Aspects of
Upper Great Lakes
Anthropology

PAPERS IN HONOR OF LLOYD A. WILFORD

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This physical anthropological study explores certain biological relationships among prehistoric Woodland groups of the Upper Mississippi Valley and the adjacent prairie region bordering the northern Great Plains. During prehistoric times this area of Minnesota, North and South Dakota, and southern Manitoba was the home of several Woodland societies. Traditionally these groups have been considered marginal offshoots from more populous and highly developed Woodland (Hopewell) centers to the southeast in Ohio and Illinois. They have also generally been regarded as ancestral to such historic Plains tribes as the Dakota, Assiniboin, Blackfoot, and Cheyenne. This paper attempts to trace the lineages of historic Plains tribes back to Woodland times and to test the hypothesis that they were descended from prehistoric Hopewell groups. To do so it will analyze the frequencies of 26 discrete morphological traits of the skull, in a total sample of 942 individuals from 19 groups, by employing a multivariate estimate of biological distance (MD²) to explore relative “affinities” or “distances” within an archaeological and ethnohistorical framework.

The traits on which this study is based are 26 discrete (discontinuous) variants of the skull. Thirteen are illustrated in Plates 1–12 that follow. The other 13 are: infraorbital suture, foramen spinosum confluent with sphenopetrosal fissure, Wormian (supernumerary) bones in lambdoid suture, Wormian bones in occipito-mastoid suture, ossicle in parietal notch, auditory exostoses, intermediate condylar canal, supraorbital foramen, post condylar canal absent, foramen in lateral pterygoid plate, accessory mental foramen, hypoglossal canal divided, and upper third molar suppressed.

SOME THEORETICAL CONSIDERATIONS

That minor skeletal variants in man are genetically determined and that each can be inherited independently has been suggested by studies of analogous skeletal variants in laboratory animals (reviewed by Grüneberg, 1963). The rationale for their use as well as their potential for the analysis of extinct human populations has been demonstrated in a number of reports (e.g., Laughlin and Jørgensen, 1956; Berry and Berry, 1967; Kellock and Parsons, 1970; Lane and Sublett, 1972). More detailed descriptions of each of these variants as well as a review of the literature pertaining to them may be found in this author’s earlier studies (Ossenberg, 1969, 1970), where they were also analyzed with respect to patterns of age and sex differences, population distribution both within and between groups of North American Indians and Eskimos, and to some extent by correlation between features.

It is essential that any population study be based on as many independently inherited traits as possible. Perhaps 50 discontinuous morphological features have been identified for the skull alone. Unfortunately, for one reason or another all are not of equal usefulness. Thus it is necessary to choose the battery of traits carefully.

One must be careful not to weight the battery too heavily with features that are possibly quite highly correlated. Sutural variations such as Wormian bones on various sites of the vault would be such an example (Ossenberg, 1969; Hertzog, 1968). Other features are ruled out because they may be as strongly influenced by mechanical or functional factors as they are by genes. Examples would be the mandibular and palatine tori (Mayhall, 1970) and the nuchal muscle markings on the occipital squama. Yet others appear to be too ambiguous in expression and/or morphological significance to permit the construction of constant and meaningful criteria for recording them “present” or “absent.” In this category I would place mastoid, ethmoid, palatine, infraorbital foramina, and the emissary foramen of Vesalius. Finally, certain features may vary too little among the particular populations under investigation to be of much
value. In the present study this was true of the parietal foramen.

The possibility of correlation is an important consideration for the use of traits in formulas of divergence which involve the summation of trait frequencies. The effect of such correlations would be to cause very high or very low values of the measure of divergence to occur more frequently by chance than they should. A. C. Berry and R. J. Berry's (1967) analysis of 99 Egyptian crania revealed only 10 significant correlations between 378 pairs of discrete traits. As is the case with the findings for mice, such an extremely low level of correlation between epigenetic traits was taken to mean that the variants are the pleiotropic manifestations of many developmental processes, and that differences between individuals in terms of the total configuration of present-absent traits reveal variation at a large number of gene loci.

Another important consideration is the possible affect of environment. That craniometric features manifest great plasticity under the influence of dietary and climatic changes is well known. While research with laboratory animals has demonstrated the affect on discontinuous traits of such factors as diet, maternal age, and litter size, it is thought that differences produced by these factors are in general less than those produced by genetic factors (Berry, 1963). Thus with respect to both important characteristics — low correlation and small environmentally induced plastic response — the minor skeletal variants would appear to have an advantage over the craniometric characters traditionally employed for population comparisons.*

Microevolutionary changes in inherited characteristics occur through time in response to selection, gene flow (mixture), and genetic drift. The complex ways in which these mechanisms interact to effect divergence and convergence between groups, as reflected in the changing morphology of the skeleton, are as yet imperfectly understood. Regardless of the microevolutionary mechanisms involved, it is an essential prerequisite that any population study be based on as many independently inherited traits as possible. In view of the large role genetic drift, in particular, is thought to have played in shaping modern racial differences, the concept of total morphological pattern is particularly crucial for human racial taxonomy.

Genetic drift, essentially, represents sampling error. Whenever a small group becomes separated from its parent population, it is less likely to contain a representative sample of the parent population’s gene pool. Throughout human history such situations must have occurred over and over again as small bands split off to migrate in search of new hunting territory, or as large groups were virtually wiped out by famine, disease, and warfare, leaving only a handful of survivors. Isolation by inhospitable terrain or other factors, with concomitant inbreeding, would then tend to perpetuate the differences initiated by drift, contributing significantly to variation.

Fig. 1 diagrams a hypothetical case in which groups B1 and B2 disperse from population B, moving in opposite directions. B1 settles in an area adjacent to C, but does not mix with C. Archaeologists later excavate several sites representing remains of these four groups and hypothesize, on the basis of geographical proximity and cultural similarities, that B1 and C are related to each other, but that they are not related to B2.

Let us assume that, because of the effects of genetic drift through time, B2 happens to have a lower frequency, say 5%, of paracondylar process than does B at 10%, while B1’s frequency of paracondylar process diverged 20% to approximate C’s 25%. Thus if only paracondylar process were considered, researchers might conclude incorrectly that B1 and C were related to each other.

Pursuing their observations further, however, the researchers find that for tympanic dehiscence, which can be inherited independently from paracondylar process, B1 has a lower frequency (15%) than B (25%), while B2 has a higher frequency closer to C (50%). In other words, tympanic dehiscence was affected by drift in the opposite direction to that taken by paracondylar process. Since each trait is inherited independently, the direction of drift in groups B1 and B2 is like a toss of the coin for each trait. A third feature, trochlear spur, might not show any drift effect at all, and so on.

* G. K. Neumann (1952) classified North American Indians and Eskimos into eight varieties defined mainly in terms of metrical traits of the skull. For the prehistoric groups in this study, measurements and indexes of skulls of the Arvilla, Blackduck, Devil’s Lake, Melita, and Manitoba groups (Hrdlicka, 1927; Anderson, 1962; Ossenberg, 1964, 1966) examined in terms of Neumann’s typology indicate that none of these cranial series falls into the Lenapid (or Lenapid-Walcolid) variety to which Illinois Hopewell belongs. Rather all these groups clearly belong in the Lakotid (or Deneid) variety — a mesocratic type of skull characterized by low-vaultedness with platybasia and a large rugged facial skeleton. Too few examples are available at present for the Laurel or Mille Lacs cultures to permit generalizations about the metrical characteristics of these skulls.

As for the historic tribes, according to data recorded by Hrdlicka (1927), the Dakota, Assiniboin, Cheyenne, and Blackfoot are all of the Lakotid (or Deneid) variety. Physical anthropological studies of the Dakota have also revealed homogeneity among the divisions of the tribe with respect to craniometric traits (Hrdlicka, 1927), as well as with respect to measurements and other somatic characteristics in the living (Sullivan, 1920; Hrdlicka, 1931). The Dakota do not appear to be closely related to their Siouan-speaking neighbors in the central Plains nor to the Siouan-speaking tribes of the southeastern states (Neumann, 1952; Pollitzer et al., 1967).

So far, the craniometric evidence suggests that the derivation of the cranial variety to which these groups belong lies, not southeast of Minnesota in Hopewell, but rather to the northwest and closer to a common ancestry with other Deneids such as the Aleuts and the Athapaskan-speaking tribes (Hrdlicka, 1945; Neumann, 1952). In view of the minor differences apparent among these several Woodland and historic groups, a rigorous multivariate analysis would be worthwhile. Ideally such a study should be based on measurements taken by one investigator.
As more and more features are taken into account the possibility becomes smaller and smaller (eventually infinitesimally small) that on the basis of the total battery of traits a spurious alignment could be constructed — in other words, an alignment that fails to reflect the fact that B1 and B2 are related through the same ancestral population B, and that they are not related to C. This hypothetical case is, of course, an oversimplification. In a real situation the relative time depths of the samples would have to be taken into account. Environmental selection and/or gene flow might tend to obscure the earlier historical relationships to the point where B1 would eventually become genetically more similar to C than to B.

Regardless of what factors shaped them, the point to be emphasized is that the larger the number of independently inherited traits considered, the better will be the chance of obtaining an accurate estimate of genetic relationship. For the study here presented 18 of the 19 prehistoric and historic samples examined recorded all 26 features.

Similar theoretical considerations underscore the desirability of including as many samples as possible in a population study. The rationale is that in this kind of research it is relative degrees of affinity or difference that are meaningful rather than absolute arbitrary levels. A population study should ideally provide for both within-group and between-group comparisons by including samples of groups of known or presumed similarity as well as samples of groups known to be unrelated or only very distantly related.

The design of the present study, for example, provides at the one end of the scale a "yardstick," or "parameter," of close within-group affinity: namely, the mean measure of distance for four tribal divisions of the Dakota, among which close genetic relationships are present in living peoples (Sullivan, 1920; Hrdlicka, 1931). At the other end of the scale, the mean measure of distance for a very diverse sample of American and African Negroes representing many tribes and regions provides a parameter of nonrelationship for between-group comparisons.

Including several subgroups of a major group — say the several subdivisions of a tribe — strengthens the research design in another way. A single subgroup might be unrepresentative of the larger population because of such factors as drift or isolation inbreeding. But if, for example, all subgroups should be unanimous in their closer affinity to Woodland phase A than to phase B, this consensus provides much stronger evidence for the relationship than would only one sample.

At a certain stage in the analysis it may be advantageous to pool subgroup samples. Pooling such data results in mean frequencies, tending to reverse or cancel out within-group fluctuations due to drift and/or inbreeding, thereby approximating a hypothetical generalized (or ancestral) population. In some cases this procedure can greatly clarify the taxonomic picture, and it was used in this study.

The prehistoric skeletal samples discussed below are defined a priori in this study by cultural criteria; namely, the archaeological complexes into which archaeologists have classified burial mounds. The assumption is that such a complex represents the material culture of a single group of people (population) over a period of time, and that successive generations of this population are represented genetically by the skeletal remains from sites classified as belonging to a focus, phase, or culture.

Such an assumption is almost certainly incorrect in some cases. There is no way of knowing what correspondence exists between archaeological unit and "population," as the latter term might be used by a geneticist or demographer. A phase, for example, could be the product of more than one population; alternatively, a single widespread population could produce localized cultural variants sufficiently distinct to justify separate phase designations. Moreover, in certain cases remains associated with a phase might include a high proportion of ritual interments of captives or trophy skulls from some other group of people.

Other problems involved in the study of extinct populations are well known; for example, the lack of information concerning pedigrees or breeding structures, and the non-randomness of samples. Of the several factors interfering with randomness, I should like to draw attention to one that is present when dealing with Woodland societies. It is the likelihood that skeletons from several mounds of a phase are in the nature of "total universes" from a number of family cemeteries. Under these circumstances, skeletal analysis, commencing at the level of mound-by-mound comparisons...
in order to set up pooled samples on the basis of a priori
genetic (rather than cultural) affinity, would be theoretically
unsound, even though such an approach might be desirable
from the point of view of complementing or paralleling the
archaeologist's method of classification. Another problem
with mound-by-mound analysis is, of course, sample size.
It would, however, be possible to approach the problem
from the phase level. Having established the skeletal attrib­
utes of the populations associated with the several phases
or aspects, one could then analyze remains from a single
mound (or even a single burial) of "unknown" phase and
determine whether its genetic attributes placed it closer to
phase A, B, or C.

WOODLAND COMPLEXES
AND CRANIAL SAMPLES

Minnesota

The Minnesota Woodland groups relevant to this study are:

- Mille Lacs culture, Malmo phase — 800 B.C.—A.D.?
- Mille Lacs culture, Kathio phase — A.D. 800–1400
- Laurel culture — 200 B.C.—A.D. 800
- Blackduck culture — A.D. 800–1400
- Arvilla Complex, south — A.D. 500–1000
- Arvilla Complex, north — A.D. 800–1400

Known largely from burial mounds, these complexes and
phases were defined by Lloyd A. Wilford (1944a, 1945a,
1950, 1955) with subsequent amendments based on more
recent excavations, analysis, and radiocarbon dates (John­
son, 1964b, 1973; Wilford, Johnson, and Vicinus, 1969;
lists is also given by K. H. Capes (1963). For the
geographical concentrations of these sites, see Fig. 2.

Although the relationships among these complexes are
not clearly defined archaeologically as yet, a few generali­
izations may be relevant to the skeletal analysis. The south
Arvilla Complex is best known from sites concentrated in
the Lake Traverse region, although the distribution extends
sparsely from the eastern border across the central portion
of Minnesota. The north Arvilla Complex, with sites con­
centrated along the eastern and western tributaries of the
Red River in northwestern Minnesota and adjacent portions
of North Dakota, is thought to represent a development and
northwesterly expansion from the earlier southern stage.
Arvilla shows a basic similarity to, or continuity with, the
Laurel culture. The complex is also characterized by a close
affinity to Blackduck, but it appears to have little in com­
mon with Mille Lacs (Johnson, 1973).

The Malmo phase of the Mille Lacs culture, which in­
cludes some of the earliest Middle Woodland sites in Min­
nnesota, shows stronger ceramic connections with Hopewell
than are indicated by any of the later Woodland complexes.
The Kathio phase is thought to have developed out of

Malmo (Wilford, 1955). The main concentration of sites for
both phases is the Mille Lacs Lake area of central Min­
nnesota.

The Laurel culture, for which the type site is close to the
northern boundary of Minnesota, has a widespread distri­
bution both east and west of this region. According to Wil­
ford, in terms of ceramics Malmo is Laurel's closest relative
in Minnesota (1955:135). James B. Stoltman (1973 and
p. 88, below) views Laurel as influenced ultimately from
Illinois Hopewell. However, others (J. Wright, 1967;
Mayer-Oakes, 1970) suggest that Laurel ceramics did not
emanate from Hopewell but were derived rather more di­
rectly from Asia along with one of the last waves of migra­
tion across the Bering Strait.

Blackduck is later than Laurel in the same general northern
area, and there is evidence of a possible development of
Blackduck from Laurel (Evans, 1961b). Nevertheless,
Blackduck also shows similarities to the Mille Lacs culture,
leading Wilford to speculate that both Blackduck and

One possible interpretation which would somewhat re­
concile these views is that at the earlier time level (200 B.C.
to A.D. 800), Laurel and Malmo represented small localized
populations in northern and central Minnesota which had
only occasional contact with each other, but that about A.D.
800 population expansion and movement caused more in­
teraction among them. As a result, the subsequent de­
development from Laurel to Blackduck in the north may have been more or less synchronized, by influence back and forth, with a parallel development in the central region from Malmo to Kathio. The similarities between Kathio and Blackduck would thus represent convergence, rather than a common ancestry in Malmo. Relevant to this interpretation is recent research indicating that the use of wild rice as a staple was a significant development in the Upper Mississippi Valley, which by about A.D. 800 had resulted in a population surge and a shift from older nomadic patterns toward the establishment of more permanent villages (Johnson, 1969a). Such a change would have been conducive to increasingly regular contacts and relationships between communities.

Similarities between Blackduck and Arvilla may be even stronger than those for Blackduck and Kathio. Artifact assemblages for these two groups have been described as nearly identical (Wedel, 1961:227). The exact nature of the relationship, however, has not been clarified. It is especially puzzling in view of the fact that Arvilla does not share Blackduck's affinity to Kathio, although all three complexes are largely contemporary during this time of population growth and supposedly greater interaction.

In summary then (admittedly oversimplified): Arvilla, Blackduck, and Laurel seem to be closely interrelated. Mille Lacs may stand somewhat apart from these three complexes but closer to Laurel and Blackduck than to Arvilla.

One persistent problem in Minnesota archaeology has been the phase designation of burial mounds with sparse or absent artifactual remains and unclear or confused burial traits. Earlier practice assigned these to Mille Lacs as a general Woodland catchall, in view of the fact that this complex characteristically had few grave furnishings and secondary often scattered burials. Recently several such sites have been removed from the Mille Lacs classification and designated, until their attribution can be more accurately determined, as "Woodland, unknown phase."

Six of the following 7 cranial samples represent named Woodland cultures or complexes of Minnesota and provide the main focus of this study. The seventh, a sample from Crookston Mound classified as "Woodland, unknown phase," was included primarily as an exercise to explore the usefulness of discrete trait analysis in the assignation of single, problematic sites. Crania of individuals of both sexes and all ages were pooled in each sample. All were judged not to be artificially deformed. Data from the following mounds were gathered from collections in the department of anthropology, University of Minnesota, unless otherwise indicated. For the locations of most mounds, see Jan E. Streiff (1972).

1. Mille Lacs culture, Kathio phase sites (abbreviation ML). 48 individuals. Mounds: Bartke, Christensen, Cooper, Fingerson, Huber, Halpin, Malmsen, Morrison, Round (not including the intrusive primary burials, Wilford, 1970:3), Shakopee 4, Synstebys, Vineland Bay.

2. Arvilla Complex, southern sites (abbreviation RRLT*). 75 individuals. Mounds: De Spiegler, Habben, Kallstrom, Red Lake River, Slinger 2, Stumne, Wilson 3. 13 crania in the collections of the U.S. National Museum were excavated in the 19th century by U.S. Army surgeons (Comfort, 1873; Thomas, 1894) from mounds geographically interspersed with, and showing traits very similar to, the early Arvilla mounds later excavated by the University of Minnesota. A preliminary study of biological distance revealed the National Museum and University of Minnesota series to be reciprocally close, suggesting they might be pooled (Ossenberg, 1966).

3. Arvilla Complex, northern sites (abbreviation RRA*). 83 individuals. Mounds: Arvilla 1, 2, 3, Lake Bronson, Fer­tile (Warner 1, 2, Peter Lee), Haarstad, Snake River. 20 crania in the collections of the National Museum were excavated in 1888–89 by Henry Montgomery from mounds on the west bank of the Red River in Walsh and Grand Forks counties, North Dakota (Montgomery, 1906; Wilford, 1970: vii).

4. Laurel culture (abbreviation L). 39 individuals. Mounds: Smith 3, 4. This collection is decayed and so fragmentary that observations could be made on only 4 — marginal foramen of tympanic plate, trochlear spur, mylohyoid bridge, and supraorbital foramen — of the 26 discrete traits.

5. Blackduck culture, northern sites (abbreviation BDN). 51 individuals. Mounds: McKinstry 2, Hungry Hall 2. 20 crania in the collections of the Royal Ontario Museum were obtained from Hungry Hall Mound 2, a Blackduck site dated about A.D. 1200. Distance analysis revealed this cranial sample to be closer to McKinstry than to Osufsen or any other Woodland phase in Minnesota (Ossenberg, 1964).


Manitoba and North Dakota

Among the many tumuli distributed throughout the region known as the northeastern Plains periphery, three additional prehistoric burial mound complexes in Manitoba and North Dakota were examined for this study. The three concentrations (see Fig. 2) were:

*RRLT is the abbreviation for "Red River Aspect, Lake Traverse phase." RRA stands for "Red River Aspect, Arvilla phase." These were the designations originally given by Wilford to the southern and northern sites of the Arvilla Complex which has been recently renamed (Johnson, 1973). The symbols are retained for convenience; otherwise, for example, AS (Arvilla south) would be confused with AS for Assiniboine.
1. Near Devil’s Lake in northern North Dakota
2. The Manitoba phase of Blackduck in south-central Manitoba
3. The Melita phase in southwestern Manitoba

All three appear to be late prehistoric (A.D. 1200 to A.D. 1700) and to represent remains of related groups of people with cultural roots close to those of Laurel, Mille Lakes, Blackduck, and Arvilla (MacNeish, 1958; Capes, 1963; Wedel, 1961). Elden Johnson (1973) placed several of the Manitoba sites in the Arvilla Complex. In general, however, the trait lists of these sites are not paralleled by those of any single Minnesota complex. They can be best described as a composite or coalescence of the traits of the Minnesota complexes.

To what extent these similarities represent cultural diffusion or actual migrations from the Upper Mississippi Valley is not known. However, the long period of cultural continuity dating from 1000 B.C. in southern Manitoba (MacNeish, 1958) hints that a very early population base may have been established within which culture evolved by diffusion in step with similar stages in Minnesota.

The following cranial samples for these three Plains groups were examined for this study:

1. Devil’s Lake, North Dakota, sites (abbreviation DL). 36 individuals. Mounds: in Ramsey and Benson counties excavated in 1887 (Montgomery, 1906; Capes, 1963:115), near Fort Totten excavated in the 19th century by surgeons of the U.S. Army, and in the Bald Hill, North Dakota, area excavated by the University of North Dakota (Hewes, 1949). The first two collections were studied in the U.S. National Museum and the latter in the Laboratory of Bioanthropology, University of Indiana. Though these mounds form a regional grouping, the complex (or complexes) is not well defined.

2. Manitoba phase sites (abbreviation MAN). 86 individuals. Mounds: Stott (MacNeish, 1954); Fidler, probably opened in the early 20th century by Bryce (Capes, 1963:74) and completely excavated by a field party from the University of Manitoba (Fiske, 1964); Arden, Morrison, Pilot, and Darlingford excavated by Henry Montgomery 1907–10 (Montgomery, 1908, 1909, 1910; Capes, 1963), with collections in the Royal Ontario Museum; Lone, McGorman, Sims, Star, and Star B excavated by William B. Nickerson 1912–15 (Capes, 1963), with collections in the National Museum of Canada.

3. Melita phase sites (abbreviation MEL). 49 individuals. All the sites of this phase were excavated by Montgomery (1908) and Nickerson (Capes, 1963). The collections are in the Royal Ontario Museum and the National Museum of Canada, respectively. The phase was named by R. S. MacNeish (1958), but it has not been adequately defined. Because of the great diversity of cultural traits represented, the Melita phase may be something of a regional catchall representing more than one group. The cranial sample is from approximately 42 mounds in the extreme southwest corner of Manitoba, where North and South Antler creeks join the Souris River (Capes, 1963).

HISTORIC PLAINS TRIBES
AND CRANIAL SAMPLES

Dakota

When first encountered by Europeans, circa 1640, the Dakota were still following what was basically a Woodland way of life. They lived in villages in the wooded region that is now Minnesota and adjacent parts of Wisconsin. In the ensuing decades they moved westward onto the Plains. Ethnologists recognize three divisions of the Dakota distinguished by territory, dialect, and to some extent by customs and way of life — Santee, Wiciyela, and Teton. Each division, in turn, comprised two or more endogamous bands (Wedel, 1961; Feraca and Howard, 1963).

The origin of the Dakota is enigmatic. Although the region where they were first encountered by white men abounds in archaeological remains, these can be only vaguely linked with the tribe in view of the rapid cultural change at the time of contact. Nevertheless the three divisions of the Dakota were first encountered by Europeans in locations which correspond to the geographical concentrations of Woodland sites:

Santee: around Mille Lacs Lake (Mille Lacs culture)
Wiciyela: near Leech Lake in north-central Minnesota (Blackduck culture)
Teton: near Big Stone and Traverse lakes (south Arvilla Complex)

The Mille Lacs culture (Kathio phase) was attributed by Wilford to the Santee Dakota on the basis of territorial correspondence and because the predominant form of burial was secondary bundle, which corresponded to the earliest recorded mortuary customs of the Dakota (Wilford, 1955:134). More recent opinion suggests that the Kathio sites are too early to link up, on the basis of cultural or demographic data, with any specific Dakota band or division (Wilford, Johnson, and Vicinus, 1969:51), and the same caution should doubtless apply to the other Minnesota Woodland phases.

Unfortunately it is not known how long the Dakota bands had occupied these territories. Two hundred or more years seem to have elapsed between the erection of the most recent mounds and European contact. Moreover, there is no known eyewitness account of the Dakota building burial mounds. When first encountered by Europeans, the Dakota practiced communal secondary interment following an interval of scaffold exposure of the corpse. While thousands of mounds in Minnesota are suspected to represent the work of ancestors of the Dakota, none have been linked to this tribe with certainty on the basis of ethnohistorical or archaeological evidence.
Assiniboin

The Assiniboin, said to be the closest relatives of the Dakota, were first seen in 1670 near the site of present-day Winnipeg. By tradition an offshoot of the Yanktonai (a band of the Wiciyela division), they are thought to have split off from the Dakota in northern Minnesota in the 17th century, spearheading the Dakota advance onto the northern prairies (Wedel, 1961). Though glottochronology is often unreliable, it is interesting that linguistic divergence points to a much earlier Dakota-Assiniboin split (Lowie, 1910). By the early historic period the Assiniboin had allied themselves with the Cree against the Dakota, and by the early 19th century their territory, like that of the Dakota, had shifted north and west.

Traditionally the Assiniboin were divided into three tribal bands, whose livelihood depended almost entirely upon the buffalo. In 1823 they were estimated by trader Joseph Renville to number 28,000 people, nearly as many as all the Dakota groups combined; other estimates of the period are smaller (Lowie, 1910).

The numerous burial mounds in the eastern portions of North and South Dakota and particularly those in southern Manitoba have persistently been attributed to the Assiniboin (MacNeish, 1954, 1958; Capes, 1963; C. Vickers, personal communication). This area was part of their earliest recorded territory. Of the other northern Plains tribes who were their closest neighbors in earliest historic times, none are known to have built burial mounds, whereas an eyewitness account of an Assiniboin mound interment was recorded as late as 1776 by fur trader Alexander Henry (Wedel, 1961:224; Capes, 1963:116).

The Assiniboin have been suggested as the putative authors of Minnesota’s Blackduck culture (Wilford, 1945a:328; 1955:136; Bennett, 1952:118). The distribution of Blackduck sites follows the supposed route of this tribe’s migration from north-central Minnesota to the Lake of the Woods region. Burials in Blackduck mounds are characteristically seated inhumations in the flesh, corresponding to the earliest documented practices of the Assiniboin. A continuum between Mille Lacs and Blackduck pottery types was also cited as evidence for the Blackduck-Assiniboin attribution. The ceramic relationship supposedly reflected the origin and subsequent breaking away of the Assiniboin (represented by Blackduck) from the Dakota (represented by Mille Lacs).

Both the Manitoba and Melita phase remains have been attributed to this tribe, although MacNeish (1958) noted that, because of the archaeological evidence for a long period of cultural continuity in southern Manitoba, the occupation of this territory by the Assiniboin (or proto-Assiniboin) may antedate by many centuries the time period assigned to the Manitoba and Melita mounds (A.D. 1200 to A.D. 1700). Stressing the similarity between the Manitoba phase and the Blackduck culture, MacNeish agreed that both could be the work of the Assiniboin. He pointed out, however, that if the attribution is correct, the Assiniboin were distributed over all of southern Manitoba as well as northern Minnesota by at least A.D. 1000. And if the Assiniboin did break away from the Yanktonai in northern Minnesota as David I. Bushnell (1927) claimed, this movement occurred long before the 17th century.

According to archaeological data, by A.D. 1350 the Cree, an Algonquian-speaking group, had moved into southeastern Manitoba, leaving remains classified as the Selkirk phase and confining the Assiniboin to the western portion of their earlier territory (MacNeish, 1958). The period about A.D. 1400 also marks the end of the Blackduck culture in northern Minnesota, later prehistoric remains in this region being classified as Sandy Lake (Cooper and Johnson, 1964). Some archaeologists have doubted that all the mounds attributed to the Assiniboin can properly be laid at their door and have felt that more than one historic tribe may be represented (Wedel, 1961; L. Symns, personal communication). G. E. Evans (1961b) suggested that the Cree might be responsible for some of these sites.

Cheyenne

According to tradition, the Cheyenne originated somewhere in western Minnesota. From there, during the late protohistoric period, they presumably pushed westward onto the Great Plains via the tributaries of the Red River (Kroeber, 1939). The Sheyenne-Cheyenne site about 12 miles southeast of Lisbon, North Dakota, abandoned around A.D. 1770, has been attributed to the Cheyenne. The pottery at this site revealed a strong Woodland influence, which, it was suggested, might eventually be linked to one of Minnesota’s phases. W. D. Strong suggested that the pottery was particularly reminiscent of Blackduck wares, but W. Raymond Wood’s recent reanalysis of the data showed that the closest cultural ties were with the protohistoric coalescent tradition sites of the Missouri River trench to the westward and that the relationship to Minnesota phases was negligible (Strong, 1940, reviewed by Bennett, 1952:134; Wood, 1971). Cheyenne speech also suggests a separation from other Algonquian languages, although it shows less separation than does Blackfoot.

Blackfoot

The Algonquian-speaking Blackfoot, whose earliest historic territory was the northern Plains, followed what is generally considered to be the prototype of High Plains culture. This, as well as their linguistic divergence from other Algonquian peoples, suggests that Blackfoot occupation of the Plains may be relatively ancient. Moreover, their unique pattern of serological traits (i.e., an unusually high incidence of blood group A) may reflect a long period of microevolutionary divergence in relative isolation from other groups.
J. W. Bennett (1952:119) suggested that Arvilla, along with other poorly known cultures of the northeastern Plains periphery, may "lie somewhere in the background of such historic tribal groups as the Blackfoot." However, no Woodland phase has been specifically linked to this tribe.

The following cranial samples for the four historic Plains tribes of the Dakota, Assiniboin, Cheyenne, and Blackfoot were examined for this study in the collections of the U.S. National Museum. Most were collected by army surgeons during the 19th-century Indian wars. The Dakota, Cheyenne, and Blackfoot series were gathered from a number of sites broadly representative of each tribe's territory (see Hrdlicka, 1927, for locations). The Assiniboin sample is drawn mainly from the cemetery of a single community. Further notes on provenience, as well as on the criteria used for splitting the Dakota series according to the three divisions of the tribe, may be found in an earlier study (Ossenberg, 1969).

1. Dakota, Teton division, Brule and Oglala bands (abbreviation DBO). 44 individuals.
2. Dakota, Teton division, other, and unspecified bands (abbreviation DT). 39 individuals.
5. Assiniboin (abbreviation AS). 31 individuals.

THE TRADITION OF HOPEWELL ANCESTRY

It has been suggested that the mound-building cultures of Minnesota and the northeastern Plains periphery originated to the south, and represent dispersal of ancestral Siouan-speaking peoples from the more highly developed Middle Woodland cultures of Ohio and Illinois. In view of the more expansive character of Illinois Hopewell (Griffin, 1964a: 243), the latter would perhaps seem the better candidate for the ancestral population. The geographical distribution of Siouan-speaking tribes (Swanton, 1936, 1943), migration legends, and linguistic analysis (Eggan, 1952: 41) point to the regions of the most highly developed Hopewell centers as the early ancestral homeland of these tribes, from whence the several groups dispersed or were driven to the southeast and northwest. Classic Illinois Hopewell overlaps in time with Minnesota's Malmo phase and Laurel culture, both of which show some ceramic similarities to Hopewell (Wilford, 1955; Stoltman, 1973).

In the light of these theories, cranial samples of Illinois Hopewell for the Classic period (approximately A.D. 100) were examined for this study (abbreviation H). 63 individuals. Mounds: Klunk 11, Wilson. Collections are in the Laboratory of Bioanthropology, University of Indiana.

The foregoing archaeological and ethnohistorical review provides the framework within which estimates of biological distance based on skeletal remains will be interpreted. One additional cranial sample (abbreviation N) of 93 skulls of American and African Negroes (a very diverse series from many tribes and regions) was included as representative of a group totally unrelated to the American Indian peoples in order to provide a "yardstick" for within- and between-group comparisons. These samples are in the collections of the U.S. National Museum.

ANALYSIS AND COMPARISONS

Frequency Ranges

Each trait used is listed below with the age limit imposed on its observation (necessitated by age regression in its expression) and the frequency range observed for the 18 Amerind prehistoric and historic samples in the present study as well as the Negro sample incidence. Incidences of bilateral traits were computed out of the total of left and right sides. For 18 of the 19 series all 26 features were recorded. Laurel phase remains being so fragmentary, observations were made for four traits only (Nos. 8, 12, 15, and 16). The following abbreviations were employed:

- AS Assiniboin
- BDN Blackduck, north
- BDS Blackduck, south
- BLFT Blackfoot
- CH Cheyenne
- CR Crookston
- DL Devil's Lake
- DBO Dakota, Brule and Oglala
- DS Dakota, Santee
- DT Dakota, Teton
- DW Dakota, Wiciyela
- D Dakota, pooled sample
- H Hopewell
- L Laurel
- MAN Manitoba
- MEL Melita
- ML Mille Lacs
- N Negro
- RRA Arvilla, north
- RLT Arvilla, south
- RRA Dakota, pooled sample

1. Os Japonicum trace (Plate 1). Age limit: adult (21 years and older). Frequency range: 4% (ML, BDS) to 25% (BLFT); 14% (N)
2. Infraorbital suture. Age limit: adult. Frequency range: 21% (AS) to 55% (ML); 30% (N)
3. Tympanic plate dehiscence (Plate 2). Age limit: 12 years and older. Frequency range: 22% (DW) to 51% (RRA); 17% (N)
4. Foramen spinosum confluent with sphenopetrous fissure. Age limit: adult. Frequency range: 4% (DS) to 24% (RRLT); 23% (N)
5. Wormian (supernumerary) bones in lambdoid suture. Age limit: 12 years and older. Frequency range: 13% (CH) to 49% (H); 31% (N). An "average" frequency of lambdoid Wormians was calculated for each sample based on the frequency of one or more ossicles in the lambdoid suture as a whole excluding asterion, plus the frequency of an ossicle at asterion. Only Wormian bones 5 mm. or more in diameter were counted "present."
6. Wormian bones in the occipito-mastoid suture. Age
Plate 1. Os Japonicum trace.

Plate 2. Tympanic plate dehiscence (arrow) and marginal foramen (into which a white pointer has been inserted).

Plate 3. Clinoid bridging. Superior (intracranial) aspect of a disarticulated sphenoid bone showing on the right the normal appearance of the anterior (A), middle (M), and posterior (P) clinoid processes. On the left the anterior and middle (AM) are joined by a bony bar. Other clinoid region anomalies not shown here include AP and AMP bridging.

Plate 4. Pterygospinous bridge. A bony bridge stretching between the lateral pterygoid plate and the sphenoid spine and situated inferomedial to the foramen ovale.
Plate 5. Pterygobasal bridge. A bony bridge stretching from the lateral pterygoid plate to a point lateral to foramen ovale.

Plate 6. Mylohyoid bridge. The mylohyoid groove, housing a nerve and artery on the medial surface of the ascending ramus, is converted to a bony canal for part of its course.

Plate 7. Trochlear spur. This anomaly represents ossification into the fibrocartilaginous pulley for the superior oblique muscle of the eyeball. Shown here on the right side.

Plate 8. Accessory optic canal. A close-up view of the right orbit, slightly tilted, showing the superior orbital fissure (S), the optic canal (O), and the accessory optic canal. During life this anomalous canal gives passage to the ophthalmic artery.
Plate 9. Parietal process of the temporal squama. Left lateral aspect of the temporal squama, from the upper margin of which a long style (broken post-mortem) had projected in articulation with the parietal bone. During life the style shields an anomalous artery, whose pattern of branching is etched into the parietal bone above the tip of the style.

Plate 10. Paracondylar process. A close-up view of the foramen magnum region of the cranial base, showing an extraordinarily large paracondylar process on the left side. In this specimen the process bears an articular facet which articulated with the transverse process of the atlas.

Plate 11. Odonto-occipital articulation. The anomalous facet which articulated with the odontoid process of the axis vertebra is seen on the anterior margin of foramen magnum.

Plate 12. Pharyngeal fossa. This is an unusually deep one.
limit: 12 years and older. Frequency range: 3% (BDN) to 19% (H); 7% (N)
7. Osicle in the parietal notch. Age limit: 12 years and older. Frequency range: 5% (DBO, DT) to 27% (ML); 18% (N)
8. Marginal foramen of tympanic plate (Plate 2). Age limit: 12 years and older. Frequency range: 28% (MAN) to 48% (MEL); 12% (N)
9. Pterygospinous bridge (Plate 4). Age limit: none. Frequency range: 2% or less (BDS, RRA female, H) to 17% (DL, RRA male); 1.6% (N)
10. Pterygobasal bridge (Plate 5). Age limit: adult. Frequency range: 2% or less (H, DW, BLFT) to 13% (MEL); 34% (N). Both complete bridges and near complete (i.e., cases in which spicules almost meet) were counted, the former being weighted by a factor of two.
11. Clinoid bridging (Plate 3). Age limit: none. Frequency range: 13% (H) to 33% (MAN, AS); 22% (N)
12. Trochlear spur (Plate 7). Age limit: 12 years and older. Frequency range: 2% or less (BLFT) to 25% (DW); 13% (N)
13. Auditory exostoses. Age limit: 12 years and older. Frequency range: 2% or less in all groups except H (20%), RRLT and ML (8%); 0% (N)
14. Intermediate condylar canal. Age limit: adult. Frequency range: 24% (H) to 61% (DS); 35% (N)
15. Mylohyoid bridge (Plate 6). Age limit: adult. Frequency range: 8% (RRA male) to 44% (MAN); 12% (N)
16. Supraorbital foramen. Age limit: adult. Frequency range: 24% (MEL) to 62% (DL, MAN); 17% (N)
17. Post condylar canal absent. Age limit: none. Frequency range: 7% (MEL) to 22% (DS); 32% (N)
18. Parietal process of the temporal squama (Plate 9). Age limit: 9 years and older. Frequency range: 4% (RRA female) to 19% (AS, CH, BLFT); 7% (N)
19. Foramen in lateral pterygoid plate. Age limit: none. Frequency range: 6% (RRLT) to 33% (BDN); 4% (N)
20. Accessory mental foramen. Age limit: none. Frequency range: 4% (ML, RRA female) to 20% (RRA male); 6% (N)
21. Accessory optic canal (Plate 8). Age limit: 12 years and older. Frequency range: 2% or less (ML, RRLT, BDN, MEL, BS, BLFT, H) to 10% (DL, MAN, AS); 0% (N). This rare anomaly is a round canal approximately 2 mm. in diameter piercing the floor of the optic canal (the "floor" being formed by the postero-inferior root of the lesser wing of sphenoid). Cases counted "present" included both complete and incomplete accessory canals (i.e., a notch in the floor of the optic canal).
22. Hypoglossal canal divided. Age limit: none. Frequency range: 11% (DT) to 30% (ML, BDN, DL); 9% (N)
23. Paracondylar process (Plate 10). Age limit: none. Frequency range: 5% (ML, BDS) to 25% (RRLT, RRA, BDN, DL, MAN, AS, BLFT); 0.5% (N). Cases counted vary from small tubercles (weighted as one) on the condylar process of the occipital bone, to large processes (weighted as two), some bearing a facet for articulation with the transverse process of atlas. The process may be involved in extremely rare cases of atlanto-occipital fusion or assimilation. This and other rare anomalies of the craniovertebral border are exemplified especially well in prehistoric crania from Minnesota and the northeastern Plains periphery.
24. Odonto-occipital articulation (Plate 11). Age limit: none. Frequency range: 0% to 7% (RRLT, RRA, MEL, MAN); 0% (N)
25. Pharyngeal fossa (Plate 12). Age limit: none. Frequency range: 4% or less (MAN, AS) to 30% (DS); 28% (N)
26. Upper third molar suppressed. Age limit: 12 years and older. Frequency range: 2% or less (ML, BDN, BDS, RRA male, MEL, D) to 14% (MAN, H); 9% (N). The molar was counted as absent when there was no sign of it having been present, erupted or unerupted (without recourse to X-ray examination).

Calculation of $MD^2$

In this paper the method of computing estimates of genetic divergence between populations is the statistic devised by C. A. B. Smith and called "measure of divergence" (Grewal, 1962) or "measure of distinctiveness" (Berry, 1963). For ease of reference this has been abbreviated as $MD^2$.

The measure of divergence $MD^2$ between two populations 1, 2 is:

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

where $\Theta$ is the angular value of the percentage incidence $p$ of each variant, defined as $\sin^2 (1 - 2p)$, measured in radians, and where $N$ equals the number of variants used in each comparison (i.e., in this study $N$ equals 26). $n_1$ is the mean number of observations per trait in population 1, and $n_2$ is the mean number of observations per trait in population 2.

The term $1/n_1 + 1/n_2$ is the variance $V$ of $(\Theta_1 - \Theta_2)$. Subtraction of this term in the expression for $MD^2$ effectively removes from $\sum (\Theta_1 - \Theta_2)^2/N$ the variance due to random sampling fluctuations.

As set out by M. S. Grewal (1962) and R. J. Berry (1963), $n_1$ is the number of individuals in population 1, and $n_2$ is the number of individuals in population 2. In the present study, based on samples of skulls in which the specimens are often damaged and have parts missing, the "effective" sample size is usually less than the actual number of individuals represented and, moreover, $n$ varies from one trait to another. Here, $n$ (the mean number of observations per trait in the population) is calculated as in the following example for the Santee Dakota:
ORIGINS AND RELATIONSHIPS OF WOODLAND PEOPLES

<table>
<thead>
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<th>Trait</th>
<th>Incidence in total right and left sides</th>
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<tbody>
<tr>
<td>1</td>
<td>7/59 sides</td>
</tr>
<tr>
<td>2</td>
<td>23/55 sides</td>
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<tr>
<td>3</td>
<td>14/56 sides</td>
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<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>2/50 sides</td>
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</tbody>
</table>

\[ N = \frac{59 + 55 + 56 + \ldots + 50}{26} = 55 \]

Ideally when \( n \) varies from trait to trait, the term \( 1/n_1 + 1/n_2 \) should be calculated separately for each trait, and \( MD^2 \) computed as

\[ \sum \left( (\Theta_1 - \Theta_2)^2 - (1/n_1 + 1/n_2) \right) / N \]

However, a good approximation can be obtained by using the simpler method, provided that the number of observations varies only slightly from trait to trait (Lane and Sublett, 1972).

Berry (1963) pointed out that \((\Theta_1 - \Theta_2)^2/V\) is approximately distributed as chi square with one degree of freedom, and that \( MD^2 \) is accordingly distributed as \( V (X^2_1 - 1) \). Hence the following significance levels will pertain to \( MD^2 \):

<table>
<thead>
<tr>
<th>( MD^2 ) Value</th>
<th>Significance Level</th>
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<tr>
<td>.1V &lt; ( MD^2 &lt; .6V )</td>
<td>( .30 &gt; p &gt; .20 )</td>
</tr>
<tr>
<td>.6V &lt; ( MD^2 &lt; 1.7V )</td>
<td>( .20 &gt; p &gt; .10 )</td>
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<tr>
<td>1.7V &lt; ( MD^2 &lt; 2.8V )</td>
<td>( .10 &gt; p &gt; .05 )</td>
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<tr>
<td>2.8V &lt; ( MD^2 &lt; 5.6V )</td>
<td>( .05 &gt; p &gt; .01 )</td>
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<tr>
<td>5.6V &lt; ( MD^2 )</td>
<td>( .01 &gt; p )</td>
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The angular transformations (\( \Theta \) values) and the \( MD^2 \) values were obtained with a programable desk calculator. Simply to facilitate discussion of the figures, an adjustment was carried out to raise all values by a constant factor \( 10^3 + 14 \). Thus \( MD^2 \) = 0.1538 adjusted becomes 29.4, \( MD^2 \) = 0.00923 becomes 4.8, etc. (Obviously, levels of statistical significance were computed for true \( MD^2 \) values, not adjusted values.)

**Interpretation of \( MD^2 \) Values**

\( MD^2 \) (adjusted) values based on 26 traits are arrayed in Tables 1, 2, and 3 with levels of statistical significance indicated. The average number of observations per trait, \( n \), in each sample is also given.

The smaller the \( MD^2 \) for any pair of groups the closer the relationship. Inferences concerning relationship depend on the relative size of differences as shown by the ranking of \( MD^2 \)'s, taking into account levels of statistical significance.

The 6 within-Dakota \( MD^2 \)'s, ranging from 0.0 to 18.0 (mean 11.2), provide a parameter of close within-group affinity. Only 2 of these 6 values reach the lowest level of significance between 30% and 20%.

At the other end of the scale, the range of 14 Negro-Amerind \( MD^2 \)'s, from 131 to 197 (mean 162.4), provides a parameter of nonrelationship. Nine of the 14 values are significant at the 1% level, and the other 5 are significant at the 5% level. The virtual absence of overlap between the total range of Amerind-Amerind \( MD^2 \)'s and the total range of Amerind-Negro \( MD^2 \)'s gives some confidence that the taxonomic picture derived from this particular battery of traits is in fact a meaningful reflection of genetic relationship.

Excluding Hopewell, the Amerind samples — both Woodland and historic — appear to represent a cluster of closely related populations as evidenced by 137 \( MD^2 \) values ranging from 0.0 to 74.6. Of these 137 values, only 5 exceed the 10% level of significance, while 24 indicate no significant divergence between the populations. Therefore, in the ensuing discussion of relationships in the Upper Mississippi Valley and Plains, when groups are described, for example, as "not very closely related," or "fairly closely related," it must be kept in mind that these statements refer only to minor differences among populations, which in terms of the broader picture form a closely related cluster.

\( MD^2 \) values for Hopewell (range 39.7 to 134) indicate a weaker relationship between Hopewell and the other Amerind groups represented in the study.

The male-female \( MD^2 \) value of 20 (.30 \( p > .20 \)) for the Dakota may be taken as a parameter of sex-difference in a large endogamous population for this particular battery of traits.

In the following sections each of the Woodland complexes is discussed in the order that seemed to facilitate the logical flow of interpretation rather than in the order of their archaeological temporal position.

**North Arvilla (A.D. 800 to 1400)**

**Prehistoric Relationships.** In certain respects Arvilla is the most enigmatic of Minnesota's Woodland complexes. Fig. 3 shows that when compared with other prehistoric groups, north Arvilla (RRA) is closest to Devil's Lake and north Blackduck and most distant from Manitoba, Mille Lacs, and south Arvilla. In view of the close cultural similarity between the southern and northern Arvilla manifestations and the assumption that north Arvilla represented a northward expansion from south Arvilla, a closer biological affinity was expected. Further analysis led to a hypothesis of "hybrid origin" for north Arvilla.

The pattern of trait frequencies of RRA males is very different from that of RRA females. For example, mylohyoid bridge had a male frequency of 8% and a female frequency of 40%. Supraorbital foramen had a male frequency of 29% and a female frequency of 57%. In comparison with the sex-difference incidence of these features in large population samples (Ossenberg, 1969), the frequency ranges are much greater than would be expected if the males and females interred at the northern Arvilla sites had come...
from the same population. No other male and female subsamples in this study show patterns of trait frequencies differing as markedly as those of north Arvilla. Thus it seemed worthwhile to calculate male and female MD$^2$'s separately for this sample. Taking the MD$^2$ 20 (the Dakota sex distance) as a parameter, the MD$^2$ 68 for RRA is large (0.20 > p > 0.10).

It is not surprising to find, therefore, that the male and female subsamples also show contrasting patterns of relationships vis-à-vis other groups. In Fig. 4 the distribution of groups in the lower left and upper right quadrants reflects fairly close agreement between males and females, corresponding quite well to the ranking of groups with respect to the pooled RRA sample shown one-dimensionally in Fig. 3. However, isolated in the upper left quadrant, closely related to RRA females but distant from RRA males, are south Blackduck (Osufsen and Schocker sites) and south Arvilla. In contrast, north Blackduck is more closely related to RRA males.

My interpretation is that north Arvilla represents coalescence, through intermarriage, between Blackduck and south Arvilla people. I hypothesize that men descended from the same, or closely related, north Blackduck population as that represented at McKinstry Mound 2 and Hungry Hall Mound 2 took wives from two other populations — a neighboring Blackduck population closely related to that represented at

<table>
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<th>GROUP</th>
<th>RRLT</th>
<th>RRA</th>
<th>RRA</th>
<th>RRA</th>
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<th>BDS</th>
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* One to five asterisks denote successively higher levels of statistical significance calculated as on p. 26 of this report. MD$^2$ values without an asterisk indicate no significant divergence between the samples.
Osufsen and a population closely related to that represented at the southern Arvilla sites. In other words, this interpretation supposes that the south-north Arvilla continuity was through the female line.

The close genetic relationship between RRA and Blackduck parallels close similarities in the artifact assemblages (Wedel, 1961:227). Moreover, the geographical position of north Arvilla (Fig. 2) lends some support to the idea of a hybrid origin. In the light of this hypothesis, it might be interesting to re-examine the artifact assemblages to see if those objects traditionally made and used by men show closer Blackduck similarities, while those more likely to have been made and used by women (for example, pottery) show closer south Arvilla similarities.

RRA people are very closely related to Devil’s Lake, a population thought to be later in time. Similarly the burial traits and artifacts of the Devil’s Lake mounds suggest that they may represent a northward expansion of the Arvilla culture (Wedel, 1961; Capes, 1963; Johnson, 1973).

RRA is not closely related to Mille Lacs. Again this would appear to correlate with the archaeological data, even though the sites of the two phases are geographically close and largely contemporaneous.

**Historic Relationships.** The affinity of RRA to Cheyenne

*Throughout the text bar graphs summarize the information in Tables 1 and 2. For example, Fig. 3 shows the ranking of MD\(^2\) values for north Arvilla. The black bars represent MD\(^2\) values (Table 1) expressing the distance of north Arvilla from other Woodland complexes, while the gray bars represent MD\(^2\) values (Table 2) expressing the distance of north Arvilla from historic tribes. The shorter the bar, the closer the relationship; i.e., RRA-CH (MD\(^2\) 0.9). The longer the bar, the weaker the relationship; i.e., RRA-MAN (MD\(^2\) 42.9).*

(MD\(^2\) 0.9 compared to the within-Dakota mean of 11.2) is the closest Woodland-historic tribe relationship revealed by this study. It is reciprocal; that is, no other Plains tribe is as close to RRA, and no other Woodland complex — not even Devil’s Lake among those postdating Arvilla — is as close to Cheyenne.

This finding confirms the tradition that Minnesota was the ancestral homeland of this tribe, and fulfills Strong’s (1940) expectation that the origin of the Cheyenne represented at the 18th-century Sheyenne-Cheyenne site might eventually be traced to Minnesota.

Blackduck (A.D. 800 to 1400)

**Prehistoric Relationships.** In agreement with other workers (for example, Evans, 1961b) who hypothesized that Blackduck represented more than one ethnic group, MD\(^2\) reveals that the north Blackduck sample from McKinstry Mound 2 and Hungry Hall Mound 2 to be not as closely related to south Blackduck (Osufsen and Schocker sites) as we might perhaps expect if these samples represented a single group. The BDN-BDS MD\(^2\) is 30, compared with the mean within-Dakota MD\(^2\) of 11. Even more revealing, however, are the rather different patterns of relationship shown by BDS and BDN vis à vis other Woodland groups (Fig. 5).

In general, BDN tends to have closer affinities to other groups than does BDS. This may mean that of the two, the northern had the more widespread affiliations within the region or perhaps was the more expansive.

I suggested above that a BDN-BDS coalescence may have given rise to north Arvilla, and that RRA males may have been derived from a population closely related to north Blackduck, while RRA females may have been derived in
part from a population closely related to south Blackduck (as well as from one closely related to south Arvilla). In Fig. 5 RRA males occupy the lower right quadrant (BDN 12, BDS 65), while RRA females represent an exception to the general pattern of these Woodland groups vis à vis Blackduck, being closer to BDS (19) than to BDN (30).

Both Blackduck groups are quite distant from the Manitoba phase sample, notwithstanding their classification together by MacNeish (1958) in a Headwaters Lakes Aspect.

Both are fairly closely related to Mille Lacs, in keeping with Wilford’s interpretation of Blackduck-Mille Lacs ceramic similarities.

The relationship of Blackduck to Laurel is of particular interest. Of the two Blackduck samples, BDS appears to be the closer to Laurel (Fig. 9), although although BDN is geographically closer, and McKinstry Mound 2 was a mixed-component site. However, since the Laurel MD's were based on only four traits, interpretations of the affinities of Laurel in this paper must be viewed as extremely tentative.

**Historic Relationships.** Consistent with the interpretation above that north Arvilla was ancestral to Cheyenne and was derived in part from Blackduck, we find that both Black-

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**TABLE 2**

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* One to five asterisks denote successively higher levels of statistical significance calculated as on p. 26 of this report. MD² values without an asterisk indicate no significant divergence between the samples.
duck groups, especially the northern one, are also closely related to Cheyenne (Fig. 5). BDN is closer to Cheyenne (MD\textsuperscript{2} 11) than to the other three Plains tribes, and possibly through north Arvilla bears a close ancestral relationship to Cheyenne. According to my hypothesis of the hybrid origin of north Arvilla, the contribution of Blackduck to the Cheyenne lineage would have been primarily through BDN males.

In contrast to north Blackduck with its close affinity to Cheyenne, south Blackduck (Osufsen and Schocker sites) shows its strongest affinity to Dakota. Again this contrast bears out Evans' theory that Blackduck represented more than one ethnic group. Moreover, the BDS-D affinity is reciprocal (MD\textsuperscript{2} 11); no other Woodland sample represented here is closer to Dakota than BDS. Further the four Dakota subgroups are unanimous (Table 2) in supporting this attribution: DT, DBO, DW, and DS are all closer to south Blackduck than to any other Woodland sample represented here. And reciprocally BDS is closer to each of these Dakota subgroups than to any of the other three Plains tribes. This consensus constitutes strong evidence for the conclusion that south Blackduck is ancestral to Dakota.

In comparing BDN and BDS archaeological patterns of relationship with other Woodland groups, we saw a possibility that south Blackduck may have been the more sedentary, or localized, of the two populations. Interestingly it is precisely this wooded region of north-central Minnesota near Leech Lake that was identified in Dakota tradition as the ancestral homeland of these tribes (Schoolcraft, 1851–54, 2:172), even though by the time of historic contact the several subdivisions of the tribe were somewhat dispersed from this area. Four to five hundred years intervene between the dates of the most recent Blackduck sites and the 19th-century Dakota skeletal remains, yet the BDS-D genetic affinity as inferred from MD\textsuperscript{2} is as close as that among the contemporaneous 19th-century divisions of the tribe. This, indeed, suggests that a large, sedentary, and cohesive ancestral Dakota population base had been established by the A.D. 1000 to 1400 time level in the region of the Mississippi headwaters. This being the case, where are the intermediate remains from the intervening 500-year period? One possibility might be skeletons found in association with Sandy Lake ceramics, which succeeded Blackduck in this region (Cooper and Johnson, 1964). Another

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candidate for an intermediate position would be the skeletal sample, yet to be analyzed, from the 17th-century Cooper Village site, attributed to Santee Dakota (Cooper, 1965).

Obviously the findings here presented do not rule out the possibility that other Woodland phases, not included in this study, may be as good, or even better, candidates for ancestral Dakota. Fig. 5 shows that there are slight affinity variations among the Dakota divisions with BDS, the Teton, and Wiciyela (western) divisions being closer than the Santee (eastern) division. Closer affinities of the Santee may eventually be discovered farther east, perhaps in Wisconsin, where W. C. McKern (1963) attributed the protohistoric Clam River phase to this subdivision of the tribe.

Mille Lacs-Kathio Phase (A.D. 800 to 1400)

Prehistoric Relationships. On the whole ML Kathio does not seem to be very closely related to the other Woodland groups of the Upper Mississippi Valley (Fig. 6). Its strongest affinity is with the southern Blackduck population (MD$^2$ 16). Less closely related are Melita (MD$^2$ 20), north Blackduck (MD$^2$ 21), and south Arvilla (MD$^2$ 24). A very speculative interpretation might suggest that the relationships ML-BDS and ML-RRLT reflect, not a common ancestry, but rather microevolutionary convergence through gene flow. Kathio and south Blackduck people were neighbors and largely contemporaries in the A.D. 800 to 1400 time period. Contact between them could account both for gene flow and for cultural exchange producing the ceramic similarities. The southerly sites of the Arvilla Complex, however, preceded Kathio in time in the same general central Minnesota region, perhaps slightly overlapping with the earlier Malmo phase of the Mille Lacs culture. Possibly the moderately close Kathio-RRLT relationship represents Kathio's inheritance from an earlier and closer Malmo-RRLT relationship. Until Malmo's very few and decayed skeletal remains have been analyzed, however, there is no evidence to indicate any relationship between them.

If gene flow did occur between Mille Lacs and Arvilla populations at the earlier Malmo time level, it apparently did not persist into the ensuing millennia through a parallel relationship between Kathio and north Arvilla. Though contemporaneous, these populations were not closely related (MD$^2$ 38). Thus, while Mille Lacs is somewhat closely related on the one hand to south Arvilla, and on the other hand to south Blackduck, the Mille Lacs population appears to have remained largely peripheral to the events shaping the Blackduck-south Arvilla coalescence which resulted in north Arvilla.

Nor is the strong northwestward thrust characteristic of Arvilla seen in Mille Lacs. The latter is closely related neither to the population represented by the Devil's Lake mounds (MD$^2$ 33) nor to the Manitoba phase population (MD$^2$ 73). Nevertheless it is noteworthy that some of the Melita phase mounds in southwestern Manitoba have cultural attributes strikingly reminiscent of Mille Lacs (Capes, 1963), while a MD$^2$ of 20 may be indicative of some genetic relationship between Melita and Mille Lacs.

Historic Relationships. The tribe (or tribes) descended from Mille Lacs are not revealed by this study. Whereas a reciprocally close affinity emerges between a Woodland group and a historic group in four cases, none of these involve Mille Lacs. While ML is closer to Blackfoot (MD$^2$ 45) than to the other three historic tribes, south Arvilla (MD$^2$ 28) is a better candidate for Blackfoot ancestor.

Mille Lacs had been ascribed tentatively by Wilford to the Santee Dakota on the basis of continuity of territory and burial practices, while others, as we have seen, pointed out that Mille Lacs was probably too early to be linked up with any particular division of the Dakota. Lending support to the latter theory, the MD$^2$ shows ML no closer to Santee than to the other two Dakota divisions (Table 2). The south Blackduck population (MD$^2$ 11) is a better candidate for Dakota ancestor than is Mille Lacs (MD$^2$ 48).

Nevertheless the possibility cannot be ruled out that people of the Kathio phase contributed in some manner to the Dakota lineage. As suggested earlier, an analysis of the 17th-century Cooper Village site remains, identified positively as Santee, would help fill a large temporal gap and might shed considerable light on this problem.

South Arvilla (A.D. 500 to 1000)

Prehistoric Relationships. South Arvilla shows closer affinity to Devil's Lake (MD$^2$ 10) than to any other prehistoric sample (Fig. 7). Moreover, RRLT and DL agree in relative affinities to other groups. Both are closer to north
ORIGINS AND RELATIONSHIPS OF WOODLAND PEOPLES / 33

Blackduck than to south Blackduck, to north Arvillia females than to north Arvillia males, and to Manitoba phase than to Melita phase. In each of these comparisons Devil's Lake has smaller $MD^2$ values than RRLT, which is consistent with its closer chronological position to the other groups.

As described above under Mille Lacs, RRLT has a fairly close relationship to ML ($MD^2$ 24), possibly reflecting microevolutionary convergence through gene flow at the A.D. 500 to 1000 time level or earlier. During the succeeding period A.D. 1000 to 1400, however, Arvillia and Mille Lacs apparently diverged, since neither north Arvillia nor Devil's Lake is as close to Mille Lacs as is south Arvillia.

**Historic Relationships.** South Arvillia is most closely related to Blackfoot ($MD^2$ 28), Cheyenne ($MD^2$ 30), and Assiniboine ($MD^2$ 39). The relationship to Dakota ($MD^2$ 58) is more distant.

Since the RRLT-BLFT affinity is reciprocal, RRLT is the best candidate for ancestral Blackfoot of all the Woodland groups represented in the study. That the actual distance ($MD^2$ 28) is greater than that for other Woodland-historic “pairs” (for example, north Arvillia-Cheyenne $MD^2$ 0.9) could reflect the greater time depth separating RRLT from 19th-century Blackfoot. The occupation of the Plains by this tribe is thought to have preceded that of the other historic tribes examined. Their alignment of $MD^2$'s (Table 2) could possibly reflect microevolutionary divergence following an early split from the south Arvillia population.

RRLT might also be represented in the Cheyenne lineage, according to the hypothesis offered earlier that south Arvillia through its female descendants gave rise to north Arvillia (the male contribution having been derived from north Blackduck) and that north Arvillia, in turn, was ancestral to Cheyenne.

**Prehistoric Relationships.** With the exception of Devil's Lake and Laurel, Manitoba phase people are not closely related to the other Woodland groups represented in this study (Fig. 8). After Devil's Lake ($MD^2$ 11) and Laurel ($MD^2$ 16), Manitoba’s next closest prehistoric relationship is with south Arvillia ($MD^2$ 34).

Burial traits and artifact assemblages attest to the cultural impact of Arvillia, not only on the Devil’s Lake region, but also in southern Manitoba (Capes, 1963; Johnson, 1973). If the southern Manitoba people were influenced genetically by the Arvillia people, this is by no means clearly indicated by $MD^2$. The alignment of MAN vis-à-vis these related populations is RRLT (A.D. 500 to 1000) $MD^2$ 34 and RRA (A.D. 800 to 1400) $MD^2$ 43. In view of this alignment, it is more likely that any movement of Arvillia people into southern Manitoba originated early from a southern rather than from a northern base.

Though Manitoba and Blackduck were originally classified together in a Headwaters Lakes Aspect (MacNeish, 1958), their respective skeletal samples do not indicate a close biological relationship (BDN 41, BDS 50).

Because of the wide geographical dispersion of the Manitoba phase sites, extending from Fidler Mound near Winnipeg on the east to Lone Mound west of Brandon and from the international border to the southern environs of Lake Manitoba, further analysis would seem advisable. It would be worth while, for example, to split the skeletal sample regionally and carry out a more detailed analysis — especially since some regional variability in cultural traits has been noted (Capes, 1963). Nevertheless the over-all picture that emerged from the present study is one of early micro-
evolutionary divergence between the Manitoba and Minnesota populations, followed by a long period of in situ development in Manitoba with relatively little genetic influence from Blackduck or Arvilla and even less from Lake Superior.

**Historic Relationships.** The relationship of this phase to the 19th-century Assiniboine (MD^2 5) was reciprocally close. No other Woodland group was as close to AS, and no other tribe among the four represented here was as close to MAN. These findings support the commonly held view that the evolutionary divergence between these two Siouan-speaking peoples began in the 17th century and then moved into Manitoba. Rather they bear out R. H. Lowie’s opinion of a much earlier linguistic divergence between these two Siouan-speaking peoples. They tie in also with MacNeish’s reconstruction, on the basis of stratigraphy and artifact analysis, placing the Assiniboine throughout all of southern Manitoba by A.D. 1000 and possibly earlier.

There is no evidence in the cranial data that the Manitoba phase population represents an offshoot of the south Blackduck (the best candidate for Dakota ancestor among the Woodland groups in this study), nor that the Assiniboine represent an offshoot of the Yanktonai band of the Wiciyela division or of any other Dakota band or division (Table 3). If the Manitoba phase population was derived from Minnesota, the data in this study points to a migration largely antedating Blackduck times and possibly derived from Laurel, with perhaps some contribution from the population associated with the early Arvilla Complex (see p. 38, below).

**Laurel (200 B.C. to A.D. 800)**

Laurel MD^2 values (Fig. 9), based on 4 traits only, are not as reliable as those for all the other groups based on 26 cranial features. It is reassuring, therefore, to find the Laurel-Negro MD^2 (338) greater than two times the largest Laurel-Amerind MD^2 (Laurel-Hopewell 145), and that Laurel shows closest affinity to other Woodland groups in the same general geographical region: BDS (MD^2 2), MAN (MD^2 16), DL (MD^2 19), and RRLT and RRA female (MD^2 30). The relatively close affinity between Laurel and south Arvilla people is also consistent with the temporal overlapping of the two phases and their similarities in cultural attributes.

Since Laurel appears to be so closely related, on the one hand, to south Blackduck (ancestral Dakota), and, on the other hand, to Manitoba phase (ancestral Assiniboine), it is possible that the Dakota-Assiniboine split occurred within a Laurel population base. The geographical intermediacy of Laurel, between Manitoba on the west and south Blackduck on the south, is favorable to such an interpretation. The microevolutionary divergence is expressed in the initially close relationship of Laurel to MAN and to BDS, and the subsequently weaker relationships between the Assiniboine and Dakota lineages as shown in Table 4.

An early Dakota-Assiniboine split does not, of course, rule out the possibility of subsequent contacts and realignments between these groups. In particular, the disruption of old tribal relationships and the shifts in territories and alliances at the time of European contact have been well documented. The westward push onto the Plains would have been conducive to increasing contact between tribes, resulting in gene flow and microevolutionary convergence. One example of this phenomenon recently studied is the change in cranial morphology of the postcontact coalescent period Arikara, attributed in part to gene flow, possibly from the Dakota (Jantz, 1972).

Similarly, following the prehistoric divergence described above, the present study hints of a reconvergence in the Assiniboine and Dakota lineages:

**Woodland-historic:**

- BDS-AS MD^2 55 (.20 > p > .10)
- MAN-D MD^2 61 (.10 > p > .05)

**Historic-historic:**

- AS-DW MD^2 39 (.30 > p > .20)

Perhaps a group of disgruntled Yanktonai (DW) broke away from other Dakota in north-central Minnesota in the prehistoric period and joined the Assiniboine — an event which might have given rise to the ethnohistorical tradition as well as to an influx of Dakota genes into the Assiniboine gene pool.

The relatively large biological distance between north Blackduck and Laurel people (MD^2 140) was unexpected. Among all prehistoric groups represented here, it was an-
anticipated that BDN would show closest affinity to Laurel, as the most likely direct lineal descendant of Laurel. Recall that Laurel and BDN sites are distributed within the same region, and that McKinstry Mound 2 is a mixed-component site (Wilford, 1955). The 33 small mortuary vessels found in this mound in association with Blackduck burials show an amalgam of Laurel and Blackduck attributes, although the surface finish conforms more often to Laurel standards (Stoltman, 1973). Mortuary practices such as packing clay into eye sockets and removal of occiputs are also strongly reminiscent of Laurel.

One possible interpretation is that BDN represents a different group (Algonquian?) intrusive in the north-central Minnesota region about A.D. 800, and that it may have been an “alien wedge” accounting for the Dakota (BDS)-Assiniboine (MAN) split at this time level. The cultural similarities to Laurel could have resulted from borrowing or diffusion.

Their very different relationship to Laurel once again distinguishes north Arvilla males from females — the males seemingly aligned with BDN in their great distance from Laurel, the females aligned with BDS and RRLT in their closer affinity to Laurel. This pattern is consistent with the interpretation of the origin of north Arvilla through fusion of these different populations. Possibly Laurel, through the BDS females, contributed in some small measure to the north Arvilla (and hence Cheyenne) lineage.

Devil’s Lake (A.D. 1200 to 1700)

These mound remains appear to represent a population with rather widespread relationships within the entire region under discussion. Perhaps the Devil’s Lake area was a strategic stopover on travel routes or a general meeting place for several bands and tribes, so that more than one group may be represented in its sample. Close affinities are with north Arvilla (MD² 4), Cheyenne (MD² 5), north Blackduck (MD² 6), south Arvilla (MD² 10), Manitoba phase (MD² 11), and Assiniboine (MD² 10). None of these values is statistically significant.

The Hidatsa, a Siouan-speaking group of village Indians, traditionally lived in this region, and some of the Devil’s Lake mounds have been attributed to them (J. Howard, personal communication). Unfortunately the few Hidatsa (“Minnetaree”) crania in the U.S. National Museum collections were in poor condition, bone being so fused with clay that very few discrete trait observations could be made. There were no mandibles. However, on the basis of those observations that could be made, the Hidatsa appeared to be no more closely related to DL than are the Cheyenne and Assiniboine. This problem requires further study.

Groups apparently not as closely related to DL include: Mille Lacs, Dakota Sioux, Blackfoot, and Melita phase. The relatively large DL-MEL distance (MD² 38) is surprising, since the cultural trait lists are so similar (Capes, 1963). Mounds in both regions contained a unique type of spirally incised mortuary pot not found in the other complexes. Splitting the DL and MEL samples to carry out a more detailed analysis may help clarify the relationship.

Melita Phase (A.D. 1200 to 1700)

This phase could perhaps represent ancestral Assiniboine (MD² 24), though the evidence is not as strong as it is for Manitoba phase (MD² 5). For one thing, the Melita and Manitoba phases do not appear to be as closely related to each other (MD² 46) as one would expect if they were contemporary segments of a single tribe. Moreover, Melita is characterized by a pattern of relationships with other Woodland groups that is distinct from Manitoba; for example, MEL is relatively closer than MAN to Mille Lacs and Blackduck.

The difficulty in interpreting the alignment of groups with respect to Melita may, to some extent, reflect the unsatisfactory definition of this phase. In this tiny area at the southwestern corner of Manitoba are clustered a great many burial mounds, exhibiting a considerable variety of traits. The ecology of the Souris region is distinct from the rest of southern Manitoba, and it has been suggested that this area may have functioned over a long period of time as a seasonal gathering place for several different groups (L. Syms, personal communication). “Melita phase” could be simply a regional catchall, comprising archaeological manifestations which upon closer scrutiny may be better split into more than one complex.

Unknown Woodland Phase: Crookston Mound

Crookston Mound, formerly classified with Mille Lacs,
THE HYPOTHESIS OF HOPEWELLIAN ANCESTRY

There are 8 Woodland complexes represented in this study whose MD²'s are based on 26 cranial traits: RRLT, RRA, BDN, BDS, DL, MEL, MAN, and ML. With the exception of ML, each of these complexes is closer to the other groups than to Illinois Hopewell. Moreover, each is closer to the four historic Plains tribes than to Illinois Hopewell. These relationships are illustrated in Fig. 10.

Excluding the figures for ML, neither the total range of 21 Woodland-Woodland MD²'s (4 to 50, mean 27), nor the total range of 28 Woodland-historic MD²'s (1 to 61, mean 32) overlaps with the range of 7 MD²'s for Hopewell (68 to 113, mean 98).

In view of the near-contemporary nature of Laurel and Hopewell, a close genetic relationship might have been predicted in support of the hypothesis of Hopewellian ancestry. But (although represented in this study by 4 traits only) Laurel, too, is closer to later Upper Mississippi Valley Woodland groups (MD² range 1 to 140, mean 61) and to historic Plains tribes (MD² range 42 to 79, mean 57) than to Illinois Hopewell (MD² 145). While geographical distances and differing time periods must be taken into account in interpreting these figures, in no case does either factor seem adequate to account for the relatively larger MD²'s vis-à-vis Illinois Hopewell. For example, while south Blackduck may be (on the average) 1,000 years later than the Hopewell sites, it is nearly as much earlier, perhaps 800 years, than the 19th-century Dakota sample. The geographical distance between BDS and the territory of the 19th-century Dakota is probably comparable to the average mileage between BDS and the Hopewell sites. Yet BDS-D genetic affinity (MD² 11) is closer than the BDS-H (MD² 106). Nor can ecological and environmental factors account for this picture, since the way of life of the Upper Mississippi Valley Woodland groups — especially with the establishment of more permanent villages following the introduction of wild rice as a major food resource — would appear to have had more in

![Fig. 10](image-url)

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common with that of Illinois Hopewell than with that of the
19th-century Dakota.

Amid the general consensus the only dissident group is
Mille Lacs.

ML-Woodland  \( MD^2 \) range 16 to 73, mean 32
ML-historic  \( MD^2 \) range 45 to 61, mean 51
ML-H  \( MD^2 \) 40

These figures suggest that Hopewell may have had a closer
genetic affinity to Mille Lacs than to the others. The ML-H
affinity would presumably have been even stronger at the
Malmo time level. Mille Lacs (Kathio) appears to be closely
related, in turn, at the A.D. 800 to 1400 time level to Black-
duck, its contemporary neighbor in north-central Min-
nesota. Interaction between ML and BD would have re-
sulted in microevolutionary convergence between these
groups, tending to obscure or weaken the earlier ancestral
affinity to Hopewell. While alternative interpretations of the
pattern of \( MD^2 \) are possible, this is the one that best seems
to fit the data so far.

The consensus of eight groups (excluding ML) is remark-
able and mitigates strongly against the tradition that the
Woodland peoples of the Upper Mississippi Valley, and the
historic Plains tribes descended from them, originated by
dispersal from Hopewell centers.

**SUMMARY AND CONCLUSIONS**

Analysis of discrete traits in cranial samples from Min-
nesota and the adjacent Plains (200 B.C. to A.D. 1700) re-
veals that the Laurel, Blackduck, Arvilla, Manitoba, Melita,
and Devil’s Lake complexes represent a cluster of closely
related populations ancestral to the Dakota, Assiniboine,
Cheyenne, and possibly Blackfoot. In contrast to the close
genetic relationship among these several Woodland and his-
toric groups, their affinity to Illinois Hopewell is weak.
Their consensus is overwhelmingly against the tradition that
the mound-building peoples of the Upper Mississippi Val-
ley migrated from the populous centers of Hopewell cul-
ture.

Similarly cranial measurements and proportions, reported
by several investigators (see note on p. 16, above) and
examined within the typological framework established by
Neumann (1952), reveal that none of the Blackduck, Ar-
villa, Manitoba, Melita, and Devil’s Lake samples (Laurel
being excluded because of lack of data) belongs to the
Lenapid variety of skull characteristic of Illinois Hopewell.
Rather, cranio metric means of these samples place them
clearly in the Lakotid (or Deneid) variety to which also
belong the Dakota, Assiniboine, Blackfoot, and Cheyenne.
The closest affinities of these groups are seen, not southeast
of Minnesota, but northwest where they may have shared
ancestral roots with other Deneids such as Aleuts and the
Athapaskan-speaking tribes.

Both types of data, discrete and metric, agree that these
Woodland and historic groups are *not* closely related to
Illinois Hopewell. Further research is needed to find out
whether discrete traits reveal the same northwestern
affinities hinted at by the cranio metric evidence. Discrete
trait comparisons should be extended to include Aleut
and Athapaskan samples in order to test the hypothesis of
common ancestry. Comparisons should also be extended
to include Archaic period burials and those associated with
other Woodland complexes in the Great Lakes region in an
attempt to trace the antiquity and geographical ramifications
of this putative relationship.

More skeletal data are needed for Laurel. Comparisons
based on 4 discrete traits showed Minnesota’s Laurel
more closely related to the other Woodland populations later in
time in the same general region, but not closely related to
Illinois Hopewell. At present evidence of northwestern gen-
etic affinities for Laurel is lacking. Even if we had such
evidence, it would not solve the problem of the derivation
of Laurel culture. Nevertheless it is intriguing to find that
the skeletal data thus far are in accord with the hypothesis
based on ceramic analysis that Laurel (200 B.C. to A.D. 800)
— the earliest potterymaking culture in northern Minnesota
— was derived through the boreal forest out of Asiatic roots
rather than from Illinois Hopewell (J. Wright, 1967) con-
tradicting the evidence presented by Stoltman (p. 89, below).

Discrete trait analysis showing Minnesota’s Laurel most
closely related to Manitoba phase (southern Manitoba) and
to south Blackduck (north-central Minnesota near Leech
Lake) points to the conclusion that Laurel is ancestral to
both these complexes. This accords with the archaeological
interpretation of a widespread distribution of Laurel, strong
cultural ties throughout the region exploited by this group,
and a continuity between Laurel and succeeding Blackduck
manifestations (MacNeish, 1958; Evans, 1961b; Mayer-

In agreement with Evans’ (1961b) hypothesis that Black-
duck represents more than one ethnic group, skeletal
analysis shows that the more northerly manifestations of
this phase (Hungry Hall Mound 2 and McKinstry Mound 2)
have different affinities than the more southerly sites (Osuf-
sen and Schocker). It is the latter to which Laurel is ances-
tral; Laurel does not appear to be as closely related to north
Blackduck. A tentative reconstruction is that north Black-
duck represents a new group intrusive in the region — an
alien wedge coming between two segments of Laurel’s de-
scent population, accounting for the microevolutionary
divergence during A.D. 800 to 1400 between Manitoba
phase and south Blackduck.

This reconstruction rests on minor differences in physical
attributes between north and south Blackduck samples.
Both are similar in their relatively large biological distance
from Illinois Hopewell. Both belong to the Deneid (or Lakotid) variety of North American Indian as defined by Neumann (1952), rather than the Lenapid variety characteristic of Illinois Hopewell. In comparison with the other groups, the north Blackduck crania are slightly more brachycranic (i.e., broader in proportion to their length). Interestingly, in view of my speculation that BDN represents an alien wedge of Algonquian-speaking people, the BDN means and indexes (Ossenberg, 1964) are virtually identical to those for a series of Chippewa skulls (Hrdlicka, 1927: 47).

Toward the end of Laurel times about A.D. 500, another closely related group associated with the Arvilla Complex moved into Minnesota from the east. Pushing northwest along the Red River and its tributaries these people encountered Blackduck groups. Skeletal data hint that coalescence of Blackduck (especially north Blackduck) and Arvilla populations resulted in the late, northern manifestations of Arvilla (A.D. 800 to 1400). Craniometric data also appear to support the idea of a hybrid origin of north Arvilla. Though Arvilla people are Deneids (or Lakotids), those associated with the earlier and more southerly sites tend to be slightly more dolichocranic and high-vaulted than those from north Arvilla sites, while north Blackduck crania, as noted above, are more brachycranic and low-vaulted.

Meanwhile another Woodland population, established in the central region of Minnesota from about 800 B.C. to A.D. 1400, seems to have remained somewhat insulated from these comings and goings of its neighbors. Mille Lacs — in contrast to Laurel, Blackduck, Arvilla, Manitou, Melita, and Devil’s Lake — shows closer genetic affinity to Illinois Hopewell, hinting that Mille Lacs ancestry may have derived in part from the southeast. This tends to support Wilford’s interpretation that the Malmo ceramic style has a stronger Hopewelian flavor than pottery associated with Minnesota’s other Woodland complexes.

In view of Mille Lacs’ apparently closer affinity to Hopewell in terms of MD², the metrical data for this group would be of particular interest. Unfortunately I have seen measurements of only two ML crania (from Round Mound). These are both mesocranic and very low-vaulted. They do not seem to be distinctive among crania from other Minnesota complexes, and they are certainly not like Hopewell. More samples are needed to resolve the problem.

In agreement with cultural inference, Mille Lacs people are not closely related to Arvilla. They do not appear to be closely related to Laurel. They do, however, show a genetic affinity to south Blackduck, which, in view of the apparently diverse ancestral origins of these groups, is interpreted to reflect microevolutionary convergence through gene flow during the A.D. 800 to 1400 time period.

The development about A.D. 800 of wild rice as a food staple is seen as an important event fostering more stable settlements and regular patterns of group contact in the Upper Mississippi Valley. Perhaps my interpretation could be viewed as “artifactual,” reflecting the fact that we happen to have more skeletal samples from the later than from the earlier periods. Nevertheless the skeletal evidence points to movements, contacts, and microevolutionary change during the A.D. 800 to 1400 time period that could be related in some manner to shifting patterns of environmental exploitation and a significant increase in population density.

The foregoing reconstruction is obviously highly speculative. It is offered more for its heuristic value than as a body of firm conclusions. More data and analysis are needed to substantiate and delineate the details.

In tracing the lineage of historic Plains tribes back to Woodland times, I feel more confident of the following three conclusions:

1) South Blackduck is ancestral Dakota. This does not rule out the possibility that other groups not included in this study are also ancestral to the Dakota — the Clam River phase of Wisconsin, for example. The group or groups intermediate in the Dakota lineage between A.D. 1400 (the end of Blackduck times) and A.D. 1700 have yet to be identified.

2) Manitoba phase is proto-Assiniboin. The divergence between the Dakota and Assiniboin lineages had commenced probably by the end of Laurel times about A.D. 800, long before the 17th-century date postulated by ethnologists. Laurel represents the ancestral population base out of which the Dakota and Assiniboin lineages emerged. The Dakota-Assiniboin split may have been brought about by the intrusion of a new group in northern Minnesota represented by north Blackduck.

3) Skeletal analysis positively identifies Arvilla as ancestral Cheyenne.

Each of these paired relationships is reciprocally strong. Each indicates as strong a Woodland-historic affinity as that revealed among several contemporary bands and divisions of the 19th-century Dakota whose close genetic relationship has been documented by other physical anthropological studies. These attributions are supported not only by discrete trait analysis, but also by skull measurements and indexes. From inspection of the figures, Osuksen (BDS) is very similar to Dakota in terms of craniometric data, while north Arvilla data could easily get lost in the table of figures for Cheyenne (Hrdlicka, 1927: 47).

In addition, cranial data hint somewhat more tentatively that the ancestral Blackfoot may have split off from a south Arvilla population at about A.D. 1000 to move onto the Plains — a vanguard of the characteristic northwestward thrust of Arvilla.

Inferences about linguistic identity of Woodland populations on the basis of genetic affinities are highly speculative. Other studies have shown that because of such processes as
migration, assimilation, and cultural diffusion there is often little correlation between glottochronological and biological estimates of distance (Spuhler, 1972; Dolgikh, 1965). Indeed we have a good example of this in the present study: the Assiniboine are linguistically akin to Dakota, yet genetically they appear to be more similar to the Cheyenne, possibly owing to recent microevolutionary convergence.

Regardless of the languages spoken by these Woodland populations, skeletal analysis has confirmed the tradition that the ancestors of the Dakota, Assiniboine, and Cheyenne came from the Upper Mississippi Valley and Plains periphery. Referring to these burial mounds, W. R. Wedel remarked that it would perhaps be expecting too much that these structures could be acceptably identified with a historic tribe or its forebears (1961: 228). From the point of view of an archaeologist or ethnologist, Wedel’s observation may not seem overly pessimistic. Because of the rapid cultural change in the protohistoric and historic periods, it is hardly likely that such attributions could ever be traced on the basis of artifacts. Fortunately, however, gene pools can in some circumstances remain stable, or at least more resistant to change than material culture or even language. Herein lies the unique potential of discrete skeletal analysis for ethnohistorical reconstruction.
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