The results of the grit tempered pottery KDE map (Figure 158) are interesting. They show peaks in the same areas but make them clearer as to the whole site. This map shows that the southeastern section of the site has a large concentration of grit tempered pottery with two other concentrations in the northeast and the south central areas of the site. Note the complete lack of artifacts in the southwest and north central. The hypothesized communal area too is relatively free of artifact peaks.

Faunal

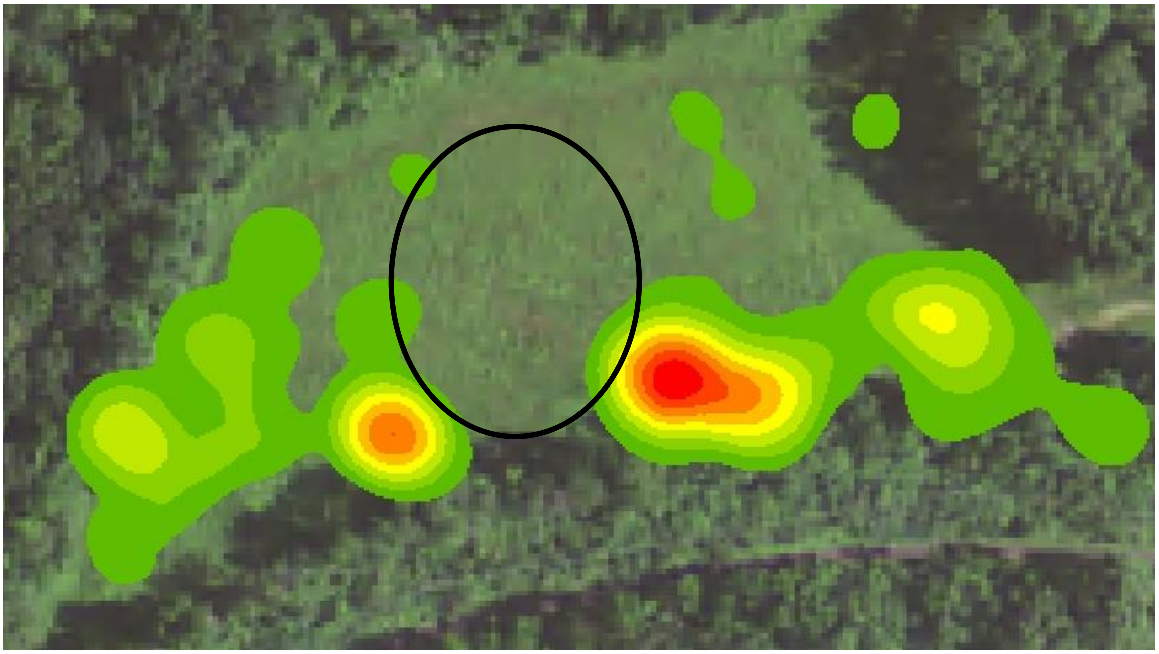


Figure 159 KDE map of Faunal count. Communal area circle included.

As noted in the IDW maps, the faunal concentrations are very low at the site (Figure 159) with very few concentrations at all. The southern area of the sample has some concentrations but the central and northern sections or almost void of faunal artifacts.

Heat treated lithics

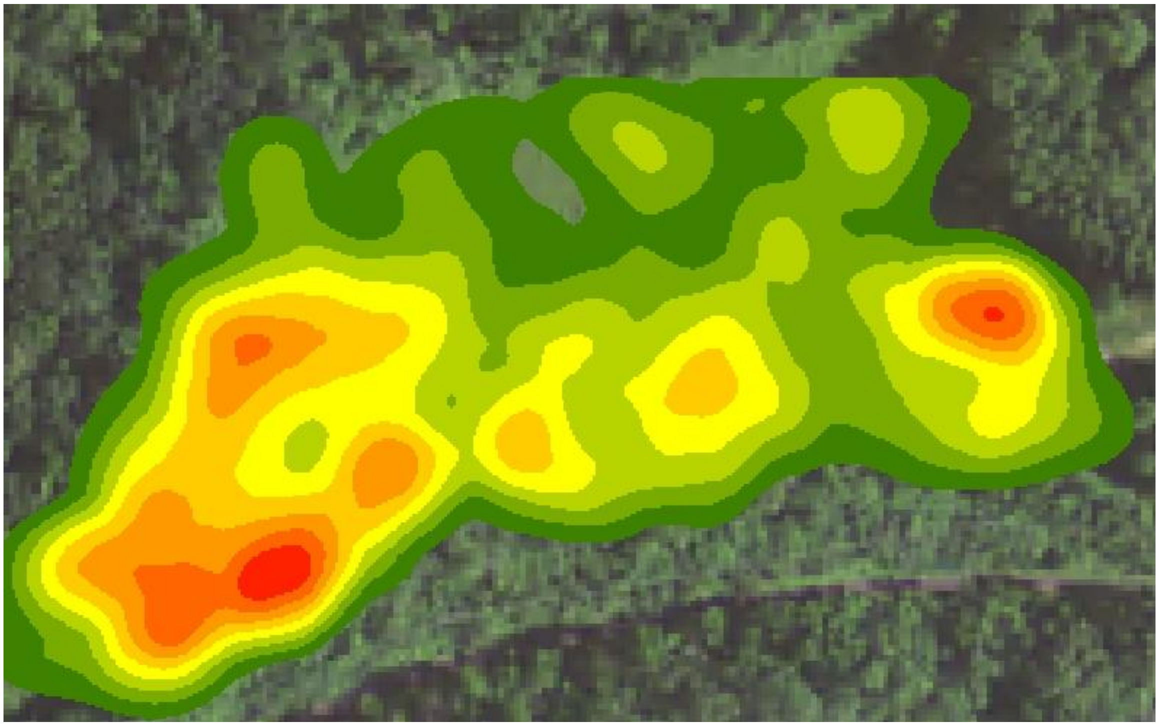


Figure 160 KDE map of Heat Treated Lithics count. Communal area circle included.

The heat treated lithics map is very illuminating (Figure 160). The IDW map gives the impression of a bunch of small aggregations across the site but the KDE map which grouped those small aggregations shows a heavy concentration in the southwestern portion of the site with another smaller one in the east. This is a very interesting result since that section of the site, the southwest, has an almost complete lack of grit tempered pottery.

All artifact peaks

Figure 161 KDE map of Density Peaks. (GRIT=WHITE, GM=BLUE, SHELL =PURPLE, HIXTON=ORANGE, FAUNAL=GREEN, CVC= PINK, PDC=BLACK). Communal area circle included.

This map (Figure 161) shows the peaks of several artifact classes (grit, shell, PdC, GM, Hixton, and Faunal) with the lesser peaks removed. It shows similar results to that of the IDW artifact peak concentration map. It shows that most of the peaks are in the eastern area, though it suggests that the peaks in the southwestern area of the site are more substantial than they appear on the IDW maps. It also leaves gaps in the same places, the large proposed communal area is clear as well as the other area that was circled in the IDW map (Figure 168). However it also shows two gaps that were not shown in the IDW maps. First, the northern central section of the site is bare; though the IDW maps did not show large concentration in this area they did show some, specifically Grand Meadow peaks in this area. There is also a bare section that is not clear in the IDW map; this section is in the eastern central area and it may be another communal area, possibly for the peoples that used grit tempered pottery, though it is also clear of shell tempered peaks.

IDW AND KDE comparison

Figure 162 KDE map of Grit Tempered Pottery (40% transparent) overlain upon IDW Grit Tempered Pottery peak map. Communal area circle included.

Figure 163 KDE map of Grand Meadow (40% transparent) overlain upon IDW Grand Meadow peak map. Communal area circle included.

These maps (Figures 162 and 163) show, in the first map the grit tempered pottery IDW map with the grit tempered pottery KDE map overlaid upon it. The second map shows the same thing with Grand Meadow. This gives an idea of how they are both using the same data just grouping them differently. The maps show large numbers of IDW bull's eye peaks, while the KDE more general site maps take many of the peaks and group them to make fewer, larger, peaks. The KDE maps are made 40% transparent so that both maps can be viewed simultaneously.

GIS point maps

In this section GIS maps are made that show the exact placement of various artifacts, rather than the fuzzy concentration comparisons shown in the previous section. The maps in the previous section dealt with general concentrations of artifacts, such as all shell tempered pottery or all Grand Meadow Chert. In this section the maps show more specific artifacts, such as shell tempered rolled rims, or end scrapers. The goal is the same, to show various activity areas, or lack thereof.

Grit Tempered Rims

Figure 164 Grit tempered rims. Note: on east side two rims were found in one ST so one is not visible. Communal area circle included.

Figure 164 shows the shovel tests that contained grit tempered rims. There were only 12 grit tempered rims found in the shovel tests; eight on the east side and four on the western side of the sampled area (east and west are set arbitrarily at the 180 line, roughly in the center). With such a small sample it is difficult to make generalizations about the site but there are more grit tempered rims on the eastern side of the site, suggesting that the habitation of the people that used grit tempered pottery was primarily focused there or at least that the pottery utilization areas were there. Note: There is also one grit/shell rim not shown, it is in the eastern area.

Shell Tempered Rims

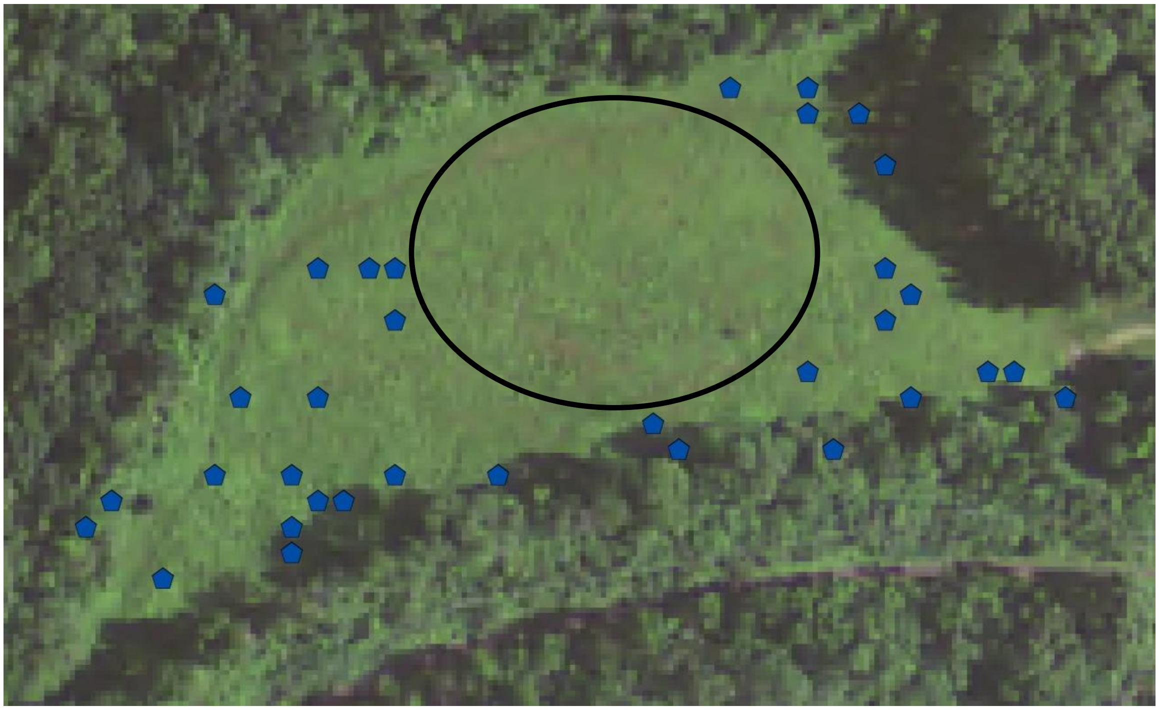


Figure 165 Shell tempered rims. Note: Several rims found in the same spots are not visible. Communal area circle included.

Figure 165 shows the locations of the shell tempered rims in the sample area. There are 16 shell tempered rims on the eastern part of the site and 20 on the west. The map shows either one concentration of rims on the far eastern edge and another in the southwestern section or shell tempered rims arranged, albeit distantly, around a central communal area. As with the grit tempered pottery this distribution could be indicative of the areas of habitation or simply of differential locations of resource use (i.e. pottery being used or created in these areas while other activities go on in other parts of the site).

Rolled Rims/Unmodified Rims

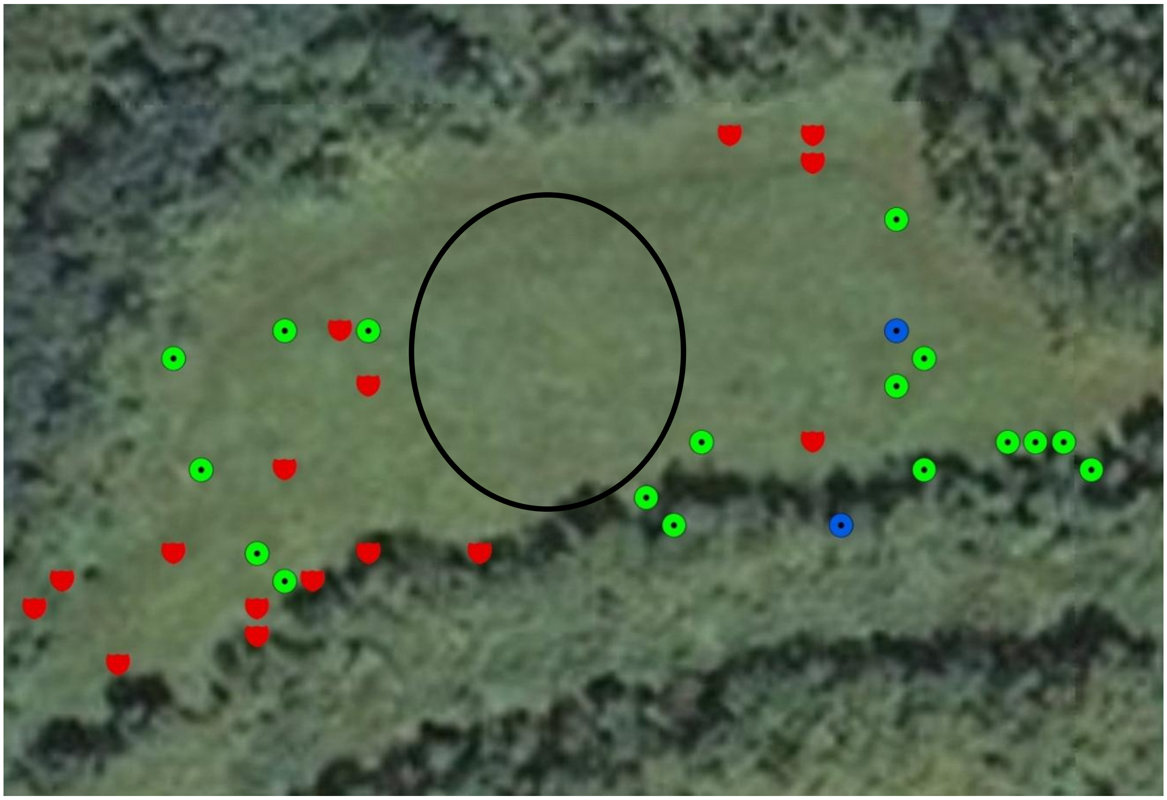


Figure 166 Rolled rims compared to non-rolled rims. Note: There are several locations with multiple rims. Communal area circle included.

Figure 166 shows the placement of rolled rims compared to non-rolled rims. The green dots show rolled rims and the blue dots show modified rims that may be rolled. The red shields show rims that are not rolled. Only the shell tempered rims are shown here, with the exception of two of the rolled rims on the eastern side that are grit tempered. There are 13 rolled/modified rims on the east and six rolled rims on the west. The eastern area also contains five non rolled rims and the western contains 14. Though not a large sample there are more rolled rims on the eastern side than there are on the west and this is corroborated by the excavation units, though not with such dramatic results (Table 6).

Blocks	West	2	3	4	1
Count	2	16	13	6	3
Per XU	0.73	0.64	0.43	0.85	1

Table 6 Amounts of rolled rims per block, shown as number per XU.

Table 6 shows similar results when compared with the ST's. Block Central is not shown because it is such a small sample, though one rolled rim was found. Block East is also not shown for similar reasons, it contains no rolled rims in the XU's though much of the XU's are taken up by two features. The features have not been fully analyzed but there is already one large rolled rim vessel found, shown in Figure 7. The blocks shown in the table generally mimic the ST's. The Western Block, Block 4, and Block 1, are all in areas with comparatively large amounts of rolled rims, as shown in the ST grid. Block 2 and Block 3 are in areas shown with little or no rolled rims. Once the features are fully analyzed from all of the blocks then better comparisons can be made.

There are two sections where rolled rims are found, a large concentration in the southeast and a smaller collection spread out on the western side. The non-rolled rims appear to be more located in the southwestern area of the site with a smaller concentration of four rims in the northeast. This map may be showing the locations of different neighborhoods (two different groups or subgroups living around a communal area). It is believed by some that rolled rims are older in time in this area than more high rim Oneota-like rims, so this also may be showing different occupations at different times, either by the same group of people changing over time or by a different group of people.

Grit Tempered Shoulders

Figure 167 Grit tempered shoulders. Communal area circle included.

Grit tempered shoulders are shown in Figure 167 there are 16 on the eastern side and only seven on the west. Most of them are located in one area to the southeast/southcentral.

Shell Tempered Shoulders

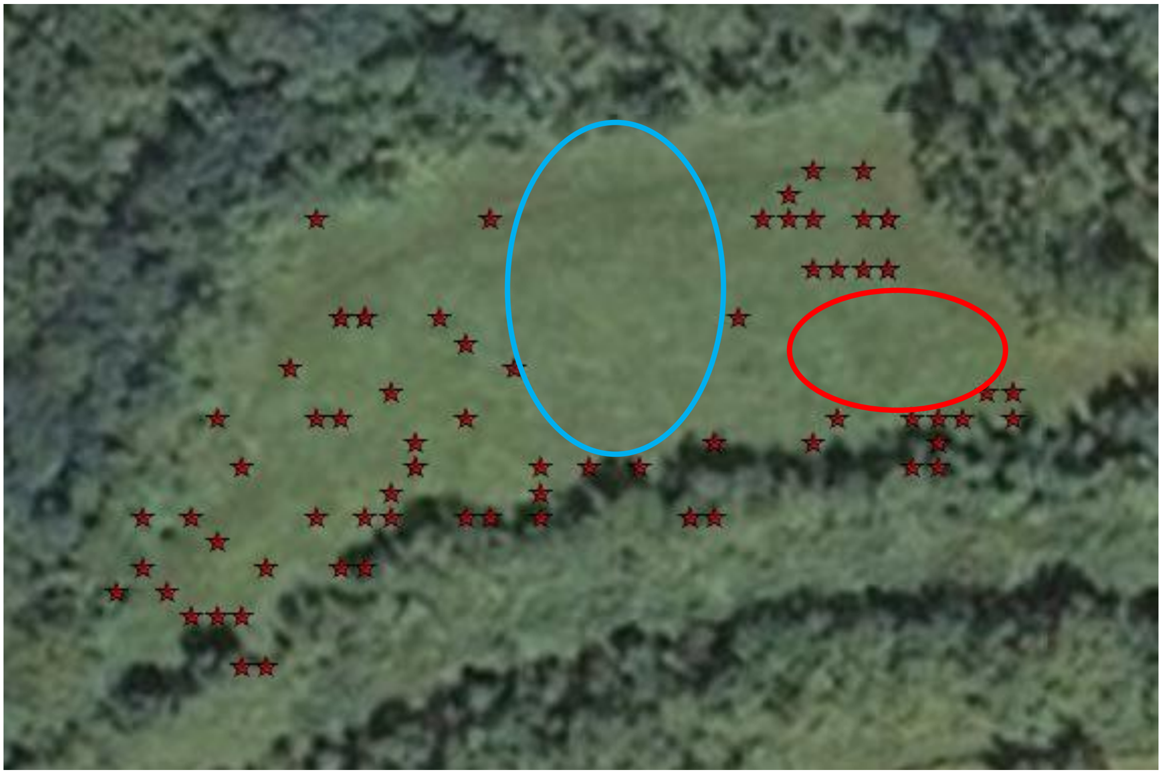


Figure 168 Shell tempered shoulders. Artifact free zones circled.

Shell tempered shoulders are shown in Figure 168. There are 35 on the east and 45 on the west (there is also one grit/shell on the east, though not shown above). The previously mentioned possible communal area of the site is very visible in this figure (shown with blue circle). There is also another blank area shown (circled in red) with concentrations shown above and below.

Decorated Grit Tempered Pottery

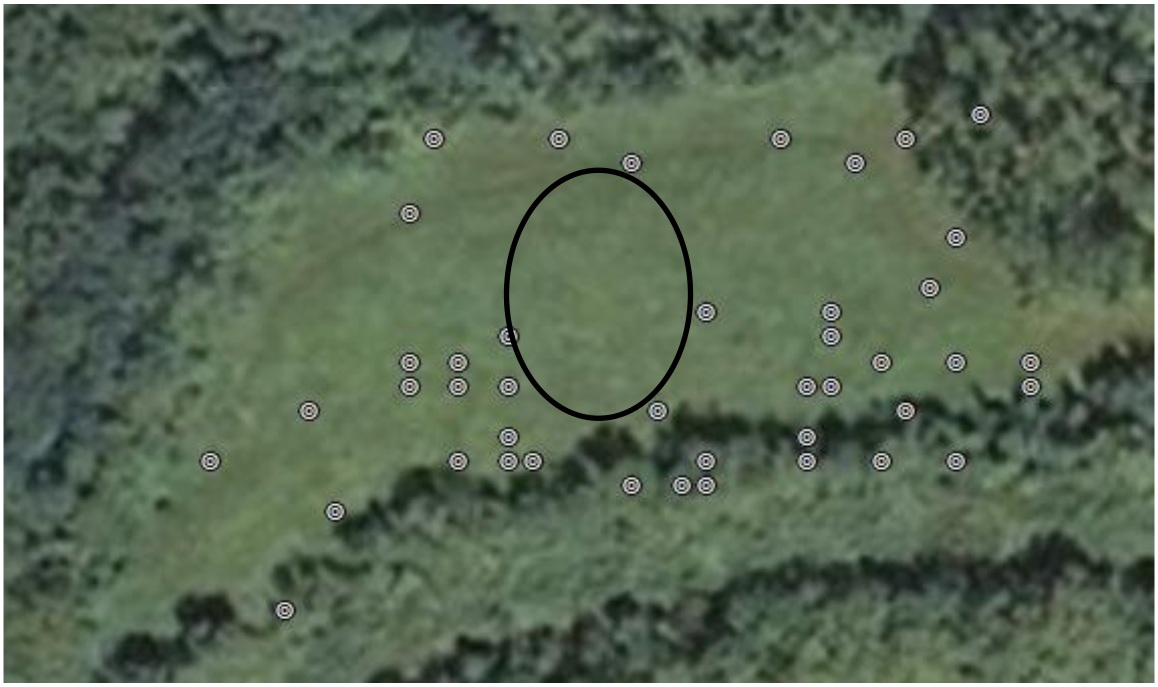


Figure 169 Decorated grit tempered pottery. Communal area circle included.

Figure 169 shows decorated grit tempered pottery in the sample area. There are 26 grit pieces in the east and 18 in the west. This generally follows the trend of more grit tempered pottery in the east, and particularly in the southeast, where there is a large concentration that matches the grit tempered shoulders.

Decorated Shell Tempered Pottery

Figure 170 Decorated shell tempered pottery.

The decorated shell tempered pottery is shown in Figure 170. There are 43 in the east and 61 in the west, with a larger concentration in the southwest area. The decorated shell tempered pottery is spread across the site more evenly than most other artifacts, though concentrations and lack thereof are visible. The central, proposed communal area has a more sparse concentration and the same area that was empty in the shell tempered shoulders (Figure 168) is nearly empty in the decorated pottery (shown circled in blue, with only two pieces of shell tempered decorated pottery in the area.

Tools

Figure 171 Tools. Communal area circle included.

Figure 171 shows the locations of all tools in the sample area, including retouched flakes and more formal tools. The proposed central communal area has very few tools. Also the area that is blank in the shell tempered shoulders (Figure 168) and nearly blank in the shell tempered decorated pieces (Figure 170) have only a few tools. The southwestern area is also very sparsely populated with tools. There are 54 in the east and 48 in the west.

Selected Tools

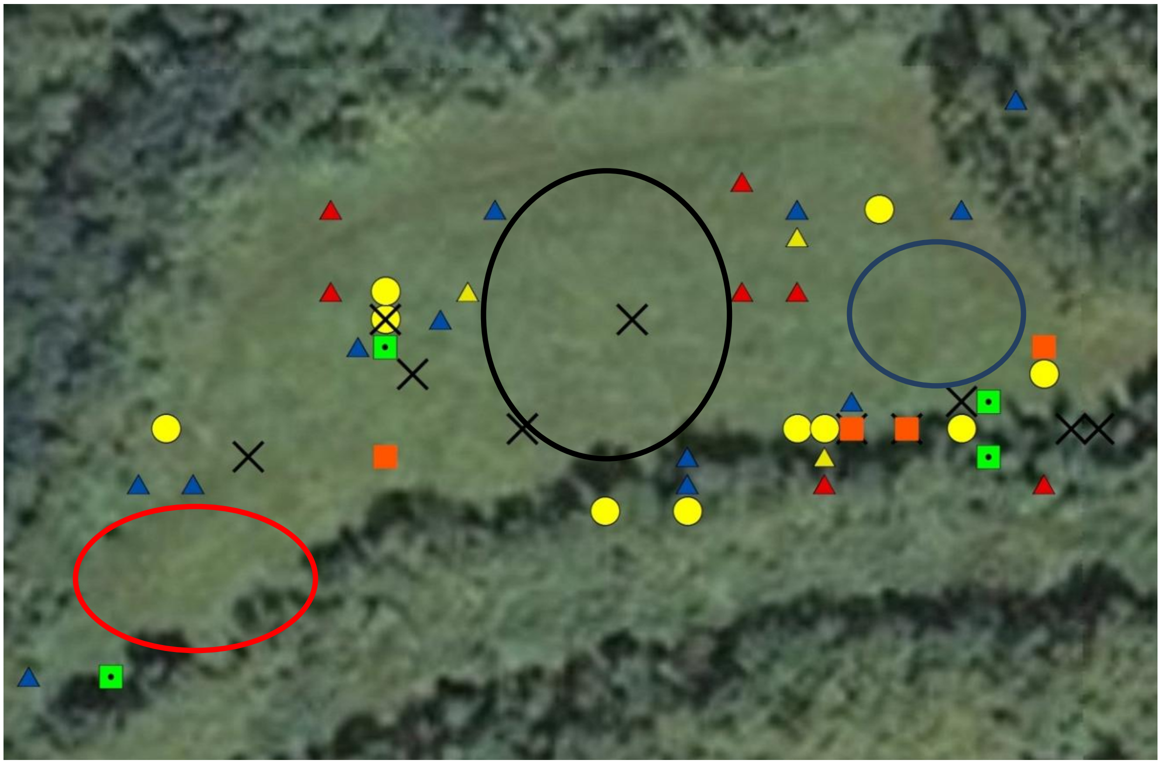


Figure 172 Selected tools. Artifact free zones circled. Communal area circle included.

The most prevalent formal tool types are shown in Figure 172 There are four End Scrapers (shown as green squares), 13 Blades (shown as black X's, several are in the same ST's), four sandstone shaft abraders (shown as orange squares), and 11 Scrapers (shown as yellow circles). There are also 23 total projectile points: three Side Notched Projectile Points (shown as yellow triangles), 12 Un-Notched Projectile Points (shown as blue triangles), and eight broken tips of Projectile Points (shown as red triangles).

The proposed communal area in the center of the site is completely empty of formal tools except for two Blades. The blank area in the east central is shown (circled in blue), this matches the blank area shown in previous figures. There is also another blank area in the southwest section of the site (shown as red circle). This area is devoid of formal tools but it has lots of shell tempered shoulders and rims (Figures 166 and168).

There are also very few pieces of grit tempered pottery in this section of the sampled area so it may be an area mostly devoted to shell tempered pottery, possibly a differential utilization area. This area may also be useful for testing in the future since it is likely that there is less mixing of different occupations, due to the lack of much grit tempered pottery

Areas Nearly Empty of Diagnostics

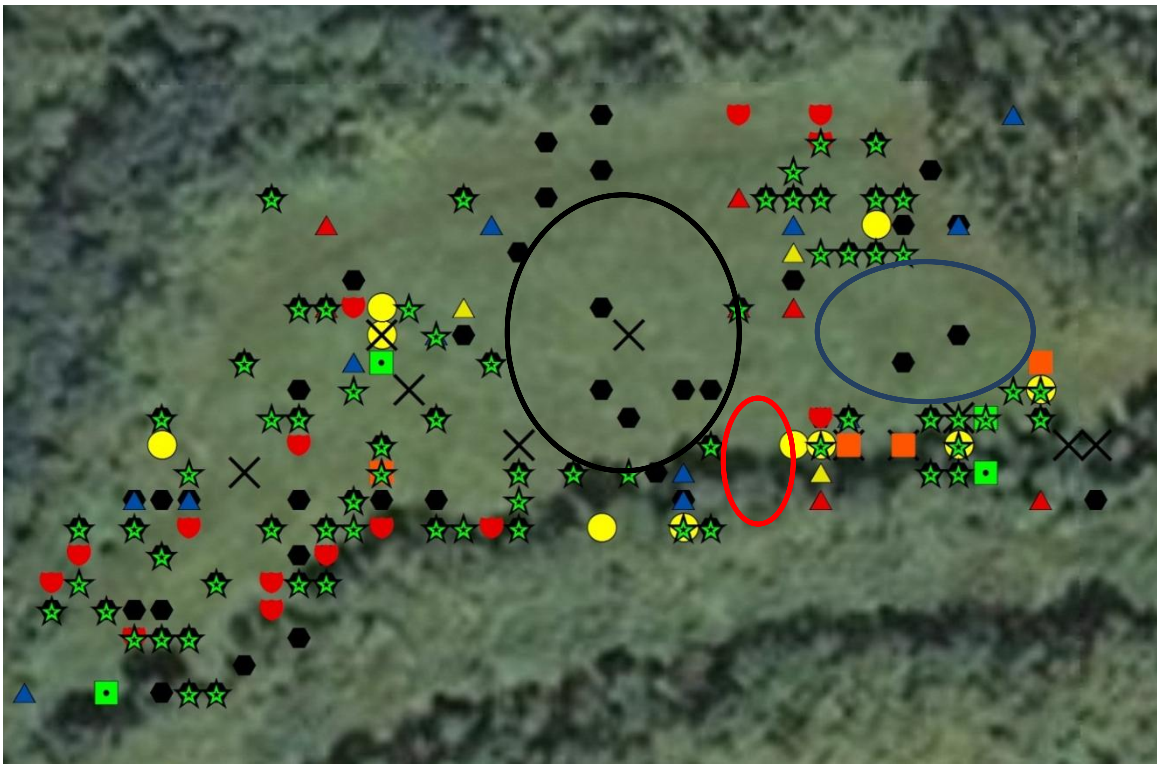


Figure 173 Selection of artifacts: Diagnostic tools, Shell tempered shoulders, decorated shell tempered pottery, and Shell tempered rims without rolled rims. Nearly empty areas circled.

Figure 173 shows several groups of artifacts overlain upon each other. There are several large concentrations of artifacts as well as relatively sparsely populated areas. The proposed communal area in the center of the site has very few artifacts. The area with the least amount of these types of artifacts (shown with a blue circle) is in the eastern central area. Note: There are pieces of decorated grit tempered pottery and grit tempered shoulders in the circled area. There are also three rolled rims (one of which is shown as a decorated piece) in the blue circled area.

Plowing Effects on ST Data

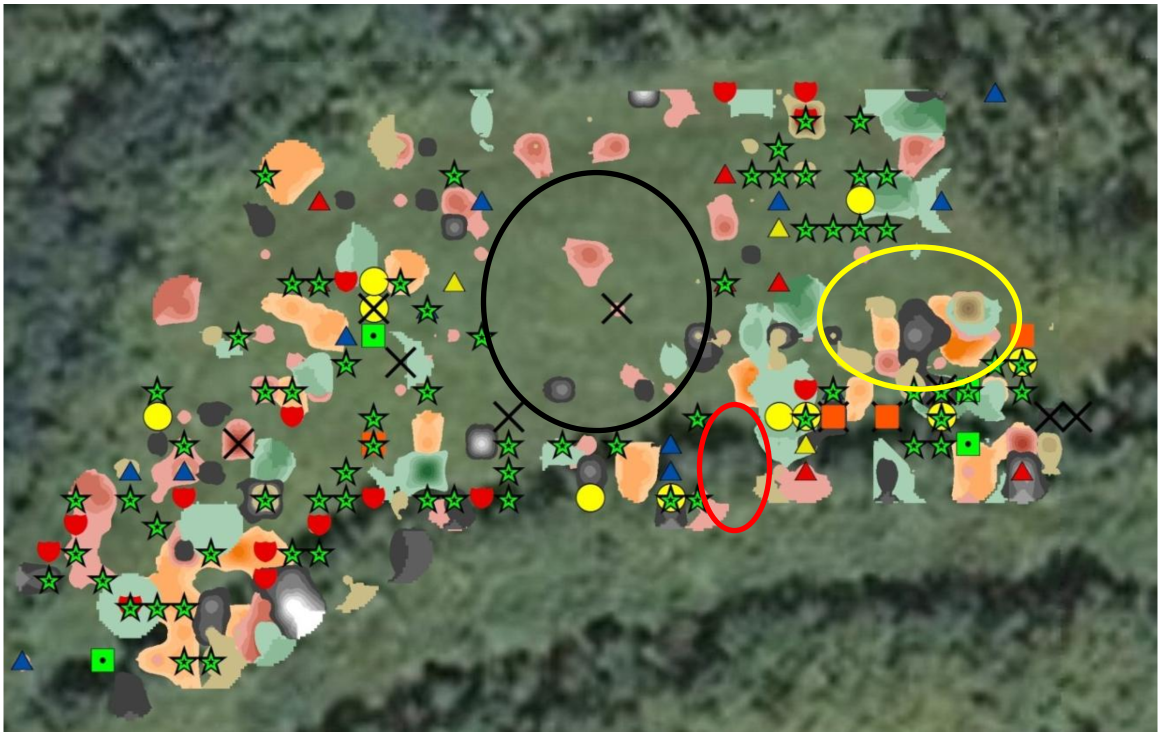


Figure 174 Several groups of artifacts shown overlain upon the IDW artifact peak maps. Circled areas.

Figure 174 shows the groups of specific artifacts (shell tempered shoulders, shell tempered rims, and diagnostic tools) overlain upon the artifact peak maps. The results are intriguing. The artifact peak maps show some of the largest concentrations of general artifacts (i.e. shell tempered pottery) are inside of the diagnostic tool, rim, and shoulder free zone (shown as a yellow oval). When looked at in this way the different data sets seem to run counter to each other. But once the topography of the area is taken into account it becomes clearer. The red circled area shown in Figures 173 and 174 is smaller, but there are very few artifacts and based on other information, it may be the location of either Christina Harrison's units or one of Wilford's, or both.

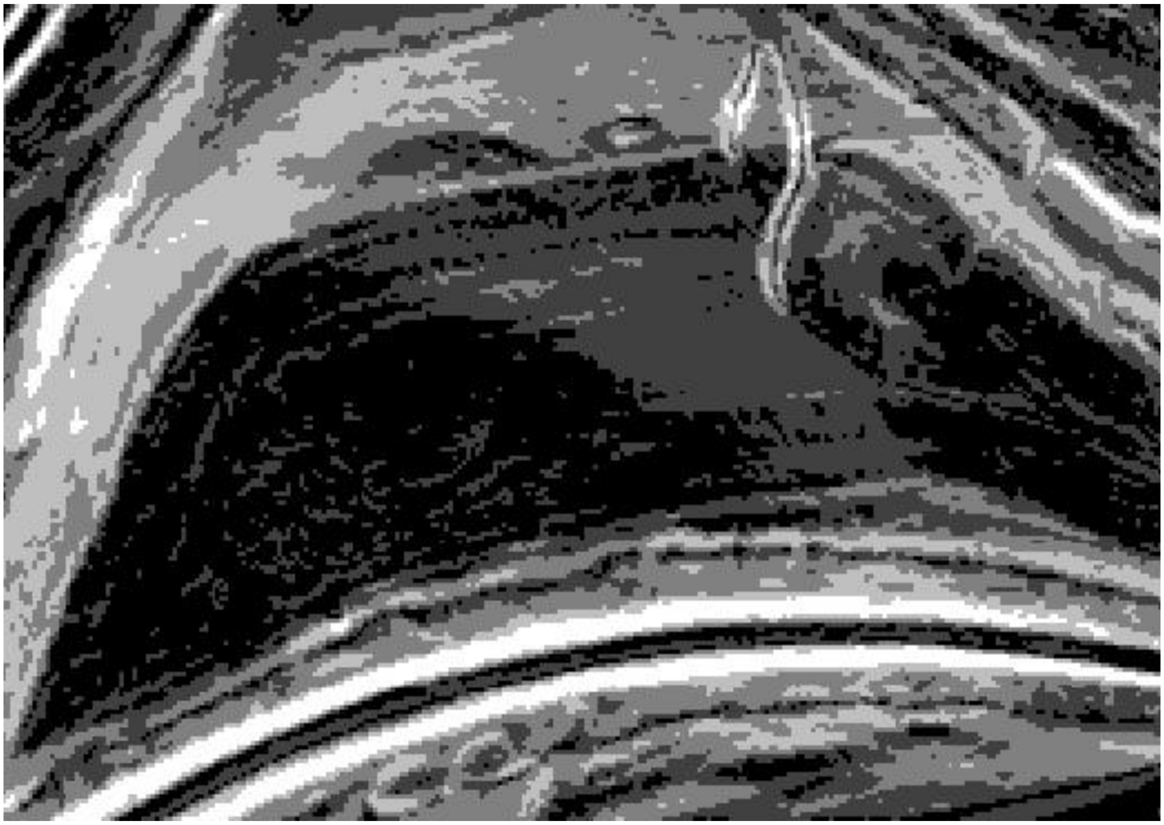


Figure 175 Map showing the slope of the Silvernale Site.

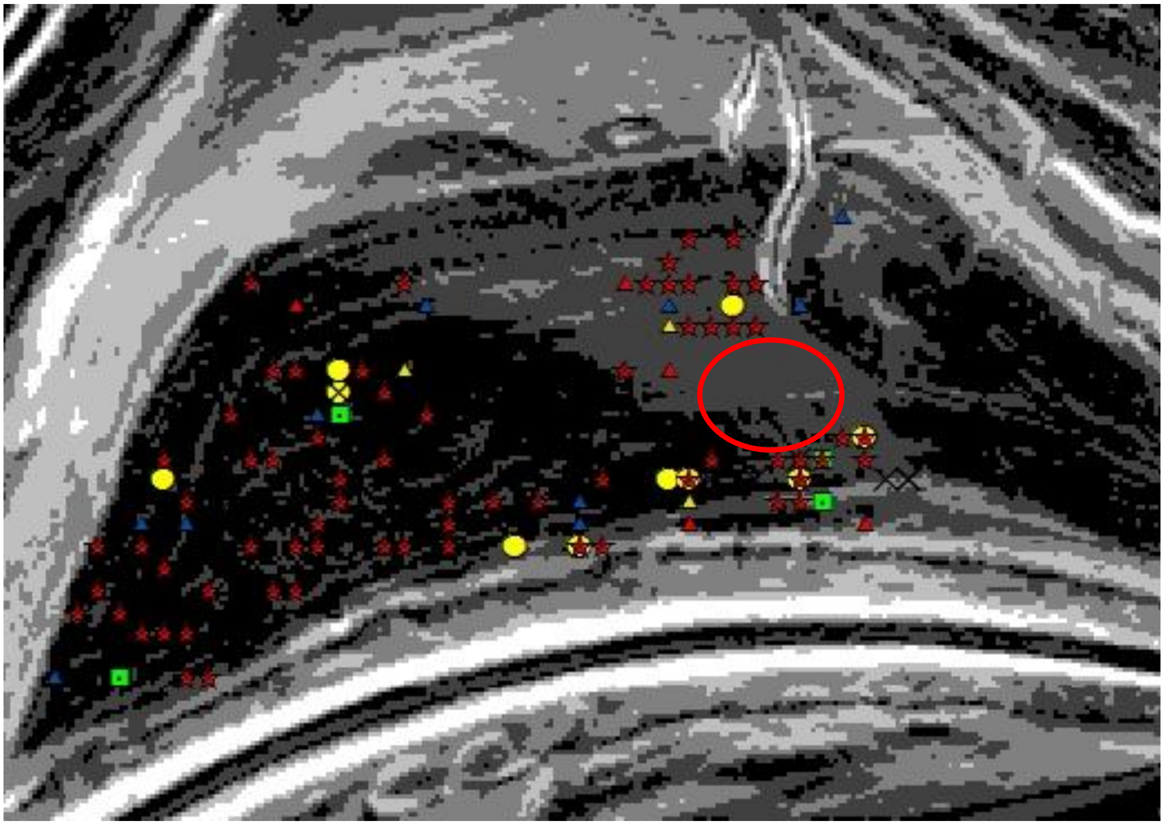


Figure 176 Map showing the slope of the Silvernale Site with shell tempered shoulders and tools overlain to show blank area.

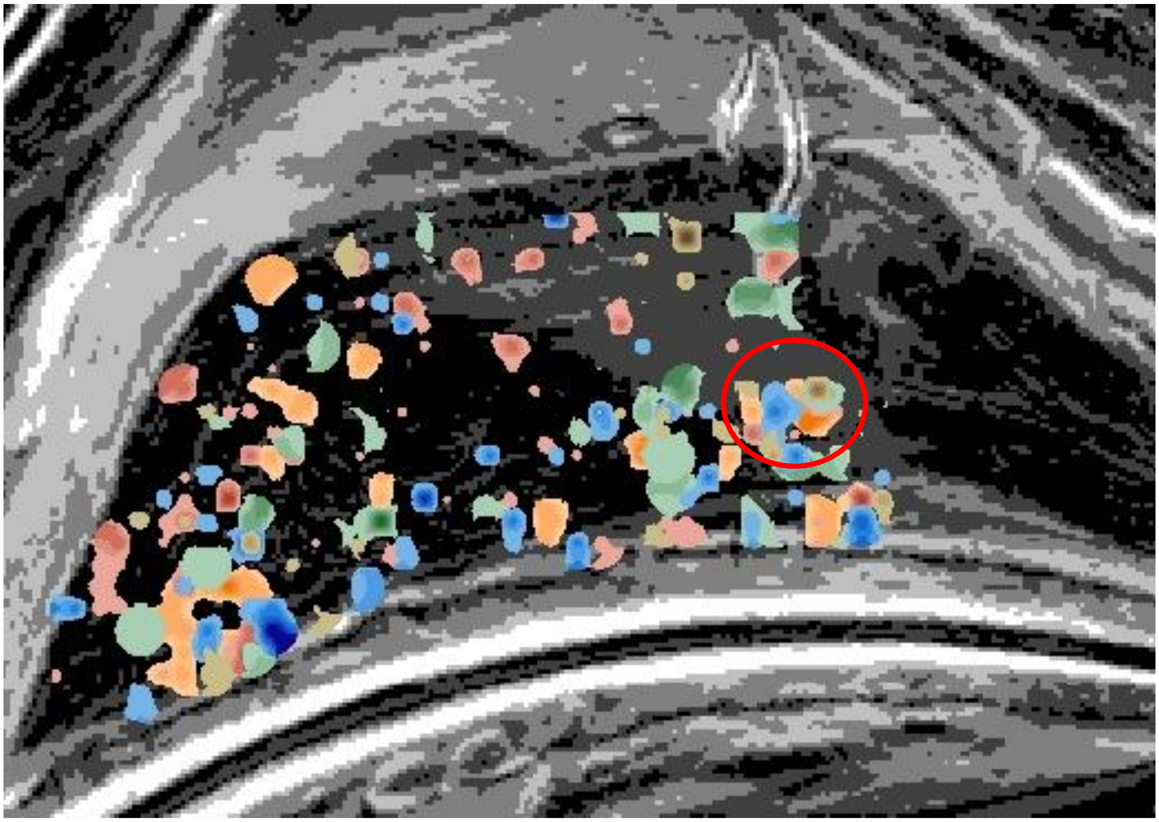


Figure 177 Map showing the slope of the Silvernale Site with artifact density peak map overlain to show blank area.

Figure 175 shows the slope of the Silvernale site. The darker the area the less slope, and the lighter the area the more slope. The shovel tests were placed uniformly across the site, however most of the ground surface that was shovel tested ended up being more level, though the northeast section is on a more sloping ground surface. In the area that is shown as blank in the previous figures there appears to be an increase in the slope (Figure 176, shown with red circle). Since most of the diagnostic artifacts are outside of this blank area it may be another communal area. If it is assumed to be a communal area then the general artifact peaks (Figure 177, shown with red circle) that are in this area may be a result of this change in elevation. It may be that plowing along with natural processes over time resulted in many of the artifacts being moved into this low area from the artifact heavy areas to the south/southwest.

Geophysics Comparison

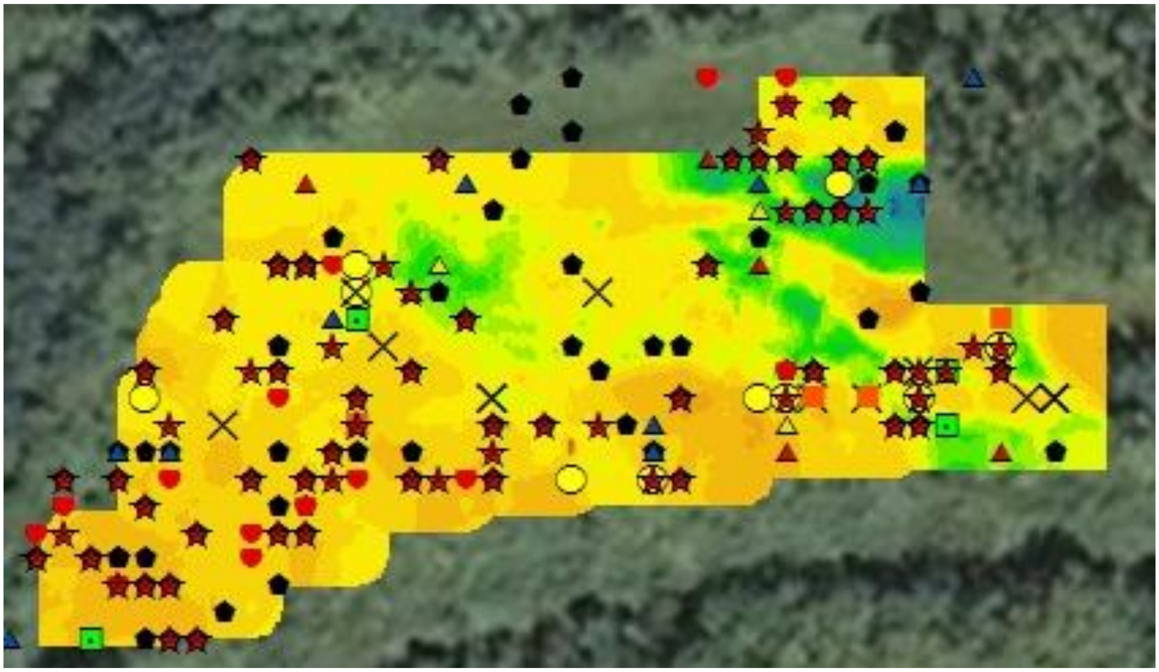


Figure 178 Geophysical map shown with diagnostic artifacts overlain upon it.

Figures 178 and 179 show the geophysical map with diagnostic artifacts overlain upon it. Figure 179 shows circles around identified suspected house features at the site. Many of the suspected house features, when looked at with the diagnostic artifact maps overlain, show blank areas with diagnostic artifacts all around them. Some of them show blank areas with no diagnostic artifacts nearby or a limited amount. These results are similar to the IDW artifact peak maps, though not exactly the same. Besides the geophysical pinpointed house features, there are other areas on these maps that appear to follow the same pattern (blank areas with heavy concentrations around them. Using these techniques along with the geophysics could help to obtain a better idea of what is below the surface. It seems likely that the 'house features' as pinpointed by geophysics could be corroborated by these methods. For example, features that are suspected using both techniques are much more likely to be house features whereas potential house features pinpointed by only one method may be more suspect.

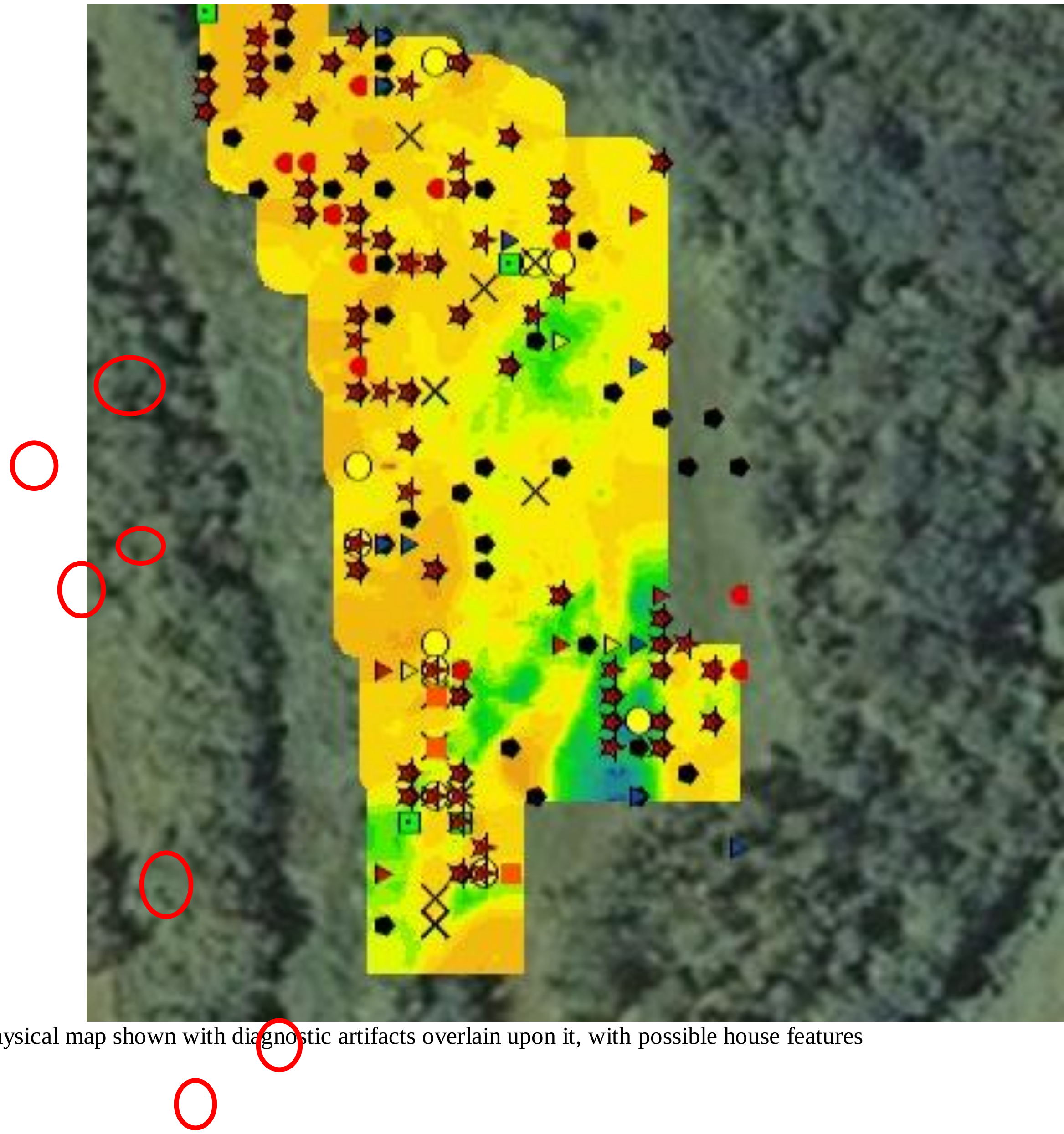


Figure 179 Geophysical map shown with diagnostic artifacts overlain upon it, with possible house features circled.

Proposed Communal Area

Figure 180 Communal area circles for KDE maps (with arrow indicating most defined communal area).

Areas with low artifact density have been circled throughout the Arch GIS portion of this thesis. Many of the circles are in slightly different locations. If these areas of low artifact density are indicative of a communal area then it would make sense for several reasons that the size of the communal area would appear to differ by artifact class. First, artifacts are differentially used in different areas of the site, so this would have an effect on the apparent size of the communal area. Second, since what is proposed here is not a defined, Mississippian type communal area, then it would make sense that the size and dimensions of the communal space would change over time. Finally, since it is in a plowed field the edges would likely appear fuzzy.

In Figure 180 the circles from the individual artifact classes are overlain upon each other. The only circles shown in this map are from the Kernel Density Estimation maps (though the other maps show similar results). The first thing apparent in this map are that the circles overlap to a large degree. There is one space in the center, indicated by the red arrow, which is a part of all of the KDE maps. This area is placed from approximately 165 meters east to 185 meters east; and 105 meters north to 125 meters north. This area is not necessarily the entire communal area but just the most defined version of it. Block 3, which contained considerably fewer artifacts and features than the other blocks, is located just a few meters to the south of this defined artifact less dense area. Future excavations might be done in this location to help get a better understanding of this proposed communal area.

CHAPTER 6: CONCLUSION

The purpose of this thesis has been to attempt to study intra-site patterning at the Silvernale site. This includes determining site boundaries as well as noting patterns in the data across the sample area at the site that may indicate the locations of previous excavations, the presence/absence of a communal area, locate different occupations or neighborhoods at the site, as well as differential resource utilization areas. The methodology of this thesis was to use advanced computer programs to study the results of an extensive shovel test grid initiated as part of a long term site study program.

In order to gain a general site profile the total shovel test artifact assemblage was compared to the total assemblage of the excavation units. Similarly, in order to test the efficacy of the shovel test data, individual blocks of excavation units were compared with data from the shovel tests that were excavated in the nearby areas of the blocks. Since the shovel tests were only excavated to the base of the plow-zone, the data from the excavation units were split into plow-zone and sub-plow zone section to allow for better comparisons.

We can conclude from these exercises that the shovel test data is reflective of the materials in the plow-zone at the Silvernale site, particularly when individual areas are studied, such as the area around a block. We can also conclude that the plow-zone materials give a somewhat accurate depiction of the materials below the plow-zone, though there are differences, particularly in respect to grit tempered pottery. Also, it appears that those features that have been truncated by plowing activities do not significantly alter the artifact composition of the plow-zone to a degree that would make it possible to specifically pinpoint features or describe their contents based on shovel test data alone.

In an attempt to study the spatial patterning of the Silvernale site, the artifact data were input into a GIS program. General material types (i.e. Grand Meadow Chert or Shell tempered pottery) were spatially studied individually and compared to one another. Specific diagnostic artifacts (i.e. end scrapers or rolled rims) were similarly compared and contrasted spatially. These were done in order to discover spatial patterning, neighborhoods, resource utilization areas, etc.

There are many conclusions that can be drawn from the comparison of these data sets. The first is that there appears to be a large communal area in the center of the sampled site. In this area there are considerably fewer total artifacts, as well as fewer diagnostic artifacts. This is corroborated by the data from Block 3, which is inside of this proposed communal area. If this is a communal area then it is not one in the sense of a Mississippian plaza, which is usually rectangular, clearly demarcated, and often clay capped. The proposed communal area at Silvernale is clearly visible in the maps of nearly every artifact class. It appears to be circular, with somewhat amorphous edges, which may have changed through time.

There also may be another smaller communal area in the eastern central area of the village. The nature of this possible communal area is unknown, though the edges of this artifact poor area appear to be more clearly defined than the large central communal area. There is an intrusion of artifacts in the southern section of this area though the artifacts may have been moved through plowing processes since it is in somewhat of a depression. The depositional processes in this area need to be studied to gain a better understanding of what is going on here.

Some of the artifacts types are clearly in different locations at the site. There is more grit tempered pottery in the eastern section of the site, particularly the southeastern section. In the southwestern section of the site there is almost no grit tempered pottery. Shell tempered pottery is spread across the site though there are specific concentrations in the southeastern and southwestern sections. As argued by Wilford there do appear to be more rolled rims in the eastern section of the site (Wilford 1950). In the southeastern section of the site there appears to be a particular concentration of rolled rims.

These data may indicate different occupations at the site at different times. Conversely it may be indicative of different neighborhoods at the site at the same time. There also appear to be two separate concentrations of grit tempered pottery, which may indicate two separate neighborhoods or occupations of people utilizing grit tempered pottery. Each of these trends should be further analyzed, and if possible dated, in order to determine whether these differences are attributable to a separation in time or group affiliation.

Geophysics were done at the site and Dobbs et al. 2003, analyzed this data in an attempt to determine the locations of features at the site. The locations of the larger features they identified have been shown in this thesis and compared to the data from the shovel tests. In many cases the results of the shovel test survey appear to corroborate the geophysics. Several suspected house features are shown with concentrations of artifacts immediately around them, while several others show no such distribution. It seems likely that the suspected house features with artifact peaks around them are very likely to be houses, while the ones without concentrations may not be houses or may be houses in a different sense (perhaps existing for shorter periods of time or having different functions). This needs to be tested, though these two techniques may complement each other and be used in the future to map general features at the site.

There appear to be large concentrations of artifacts and features in both the southeast and southwest portions of the site. It seems likely that this indicates that the village site continues to the east and south of the presently sampled area. This is corroborated by excavations that have taken place on the far eastern end of the terrace. These excavations have revealed Silvernale materials much farther to the east than they were previously believed to have been. And not only does it appear that the village continues to the south and east but it appears that some of the most intense occupations may have taken place in these areas.

There were a few previous excavations at Silvernale, though none of them were mapped well enough for their locations to be positively identified. As mentioned earlier in this thesis, there are a few likely locations for different excavation units based upon literature research, direct discovery by shovel tests, and geophysics. The exact location of Christina Harrison's XU's is ongoing though Figure 174 shows a likely location for the bulk of her units. Work at the site in 2011 discovered her datum spike, but how that datum point relates to her excavations is unclear at this time as it does not appear to correlate with her map.

The model used in this thesis can be applied to other sites in the area and around the world. Future research into this method will likely improve the model and make it possible to more accurately map this site and others. Any systematic collection of a site can use this model, particularly a systematically grid collected surface collection.

CHAPTER 7: FUTURE DIRECTION FOR RESEARCH

There are many different ways in which the work from this thesis can be continued. This specific database has future applications, other databases based off of this can be created, and work at Silvernale needs to continue to try to better understand the site and its relationships to the area and other areas.

The work done in this thesis has barely scratched the surface as far as what kinds of analyses can be done with this database. Advanced statistics on the data and on specific concentrations of artifacts should be done, with a focus on statistical techniques that allow for multiple dependent and independent variables such as canonical correlation. The conclusions of this thesis should be ground truthed in order to measure the efficacy of the techniques. The data from the excavation units should be added on to GIS in order to make better comparisons between the data sets, including comparing different excavation units to each other to find differences within the blocks. Similarly once the features are completed their added data could be useful as well.

In my senior project (Harvey 2009) it was apparent that not only were there differences horizontally but also vertically. The artifact concentrations appeared to become tighter when, for example, the 0-10cm levels were compared with those levels below. There was not time to continue this line of research in the present work but it should be done and it would undoubtedly produce more refined results. There is a large amount that can be learned from this database, especially with regard to answering specific research questions or deciding where to place excavation units in order to find specific kinds of artifacts.

There is still a large amount that can be learned about the Silvernale village site and the villages in the surrounding area. If the database is ground truthed it may be possible to use it in conjunction with excavation data and the results of the geophysics in order to map the site. There is still a lot that is unknown about the villages in the Red Wing area and answering questions at Silvernale allows us to ask the same questions at other nearby sites. For example, if the proposed communal area is accurate then this raises the question of looking for similar communal areas at the other Red Wing villages.

Dates are also needed that are related to the different pottery concentrations to determine if the different sections are contemporaneous neighborhoods or different occupations at different times. The shovel test data indicate that the biggest concentrations of artifacts are in the southeast and southwest areas of the site, so excavations should be placed past these areas in order to get a better understanding of the village as well as to map the limits of the village. The southwestern portion seems like it could be particularly illuminating since there is very little grit tempered pottery or rolled rim pottery. This could mean that this area is more likely to be single component. In that case we may be able to get an unmixed selection of artifacts to get a profile of this one component of the Silvernale village.

Finishing Feature 21 could be useful, as well as possibly excavating the likely associated house feature. Excavating this house feature and others could help to determine the efficacy of utilizing both the shovel test data and the geophysics to better map the site. The excavations from the far eastern area of the site are still being analyzed and the data from that could be help to understand what is happening in the eastern part of the sampled area.

The most important thing to do would be to repeat this methodology at different sites nearby and around the world. This could help to determine the efficacy of the technique, as well as to refine the methodology. Similarly, a controlled surface collection, collected in systematic grids may be able to do similar kinds of analyses. Also, a comparison between the two methods could be interesting, though as noted earlier, surface materials move more freely than those in deeper levels so the surface collection may be less accurate.

The current study was done on a densely occupied village and the results were very useful but it should be tested on some less densely occupied sites in order to determine if the method works as well. Furthermore, the Silvernale site has features and other materials below the plow-zone but some other sites may only have materials in the plow zone. For these sites, this method could be even more useful, since otherwise almost no data would be available from those sites.

REFERENCES CITED

Ammerman A.J.
1985 *Plow-Zone Experiments in Calabria, Italy*. Journal of Field Archeology (12) 1: pp. 33-40

Arzigian, C.
2008 *Minnesota Statewide Multiple Property Documentation Form for the Woodland Tradition*. Submitted to The Minnesota Department of Transportation.

Binford, L.R.
1978-A. *Dimensional Analysis of Behaviour and Site Structure: Learning from an Eskimo Hunting Stand.* American Antiquity 34: 330-361.

1978-B. *Nunumiut Ethnoarchaeology.* New York: Academic Press

Cardinal, J. S.
2011 Site Identification, Delineation, and Evaluation through Quantitative Spatial Analysis: Geostatistical and GIS Methods to Facilitate Archaeological Resource Assessment. An unpublished Master's thesis, university of Albany, SUNY.

Cowan, F.L., Odell, G.H.
1990 *More on estimating tillage effects: Reply to Dunnell and Yorston*. American Antiquity (55) 3: pp. 598-605

Dobbs, C., R. Schirmer, and D. Johnson
2003 *Reviving Silvernale (21GD 03): Archaeological and Geophysical Investigations*. Submitted to Joint Powers Board, Cannon Valley Trail.

Dunnell, R.C.
1990 *Artifact Size and Lateral Displacement Under Tillage: Comments on the Odell and Cowan Experiment.* American Anitquity (55) 3: pp. 592-594

Dunnell R.C., Simek, J.F.
1995 *Artifact Size and Plowzone Processes.* Journal of Field Archeology (22) 3: pp. 305-319

Fleming, E. P.
2009 *Community and Aggregation in the Upper Mississippi River Valley: The Red Wing Locality*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Minnesota, Minneapolis.

Gibbon, G. E.
1979 *The Mississippian Occupation of the Red Wing Area*. Minnesota Prehistoric Archaeology Series No. 13, Minnesota Historical Society, St. Paul.

Green, W.
1987 *Between Hopewell and Mississippian: Late Woodland in the Prairie Peninsula as Viewed from the Western Illinois Uplands.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Wisconsin, Madison. P. 68.

Hager, T.
2012 *Silvernale: A Feature Presentation. Analysis of Features 9 and 10 at the Silvernale Village (21GD03).* Unpublished Master's thesis, Department of Anthropology, University of Minnesota, Mankato. In preparation.

Harvey, K. G.
2009 *Systematic Subsurface Testing: An Investigation of the Silvernale Village in Red Wing, MN*. Unpublished senior project, Department of Anthropology, University of Minnesota, Mankato.

Kouwenhoven, J. K. and R. Terpstra
1979 *Sorting Action of Tines and Tine-like Tools in the Field.* Journal of Agricultural Engineering Research 24:95-113

Krakker, J., M. Shott, P. Welch
1983 *Design and Evaluation of Shovel-Test Sampling in Regional Archaeological Survey*. Journal of Field Archaeology 10(4): 469-480

Lewis, R.B; Stout, C.; and Weston, C.B.
1998 The Design of Mississippian Towns. A chapter in *Mississippian Towns and Sacred Spaces: Searching for an Architectural Grammar*. 1-21

Lightfoot, K.
1986 *Regional Surveys in the Eastern United States: The Strengths and Weaknesses of Implementing Subsurface Testing Programs*. American Antiquity 51(3): 484-504

1989 *A Defense of Shovel-Test Sampling: A Reply to Shott*. American Antiquity 54(2): 413-416

Lynch, M.
1980 *Site Artifact Density and the Effectiveness of Shovel Probes*. Current Anthropology 21(4): 516-517

Martinek, D.
1998 *Oneota Food Storage Technology-Experiment in Pit Storage of Maize*. Unpublished report available at the Murphy library, University of Wisconsin-La Crosse

Milillo, T. M.

2009 *Applying Geostatistical Interpoloation Methods to Studies of Environmental Contamination of Urban Soils and Image Analysis of Time-of-Flight Secondary Ion Mass Spectrometry.* Unpublished dissertation. University of Buffalo, SUNY.

Mills, T.
2009 *A GIS Based Approach to the Spatial Analysis of the Fincastle Bison Kill Site (DIOx-5)* Unpublished Master's thesis. University of Lethbridge, Alberta, Canada.

Mink, C.G.
1992 *Cahokia: City of the Sun*. Cahokia Mounds Museum Society. p.63

Nance, J.D., Ball, B.F.
1986 *No Surprises? The Reliability and Validity of Test Pit Sampling.* American Antiquity 51(3): 457-483

1989 *A Shot in the Dark: Shott's Comment's on Nance and Ball.* American Antiquity54(2): 405-412

Nartov, P. S.
1979 *Movement of soil masses by the working surfaces of spherical disks*. National Tillage Machinery Laboratory Report NTML-WRG-876.

Nolan, K.C.
2010 *Multi-Staged Analysis of the Reinhardt Village Community: A Fourteenth Century Central Ohio Community in Context.* Unpublished Ph.D. dissertation, Department of Anthropology, Ohio State University.

Odell, G., F. Cowan
1987 *Estimating Tillage Effects on Artifact Distributions*. American Antiquity 52(3): 456-484

O'Brien, M. J. and D. E. Lewarch
1981 Effect of Short Term Tillage on Aggregate Provenience Surface Pattern. In *Plowzone Archeology: Contributions to Theory and Technique*, edited by M. J. O'Brien and D. E. Lewarch, pp. 7-47. Vanderbilt University. Publications in Anthropology No. 27.

Schirmer, R. C.
n.d. Silvernale. In *Mounds, Villages, and Feasts: The Archeology of Red Wing*. Edited by R. C. Schirmer. Volume in preparation.

2002 *Plant-use Systems and Late Prehistoric Culture Change in the Red Wing Locality*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Minnesota, Minneapolis.

2005 Introduction to Red Wing. Presentation for the initial meetings for *Mounds, Villages, and Feasts: The Archaeology of Red Wing*. Volume in preparation. Ronald C. Schirmer senior editor. Presented November 19, 2005, Anderson Center, Red Wing, Minnesota.

Shott, M. J.

1985 *Shovel Test Sampling as a Site Discovery Technique: A Case Study From Michigan.* Journal of Field Archaeology 12:458-469.

1987 *Feature Discovery and the Sampling Requirements of Archaeological Evaluations.* Journal of Field Archaeology, Vol. 14.

1989 *Shovel Test Sampling in Archaeological Survey: Comments on Nance and Ball, and Lightfoot.* American Antiquity 54:396-404.

Stone, G.

1981 *On Artifact Density and Shovel Probes*. Current Anthropology 22(2): 182-183

Trubowitz, N.L.

1981 *Settlement Pattern Survival on Plowed Northeastern Sites*. Unpublished paper presented at the 1981 annual society for American archaeology meeting, San Diego, CA.

Warmka, T.

2009 *Mapping Artifact Distributions Using Shovel Tests.* Unpublished senior project, Department of Anthropology, University of Minnesota, Mankato.

Wilford, L.

1947 Original unpublished field notes from Silvernale Village (21 GD 03) Excavations. Manuscript on file, Fort Snelling, Minnesota.

Wilford, L.

1950 Original unpublished field notes from Silvernale Village (21 GD 03) Excavations. Manuscript on file, Fort Snelling, Minnesota.

Yorston, R.M.

1990 *Comment on Estimating Tillage Effects on Artifact Distributions.* American Antiquity (55) 3: pp. 594-598.