BIOLOGICAL AFFINITIES AMONG OHIO AND GREAT LAKES ARCHAIC AMERINDIANS: A MULTIVARIATE ANALYSIS BASED ON CRANIAL MORPHOLOGY.

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ABSTRACT

Discontinuous traits of the cranium are used in a comparison of six Archaic skeletal samples from the Great Lakes region and six northern Ohio Late Archaic (Glacial Kame) skeletal samples. The Smith-Grewal measure of divergence with the Freeman-Tukey transformation is used to establish biologic distances among the populations represented by the samples. Principal coordinates analysis is used as a clustering method.

This study proposes a provisional hypothesis concerning the biologic relationships of these populations. The Ohio Late Archaic samples and the Great Lakes Archaic samples demonstrate short relative intra-regional biologic distance, and the Ohio Late Archaic samples show affinity to two Great Lakes Archaic samples, Port au Choix and Cole Gravel Pit. Lack of temporal and spatial continuity between these two major clusters suggest limited genetic exchange and a possible ancestor-descendant relationship. In addition, significant biologic variation exists at a local level for each cluster, thus these data do not support the establishment of a "physical type" for either the Ohio or Great Lakes samples.

INTRODUCTION

Hypothesized patterns of biologic affinity among prehistoric skeletal samples often are a biproduct of analyses focused on the establishment of physical "types" associated with a cultural tradition (Hooton 1920, 1930; Snow 1948; Converse 1981). This classical approach to the study of taxonomic aspects of skeletal biology, however, avoids the fundamental issue of genetic (biologic) diversity of populations within cultural traditions because of its static, essentialist nature (Mayr 1982). Thus, these basically descriptive accounts have done little to expand our views concerning the dynamic processes underlying patterns of affinity among prehistoric groups. Recent studies of genetic variation in human populations have demonstrated that a vast amount of local, biologic diversity exists within regionally and/or culturally defined groups (Lewontin 1972; Latter 1980). These studies consistently have found these sources to account for more variation than even the differences between major continental population groups, and suggest that hypotheses considering local variation as a potential source of diversity are worthy of consideration.

Following the pioneering work of Susan Pfeiffer (1977, 1979) in her studies of Archaic populations in the Great Lakes region, we will consider local population diversity in twelve Late Archaic skeletal samples and interpret the patterns of affinity among the samples.

The present analysis utilizes six samples studied by Pfeiffer (1979) and six representatives of the Late Archaic burial complex in northern Ohio specifically referred to as the Glacial Kame complex (Fitting and Brose 1971). As Pfeiffer (1977) has studied the Glacial Kame Reigh site (Wisconsin), an evaluation of the concept (hypothesis) of a Glacial Kame

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Schneider, Kim N., and Paul W. Sciulli
1983 Biological Affinities Among Ohio and Great Lakes Archaic Amerindians: A Multivariate Analysis Based on Cranial Morphology. *Ontario Archaeology* 40: 3-8.

"physical type" may be made. If the concept of a "physical type" is valid, we would expect the Reigh sample to cluster with the other (Glacial Kame) Late Archaic samples examined. This ancillary test of the "physical type" concept is made, however, from a fundamentally different research methodology which is founded on an evaluation of biologic similarities and differences, not on the traditional establishment of a singular typology.

MATERIALS AND METHODS

Discontinuous traits of the cranium and mandible were collected from at least 115 individuals from six Late Archaic burial complex sites in the northwestern region of Ohio (Table 1).

TABLE 1
FREQUENCIES OF DISCONTINUOUS TRAITS IN THE SIX NORTHERN OHIO LATE ARCHAIC SAMPLES.

Trait	WC Williams Cemetery	SW Stratton Wallace	ML Muzzey Lake	CW Clifford Williams	B Boose	KT Kirian Treglia
Left sagittal sulcus	7/18	7/16	8/27	7/23	6/16	8/13
One parietal foramen	14/14	16/32	20/52	19/48	13/31	17/24
Lamboid wormians	28/30	14/16	26/27	21/22	16/16	13/13
Asterionic bones	10/40	16/32	27/56	19/44	5/20	14/24
Two mental foramina	5/35	2/23	2/26	5/40	1/24	2/25
Gonial eversion	18/33	12/24	13/24	12/27	6/25	10/23
Mylohyoid arch	5/33	4/24	3/24	15/36	11/25	14/23

The Ohio sites described in Converse (1981) are generally referred to or are artifactually similar to the Glacial Kame burial complex (Cunningham 1948; Converse 1981) which is considered to date from about 3450-2450 **BP** (Fitting and Brose 1971). Two Ohio sites are dated (Williams Cemetery 2600-2800 **BP** and Kirian Treglia 2775-2900 **BC)** and fall into this time span. The six upper Great Lakes samples studied by Pfeiffer represent the Maritime, Laurentian, Lamoka, Old Copper and Glacial Kame Archaic traditions, and date from 4700-3660 **BP** (Pfeiffer 1977:36).

Seven discontinuous traits are used in this analysis (Table 1). These traits were used to provide comparability between published data and those collected by the authors for the Ohio Late Archaic samples. Each is discussed in Pfeiffer (1977) and are figured in Berry and Berry (1967), Ossenberg (1974) and E1-Najjar and McWilliams (1978). Although sample size per site are relatively small, all available data were used. As in Pfeiffer's study, right and left sides are combined for bilateral traits (Ossenberg 1981) and the sexes pooled for all traits. Only fully mature individuals as judged by dental development and epiphyseal union are scored for trait expression. Dichotomous scoring follows Anderson (1969). Of the seven nonmetric traits used for the analysis, only gonial eversion requires subjective interpretation. However, as Pfeiffer's study used the data from Port au Choix collected by Anderson and also follows Berry and Berry (1967) and Ossenberg (1974), we suspect that interobserver error is minimal.

Comparisons between samples are based on the percentages of trait expression. The percentages are transformed from a binomial to a normal distribution using the Freeman-

Tukey (1950) transformation:

$$\Theta = \arcsin\sqrt{\frac{r}{n+1}} + \arcsin\sqrt{\frac{r+1}{n+1}}$$

where r is the number of times a trait occurs and n is the sample size. The measure of divergence (MD) between two samples for a given trait can then be found as:

$$MD = (\Theta_1 = \Theta_2)^2 - \left(\frac{1}{n_1 + \frac{1}{2}} + \frac{1}{n_2 + \frac{1}{2}}\right)$$

(deSouza and Houghton 1977) with the mean measure of divergence (MMD) equaling the sum of these values for all traits divided by the number of traits. Following the determination of the MMD between all pairs of samples, matrices of MMD's were constructed in order to perform a principal coordinates analysis for clustering. For these analyses, negative MMD's are treated as zero. Positive MMD's are employed as phenetic measures of dissimilarity based on the assumption that statistical significance does not necessarily reflect biological significance.

Matrix operations follow Marida, Kent and Bibby (1979) and were executed using the SPEAKEASY III Omicron matrix operation package (Doebelin 1977). As this transformation is different from that used by Pfeiffer, we first analyzed her data using the method presented to check for comparability.

RESULTS

Table 2 presents the matrices of MMD's and Fig. 1A and **B** the principal coordinates analysis of Pfeiffer's MMD's and the MMD's we calculated using the Freeman-Tukey transformation. These two analyses, although mirror images, provide the same clustering and are consistent with Pfeiffer's results: Port au Choix (PAC) is separated from all other samples but is closest to Cole (CO); the Laurentian and Old Copper samples (Frontenac Island (FI), Morrison Island-Allumette Island (MI-AI), Reigh (RE) and Onconto (ON)) form a cluster with the Morrison Island-Allumette Island in a central position. Two traits, lamboidal wormians and gonial eversion contribute virtually all of the separation between these two general clusters.

TABLE 2

MATRICES OF MMD'S FOR THE UPPER GREAT LAKES SAMPLES.
(Above the diagonal are MMD's presented by Pfeiffer (1979), below the diagonal are the MMD's calculated in the present study).

	Cole Gravel Pit CO	Frontenac Island FI	Morrison Island-Allumette Island-MI-Al	Reigh RE	Onconto ON	Port au Choix PAC
CO		0.261	0.231	0.361	0	0.076
FI	0.192		0	0.039	0.036	0.528
MI-Al	0.118	0		0	0.023	0.423
RE	0.221	0.007	0		0.098	0.445
ON	0	0	0	0.030		0.361
PAC	0.005	0.508	0.361	0.409	0.297	

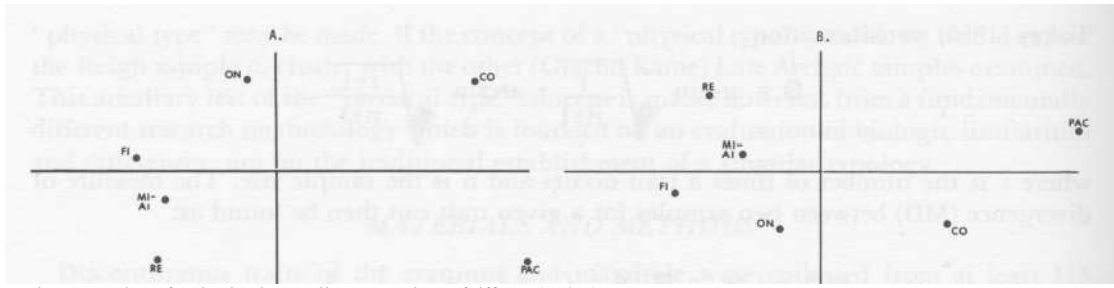

Fig. 1 A. Plot of principal coordinates using Pfeiffer's (1979) MMD's.
B. Plot of principal coordinates of Pfeiffer's (1979) MMD's With Freeman-Tukey Correction.

Table 3 and Fig. 2 present the 12 x 12 matrix of MMD's between each pair of samples and its principal coordinates analysis. Immediately apparent is the separation between two major clusters, a Laurentian-Old Copper cluster and a Maritime-Glacial Kame-Laurentian (Lamoka) cluster. Figure 2 appears stable in that it retains the general pattern of clustering seen in figure 1 B.

TABLE 3

MATRIX OF MMD'S FOR THE LATE ARCHAIC NORTHERN OHIO AND THE ARCHAIC GREAT LAKES SAMPLES

	Williams Cemetary	Stratton Wallace	Muzzey Lake	Clifford Williams	Kirian Treglia	Boose	Frontenac Island	Reigh	Port au Choix	Morrison Island-Allumette Island	Cole	Onconto
	WC	SW	ML	CW	KT	B	Fl	RE	PAC	MI-Al	CO	ON
WC												
SW	0											
MI.	0	0										
CW	0	0	0									
KT	0.13	0.08	0.17*	0.03								
B	0.04	0.03	0.04	0	0							
Fl	0.32	0.33*	0.43*	0.45*	0.71*	0.60*						
RE	0.35*	0.26*	0.35*	0.36*	0.61*	0.58*	0					
PAC	0.04	0.12*	0.08*	0.06	0.21*	0.07	0.51*	0.41*				
MI-AI	0.15	0.11	0.24	0.27	0.35*	0.45*	0	0	0.36*			
CO	0	0	0	0	0.14	0	0.19	0.22	0	0.12		
ON	0.19*	0.22*	0.31*	0.25*	0.53*	0.46*	0	0.03	0.30*	0	0	

* Significantly different. $X^2 > X^2 (05)[7] = 14.067$

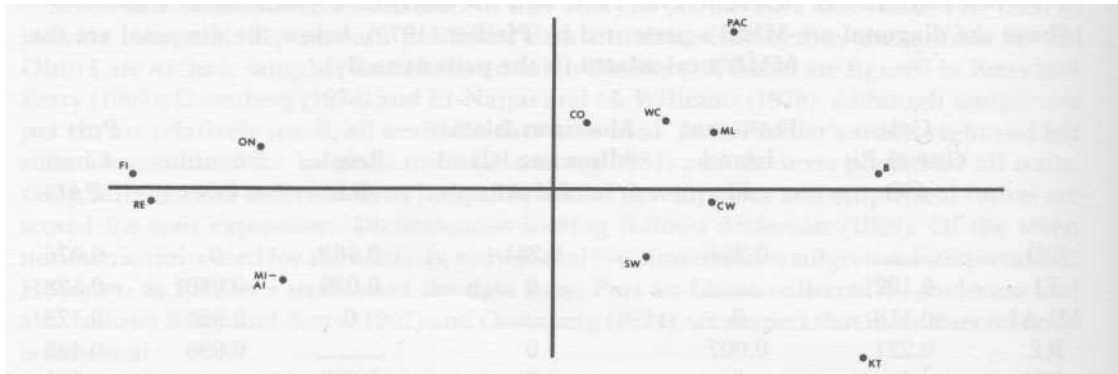

Fig. 2 Plot of principal coordinates analysis based on MMD's (Table 3) between each of the northern Ohio Late Archaic samples and Archaic Great Lakes samples.

DISCUSSION AND CONCLUSIONS

The results of this study are in general agreement with the findings of Pfeiffer (1979). Intra-complex homogeneity would be expected if cultural traditions represent biologic exchange networks. However, this assumption is not strongly supported by our data. Although the two major clusters generally represent different cultural traditions, significant inconsistencies exist. The affinity among northern Ohio samples, the Maritime Port au Choix sample and the Laurentian (Lamoka) Cole sample is problematic. As the populations represented by these samples are allochronic and allopatric, this pattern probably does not reflect continuing biologic interaction. Rather it may suggest a historical relationship. If this were true either these populations would be ancestor-descendant, or they would have derived from a common ancestral population. In any event, the northern Ohio samples, Port au Choix and Cole appear to have shared a more recent common ancestor than any of these have with the samples of the alternate cluster. This is *a provisional hypothesis* because a number of refinements and additions could be made. For example, including a larger number of discontinuous traits and increasing the number of samples and sample sizes from the Great Lakes region might provide alternate interpretive clusters. Also, Archaic samples from other geographic areas could be included, e.g., Illinois Valley, Ohio Valley and Kentucky, to provide a wider regional analysis. The above hypothesis should be treated as a null hypothesis subject to refutation based upon data from additional samples.

The salient feature of this study is the recognition of significant intra-complex variation. As in Pfeiffer's study, we cannot find consistent, unambiguous evidence for "physical types" associated with cultural traditions. For example, Cole and Frontenac Island both represent the Laurentian tradition but are biologically separated, and the Glacial Kame sites in northern Ohio show no special relationship to the Wisconsin Glacial Kame Reigh site. In addition, the northern Ohio sites, although separated from the Laurentian-Old Copper cluster, do not form a tightly associated group as can be noted by the somewhat distant placement of the Boose **(B)** and Kirian Treglia (KT) samples from the main cluster. From these data there is little basis for treating each cultural tradition as a homogeneous biological entity representing a "physical type", nor for pooling samples from similar cultural traditions. Rather, this study recognizes that cultural similarity does not necessarily indicate biological relatedness, and that significant variation exists within each of the two major clusters.

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