Doms 1988) and sorted by raw materials and functional categories including projectile point/knives, bifaces, retouched flake tools, ground stone tools, and debitage. Presence or absence of cortex was noted to study cobble utilization, and bifaces were sorted into discards and rejects following the work of Callahan (1979) to study tool manufacturing activities. Ceramics were sorted by the major varieties noted for Delaware (Custer 1984). Surface treatments, design motifs (if present), and paste attributes were also noted. Where textile or cordage impressions were present on ceramic sherds, clay impressions were made to study cordage and textile technologies.

RESULTS AND INTERPRETATIONS

SITE STRATIGRAPHY

As was noted in the discussion of the research design and field methods, there was some question as to whether buried landscapes, which could have been living surfaces for prehistoric groups, were present at the site. Initial inspection of profiles of the DelDOT Phase II test units by a consulting pedologist seemed to indicate that such landscapes could be present (Cunningham 1984; Catts et al. 1988:126). The same consultant looked at site profiles from the sewer line excavations and concluded that the soils in the sewer line ROW consisted primarily of a recent plowzone 30-35cm thick underlain by clay loams with gravels that contained no artifacts and were probably of early Holocene/Late Pleistocene age, more than 10,000 years old (Lewis, Basalik, and Brown 1987:43-44; Geo-Sci Consultants, Inc. Report of Investigation Form 7/9/85). However, the sewer

line study (Lewis, Basalik, and Brown 1987:43) also notes two locations where landscapes did seem to be buried by aeolian deposition or slope wash. However, the sewer line report provides nothing more than a representative profile and the soils data are not at all linked to any other data in the report. Furthermore, it is impossible to tell if the sewer line excavations ever did more than excavate and screen the plowzone soils. Therefore, there is no way to know if any artifacts were recovered from the buried soils alluded to in their report.

Three profile descriptions by the pedologist consultant were available for study (Geo-Sci Consultants, Inc. Report of Investigation Form 7/9/85), and in the profile descriptions, the consultant notes a series of silt-loam B horizons, some of which are described as argillite (B+) and one of which is noted as the result of a depositional event distinct from that which deposited the plowzone (2B+1, 2B+2). In all three cases, these B horizons are underlain by C horizons comprised of sands and gravels. In a summary of the profiles, the consultant estimates the ages of the B horizons at 4-5,000 years and presumably they could have contained artifacts. However, again there is no indication of where these units were located, nor is there any indication that these soils were tested for the presence of prehistoric artifacts.

It can be noted that the sewer line report illustrates seven "diagnostic artifacts" recovered from their excavations (Lewis, Basalik, and Brown 1987:51). No information on their provenience is provided, but given the description of field methods and comments about "culturally sterile" subsoils (Lewis, Basalik, and

Brown 1987:43), it seems likely that these artifacts were derived from plowzone contexts. Two stemmed points which could date between 3000 BC - AD 1000 are illustrated. If these artifacts did indeed come from the plowzone, they would indicate that the surface soils are up to 4-5,000 years old, in which case it would be difficult for underlying soils to be the same age, especially if they are a different depositional event. In sum, the stratigraphic interpretations from the sewer line excavation report are ambiguous, confusing, contradictory, and incomplete. They do not provide much guidance for understanding the profiles from the DelDOT and UDCAR excavations, even though the same pedologist consultant described sewer line and DelDOT profiles.

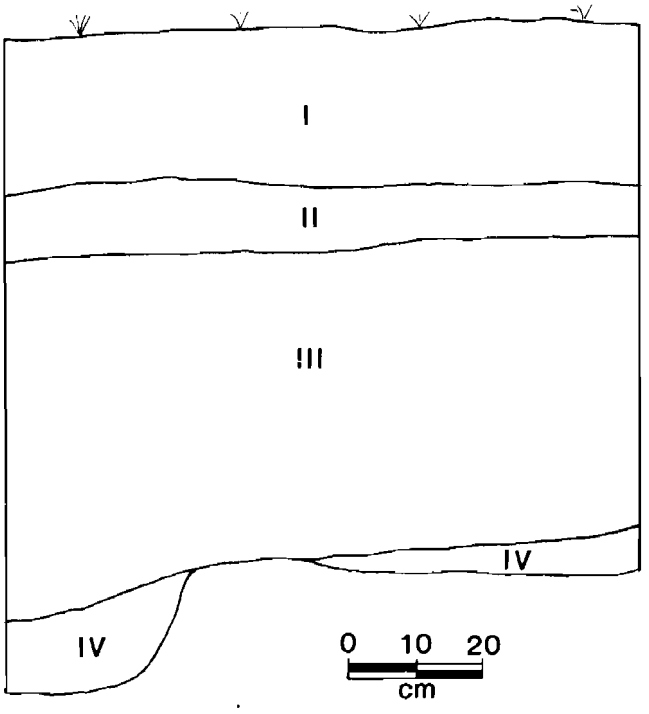
Because the stratigraphic data from the site were unclear, James Pizzuto, a geomorphologist from the University of Delaware Department of Geology, carried out an extensive study of the site and its sediments and a report on his work is included as Appendix I along with cross-section profiles and detailed profile descriptions. Pizzuto's analysis specifically addressed the issue of whether or not buried Holocene landscapes were present at the site. His findings indicate that such landscapes are not present at the Lewden Green Site, at least in the area excavated by UDCAR and DelDOT archaeologists. When Pizzuto's profile descriptions are compared to those noted by the pedologist during the initial consultations, it can be seen that the alleged Holocene deposits beneath the plowzone are the same unit which Pizzuto describes as a "slightly gravelly muddy sand." This unit is most likely part of the Pleistocene-age Columbia Formation

(Jordan 1964), and Pizzuto provides several reasons why it is not a Holocene-age soil in Appendix I. Thus, it seems as if the initial pedologist's identification was in error and confused one of the finer-grained non-gravelly facies of the Columbia Formation with a Holocene-age soil.

The basic data from Pizzuto's analysis indicate that the Holocene geomorphological history of the Lewden Green Site is quite simple. Figure 15 shows a sample test unit profile from unit S30W15 which contains all of the depositional units described by Pizzuto in Appendix I. Horizon IV, the deepest unit, represents the gravelly facies of the Columbia Formation and is the fluvial gravel noted by Pizzuto. Horizons II and III are loamy sands with little or no development and these soils are also Pleistocene age fluvial facies of the Columbia Formation. These soils are similar to the finer-grained Columbia Formation deposits described by Jordan (1964) and have been observed both above and below the gravel deposits in the Lower Christina/Churchman's Marsh area (Custer 1982; Custer and Watson 1987). These deposits do not show much pedogenic development because their coarse texture and good drainage are not conducive to the trapping of groundwater as it moves through the subsurface soils and consequent illuviation of clay minerals and clay-sized particles. Also, source materials of clay minerals and clay-sized soil particles are rare in the thin over-lying soils. Consequently, there is little or no pedogenic development in Horizons II and III. Horizon I is a modern plowzone which contains 99 percent of the artifacts recovered from the site. None of these artifacts is older than 3000 BC, and Horizon I is

FIGURE 15

Profile from S30W15



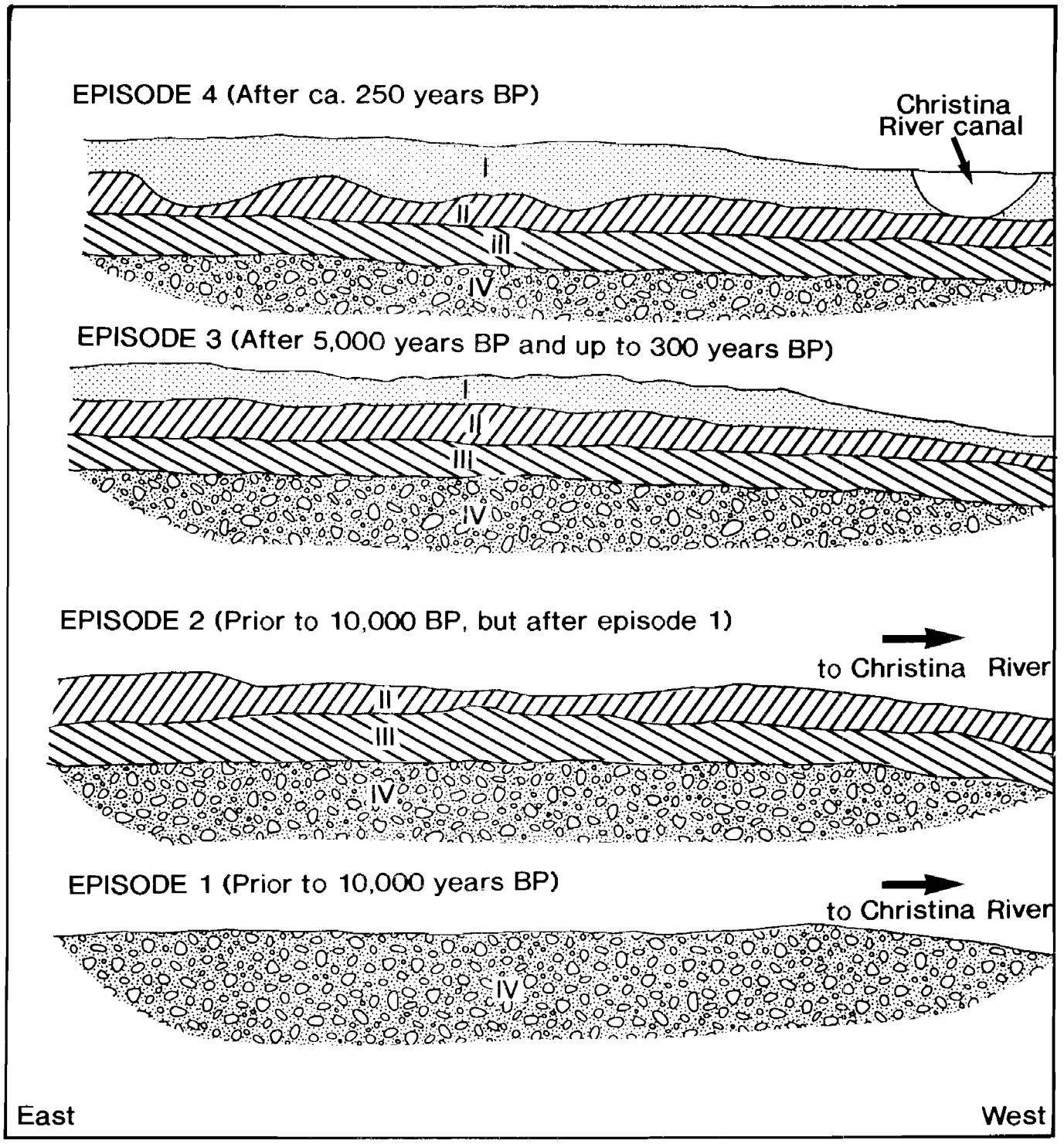
I - Light brown sandy loam plowzone
II - Mottled orange sand and brown loam
III - Orange-brown sand with a small amount of clay
IV - Orange sand with much gravel

composed of a plowed up mixture of a thin modern surface soil and older underlying soils. Historic plowing and modern deforestation and development caused additional reworking of these soils and colluvial action caused this profile to be thicker in some locations.

Figure 16 shows a reconstruction of the geomorphological development of the Lewden Green Site. Episode 1 predates 10,000 years ago and consists of the high energy fluvial deposition of Columbia Formation coarse sands and gravels (Horizon I). Episode 2 consists of deposition of two loamy sand horizons (Horizons II and III) after the deposition of Horizon I. Episode 2 occurred after Episode 1, but prior to 10,000 years ago. It is not clear

FIGURE 16

Geomorphological History of the Lewden Green Site



if the amount of time separating Episodes 1 and 2 was hours, centuries, or scores of centuries; but, it is known that the deposition of these units took place prior to the human occupation of northern New Castle County. Episode 3 consists of the development of surface soils primarily through limited accretion of organic materials and colluvial processes. It is not clear how soon after the end of Episode 2 this process occurred, but we can say for sure that the process was taking place by 5000 years ago and that human beings were living on this land surface by at least 3000 years ago. It should be noted that Pizzuto saw no evidence to believe that any soil discontinuities were present and the process of surface soil formations continued with little interruption throughout the site over the past 10,000 years. Episode 4 occurred with the first historic plowing of the site and the older thin surface soils of the site and their associated artifacts were disturbed and mixed together. Also, during this time period, the canal cutting off the "Great Bend" of the Christina River was constructed to bring the river adjacent to the site. It is important to note that this direct juxtaposition of the site and a major watercourse occurred only very recently in the site's history and, therefore, there has been little or no alluvial input of sediments at the site since the end of the Pleistocene.

In sum, the artifacts at the Lewden Green site are all found in disturbed plowzone contexts. The soils disturbed by historic plowing were thin surface soils that developed in situ via pedogenic development of much older Pleistocene age sediments of the Columbia Formation. There are no buried Holocene soils at

TABLE 2

SUMMARY CATALOGUE - LITHIC ARTIFACTS -
UDCAR AND DelDOT EXCAVATIONS

ARTIFACT Type	**RAW MATERIAL** Quartzite	Quartz	Chert	Jasper	Arg	Iron	Chal	Other	TOTAL
Flakes	103(31)	625(131)	797(134)	2382(261)	--	--	73(7)	15(1)	3995
Flake Tools	------	3	3(2)	14(5)	1	--	---	4(1)	25
Woodland I Points	------	1	-------	5(2)	2	1	---	---	9
Woodland II Points	------	2	2	8	--	--	1	---	13
Early Stage Biface Rejects	1	5(1)	4(3)	3	1	--	---	---	14
Late Stage Biface Rejects	------	8(3)	6(1)	18(2)	1	1	---	---	34
TOTAL	104	644	812	2430	5	2	74	19	4090

KEY
Arg - argillite
Iron - ironstone
Chal - chalcedony
( ) - items with cortex

the site and there has been little change in the site's geomorphology since the beginning of the early Holocene 10,000 years ago.

EXCAVATED ARTIFACTS

Table 2 provides a summary catalogue of the lithic artifacts recovered from the UDCAR and DelDOT excavations and Table 3 provides a summary catalogue of the prehistoric ceramics.

TABLE 3

SUMMARY CATALOGUE - CERAMICS - UDCAR AND DELDOT EXCAVATIONS

VARIETY		NUMBER OF SHERDS
Minguannan	(A.D. 1000 - A.D. 1600)	421
Hell Island	(A.D. 600 - A.D. 1000)	78
Coulbourn	(400 B.C. - 100 B.C.)	1
Wolfe Neck	(700 B.C. - 400 B.C.)	4
Dames Quarter	(1200 B.C. - 700 B.C.)	1
Unidentified		133
TOTAL		638

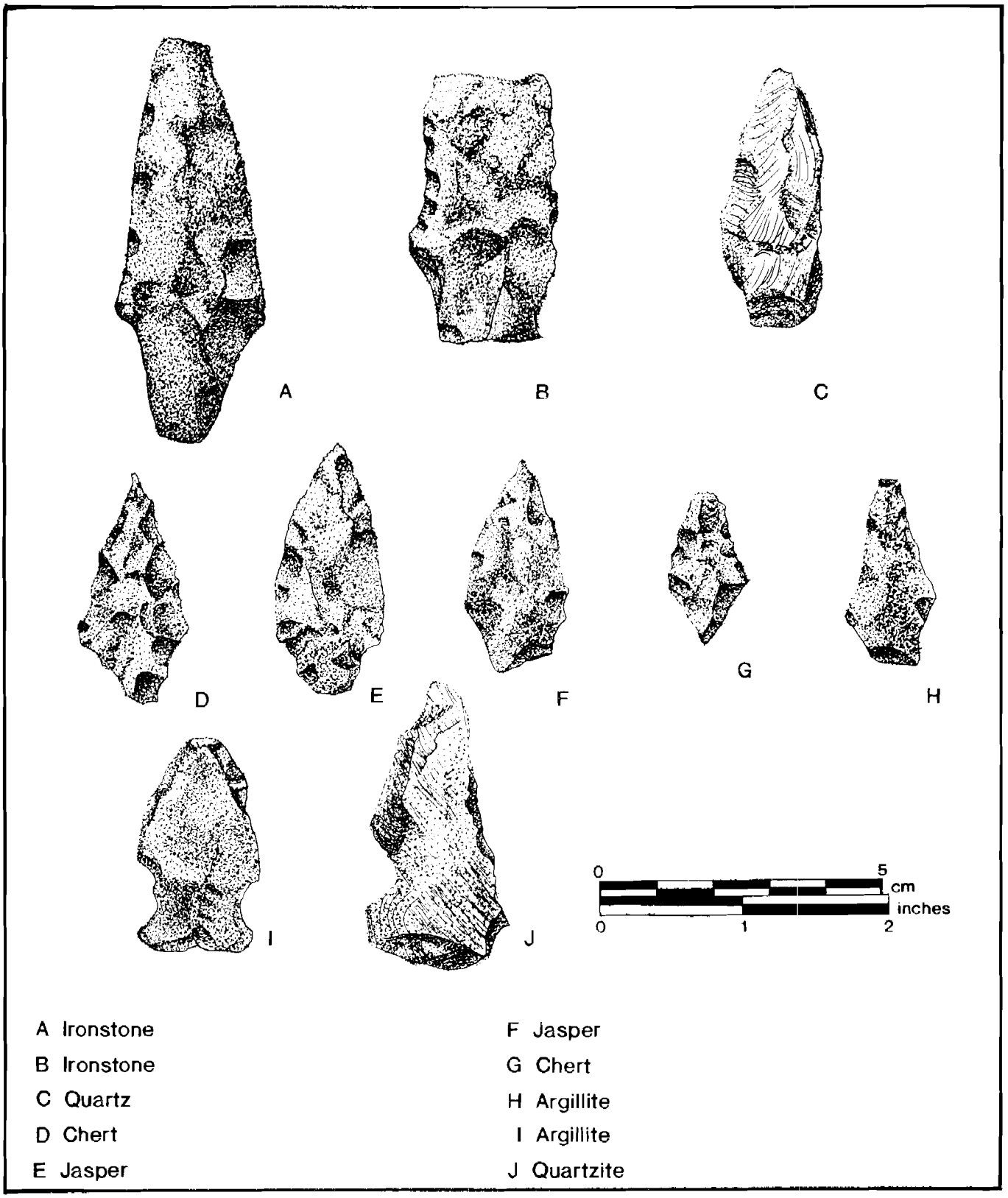
Figures 17 and 18 show a sample of the projectile points found at the site, and Figures 19 and 20 show samples of flake tools and bifaces. Figure 21 shows a sample of the ceramic artifacts. Detailed discussions of the artifact assemblages are noted in later sections of this report.

FEATURES

Although a number of soil stains and anomalies were observed at the base of the plowzone soils, none were cultural features. Instead, these soil stains were seen to be historic fence posts, animal burrows, or tree roots. It should be noted that the sewer line excavations also did not discover any prehistoric

FIGURE 17

Stemmed and Notched Points



A Ironstone
B Ironstone
C Quartz
D Chert
E Jasper
F Jasper
G Chert
H Argillite
I Argillite
J Quartzite

FIGURE 18

Triangular Points

A

B

C

D

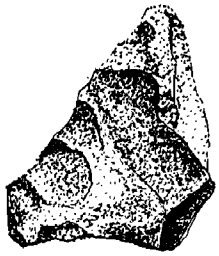
E

F

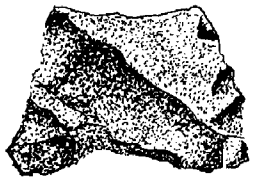
G

H

I



J

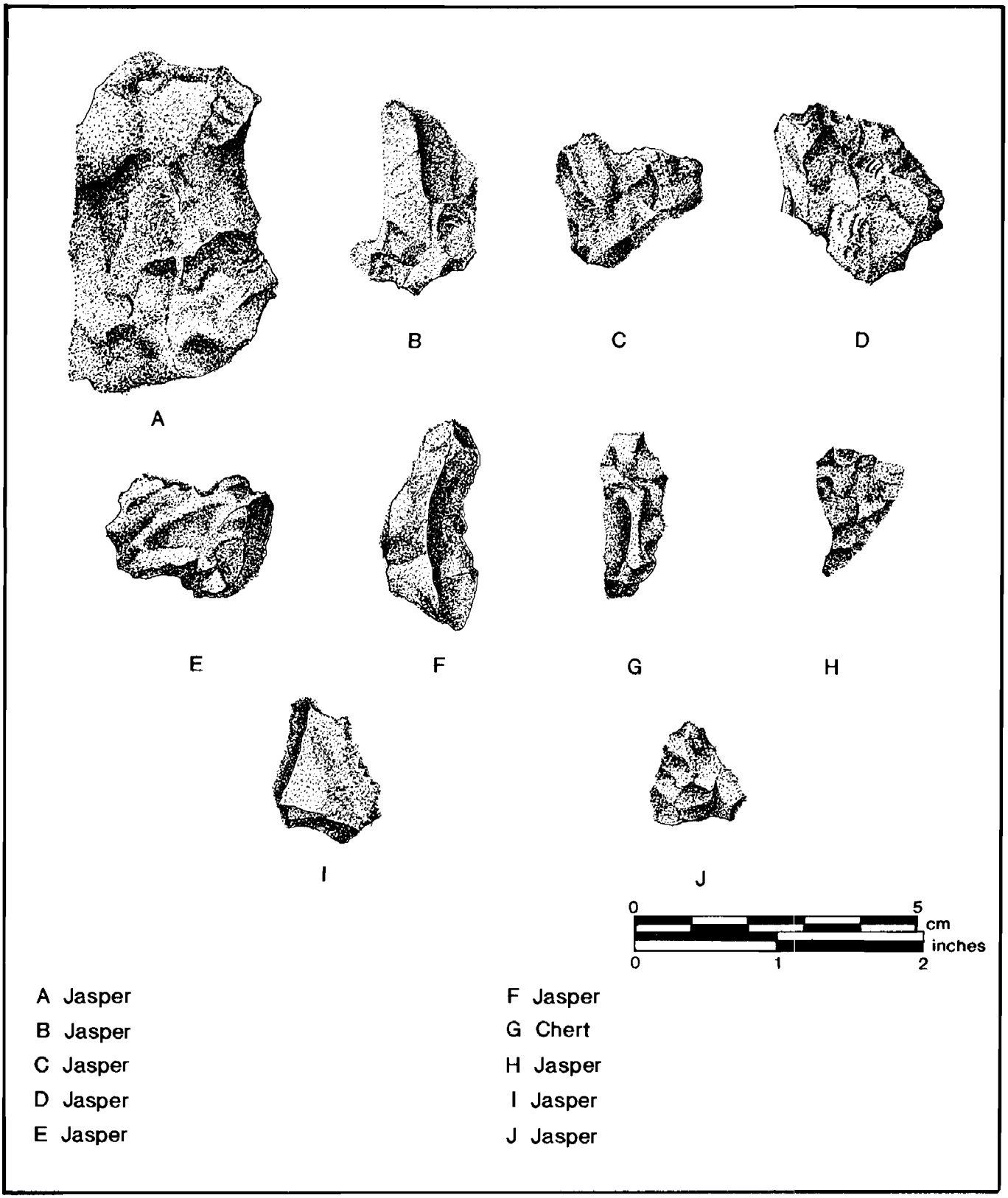


K

A Jasper
B Jasper
C Jasper
D Quartz
E Chert
F Jasper
G Chert
H Jasper
I Jasper
J Jasper
K Jasper

FIGURE 19

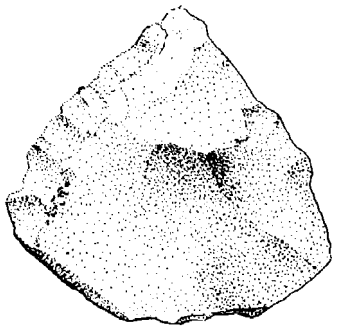
Flake Tools



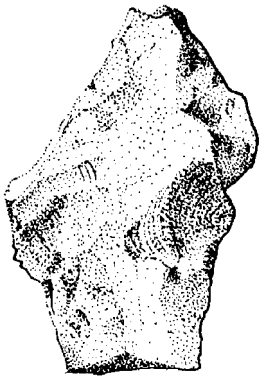
A Jasper
B Jasper
C Jasper
D Jasper
E Jasper
F Jasper
G Chert
H Jasper
I Jasper
J Jasper

FIGURE 20

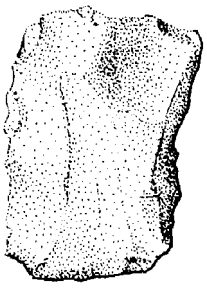
Bifaces



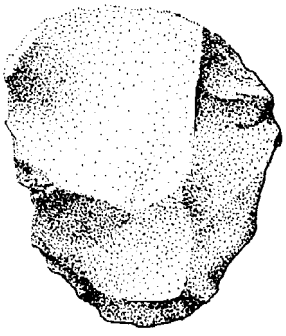
A



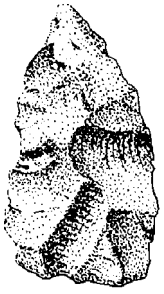
B



C

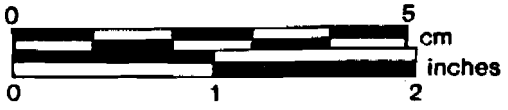


D



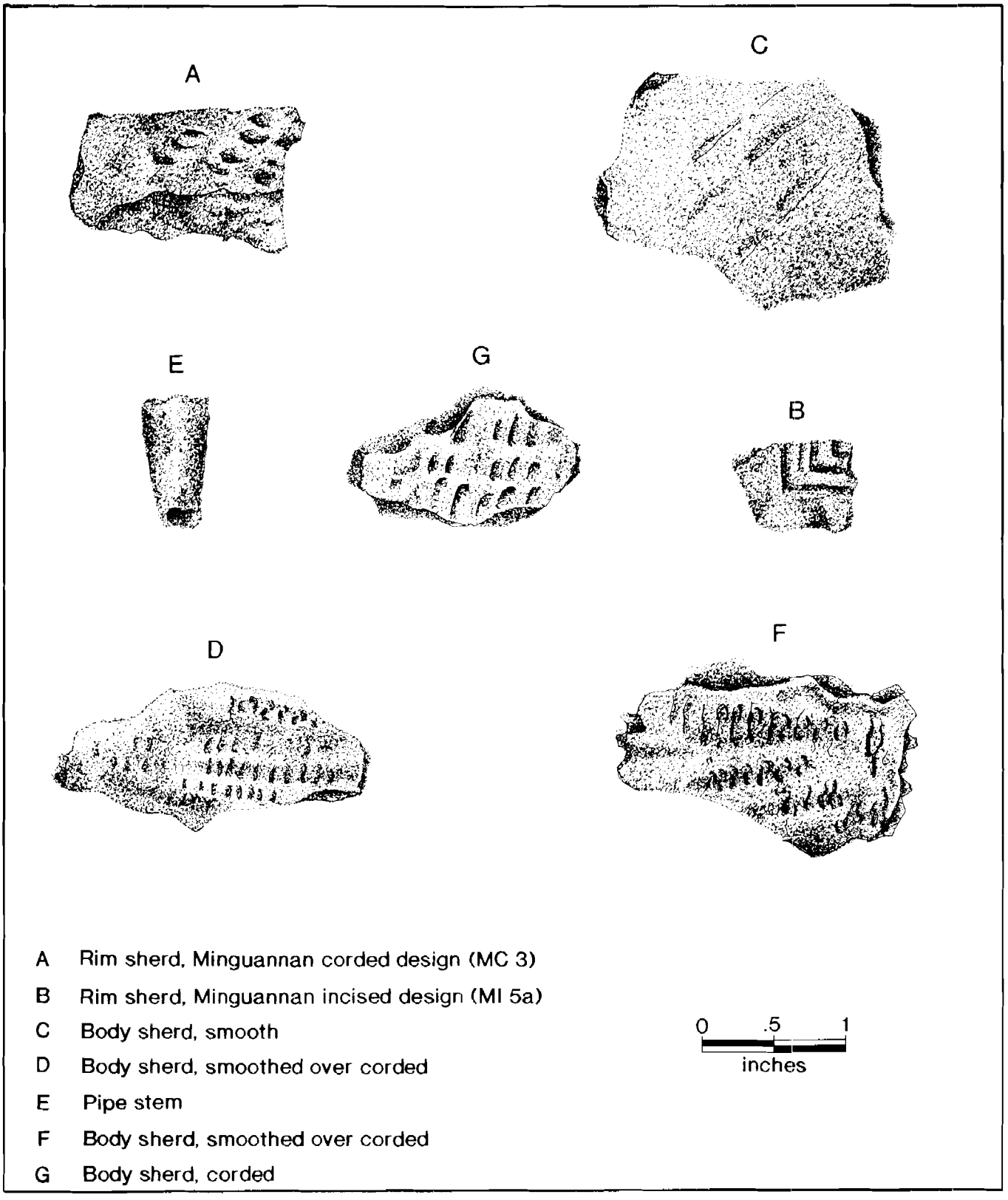
E

F



A Chert
B Jasper
C Jasper
D Jasper
E Jasper
F Jasper

FIGURE 21
Ceramic Artifacts



A Rim sherd, Minguannan corded design (MC 3)
B Rim sherd, Minguannan incised design (MI 5a)
C Body sherd, smooth
D Body sherd, smoothed over corded
E Pipe stem
F Body sherd, smoothed over corded
G Body sherd, corded

archaeological features.

BLOOD RESIDUE ANALYSIS

Blood residue tests were undertaken on artifacts from the Lewden Green Site using protocols developed by UDCAR (Custer, Ilgenfritz, and Doms 1988). A total of 79 soil and gravel samples were tested and only seven samples showed very slight positive reactions indicating that soil contamination, which could cause false positive reactions on artifacts, is not a problem at the site.

Ninety tools were tested and 24 showed positive reactions. Of 33 flake tools tested, 10 showed positive reactions. Of 53 bifaces tested, 13 showed positive reactions and five of these reactions came from triangular points. This finding underscores the presumed function of these tools as hunting, and perhaps butchering, tools and indicates that animal resource processing took place at the site. Also, the fact that almost one third of the flake tools showed positive reactions indicates that some of the flake tools were used for butchering and game processing. The absence of blood residues on other flake tools indicates that flake tools were used for purposes other than animal resource processing. The tools with positive reactions are scattered throughout the site and no specific animal resource processing area is apparent. In sum, the blood residue analysis shows that animals were butchered and processed at the site. However, the majority of the tool assemblage may have been used for other purposes as well.

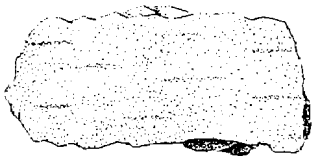
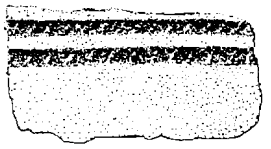
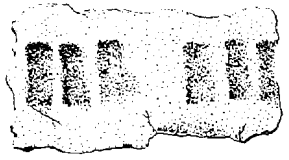
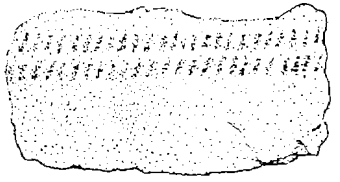
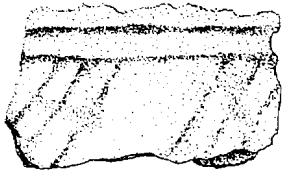
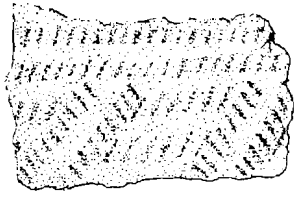
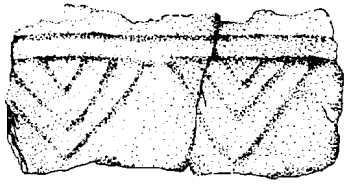
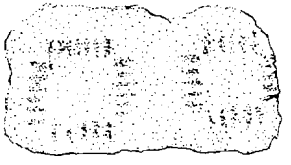
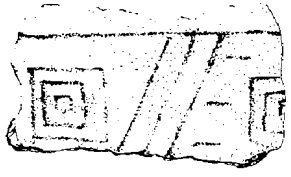
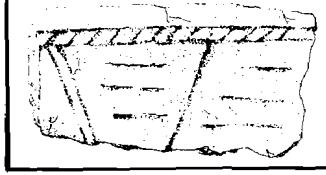
SITE CHRONOLOGY

Because there is no stratigraphic data from the site to use for chronological information, and because the disturbed plowzone contexts would not yield radio-carbon dates, a discussion of site chronology must focus on diagnostic artifacts. Figure 17 shows the stemmed and notched points found at the site and although most of these points are not particularly diagnostic of any particular time period, they are typical of local Woodland I Period (ca. 3000 BC - AD 1000) assemblages (Custer 1989:147-160) and could date to any portion of this time period. Figure 18 shows a sample of triangular points from the site and these projectile points are characteristic of the Woodland II Period (ca. AD 1000 - 1600) (Custer 1989:301-302). A similar range of diagnostic projectile points were recovered from the sewer line excavations (Lewis, Basalik, and Brown 1987:51).

Table 3 lists the diagnostic ceramic types recovered from the site and the overwhelming majority of identifiable sherds are of the Woodland II Minguannan variety dating to ca. AD 1000 - 1600 (Custer 1989:302-307). Woodland I ceramic types identified at the site, including Hell Island, Coulbourn, Wolfe Neck, and Dames Quarter, span the entire time range of ceramic production during the Woodland I Period, ca. 1000 BC to AD 1000 (Custer 1989:168-176). Although the sewer line excavations did recover ceramic artifacts, the report on the excavations notes that all were too small for identification (Lewis, Basalik, and Brown 1987:46). Consequently, they add no data to the discussion of the site chronology.

FIGURE 22

Minguannan Ceramic Design Motifs

MOTIF		NUMBER OF SHERDS	MOTIF		NUMBER OF SHERDS
	MINGUANNAN PLAIN (MP)	19		MINGUANNAN CORDED (MC 1)	3
	MINGUANNAN INCISED (MI 1)	1		MINGUANNAN CORDED (MC 2)	1
	MINGUANNAN INCISED (MI 3a)	1		MINGUANNAN CORDED (MC 4a)	2
	MINGUANNAN INCISED (MI 4b)	1		MINGUANNAN CORDED (MC 5)	1
	MINGUANNAN INCISED (MI 5a)	4			
	MINGUANNAN INCISED (MI 5b)	1			

Broad line incising

Pseudo cord impression

Direct cord impression

0 .5 1

inch

Sourse for design motifs – Custer 1989: 305

The frequencies of diagnostic artifacts within the Lewden Green assemblage suggests that the Woodland II occupations of the site were most likely larger and more intensive than the earlier Woodland I occupations. For example, Woodland II ceramics account for 80 percent of the identifiable ceramic assemblage while Woodland I wares account for only 20 percent. Furthermore, Hell Island wares, which date to the end of the Woodland I Period, ca. A.D. 500-900 (Custer 1989:175-176), account for 93 percent of the identifiable Woodland I ceramics.

A number of Minguannan rim sherds with incised designs were recovered from the Lewden Green Site. Figure 22 shows the varied design motifs and their frequency in the ceramic artifact assemblage. Although some of the more complex design motifs are present in both corded and incised varieties (MI4b, MI5a, MI5b, MC4a, MC5), the more simple motifs (MP, MI1, MI3a, MC1, MC2) account for 74 percent of the rim sherds. Because the presence of predominantly simple design motifs is believed to be characteristic of the later portions of the Woodland II Period (Custer 1989:304-306), the bulk of the Woodland II occupation of the Lewden Green Site may post-date AD 1350.

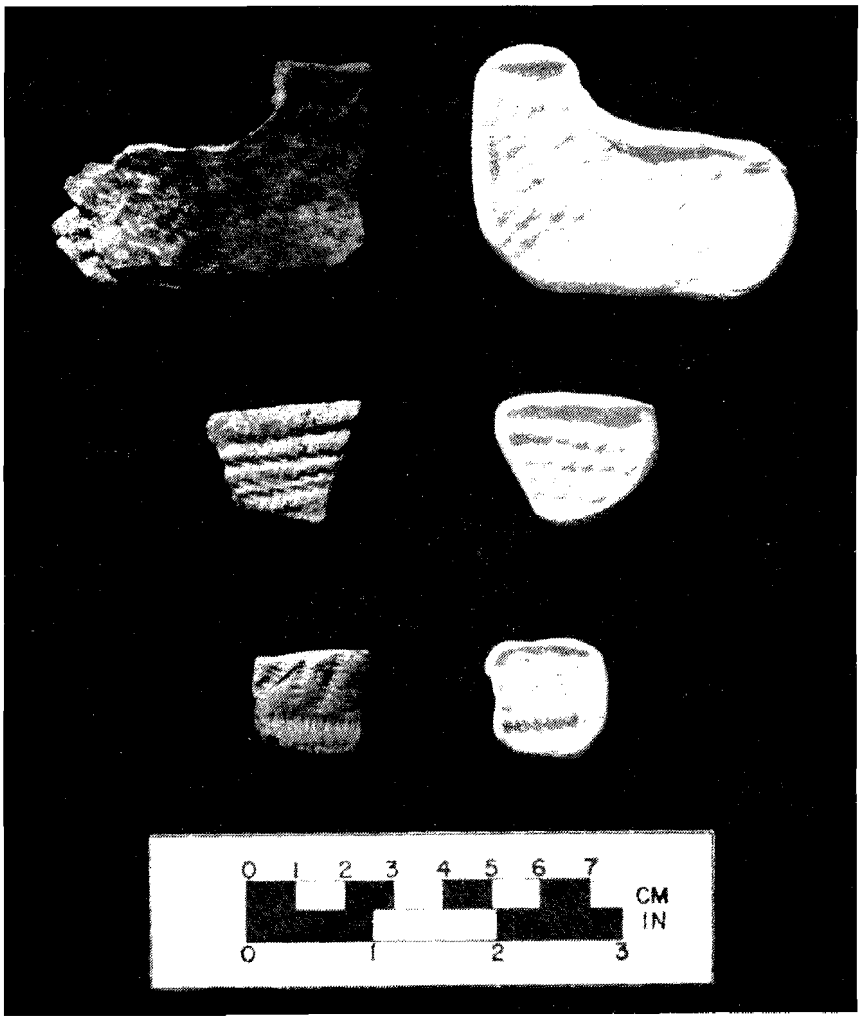
In sum, the occupation of the Lewden Green Site occupations span the Woodland I and Woodland II periods with the majority of the artifacts dating to the later portions of the Woodland II Period.

CERAMIC AND TEXTILE TECHNOLOGIES

Analysis of surface treatments of the ceramic sherds provides some insights on both ceramic and textile technologies.

FIGURE 23

Ceramics and Textile Impressions



A - Rim Sherd, Minguannan Corded Design (mc 3). Impression shows Z-twist cord on cord-wrapped stick used to stamp rim.

B - Rim Sherd, Minguannan Corded Design (mc 3). Impression shows tightly-wrapped cord-wrapped stick used to stamp rim.

C - Rim Sherd, Minguannan Corded Design (mc 1). Impression shows direct cord impression with S-twist cord.

Of the 421 identifiable Minguannan sherds, 12 (3%) were rim sherds where no specific surface treatment could be discerned, 93 (22%) had wiped over corded surface treatments, 18 (4%) had corded surface treatments, and 298 (71%) had wiped or smoothed surface treatments. Clearly, smoothed body surface treatments

FIGURE 24

Varieties of Cordage Twists

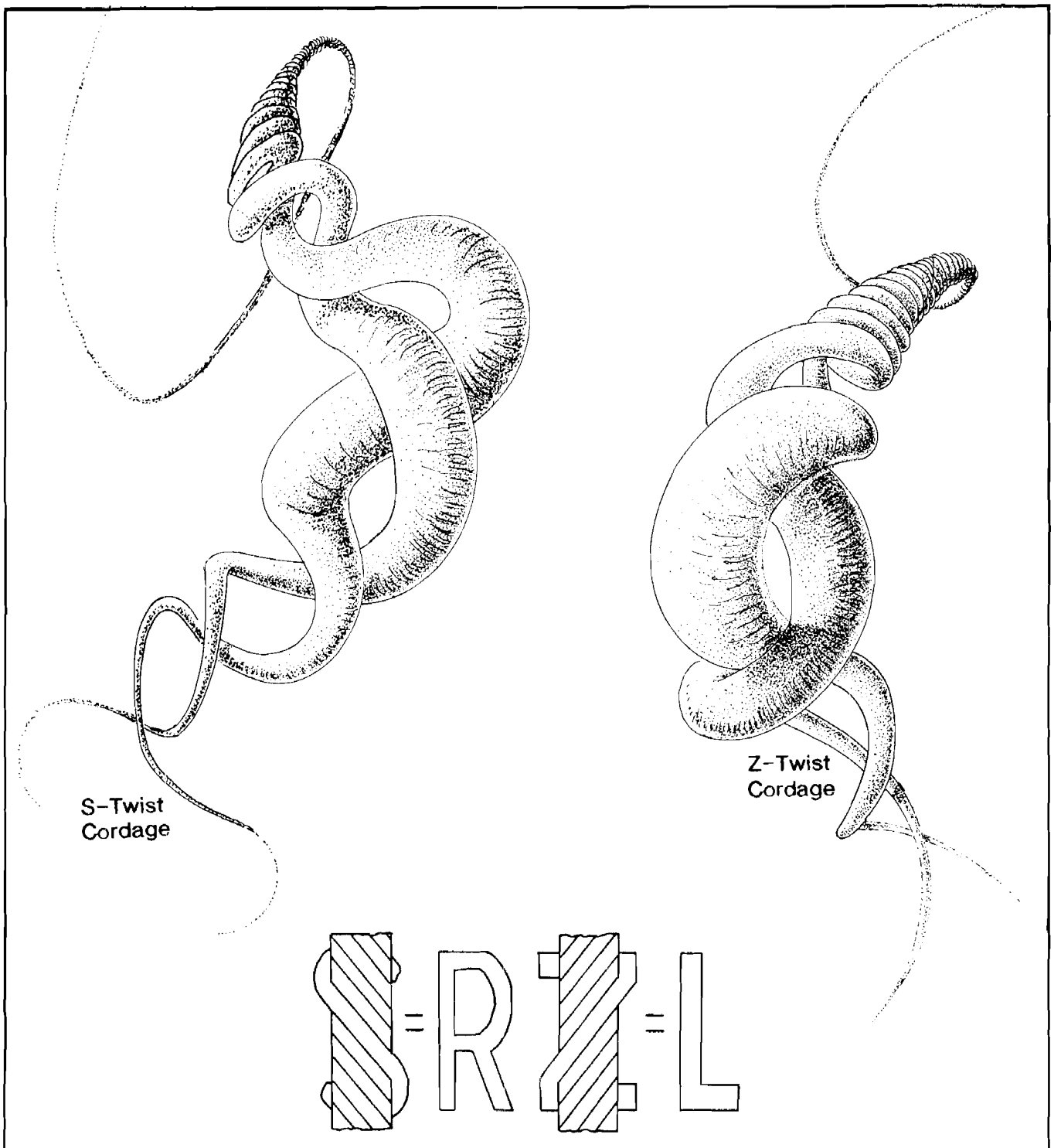


Fig. 1.—Direction of twist, spin or weft slant and symbols employed in their description (after Hurley, 1979).

were the dominant surface treatments used at the Lewden Green Site, and, given the fact that most of the design motifs seem to post-date AD 1350, smoothed body treatments may also characterize late Woodland II Minguannan ceramic technologies.

Where cordage impressions from body surface treatments or corded rim designs are present, it is possible to make clay impressions of the ceramic sherds to study the cordages and textiles. Figure 23 shows the paired ceramics and clay impressions. In general, the clay impressions show that tightly twisted cords and cord-wrapped sticks were used to create the rim designs shown in Figure 22.

Examination of the clay impressions of textiles and cordage can show patterns of cordage manufacturing. For example, numerous studies (Peterson and Hamilton 1984; Adovasio 1983) have shown that the direction of cordage twists can be used to identify ethnic groups of regional social interaction groups in the ethnographic and archaeological societies. Two basic cordage patterns (Figure 24) are present in the assemblage (S-twist - Figure 23c, Z-twist - Figure 23a); however, from a total of 34 observable cordage impressions, 25 (74%) were Z-twists and nine (26%) were S-twists. Thus, Z-twist cordages seem to dominate Minguannan cordage assemblages as recorded from ceramic design impressions.

STONE TOOL TECHNOLOGIES

A variety of lithic artifacts from the Lewden Green Site assemblage can be analyzed to learn about prehistoric tool technologies. The Woodland I stemmed and notched points (Figure

17) show a variety of damage and breakage patterns which provide data on their functions. Transverse fractures indicative of knife usage (Figure 17B), tip damage indicative of projectile point use (Figure 17A, C, G, H, I), and breakage patterns and irregular blade cross-sections indicative of failed point resharpening (Figure 17F, J) are all present. Among the triangular point assemblage (Figure 18), signs of damage from projectile point use are most common (Figure 18A-H) although points rejected late in their manufacturing process are also present (Figure 18 I-K). Thus, refurbishing of tool kits was one of the activities which took place during the Woodland I and Woodland II occupations of the site.

The biface assemblage (Figure 20) includes early stage (Figure 20B and D), middle stage (Figure 20A and C), and late stage (Figure 20E and F) bifaces. Some bifaces have cortex present (Figure 20A and D) although some seem to have been manufactured from large pieces of primary cryptocrystalline materials (Figure 20B). Thus, manufacturing of bifaces from local cobbles and curated raw materials took place at the site with the entire range of biface reduction activities and stages being represented.

A variety of flake tools are present in the Lewden Green assemblage and Figure 19 shows a sample of these tools. Most of the flake tools are blocky flakes which have had their lateral or distal edges retouched (Figure 19A-E), although some elongated blade-like flakes with retouched lateral edges (Figure 19F and G) and small bifacially retouched flakes (Figure 19H-J) are present. Blood residues are present on some examples of all of these types

of flake tools indicating that all varieties functioned at some times as game animal processing tools. Other uses are also likely. Almost one third of the flake tools show signs of remnant cortex (Table 2) indicating that they were derived from cobble cores. However, many of the flake tools seem to have been manufactured on flakes which were struck from prepared cores of primary cryptocrystalline raw materials. In sum, flake tools were manufactured for a variety of purposes from a variety of lithic raw materials at the Lewden Green Site.

TABLE 4

SUMMARY CATALOGUE - LITHIC ARTIFACTS - SEWER LINE EXCAVATIONS*

ARTIFACT Type	**RAW MATERIAL** Quartzite	Quartz	Chert	Jasper	TOTAL
Flakes	52	79	164	382	677
Flake Tools	--	--	---	---	---
Bifaces	--	2	1	4	7
Cores	2	3	1	-	6
Points	--	--	3	5	8
TOTAL	54	84	169	391	698

* Source: Lewis, Basalik, and Brown 1987:48

Analysis of the debitage from the site shows lithic resource utilization. In considering raw material frequencies among the debitage, the data from the sewer line excavations (Table 4) were combined with the UDCAR and DelDOT data (Table 2) to form a combined summary catalogue (Table 5). Unfortunately, cortex percentages, which are indicators of cobble utilization, were not

TABLE 5

COMBINED SUMMARY CATALOGUE - LITHIC ARTIFACTS

ARTIFACT Type	RAW MATERIAL Quartzite	Quartz	Chert	Jasper	TOTAL
Flakes	155	704	961	2764	4584
Flake Tools	--	3	3	4	10
Bifaces	1	15	11	25	52
Cores	2	3	1	-	6
Points	--	3	5	18	26
TOTAL	158	728	981	2811	4678

systematically reported for individual artifact types of varied raw materials and these data could not be included in the combined summary catalogue.

Examination of Tables 2, 4, and 5 shows that jasper is the most common lithic raw material in the debitage assemblage by an order of magnitude. Chert and quartz are the next most frequent raw materials and quartzite is the least frequent. Based on the data in Table 2, cortex is present on 14 percent of the debitage and Table 6 shows the percentage of debitage with cortex for each

TABLE 6

DEBITAGE CORTEX FREQUENCY

	Qtzite	Qtz	Chert	Jasper	Chal
Total Debitage	103	625	797	2382	73
Debitage with cortex	31	131	134	261	7
% Debitage with cortex	30%	21%	17%	11%	10%

KEY:
Qtzite - quartzite
Qtz - quartz
Chal - chalcedony

of the major lithic raw materials. Quartz and quartzite have the highest cortex percentages, chert has a slightly smaller middle range value, and jasper and chalcedony have the lowest cortex frequencies. These data indicate that secondary quartz and quartzite cobbles were being reduced for use as bifaces and cores and that cryptocrystalline debitage was more commonly derived from primary lithic sources, perhaps cores and bifaces which were transported from the nearby Delaware Chalcedony Complex outcrops near Newark (Custer, Ward, and Watson 1986).

TABLE 7

RAW MATERIAL PERCENTAGES BY ARTIFACT CLASS - COMBINED SITE DATA

ARTIFACT Type	RAW MATERIAL Quartzite	Quartz	Chert	Jasper
Flakes	4%	15%	21%	60%
Flake Tools	--	30%	30%	40%
Bifaces	2%	29%	21%	48%
Cores	33%	50%	17%	--
Points	--	12%	19%	48%

Table 7 shows raw material percentages by artifact class and Table 8 shows raw material preferences by artifact class. For all artifact classes, except cores, jasper is the most commonly used raw material. These data indicate that quartzite, and probably quartz cobbles, which are locally available at the site, were being reduced to produce flakes for use as cutting or scraping tools with little or no edge modification. Similar expedient cobble core reduction has been noted at other local

TABLE 8

RAW MATERIAL PREFERENCES BY ARTIFACT CLASS

Flakes	J, CH, Q, QZ
Flake Tools	J, CH-Q, QZ
Points	J, CH, Q, QZ
Bifaces	J, Q, CH, QZ
Cores	Q, QZ, CH, J

KEY

J = Jasper
CH = Chert
Q = Quartz
QZ = Quartzite

sites (eg. - Custer 1987, 1988). Primary jasper and other cryptocrystalline materials, were used for both biface production and flake tool manufacture. Some locally available cryptocrystalline cobbles were being utilized, but for the most part, cryptocrystalline lithic use seems to have focused on cores and bifaces of primary materials which were transported to the site.

In sum, a variety of lithic raw materials from varied sources were being reduced at the Lewden Green Site to produce a variety of bifacial and unifacial tools which were used for numerous different purposes. Local cobble materials were utilized as part of an expedient lithic technology while primary cryptocrystalline materials formed part of a curated and transported lithic technology during both Woodland I and Woodland II times.

ACTIVITY AREAS AND SITE FUNCTION

Distribution maps of varied artifact classes were prepared for the area excavated by UDCAR and DelDOT archaeologists. Data from the sewer line excavations were not included in the maps

because they were somewhat far removed from the main site excavations. Figure 25 shows the distribution of total artifacts and Figures 26-28 show distributions of ceramics, tools, and debitage. Comparison of Figures 25-28 shows that most artifacts were concentrated on the western end of the site. Only the distribution of tools (Figure 27) differs from the pattern seen for total artifacts, debitage, and ceramics, with the tools being more widely scattered across the site than the other artifact classes. These distributions suggest that the habitation and tool reduction activities were concentrated at the western end of the site while resource processing, including processing of game animals - based on the results of blood residue analysis - took place at a variety of locations throughout the site.

Figure 29 shows the distribution of bifaces and points and it can be seen that these artifacts are scattered at several locations in the eastern area of the site away from the main artifact concentration in the western site area. Figures 30 and 31 show the distributions of artifacts with and without cortex. The distribution of artifacts with cortex shows a scatter across the site while artifacts without cortex are concentrated on the western end of the site. These distributions suggest that secondary lithic raw materials were utilized at the scattered processing locales across the site while primary materials were utilized at the main habitation area on the western end of the site. The association of the secondary lithic utilization with the scattered processing locales underscores the identification of local cobble resources as a source of expedient tools.

FIGURE 25

Distribution Map - Total Artifacts

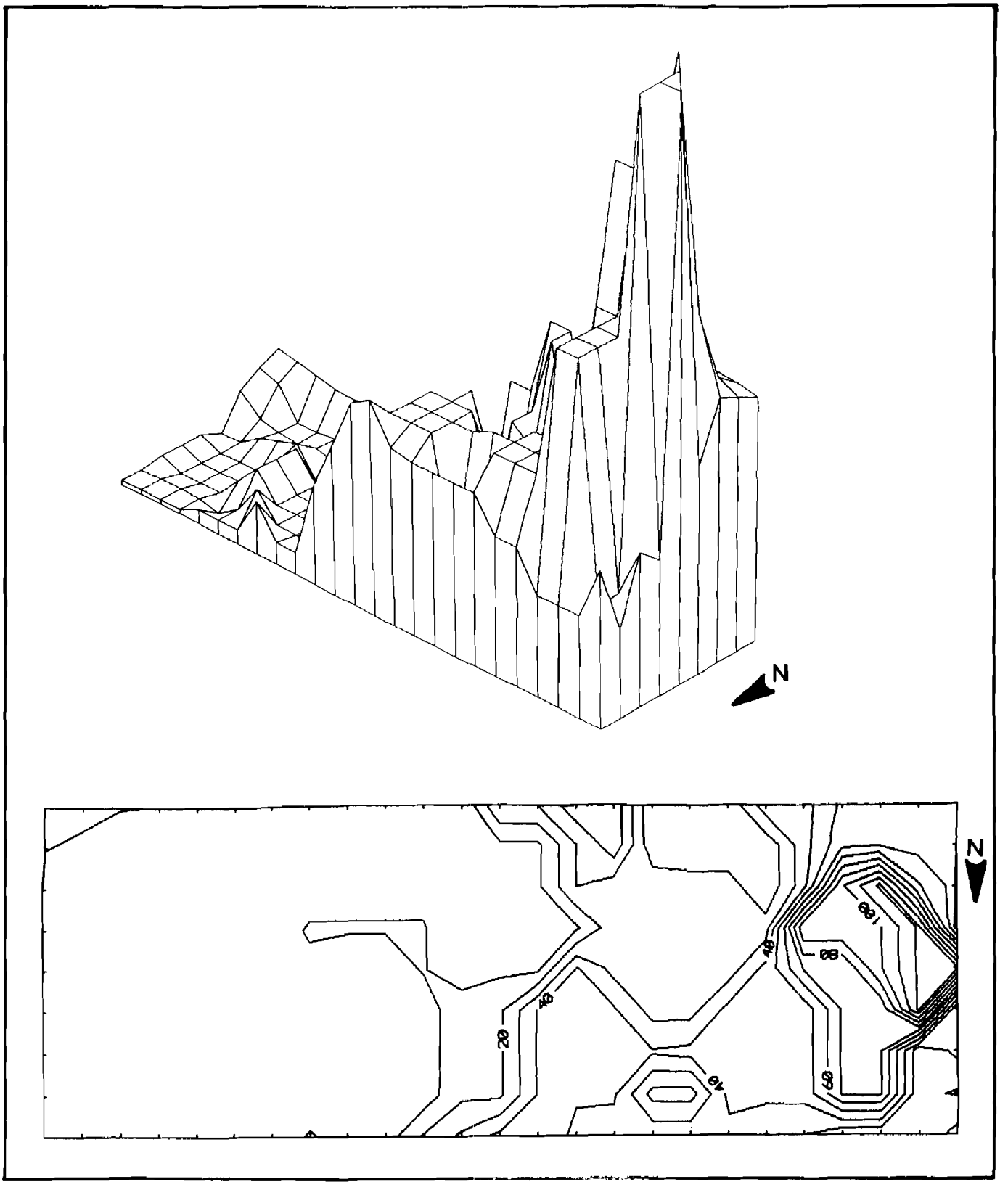


FIGURE 26

Distribution Map - Ceramics

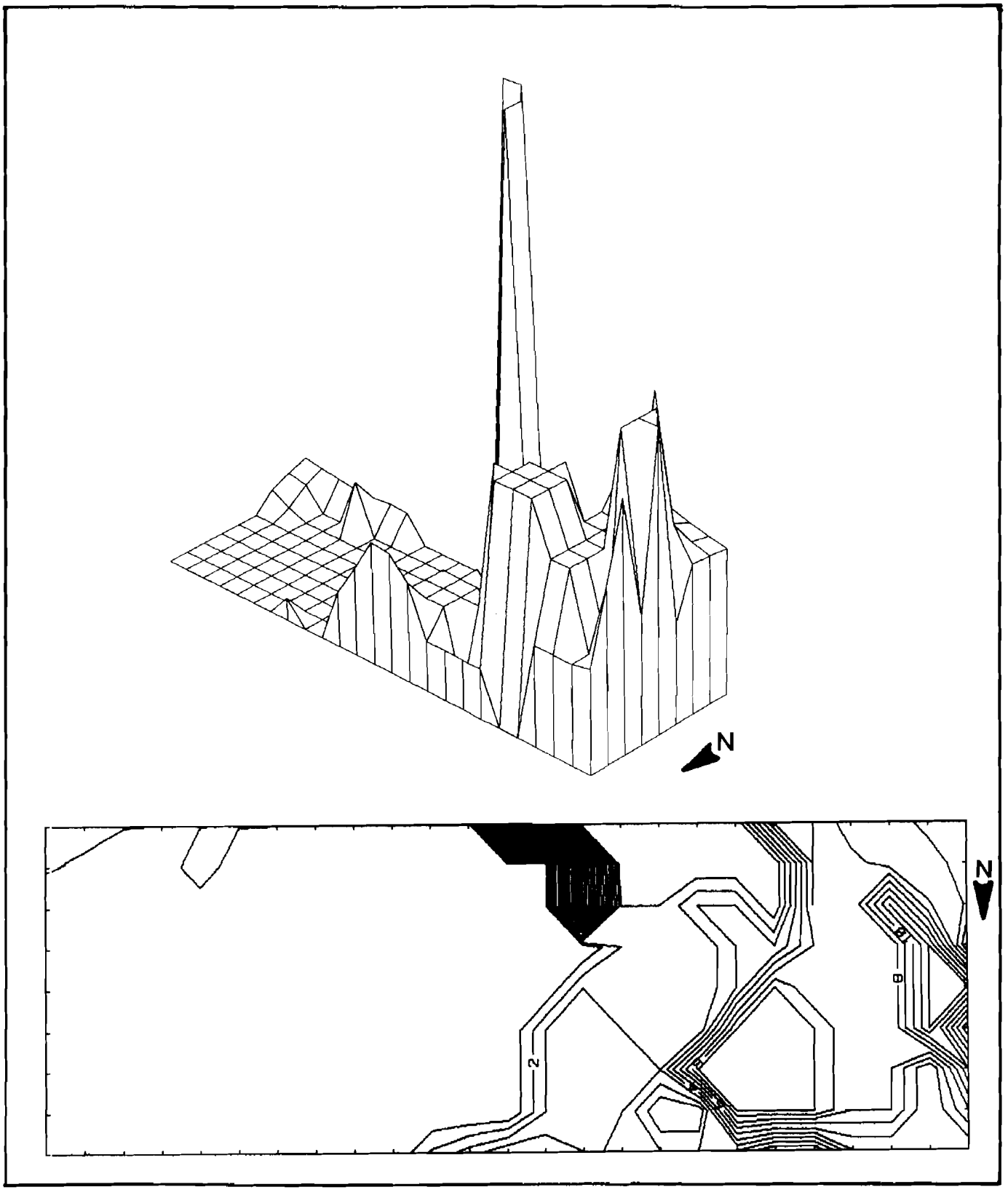


FIGURE 27

Distribution Map - Tools

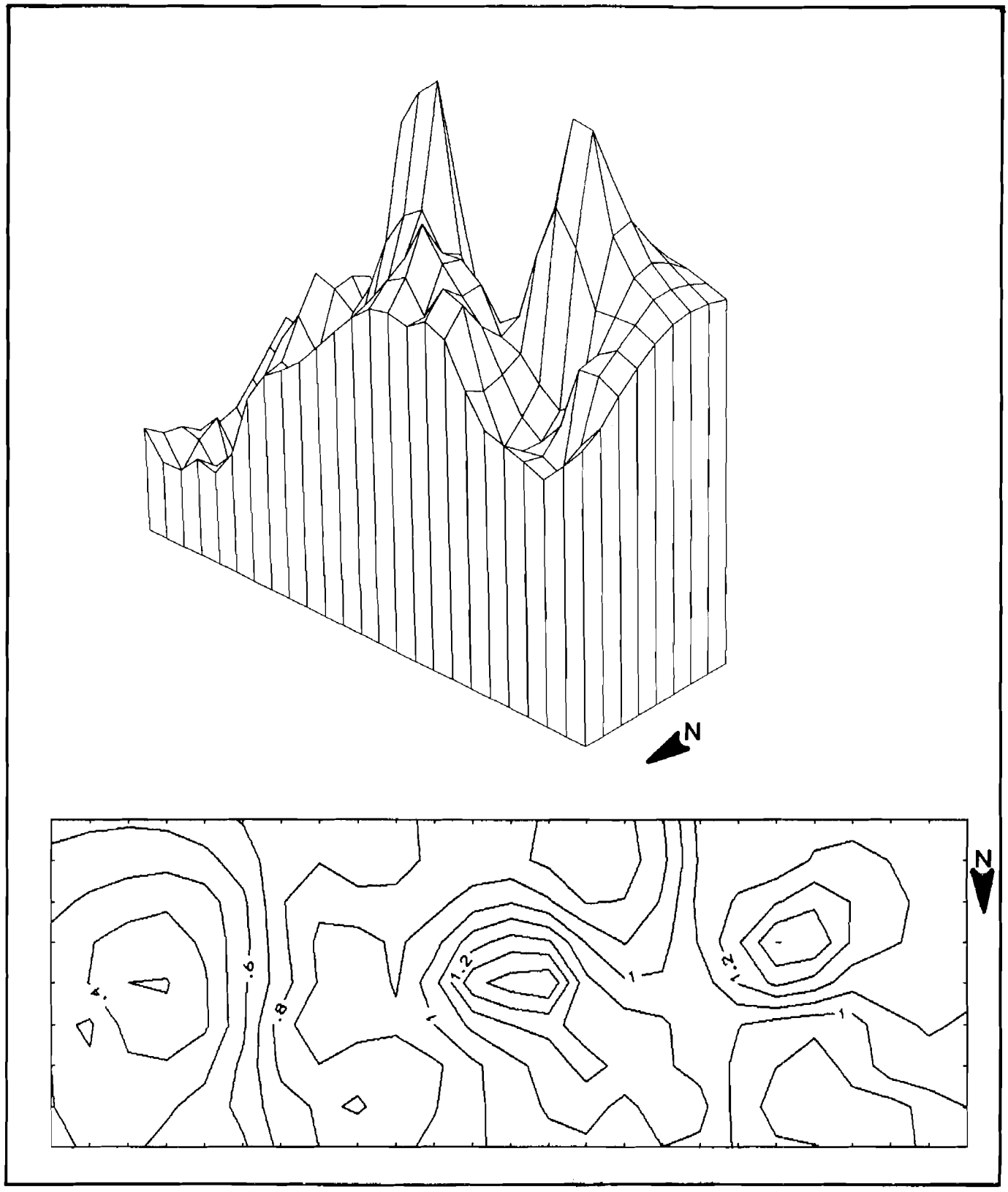


FIGURE 28

Distribution Map - Debitage

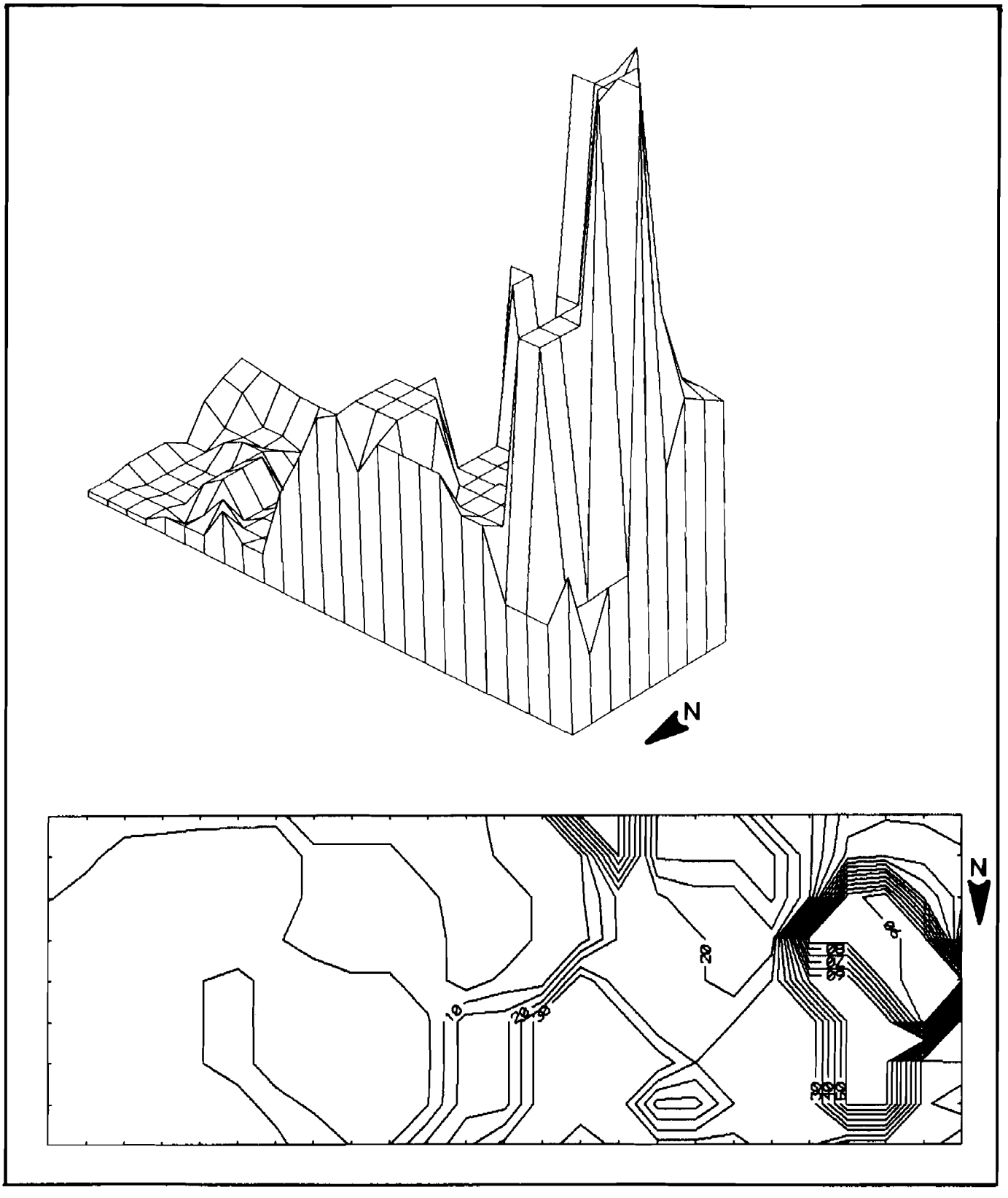


FIGURE 29

Distribution Map - Bifaces and Points

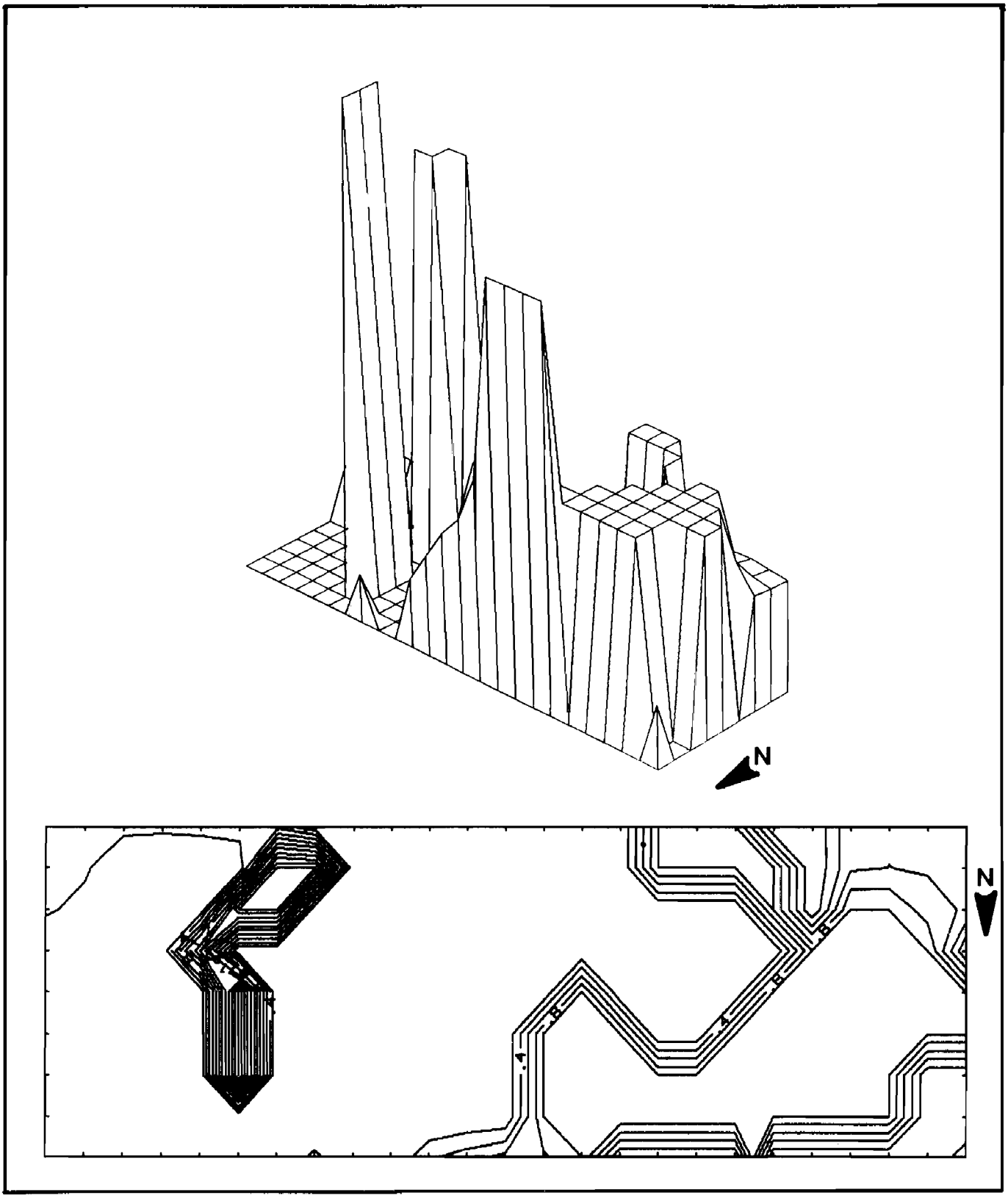


FIGURE 30

Distribution Map - Artifacts with Cortex

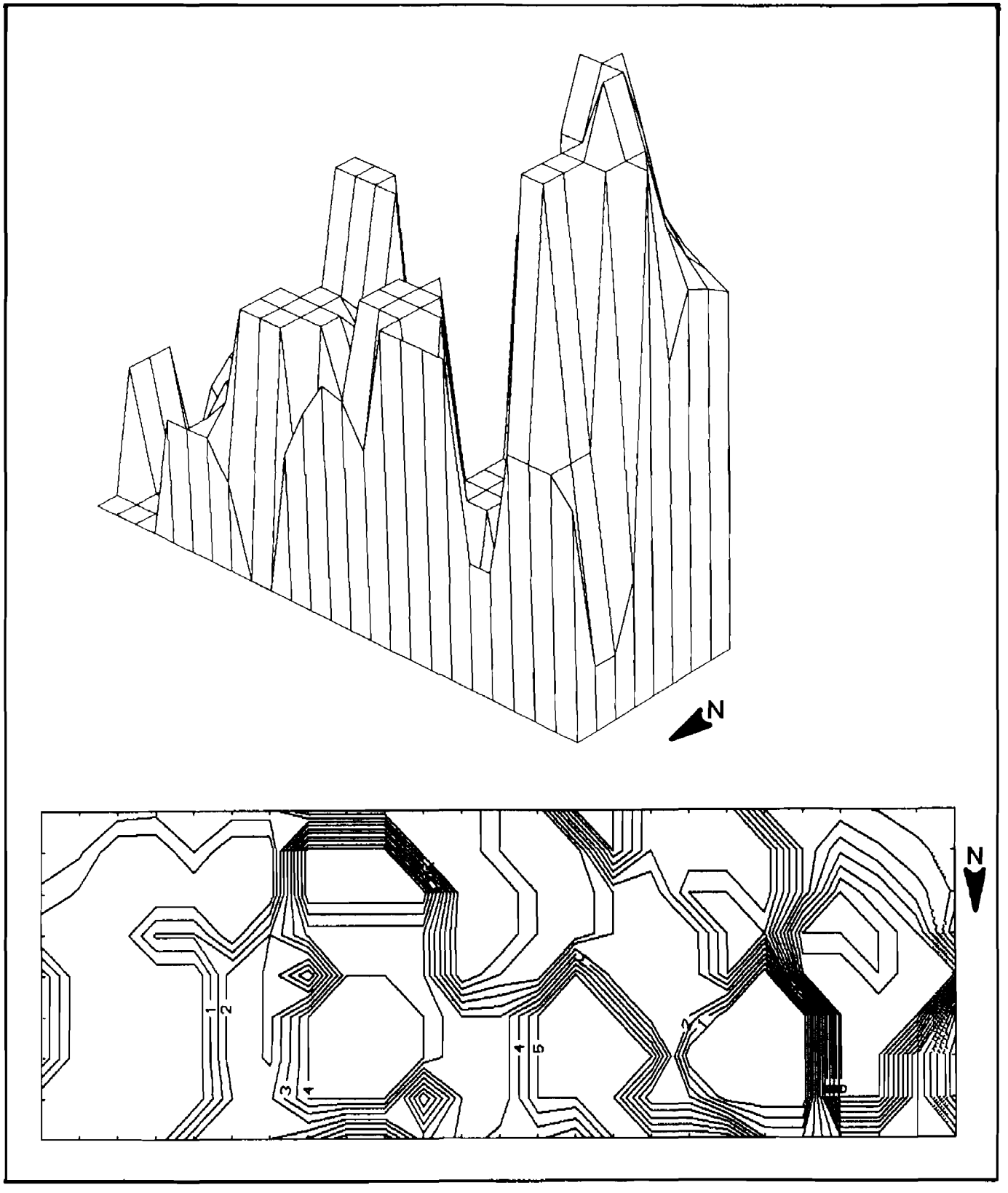
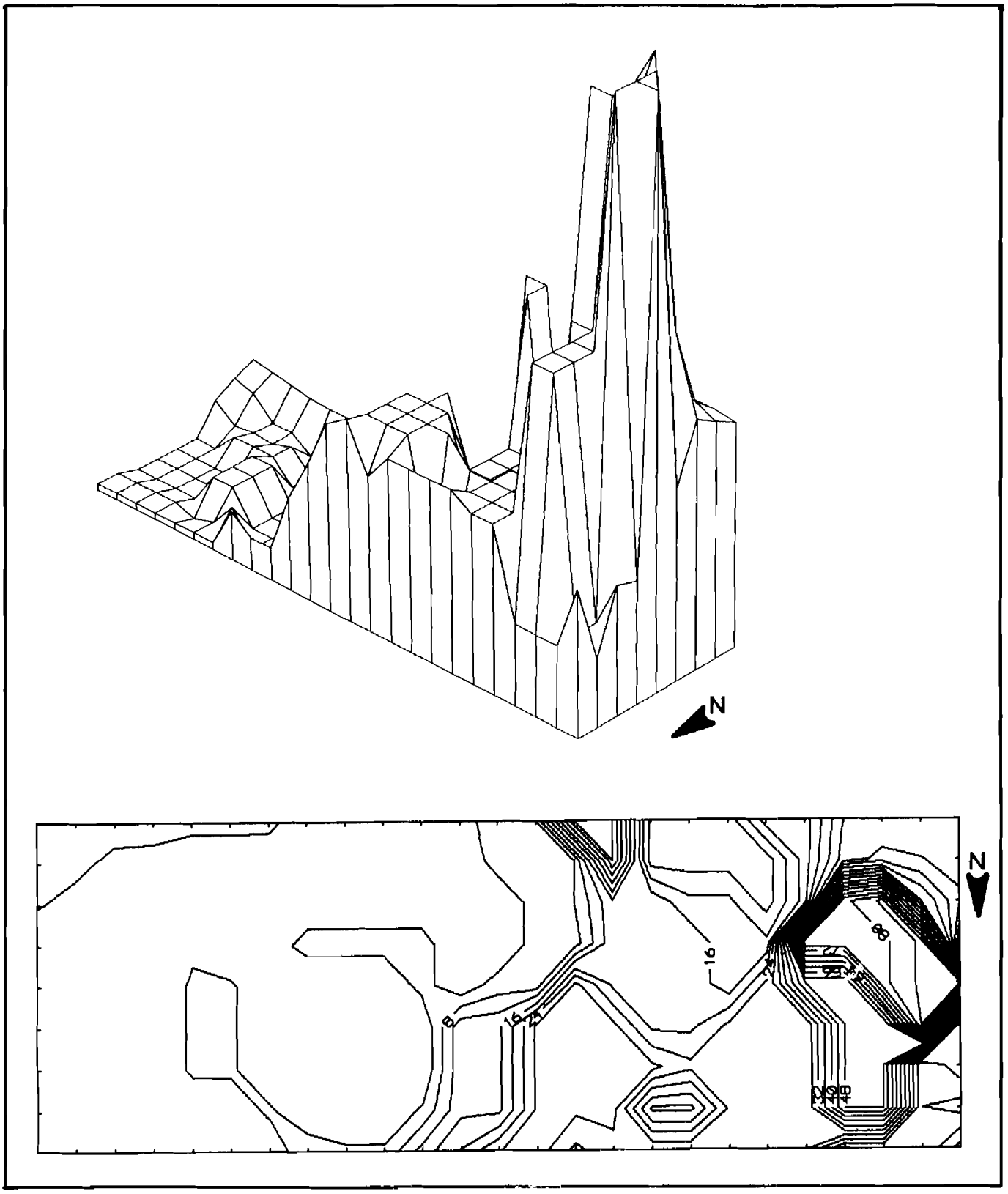


FIGURE 31

Distribution Map – Artifacts Without Cortex



Analysis of distributions of cortex and non-cortex debitage by individual raw materials shows similar patterns. Mapped distributions include quartzite (Figures 32 and 33), quartz (Figures 34 and 35), chert (Figures 36 and 37), and jasper (Figures 38 and 39). Quartzite, both with and without cortex, chert with cortex, and jasper with cortex all show distributions with isolated concentrations outside the main artifact concentration at the western end of the site. The fact that these raw material distributions with cortex are found in the same area as the isolated procurement locales further supports the idea that cobble resources were used as expedient tools at the Lewden Green Site. The presence of quartzite debitage without cortex at the same locales probably represents intensive reduction of quartzite cobbles to their interior sections which produced debitage with no signs of cortex. Furthermore, spatial distribution indicates that quartzite raw material was used almost exclusively as a source for expedient tools.

To summarize, the Lewden Green Site includes a concentrated habitation area on the western end of the site with a number of scattered processing locales throughout the eastern portion of the site. Based on blood residue analysis, both animal resources and other resources, perhaps plant foods or wood, were processed at these scattered locales. Expedient tools were manufactured from locally available cobble resources at these procurement activity loci. At the main artifact concentration area, the presence of relatively large numbers of ceramic sherds indicates food cooking and processing. Limited expedient tool production, biface reduction, and resource processing utilizing a variety of

FIGURE 32

Distribution Map - Quartzite Artifacts with Cortex

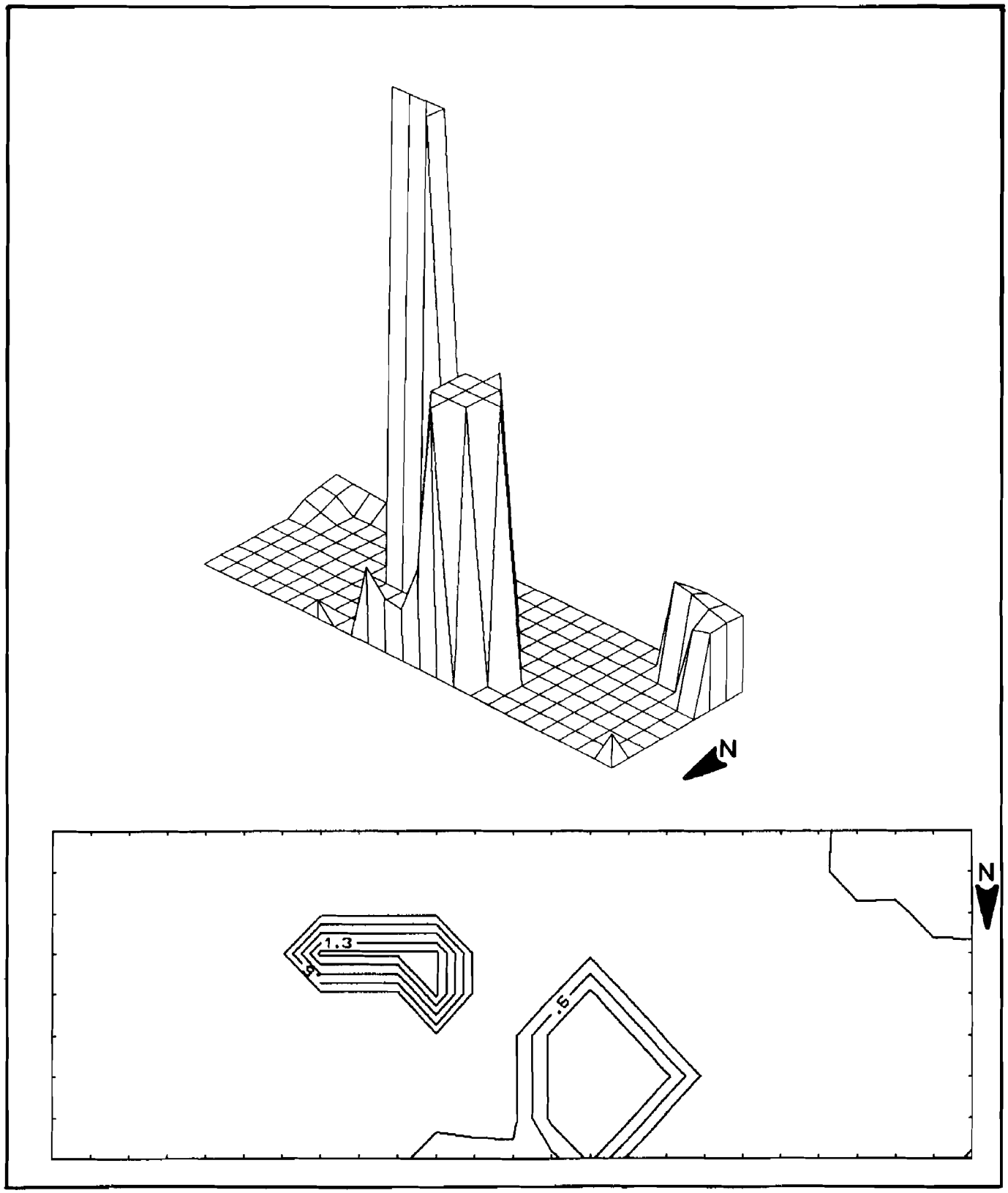


FIGURE 33

Distribution Map - Quartzite Artifacts without Cortex

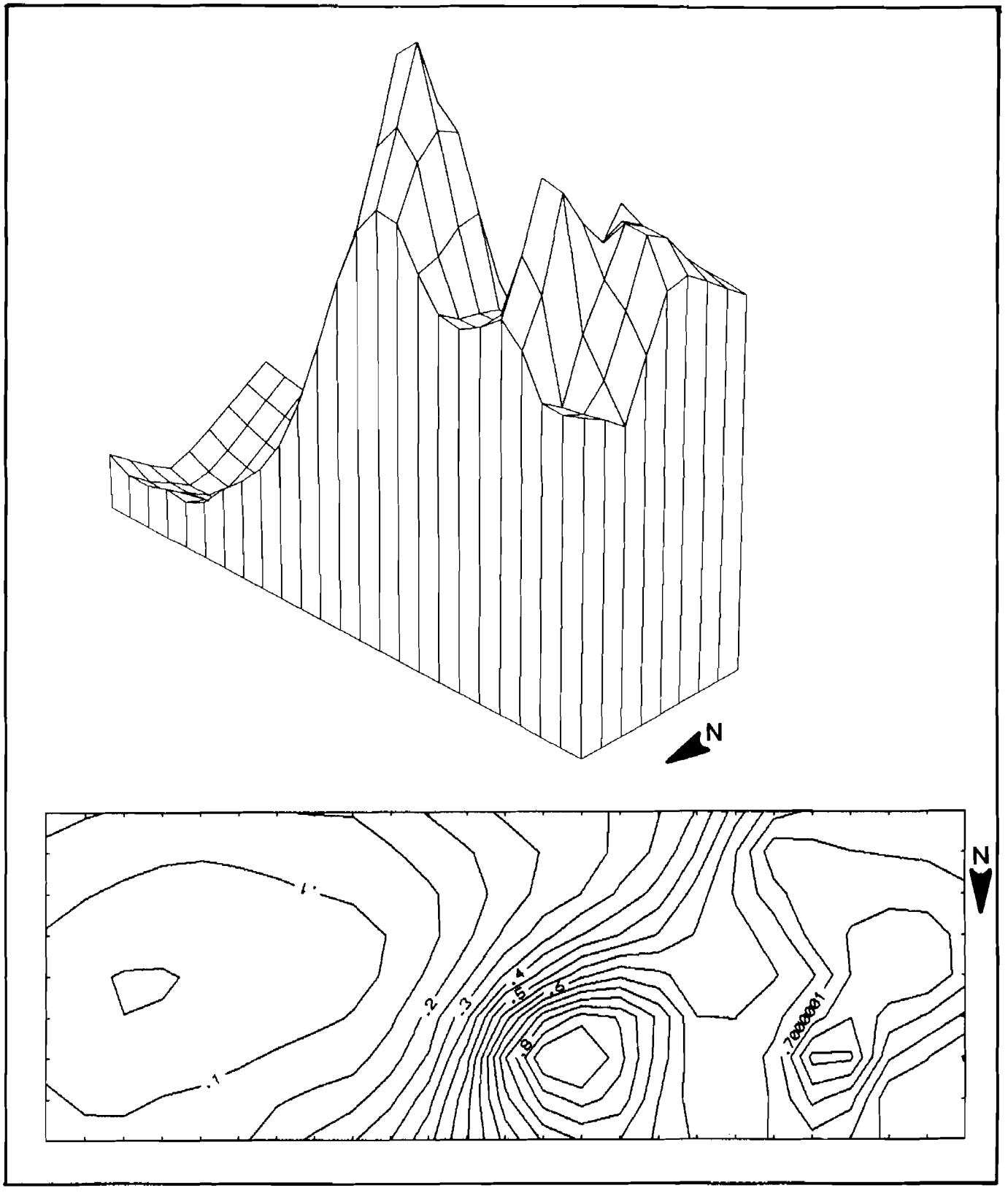


FIGURE 34

Distribution Map – Quartz Artifacts with Cortex

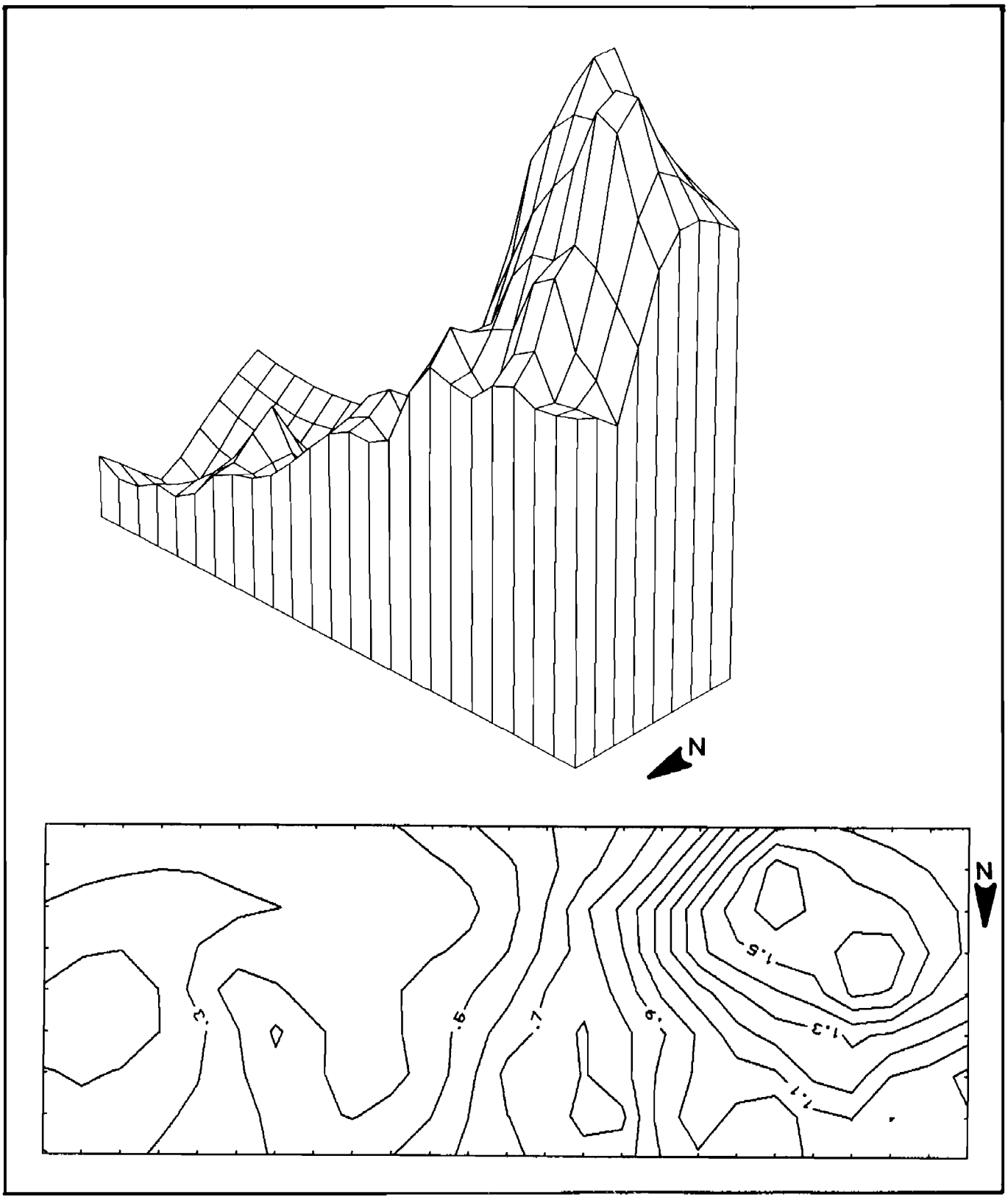


FIGURE 35

Distribution Map – Quartz Artifacts without Cortex

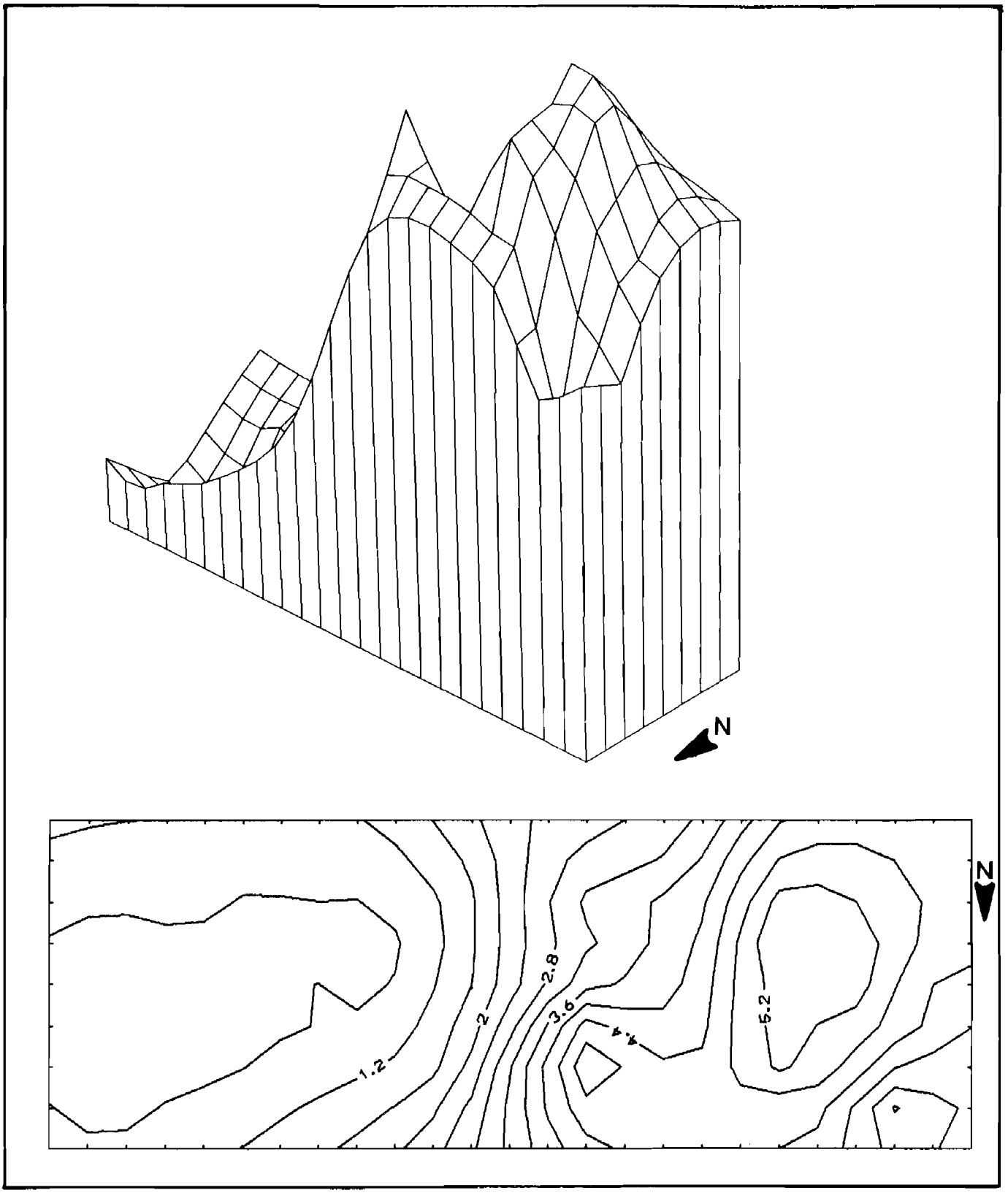


FIGURE 36

Distribution Map - Chert Artifacts with Cortex

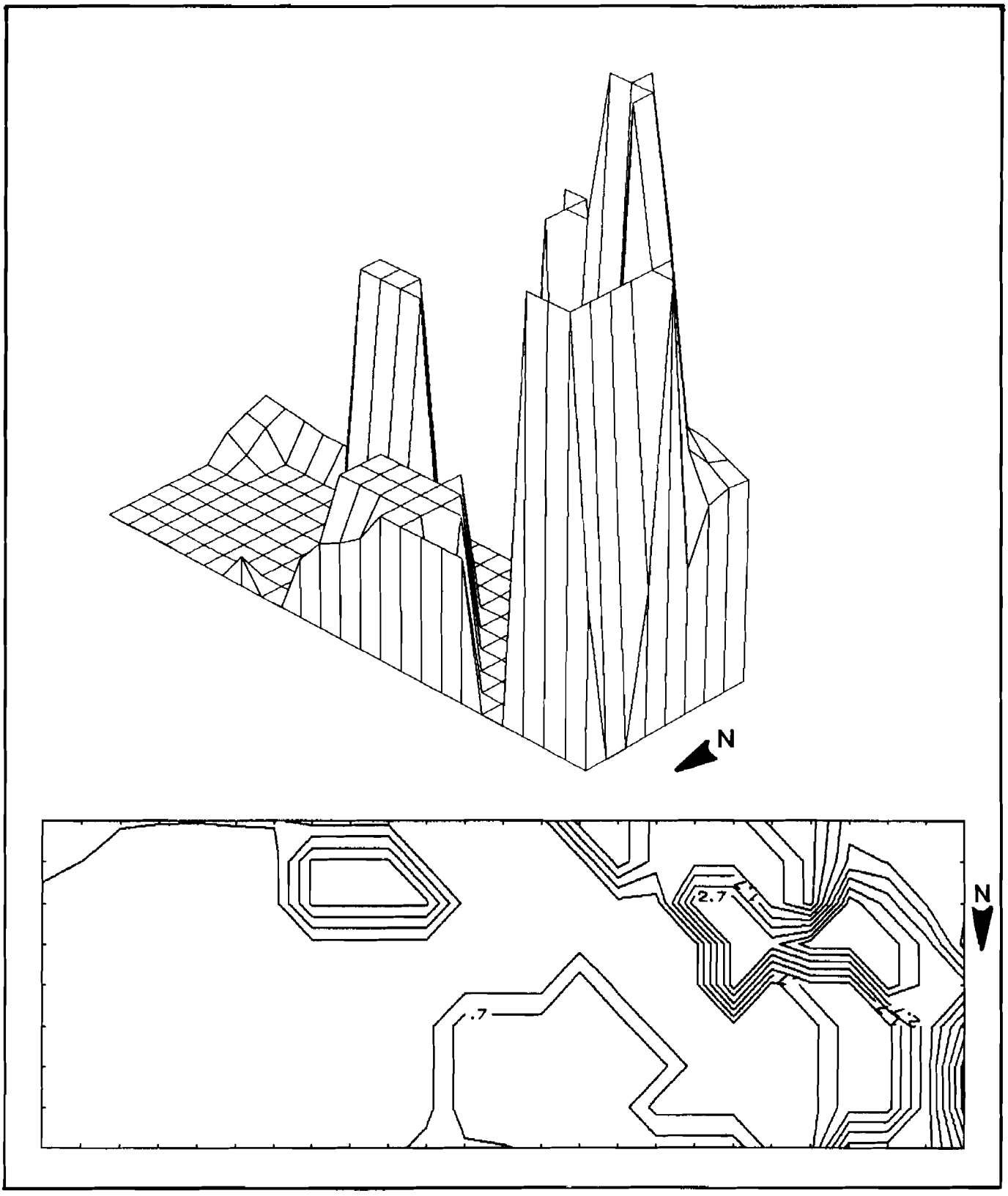


FIGURE 37

Distribution Map – Chert Artifacts without Cortex

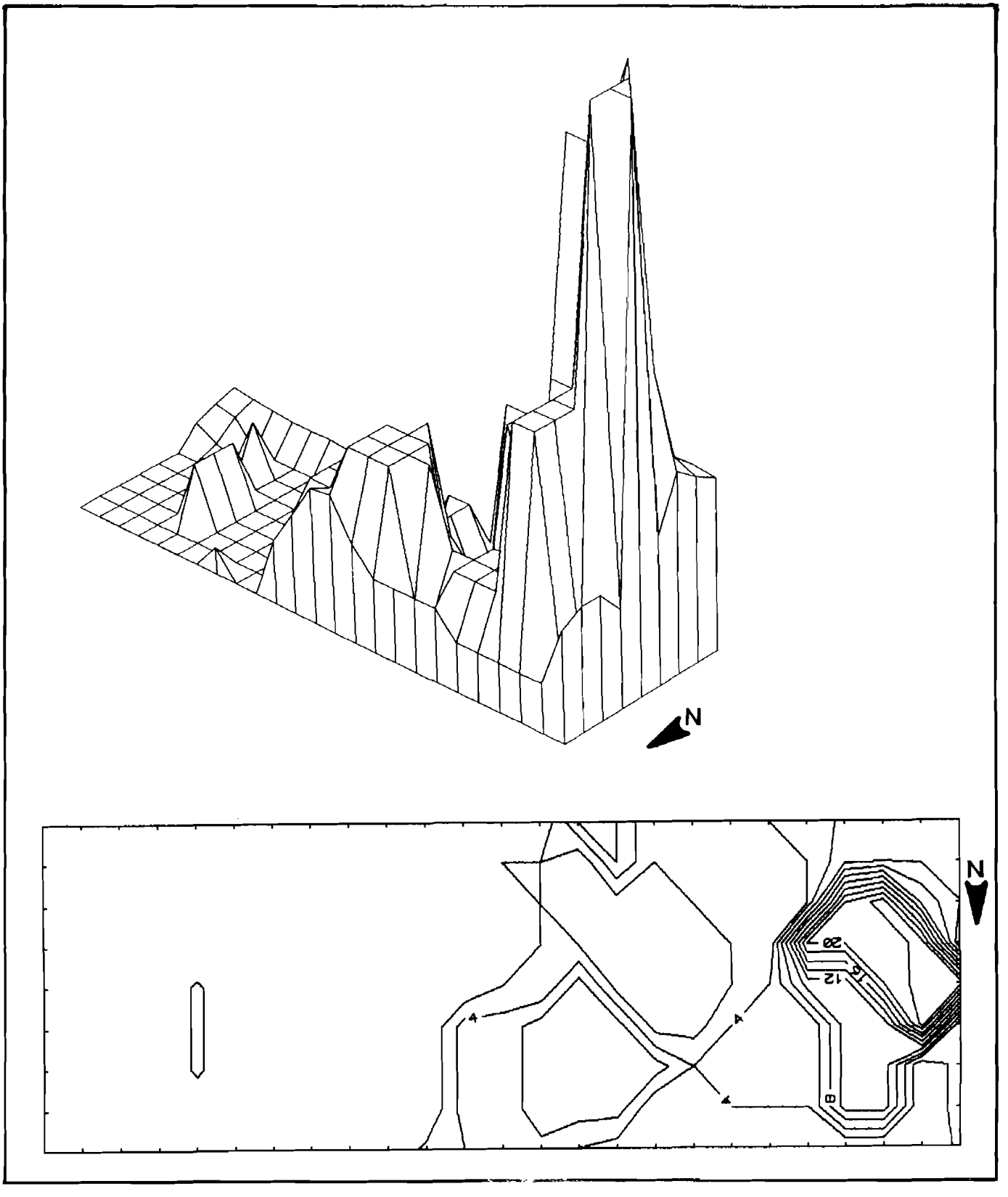


FIGURE 38

Distribution Map - Jasper Artifacts with Cortex

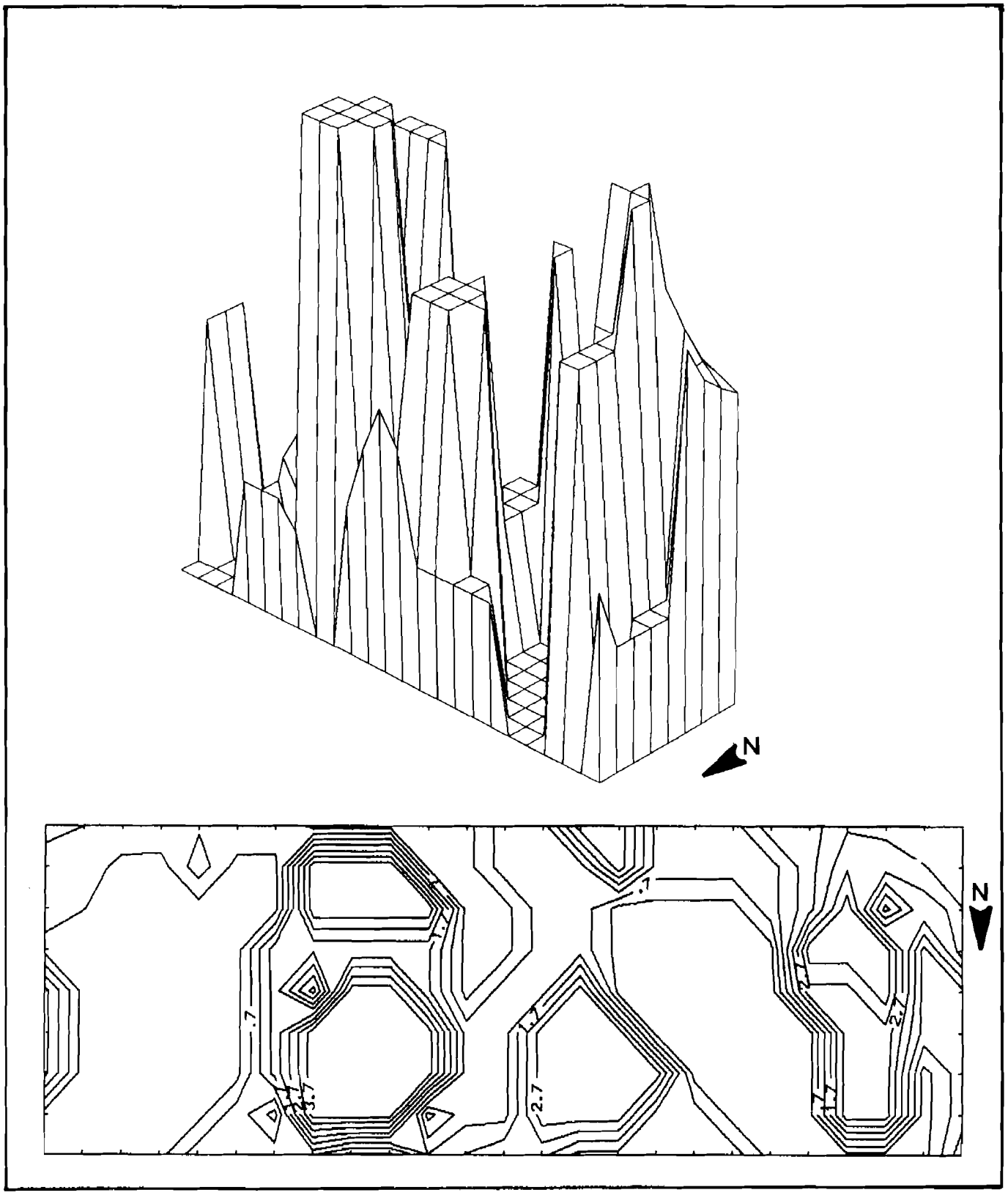
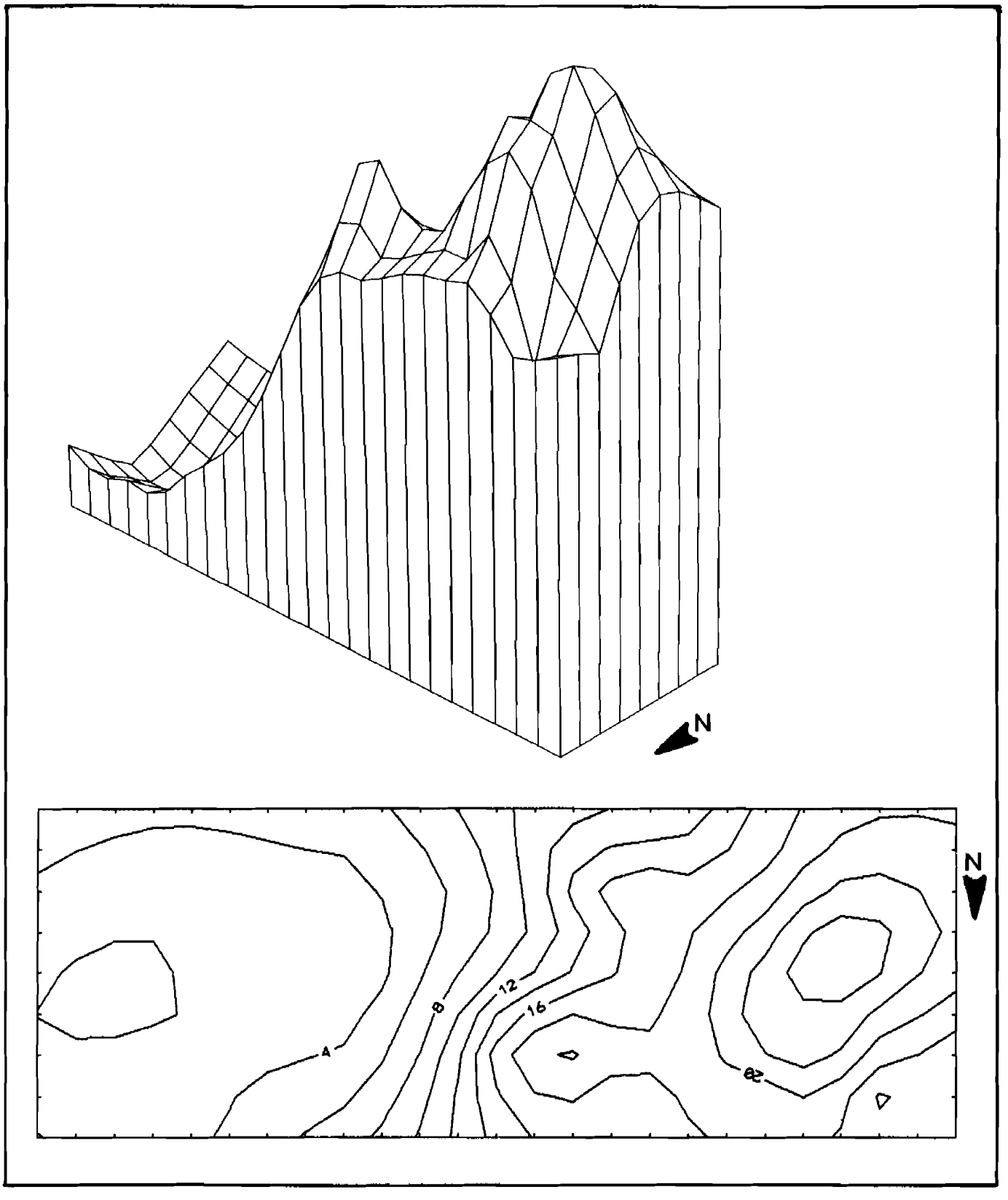


FIGURE 39

Distribution Map - Jasper Artifacts without Cortex



flake tools also occurred at the main habitation area of the Lewden Green Site. Based on the variety of activities which occurred at the site, the relatively large number of artifacts recovered, and the spatial separation of habitation and processing activities, the site is most likely a base camp whose major use dates to the later portions of Woodland II Minguannan Complex times. Based on the size of the site, which was determined through the initial testing, the Lewden Green Site is not as large as large macro-band base camps, such as the Clyde Farm Site (Custer 1982); therefore, the Lewden Green Site is probably a micro-band base camp rather than a macro-band base camp.

It should be noted that in the sewer line report, the Lewden Green Site is characterized as a procurement site, and the UDCAR analyses of site function used at other local sites are subjected to a number of ad hominem criticisms (Lewis, Basalik, and Brown 1987:61-63). In reply, we note that the sewer line excavations covered only a small portion of the site, which is probably an outlying procurement locale similar to those identified in the UDCAR and DelDOT excavations, and such a characterization of the site's function, based on analysis of only a small portion of the site, is not likely to yield accurate results. Furthermore, we feel that the research approach of the sewer line report, which used average flake size and gross measures of cortex percentage within the entire assemblage for the characterization of lithic resource use, reduction activities, and site function, are not viable alternative research methods. For example, calculation of cortex percentage for the entire assemblage regardless of raw

material blurs important lithic resource use patterns. Also, analysis of flake size to characterize lithic reduction is usually part of extensive study of many aspects of lithic technology at a site as was done in the example (Stewart 1985) cited in the sewer line report. However, the sewer line report never produced a comparable analytical context within which to interpret the flake size data. Also, lumping together of all

debitage, regardless of raw material, for analysis of flake size is likely to blur meaningful variability. Consequently, we have no plans to use the sewer line report's analytical approach to lithic artifacts to replace the UDCAR and DelDOT analytical methods used in this report.

In sum, the Lewden Green Site is viewed here as a micro-band base camp whose main occupation dates to the end of the Woodland II period. Figure 40 shows the distribution of the inferred activity areas at the site. In addition, the findings at the Lewden Green Site meet the expectations of the Northern Delaware Management Plan for all the time periods.

CONCLUSIONS

The excavations at the Lewden Green Site provide data that have implications for a number of regional research issues and each of these issues is discussed below.

REGIONAL GEOMORPHOLOGY AND PALEOENVIRONMENTS

The stratigraphic data from the Lewden Green Site is of interest with regards to regional trends in Holocene geomorphology. Soils data from Lewden Green indicate relative stability of the landscape around the site throughout the Holocene. In contrast, sedimentary data from some of the high bluffs overlooking the Christina River and Churchman's Marsh indicates pronounced alterations of landscapes, primarily through aeolian processes throughout the Holocene (Custer and Watson 1987). The Lewden Green Site differs from the bluffs in that it is on a low-lying gentle slope close to the drainage.