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Edited by
JERALD T. MILANICH
FLORIDA STATE MUSEUM
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PREFACE

The Thirty-Sixth Southeastern Archaeological Conference was held in Atlanta, Georgia, on November 8-10, 1979. Roy S. Dickens served as local arrangements chairperson and Robert L. Blakely and Anne F. Rogers were program co-chairpersons. For the first time ever a student paper competition was held, and a committee chaired by Stephen Williams selected Julie Stein as the winner. Ms. Stein's paper was entitled "Geologic Analysis of the Green River Shell Middens."

The conference was the largest for the SEAC to date. One hundred fourteen papers were presented in fifteen sessions. And for the first time three sessions ran concurrently each morning and afternoon. This complexity necessitated the printing of a floor plan of the meeting rooms which also showed the locations of both men's and women's rooms. A once small conference has clearly become big time.

I am grateful to Vernon J. Knight and Diane Coupe for their help in preparing this Bulletin for publication. Jim handled most of the correspondance with authors, all of whom graciously provided us with excellently prepared copy and graphics.

J.T. Milanich
Florida State Museum

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TREND SURFACES AND THE DELINEATION OF DISTURBED AND IN SITU SITE STRUCTURE: TWO EXAMPLES FROM NORTH CAROLINA

Trawick Ward

The purpose of this paper is to discuss some preliminary findings concerning the correlation between the structure of undisturbed, in situ features and architecture and the patterns of various classes of artifacts contained in the plow zone. The study of the interrelationships between disturbed and undisturbed site structures is certainly neither novel nor revolutionary.

Recently several researchers (Binford et al. 1970; Redman and Watson 1970; Schiffer and Rathje 1973; Flannery 1976; and Faulkner and McCollough 1978) have dealt explicity with the problem of the degree of coincidence between disturbed site structure and the undisturbed matrix. These studies have, however, been primarily concerned with surface-subsurface correlations. Few have attempted to investigate on a large scale the degree of correspondence between the patterns of artifact densities within the plow zone and the buried in situ spatial structure represented by features, houses, and other architectural forms.

My interest in this area grew out of a concern over a growing number of reports dealing with the excavation of small, plow-disturbed sites where a high degree of horizontal spatial integrity has been simply assumed. It was felt that many of the spatial relationships among various artifact types and classes were not reflecting the activity structure and adaptive poses of past cultural systems as much as they were indicating agricultural practices as well as fortituous and capricious natural forces. This skepticism eventually led to a series of spatial studies involving a somewhat unique body of data from two sites that the Research Laboratories have been excavating for several years. The most well known of these is the Warren Wilson site, Bn29, the subject of a recent book by Roy Dickens (1976). As most of you know, this site represents a late prehistoric Cherokee village located on the floodplain of the Swannanoa River in Buncombe County, North Carolina. In many ways, Warren Wilson is typical of the medium sized villages occupied during the Pisgah phase in western North Carolina. The other site, not so well known as yet, is located on the Dan River in the northern piedmont section of Stokes County. This site, Sk1a, comprises a historic Souian village that has been putatively identified as a component of Upper Saurtown. It too is "typical" of many of the Dan River Phase occupations along the Dan and its tributaries in North Carolina and Virginia. Jack Wilson (1977) has recently detailed a segment of the subsistence cycle at Sk1a and is currently carrying out an extensive study of the Dan River phase.

My interest in these sites results from the fact that large portions of their respective village areas have been totally excavated, bringing to light considerable information concerning the spatial arrangements of features, burials, houses, palisades as well as other architectural forms. Over 24,000 ft^2 have been opened at Bn29, while well over 10,000 ft^2 have been exposed at Sk1a, and the work is continuing today. The scale of the excavations alone certainly does not make them unique, but the fact that they have been consistently excavated utilizing exacting field techniques resulting in the near total recovery of plow zone materials does set them apart. This plow zone data, in conjunction with the in situ village plans have permitted the evaluation of several assumptions concerning the relationships between disturbed and undisturbed site structures. Concomitantly, new insights into the spatial analysis of plow zone sites have also surfaced.

The scope of this paper is too limited to allow a detailed discussion of the research objectives currently being investitated. As a consequence, only a broad, general overview will be presented.

As mentioned previously, the first objective has been to explore the degree of correlation between undisturbed feature artifact output and the disturbed artifact distributions contained in the plow zone. Based on studies of surface-subsurface correspondences, the picture is unclear, and it appears that a myriad complex of factors are at play (Flannery 1976). However, by comparing the plow zone artifact densities with the known in situ structure, the best possible conditions for patterned correspondence between the two contexts exist. Patterned correspondence simply refers to the fact that if undisturbed areas of the site have high artifact output, it is expected that this trend would be discernable within the plow zone and vice versa.

If some form of predictative relationship between the two contexts could be established, it was felt that the different classes of artifacts would display differential degrees of predictative acuity and further that certain kinds of specimens would readily indicate specific types of subsurface facilities. For example, it was hypothesized that the presence of concentrations of bone in the plow zone would indicate subsurface trash pits. This relationship is based on several assumptions. First, it was somewhat ethnocentrically assumed that bone, because of its unattractive and noxious nature would very likely be cleaned up and deposited in a secondary context (see South 1977). It was also assumed that bone elements would be broken up into smaller and smaller fragments with each successive plowing and that these smaller, dispersed fragments would lose their survival potential. Consequently, only those pieces kicked up by the most recent plowings would be present in the plow zone, and these should be concentrated in close proximity to their points of entry.

Because of its small size and unobnoxious presence, lithic debris was considered to have most likely entered the record in a primary or de facto context (see Schiffer 1972; Binford 1978; South 1979). A similar disposal pattern was suggested for the small triangular arrow points common at both sites. As a result of the way in which it was assumed these specimens entered the record - or were "transformed" from systemic to archaeological context to use Schiffer's (1976) terminology - it was hypothesized that plow zone densities of debitage and arrow points would have little predictive value in locating subsurface features.

A third objective was to define the intra-site structure contained in both the plow zone and the undisturbed context. Recent studies, by and large, have either relied totally on in situ deposits when both disturbed and undisturbed materials were present (Smith 1978) or assumed a degree of spatial association for plow zone or surface artifact distributions when intact remains were lacking (House and Wogaman 1978). Few, if any, spatial or activity analyses have utilized both contexts in interpreting spatial patterns and those cultural, systemic processes encoded in such patterns. Specifically, it is felt that most specimens in primary or de facto context are contained in the plow zone at sites similar to Warren Wilson and Sk1a, while secondary refuse deposition primarily comprises the in situ artifact patterns. By using data from both contexts, it is hoped that a complimentary relationship can be established that will allow for a more complete understanding of the site formation processes as well as spatial dynamics.

The artifact classes used in the study have been ceramics, animal bone, debitage and projectile points. The choice of these categories was dictated, for the most part, by factors of preservation and sheer numbers. Only a few kinds of specimens are represented at both of the sites in sufficient quantities for valid inter- and intra-comparisons. This handicap is particularly acute when dealing with materials from the plow zone not only at Bn29 and Sk1a but at most sites in the Southeast. The more fragile materials, including ethnobotanical specimens, shell, and other organic remains are simply not able to withstand the disturbance and exposure.

Plow zone counts were calculated for each of the different classes of artifacts per 10 ft grid unit. There were 242 such units at Bn29 and 102 at Sk1a. Since a midden was lacking in both instances, the undisturbed context consisted of various post holes, pits, and depressions that had been truncated by the plow. To compare their output with the plow zone, artifacts counts per feature square were calculated. If more than one feature occurred in a given square, the contents were totaled so that there was only one count per artifact class per square. A summary of these data are presented in Tables 1 and 2.

To determine the degree of correspondence and coincidence between the disturbed and undisturbed contexts, these data were quantified and simplified by using the computer graphics SYMAP program to create contour, trend surface and residual maps of each class of artifact from both contexts at each site. This computer mapping technique has had widespread use in archaeology (Redman and Watson 1970; House and Wogaman 1978) and provides an easy means of constructing distributional or density maps than can be studied descriptively as well as quantitatively. Most archaeological SYMAPs, however, have only used the contour capability of the package. The mapping of trend surfaces and the residuals from these surfaces has not been extensively tested on either an inter-site or intra-site level (Hodder and Orton 1976) nor has it been used to explicate the variability between disturbed and undisturbed site structures.

Table 1. Sk 1 Plow Zone and Feature Variables

Feature Variables Denoted By F.

Variable	N	Mean	Standard Deviation	Sum
Ceramics	102	658.1	405.6	67130
Lithics	102	75.1	70.8	7658
Bone	102	13.9	25.1	1419
CSPP	102	8.3	8.3	842
Ceramic (F)	60	244.2	237.1	14654
Lithics (F)	61	46.3	56.7	2824
Bone (F)	61	158.2	217.9	9651
CSPP (F)	60	4.7	6.7	282

For a detailed discussion of the statistical foundations and limitations of trend surface analysis, the reader is referred to Davis (1973). Here I will only cover in a very superficial way some of the general statistical principles involved. Basically trend surface is one of several regression techniques, and as such it separates data into two components--a general regional trend and localized deviations or residuals from this trend. Archaeologists often consider a geographical area such as a river basin as a region and intuitively look for broad trends in site size, content, temporal range, and function. On the other hand, we are also interested in localized deviations from the trend such as the large ceremonial center or the small activity specific loci. On the intra-site level we look for general trends in the distribution of artifacts and features while at the same time, fluctuations in the overall distribution are also noted with interest. These "blank" areas and "hot spots" provide the foundation for structural studies and activity analyses.

Table 2. Bn 29 Plow Zone and Feature Variables

Feature Variables Denoted By F.

Variable	N	Mean	Standard Deviation	Sum
Ceramics	242	1673.7	687.8	405035
Lithics	242	32.9	17.1	7970
Bone	242	29.9	49.3	7230
CSPP	242	4.0	2.9	974
Daub	242	4.0	22.7	970
Ceramic (F)	47	242.6	412.0	11400
Lithics (F)	46	15.9	21.5	731
Bone (F)	47	210.3	509.0	9883
CSPP (F)	46	1.4	2.5	64

Trend surface and residual, as well as contour maps, were calculated for each category of artifact from each context at both sites. Second, third, and fifth order surfaces were fitted and these were compared with each other as the known excavated surfaces to determine if the added resolution was significant.

Since one of the main goals was the investigation of the relationship between the plow zone distribution of artifacts and the distribution of features and structures, the maps of residuals from the trend surfaces were of primary importance. However, by comparing the various trends of different artifact classes within the two structural contexts, hopefully patterns can be identified and correlated with in situ structural components. These patterns may then be used to develop spatial models that will facilitate activity analyses of disturbed context data. This segment of the research is only beginning and will require similar data from a variety of sites.

Comparing the large number of maps with one another and the excavation plans has not been an easy task. The simple, yet time consuming, visual inspection using overlays has proven most productive. Some fairly simple quantitative techniques have also been used to not only aid in comparing the maps but to add another dimension to the overall analysis. The Statistical Analysis System or SAS has provided a flexible program to create data sets from the artifact classes which were used to calculate an array of correlation coefficients (Tables 3, 4). This procedure complimented the SYMAP comparisons and aided in isolating corre-

Table 3. Correlation Coefficients between Sk 1 Plow Zone and Feature Variables

Feature Variables Denoted By F .

	Ceramics	Lithics	Bone	CSPP	Ceramic (F)	Lithics (F)	Bone (F)	CSPP (F)
Ceramics	1.00	0.44	0.49	0.61	0.03	0.08	0.39	0.18
Lithics	0.44	1.00	0.35	0.52	0.11	0.27	0.34	0.36
Bone	0.49	0.35	1.00	0.40	0.23	0.31	0.43	0.53
CSPP	0.61	0.52	0.40	1.00	0.22	0.24	0.44	0.44
Ceramic (F)	0.03	0.11	0.23	0.22	1.00	0.72	0.58	0.73
Lithics (F)	0.08	0.27	0.31	0.24	0.72	1.00	0.58	0.70
Bone (F)	0.39	0.34	0.43	0.44	0.58	0.58	1.00	0.65
CSPP (F)	0.18	0.36	0.53	0.44	0.73	0.70	0.65	1.00

Table 4. Correlation Coefficients between Bn 29 Plow Zone and Feature Variables

Feature Variables Denoted By F.

	Ceramics	Lithics	Bone	CSPP	Ceramic (F)	Lithics (F)	Bone (F)	CSPP (F)
Ceramics	1.00	0.42	0.24	0.46	-0.10	0.00	-0.06	-0.13
Lithics	0.42	1.00	0.12	0.24	-0.24	-0.04	-0.22	-0.18
Bone	0.24	0.12	1.00	0.17	0.29	0.35	0.47	0.13
CSPP	0.46	0.24	0.17	1.00	0.04	0.06	-0.07	0.00
Ceramic (F)	-0.10	-0.24	0.29	0.04	1.00	0.55	0.75	0.85
Lithics (F)	0.00	-0.04	0.35	0.06	0.55	1.00	0.31	0.62
Bone (F)	-0.06	-0.22	0.47	-0.07	0.75	0.31	1.00	0.48
CSPP (F)	-0.13	-0.18	0.13	0.00	0.85	0.62	0.48	1.00

spondence between different artifact variables. Of course the correlation coefficients only measure general correspondence between two variables, and since sample locations are not taken into consideration, it is possible to have a high r value and very little spatial overlap and vice versa. In this regard, the SYMAPs have been extremely helpful in evaluating the correlation coefficients.

Much of the data analysis has yet to be completed. A few general comments can, however, be offered in light of the stated research objectives. The first objective was to determine the degree of coincidence between the patterns of artifact distributions within the plow zone and the patterns of artifact output from undisturbed features and other structural components. It now appears that artifact distributions within the plow zone may or may not have a significant degree of structural overlap with major concentrations of such undisturbed facilities as trash pits, houses, or storage units. The degree of overlap is dependent on many variables, but one of the major factors, at least at Bn29 and Sk1a, is the storage and refuse disposal patterns.

A distinct and different form of storage and garbage disposal was practiced at each site. At Sk1a most of the gargage was disposed of in specially prepared trash pits or large abondoned storage facilities normally associated with house structures. In contrast, the Warren Wilson data suggest that the overwhelming bulk of refuse was collected and dumped along the palisades. This pattern is not unlike that described by Binford for the Mask site where the disposal mode defines a distribution that is inversely related to patterns of use intensity (Binford 1978:356). At both sites high density zones, for the most part, reflect disposal and not activity areas. At Warren Wilson very few trash or storage receptacles were dug, indirectly indicating not only an above ground refuse disposal mode but also the presence of above ground storage facilities. As a consequence, there is very little correlation and overlap between the patterns of artifact output in the plow zone and the in situ site structure (see Figures 1-4). On the other hand, the Sk1a data show a fairly strong predictive relationship between the two contexts. These different patterns are reflected in the various SYMAPs as well as the array of correlation coefficients.

Although the degree of correspondence between the plow zone and what lies beneath it will vary considerably from site to site, on sites where refuse was disposed of in subsurface pits bone in the plow zone appears to be a fairly strong indicator of the locations of such facilities. This relationship was detected by the residual maps and reinforced by the correlation coefficients from both sites. Although at Sk1a there were several high correlations (r .4) between plow zone and feature content, the only correlation above .4 at Bn29 was derived when feature bone content was compared with plow zone bone output. Also as expected, lithic debris and projectile points were not as frequently found in secondary context

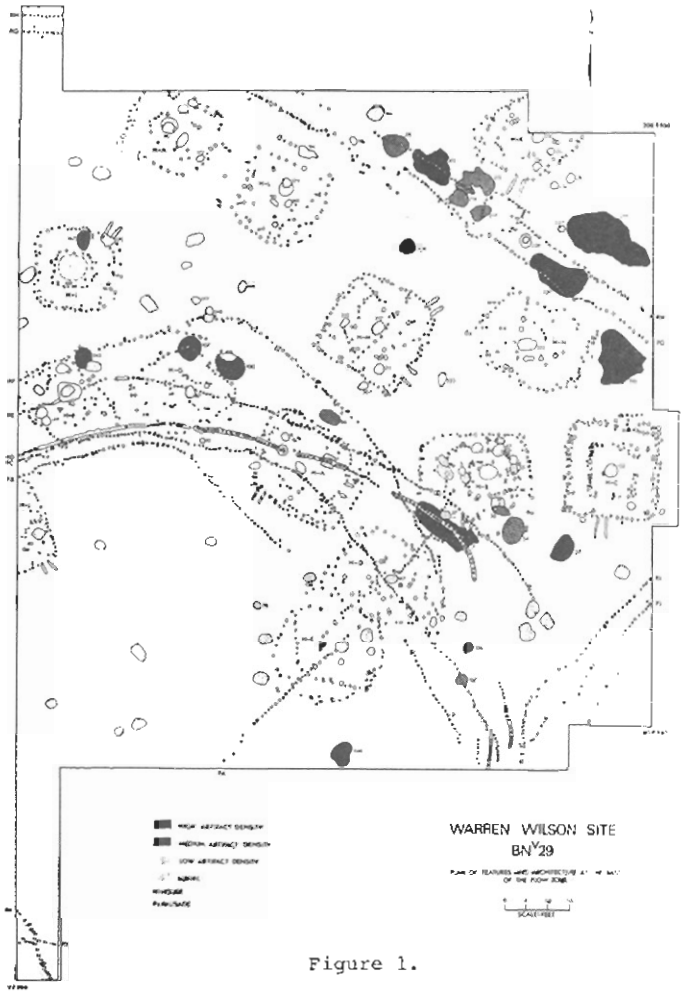

Figure 1.

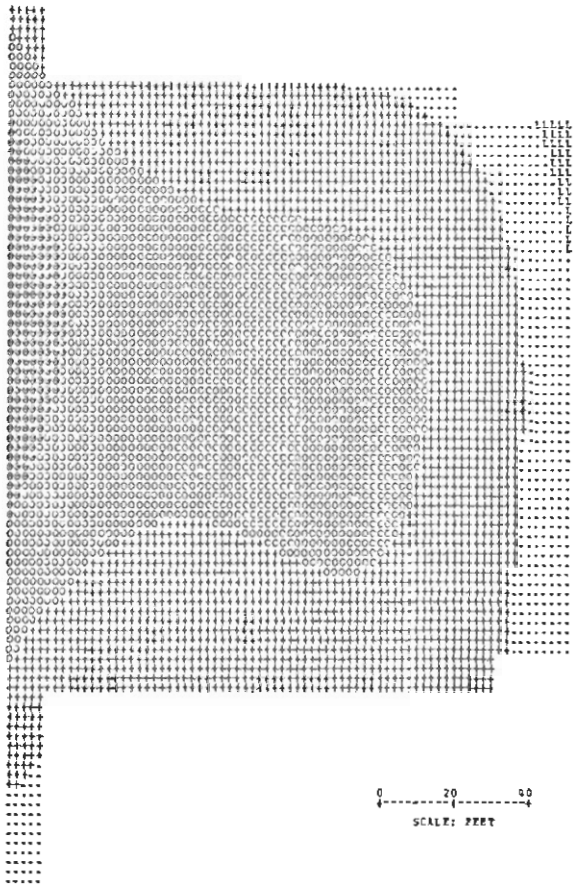

Figure 2. Ceramic distribution, plow zone, third order trend surface.

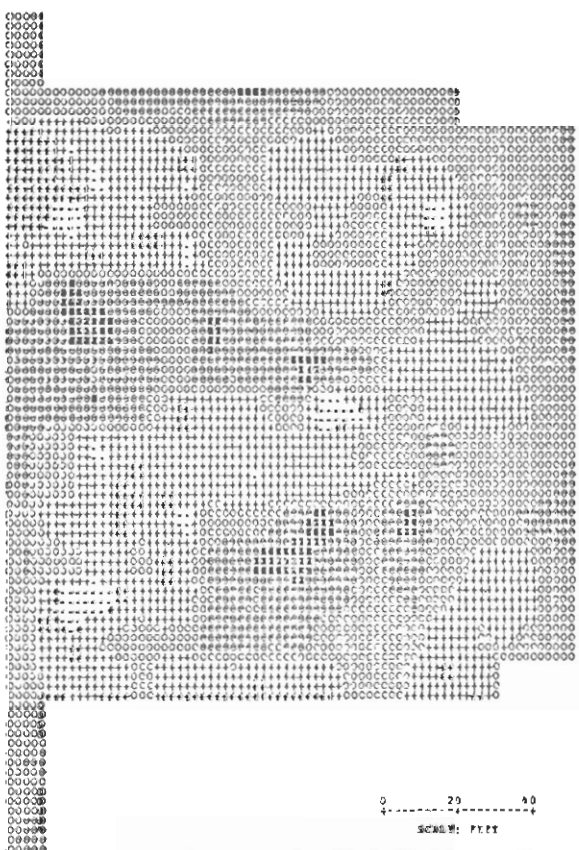

Figure 3. Ceramic distribution, plow zone, map of residuals from a third order trend surface.

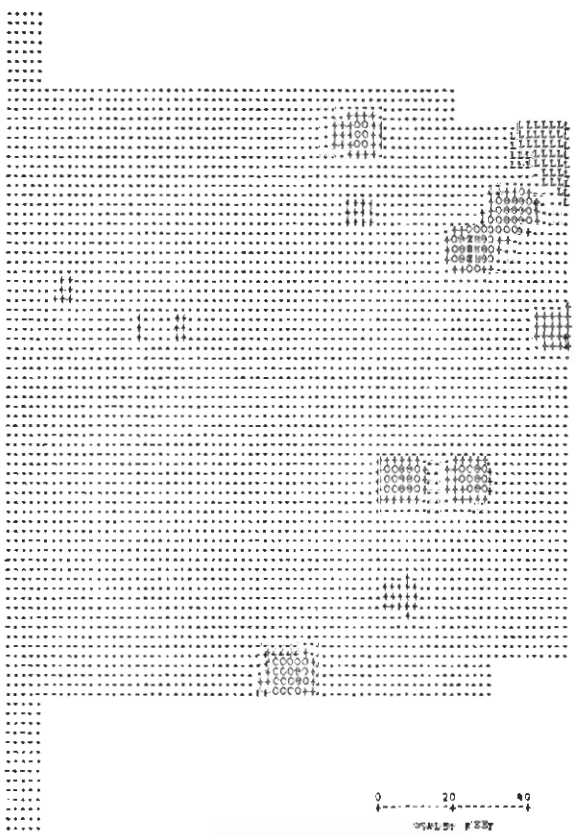

Figure 4. Ceramic distribution, features, map of residuals from a third order trend surface.