LITHICS AT SHOOFLY VILLAGE

AN INTRA-SITE ANALYSIS

by

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INTRODUCTION

In the summer of 1984 Arizona State University hosted an archaeological field school which was directed by Dr. Charles L. Redman. The project focused upon a large masonry pueblo site located on the northern frontier of the Hohokam region in the Sinagua area. Shoofly Village lies just south of the Mogollon Rim near Payson, Arizona. A number of graduate students from Arizona State University participated in the planning and orientation of the project by assisting with specific projects and in particular, this paper deals with one such project, the distribution of the lithic artifacts on the site.

The project was oriented toward several problem domains (Redman 1984) which guided the field and lab strategies. These were 1) to define the prehistoric subsistence-settlement system; 2) to investigate the role of inter-regional trade in the area; 3) explain the structure of the site; 4) determine the relation of Shoofly to small sites in the vicinity; 5)investigate the nature of the agricultural regime; 6) develop plans for a public awareness program and 7) to assemble data and prepare to nominate Shoofly to the National Register. Lithic data recovery was oriented toward addressing as many of these goals as possible but at the same time an attempt to reconcile other types of considerations with analytical ones also guided the data recovery strategies. A concerted effort was made to gain expedient turn-around of information while in the field, and attempts to create field forms which were detailed and informative as well as efficient and easily used by students were made. The data obtained in the field is very important in many cases to further structure field strategies in the remainder of the project (Redman 1973). Giving priority to such a strategy greatly influenced the types and intensity with which initial analysis was conducted (trade-offs of detail were made for expedient acquisition of more generalized data) and in essence what was produced was an initial sort of 100% of the chipped stone artifacts (ground stone objects are not included in this discussion). Basically, three general goals structured the initial sorting analysis: 1) to obtain information pertinent to the research goals; 2) initiate an analysis system which was oriented toward a basic foundation in lithic analysis; and 3) obtain in-field feedback results to further structure field decisions.

RAW MATERIAL SOURCES AND CLASSIFICATION

The lithics at Shoofly made up a large and important portion of the assemblage. A large number of artifacts were present and these showed considerably more variability than the ubiquitous plainwares which were so prevalent. Several primary areas of interest were regarded as important data components. First of all, in order to discuss resource utilization and subsistence strategies, trade with other groups, etc., we were interested in the number and kinds of raw materials utilized. Categories for what were originally believed to be different chert varieties were featured as well as a number of other rocks: quartz, limestone, obsidian, basalt, sandstone, quartzite, and others.

In the beginning raw material source areas were not well understood and we believed that different cherts occurred in different areas which could be defined. Subsequent investigation and attempts to separate material has produced information contrary to those original ideas and now the categories originally used are not necessarily applicable nor pertinent, for several reasons. First, the small nature of the artifacts themselves does not allow them to be identified in the categories provided, therefore many ambiguous items occur. Second, we are not sure that the types as originally defined (Birch Mesa Chert, East Verde Chert, Tontazona Chert) occur only in the areas where they were thought to, or whether perhaps they outcrop in several areas throughout the region south of the Mogollon Rim. The chert types above are part of two of three chert beds which were laid down successively in the past (Martin, Naco, and Redwall formations), and most of the cherts visually inspected appeared to be Redwall and Naco (Paul Knauth personal communication), but these occur throughout a wide portion of the central Arizona region and it is not known what kinds of variability exist between outcrops or where they are located (and if in fact they would approach the original categories defined). Therefore, the cherts found at the site are considered under one category, local cherts, and no attempts to distinguish between them are made at this time. Even though others have attempted to do this in the past, we are not sure how accurate or productive this type of approach may be (Stafford 1979), and upon consultation with geologists who study the area intensively, decisions were made to collapse the chert categories into one.(Paul Knauth personal communication), with an additional category for unrecognizable or miscellaneous cherts.

Other types of raw materials tend to occur locally also . Quartzite is found in the chert beds, and limestone there as well. Sandstone and basalt are found in outcrops on the site and gravels in the soils contain chert nodules, fine-grained basalt nodules, greenstone, and others. Additionally, more exotic specimens such as the quartz crystals and the red (what was originally believed to be argillite) quartzite may be found nearby at the East Verde crossing and at the Natural Bridge to the west.

Essentially the only true intrusive lithic type noted was the obsidian. It is believed that some of the material is Government Mountain obsidian from the north near Flagstaff, Arizona, however other obsidian occurs to the south as well (near Globe, Arizona), and further testing to source the materials is needed. Additionally a substantial amount of schist was found at Shoofly Village, and although it is known to occur extensively to the south we do not know where, or how far away this particular variety is found.

We should have this done.

TECHNOLOGICAL AND FUNCTIONAL CATEGORIES

In addition to categories for raw materials, technological and functional variables were of interest as well. These included hammerstones, cores, core tools, utilized flakes, primary flakes, interior flakes, retouched tools, projectile points, and special tools such as tabular knives and others. The definitions of these items followed Crabtree (1972) for the most part, however additional terms are found in Appendix I.

Analysis in the field for immediate feedback was not altogether successful the first season. Several problems, the primary one being the short field season, and the fact that we were working with students untrained in lithic analysis, greatly affected the reliability and expediency of the project. The consistency and accurateness of student-performed analysis was generally not reliable enough to use without re-checking the data and this along with other problems resulted in our gaining little substantial feedback in the field. Most of the lithics were analyzed after the season was terminated, and re-analysis of those done by students also was performed, however the educational process of teaching students lithic analysis did prove successful in itself.

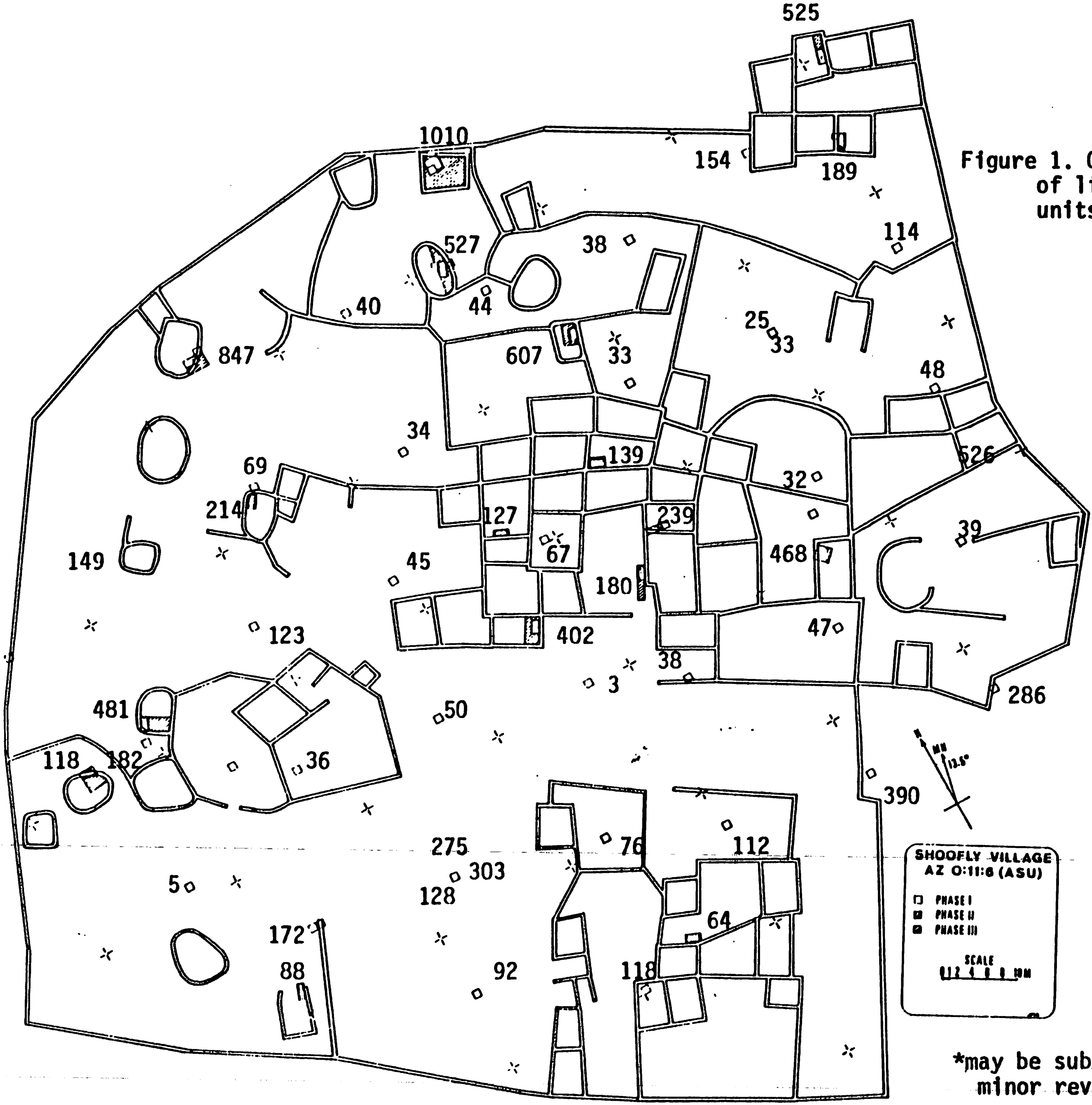
The technological and functional analyses were oriented toward gaining better understanding of the intra site distributional patterns of activity sets, toward gaining knowledge of the subsistence activities conducted there and better understanding the technological aspects of the group/s who lived at Shoofly. The categories were fairly efficient for such questions, however some modification for the future excavations can be anticipated, including consolidating some of the variables and adding detail to others. Some of the major problems included the terminology used to distinguish primary from other flakes, ascertaining retouch from use-wear, and in dealing with tools with multiple uses. Although some general modifications and refinements are in order, some very interesting results were produced.

LITHIC DISTRIBUTION

The rough sort analysis of the lithics from Shoofly Village involved in excess of 11,000 artifacts of which interior flakes and shatter were the most common. Distribution of the raw counts of these are given in Figure 1 for all levels and all size units.

Since each of the units described were dug in natural levels and sizes, depths and volumes of dirt removed varied, calculation of more standardized ratios are needed before better comparisons between all units can be made. Many of the units were expanded and some included the entire room, so in order to better control for size differences

Figure 1. Gross totals of lithics, all units. *



*may be subject to minor revisions

without calculating volume the larger units of variable size were eliminated from the following analysis, and only 1x1 m units were used. The 1x1 units are illustrated in Figure 2 by the small squares.

In all instances two areas, the burial area in the south plaza and the southern exterior of the east wall show very dense concentrations of lithics and in general of utilized flakes, cores and hammerstones as well. In addition, it is interesting to note the dispersed distribution of lithic items in the core room areas--no concentrations are noted. Clearly the inferences which may be drawn from raw count distributional data are limited and since the number of potentially important variables is fairly numerous a quantitative methodical assessment of the counts is very difficult without using special techniques. Therefore in order to better organize the variables and their values in each level of each 1x1 a clustering technique was initiated to help sort out the patterns.

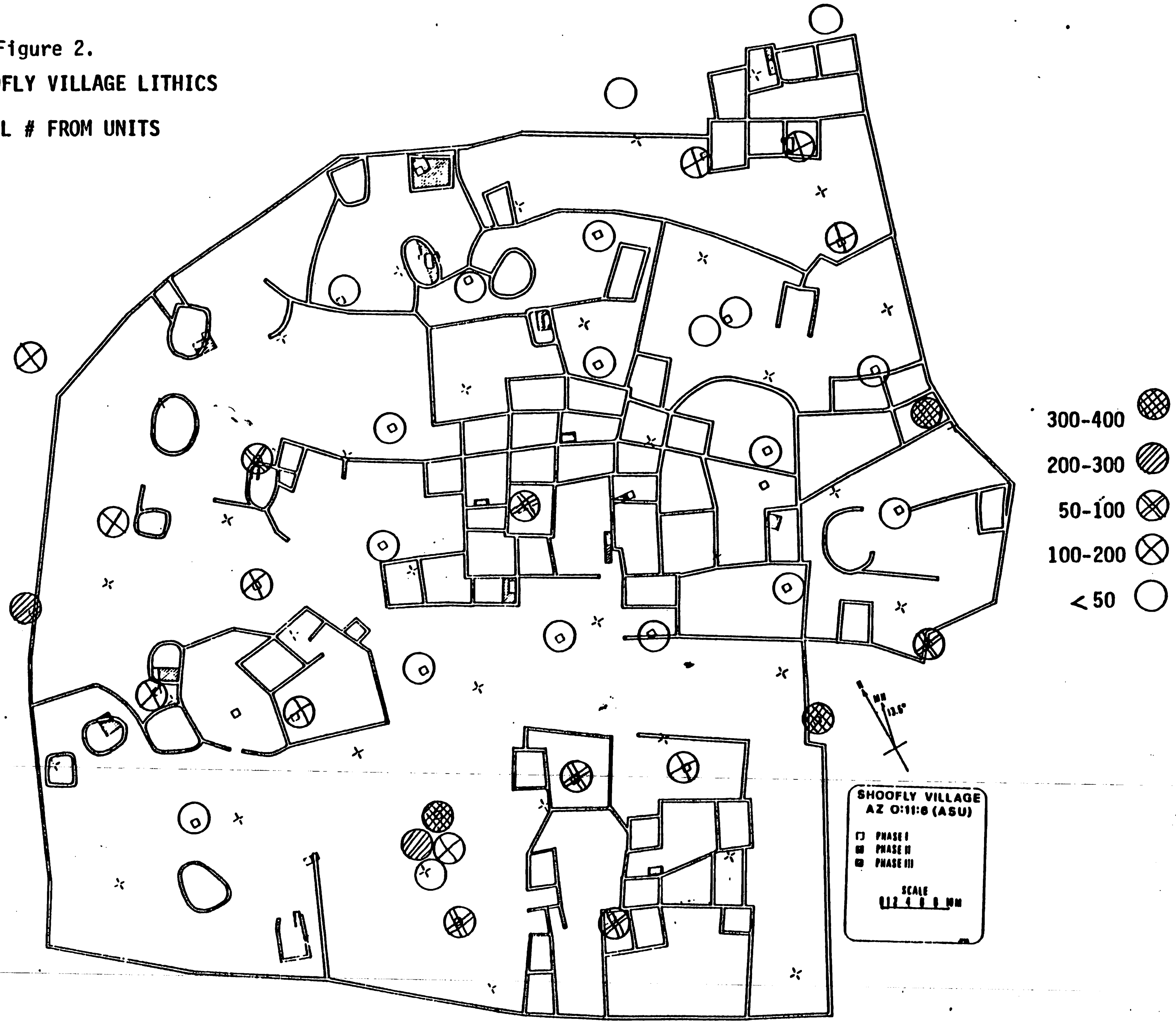
CLUSTER ANALYSIS OF LITHIC DATA

Cluster analysis is a heuristic device used extensively in a number of disciplines as a way of simplifying and organizing extensive amounts of multivariate data, and as a tool for use in generating hypotheses and searching for natural groupings in data (Everitt 1980:7). In archaeology, cluster analysis is an excellent means of simplifying large quantities of data and of generating hypotheses for further testing but should be used in accordance with its limitations. It is not a finalizing or confirming technique, but one which should be used in pattern searching and then tested for confirmation. Spatial analysis using clustering techniques has been discussed (Kintigh and Ammerman 1982) as an excellent means of unraveling and coping with complex artifact assemblages and

Figure 2.

SHOOFLY VILLAGE LITHICS

TOTAL # FROM UNITS



defining types of cluster relationships, and in particular the K-Mean's technique has proved valuable in this regard.

Using lithics from Shoofly Village two cluster analyses were performed on 12 variables: core, hammerstone, primary flakes, interior flakes, shatter, utilized flakes, utilized core, retouched flakes, projectile point, crystals, tabular knife, and others. A total of 134 cases involving the 1x1 m squares by levels were used. Two different cluster programs, the Ward's method and K-Mean's were used on standardized data (this standardization was done by the computer program). The Ward's technique is a hierarchical agglomerative process whereby at each step in analysis the union of every possible pair of clusters is considered and the two clusters whose fusion results in the minimum increase in the error sum of squares are combined (Everitt 1980:31). The K-Mean's however is a divisive method and does not contain many of the problems involved with hierarchial techniques(ie. Everitt 1980:67), but rather involves a reallocation process whereby items may be re-classified into groups which are better suited instead of being poorly classified at an early stage of the process and remaining there. The particular program used, Clustan (Wisehart 1983) featured iterative relocation with hierarchic fusion ; a total of 10 iterations were performed.

Results of the two analyses produced some interesting patterns. Although the two were quite different processes, very similar products in the way of group membership and the overall size of groups resulted. One cluster, #3 accounted for almost the entire assemblage and had a membership of 118 (K-Mean's) or 121 (Ward's) cases. In the K-Mean's analysis Cluster 3 contained minimally 85 cases--even in the maximum group (10) designation. Although a two cluster association was perhaps the strongest from the coefficients produced, I originally believed that two clusters over-simplified the process and used the next most optimal set of four clusters. In actuality this made little difference in the overall trends and there still remain one major group and one minor grouping. Figures 3,4,5, and 6, illustrate the means for each type variable in the clusters. Cluster 3 contains the majority of cases and features a moderate distribution of all variables except for tabular knives, with the interior flakes, shatter, and utilized flake categories being slightly higher than the other types (with mean values of 10-20). Cluster 1 however contained from 10-13 cases, but these featured different variable concentrations. Here, quantaties of cores and primary flakes are substantially higher and interior flakes, shatter, and utilized flake variables much higher than in Cluster 3 (Figure 4). Whereas Cluster 3 was fairly evenly distributed throughout the site, Cluster 1 is quite limited and occurs primarily in areas with high densities of artifacts (Figure 7), such as the south plaza, and near east and west exterior walls. Notably, none occur in any levels in the central core rooms. In addition to horizontal distribution of the clusters, vertically the clusters show interesting patterns as well. In several units episodes of Cluster 1 occur together or alternate with Cluster 3 (86E 85N; 141E 171N; 161E 73N; 47E 141N; 85E 85N), while in a few areas Cluster 1 characterizes the entire unit (85E 86N; 58E 121N). For the most part however, Cluster 3 tends to be homogenous throughout the units and their levels. (Figure 8)

DISCUSSION

The use of clustering techniques in this distributional study of

Figure 3. Mean values of variables.

Cluster 3

118 (K-Mean's), 121 (Ward's) cases

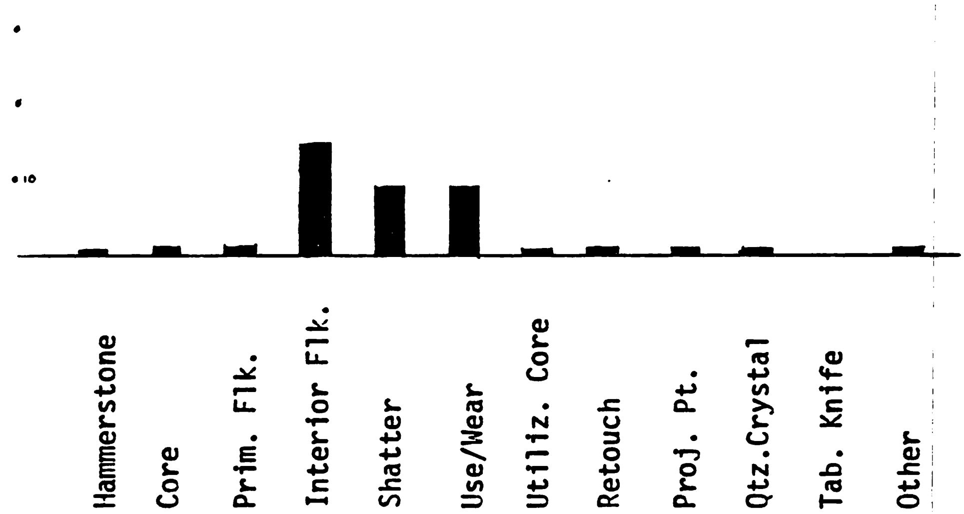
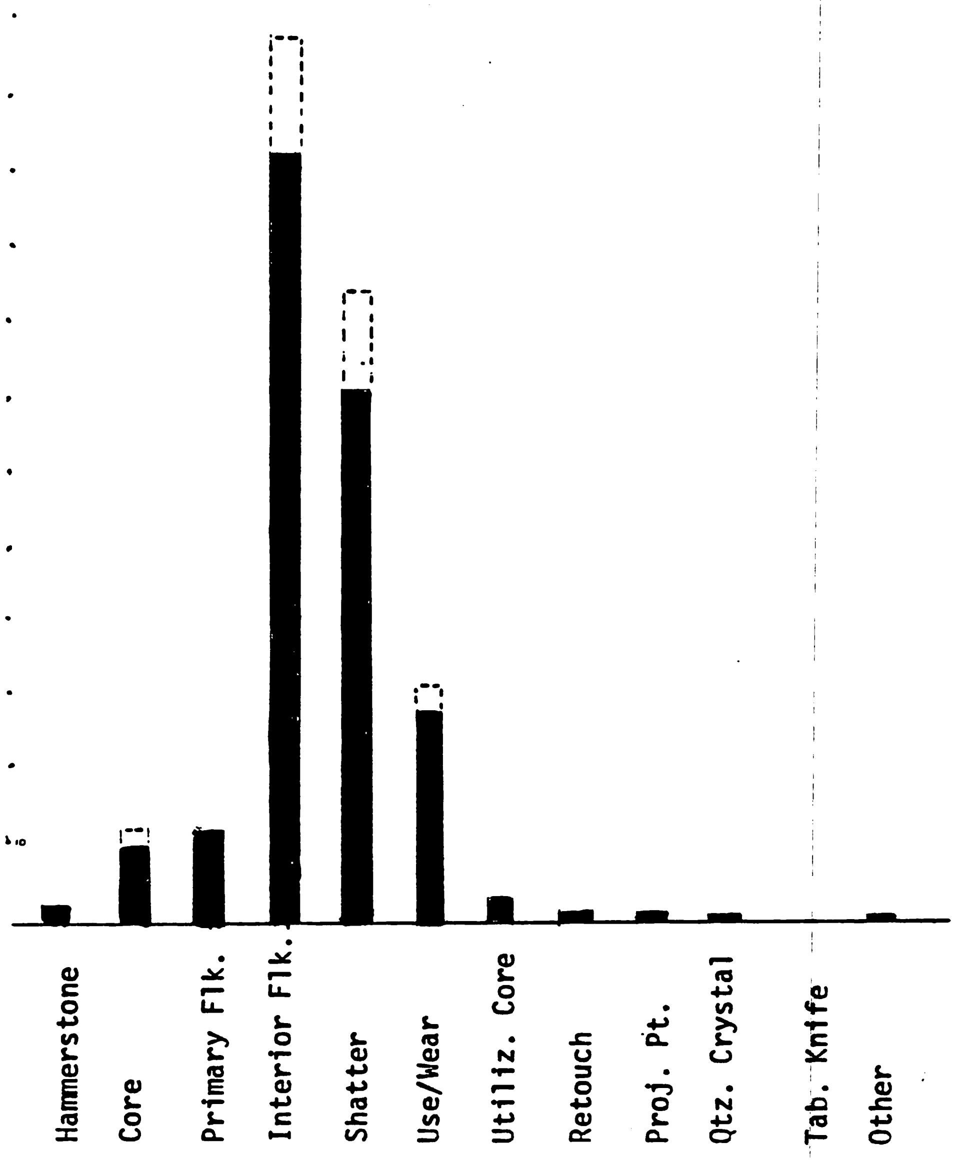


Figure 4. Mean values of variables.

<u>Cluster 1</u>

Solid=K Means (13 cases)
Dash=Ward's (10 cases)



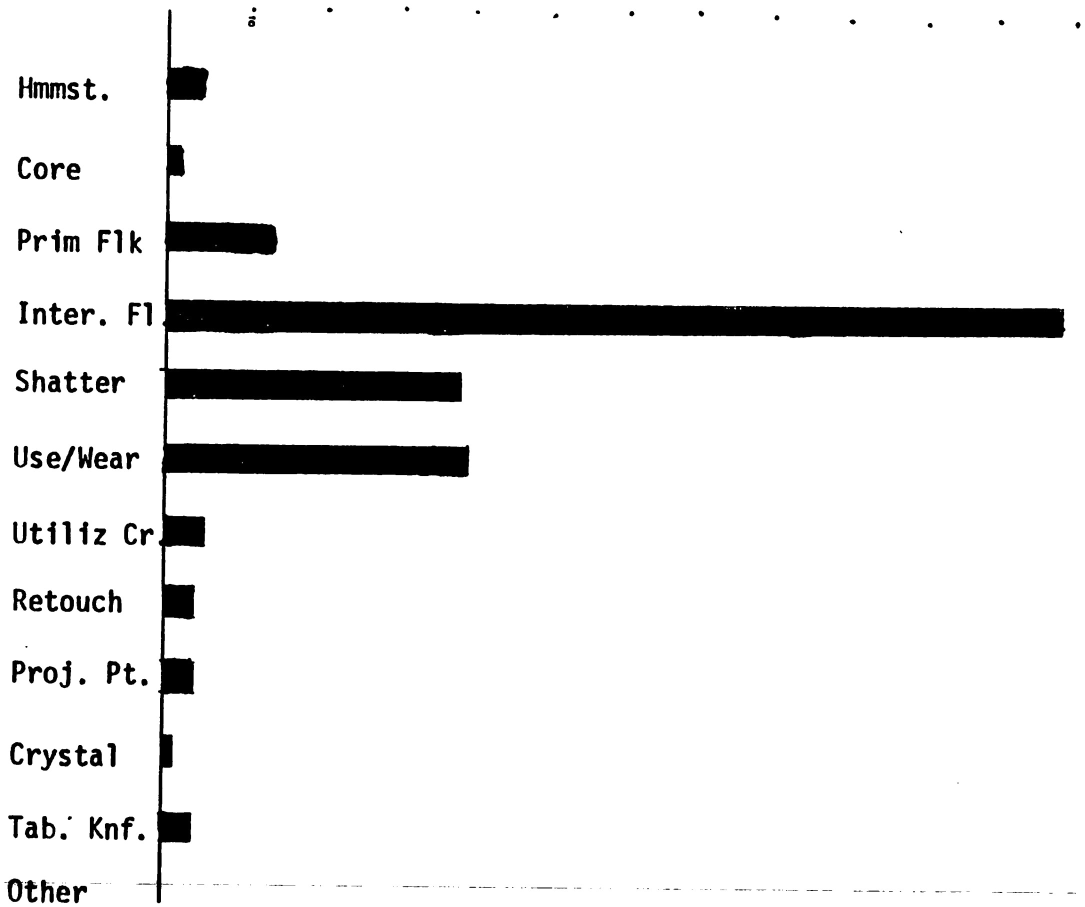


Figure 5. Mean values of variables.

Cluster 2

2 cases

Figure 6. Mean values of variables.

Cluster 4

1 case

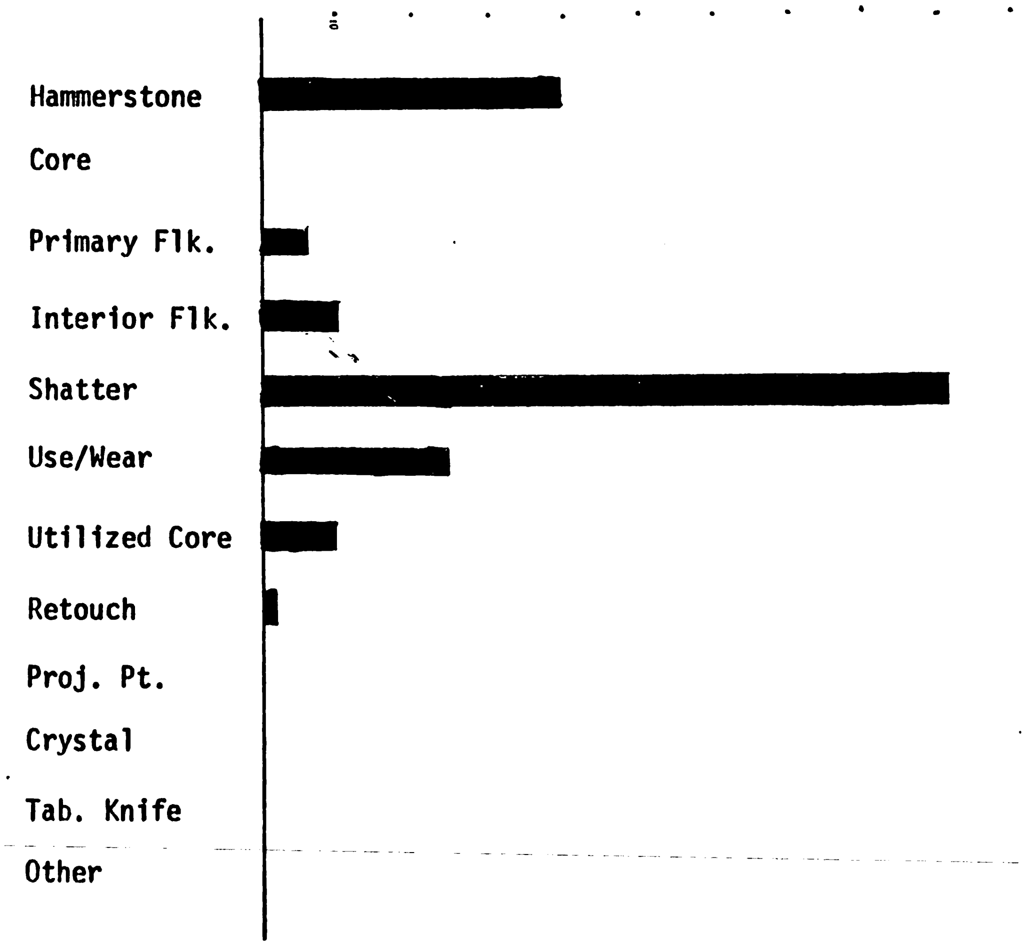


Figure 7.

SHOOFLY VILLAGE LITHICS

CLUSTER AFFILIATION

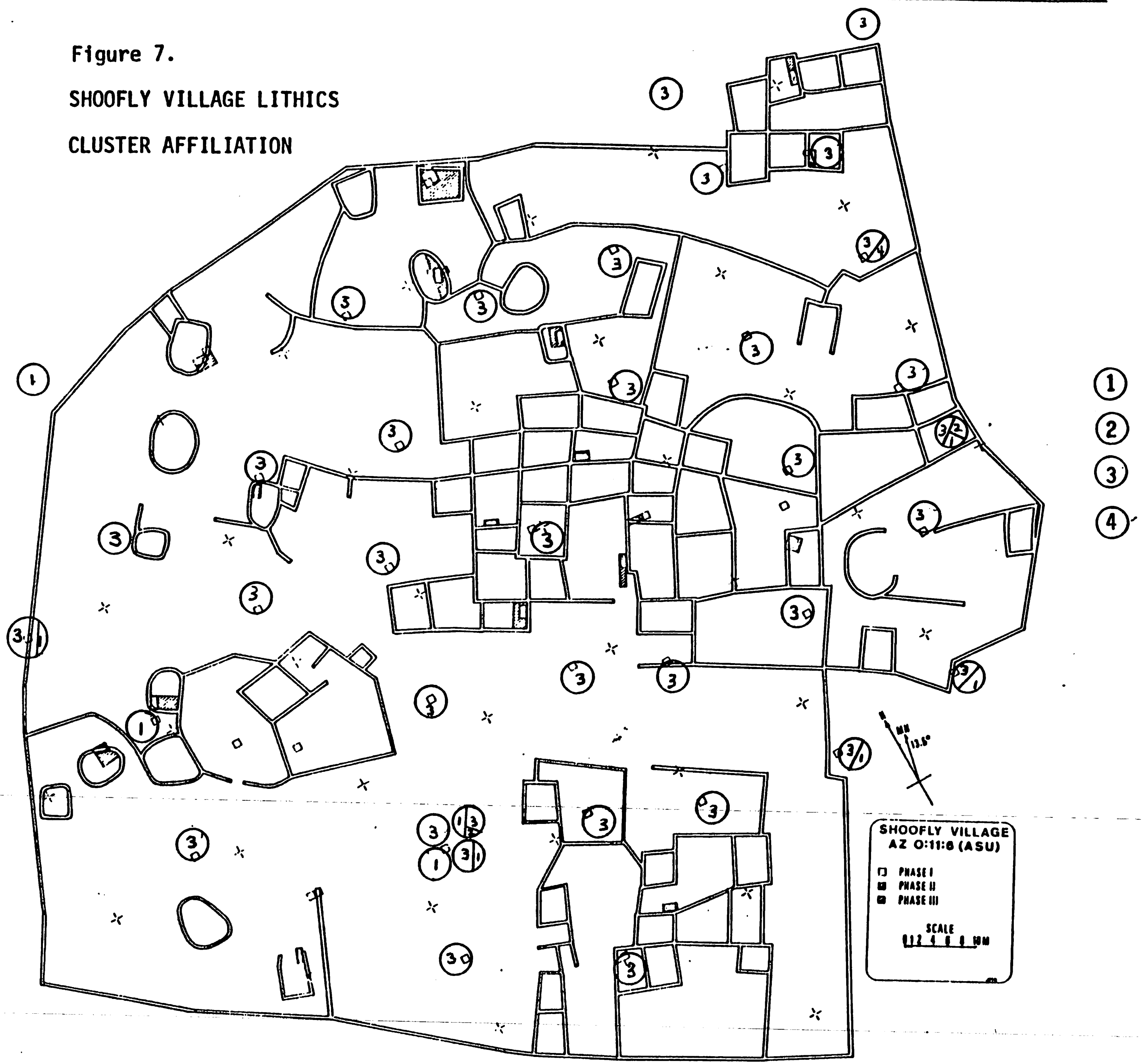
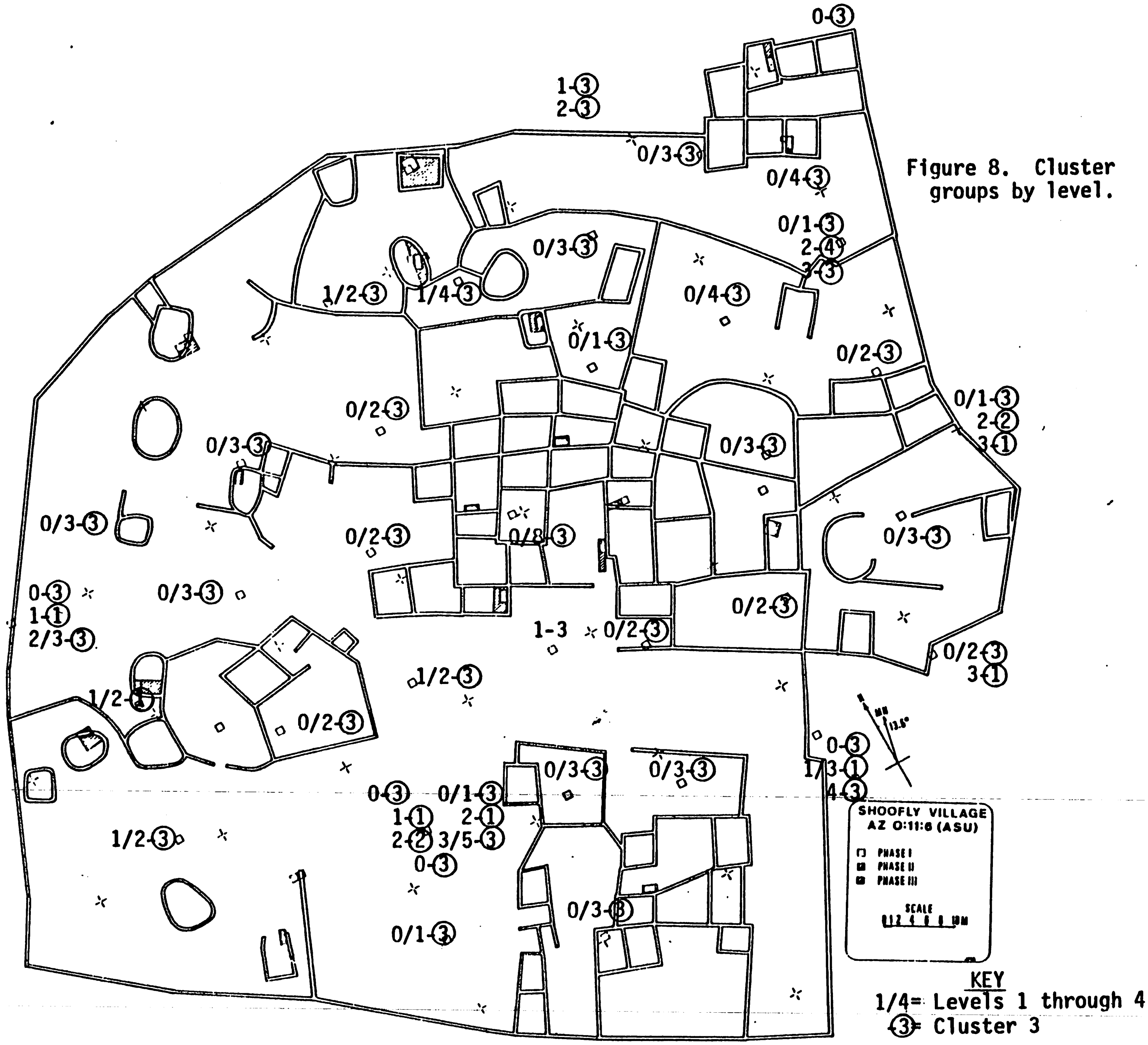


Figure 8. Cluster groups by level.



lithics from the 1984 session at Shoofly Village has resulted in some interesting patterns. Two major clusters are noted and these are distinguished by different mean values of variables. The most predominant cluster contains a fairly even distribution of all variables with the interior flakes, shatter and utilized flakes being slightly more numerous, and this type of distribution was characteristic of most of the units across the site. Alternatively, another cluster type contained several cases with high concentrations of interior flakes, shatter and utilized flakes, and moderate amounts of cores and primary flakes. It appears that these cluster differences are not simply products of sheer numbers of artifacts(Figures 9 & 10) but since standardized data were used they represent differing ratios of certain types to others. The more common cluster features a more even distribution of different types while marked concentrations of variables or high absolute numbers occur in the other.

Interpretation of the patterns presented above are quite difficult at a complex site like Shoofly Village. In addition to consideration of the compositional and distributional characteristics of behavioral activity sets, post depositional factors such as trash disposal are also important. Whereas primary refuse or discard behavior may be characterized by certain ratios of artifacts, these ratios could be greatly changed (or not) when subjected to secondary dumping or sweeping activities . At a large permanent habitation site these types of secondary activities might be expected to overshadow primary patterns which could be ascertained and could result in homogenous types of artifact dis-

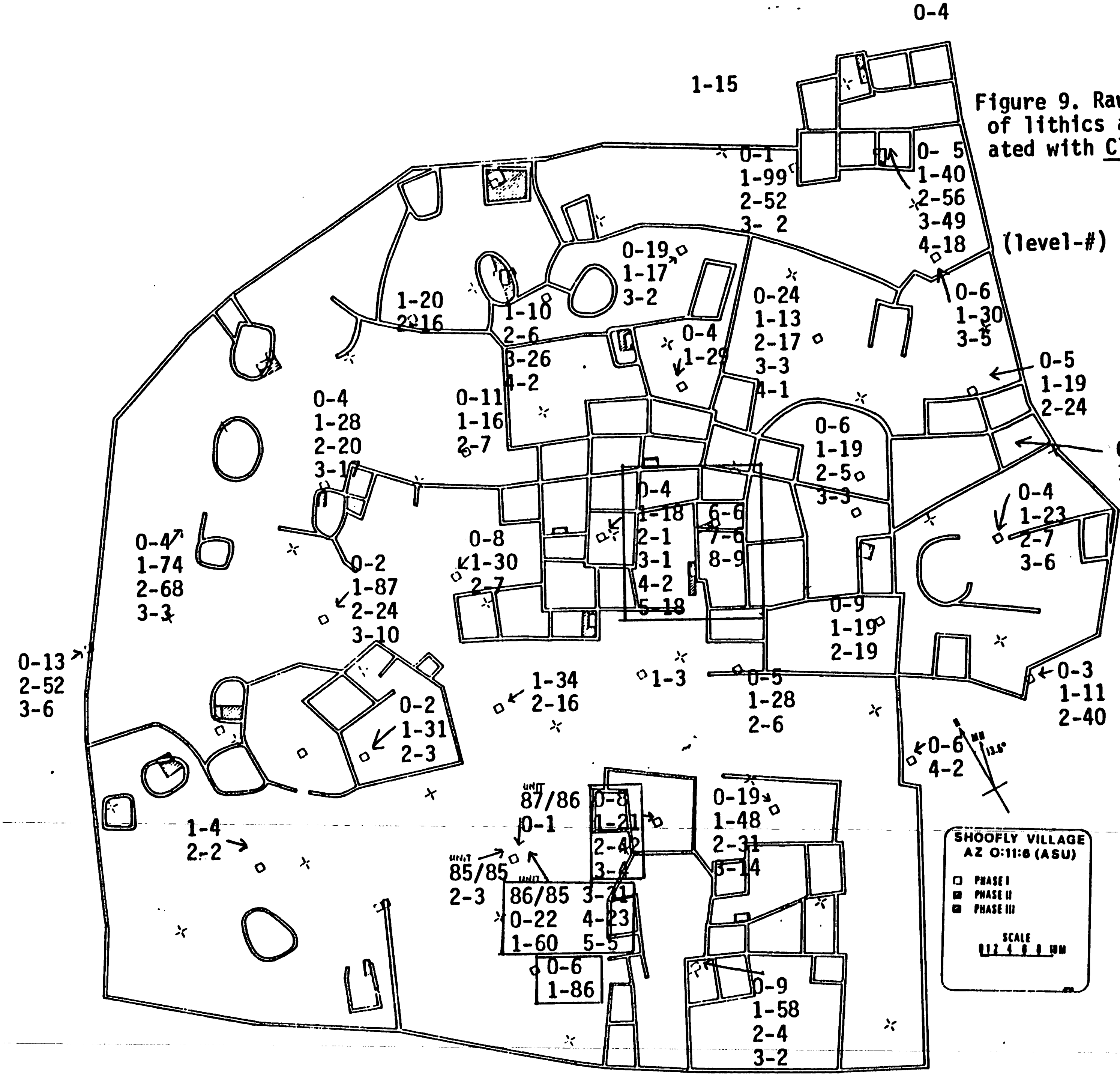


Figure 9. Raw counts of lithics associated with Cluster 3.

(level-#)

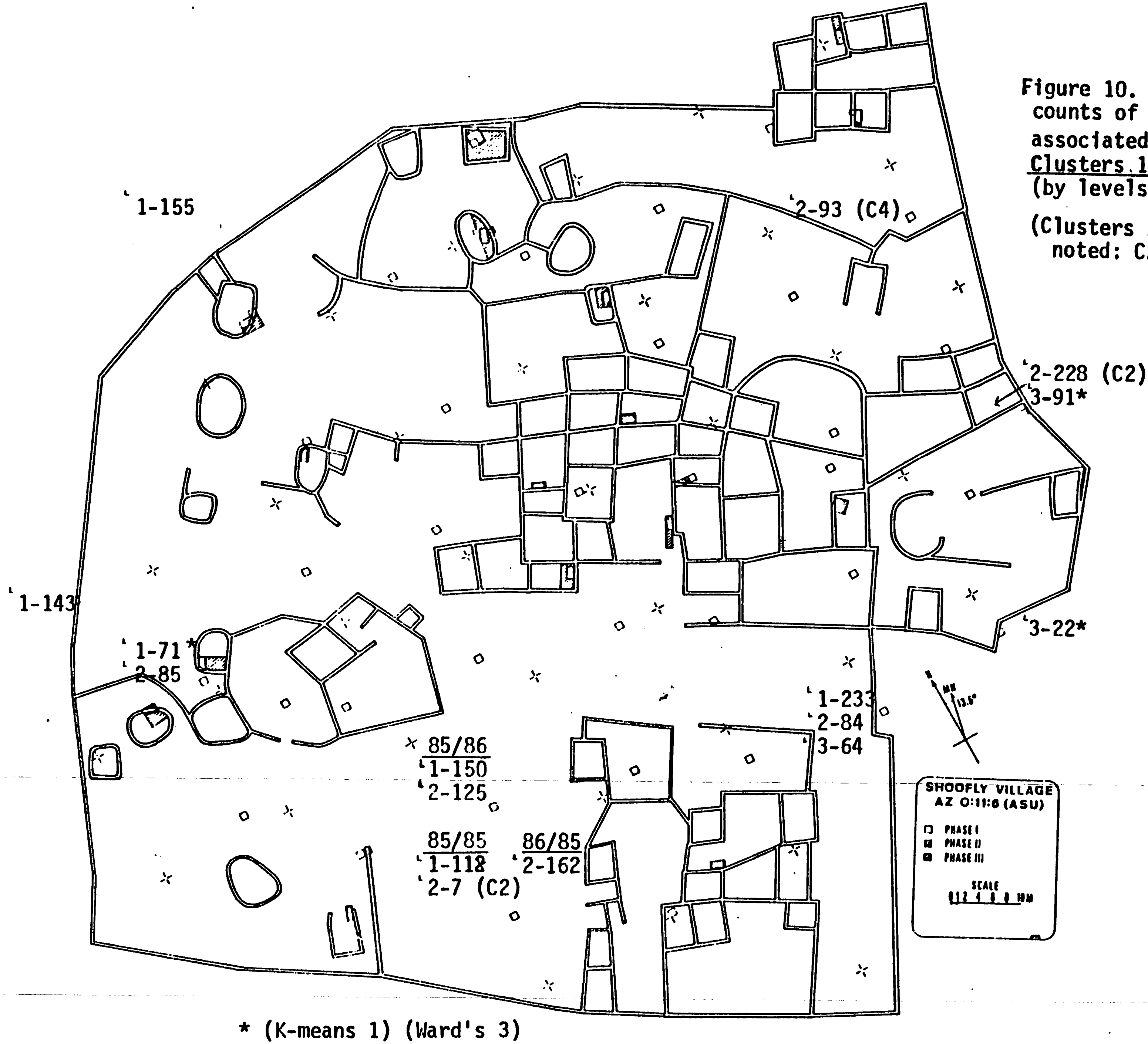


Figure 10. Raw counts of lithics associated with Clusters 1,2,&4. (by levels)

(Clusters 2&4 noted: C2, C4)

tributions which do not reflect primary activity sets, but are productions of secondary disposal. Further complicating the process, incidental dumping from primary activities may result in a heterogenous mixture of artifact types in trash areas, so that different distinct layers of material are present.

This discussion of primary and secondary disposal is critical to the intra-site analysis at Shoofly Village. At a smaller short term occupation area, primary disosal might be a convincing argument for the presence of clusters, however secondary disposal must be of major consideration at a pueblo habitation site. At the same time, one cannot rule out the possibility that primary refuse does not occur. Perhaps in this regard a look at several variables might be more productive. The more homogenous and widespread distribution of Cluster 3 is a pattern which might be expected to occur in a site maintenance situation where sweeping consistently disturbed the primary remains and/or where traffic and population was high or where more homogenous types of activities were widespread. Note the almost mundane nature of Cluster 3, perhaps reflective of a variety of activities, but ones which are so disturbed or homogenous that no distinct patterns occur. Alternatively, Cluster 1 contains a rather distinct signiture which reappears horizontally and vertically in the archaeological record. Several areas where Cluster 1 appears are almost certainly midden areas--these are located outside the walls in areas where artifacts are exceedingly dense . Similar areas inside the compound are also included in Cluster 1, but are located proximally to walled plaza areas and in open plazas where dumping might not be readily expected. From these observations several tentative hypotheses can be constructed for further testing. First, the activities characteristic in midden layers outside the site are reflected inside the compound. Since the nature of the outside clusters are probably middens, and the interior areas are not what we would readily call midden areas, perhaps these deposits represent primary rather than secondary activities (ie. knapping activities are represented as primary activities inside the compound whereas outside they are the result of dumping). The character of these assemblages could be similar simply because they are episodal in nature, but of course they are highly dependent upon other factors as well. Second, the southern portion of the site contains almost all of the Cluster 1 cases. This is quite notable, and if in fact the clusters are representative of different activity sets, it is interesting that they may have been conducted in this area. It seems that more open space is present here, and the patterns could be a result of the differential use of the area, either on a synchronic or diachronic scale.

These observations are very tentative in nature and are presented primarily to demonstrate the value of heuristic techniques in spatial analysis of sites. Cluster analysis has helped provide the patterns from which more sophisticated questions can be addressed . At Shoofly Village followup of these preliminary investigations would not only add to our knowledge of the behavioral relationships at the site, but would also allow us to ask better questions and conduct more sophisticated inquiries into the prehistoric activities which influenced those relationships.

APPENDIX I

Lithic Terminology

Hammerstone: Any cobble with battering or abrasion, or combinations of such on the protruding edges. Although negative flake scars may be present, the tool has no obvious characteristics of cores and instead represents a device for hammering, battering, or crushing/grinding.

Core: A lithic item with evidence of flake removal in the way of negative flake scars. Some may exhibit few flake scars characteristic of new or partially used cores, and others may be remnants of multiple flake removal resulting in exhaustion. Crushing may be present on the platform edge, but this is a result of the flake removal and not from use as a hammerstone or other tool.

Core Tool: A core which has secondary use as a tool, either by evidence of battering/grinding on the prodruding edges (such as in hammerstone use) or use/wear scars on the edges. Also included in this category are obvious results of nodular reduction if they can be so determined.

Primary Flakes: Flakes with any cortex present.

Interior Flakes: Flakes with no obvious cortex.

Angular Shatter: Angular fragments which result from knapping activities, and which show no flake characteristics.

Use/Wear Modified: Flakes or angular fragments which show step fractures, nibbling, grinding or polish on the edges resulting from use of the tool.

Facial/Marginal Retouch: Items which have been retouched into functional tools. These do not necessarily have to exhibit a formalized morphology, but include any flake with flake scars intentionally removed for purposes of thinning, edge shaping or sharpening etc.

Projectile Point: Any facially or marginally modified tool which features a pointed end and basal hafting area, and which is believed to be of a size suitable for arrow hafting. Bifaces, preforms, knives, drills and other more ambiguous forms should be placed in the retouch category.

Other Stone Items: Includes quartz crystals, mineral fragments, tabular tools and enigmatic stone items.

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