ARCHAEOLOGICAL SYSTEMATICS AND BASKETMAKER CULTURAL ECOLOGY: SOME CEDAR RESA PROJECT EXPERIMENTS

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Introduction

It has been observed for a number of years that some rather profound changes in subsistence - settlement systems occurred in the Anasazi province of the Southwest between Early Basketmaker II and Late Basketmaker III times (Herold 1961). Some researchers propose that the BM II adaptation was primarily based on hunting-gathering while the BM III subsistence - settlement system was based predominantly on farming. From this proposition, a suite of specific hypotheses can be advanced concerning changes in demography, settlement patterns, environmental exploitation, and tool - facility production which occurred as Basketmaker culture evolved (Glassow 1972; Lipe and Matson 1971).

This report describes some methods employed and a few results obtained in an ongoing study of Basketmaker ecological adaptation and cultural evolution. Observation and collection of cultural and environmental data was done using probability sampling techniques in a survey of the Cedar Mesa region of southeastern Utah (Fig. 1) (Slide 1).

The sampling consisted of dividing the Cedar Mesa area into drainage basins and then selecting five of these drainage clusters by a stratified random sample technique. The five clusters were then gridded with 400 square meter quadrants and a 7.5 simple random sample of quadrants were selected from each drainage cluster. Every quadrant selected was "swept" by a survey crew which located and mapped sites, collected artifacts, and recorded observations about on-site natural environmental variables (Lipe and Matson 1971).

This brief report deals only with Basketmaker II sites and artifacts sampled from the Hardscrabble drainage cluster (Fig. 2) (Slide 2). These are 15 sites of various sizes and at various locations and artifacts grouped into 28 classes thought to be functionally related to subsistence activities.
Analysis

First, a Q-mode analysis of the 15 BM II sites from Hardscrabble was done. The 15 sites were compared on the basis of relative frequency of artifacts in 26 functional classes and 11 classes of debitage. A battery of cluster analysis and multidimensional scaling techniques were employed on the data in unstandardized, standardized and nominalized form. These experiments revealed that the best results were obtainable by using standardized relative frequency data (cf. Matson and True 1976).

Figure 3 (Slide 3) shows the results of clustering the 15 Hardscrabble sites using city block distances and Ward's error sum of squares clustering technique (Sneath and Sokal 1973). Cluster 1a includes four small sites with a few utilized flakes, several projectile points and bifaces, and small amounts of debitage. In addition, site 5 has a hearth feature and there were ashy spots on sites 5 and 7. Cluster 1b consists of 2 very small sites which join cluster 1a at a low level. They have very few utilized flakes, projectile point fragments, denticulates, and waste flakes along with a hearth and ashy spots. Taken together, cluster 1 seems to consist mainly of limited activity sites which were, perhaps, campsites used for hunting activities.

Cluster 2 includes sites 2, 3, 8, 11, 12, and 14 which are all relatively large. They contain large numbers of scrapers, utilized flakes, and debitage. Large projectile points are found in sites 2, 8, 11, 12 and small points are found in sites 3 and 14. Denticulates, gravers, drills, projectile point fragments, bifaces, hammerstones, cores, flakes, metates, gizzard stones, hearths, and ashy spots are found among the sites of this cluster. All in all, the sites appear to be multiple-use occupation sites where maintenance and extractive activities occurred.

Site 10 joins sites 13 and 15 at a low level to form cluster 3. These are medium sized sites with moderate numbers of scrapers, utilized flakes, denticulates,
drills, and debitage. Site number 10 may be unique in that it contains 1 chopper, 1 lance, 1 metate and a hearth. Sites 10 and, possibly, 13 and 15 seem to be limited activity sites used for plant food processing.

Both metric and non-metric multidimensional scaling methods were applied to the $Q$-mode analysis. Both methods gave similar results. Torgerson's metric MDS (Torgerson 1958) solution accounted for 74% of the initial variance in a 4 dimensional configuration.

In Figure 4 (Slide 4), the most important vector is number 1. It separates the sites on the basis of amounts of artifacts. Thus, sites 2, 11, 12, and 13 would be expected to have large numbers of artifacts, 10, 4, and 9 small numbers, and the remainder of the sites would be intermediate. This was tested by ranking sites on total amounts of artifacts and comparing this with their rank on vector 1. A Spearman's rank order correlation of .66 resulted (significant because it would occur by chance less than 5 in 1000).

Vector 2 is more difficult to interpret, but it may be related to temporal variance. Site 3 could be a younger site, perhaps BM III, because it has small projectile points (thought to be later in time than large points) and what appears to be Aino pottery.

Vector 3 (Fig. 5) (Slide 5) is related to presence of ground stone artifacts (names and relates). Sites 10, 2, 3, 11, and 12, at the right end of Vector 3, all have ground stone artifacts, while the other sites have none. Vector 3, then, separates sites where plant processing took place from others. Vector 4 is not readily interpretable.

In the $Q$-mode analysis, when 28 functional classes were compared on the basis of their relative frequency at the 15 sites, unstandardized data provided the best results. It was hoped that the $Q$-mode analysis would distinguish "tool kits" or clusters of functionally related artifact classes.
Cluster analysis, using city block distances and Ward's error sum of squares (Fig. 6) Slide 6), resulted in 3 large clusters at low levels and numerous smaller clusters at higher levels. Cluster 1a consists of those processing tools (especially unifacial scrapers, utilized flakes, and denticulates) along with debitage, large bifaces, and gizzard stones found in abundance on the large occupation sites. Cluster 1b is made up of small bifaces, projectile point classes, and drills found on the large occupation sites (especially sites 2, 11, and 12) in association with the artifacts of cluster 1a.

Cluster 2 consists of small projectile points, hammerstones, manos, and gravers. Cluster 3 includes large projectile points, drills, choppers, and metates.

Both clusters join at a very low level suggesting they include all those tool classes which differentiate the various limited activity sites (both procurement and maintenance) found in the Hardscrabble drainage.

Non-metric and metric MDS analyses give similar results. Four dimensions of Torgerson's metric MDS account for 82% of the initial variance. Vector 1 seems to be related to frequency of occurrence among artifact classes (Fig. 7) (Slide 7). A specimen's rank order correlation on the artifact classes between frequency of occurrence and vector 1 is .06 (significant at .001).

Vector 2 seems to correspond to temporal placement of projectile point classes. Classes 10, 11, and 12 (large points) are relatively to the right of classes 13, 14, and 15 (small points) indicating a rough seriation.

Vectors 3 and 4 are harder to interpret. (Fig. 8) (Slide 8). Vector 3 seems to correspond roughly with lithic tool manufacturing (i.e., hammerstones, debitage, and cores are at the upper end of vector while other classes are lower). Vector 4 seems to separate plant processing tools (i.e., manos, metates, and choppers) on the right from others. In general, the commonly occurring tools are found in the center of the configuration, while scarcer classes lie around the periphery.
Conclusions

In sum, this has been a limited and preliminary report of some of the Q and R mode multivariate analyses of intersite artifact distributions in the Hardscrabble drainage of Cedar Mesa. The Hardscrabble Basketmaker sites cluster into 3 broad types of sites: 1) small, limited use hunting sites; 2) large, multiple-use occupation sites used for both maintenance and procurement activities; and, 3) medium-sized limited activity sites possibly associated with plant procurement and processing.

Interestingly, the only 2 sites which may date to the BM III period or later are sites 3 and 14 found in Cluster 2 (occupation sites). If the absence of BM III sites in the hunting and plant procurement special activity sitesclusters is significant, we may have some confirmation of the earlier proposition that BM II occupation was based on hunting-gathering while the BM III adaptation was basically agricultural and sedentary.

Future work will refine the artifact classes in an attempt to make them more reflective of subsistence functions. Then more R and Q mode analyses will be carried-out on both intrasite and intersite cultural distributions.

The results of these analyses, along with natural environmental data and appropriate ethnographic analogies, will be used in an effort to model the subsistence-settlement systems functioning on Cedar Mesa during the BM II and BM III periods.
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Bibliography

Glassow, M.

Herold, J.

Lipe, J.D., and R.G. Matson

Matson, R.G., and D.L. True

Sneath, P.H.A., and R.R. Sokal

Torgerson, W.S.
Fig. 1: CEDAR MESA STUDY AREA and Hardscrabble Drainage Cluster

Fig. 2: Hardscrabble Drainage Cluster, Sampled Quadrats, and BMII Sites

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Fig. 3: Ward's Error Cluster Analysis, Standardized Distances

Fig. 4: Dimensions 1 and 2 of Torgerson's Metric MDS Standardized Matrix
Fig. 5: Dimensions 3 and 4 of Torgerson's Metric MDS, Standardized Matrix

Fig. 6: Ward's Error Cluster Analysis, Unstandardized Distances

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Fig. 7: Dimensions 1 and 2 of Torgerson’s Metric MDS, Unstandardized Matrix

Fig. 8: Dimensions 3 and 4 of Torgerson’s Metric MDS, Unstandardized Matrix