On Morphometric Differentiation of Clovis and Non-Clovis Blades

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In an effort to assess the age of 5GN149, a lithic workshop in the Gunnison Basin, Colorado (Cooper, this volume), we investigated morphometric variation in the blades from this assemblage. We followed the analytical lead of Collins (1999), who, in his valuable study of Clovis blade technology, grappled with the question of how to recognize Clovis-age blades in the absence of independent age control or associated diagnostic artifacts.

Collins's solution was to plot on triangular graphs the ratios of length, width, and thickness to the sum of all three measures in blades of unknown affinity—notably, the Keven Davis cache—against comparable data from blades of known Clovis and non-Clovis affinity (Collins 1999:Figures 8.6–8.10). Although Collins was careful to incorporate additional observations, it was primarily from his visual inspection of the scatter of points on the graphs that he concluded the Keven Davis specimens "fit well within the range of known Clovis blades" and were thus of Clovis age (Collins 1999:172).

This approach is more intuitively satisfying than statistically informative, for it requires the analyst to assess visually how well defined a scatter of points from an assemblage might be, and the degree to which the scatter from an unknown sample overlaps the scatter of any known groups. Such an approach cannot give a meaningful measure of the distances between scatters; it also cannot help to determine whether such distances are statistically significant, or identify the variables most effective in sorting blades of different ages.

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There are, however, statistical techniques that yield such data, and we applied one of these—discriminant analysis—to the analysis of Clovis and non-Clovis blades. This technique quantitatively separates qualitatively defined groups. Here, metric variables of blades from *known* groups are used to create statistical classification functions. These are first used to classify the known specimens (thus measuring the reliability of the procedure and within-group homogeneity), then to classify specimens of *unknown* affinity into those groups.

The known groups were blades from Clovis (n = 34), Archaic (n = 54), and Late Prehistoric (n = 35) assemblages (data from Collins 1999:Table 6.1; Mallouf 1989; Tunnell 1978). The variables used in the analysis were maximum length, width, and thickness, and platform width and depth. As Collins (1999) notes, other attributes might be useful in distinguishing blades (e.g. curvature), but these data are rarely available.

Group definitions can be created using either all variables or only those that significantly differentiate the known groups (measured by the F statistic). Initially, our analysis incorporated all five variables; of those, only maximum length, width, and platform width proved to significantly discriminate the known groups. But because we lack data on platform width for the Late Prehistoric blades, we excluded this variable from further analyses. Doing so insures specimens of unknown affinity are not classified as Clovis or Archaic, simply for lack of comparative Late Prehistoric data.

The subsequent analysis revealed that Clovis, Archaic, and Late Prehistoric blades could be differentiated by just length and width; thickness did not significantly aid in sorting the three groups. Using just those two variables, Clovis, Archaic, and Late Prehistoric blades proved significantly different; the Mahalanobis distances between the three group centroids are significant (at $p = .001$).

Overall, 87 percent of the known blades (Table 1a) were correctly classified into their actual groups (if morphometric differences were absolute, the figure would be 100 percent). However, classification was least successful (73.5 percent) for the group of Clovis blades. Although this suggests morphometric variation might be greater in Clovis than in non-Clovis blades, it should be

Table 1. Predicted classification of blades of known and unknown affinity, based on discriminant analysis.

	Clovis	Archaic	Late Prehistoric
a. Blades of known affinity			
Clovis	25 (73.5%)	3	6
Archaic	3	51 (94.4%)	0
Late Prehistoric	3	1	31 (88.6%)
b. Blades of unknown affinity, but suspected as Paleoindian			
5GN149	8	30	4
Anadarko	14	7	0
Brookeen	6	23	10
Cedar Creek	4	2	1
Keven Davis	8	0	1
Pelland	5	0	2

noted that the majority (6/9) of the misclassified Clovis blades derive from workshops (Pavo Real and Yellow Hawk), where blades occur in various stages of reduction, and which in one case (Yellow Hawk) lack other technological attributes of Clovis (Collins 1999:159, pers. comm. 2006).

As for the blades of unknown affinity (Table 1b), almost all the Keven Davis specimens (89 percent) are assigned to the Clovis group (except Blade 11 [Collins 1999: Figure 6.13]). The Anadarko, Brookeen, Cedar Creek, and Pelland blades, suspected by various authors to have Paleoindian affinities, all include specimens that fall into the Clovis group. However, Brookeen has relatively few in that group, is statistically less likely to be Paleoindian, and is in a geological context indicative of much younger age.

The 5GN149 specimens were mostly classified with the Archaic blades. Although this suggests this is not a Clovis assemblage, other factors must be considered. This sample is dominated by early-stage forms, discarded blades, and manufacturing failures. The assemblage has fragments of later stage, and more "Clovis-like" blades (in curvature and other non-metric attributes), but for lack of completeness they were not included in this analysis. Presumably the unbroken versions of these were transported elsewhere. Finally, the 5GN149 blades are manufactured of quartzite; its quality and fracture mechanics may have required alterations in the blade technology and may have contributed to morphometric differences from Clovis-age blades made of high-quality chert (and found in caches).

We hope to further this analysis by incorporating data on quartzite blades of known ages and by continuing to investigate the age of 5GN149 and other blade-yielding sites.

References Cited

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