AFFINITIES OF PREHISTORIC AND MODERN KODIAK ISLANDERS AND THE QUESTION OF KACHEMAK-KONIAG BIOLOGICAL CONTINUITY

G. RICHARD SCOTT

Abstract. Hrdlička opined that the Pre-Koniag (Kachemak) peoples from the lower horizons of the Uyak site on Kodiak Island were not ancestral to the Koniag of the upper level, and he felt that neither group was related to Eskimos. A closer examination of metric and morphologic skeletal and dental traits suggests he erred on both points. While craniometric analyses show the Pre-Koniag and Koniag are markedly different, nonmetric cranial and dental trait frequencies indicate a close relationship between these populations. Craniometric data also suggest the Pre-Koniag were aligned with Yupik Eskimos while the Koniag were largely distinctive, with only weak ties to Aleut and Na-Dene groups. Nonmetric cranial traits indicate the Pre-Koniag and Koniag were related to Yupik groups from southwest Alaska. The distinctive craniometric features of the Koniag may reflect admixture with neighboring non-Eskimo populations, but cranial deformation, present in the Koniag but essentially absent in the Pre-Koniag, may also contribute to the different opinions on the taxonomic placement of the prehistoric Koniag among northern populations. Despite a significant influx of European genes, the modern Alutiiq-speaking population of Kodiak Island is most closely allied genetically with Yupik Eskimos, Aleuts, and Inupiaq Eskimos.

Between 1931 and 1936, Aleš Hrdlička of the Smithsonian Institution directed large-scale excavations on Kodiak Island aimed primarily at recovering a large collection of prehistoric human skeletal remains. Although small samples were obtained from different areas of the island, his major emphasis was on the Uyak site (also referred to as Our Point and Jones Point) located at the junction of Uyak Bay and Larsen Bay. At this site, which covered eight acres and ranged from a few centimeters to over six meters deep, Hrdlička and his coworkers excavated over 8000 m³ of midden. In the process, approximately 500 human skeletons and 4600 artifacts were recovered (Hrdlička 1944a:141; Heizer 1956; Steffan 1991).

As an archaeologist, Hrdlička might best be described as incautious. During the early phases of the excavation, he thought the Uyak site was stratified, but nonconformities led him to abandon efforts to associate skeletons and artifacts with fine-grained stratigraphic units. Ultimately, he classified materials into three stratigraphic layers labeled Blue, Red, and Black (based, seemingly, on the availability of crayolas and pencils to mark specimens). The Blue or deep level basically made up the bottom one meter of the midden; the Red or

G. Richard Scott, Department of Anthropology, University of Alaska, Fairbanks, AK 99775

ARCTIC ANTHROPOLOGY Vol. 29, No. 2, pp. 150–166, 1992
intermediate level was two to four meters thick and comprised the bulk of the older deposits; and the Black or upper level included the top meter of the deposit. Skeletons and artifacts from the Blue and Red levels were labeled Pre-Koniag while materials from the uppermost Black level were referred to as Koniag.

Use of the term Pre-Koniag (now abandoned by archaeologists in favor of Kachemak) seems to carry the connotation of a direct ancestral-descendant relationship between the populations of the lower Blue and Red levels and the Koniag from the Black level. This was not, however, the conclusion Hrdlička (1944a) reached in his volume *The Anthropology of Kodiak Island*. On the basis of cranial measurements and morphology, he felt there was no close or direct relationship between the Pre-Koniag and Koniag populations:

> Our excavations on Kodiak Island and especially those at Our Point in Uyyak Bay, have shown beyond any doubt that the Koniags had been relative newcomers to the island, having occupied it for but a few centuries; and that before them and for a much longer period the island was peopled by a distinct human strain, differing from the Koniags considerably both culturally and physically. . . . The Koniags themselves must have come to the island in large numbers sufficient to annihilate and drive out the oldtimers, for apparently they suddenly took over the old sites everywhere and established themselves on the top of them, without any period of infiltration, transition, or perceptible admixture (Hrdlička 1944a:394).

Clearly, Hrdlička favored replacement rather than local evolution as the explanation for intra-island relationships between the Pre-Koniag and Koniag populations. As for external relationships, he felt neither of these prehistoric Kodiak Island populations was related to Eskimos. In his *Catalog of Human Crania in the United States National Museum* (Hrdlička 1924, 1927, 1931, 1940, 1942, 1944b), he includes both samples (along with Aleuts) in the volume on *Non-Eskimo Peoples of the Northwest Coast, Alaska and Siberia* (1944b) rather than in the catalog entitled *The Eskimo in General* (1942). Hrdlička was confident that the Pre-Koniag and Koniag represented significantly different biological populations with neither showing close affinities to Eskimos. He exuded less confidence in his conclusions on the external relationships of the two Kodiak Island populations.

Geographically, Kodiak Island occupies a central position in the Gulf of Alaska with prehistoric and ethnographers converging that the island was a crossroads, not an isolate (see Clark 1984a, 1984b, 1988; Crowell 1968; Dumond 1979, 1987; Jordan and Knecht 1968; Lantis 1947; Townsend 1979). With the sophisticated watercraft of the North Pacific culture area, the peoples on the island had both friendly and hostile interactions with Aleut, Eskimo, and Indian groups from the Aleutians, Alaska Peninsula, southwest Alaska, Cook Inlet, Kenai Peninsula, Prince William Sound, and southeast Alaska. Because of extensive intergroup contacts, periodic migrations, warfare, and slaving in the North Pacific, the Kodiak Island population had a high potential for the intermingling of disparate elements, both cultural and genetic.

It is no wonder workers have struggled for decades to unravel the human biological history of Kodiak Island. Beyond Hrdlička’s efforts, physical anthropologists have reassessed the Uyyak Bay skeletal collection for a variety of metric and morphologic skeletal and dental traits. Different analytical approaches addressing the same problem of continuity vs. discontinuity on Kodiak Island have yielded both congruent results and conflicting interpretations. My goal is to sort out agreement and disagreement and arrive at a parsimonious explanation for the internal and external relationships of the prehistoric populations of Kodiak Island.

Before reviewing analyses and interpretations of the biological affinities of Kodiak Islanders, I briefly outline the methods and assumptions underlying the use of biological characteristics in reconstructions of population history. Summaries are then presented based on the analyses of three different types of skeletal data (craniometrics, nonmetric cranial traits, dental morphology). Genetic data are used to assess the relationships of the living population of Kodiak Island.

### Biological Distance Analysis

When inferences on population origins and relationships are based on the analysis of biological characteristics, methods and assumptions should be made explicit. For example, as interest is in estimating relative degrees of genetic relatedness, the traits used in a biological distance analysis should be strongly heritable. Metric and nonmetric traits of the skeleton and dentition fulfill this criterion, but, as with all quantitative variables, some environmental component of variance underlies their expression (Falconer 1981; Grünberg 1963; Mizoguchi 1977; Osborne and DeGeorge 1959; Scott and Potter 1984). It is assumed, however, that the genotypic component of trait development is high enough that measurements and trait frequencies reflect primarily the genetic constitution of a population and not its environmental background.

A basic assumption in between-group comparisons is that the closer the phenotypic similarities between two groups, the closer the genetic relationship. Typically, workers derive similarity measures in the form of biological distance statis-
tics computed from pairwise sample comparisons among three or more groups. Although different distance statistics are used for metric and nonmetric traits, the principles underlying the methods are similar (cf. Constandse-Westermann 1972; Weiner and Huizinga 1972). Both commonly yield distance values presented in matrices that are difficult to read, especially when large numbers of samples are compared simultaneously. Cluster analysis, based on distance values, is often performed to portray results in the form of dendrograms.

When graphic methods are used with genetic distance estimates, the proximity of groups on a dendrogram (or coordinate plot) provides a visual clue to relative degrees of similarity. Branching dendrograms have the superficial appearance of phylogenetic trees, but technically, they are hierarchical representations of phenotypic similarity. They may be used to infer phylogeny (i.e., historical relationships) given the following assumptions:

1. Evolution is a branching process characterized by a series of common ancestral populations for finer and finer subdivisions at and below the level of species (e.g., Homo sapiens, Asians, North Asians, Eskimo-Aleuts, Eskimos, Yupik Eskimos).

2. Groups with numerous genetically mediated biological differences are distantly related, while groups showing a preponderance of similarities have a recent common ancestor.

3. When groups fission and geographic isolation is established between two or more daughter populations, founder’s effect and genetic drift are the primary mechanisms underlying genetic differentiation.

4. The rate of gene flow between groups is sufficiently low to discount as a significant contributor to derived patterns of relationship.

5. A sample should include only those individuals from a specific breeding population, since introduced elements from other populations (e.g., war captives, slaves, marriage partners obtained through exchange) could bias the characterization of a group’s biological parameters.

6. The characters used in a distance study are not subject to strong selective forces (i.e., they are basically nonadaptive).

7. A more reliable assessment of similarity and affinity can be achieved when many morphometric characters (especially uncorrelated variables), or alleles, are used in a distance analysis (Livingstone 1991).

8. Measurements and observations are obtained through standardized procedures so intra- and interobserver errors do not seriously bias patterns of relationship.

As different lines of evidence are explored, one additional point should be noted. When comparisons are made among the same set of populations, distance values from one suite of biological variables (e.g., the dentition) should parallel distance values based on variables from another biological system (e.g., blood group alleles). Sokal and Sneath (1963) refer to this as the “hypothesis of nonspecificity.”

Craniometrics

Hrdlička was the first physical anthropologist to systematically measure the Uyak Bay skeletal collection. He provided summary statistics (means and ranges) for cranial and postcranial measurements (Hrdlička 1944a:369–434) and specimen by specimen descriptions that included 15 measurements, eight indices, two angles, and one module for adult males and females and children from the Uyak Blue, Red, and Black levels (Hrdlička 1944b:34–60). His raw data are important as they have been analyzed by subsequent workers with more sophisticated statistical methods than were available in the 1940s (Brennan and Howells n.d.; Utermohle and Merbs 1979).

Hrdlička (1944a) did not compute distance statistics but reached conclusions by comparing the two Kodiak Island samples with other Native American groups in a pairwise fashion. For example, he compared Koniag craniometric means to those for Eskimos (primarily High Arctic samples), Aleuts, and a small sample of southwest Alaskan Indians.

He concluded that the Koniag were quite distinct from Eskimos but showed some similarity to Aleuts. The measurements for the Alaskan Indian sample were close to those of the Koniag, but he was reluctant to conclude they were closely related because of the small size of the Indian sample (four males, four females). He compared Pre-Koniag measurements to those of the Koniag, Eskimos, Algonquians, and a small Athapaskan sample from Shageluk. He found that the Pre-Koniag differed in many ways from the Koniag and Eskimos and argued that their closest metrical similarities were to the American Indian samples. Comparisons were not made between the Pre-Koniag and Aleuts because these groups were thought to exhibit major differences.

Hrdlička (1944a:411) believed the Pre-Koniag and Koniag represented “substantially different anthropological strains.” Both were viewed as only distant relatives of Eskimos. The Koniag showed some ties to Aleuts but important differences were noted. Both the Pre-Koniag and Koniag showed similarities to Alaskan Indian samples, but the Pre-Koniag were thought to be closer to Alaskan Athapaskan and Algonquian Indians.

Hrdlička (1944a) reached conclusions with a strong dose of typological intuition supplemented by a few numbers, especially cranial length, cranial breadth, and the derived cranial index. He says for
the Pre-Koniag that one-fifth of the male skulls and one-third of the female skulls approach the physiognomy of Eskimos. The rest of the Pre-Koniag sample exhibited a cranial form similar to that of American Indians. He expressed uncertainty as to whether the Eskimo component of the Pre-Koniag could be attributed to "ancient admixture" or common ancestry. For the Koniag, Hrdlička provided no fractional breakdown of ethnic constituents although Aleuts, Indians, and Eskimos might have been represented.

To exploit the vast array of data Hrdlička (1924, 1927, 1931, 1940, 1942, 1944b) amassed in his catalogs of human crania, Brennan and Howells (n.d.) employed factor analysis to assess relationships among 22 American Indian, 19 Eskimo-Aleut, and five Asian skeletal samples, along with the Koniag and Pre-Koniag. Using nine cranio metric variables, they focused on the general pattern of relationships among Native American and Asian populations. As a by-product of this effort, they put Koniag and Pre-Koniag cranial variation into a broader context than Hrdlička's (1944a) circumscribed comparisons.

In their analysis, Brennan and Howells (n.d.) found that five factors accounted for the majority of variance among the Native American and Asian samples. In a dendrogram based on these five factor scores, the fundamental dichotomy was not between Native Americans and Asians but between American Indians and Eskimos. Five Asian samples clustered with American Indians while the Chukchi and Siberian Eskimos were grouped with North American Eskimos. Pre-Aleuts and Aleuts clustered with Indians rather than Eskimos, contrary to what one might expect on linguistic grounds. As for the Koniag, they were on a branch within the larger American Indian cluster that included Na-Dene and Aleut samples. The general Eskimo branch included a fundamental split between Yupik and Inupiaq Eskimo samples. The PreKoniag sample clustered broadly with Eskimos and more specifically with five Yupik Eskimo samples, Yukon Indians (Athapaskans), and the Chukchi.

A second reanalysis of Hrdlička's cranio metric data was performed by Utermohle and Merbs (1979). Unlike Brennan and Howells, these authors did not include American Indian samples as they were primarily interested in relationships among Eskimos, Aleuts, and the Chukchi. Their multivariate distance analysis included both Pre-Koniag samples (Red and Blue) and the Koniag along with 17 Eskimo, three Aleut, and two Chukchi samples. The dendrogram for this sample array illustrated a fundamental split between recent Aleuts and Koniags on the one hand and all other Eskimo groups (plus pre-Aleuts and the Chukchi) on the other. More specifically, the Red and Blue Pre-Koniag samples clustered closely together, indicating a high degree of similarity, and both were aligned with samples broadly defined as Siberian and Early Alaska (Utermohle and Merbs 1979). The relationship found between the Koniag and recent Aleuts was not close, but they were more similar to one another than to any other group in the sample array.

Although he focused on intergroup relationships among high Arctic Eskimo populations, Utermohle (1984) included Pre-Koniag (Blue only) and Koniag samples in a study of cranio metric variation among 21 Eskimo and two Aleut skeletal series. Utermohle (1984) used the 70 cranio metric variables listed by Howells (1973), but because of high intertrait correlations, distance values and associated dendrograms were based on reduced trait sets.

Utermohle's (1984) dendrograms for males and females showed subtle distinctions, but results were basically consistent for the two sexes and different measurement suites. The fundamental dichotomy in Utermohle's dendrograms was between Eskimos in general and Aleut-Koniag. The Koniag were not especially close to the Aleut but in this sample array dominated by Eskimos, they clustered together. The Eskimo cluster also showed a basic dichotomy between Inupiaq (Alaskan, Canadian, and Greenlandic) and Yupik samples (Siberian and St. Lawrence Islanders). The Pre-Koniag sample (Uyak Blue) clustered with the Yupik Eskimo samples. In one analysis, based on 24 cranio metric variables, Utermohle (1964, 1988) derived a dendrogram where the major dichotomy was between Inupiaq Eskimos and Yupik-Aleut samples. For the latter cluster, Koniag branched off first indicating they were the most highly differentiated of the 12 Yupik-Aleut samples. The next samples to branch off were Aleut and Paleo-Aleut. Pre-Koniag branched off prior to the finer subdivisions among the Yupik samples.

Utermohle's (1984, 1988) work shows that, in the context of Eskimo-Aleut cranio metric variation, the Koniag are very distinctive. They showed no close similarity to any Eskimo sample, although some deep ties to Aleut populations were indicated. As for the Pre-Koniag, they consistently showed their greatest metrical similarity to Yupik samples from Siberia, St. Lawrence Island, and Nunivak Island.

To determine if the cranio metric variation shown by Eskimos and Aleuts correspond to linguistic groupings, Zegura (1975, 1978) obtained measurements from 12 protohistoric and historic Native Alaskan, Canadian, and Greenlandic skeletal samples (six Inupiaq, five Yupik, one Aleut). His problem dictated the inclusion of only the Koniag sample, so the question of relationships between the Pre-Koniag and Koniag was not addressed.
Using generalized distance (D^2) values and unweighted pair-group cluster analysis, Zegura (1978:28) derived dendrograms which, for the most part, illustrated correspondence between Eskimo linguistic divisions and craniometric variation. For example, in his dendrogram for males, three Central Yupik groups clustered together on one branch while five Inupiaq groups (plus Siberian Yupik) clustered on two allied branches. The remaining three samples (Koniag, Aleut, Chirikof Island) failed to cluster closely with any other sample. In sum, Zegura (1978) found that the Koniag were highly differentiated when compared to Inupiaq and Yupik Eskimo samples. For this sample array, the Koniag were most similar to Aleuts with secondary ties to Chirikof Islanders.

Heathcote's (1986) analysis of Eskimo-Aleut cranio metric variation paralleled that of Zegura in that attention was limited to relatively recent populations. Thus, he measured the Koniag sample but not the Pre-Koniag. Using a large battery of directly measured traits (80) and derived indices and angles, Heathcote compared the Koniag to three Inupiaq (MacKenzie Delta, Point Barrow, Point Hope), two Yupik (St. Lawrence Island, Lower Kuskokwim River), one Aleut (Kagamil), and two North American Indian samples (northern Athapaskans, Iroquois).

Although Heathcote (1986) did not use dendrograms to illustrate relationships, he provided generalized distance values (D^2) between the Koniag and eight other Native American samples. In the only analysis that included Athapaskans and Iroquoians, these distance values indicated that four of the samples were about equally similar to the Koniag: St. Lawrence Island, Lower Kuskokwim, Athapaskan, and Aleut. The Koniag were least similar to MacKenzie Eskimos and Iroquoians with the Point Barrow and Point Hope samples falling between the two extremes. In a series of experimental analyses using different trait batteries and limited to comparisons among Eskimo and Aleut samples, a common pattern emerged: the Koniag were most similar to the two Yupik samples and the Aleut, with consistently higher distances to the three Inupiaq samples. In Heathcote's distance matrices, it is noteworthy that his smallest distance values were between Inupiaq-Inupiaq, Yupik-Yupik, and Yupik-Athapaskan samples where D^2 ranged between 20 and 30. Koniag distance values were in the 40 to 50 range when compared to Yupik, Aleut, and Athapaskan samples, and over 70 when compared to Inupiaq groups. Although the Koniag were more similar to some groups than to others, they were still distinctive in showing relatively large generalized distances in all pairwise comparisons.

Nonmetric Cranial Traits

Zegura (1975) examined 15 nonmetric traits in 12 Eskimo-Aleut samples as an adjunct to his craniometric comparisons. He found relatively little congruence between the patterns of relationship indicated by these two types of variables. While craniometric variation paralleled the linguistic divisions of northern populations, the dendrogram based on nonmetric trait frequencies showed minimal correspondence. The Koniag sample, for example, did not cluster closely with Yupik, Inupiaq, or Aleut samples although mean distance values indicated slightly closer similarity to Aleuts.

The work of Ossenberg (1976, 1977, 1989) on nonmetric cranial trait variation has more bearing on the question of Kodiak Island relationships because she observed 25 variables in both Pre-Koniag samples and the Koniag. These data were then used to compute Mean Measures of Divergence (MMDs) in comparisons with multiple Aleut, Yupik, Inupiaq, Na-Dene, American Indian, and Asian samples.

When nonmetric cranial trait data for the Kodiak Island samples were compared to those for just Eskimos and Aleuts, Ossenberg (1989) found a basic dichotomy between Yupik Eskimos on the one hand and Inupiaq Eskimos and Aleuts on the other. In her dendrogram, Pre-Koniag and Koniag samples were grouped closely together at a terminal branch of the Yupik cluster. When Na-Dene (Tlingit, Apache, Navajo, Haida?) and American Indian (Algonquian, Siouan) samples were included in an expanded analysis, the Pre-Koniag and Koniag samples still clustered together with their closest ties to Yupik-speaking groups of southwest Alaska. The greatest external similarity of the tightly linked Aleut samples was to Na-Dene (Ossenberg 1989).

Despite close internal linkages of the Early, Middle, and Late Kodiak Island samples, Ossenberg (1989) noted the distance values of the three samples showed temporal differences when compared to major northern populations. Compared to Aleuts and northern Athapaskans, early Kodiak showed lower MMDs than middle and late Kodiak. By contrast, MMDs decreased from early through middle to late Kodiak when compared to Yupik and Inupiaq Eskimos. That is, distances based on nonmetric cranial traits indicate prehistoric Kodiak Islanders became less similar to Aleuts and Athapaskans and more similar to Yupik and Inupiaq Eskimos over the course of time.

In a reanalysis of Ossenberg's data (25 traits and nine samples) using a different analytical approach (Harpending and Jenkins 1973), her conclusions received general support. In Table 1, distance values are shown in a symmetrical matrix among the nine groups, including the three Kodiak
Table 1. Symmetrical Relationship Matrix Based on Analysis of 25 Nonmetric Cranial Traits
(Distance Values × 1000)*

<table>
<thead>
<tr>
<th></th>
<th>Kodiak (early)</th>
<th>Kodiak (middle)</th>
<th>Kodiak (late)</th>
<th>Paleo-Aleut</th>
<th>Neo-Aleut</th>
<th>Eskimo</th>
<th>Chukchi</th>
<th>Na-Dene</th>
<th>Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kodiak (early)</td>
<td>23</td>
<td>11</td>
<td>10</td>
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<td>-5</td>
<td>-4</td>
<td>-5</td>
<td>-7</td>
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<tr>
<td>Kodiak (middle)</td>
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<td>13</td>
<td>-12</td>
<td>-13</td>
<td>4</td>
<td>2</td>
<td>-5</td>
<td>-20</td>
</tr>
<tr>
<td>Kodiak (late)</td>
<td>10</td>
<td>13</td>
<td>19</td>
<td>-12</td>
<td>-13</td>
<td>7</td>
<td>7</td>
<td>-6</td>
<td>-22</td>
</tr>
<tr>
<td>Paleo-Aleut</td>
<td>-2</td>
<td>-12</td>
<td>-12</td>
<td>24</td>
<td>9</td>
<td>19</td>
<td>-7</td>
<td>-6</td>
<td>4</td>
</tr>
<tr>
<td>Neo-Aleut</td>
<td>-5</td>
<td>-13</td>
<td>-13</td>
<td>9</td>
<td>19</td>
<td>7</td>
<td>-6</td>
<td>-4</td>
<td>14</td>
</tr>
<tr>
<td>Eskimo</td>
<td>-4</td>
<td>4</td>
<td>7</td>
<td>-10</td>
<td>-7</td>
<td>15</td>
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<td>7</td>
<td>-11</td>
<td>6</td>
<td>14</td>
<td>25</td>
<td>-5</td>
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</tr>
<tr>
<td>Na-Dene</td>
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<td>-5</td>
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<td>4</td>
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<tr>
<td>Woodland</td>
<td>-21</td>
<td>-20</td>
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<td>14</td>
<td>14</td>
<td>15</td>
<td>-21</td>
<td>10</td>
<td>62</td>
</tr>
</tbody>
</table>

*Computed from data provided by N. S. Ossenberg.

Island samples. In this matrix, the largest positive values indicate closest similarity while the largest negative values indicate greatest dissimilarity. Four major points emerged from this analysis: (1) the three Kodiak samples are more similar to one another than to any other sample; (2) although no Kodiak sample is particularly close to the Aleut, early Kodiak is more similar to both Paleo-Aleuts and Neo-Aleuts than middle and late Kodiak, which are about equally distant from the Aleut; (3) similarity to Eskimos and the Chukchi increases on Kodiak Island from early to middle to late; and (4) the Na-Dene and Woodland distance values show no temporal trend and remain about equal from early to late Kodiak. The first three points reaffirm Ossenberg’s conclusions that the three Kodiak Island samples were related closely to one another even though the early Kodiak sample was closer to Aleuts while the later Kodiak samples were closer to Eskimos. The only point of disagreement is the absence of a temporal trend between the three Kodiak samples and Athapaskans, but Ossenberg’s MMD values for Athapaskan-Kodiak differ only slightly from early (28.7) to middle (31.6) to late (38.9).

Another major study of nonmetric cranial variation in northwest North America was conducted by Finnegan (1972, 1974), but he did not examine the Uyak site collections. His emphasis was on Northwest Coast Indians although he included observations on some Eskimo and Aleut samples. An attempt was made to compare his data to those of Ossenberg, but only eight traits were observed in common in the two studies. With this limitation in mind, a comparison of Ossenberg’s (1988a) data on the three Kodiak Island samples to those of Finnegan (1974) for three Indian (coastal and interior Salish, Haida) and three Eskimo (Yukon River, coastal, St. Lawrence Island) samples showed that both the Pre-Koniag and Koniag samples were consistently closer to Eskimos than to Northwest Coast Indians. Although no group exhibited the close internal relationships of the three Kodiak samples, the closest external ties of the Pre-Koniag and Koniag were with Yukon Eskimos.

Dental Morphology

The most intensive and extensive analyses of Native American crown and root trait variation have been performed by Turner (1971, 1983, 1984, 1985, 1986, 1988a, 1988b). His primary goal was to assess differences and similarities in dental trait frequencies among Eskimo-Aleuts and North and South American Indians to ascertain the number and timing of migrations into the New World. After examining thousands of individuals in dozens of samples representing all major geographic areas of the Americas, Turner (1983, 1986) concluded that dental data supported a model of three major migrations to the New World. In addition to discerning the biological dichotomy between American Indians and Eskimo-Aleuts, he found that groups allied to the Na-Dene language family (i.e., Greater Northwest Coast) constituted a major and separate subgroup of American Indians. His New World trichotomy, including Eskimo-Aleuts, Na-Dene, and Macro-Indians, has received support from linguistic and genetic evidence (Greenberg et al. 1986).

Within the broader context of Native American dental variation, Turner (1988a) observed the Pre-Koniag and Koniag skeletal samples. When he analyzed the three Kodiak samples individually, he found that they clustered on a finely divided branch that included six Northwest Coast Indian, one Alaskan Athapaskan, and two Inupiaq Eskimo samples. Regarding internal Kodiak Island relationships, Turner concluded there were no fundamental differences between the Uyak Blue, Red, and Black series. For that reason, in most analyses, he combined the Pre-Koniag and Koniag sample...
Table 2.  Symmetrical Relationship Matrix Based on Analysis of 12 Nonmetric Crown and Root Traits (Distance Values \times 1000)*

<table>
<thead>
<tr>
<th></th>
<th>Uyak Blue</th>
<th>Uyak Red</th>
<th>Uyak Black</th>
<th>St. Lawrence</th>
<th>Eskimo</th>
<th>Aleut</th>
<th>North. Cent.</th>
<th>Gulf of Georgia</th>
<th>Archaic Canada</th>
<th>Alabama</th>
<th>Mexico</th>
<th>Peru</th>
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<tr>
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<td>53</td>
<td>48</td>
<td>18</td>
<td>-3</td>
<td>24</td>
<td>5</td>
<td>-18</td>
<td>-22</td>
<td>-28</td>
<td>-19</td>
<td>-49</td>
</tr>
<tr>
<td>Uyak Black</td>
<td>48</td>
<td>59</td>
<td>89</td>
<td>17</td>
<td>17</td>
<td>-6</td>
<td>-6</td>
<td>-8</td>
<td>-6</td>
<td>-15</td>
<td>-19</td>
<td>-33</td>
</tr>
<tr>
<td>St. Lawrence</td>
<td>18</td>
<td>45</td>
<td>17</td>
<td>86</td>
<td>38</td>
<td>23</td>
<td>-18</td>
<td>-27</td>
<td>-27</td>
<td>-30</td>
<td>7</td>
<td>-28</td>
</tr>
<tr>
<td>Eskimo</td>
<td>-3</td>
<td>32</td>
<td>-8</td>
<td>30</td>
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<td>0</td>
<td>22</td>
<td>2</td>
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</tbody>
</table>

*Data sources: Scott 1990 (Uyak samples); Scott and Gillispie n.d. (St. Lawrence Island); Turner 1985 (all other samples).

data into one Kodiak Island sample (cf. Turner 1983, 1988b). This pooled Kodiak Island sample showed the lowest MMJ values when compared to Northwest Coast Indians while much larger distance values were derived for Kodiak-Eskimo and Kodiak-Aleut comparisons (Turner 1983). On this basis, Turner (1986a) concluded the inhabitants of the Uyak site may have been Na-Dene-speaking Indians rather than Eskimos.

As Turner did not examine the Uyak series in its entirety, I made additional observations on the crown and root morphology of every Pre-Koniag and Koniag specimen in this collection (Scott 1990). More precisely, 21 crown and root traits (on 27 teeth) were scored for presence and degree of expression. In a chi-square analysis of the three Kodiak samples, only two of 27 traits showed a significant difference in frequency between the Uyak Blue, Red, and Black series. Moreover, even traits which did not differ significantly among the three samples showed no pattern of frequency variation that suggested the Uyak Blue and Red samples were more similar to one another than to Uyak Black. This supports the finding of Turner of no noteworthy dental morphological dichotomy between the Pre-Koniag and Koniag inhabitants of the Uyak site.

Using the same biological distance method (i.e., Harpending and Jenkins 1973) applied previously to nonmetric cranial trait variation, distance values were computed between the three Uyak samples and 11 other Native American groups based on 12 crown and root traits (Table 2). All sample data except those for St. Lawrence Island Eskimos (Scott and Gillispie n.d.) were taken from Turner (1984, 1985, 1986). From these distance values, it is evident that: (1) the three Uyak samples are more similar to one another than to any other sample; (2) the distance values between the Blue, Red, and Black samples (48, 53, 59) are so close that no single sample (e.g., Black) can be considered an outlier; (3) the Uyak samples, as a group, show their greatest similarity to St. Lawrence Island Eskimos, Aleuts, and a composite Eskimo sample (dominated by Inupiaq groups); (4) paralleling Ossenberg’s (1989) study of nonmetric cranial traits, the Pre-Koniag samples are more similar to Aleuts than are the Koniag; (5) contrary to the analysis of nonmetric cranial traits, dental traits do not show that Uyak Black is closer to Eskimos than the Pre-Koniag samples; (6) 23 of 24 distance values between the Uyak samples and American Indians are negative which suggests no close ties between Indian populations and prehistoric Kodiak Islanders; and (7) of the Indian samples, only northern Maritime appears weakly related to the Kodiak Island samples while Athapascons show consistently high negative values with the three Uyak samples.

A principal components analysis of the distance matrix shown in Table 2 yields eigenvectors which can be plotted on a two-dimensional coordinate system (Fig. 1). This plot shows a fundamental dichotomy on the X-axis (E1) between Eskimo-Aleuts, including Uyak (high positive), and American Indians (negative). The Y-axis (E2) separates Na-Dene (Athapaskan and Northwest Coast Indians) from Macro-Indians and the Uyak samples from Eskimos and Aleuts. Thus, dental traits show that the Uyak samples, while similar to one another
Genetic Variation

Genetic data for modern human populations are not directly pertinent to the question of continuity between the Pre-Koniag and Koniag. However, an analysis of gene frequencies is useful for addressing the external relationships of the living inhabitants of Kodiak Island.

Chown and Lewis (1962) were the first workers to assess Koniag genetic variation when they sampled three “isolates” on the Alaska Peninsula for 22 blood group alleles at seven loci. Although pronounced genetic diversity was evident among these isolates, which they attributed to European admixture and genetic drift, they made no comparisons to other Native American populations.

However, Szathmary (1979a) used their data in a genetic distance study which compared the Koniag with eight Inupiaq, four Na-Dene, and five Algonquian samples. In her dendrogram based on Nei’s standard distance values, the Inupiaq samples clustered together as did the Na-Dene samples. The Koniag clustered with Algonquians, but she dismissed this result as anomalous.

The most extensive genetic survey of Kodiak Island was conducted by Majumder et al. (1980) who analyzed 31 genetic loci (red cell antigens, serum proteins, enzymes) in four modern Koniag (Old Harbor, Ouzinkie, Larsen Bay, Akhiok) and two Aleut (St. Paul, St. George) communities. Although these authors attempted to exclude individuals of mixed or uncertain ancestry, the presence of European alleles in relatively high frequencies (see also Denniston 1960) indicates they were not altogether successful in this endeavor.

While Majumder et al. (1988) performed a genetic distance analysis, it was limited to the six Kodiak Island and Aleut samples in their survey so these results are not directly pertinent to the question of broader Kodiak Island genetic relationships. Their data are, however, useful for making comparisons to other Native American and Asian populations.

Following the distance method of Harpending and Jenkins (1973), allele frequencies for the combined Kodiak Island samples were compared to those of Aleuts, Eskimos, North Asians, and North and South American Indians. Genetic data were obtained primarily from the compendia of Mourant et al. (1976) and Rouchoudhury and Nei (1988), supplemented by the more specific reports of Ferrell et al. (1981), Scott and Wright (1978, 1983), Scott et al. (1966), and Szathmary (1979b, 1983; Szathmary et al. 1974, 1975, 1983). As not all pertinent groups were genetically surveyed for the same suite of polymorphic loci, genetic distance analyses maximized either the number of groups or number of loci. Alleles of primarily European origin (e.g., r and A<sup>2</sup>) were excluded from the analyses.

Analysis I

For this analysis, 15 groups were assessed for genetic distance on the basis of 10 alleles at five loci (A<sub>1</sub>, B, MS, Ms, NS, R<sub>1</sub>, R<sub>2</sub>, R<sub>0</sub>, k, Hp). In terms of distance values (X<sup>10</sup>), Kodiak Island is most similar to the Chukchi (44), Greenlandic Inupiaqs (21), Alaskan Inupiaqs (20), Aleuts (19), and Central Yupiks (17). Their greatest divergence is from Northwest Coast Indians (~66), Alaskan Athapaskans (~35), Tlingits (~34), and Canadian Athapaskans (~31).

In Figure 2A, the 15 samples are plotted on the first two eigenvectors. The first eigenvector (E1), which accounts for 51.4% of the total variance, shows a dichotomy between Indians (Na-
Dene, Algonquian) and the nine Eskimo, Aleut, Chukchi, and Kodiak Island samples. When the second eigenvector (E2; 15.4% of variance) is taken into account, the Kodiak Island sample falls in the middle of the general Eskimo-Aleut cluster about equidistant from Aleuts, Central Yupiks, St. Lawrence Islanders, the Chukchi, and Alaskan Inupiaq. Genetically, Kodiak Island is far removed from Na-Dene, Northcoast, and Algonquian Indian samples.

**Analysis II**

While the first analysis maximized the number of samples, this analysis increased the number of alleles to 19 (adding P1, Fy*, Di*, ESD1, PGM1*, AK1, ACP8, CPT1, and Ce3 to the initial 10 alleles). To accomplish this, it was necessary to combine gene frequency data for broader population groupings (e.g., Yupik Eskimo, Inupiaq Eskimo, Na-

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**Figure 2.** Plot of first two eigenvectors based on distance analysis of (A) ten alleles at five loci and (B) 19 alleles at 14 loci.

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**Summary and Synthesis of Kodiak Island Biological Relationships**

Clearly, disagreements exist among physical anthropologists as to the closest external relationships of the prehistoric inhabitants of Kodiak Island (Table 3). Of eight authors, only Hrdlička and Turner have posited the Pre-Koniag were biologically Indians rather than Eskimo-Aleuts. Hrdlička suspected Algonquian or Athapaskan affinities, while Turner (1900a:28) felt that Tanaina-speaking Athapaskans might have inhabited Kodiak Island in prehistoric times. When Collins (1945:359) compared the Pre-Koniag to regional Eskimo samples, rather than Eskimos in general, he found they were more similar to southwest Alaskan Yupik Eskimos than to Algonquians. Ossenberg, Utermohle, and Brennan and Howells also point to ties between the Pre-Koniag and Yupik Eskimos. I ally the Pre-Koniag with Eskimos and Aleuts rather than Indians, but a more specific assignment is not possible at this time.
Table 3. Views of Different Anthropologists on the Biological Affinities of the Pre-Koniag, Koniag, and Modern Populations of Kodiak Island

<table>
<thead>
<tr>
<th>Author</th>
<th>Pre-Koniag</th>
<th>Koniag</th>
<th>Living Koniag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hrdlička (1944a)</td>
<td>Indian (Algonquian/Athapaskan)</td>
<td>Aleut?/Indian? (Athapaskan)</td>
<td>Indian (Na-Dene?) Eskimo (Yupik?)</td>
</tr>
<tr>
<td>Brennan &amp; Howells (n.d.)</td>
<td>Yupik Eskimo</td>
<td>Aleut/Indian (Na-Dene)</td>
<td>—</td>
</tr>
<tr>
<td>Utermohle (1984, 1988)</td>
<td>Yupik Eskimo</td>
<td>—</td>
<td>Aleut?</td>
</tr>
<tr>
<td>Zegura (1975, 1978)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Heathcote (1986)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ossenberg (1989)</td>
<td>Yupik Eskimo</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Turner (1986a)</td>
<td>Indian (Na-Dene/Northwest Coast)</td>
<td>Indian (Na-Dene/Northwest Coast)</td>
<td>—</td>
</tr>
<tr>
<td>Scott (1990)</td>
<td>Eskimo/Aleut</td>
<td>Eskimo/Aleut</td>
<td>Eskimo/Aleut*</td>
</tr>
</tbody>
</table>

*Based on genetic data.

For the Koniag, Hrdlička, Utermohle, Zegura, Heathcote, and Brennan and Howells all found evidence for a relationship to Aleuts although none argued this linkage was particularly close. Hrdlička and Brennan and Howells also suggested Koniag ties to Indians, specifically Athapaskans and/or Tlingits (i.e., Na-Dene speakers). Moreover, Heathcote derived distance values between the Koniag and Athapaskans that were about equal to those between Koniag-Aleut and Koniag-Yupik Eskimo. By contrast, Turner found no close ties between the Koniag and Aleuts and proposed the Koniag were biologically Indian rather than Eskimo-Aleut. Of the eight workers, only Ossenberg argues for a close relationship between the Koniag and Yupik Eskimos. In my dental analysis, the Koniag were most closely allied with Eskimos and Aleuts.

Seven of the eight workers noted above dealt only with human skeletal material so they did not address the biological affinities of the living inhabitants of Kodiak Island. Hrdlička (1944a), however, had an opinion on this matter based on the measurements and morphology of living Kodiak Islanders. Regarding those individuals considered “full-bloods,” he noted their: physiognomy (is) nearer that of some of the more Indian-like southern and southwestern Eskimo, or the southeastern Alaskans with the prevalent British Columbia Indian, than that of the real Eskimo. In general by their physiognomy one could not class these people as Eskimo, nor again as typical Indian, but they are nearer to the latter, particularly to the southern Alaskans (Hrdlička 1944a:354).

Linguistically, the modern population of Kodiak Island speaks Alutiiq, or Sugpiaq, one of the five major subgroups of Yupik Eskimo (Wodbury 1984). Genetically, living Kodiak Islanders are most closely allied to Eskimos and Aleuts although available data do not indicate they are closer to either one or the other. Moreover, genetic distance analyses suggest no significant Indian (Na-Dene, Northwest Coast) contribution to the modern gene pool of Kodiak Island. Majumder et al. (1988) did not assay rare albumin variants such as albumin Naskapi which reaches a polymorphic frequency (> 1%) in Athapaskan and Algonquian populations (Lampl and Blumberg 1979), but is absent in Eskimos. The presence of this allele in living Kodiak Islanders would suggest an Indian substrate on the island or, minimally, gene flow from Athapaskans on the mainland.

Another way to highlight the disparate conclusions of physical anthropologists on the biological history of Kodiak Island is to focus on results indicated by different types of data. Table 4 shows general conclusions for Pre-Koniag/Koniag continuity and the closest external relationships of the Pre-Koniag, Koniag, and living Kodiak Islanders as indicated by cranio metric, nonmetric cranial, dental, postcranial, and genetic data. Regarding Pre-Koniag/Koniag continuity, cranio metric data consistently indicate a significant difference between these two groups, supporting arguments against biological continuity. In contrast, analyses of nonmetric cranial and dental morphologic traits suggest no difference between the Pre-Koniag and Koniag, supporting arguments for continuity. Another line of evidence which supports continuity comes from Hrdlička’s measurements of postcranial remains. Although no worker has performed a distance analysis based on the postcranial, measurement data on Pre-Koniag and Koniag long bones are remarkably similar, so much so that Hrdlička (1944a:425) remarked:

The relations of the Pre-Koniag and Koniag arm bones, while a trace less marked than those of the
The Aleut, and American Eskimos, however, do not belong to the Na-Dene (1986; Heathcote 1975, 1988a; Zegura 1988a; Scott 1990).

For external relationships, there is almost a consensus on the affinities of the Pre-Koniag. Analyses of craniometric and nonmetric cranial data suggest they were most closely allied with Yupik Eskimos. Although Turner (1988a) felt the Pre-Koniag were probably Indians, he recognized his sample array was deficient in Yupik Eskimo groups. In a reanalysis of Turner’s data, which included my observations on the Uyak samples, the Pre-Koniag were more similar to Eskimos and Aleuts than to Indians so dental data ultimately may show correspondence with other lines of evidence. The Koniag are more problematic. Cranometric analysis revealed ties between this sample and Aleuts and Na-Dene groups, while nonmetric cranial traits pointed to Yupik Eskimo affinities. Dental data indicated either Indian (Northwest Coast, Na-Dene) or Eskimo and Aleut affiliations (Turner 1988a; Scott 1990).

Reaching a definitive conclusion on the biological affinities of the Koniag remains a problem. The absence of particular groups in certain analyses is one limiting factor. It should be emphasized, however, that no worker, with the exception of Hrdlička (1944a), selected their samples with Kodiak Island as the central focus. For example, Utteromhle’s (1984, 1988) extensive cranometric analysis of northern populations was deficient in American Indian samples. The same was true for the studies of Zegura (1975, 1978) and Heathcote (1986; although one analysis included Athapaskans and Iroquoians), and these workers did not measure the Pre-Koniag. Only Brennan and Howe (n.d.) included a wide array of American Indian, Eskimo-Aleut, and Asian populations in their study, but they were limited in their reliance on Hrdlička’s relatively small suite of cranometric variables. For dental studies, Turner observed a large number of American Indian and Eskimo-Aleut samples, but southwestern Alaskan Yupik groups, a key element in this inquiry, were not represented in his analyses (Yupik dental data were limited to St. Lawrence Island and Siberian Yupik samples). Ossenberg’s sample array with its large number of Eskimo and Aleut groups is perhaps the best for resolving questions of Pre-Koniag and Koniag biological affinity. It could be improved only through the addition of a few more Inupiaq Eskimo and Northwest Coast Indian samples.

Genetic data show the living Koniag population is most closely related to Aleuts, Yupik Eskimos, and Inupiaq Eskimos. Unfortunately, no set of biological data bridges the gap between past and present Kodiak Island populations. Crown and root traits, observable in skeletons and living individuals, are potentially the most useful for linking prehistoric and modern populations, but sorting out the effects of recent admixture on polygenic characters poses methodological problems. Six to eight centuries of separation, involving untold events of migration, mate exchange, and population decimation, preclude a definitive answer on the ancestral-descendant relationship of prehistoric (Uyak Black) and modern Koniags.

**Discussion**

My goal was to arrive at a parsimonious explanation for Pre-Koniag/Koniag relationships, and determine which neighboring groups were most closely related to prehistoric Kodiak Islanders. First, most workers have concluded the Pre-Koniag are similar to Eskimos but not Hrdlička’s (1942) “Eskimos in general.” The Pre-Koniag differ consistently from the long and narrow-headed, high-vaulted Inupiaq Eskimo populations of the High

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**Table 4.** Synthesis of Conclusions from Different Types of Data on the Question of Pre-Koniag/Koniag Continuity and the Closest External Relationships of the Pre-Koniag, Koniag, and Living Kodiak Islanders

<table>
<thead>
<tr>
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<th>Pre-Koniag</th>
<th>Koniag</th>
<th>Living Koniag</th>
</tr>
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<td>Aleut?/Na-Dene?</td>
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<tr>
<td>Nonmetric cranial traits</td>
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</tr>
<tr>
<td>Dental morphology</td>
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<td>Indian (NW Coast/Na-Dene) or Eskimo/Aleut</td>
<td>Indian (NW Coast/Na-Dene) or Eskimo/Aleut</td>
<td>—</td>
</tr>
<tr>
<td>Post-craniual measurements</td>
<td>YES</td>
<td>—</td>
<td>—</td>
<td>Eskimo/Aleut Chukchi?</td>
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<tr>
<td>Gene frequencies</td>
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<td>—</td>
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</table>
Arctic of Alaska, Canada, and Greenland, but they do not differ significantly from Yupik Eskimo populations of Siberia, St. Lawrence Island, and, in particular, southwest Alaska. While they show some similarity to Athapaskans, their overriding relationship is with Yupik Eskimos. Had Hrdlička (1944a) examined his own measurement data on Eskimos by region, as Collins (1945) did, he likely would have arrived at the same conclusion.

While most evidence indicates the Pre-Koniag were an early variant of Yupik Eskimo, deriving Koniag relationships is problematic. Workers who have assessed nonmetric cranial and dental traits concur there is no significant or patterned difference between the Pre-Koniag and Koniag, suggesting biological continuity on Kodiak Island from Kachemak to Koniag times. Cranio metric analyses, by contrast, run counter to this conclusion.

Why is there no agreement on the question of Kachemak/Koniag continuity between craniometry and other types of skeletal and dental data? While no one questions the discriminatory power of cranio metric data in taxonomic studies, there are two factors which, in this instance, may complicate cranio metric assessments through time and space.

First, the process of brachycephalization, observed in many parts of the world over the past 2000 years (Weidenreich 1945), is also evident among Arctic populations. This trend to increasing round-headedness is apparent in comparisons between Birnik and their Inupiaq descendants and between Paleo-Aleuts and Neo-Aleuts (Uttermore 1984). It may be no coincidence that one outstanding contrast between the Pre-Koniag and Koniag is in the hyperbrachycrania shown by the latter population. However, since the mechanisms underlying brachycephalization remain obscure and controversial, it is difficult to factor this process into the Pre-Koniag/Koniag cranio metric dichotomy even though it may have played some yet undefined role.

Second, workers who have measured the Koniag series all mention that many specimens show signs of vertico-occipital or lambdoidal cranial deformation (Hrdlička 1944a, 1944b; Zegura 1978; Uttermore 1984; Heathcote 1986). Uttermore (1984:124) noted that in the Uyak Black series “slight to moderate occipital flattening characterizes the majority of the sample.” Opinions vary on how this environmentally induced alteration of cranial form might have influenced cranio metric measurements and associated distance values. When Zegura (1978:30) found Chirikof Island and Kodiak Island failed to cluster with other Yupik samples, he felt “the slight cranial deformation noted in these two groups (although absent in the rest) may have been the reason for their peripheral placement.” Uttermore (1984:309), by contrast, preferred another interpretation for the distinctive placement of the Koniag when he concluded that “Although no attempt was made to determine the impact of cranial deformation among the Koniag sample of Uyak Black, there exists a strong potential for external influences in the development of the current morphological pattern on Kodiak Island.”

While estimates for the frequency of Koniag cranial deformation vary widely (Hrdlička 1944b: 14.9%; Scott 1990: 46.3%; Heathcote 1986: 93.3%), this marks a pronounced difference from the Pre-Koniag who exhibit a low frequency of deformation (Hrdlička 1944b: 3.1%; Scott 1990: 1.3%). Pinart (1873) even claimed that the Koniag intentionally flattened their skulls “by compressing strongly the rear of the head to induce it to become as wide as it is long.” In some crania, this effect was almost achieved with cranial indexes in the high 80s and low 90s (if breadth equaled length, this index would be 100).

Heathcote (1986) assessed the impact of deformation on Koniag cranial measurements, but he was hampered by having only two undeformed crania which could be compared to 23 deformed specimens. He found deformed crania were shorter (5.2 mm) and broader (4.2 mm) than undeformed crania, but his small samples precluded any definitive conclusion regarding the overall impact of deformation. Interestingly, in all but one of Heathcote’s (1986:171) generalized distance analyses, the Inupiaq samples from Pt. Barrow and Pt. Hope were more similar to the Yupik samples from St. Lawrence Island and Lower Kuskokwim than these Yupik samples were to the Koniag. In the one analysis where he eliminated cranio metric variables that could have introduced “environmental noise” (including deformation), Koniag-Yupik distance values were disproportionately reduced relative to Inupiaq-Yupik distances. However, even this attempt to remove environmental factors still left the Koniag as distinctive with ties as close to Aleuts as to Yupik Eskimos. While cranial deformation influences some measurements, eliminating this source of “noise” does not account for all aspects of Koniag uniqueness. Still, it seems likely that this behavioral practice has contributed in some way to the notion promulgated by craniometrists that these prehistoric Kodiak Island populations were disjoint groups, especially when one considers that long bone dimensions were almost identical between the two populations.

With but few exceptions (e.g., wormian bones), nonmetric cranial and dental traits are unaffected by cranial deformation and both provide evidence for Pre-Koniag/Koniag continuity. Still, the cranio metric uniqueness of the Koniag should not be ignored. I concur with Heathcote (1986:174) who refers to the Koniag as a “special Yukit case.” While they are technically a Yupik population, they are more closely related to Aleuts than are other...
Yupik groups and nonmetric cranial and dental traits even suggest some ties to Na-Dene populations.

There is no way to gauge accurately the degree to which the distance studies of the Pre-Koniag and Koniag violate the stated assumptions for making historical inferences on the basis of biological characteristics. Most workers examined large trait sets and used well-defined methods in adequate if not large sample. In most dendrograms, patterns of differentiation accord well with the linguistic divisions of northern groups, reflecting divergence events driven by chance (i.e., founder's effect, genetic drift) rather than selection. With a few exceptions, different types of data showed congruent patterns of relationship, providing some support for the hypothesis of nonspecificity.

Factors that pose potential problems in the evaluation of prehistoric Kodiak Island relationships, in addition to cranial deformation as a source of "environmental noise," include gene flow and population heterogeneity (assumptions 4 and 5). That is, the Pre-Koniag and Koniag samples may have included hybrids and individuals from other populations (e.g., Aleuts or Tlingits). Pinart (1873) noted "The Koniags, in spite of their exhibiting the characteristic traits of the Eskimo family, seem to be mixed with foreign blood . . . ." If the narratives recorded by Pinart are historically accurate, this admixed appearance might be partly attributable to gene flow between the Koniag and "Koloches" (Tlingits?) who allegedly were coreidents on the island before being driven out. Female slaves from other groups, obtained through warfare or harter, could also have introduced biological heterogeneity into the Pre-Koniag and Koniag samples. Unfortunately, neither individuals from other populations nor hybrids can be sorted out by distance values and dendrograms based on summary statistics. Using typology to estimate the ethnicity of individuals within a sample (Hrdlička 1944a) is an art no longer practiced by modern skeletal biologists.

The modern population of Kodiak Island has been strongly impacted by the introduction of European genes. However, when these genes are factored out, the living Koniag show their closest affinities to Aleuts, Yupik Eskimos, and Inupiaq Eskimos. If there was "ancient admixture" between Koniag and Na-Dene-speaking Indians, it has left no clear trace in the genetic profile of the modern populations.

Postscript

Archaeologically, there are many differences between the Kachemak and Koniag traditions on Kodiak Island (mortuary practices, house forms, sweat baths, settlement patterns, ceramics, labret styles, etc.), but there are also many similarities (see Jordan and Knecht 1988). However, the interpretation of this record is best left in the able hands of North Pacific archaeologists. Don Dumond (1991) has prepared a detailed archaeological review of the Kachemak-Koniag problem which appears, along with a more profusely illustrated version of my analysis (Scott 1991), in the University of Oregon Anthropological Papers No. 44.

Prehistorians who have examined the same body of evidence for the Kachemak and Koniag traditions have proposed varied interpretations to explain the similarities and differences between the two (local evolution, diffusion, amalgamation, migrations, differing levels of population replacement, etc.). After working on Kodiak Island for several years, Dick Jordan concluded that most of the differences between the Kachemak and Koniag traditions reflected internal changes and some diffusion but no major episodes of population replacement. We spent many hours debating this point because, at the time, I took the opposite position based on evidence from physical anthropology, linguistics, and archaeology. I considered it likely that at least some of the Kodiak Islanders were Indians and the Pre-Koniag were replaced by the Koniag who represented a different biological population. When the Smithsonian Institution provided me the opportunity to examine the Uyak skeletal collection in its entirety, I thought this would be the ideal opportunity to prove Dick wrong. Much to my surprise, my observations on the Uyak collection, along with a more thorough perusal of the literature, supported Dick's position on the prehistory of Kodiak Island. While certain aspects of Koniag skeletal biology remain baffling, I reached conclusions far removed from my preconceptions. Needless to say, Dick was pleased.

Acknowledgements. My work on the Uyak collection was funded by the Department of Anthropology, Smithsonian Institution. I thank Don Ortner and Doug Owsley for the hospitality shown during my stay in Washington. Dick Jordan, friend and colleague, was most supportive of this study. This paper is dedicated to his love of Kodiak Island and its prehistory.

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Utermohle, C. J.

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