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TWO PAPERS ON THE PHYSICAL ANTHROPOLOGY OF CALIFORNIA INDIANS

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I. SJo-68 DENTAL MORPHOLOGY AND ITS BEARING ON THE "DIHYBRID THEORY" OF AMERICAN INDIAN ORIGINS

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ABSTRACT

Despite some two decades of research on the origins of the American Indian, the dihybrid model proposed by Joseph Birdsell (1951) persists as one of the few paradigms couched in an essentially evolutionary framework. Birdsell holds that, in addition to the unquestionable Mongoloid ancestry, there is also a genetic contribution from an archaic Caucasoid (Amurian) element.

This paper presents data on the dental morphology of an Early Horizon Californian skeletal series (San Joaquin-68). This temporally early, geographically peripheral sample fulfills the criteria for analysis of American Indian origins proposed by Birdsell. Incisor labial and lingual shoveling is frequent and often marked in expression, Carabelli's cusp is uncommon, the protostylid complex is in high frequency, as is incisor winging, and 3-rooted mandibular first molars are relatively common. All of these features stand in contrast to the Caucasoid dental plan. The SJo-68 series is compared to samples of archaic and Mediterranean Caucasoids, Asiatic Mongoloids, and American Indians, all of which support the contention that the American Indian is of a uniracial, Mongoloid origin.

INTRODUCTION

The origin of the American Indian has long been of interest to laymen and scholars alike. Substantial evidence indicates that the New World was first populated by migrant hunters from eastern Siberia who crossed the now-submerged Bering Land Bridge, reaching Alaska more than 12,000 years ago (Stewart, 1973). There is less evidence or agreement on the number of migrations and the region within Asia from which these Paleolithic people originated. The biological characteristics and origin of the early Asian geographic race is itself still poorly known. One excellent reason for research on the skeletal and dental variation of native Americans is that it helps to further our understanding of ancient Asian populations whose skeletal remains are less common than those from the Americas, especially North America.

One worker, Joseph B. Birdsell, stands out in his pioneering efforts to unravel the biological history of the American Indian by employing concepts from evolutionary biology rather than continuing to apply the methods of classical taxonomy. Birdsell's review of the racial features of Indians, Asians, and Australians suggested to him that the genetic character of American Indians resulted from a dihybrid mixture in Asia between Mongoloids, who evolved late out of Amurians in cold northeastern Asia, and earlier-evolved eastern Caucasoids, called Amurians by Birdsell.

It is the purpose of this paper to examine this hypothesis in light of an available skeletal series of prehistoric California Indians that conforms to suggestions for analysis set forth by Birdsell. The selection of this series is based on its definite antiquity, its geographic provenience, its large sample size, and the preservation of the dentition, a tissue suggested by Birdsell as valuable for investigating his model.

THE DIHYBRID MODEL

Synoptically, Birdsell's argument rests on two assumptions. First, all evidence indicates that modern man did not originate in northeastern Asia or in the New World. Second, what has become the Mongoloid race was the last of the major groups to differentiate; "Their definitive phase of evolution occurred late in the fourth glacial period as the result of extreme environmental stressing in a dry Arctic environment" (Birdsell,1951:7).

Taking into account the temporal and geographic requirements involved in polyracial theories of American Indian origins, Birdsell convincingly argues that earlier claims of Negritoid, Carpentarian, Melanesian, Australian, and/or Mediterranean Caucasoid contributions to the peopling of the New World are unreasonable given the prescriptions involved in having any of these groups at the right place at the right time for entry into the Americas. Temporal and spatial restrictions allow only two likely sources of New World

Indians: One, the Amurian branch of the "Caucasoid" race and, two, the "newly-evolved" Mongoloid race. The Amurian group is defined as the hypothetical antecedent mainland population located in the Amur River basin, "...a region which must have been occupied by the populations ancestral to ...the living Ainu..." (1951:12).

From these two sources, the American Indian is considered to possess a dihybrid racial origin, and "...the universally admitted Mongoloid element has been adulterated only by an archaic Caucasoid contribution from the Amurians" (Birdsell, 1951:62).

Implicit in this argument is that, since the Amurian peoples were present in the right place (east Asia) at the right time (late Würm glaciation), then, not only could they have contributed to the New World gene pool, but they did in fact do so. Our physical anthropological knowledge for eastern Asia prior to the fourth interglacial has advanced but little in the last two decades, and Birdsell's hypothesis of an archaic Caucasoid group is still tenable.

There is almost no skeletal evidence of early man in eastern Asia between the terminal Pleistocene and the occurrence of wholly modern Mongoloids (i.e. between about 10,000 and 5,000 years ago). Examining the Upper Pleistocene finds in northern Asia, though, the morphological variability in the three adult skeletons from Upper Paleolithic deposits in the Upper Cave at Choukoutien is noteworthy (e.g. Weidenreich, 1939). The male cranium is described as Neanderthaloid with certain Caucasian features. The two female skulls have morphologic similarities with Melanesians and Eskimos respectively. If these skeletons are coeval there is no problem accounting for the morphologic variation in American Indians, even if microevolutionary changes did not occur after entrance into the Americas. W. W. Howells, regarding the Mongoloid features of these skulls, has labelled them "unmigrated American Indians" (1959:300); likewise, Birdsell sees the phylogeny of the American Indian as stemming at least from the morphology of these individuals, especially the male cranium, skull no. 101 (Birdsell, 1951:17). The other Upper Pleistocene finds from Asia, such as those from near Ting T'sun (Movius, 1956), Tzeyang (Pei and Woo, 1957), Changyang (Chia, 1957), and Liukang (Woo, 1959), are each presented by these authors as examples of a primitive Mongoloid stock, and the few available teeth exhibit Mongoloid features.

So too, the candidates for early man in the New World mentioned by Birdsell (Brown's Valley, Punin, Lagoa Santa, and the Paltacalo series) do not support the contention of an archaic Caucasoid element. Temporally more recent New World skeletal evidence is also unconvincing (including finds since Birdsell's paper). Birdsell concluded, "... that the cranial materials offer even less substantiation of the Amurian-Mongoloid hypothesis than do the living peoples" (1951:49).

Birdsell's model provides for two alternatives depending on when the earliest immigrants entered North America:

> If modern man reached the New World as early as during the third interglacial period, it is predicted that this type will be found to be unmixed Amurian in its characteristics. Any group of people migrating across

> Bering Strait in post-glacial times should be dihybrid in origin [1951:63] .

All anthropological and geological information to date supports a terminal or late glacial movement by man into the New World; we may cite Wormington (1964) as the most comprehensive current work (see also Hopkins, 1967; Bryan, 1969; and Borden, 1969). Consequently, Birdsell's model would have the migrants as dihybrid in origin, and, thusly interpreted, the model becomes that of a single migration of indeterminant length and number of immigrants. Implicit in this model is the assumption that admixture occurred between the Amurian and Mongoloid groups prior to their entrance into the New World, and only the resultant hybridized group reached the Americas.

Birdsell provides no explanation as to why or how extensive gene flow would have occurred between Caucasoid and Mongoloid peoples at any point in time (except, of course, along common areal peripheries).

It is not surprising that Birdsell's most substantial evidence among living Indians should come from geographically marginal, relict populations. The Cahuilla of southern California and the Pomo and Yuki of northern California are cited (1951:63) as being the most suggestive of possessing a high frequency of archaic Caucasoid characteristics. It is instructive to note in passing what these characteristics are.

Five "distinctively Caucasoid" traits are listed for these Californian groups: 1) unusually abundant facial hair, 2) early graying of the facial and head hair, 3) concave nasal profile with unusual breadth, 4) greatly developed ear lobes, and 5) a marked tendency towards obesity (1951:36). But the 'propositae' illustrated in the article (see also Birdsell,1972:492) are not -- with one probable exception -- representative of their groups. There is the assumption that the individuals selected do not possess appreciable post-Columbian White admixture. Not unreasonably, most if not all of these traits would be expected to be possessed by particular individuals within any living New World group due simply to independent assortment and random recombination within a wholly Mongoloid population. Although it is stated that Birdsell's model relies primarily upon natural selection as an evolutionary force (1951:6-7), there is no mention of the likelihood of convergent evolution. It is, of course, the frequency rather than the mere presence of traits which distinguishes between geographic races.

From this critical standpoint, one becomes skeptical of Birdsell's comment that, "This [ant roposcopic] evidence, as slim as it is, is the best testimony for an Amurian element in the Americas" (1951:36). Simply put, there are too many alternative hypotheses to explain the minor, observed variations, but most importantly, claiming features to be markers of an hypothetical pop lation is untestable.

A METHODOLOGICAL APPROACH

Birdsell comments that, "It is believed that the Mongoloid component in the immigrants would increase with the passage of time" (1951:63).

Ideally, then, the detection of a non-Mongoloid component in the New World would derive from 1) the examination of one or more prehistoric series which approximate as closely as possible the earliest immigration into the Americas, 2) samples from refugial areas would provide somewhat of a safeguard against admixture with more recent immigrants, 3) characteristics examined should be under relatively complete genetic control, and the selection of traits should consist of those which will discriminate between the populations in question (in this case between Caucasoid and Mongoloid groups), and 4) a populational rather than a typological approach is requisite.

These requirements are met in the following analysis of the dental morphology of the skeletal series from a Central Californian site, San Joaquin-68, which, although its antiquity is not remarkable (ca. 4,000 years B.P.), it is still the earliest series to meet the demands of sample size, geographically peripheral location, and sufficient preservation to afford the desired examinations. An alternative, the much earlier (pre-Anathermal ?) series from the Tranquillity site (Fre-48), California, reported by Angel (1966) is too small (two fairly complete skeletons and altogether about a dozen individuals represented), and the dentition is in extremely poor condition.

It will be noted that this method of utilizing appropriate skeletal material and traits possessing strong genetic components was proposed by Birdsell as an approach "... pertinent to the solution of American Indian origins" (1951:55). Specifically, Birdsell even lists nine dental characteristics which he notes to be "promising phenotypic traits" (1951:56). The utility of the dentition for the identification of microevolutionary changes has been discussed elsewhere (Turner, 1969).

MATERIAL AND METHODS

SJo-68, the Blossom Site, has been described by R. F. Heizer (1949) and Ragir (1972) as a single-component, Early Horizon habitation site. The low-lying midden is situated on an alluvial plain, south of the Mokelumne River and northwest of the town of Thornton.

Radiocarbon dating of a combined sample of scattered bits of burnt wood screened from the midden (C-440 and C-522) place the occupation of the site at 4052 ± 160 radiocarbon years B.P. A sample of calcined and carbonized human bone (M-647) was radiocarbon dated at 4350 ± 250 years B.P. (Heizer, 1958). More recently, Ragir (1972) has reported dates calculated from human bone collagen. An untreated sample (I-2749a) dates as 3585 ± 110 B.P., and two samples, each treated overnight with two-molar sodium hydroxide, date at 3775 ± 160 B.P. (I-2479b) and 2980 ± 110 B.P. (I-3038).

The first two of these three collagen dates are from four feet below present ground surface while the third is from one foot below the surface (Ragir, 1972:32).

These dates and the associated artifacts (Beardsley, 1948; Ragir, 1972) place SJo-68 in the Windmiller Culture of the Californian Early Horizon. Ragir states that the known Windmiller Culture sites range between three and four thousand years B.P. (1972:121-123) which is more conservative than the earlier estimate of four to seven thousand years ago made by Heizer and Cook (1949).

The data of this report are from 27 individuals out of a total of 188 individuals and at least five cremations (Ragir, 1972:163-166). Selection was based only on the preservation of teeth, and, as is crucial in many prehistoric Californians (see Leigh, 1928; Kennedy, 1960; Molnar, 1971), individuals without extensive pre-mortem tooth loss and/or extreme attrition (which often removes all of the tooth above the cingulum). Table 1 lists the sex and age distribution of the usable sample.

The traits examined and their grading scales are those established in the literature. Data collection was accomplished through visual and hand lens examination of the teeth with constant comparison of the traits against standardized plaques. All observations were made by one of us (CGT). No metrical traits were examined.

Using chi-square analysis none of the traits exhibit sexual dimorphism significant at the 0.05 level. All data are presented with the sexes (male, female and unknown) pooled, and, unless noted, all counts are of teeth, not individuals, a procedure necessitated by the sample's condition.

SJo-68 DENTAL MORPHOLOGY

1. Incisors. A. Hrdlička was the first (1907:55; see also Hrdlička, 1920 and 1921) to comment that the incidence of maxillary incisor lingual shoveling in American Indians, as in Mongoloid populations in general, is essentially unity. Table 2 indicates that shoveling is in high frequency in the SJo-68 series and thus fits the Mongoloid dental plan per this trait. This incidence is close to that of more recent American Indian series such as prehistoric Texas Indians where stronger maxillary central incisor shoveling grades are also 100 per cent (n = 124 individuals) (Goldstein, 1948:70), Indian Knoll's 100 per cent (n = 30 individuals) (Dahlberg and Snow, in Dahlberg, 1951:144), and the Papago of Arizona with 100 per cent shoveling

(n = 198 individuals) (D. H. Morris, 1965:116). In South America the prehistoric Atacama all possessed shoveling (n = 17 individuals) (DeVoto and Arias, 1967:1478), and living Pewenche Indians in Chile have 95 per cent shoveling (n = 60 individuals) (Rothhammer et al. 1968:163).

In the mandible, where the degree of lingual marginal ridging is always less developed than in the maxillary teeth (Carbonell, 1963), the frequency of some shoveling expression for the SJo-68 series is still high, 93.8 per cent (15/16) in the central incisors and 90.0 per cent (18/20) in the laterals.

The degree of lingual shoveling is also noteworthy. In the maxilla, two-thirds (10/16)of the teeth exhibit full shoveling while the other third (6/16) possess semi-shoveling (Table 2). This is in contrast to the distribution in Caucasoids (here an American White [Mediterranean Caucasoid] series described by Hrdlička, 1920:452) where full-shoveling is a mere 1.1 per cent (8/742 individuals) and semi-shoveling is only 5.8 per cent (43/742 individuals). Although a quarter of this White sample (23.7%, 176/742 individuals) has trace shoveling, this still leaves over half (69.4%, 515/742) of these Caucasians with no lingual ridging.

Given the simple models proposed for the inheritance of lingual shoveling (e.g. Abrahams, 1949; Turner, 1969), it seems quite likely that, if present, a genetic contribution from a Caucasoid population would be apparent in a descendant series (e.g. SJo-68) due to random recombination of the alleles for this trait. Nor is the absence of shoveling detectable in the upper central incisors even when larger, though more recent samples of American Indians without European admixture are examined.

Alternatively, if lingual shoveling is a quasi-continuous trait under polygenic control (e.g. Scott, 1972, 1973), then gene flow between Caucasoid and Mongoloid peoples would reflect itself in a lowered incidence of full shoveling in the descendent Mongoloid groups in the Americas. This is not, however, what is observed in the SJo-68 sample.

Campbell notes that shoveling "... is by no means a characteristic of the Australian's teeth" (1925:28). Riesenfeld (1956) found no cases of full shoveling in Australians (n = 47 incisors). Barksdale (1972) did not encounter any cases of full shoveling in his study of six Papuan groups (n = 279 individuals) from New Guinea, and semi-shoveling was consistently less than ten per cent for these Melanesians.

The labial surfaces of the incisors in the SJo-68 series also exhibit marginal ridging (Table 2), a feature seldom seen in Europeans. In the mandible, only the mesial labial borders of the lateral incisors possess this trait (15%, 3/20), but in the maxilla, all of the available teeth possess either labial shoveling of the mesial border (50%, 4/8) or ridging of both the mesial and distal borders (50%, 4/8).

Four grades of medial lingual ridges were tabulated for the incisors (Table 3). Most of the incisors (75%, 39/52) lack lingual ridges. When present, though, they are much more common on central (7/8) than on lateral incisors (1/8) in the maxilla, while the reverse is true for the mandibular incisors. The presence of multiple ridges seems to be confined to the maxillary centrals, but none of the teeth examined have more than two medial lingual ridges. No lingual tubercles were found.

The position of the central incisors could be examined in eight maxillary arcades (Table 4). Incisor winging, the mesial rotation of the incisors (Enoki and Dahlberg, 1958), is 12.5 per cent (1/8 individuals) in this small sample. Dahlberg comments that, "The frequencies [of winging] vary from 22 to 38 per cent among Indian tribes, but drop to 10 per cent for Japanese and to 3 per cent for Chicago Whites" (1963:156, see also Scott, 1973:190). The SJo-68 frequency is closer to the Mongoloid than to the Caucasoid frequencies.

2. <u>Canines</u>. The only trait scored on the canine is the <u>tuberculum dentale</u>. This term is used here in a broad sense to refer to "... any pronounced single or multiple tubercle or cusp with a free apex that occurs on the lingual surface of maxillary incisors and canines" (Turner, 1967:39). In the SJo-68 series (Table 5), the occurrence of such tubercles is similar to that of other American Indians, 20 per cent (9/45). Except for Arctic populations where the incidence of <u>tuberculum dentale</u> is low (less than 10%, Turner, 1967:45; see also Moorrees, 1957:26), this trait does not appear to characterize any particular geographic group; frequencies of the tubercle are generally less than 25 per cent. As in the SJo-68 series, the incidence of <u>tuberculum dentale</u> is typically higher on the canine than on either of the maxillary incisors.

3. <u>Premolars</u>. The features of the mandibular first and second premolars are scored by the criteria of Kraus and Furr (1953) and Ludwig (1957) respectively. No traits were scored on the maxillary premolars.

The modal form of the lower first premolar (Table 6) is: One external lingual groove, an uninterrupted sagittal sulcus with two occlusal pits and an independent apex on the deuteroconid, just one lingual cusp which is situated mesially, and the medial occlusal ridge is not bifurcated.

The second lower premolar (Table 7) has this modal form: Both a mesial and a distal accessory occlusal ridge and a divergent medial-occlusal ridge on the protoconid; the lingual cusp is mesial and independent of the buccal cusp; the sagittal sulcus is interrupted, and the multiple cusp, when present, is distal to the deuteroconid.

There is essentially no comparative data for $P\overline{2}$, but four studies involving five different ethnic and geographic groups have followed Kraus and Furr's scheme for the lower first premolar. D. H. Morris (1965) presents data for the living Papago of Southern Arizona and for the skeletal series from Pecos Pueblo, New Mexico; Turner (1967) studied Eskimo skeletal series (Kodiak Island, Arctic Coast, Sadlermiut, and Greenland), Aleut series, and northern Indians (Southeast Alaska and Arctic Interior); Turner and Scott (1973) describe the premolars of living Easter Islanders, and Harris et al. (n.d.) provide data on living Yap Islanders, Micronesia. Although minor variations exist in the number of traits examined, it is of interest that the modal condition for the morphology of P1 in each of these seven series is the same as that stated above for the SJo-68 sample in spite of potential sampling or inter-observer error. All of these seven are Asian or Asian-derived series, though, and it may be this consideration rather than any inherent lack of variation in the lower first premolar that accounts for the lack of discriminatory power for the traits examined. Certainly, much more work needs to be done in dental anthropology on non-Mongoloid populations.

4. Molars. Considering the maxillary molars first, the variation in hypocone size is presented in Table 8. The SJo-68 series nicely demonstrates the field effect (e.g. Dahlberg, 1951, 1963) for increasing reduction and loss of the hypocone from the first to the third molars. The first molar has an incidence of unity (32/32) for the full-size hypocone (grade 4) while the second molar typically exhibits a reduced hypocone (grade 4-), and the third molar possesses both the smallest hypocones and the greatest variability in types of expression. These general conditions are typical of all human populations, but there is a more than usual retention of the full-size hypocone on the first molar in this sample (cf. Scott, 1973:178).

The observed variation in Carabelli's trait is given in Table 9. As is typical of several Mongoloid series studied, and in contrast to Caucasoid samples, the SJo-68 molars do not commonly possess actual cusps, although the frequency of the complete complex is fairly high (80% for M1 and 96% for M2) as with other American Indian series.

The protostylid complex was scored for the lower molars (Table 10). The frequency of this trait (ca. 22% for M1) is somewhat higher than for that reported for Southwest Indians (Scott, 1973:206), for Eskimo and Aleut (Turner, 1967), and for Pacific Islanders (e.g. Turner and Scott, 1973; Harris et al., n.d.). However, the SJo-68 frequencies for the protostylid complex of the three molars are closer to these Mongoloid groups than for the sketchily known Caucasoid groups.

Lower molar cusp number in this series (Table 11) exhibits the typical influences of the field effect. Retention of five cusps is the mode for the first (96%) and second (82%) molars while the frequency is low in the third molars.

The habitual retention of five cusps on M1 makes this trait of little interest for between-group comparisons, but the variability on the second molar suggests that the SJo-68 series aligns with the Mongoloid in contrast to Caucasoid or Negroid groups. In these latter two geographic races, the incidence of five cusps on M2 is well below one-third (e.g. Jørgensen, 1955: Table 5; Scott, 1973:Table 66) while the frequency in Mongoloid groups appears to be over one-half and is commonly in excess of three-fourths of all individuals (or teeth) examined.

Mandibular molar groove pattern likewise exhibits less inter-group variation on the first than on the second or third molar. In the SJo-68 series (Table 12), the Y cusp pattern (occlusal contact between cusps 2 and 3) on $\overline{M2}$ and $\overline{M3}$ is uncommon. The low frequency is not uncommon in Mongoloid populations, but Caucasoid and, to a lesser extent, Negroid groups typically retain the phylogenetically more ancient Y pattern to a greater degree on these posterior molars.

Scoring the molars for the occurrence of supernumerary cusps, the incidence of cusp 5 on the maxillary molars is 10.5 per cent on $\underline{M1}$ (4/38) and absent on the second (0/24) and third (0/16) molars. Cusp 6, the "entoconulid," on the lower molars is moderately common on the first (8.8%, 3/34) and second (8.7%, 2/23) molars, but was not found on the third molar (0/22). Cusp 7, the "metaconulid," occurs on 5.9 per cent (2/34) of the lower first molars, but not on the second (0/23) or third (0/22).

Molar enamel extensions, the deflection of the enamel border on the buccal aspect of the crown-root junction, are common in the SJo-68 series (Table 13), ranging from 75 per cent ($\overline{M1}$) to unity ($\underline{M2}$). Comparison with Danish series (Pedersen and Thyssen, 1942 cited in Pedersen, 1949; Jørgensen, 1956) and an American White series (Chappel, 1927) suggest that enamel extensions, notably the marked forms, are uncommon in Europeans while being reasonably common in the New World.

5. Rare morphological variants. Table 14 presents the incidence of nine features which may be under essentially genetic rather than environmental control. Too little data are available to allow any meaningful comments on their anthropological significance, however.

6. Root configurations. Tables 15 and 16 present the root numbers and forms found in the SJo-68 series for the upper and lower arcades respectively. The classification is that originated by Turner (1967:133-152). As defined here, a root is independent of other roots for at least half of its overall length. A radical (or 'partial root') is free for less than half of its total length or may not even possess an independent apex, being recognized only by its elevated contour as seen in cross section. This scoring procedure differs from that used by some (e.g. Alexandersen, 1963) which equates root apices with root number.

Because most of the studies have been done on living subjects without benefit of radiography and because most workers dealing with skeletal series or samples of extracted teeth have ignored the roots, this discussion must be essentially descriptive. Some of the exceptions are Pedersen's work on the East Greenland Eskimo (1949), papers by Tratman (1938) and Turner (1971) which are concerned with three-rooted mandibular first molars, and the work by Alexandersen (e.g. 1963) on double-rooted lower canines.

One example of a three-rooted mandibular first molar (3RM1) occurs in the SJo-68 series (Table 16) yielding a sample frequency of 4.5 per cent. This incidence compares well with other American Indian samples (mean = 5.9%, excluding Eskimo-Aleuts and Navajos), but stands in contrast to the lower incidence in the Negroid (absent) and Caucasoid (mean = 1.1%) samples studied to date (see Turner, 1971).

No example of two-rooted lower canines was found.

7. Additional observations. The size and incidence of the palatine and mandibular tori were recorded for the SJo-68 series (Tables 17 and 18 respectively). To date, only the high frequency of very pronounced tori among Eskimo groups has been recognized as of discriminatory utility in inter-group studies (*cf*. Hrdlička, 1940; Woo, 1950; N. T. Morris, 1970). As noted by Moorrees, only additional studies (and new techniques or procedures ?) will reveal whether the observed variations are "incidental or part of a geographic pattern" (1957:61).

The incidence of congenital absence of third molars is 3.3 per cent (2/61) as a tooth count and 5.9 per cent (1/17) as an approximate individual count.

No example of cosmetic or craft-related tooth modification was found. As already noted, though, occlusal attrition is severe in this series (*cf*. Leigh, 1928; Molnar, 1971).

PREHISTORIC AFFINITIES

In addition to the remarks on inter-group comparisons in the above descriptions, we have compared the SJo-68 dental series to select groups from the New and Old Worlds in order to estimate morphological relationships with this early New World sample. Two problems occur: Small sample sizes may produce spurious similarities or differences, especially when dealing on a subspecific level, and, two, inter-observer differences caused by the absence of agreed upon standards have often resulted in false interpretations of relationship. Phylogeny is also confounded by genetic adaptation of the individual populations to their specific environments subsequent to their biologic separation from other groups, although this has not yet been demonstrated for the dentition. Table 19 presents dental trait frequencies for seven series in addition to the SJo-68 data.

The Sakhalin Ainu are presented here as a putative example of archaic Caucasoids which emigrated from the Southeast Asian source of this race. The Ainu have been the subject of countless arguments both for and against their archaic Caucasoid affiliation. Birdsell stated that the Ainu are "closely related" to the eastern branch of the Caucasoid race (1951:12), and he has remained firm in this opinion (*e.g*. Birdsell, 1972:499-500). Others have argued that the Ainu are reasonably within the range of Mongoloid variation, and simply evidence extremes for some few traits (*e.g*. facial and body hair). Two studies on the Ainu dental morphology are available, one by Suzuki and Sakai (1957) which is based on a small series of morphologically and culturally pure Ainu, and the second by Hanihara (1973) is an analysis specifically aimed at testing the non-Caucasoid (and non-Amurian) nature of the Ainu.

Relative to the SJo-68 sample, I2 lingual shoveling is more common in the Ainu, although both groups lack examples of trace- and no-shoveling. This grade distribution is in the direction of intensification of this Mongoloid dental feature, which, of course, is most pronounced in certain American Indian groups living today. The Ainu exhibit an intermediate frequency of the cusp of Carabelli (i.e. the forms with free apices) on M1 and may lack actual cusps on M2; Hanihara reports a frequency of 9.5 per cent (10/105 individuals) for living Ainu (1973:Table 2). The low but positive incidence of protostylid tubercles on M1 conforms to known Mongoloid samples. The Ainu possess a greater incidence of six-cusped M1 than the SJo-68 series, or, for that matter, any of the other groups in Table 19. This is probably not just a function of sample size because Hanihara (1973) reports an incidence of 26.6 per cent (21/79 individuals). Palatine and mandibular tori appear more commonly in the Ainu than in the SJo-68 series. Upper central incisor shoveling and the frequency of large hypocones on M1 are similar to those in SJo-68, but there is a more pronounced trend towards the loss of the hypocone on M2 (as with most groups) among the Ainu than that evidenced in the SJo-68 sample.

The dental plan of the Ainu lends no support to the view that these people are Caucasoid. The problem exists that genetic changes through time may have occurred so that the living Ainu are different (i.e. more Mongoloid) in their dental form than their potential archaic ancestors. Examinations of the osteology (Yamaguchi, 1967), dermatoglyphics (Kimura, 1962), and serologic polymorphisms (Omoto, 1972) do not support such an interpretation, however.

Analysis of a larger, prehistoric sample of the Ainu dentition would help to further clarify this problem; there does not appear to be any difficulty distinguishing these people from the present, Japanese inhabitants (Howells, 1966). Now, though, we simply note that the SJo-68 series is similar to the Ainu only insofar as both series reflect Mongoloid dental characteristics, and, interestingly, the differences (e.g. I2 shoveling, protostylid tubercles) are due to the Ainu expressing the Mongoloid plan more intensely; hypocone reduction is the only, tentative, exception for the traits examined.

Descendants of the Amurians are represented by the Australian Aborigines. (That is, Birdsell suggested that the Australians are descended in part from the Murrayians who shared a common ancestry with the Amurians.) Both the Australians and the SJo-68 sample appear to have a strong retention of full-size hypocones on M1, a tendency which contrasts with the direction in which American Whites (Mediterranean Caucasoids) have evolved. The Australians are also notable in their retention of the hypocone on M2 and M3, perhaps as a selective response to their need for greater tooth mass (cf. Molnar, 1972). As noted below, though, this apparent need for tooth mass is not evidenced in the lower molars where the Australians and some other groups have not retained the hypoconulid, especially on M2. The teeth are large in size, though. The Australian sample is similar to SJo-68 in its low incidence of palatine and mandibular tori, particularly when one considers the larger grades, but is quite distinct in its high frequency of Carabelli's cusp on M1.

Riesenfeld (1956) provides data on maxillary incisor shoveling for Oceanic groups wherein he notes that the Australians have 64 per cent shoveling (51% trace and 13% semi) in a sample of 47 teeth (22I1 + 25 I2). This suggests that the archaic Caucasoids are considerably closer to the Mongoloid pattern of shoveling than to that of the Mediterranean branch, but they are not similar or truly intermediate to the grade distribution in the SJo-68 sample.

Insofar as the Australians are the best example of the archaic Caucasoid branch referred to by Birdsell, it is unfortunate that a more recent study with more comparable analysis is not available for their dental morphology than Campbell's pioneering work (1925). Hanihara's brief analysis (1973) does suggest that the Australians are relatively unlike the Asiatic and New World groups studied to date. It has long been recognized that the Mediterranean Caucasoids have followed a different evolutionary track and are, therefore, not nearly as useful for the purposes of these comparisons (e.g. Birdsell, 1951:14).

As the evidence stands, there is no good case for a phylogenetic relationship between the Australian Aborigine and the American Indian. Similar frequencies obtain for the mutual absence of moderate and large grades of mandibular and palatine tori, but the dental evidence provides several distinctions: Australians have almost no incisor shoveling (and no marked examples), Carabelli's cusp is much more common, as is reduction of cusp number on $M\overline{1}$, and there is a greater retention of the hypocone.

The recently studied group of American Whites (Scott, 1973) is the most directly comparable data on the Mediterranean Caucasoids (this particular sample is from California and Arizona). Additional data on a variety of Southeastern European Whites has recently been reported by Kochiyev (1973). The striking differences relative to the SJo-68 series is the absence of moderate and pronounced grades of incisor shoveling, simplification of the Caucasoid maxillary molars evidenced by the reduction of the hypocone on $M\underline{1}$ and $M\underline{2}$, and the relatively high incidence of an actual cusp of Carabelli. Although the frequencies for cusp number are close to SJo-68 for $M\overline{1}$, the Whites are noted, as are the Australians, for the absence of the hypoconulid on the lower second molars compared to Mongoloid groups. At least for the first molar, the SJo-68 series exhibits a greater incidence of actual tubercles at the protostylid sites than do the Whites. In all, the Mediterranean Caucasoids are quite distinct, and these comparisons agree with the suggestion by Thoma (1973) that the Mongoloids represent an early separation onto a separate evolutionary track, probably during the Neandertal stage.

The Papago, a Sonoran desert Uto-Aztecan group in Southern Arizona, are presented here as an Indian group which appears to have occupied the same geographic area for several millenia. Compared to this early California series, the Papago possess very similar grade distributions of lingual shoveling in both $I\underline{1}$ and $I\underline{2}$. A different grading procedure for the grade 4 hypocone is responsible for the frequencies being considerably different in these Papago; the biologically similar Pima Indians do not express any notable difference to the SJo-68 sample except for a higher frequency of three-cusped $M\underline{2}$ (19%, 36/182 individuals) when Dahlberg's scale is used (see Dahlberg, 1951:165-166). The Papago exhibit relatively high frequencies of Carabelli's cusp (i.e. with a free apex) which is roughly twice that of even the White series, suggesting a possible trend towards increasing tooth mass or complexity. In contrast, there is a reduction in molar size in the Papago as seen in the higher frequency of absence of the fifth and sixth cusps in the Papago $M\overline{1}$ and $M\overline{2}$ relative to SJo-68; in this latter feature, the Papago approximate the Caucasoid condition. The molar groove patterns of the

Papago are more like the SJo-68 condition than like Whites. No protostylid cusps appear to occur in the Papago.

The Hopi are also a Uto-Aztecan group with considerable antiquity in their homeland of Northeastern Arizona (e.g. Seltzer, 1944), but these people occupy a higher, wetter and colder ecologic setting than do the Papago. The Hopi exhibit lower incidences of the extreme form of incisor shoveling relative to SJo-68 and other American Indian groups in Table 19, but clearly do not align with the Caucasian examples. Although the distribution of hypocone forms on M1 is similar between the Hopi and SJo-68, M2 exhibits an appreciable reduction in hypocone size relative to SJo-68 and is even more extreme in this respect than the American White series. For the other traits in Table 19, the Hopi series is not readily distinguished from the other samples.

The Navajo represent a recent Athapascan immigration into the American Southwest and possibly are relatively recent to the New World. This particular sample was collected at Keams Canyon (Hopi Reservation), Arizona, which, because of admixture, may account for its gross similarity to non-Athapascan Southwest groups. Upper incisor shoveling is clearly Mongoloid, but is not notable relative to other American Indian groups. As seen in the other native groups, the Navajo do not exhibit the strong retention of large hypocones on the molars. The Navajo and Hopi series both indicate somewhat higher frequencies of actual cusps at the Carabelli and protostylid sites than do the Caucasian samples.

The Aleut, along with the Eskimo, are possibly the most recent pre-Columbian immigrants into the New World, and, as such, are suggested to best approximate the nature of Northeastern Siberian dentitions. The Aleuts do not exhibit the high incidence of full shoveling characteristic of American Indians, including SJo-68, but there is also an absence of non-shoveling in these Arctic Mongoloids. The distributions of the hypocone form is similar to SJo-68 for M1 and M3, but cusp four reduction is more pronounced on M2 for the Aleut. Carabelli's cusp is conspicuous by its absence, but the protostylid cuspule is, relatively, not uncommon in this northern series. Cusp number in the Aleuts tends toward increasing (or at least not reducing) tooth mass; possession of five- and six-cusped molars is more common in the Aleut M1, notably so for M2.

The characteristics of Mongoloid and Caucasoid dental features differentiate from one another rather clearly (Table 19), but, since it is the relative proportions within the grade distribution per trait which best distinguishes these groups, rather than specific percentages, it is not possible to state unequivocally that there is no archaic Caucasoid component in the SJo-68 sample, or, by extension, other American Indian groups. By the same token, however, Birdsell's model contends that, if present, a Caucasoid element should manifest itself more clearly in this temporally early, marginal series than in, say, living series of American Indians. Using the approach suggested to be ". . . pertinent to the solution of American Indian origins" (Birdsell, 1951:55), the parsimonious conclusion is that the Asian immigrants into North America were sufficiently within the known range of Mongoloid dental variation to exclude the need for assuming any Caucasoid element.

SUMMARY AND CONCLUSIONS

Temporal and spatial limitations, in addition to the biologic evidence itself, strongly mitigates against the possibility of racial groups other than archaic Caucasoid and Mongoloid immigrating into the New World prehistorically. The Asian origin of the American Indian is without question, but whether there was also a Caucasoid contribution has not been adequately determined. Birdsell's delineation of some somatic traits which are in low frequency in some Indian groups and which are common in modern Caucasian populations has been cited as *a priori* evidence of such a non-Mongoloid component.

The present study describes and compares the dental morphology of an Early Horizon California skeletal series dating *circa* 2,000 B. C. This description is of value in its own right, but, of equal interest, the SJo-68 series does not exhibit any recognizable Caucasoid component.

It may be argued that this series is simply too recent and that the many millenia between the peopling of the New World and the occupation of SJo-68 was more than sufficient to dilute the Amurian characteristics beyond recognition. A review of the dental morphology of the isolated early man finds from both Northeast Asia and from North and South America indicates that this is not the case. Although the details are beyond the scope of this paper, examination of the literature devoted to early man skeletal descriptions (*e.g.* Jenks, 1936; Black and Eyman, 1963; Anderson, 1965; Angel, 1966; Romano, 1970; Breternitz *et al.*, 1971) shows that the Mongoloid rather than the Caucasoid dental complex (see Hanihara, 1967) is manifest in all prehistoric American Indians. This is to say that, as in SJo-68, the Mongoloid dental complex has 1) a high frequency of lingual shoveling on I1 and I2, 2) a high frequency of the protostylid complex (when all grades are considered), and 3) a low incidence of actual *cusps* of Carabelli. Additionally, the SJo-68 series is characterized by retention of large hypocones on M1, some protostylid cuspules, relatively common incisor winging, and the occurrence of 3RM1. All of these features stand in significant contrast to the Caucasoid dental plan.

Finally, even though no recognizable Caucasoid element can be found in the SJo-68 dental series, the contention may be made that the authors are "easy evolutionists" (*cf.* Birdsell, 1972:499) in that they rely on a parsimonious interpretation of the data. This is indeed true, and it has already been mentioned that the use of epigenetic traits which vary in proportion instead of simple occurrence prevents absolute proof of a single biologic origin of the American Indian. There are also the questions of how much gene flow from a non-Mongoloid source could have occurred and yet go undetected, and, secondly, what influence the actual movement of people into North America through the so-called "Arctic filter" had on either the diminution or the accentuation of non-Mongoloid characteristics. It is possible, then, that a proportionately insignificant non-Mongoloid genetic contribution, if indeed it existed, will not be found in the New World simply because it was selected out as the aboriginal immigrants crossed the Bering Platform to North America.

In any event, there is no evidence of it either in the subfossil record of modern man in northeastern Asia or in the New World, and the biologic evidence of this early California series points entirely towards an immigration of only Mongoloid peoples.

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Table 1

Distribution of SJo-68 Sample by Age and Sex

Age	Male	Female	Sex uncertain	M+F+? n	%
Infant (x-3 yrs.)	0	0	1	1	3.7
Child (4-6)	1*	0	3	4	14.8
Child (7-12)	0	0	5	5	18.5
Adolescent (13-17)	3	1	3	7	25.9
Subadult (18-20)	0	3	0	3	11.1
Young Adult (21-35)	2	1	0	3	11.1
Middle Aged (36-55)	2	2	0	4	14.8
Totals	8	7	12	27	

*Sex based on very large size of erupting first permanent molars.

Table 2

Incisor Shoveling Variation
(Tooth count, sexes pooled)

	Maxilla				Mandible			
	Central		Lateral		Central		Lateral	
Degree of Shoveling	n	%	n	%	n	%	n	%
Lingual surface*								
None	0/16	0.0	0/15	0.0	1/16	6.2	2/20	10.0
Trace	0/16	0.0	0/15	0.0	12/16	75.0	15/20	75.0
Semi-Shovel	6/16	37.5	8/15	53.3	3/16	18.8	3/20	15.0
Shovel	10/16	62.5	7/15	46.7	0/16	0.0	0/20	0.0
Barrel	0/16	0.0	0/15	0.0	0/16	0.0	0/20	0.0
Labial surface								
Mesial labial Shovel	4/8	50.0	7/9	77.8	0/16	0.0	3/20	15.0
Distal labial Shovel	0/8	0.0	0/9	0.0	0/16	0.0	0/20	0.0
Double Shovel	4/8	50.0	2/9	22.2	0/16	0.0	0/20	0.0

*After A. Hrdlička, 1920

Table 3

Incisor Medial Lingual Ridge Number
(Tooth count, sexes pooled)

	Maxilla						Mandible					
Number of Medial	I1		I2		Total		I1		I2		Total	
Lingual Ridges*	L	R	L	R	(Maxilla)	Percent	L	R	L	R	(Mandible)	Percent
No Lingual Ridges	3	3	7	5	18/26	69.2	6	7	3	5	21/26	80.8
One " "	1	2	0	1	4/26	15.4	0	0	3	2	5/26	19.2
Two " "	2	2	0	0	4/26	15.4	0	0	0	0	0/26	0.0

*After C. Turner, 1967

Table 4

Maxillary Central Incisor Rotation
(Individual count, sexes pooled)

	Individuals	
Form of Winging*	n	%
Bilateral	0	0.0
Unilateral	1	12.5
Straight (none)	7	87.5
Unilateral Counter-winging	0	0.0
Bilateral Counter-winging	0	0.0
Total	8	100.0

*After K. Enoki and A. A. Dahlberg, 1958.

Table 5

Tuberculum Dentale*
(Tooth count, sexes pooled)

Tooth, maxilla	Left	Right	Sides Pooled	Percent
Canine	2	2	4/12	33.3
Lateral incisor	1	2	3/17	17.6
Central incisor	1	1	2/16	12.5

*After C. Turner, 1967.

Table 6

Mandibular First Premolar Variation
(Tooth count, sexes pooled)

Characteristic*	First Premolar Left	Right	Sides Pooled	Percent
1a. No external lingual groove	4	2	6/15	40.0
1b. One external lingual groove	5	4	9/15	60.0
1c. Two external lingual grooves	0	0	0/15	0.0
2a. Interrupted sagittal sulcus	8	8	16/16	100.0
2b. Uninterrupted sagittal sulcus	0	0	0/16	0.0
3a. Lingual cusp is mesial	6	7	13/16	81.2
3b. Lingual cusp is distal	0	0	0/16	0.0
3c. Lingual cusp is medial	2	1	3/16	18.8
4a. One lingual cusp	7	7	14/16	87.5
4b. Two lingual cusps	1	1	2/16	12.5
4c. Three lingual cusps	0	0	0/16	0.0
4d. Four lingual cusps	0	0	0/16	0.0
5a. Single medial occlusal ridge, buccal cusp	3	1	4/4	100.0
5b. Divergent medial occlusal ridge, buccal cusp	0	0	0/4	0.0
6a. One occlusal pit	2	1	3/16	18.8
6b. Two occlusal pits	6	7	13/16	81.2
7a. Fused lingual and buccal cusp	6	8	14/16	87.5
7b. Independent lingual and buccal cusp	2	0	2/16	12.5

*After B. S. Kraus and M. L. Furr, 1953.

Table 7

Mandibular Second Premolar Variation
(Tooth count, sexes pooled)

Characteristic*	Second Left	Premolar Right	Sides Pooled	Percent
1a. One distal accessory ridge, buccal cusp	0	0	0/8	0.0
1b. One mesial accessory ridge, buccal cusp	0	1	1/8	12.5
1c. Mesial and distal accessory ridge	3	4	7/8	87.5
2a. Single occlusal ridge, buccal cusp	0	2	2/6	33.3
2b. Divergent occlusal ridge, buccal cusp	2	2	4/6	66.6
3a. Lingual cusp is medial	0	3	3/13	23.1
3b. Lingual cusp is mesial	5	4	9/13	69.2
3c. Lingual cusp is distal	0	1	1/13	7.7
4a. One lingual cusp	3	3	6/10	60.0
4b. Two lingual cusps	1	3	4/10	40.0
4c. Three lingual cusps	0	0	0/10	0.0
5a. Lingual cusp is independent	4	5	9/10	90.0
5b. Lingual cusp is fused	0	1	1/10	10.0
6a. Multiple lingual cusp is medial	0	0	0/4	0.0
6b. Multiple lingual cusp is distal	1	2	3/4	75.0
6c. Multiple lingual cusp is mesial	0	1	1/4	25.0
7a. Sagittal sulcus is interrupted	2	3	5/9	55.6
7b. Sagittal sulcus is not interrupted	1	3	4/9	44.4

*After F. J. Ludwig, 1957.

Table 8

Maxillary Molar Cusp Patterns
(Tooth count, sexes pooled)

Tooth	Grade*	4		4-		3+		3	
		n	%	n	%	n	%	n	%
M1		32/32	100.0	0/32	0.0	0/32	0.0	0/32	0.0
M2		0/22	0.0	19/22	86.4	3/22	13.6	0/22	0.0
M3		1/14	7.1	1/14	7.1	5/14	35.7	7/14	50.0

*After A. A. Dahlberg, 1951.

Table 9

Carabelli's Trait
(Tooth count, sexes pooled)

Form*	M1 n	M1 %	M2 n	M2 %
Smooth	5/25	20.0	23/24	95.8
Furrow	0/25	0.0	0/24	0.0
Pit	10/25	40.0	1/24	4.2
Double Furrow	3/25	12.0	0/24	0.0
"Y" Form	6/25	24.0	0/24	0.0
No Contact with Lining Groove	0/25	0.0	0/24	0.0
Small Contact with Lining Groove	0/25	0.0	0/24	0.0
High Cone	1/25	4.0	0/24	0.0

*After A. A. Dahlberg, 1963, and elsewhere.

Table 10

Protostylid Variation
(Tooth count, sexes pooled)

Grade*	M1 n	M1 %	M2 n	M2 %	M3 n	M3 %
No cusp, straight buccal groove	19/28	67.9	17/26	65.4	10/16	62.5
No cusp, pit in buccal groove	8/28	28.6	9/26	34.6	2/16	12.5
No cusp, curved buccal groove	0/28	0.0	0/26	0.0	0/16	0.0
Small cusp, buccal groove just beginning	0/28	0.0	0/26	0.0	0/16	0.0
Slight cusp	1/28	3.5	0/26	0.0	0/16	0.0
Moderate cusp	0/28	0.0	0/26	0.0	0/16	0.0
Strong cusp	0/28	0.0	0/26	0.0	4/16	25.0

*After A. A. Dahlberg, 1963, and elsewhere.

Table 11

Mandibular Molar Cusp Number*
(Tooth count, sexes pooled)

	4		5		6	
Tooth	n	%	n	%	n	%
M1	0/23	0.0	22/23	95.6	1/23	4.4
M2	1/27	3.7	22/27	81.5	4/27	14.8
M3	6/23	26.1	8/23	34.8	9/23	39.1

*Modified after W. K. Gregory, 1916: see C. Turner, 1967 and elsewhere.

Table 12

Mandibular Molar Groove Patterns
(Tooth count, sexes pooled)

		Y		+		X		H	
Tooth	Pattern*	n	%	n	%	n	%	n	%
M1		21/23	91.3	2/23	8.7	0/23	0.0	0/23	0.0
M2		0/27	0.0	10/27	37.0	17/27	63.0	0/27	0.0
M3		0/23	0.0	3/23	13.0	17/23	73.9	3/23	13.0

*After W. K. Gregory, 1916; M. Hellman, 1928; and K. D. Jørgensen, 1955.

Table 13

Molar Enamel Extension Variation
(Tooth count, sexes pooled)

	Maxilla						Mandible					
	M1		M2		M3		M1		M2		M3	
Grade*	n	%	n	%	n	%	n	%	n	%	n	%
No line	4/35	11.4	0/19	0.0	2/9	22.2	6/24	25.0	3/24	12.5	1/12	8.3
Slight	18/35	51.4	2/19	10.5	2/9	22.2	6/24	25.0	7/24	29.2	2/12	16.7
Medium	4/35	11.4	3/19	15.8	1/9	11.1	0/24	0.0	4/24	16.7	3/12	25.0
Marked	9/35	25.7	14/19	73.7	4/9	44.4	12/24	50.0	10/24	41.6	6/12	50.0
Reversed	0/35	0.0	0/19	0.0	0/9	0.0	0/24	0.0	0/24	0.0	0/12	0.0

*After R. W. Leigh, 1930; and G. Lasker, 1950.

Table 14

Rare Morphological Variants
(sexes pooled)

Form of Variant*	Maxilla		Mandible		Pooled
	teeth	individuals	teeth	individuals	(teeth)
Occlusal Pits	8	5	16	8	24
Buccal Pits	0	0	13	6	13
Hypoplasia	0	0	5	3	5
Pegging of incisors	1	1	0	0	1
Supernumerary teeth	1	1	0	0	1
Crown Wrinkling	0	0	0	0	0
Gemmate	0	0	0	0	0
Odontomes	0	0	0	0	0
Triform (Lateral Incisors)	0	0	0	0	0

*After M. Diamond, 1952; P.O. Pedersen, 1949; and J. H. Scott and N.B. Symons, 1958.

Table 15

Maxillary Tooth Root Number and Root Configuration
(Tooth count, sexes pooled)

Root Number	Configuration*	I1 n	I1 %	I2 n	I2 %	C n	C %	P1 n	P1 %	P2 n	P2 %	M1 n	M1 %	M2 n	M2 %	M3 n	M3 %
1	1 root no fusion	8	72.7	9	64.3	2	25.0	2	14.3	0	0.0	0	0.0	0	0.0	0	0.0
2	2 roots no fusion	0	0.0	0	0.0	0	0.0	1	7.1	1	10.0	0	0.0	0	0.0	0	0.0
3	3 roots no fusion	0	0.0	0	0.0	0	0.0	1	7.1	0	0.0	0	0.0	1	8.3	0	0.0
1	2 roots fused into one	1	9.1	2	14.3	3	37.5	8	57.1	8	80.0	0	0.0	0	0.0	0	0.0
1	3 roots fused into one	2	18.2	3	21.4	2	25.0	1	7.1	1	10.0	0	0.0	1	8.3	0	0.0
1	4 roots fused into one	0	0.0	0	0.0	1	12.5	0	0.0	0	0.0	0	0.0	3	25.0	2	66.7
2	2 roots fused, one free	0	0.0	0	0.0	0	0.0	1	7.1	0	0.0	0	0.0	1	8.3	0	0.0
3	2 roots fused, two free	-	-	-	-	-	-	-	-	-	-	4	50.0	4	33.3	0	0.0
3	3 roots fused, two free	-	-	-	-	-	-	-	-	-	-	0	0.0	1	8.3	0	0.0
3	2 roots fused, one free, two fused	-	-	-	-	-	-	-	-	-	-	3	37.5	0	0.0	0	0.0
2	2 roots fused, two fused	-	-	-	-	-	-	-	-	-	-	0	0.0	1	8.3	1	33.3
2	4 roots fused, one free	-	-	-	-	-	-	-	-	-	-	1	12.5	0	0.0	0	0.0
	Number of Teeth Examined	11		14		8		14		10		8		12		3	

*After C. Turner, 1967.

Table 16

Mandibular Tooth Root Number and Root Configuration
(Tooth count, sexes pooled)

		I1		I2		C		P1		P2		M1		M2		M3	
ot Number	Configuration*	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
1	1 root no fusion	10	62.5	0	0.0	0	0.0	0	0.0	10	66.7	0	0.0	0	0.0	0	0.0
1	2 roots fused into one	2	12.5	7	46.7	13	86.7	5	27.8	2	13.3	0	0.0	4	22.2	4	36.4
1	3 roots fused into one	2	12.5	8	53.3	2	13.3	12	66.7	3	20.0	0	0.0	3	16.7	0	0.0
1	4 roots fused into one	2	12.5	0	0.0	0	0.0	1	5.5	0	0.0	0	0.0	4	22.2	0	0.0
2	2 roots fused, one free	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.6	0	0.0
3	2 roots fused, one free, two fused	-	-	-	-	-	-	-	-	-	-	1	4.5	0	0.0	0	0.0
2	2 roots fused, two fused	-	-	-	-	-	-	-	-	-	-	14	63.6	6	33.3	7	63.6
2	2 roots fused, three fused	-	-	-	-	-	-	-	-	-	-	7	31.8	0	0.0	0	0.0
	Number of Teeth Examined	16		15		15		18		15		22		18		11	

*After C. Turner, 1967.

Table 17

Palatine Torus in SJo-68 Sample
(Individual count, sexes pooled)

Grade	Individuals n	%
Absent	15	75.0
Slight	5	25.0
Medium	0	0.0
Large	0	0.0
Very large*	0	0.0
Total	20	100.0

*As in some Eskimo

Table 18

Mandibular Torus
(Individual count, sexes pooled)

Grade*	Individuals n	%
Absent	17/18	94.5
Very slight	1/18	5.5
Other	0/18	0.0

*After E. A. Hooton, 1918 and
N. T. Morris, 1970.

Caption
TABLE 19

Intergroup comparisons of morphologic dental traits. Trait selection is based on availability of data and between-observer comparability. Group selection is discussed in the text. Sexes are pooled in all samples. The SJo-68, Sakhalin Ainu, and Australian Aborigine series are tooth counts; the others are individual counts; only symmetric individuals are used for the Papago. Data sources: SJo-68 (present study), Sakhalin Ainu (Suzuki and Sakai, 1957), Australian Aborigine (Campbell, 1925), American White (Scott, 1973), Papago (D. H. Morris, 1965), Hopi and Navajo (Harris and Scott, 1972 and Scott, 1973), and Aleut (Turner, 1967). Grading scales: lingual shoveling (Hrdlička, 1920), hypocone size (Dahlberg, 1951), Carabelli's cusp (grades 6 and 7 of Dahlberg, 1963), cusp number (Gregory, 1916, Hellman, 1928 and Jørgensen, 1955), protostylid tubercle (grades 4, 5, and 6 of Dahlberg, 1963), palatine torus (Woo, 1950), mandibular torus (Hooton, 1918 and N. T. Morris, 1970). Frequencies equaling less than 100% indicate that additional variants were scored.

Table 19a

Tooth	Trait/ Grade	SJo-68 n	SJo-68 %	Sakhalin Ainu n	Sakhalin Ainu %	Australian Aborigines n	Australian Aborigines %	American Whites n	American Whites %	Papago n	Papago %	Hopi n	Hopi %	Navajo n	Navajo %	Aleut n	Aleut %
I1	Shoveling																
	absent	(16)	0.0	(17)	0.0	-	-	39	41.5	(184)	0.0	(164)	0.0	(135)	0.0	(48)	0.0
	trace	(16)	0.0	(17)	0.0	-	-	54	57.4	-	-	16	9.8	(135)	0.0	4	8.3
	semi	6	37.5	3	17.7	-	-	1	1.1	71	38.6	94	57.3	64	47.4	30	62.5
	full	10	62.5	14	82.3	-	-	(94)	0.0	113	61.4	54	32.9	71	52.6	14	29.2
I2	Shoveling																
	absent	(15)	0.0	(18)	0.0	-	-	21	40.4	10	6.6	4	2.4	1	0.6	(58)	0.0
	trace	(15)	0.0	(18)	0.0	-	-	31	59.6	-	-	22	13.1	11	6.9	2	3.4
	semi	8	53.3	2	11.1	-	-	(52)	0.0	76	50.0	73	43.5	81	50.9	21	36.2
	full	7	46.7	16	88.9	-	-	(52)	0.0	66	43.4	53	31.5	52	32.7	35	60.3
M1	Hypocone																
	4	32	100.0	23	92.0	83	94.3	97	89.8	46	27.4	155	90.1	140	89.7	80	93.0
	4-	(32)	0.0	2	8.0	5	5.7	11	10.2	122	72.6	16	9.3	14	9.0	6	7.0
	3+	(32)	0.0	(25)	0.0	(88)	0.0	(108)	0.0	(168)	0.0	(172)	0.0	1	0.6	(86)	0.0
	3	(32)	0.0	(25)	0.0	(88)	0.0	(108)	0.0	(168)	0.0	1	0.6	1	0.6	(86)	0.0
M2	Hypocone																
	4	(22)	0.0	1	7.1	200	96.2	12	11.5	(104)	0.0	9	5.5	9	6.0	4	3.6
	4-	19	86.4	8	57.1	8	3.8	58	55.7	33	31.7	83	50.6	54	36.2	16	14.4
	3+	3	13.6	1	7.1	(208)	0.0	5	4.8	41	39.4	39	23.8	51	34.2	56	50.5
	3	(22)	0.0	4	28.6	(208)	0.0	29	27.9	30	28.8	33	20.1	35	23.5	35	31.5
M3	Hypocone																
	4	1	7.1	-	-	111	71.2	-	-	-	-	(34)	0.0	(42)	0.0	(66)	0.0
	4-	1	7.1	-	-	9	5.8*	-	-	-	-	2	5.9	(42)	0.0	8	12.1
	3+	5	35.7	-	-	-	-	-	-	-	-	4	11.8	10	23.8	25	37.9
	3	7	50.0	-	-	36	23.0	-	-	-	-	27	79.4	28	66.7	33	50.0
M1	Carabelli's Cusp	1	4.0	2	13.3	20	33.3	27	24.3	68	42.8	6	4.0	1	0.8	(61)	0.0
M2	Carabelli's Cusp	(24)	0.0	(16)	0.0	-	-	1	1.0	9	6.8	1	0.7	(91)	0.0	(40)	0.0
M3	Carabelli's Cusp	-	-	-	-	-	-	-	-	-	-	(20)	0.0	(10)	0.0	-	-

Tooth	Trait/ Grade	SJo-68 n	SJo-68 %	Sakhalin Ainu n	Sakhalin Ainu %	Australian Aborigines n	Australian Aborigines %	American Whites n	American Whites %	Papago n	Papago %	Hopi n	Hopi %	Navajo n	Navajo %	Aleut n	Aleut %
$M\bar{1}$	Cusp Number																
	6	1	4.4	4	40.0	-	-	-	-	30	19.9	-	-	-	-	29	22.1
	5	22	95.6	5	50.0	83	94.3*	91	95.8*	120	79.5	115	99.1*	169	100.0*	102	77.9
	4	(23)	0.0	1	10.0	5	6.2	4	4.2	1	0.7	1	0.9	(169)	0.0	(131)	0.0
$M\bar{2}$	Cusp Number																
	6	4	14.8	-	-	-	-	-	-	11	10.3	-	-	-	-	25	22.7
	5	22	81.5	-	-	40	32.0*	18	17.8*	47	43.9	-	-	-	-	76	69.7
	4	1	3.7	-	-	85	68.0	83	82.2	49	45.8	-	-	-	-	9	8.2
$M\bar{3}$	Cusp Number																
	6	9	39.1	-	-	80	72.7*	-	-	-	-	-	-	-	-	15	30.0
	5	8	34.8	-	-	30	27.3*	-	-	-	-	-	-	-	-	28	56.0
	4	6	26.1	-	-			-	-	-	-	-	-	-	-	7	14.0
$M\bar{1}$	Groove Pattern																
	Y	21	91.3	6	60.0	-	-	9	81.8	47	92.2	34	75.6	48	78.7	80	64.5
	+	2	8.7	3	30.0	-	-	(11)	0.0	3	5.9	4	8.9	1	1.6	29	23.4
	X	(23)	0.0	1	10.0	-	-	2	18.2	1	2.0	7	15.6	11	18.0	15	12.1
	Hy	(23)	0.0	(10)	0.0	-	-	(11)	0.0	(51)	0.0	-	-	-	-	(124)	0.0
$M\bar{2}$	Groove Pattern																
	Y	(27)	0.0	-	-	-	-	2	10.5	1	3.4	4	11.8	4	6.7	16	13.9
	+	10	37.0	-	-	-	-	3	15.8	15	51.7	8	23.5	21	35.0	53	46.1
	X	17	63.0	-	-	-	-	13	68.4	13	44.8	22	64.7	33	55.0	46	40.0
	Hy	(27)	0.0	-	-	-	-	(18)	0.0	(29)	0.0	-	-	-	-	(115)	0.0
$M\bar{3}$	Groove Pattern																
	Y	(23)	0.0	-	-	-	-	-	-	-	-	1	14.3	3	30.0	4	6.7
	+	3	13.0	-	-	-	-	-	-	-	-	1	14.3	(10)	0.0	26	43.3
	X	17	73.9	-	-	-	-	-	-	-	-	5	71.4	7	70.0	29	48.3
	Hy	3	13.0	-	-	-	-	-	-	-	-	-	-	-	-	1	1.7

Table 19c

Tooth	Trait/ Grade	SJo-68 n	SJo-68 %	Sakhalin Ainu n	Sakhalin Ainu %	Australian Aborigines n	Australian Aborigines %	American Whites n	American Whites %	Papago n	Papago %	Hopi n	Hopi %	Navajo n	Navajo %	Aleut n	Aleut %
$M\bar{1}$	Protostylid Tubercle	1	3.5	1	5.3	-	-	(99)	0.0	(154)	0.0	1	1.1	1	1.2	(65)	0.0
$M\bar{2}$	Protostylid Tubercle	(26)	0.0	-	-	-	-	(96)	0.0	(131)	0.0	(77)	0.0	2	2.7	2	3.8
$M\bar{3}$	Protostylid Tubercle	4	25.0	-	-	-	-	-	-	-	-	-	-	-	-	1	4.5
Palatine Torus																	
	absent	15	75.0	4	36.4	145	80.0	-	-	-	-	-	-	-	-	-	-
	slight	5	25.0	2	18.2	24	13.1	-	-	-	-	-	-	-	-	-	-
	medium	(20)	0.0	2	18.2	9	4.9	-	-	-	-	-	-	-	-	-	-
	large	(20)	0.0	3	27.2	3	1.6	-	-	-	-	-	-	-	-	-	-
	very large	(20)	0.0	(11)	0.0	1	0.5	-	-	-	-	-	-	-	-	-	-
Mandibular Torus																	
	absent	17	94.5	2	18.2	$>$100	100.0	-	-	-	-	-	-	-	-	-	-
	slight	1	5.5	2	18.2	($>$100)	0.0	-	-	-	-	-	-	-	-	-	-
	medium	(18)	0.0	2	18.2	($>$100)	0.0	-	-	-	-	-	-	-	-	-	-
	large	(18)	0.0	5	45.5	($>$100)	0.0	-	-	-	-	-	-	-	-	-	-
	very large	(18)	0.0	(11)	0.0	($>$100)	0.0	-	-	-	-	-	-	-	-	-	-

* = probable over-estimate due to not scoring additional variant forms
- = data not available or cannot be adapted
n = number possessing trait
(x) = number examined
Hy = hypoplastic

II. OBSERVATIONS ON PHYSICAL STRENGTH OF SOME WESTERN INDIANS AND "OLD AMERICAN" WHITES

Robert F. Heizer and Carol Treanor

During the year 1972-73 while one of us (RFH) was a Fellow at the Center for Advanced Study in the Behavioral Sciences (Palo Alto), the other (CT) was serving on the Computer Program staff at the Center, we collaborated on collection and analysis of certain data on the physical strength of Native Americans (Indians) and Old Americans (Whites) and the results, with commentary, are presented in this paper. Anthropologists have for a long time attempted to combat casual assessments of racial inferiority or superiority by arguing that these are usually based upon very subjective evidence. We provide here a body of objective data by which it is possible to achieve one measure of comparison between Native Americans and white Americans.

Literate observers who left a record of California Indians in the late eighteenth and early nineteenth century were European and American explorers and travellers. The Franciscan missionaries who had so much to do with Indians from 1769 to 1834 provide us with almost nothing in the way of objective and useful data on the neophytes under their charge. Generally speaking, despite differences in country of origin and creed, late eighteenth and early nineteenth century observers shared in the "Protestant ethic" whose tenets were devotion to hard work and self-denial, and it was only natural that they would evaluate other people they encountered in terms of these moral precepts. When some early European visitor to California described the Indians he saw as "lazy" or "self-indulgent," he was really saying "We work hard and are serious about life, but the Indian has no aim in life but to work as little as possible and enjoy being shiftless." That is one way to judge people, but it is not the only way. Cultures are workable systems by the application of which people get along sufficiently well to carry on the day-by-day routine of getting enough to eat, manage to mitigate the hazards which threaten their physical survival (whether these be from wild animals, famines, aggressive neighbors, floods, energy crises, earthquakes, droughts, tidal waves, and so on), and reproduce themselves in sufficient quantity to guarantee the maintenance and continuation of the social group. In these respects it appears that the California Indians at the time of their discovery by Europeans were a successful segment of humanity. We can say this because when the California Indians were first seen they constituted, as a whole, a series of small nations living side by side with neighbors with whom they had arranged reasonable terms of coexistence. There may have been occasional altercations (at times reaching the intensity of what ethnographers have termed warfare) over unauthorized crossing of tribal boundaries for the purpose of collecting seeds or hunting deer (we would call this poaching), but by and large the California Indians were clearly a congeries of independent societies (nations) who realized that survival, and perhaps more importantly, being able to live in peace, was more desirable than living in constant fear of armed attack.

For some reason the California Indians do not seem to have impressed white observers very favorably. In many cases the only Indians seen were mission neophytes who had been forced to abandon their customary ways and conform to the strict and repressive regimen of mission life. Describing Indians in this situation would be rather like a foreign visitor describing Americans through persons he encountered in a penitentiary. Other observers saw Indians who were the survivors of once larger groups who had been decimated and harassed, or were being harassed, by the gold miners who swarmed into California after 1848. The Indians were not in very good shape in those years, and the safest way to live was to do nothing to excite the suspicion of some rough miner who would "shoot first and ask questions afterward." By this we mean to say that by being retiring, obsequious, non-controversial and subservient, an Indian who was near whites in the 1850's and 1860's might avoid getting killed merely because he was an Indian. Deprived of their food-gathering means through seizure of the lands and streams used for hunting and fishing, and excluded from participation as equals in the new economy (farming, manufacturing, business, gold mining) they were simply squeezed out of everything which the dominant whites were able to do, or use. It is not surprising, therefore, that Indians from 1849 on seemed to cut a poor figure and were described in such unfavorable terms.

We give here a selected series drawn from a much larger collection of quotations on Indian character from the writings of observers of earlier times. Most of these are stated in terms that are distinctly unfavorable. A few are neutral, and still fewer actually say things which are positively favorable. One notes a preponderance of terms of derogation and opprobium--for example: bestial, brutish, brutal, careless, capricious, childish, contemptible, cowardly, cruel, debased, degraded, despicable, dirty, dull, fickle, filthy, inconstant, indolent, indifferent, inferior, improvident, lazy, loose, low, mean, miserable, negligent, pusillanimous, shiftless, squalid, stupid, thievish, treacherous.

After going through the following excerpts of characterizations of California Indians, the reader will sense the low regard of Indians held by many, perhaps most, whites in California a century and more ago. Along with the low opinion of Indian morals and diligence, there ran also the parallel belief of their inferiority in both mental and physical attributes. If Indians who lived in such a favored area did not develop a more outstanding culture, then they were mentally backward. If they did not effectively fight (with their bows and arrows) against the whites (with their pistols and repeating rifles), then they were cowardly and inept. Rather than view the conflict between self-assured and agressive whites and peaceful poorly-armed Indians as an unequal competition, the whites considered that the Indians lost the struggle because they were backward and cowardly and weak. It is this matter of weakness, in the physical or corporeal sense, that we later consider.

We may suppose that the derogatory comments of eighteenth and nineteenth century observers reflect, in part at least, their preconceptions of primitives--hunting and gathering peoples in particular. But since these accounts were widely read, the characterizations as such helped to shape and reinforce the opinions which readers, who did not know California Indians, were to develop. Many of these attitudes persist today, though awareness is growing that it is bad taste to express them publicly. It may be painful for Native Americans today to read these words and we do not recite them here because we are unaware of or insensitive to the pain they may evoke. We quote them because they are still in the published literature that is read and cited today, and believe that it is useful to remind people that these were views held a century ago by the great grandfathers of some California citizens. And, precisely because such evaluations of Indian character were so widely shared a century or so ago, their residual effect may to some extent still be a part of the attitude or belief of some living persons today. Only by publicly exposing these incorrect and vicious expressions which were aimed at advertising the assumed superiority of whites in earlier times can we hope to eradicate them insofar as they still exist in the thinking of some Californians today.

Quoted below, with the briefest indications of authorship, is a sample of opinions of early observers about the California Indians they saw. The selection of quotations includes examples from Franciscan missionaries, early European visitors, secular historians, run-of-the-mill California historians and writers of the Gold Rush period.

Font, one of the first Franciscan missionaries, in 1775 described the Indians as "distinguished from beasts only by possessing the bodily or human form, but not by their deeds." The round-the-world voyager Von Kotzebue in 1830 was of the opinion that "in stupid apathy they exceed every race of men I have ever known, not excepting the degraded races of Tierra del Fuego and Van Diemen's Land." The English sea captain Vancouver in 1789 described the California Indians as "certainly a race of the most miserable beings I ever saw possessing the faculty of human reason...very ill made, their faces ugly, presenting a dull, heavy and stupid countenance, devoid of sensibility or the least expression." Engelhardt, an official church historian wrote in his Missions and Missionaries of California (1930): "All accounts agree in representing the natives of California as among the most stupid, brutish, filthy, lazy and improvident of the aborigines of America." Tuthill, in one of the first general histories of California (1866), Hittell in 1897, and Bancroft in 1886 held a similar view of the Indians, and used such phrases as "stupid and brutish," "contemptible physically as intellectually," "lazy and improvident." The Gold Rush period observers (or at least some of these who were literate) sang the same tune, describing the Indians in such phrases as "possessed of mean, treacherous and cowardly traits of character," "the lowest grade of human beings," "low, shiftless, indolent and cowardly," "in their habits little better than the ourang-outang," and so on.

Bancroft (History of California I:777, 1886) wrote: "There are some who assert that the character of the Californian (Indian) has been maligned. It does not follow, they say, that he is indolent because he does not work when the fertility of his native land enables him to live without labor; or that he is cowardly because he is not incessantly at war; or stupid and brutal because the mildness of the climate renders clothes and dwellings superfluous. But is this sound reasoning? Surely a people assisted by nature should progress faster than another struggling with depressing difficulties."

A slightly more favorable note is sounded by Hittell when he says, "It must not be forgotten that there are descendants of these aboriginal inhabitants still left in the State of California, who hire themselves out as workmen. There may be an admixture of foreign blood in some of these cases; but from what can be observed of the remnants of the ancient people, there is every reason to believe that, if the proper means had been taken, they might have been civilized. It would not have taken much to make them into a better people than many of the common herd of Mexican convicts, vagabonds and vagrants who came into the country as soldiers or colonists and who prided themselves upon belonging, in contradistinction to the Indians, to the gente de razon." Pickering, a member of the United States Exploring Expedition under Wilkes referred to the California Indians as "fine, robust men, of low stature and badly formed." Fletcher who was the chaplain on Drake's ship spoke of the Coast Miwok Indians they visited with in the summer of 1579 as "commonly so strong of body that that which two or three of our men could hardly beare, one of them would take upon his backe, and without grudging carrie it easily away, up hill and downe hill an English mile together." Pfeiffer (Second Journal, 1856, p. 365) said, "Many of them are diminutive in stature, but they do not lack muscular strength, and we saw some who were tall and well formed," and Bryant (What I Saw in California, 1848, p. 266) reported the Indians as "rather below the middle stature, but strong, well-knit fellows...good looking and well-limbed."

Stephen Powers (Tribes of California, 1877, p. 416) wrote "That they were equal to Europeans in bread-winning strength nobody claims, for they lived largely on vegetable food, and that of a quality inferior to bread and beans. But as athletes they were superior, and they were a healthy, long-lived race. In trials of skill they used to shoot arrows a quarter of a mile, or drive them a half inch into a green oak. I knew a herald on the Upper Sacramento to run about fifty miles between ten or eleven o'clock and sunrise in September; another in Long Valley near Clear Lake, ran about twelve miles in a little over an hour. The strength of their lungs is shown by the fact that they would formerly remain under water twice as long as an American in diving for mussels.[1] All things taken together, I am well convinced that the California Indians were originally a fruitful and comparatively a healthy and long-lived race."

The abilities of Indian runners is further attested to by J. Bourke (Journ. Amer. Folklore, Vol. 2, 1889) who told about a Mohave runner, Panta-cha, who could run 100 miles between sunrise and sunset and after a brief rest make the return trip, the whole 200 miles being covered in 24 hours, the average speed being 8.4 mph. Bourke hired another Mohave runner who went 21 miles in 3.5 hours (average 6.0 mph) and noted that "this was regarded so commonplace a performance as to be worth but two dollars for the round trip."

Being aware of the almost invariably low opinion which white observers held of California Indians, and noting that they were often described as physically weak, we were interested in testing in some way the accuracy of such evaluations. Attributions such as "bestiality", "carelessness," "capriciousness" and the like are, of course, not subject to objective verification or denial, there being no measure one can apply to such imputed characteristics, especially when they have been offered by persons untrained in psychology a century or more ago. But for the supposed physical weakness of California Indians there do exist objective data which allow us to compare California Indians not only with certain other Native Americans, but also white Americans. If California Indians in the nineteenth century were a physically degenerated and weak population, then this should be apparent in measurements of their muscular strength.

The measurement of physical strength available to us is the hand-grip pressure, measured in kilograms, exerted on the Collins dynanometer. For California Indians, E. W. Gifford collected a large series of dynanometer readings and published these in his monumental study, Californian Anthropometry.[2] Data for several Southwestern

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1/ Livingstone Stone in Report of the Commissioner, U. S. Commission on Fish and Fisheries, for 1878, Part VI (Washington, 1880) speaks admiringly of the ability of the Wintu Indians to remain under water in the McCloud River whose temperature was below 50 degrees Fahrenheit.

2/ University of California Publications in American Archaeology and Ethnology, Vol. 22, No. 6, 1926.

American Indian tribes were collected and published by A. Hrdlicka.[3/] Hrdlicka used the same instrument (Collins dynanometer) which was employed for the measurements reported by Gifford. For white Americans, as well as some immigrant Americans of European origin, the same instrument was used to determine muscular strength (pressure) of right and left hands.

Gifford's data are a kind of grab sample since they consist of measurements which were made at different times among different tribal groups by anthropologists who happened to be carrying with them a Collins dynanometer and, at the urging of Alfred Kroeber, recorded data on physical measurements, including muscular strength (i.e. hand squeeze in kg) as the opportunity allowed.

Hrdlicka's data come from his own field observations---those of an incredibly devoted scientist and an indefatigable worker. Where he could, during the years he was studying the physical characteristics of surviving American Indian populations, he got people to squeeze the dynanometer, and recorded their performances.

The information we have on white Americans also comes from Hrdlicka who made a study of the physical characteristics of a large number of individuals who fitted his definition of "Old Americans"---persons whose ancestors on each side of the family were born in the United States for at least two generations.[4/] Hrdlicka was studying what might be called the "American race," a term which does not mean much as such, but which could have particular meaning if one were interested in trying to define the phenotypic characteristics of the American population.[5/]

When we examined the data on California Indians, other American Indians, and Old Americans, we immediately encountered problems of comparability. All the measurements were equivalent because they were given in kilogram readings on the same instrument, the Collins dynanometer. For California Indians we had quite specific data in terms of age, sex and tribe, but there were too few subjects to analyze the data on the basis of tribal affiliation. We solved this by combining the data into two lumped units of northern and central California tribes.

3/ Physiological and Medical Observations Among the Indians of Southwestern United States and Northern Mexico, Bureau of American Ethnology, Bulletin 34, 1908.

4/ The Old Americans. Williams and Wilkins, Baltimore. 1925.

5/ Among studies made see F. Boas, The American People. Science, May 28, 1909: 839 ff; Ibid. Changes in Bodily Form of Descendants of Immigrants. Columbia University Press, 1912; Ibid. Report on an Anthropometric Investigation of the Population of the United States. Journal of the American Statistical Association 18:181-209, 1922; G. T. Bowles, New Types of Old Americans at Harvard and at Eastern Women's Colleges. Harvard University Press, 1932; E. A. Hooton, What is an American? American Journal of Physical Anthropology. 22:1-26, 1936; H. L. Shapiro, A Portrait of the American People. Natural History 54:248-255, 1945; T. D. Stewart, Anthropology and the Melting Pot. Annual Report of the Smithsonian Institution for 1946:315-344, 1947; T. D. Stewart, The People of America. Scribners, 1973.

For some Southwestern area American Indians there were enough data to allow separate tribal-national groups to be considered as units---these were the peoples identified by Hrdlicka as Apache, Pueblo, Hopi, Zuni, Mohave-Yuma, Maricopa, and Pima-Papago.

There is something to be desired in terms of this being an ideal body of data to analyze. The California Indian records are too scant for particular groups to analyze on a tribe-by-tribe basis and therefore, as already stated, we were forced to combine a number of small sets of tribal data into larger and quantitatively more meaningful units.[6/]

We know nothing about the field sampling procedures used, and assume that Hrdlicka as well as the several ethnographers who contributed data for Gifford's compilation secured as many individual dynanometer measurements as they were able under the undoubtedly variable situations. Presumably no conscious effort was made to select persons on the basis of sex or age, so the data are essentially a grab sample. For this reason we decided to use as conservative a statistical procedure as possible in the attempt not to exploit results which might be due to sampling aberrations. The technique chosen was analysis of variance (ANOVA) where the unit of analysis was the means for each cell. In other words, data on individuals were not used in the ANOVA but only the means obtained from the individual data.

In order to remove the variance due to sex and age 3 way ANOVA was performed where the three factors were tribe, sex, and age groups. After the ANOVA produced a significant F for tribes, Tukey contrasts were performed to indicate exactly which pairs of tribes were significantly different.

The ANOVA on the means showed significant differences, at the .05 level, between tribes in both the right and left hands. The ANOVA tables are given below:

6/ Gifford's data on dynanometer tests include persons of all ages from 18 California tribes. For purposes of comparability we used measurements only of men and women between 21 and 60 years of age. The Central California tribes in our sample include persons identified as Wintu (Nomlaki), Pomo, Yana Salinan, Patwin, Maidu, Sierra Miwok, Yokuts, Monache and Chumash. The Northern California groups represented are Hupa, Karok, Yurok, Chimariko, Achomawi, Atsugewi, Chilula and Whilkut.

ANALYSIS OF VARIANCE: RIGHT HAND

SOURCE	SUM OF SQUARES	DEG. OF FREEDOM	MEAN SQUARE	EXPECTED MEAN SQUARE	F	p
MEAN	85294.31	1	85294.31	80.000		
T(Tribe)	239.8632	9	26.65146	8.000	3.01	.025
S(Sex)	5752.832	1	5752.832	40.000	650.57	.001
A(Age)	632.8215	3	210.9405	20.000	23.86	.001
TS	107.8633	9	11.98481	4.000	1.36	*
TA	186.5256	27	6.908357	2.000	.78	*
SA	79.26831	3	26.42276	10.000	2.99	.05
TSA	238.7556	27	8.842800	1.000		

ANALYSIS OF VARIANCE: LEFT HAND

SOURCE	SUM OF SQUARES	DEG. OF FREEDOM	MEAN SQUARE	EXPECTED MEAN SQUARE	F	p
MEAN	70471.69	1	70471.69	80.000		
T(Tribe)	436.2207	9	48.46896	8.000	8.70	.001
S(Sex)	4485.008	1	4485.008	40.000	804.63	.001
A(Age)	459.1738	3	153.0579	20.000	27.46	.001
TS	146.5078	9	16.27864	4.000	2.92	.025
TA	117.8418	27	4.364511	2.000	.78	*
SA	40.03320	3	13.34440	10.000	2.39	*
TSA	150.4980	27	5.574001	1.000		

More detailed analysis after the ANOVA revealed only one significant difference on the right hand--in this case between the Northern California Indians and the Southwestern Papago and Pima groups. Detailed contrasts on the left hand data revealed several pairs of significant differences. Of particular interest was the finding that the Old Americans were considerably weaker in muscular strength than the Central and Northern California Indians and the Apache Indians in the left hand. Furthermore, the Old Americans were not significantly stronger than any of the Indian tribes represented in our data. So we may conclude that the Old Americans measured by Hrdlicka and the Native Americans in California and the Southwest measured by Hrdlicka and other anthropologists, insofar as they can be taken as representative of whites and Indians, do show differences in muscular strength as measured with the Collins dynamometer, and that the Indians prove to be (except for the Papago) not weaker but stronger. If this is accepted, then the century-old implication that the California Indians succumbed to the white invasion because they were a physically weak people who could not stand up against the more powerful whites may not be true. We are, of course, aware that physical strength can be assessed by other means than the muscular force exerted by the right and left hands.

Generally speaking, there is little doubt but that the Indian way of life, both for males and females, involved more vigorous physical activities than did the life routine of most, if not all, of Hrdlicka's sample of Old Americans. We cannot support this last allegation with evidence that amounts to proof, but if we take the range of activities that men and women in aboriginal California societies engaged in[7/] and compare this with urban American male-female activities in the first two decades of the present century, we believe that it is positive that Indians, in the course of daily existence, used their muscles to a far greater extent. Granted this, Indians may have developed muscular strength to a higher degree of its potential than the urban whites to whom they are compared. If we could reverse the roles and have the same male and female Old Americans living as Indians were at the time the latter were measured with the Collins dynanometer, we might find the Indians' record was no better than the whites. We know of no way to resolve this question which revolves around the differential of life patterns experienced by two different racial groups who were operating in what were essentially different cultural worlds. But this is, after all, not the matter we were addressing ourselves to--our inquiry was aimed at trying to learn whether California Indians were a weakling segment of humanity, and although we have compared Indian muscular force records against those of Old Americans of the same period in the early twentieth century, we have no data for either group from a half-century earlier when the question of the Indian's physical inferiority was raised. How urban and rural whites and Indians would have performed if a Gifford or Hrdlicka had journeyed about in the eighteen-fifties with a Collins dynanometer (not yet invented) we cannot say, but we would incline to think that, relatively, things were the same, and that Indian men and women would have been a match for the newly Argonauts.

Many otherwise informed people in California still believe (because they were so taught by their third and fourth grade teachers) that the California Indias (often still referred to as "Diggers") were a "low-cultured" people who ate acorns, did not practice agriculture or make beautiful pottery, and hold the idea that they were physically inferior and that this accounts for their failure to withstand the onslaught of the whites. The real reason why the California Indians succumbed to the whites surely lies in other factors, among them being a long tradition of maintaining political independence, being divided into perhaps as many as 500 autonomous units (Kroeber calls them tribelets or ethnic nationalities), and thus being unable to meet the threat of the whites by general and united action. Also involved, we believe, was a world view shared by most California Indians which placed value on getting along with other people rather than glorifying aggressive behavior. The gold miners of the eighteen-fifties and eighteen-sixties were a particularly rough bunch who were armed to the teeth with pistols and repeating rifles, and with their attitudes about how worthless Indians were, with a "shoot first and talk afterwards" behavior, they found the Indian with his bow and arrow an easily bested foe.

The significant differences between the Old Americans and Indian tribes for the left hand (see Table 2) are summarized in the following table. Here the groups are arranged from weakest to strongest in terms of performance with the Collins dynanometer. Vertical lines at the right indicate groups within which no significant

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7/ N. C. Willoughby. Division of Labor Among the Indians of California. University of California Archaeological Survey, Report No. 60:1-79, 1963.

differences were found.

Papago	26.2
Old Americans	27.4
Hopi	27.8
Zuni	28.6
Pueblo	28.7
Mohave	28.8
Maricopa	30.7
Central Calif.	32.3
Apache	32.5
North Calif.	33.5

We secured essentially the same results when ANOVA and detailed comparisons were made on the data for the left hand of men and of women.

The means used in the ANOVA and other detailed contrasts are shown in the following table. Many differences between groups defined by sex and age are obvious in this tabulation, but the figures bear out our conclusion that western American Indians were physically able peoples who were not inferior in this regard to the American whites who usually wrote and acted as though they were superior. The whites were, of course superior in the literal sense of the word when we apply it to the situation of the face-to-face meeting in combat of the two groups. But whether the victor in such an unequal contest--one which he has clearly won--is justified in taking this as proof of his superiority in any other than a win-or-lose sense, we can question. The recent U. S. -Indochina war is another of these unequal technological-racial-political contests. The United States drained off its treasure (money as well as irreplaceable natural materials) and men (50,000 dead) in a war which it lost. The United States fought that war against a people it was forced to dehumanize in much the same way it tried to dehumanize the California Indians. But that formula did not any longer work in 1970 as it had in 1850, and this we take as a hopeful sign that things are a little better than they were a century ago.

		Old American	Northern California	Central California	Apache	Pueblo	Hopi	Zuni	Mohave Yuma	Maricopa	Papago Pima
Male	24-29	42.3 (86)	56.2 (3)	53.0 (3)	46.0 (28)	41.6 (15)	41.9 (21)	41.4 (19)	43.0 (24)	47.8 (7)	39.9 (31)
	30-39	43.2 (61)	48.8 (9)	37.0 (1)	45.6 (7)	42.9 (15)	40.7 (16)	39.1 (16)	49.0 (11)	44.2 (11)	40.9 (23)
	40-49	40.9 (45)	43.8 (5)	39.8 (8)	41.8 (10)	38.6 (11)	38.1 (4)	41.0 (8)	38.4 (9)	48.0 (12)	38.0 (22)
	50-59	40.3 (33)	36.1 (7)	37.4 (12)	32.4 (5)	34.4 (11)	33.3 (8)	31.2 (11)	36.3 (21)	38.3 (7)	32.7 (12)
	Mean	41.7 (225)	46.2 (24)	41.8 (24)	41.4 (50)	39.4 (52)	38.5 (49)	38.2 (54)	41.7 (65)	44.6 (37)	37.9 (88)
Female	22-29	25.2 (70)	28.3 (7)	27.3 (3)	26.4 (11)	24.7 (14)	26.7 (7)	27.9 (5)	24.8 (5)	29.5 (6)	23.9 (15)
	30-39	24.0 (68)	27.8 (9)	26.0 (6)	26.9 (5)	23.2 (5)	25.4 (10)	24.7 (6)	25.7 (10)	28.9 (12)	22.9 (15)
	40-49	23.0 (32)	18.0 (4)	22.0 (1)	25.7 (8)	21.1 (6)	25.7 (5)	24.3 (6)	27.6 (8)	22.2 (5)	20.8 (13)
	50-59	18.3 (26)	26.3 (8)	22.8 (5)	25.3 (2)	20.8 (3)	20.9 (7)	21.8 (12)	22.3 (6)	19.1 (7)	18.7 (13)
	Mean	22.6 (196)	25.1 (28)	24.5 (15)	26.1 (26)	22.4 (28)	24.7 (29)	24.7 (29)	25.1 (29)	24.9 (30)	21.6 (56)
Overall Mean		32.1 (421)	35.7 (52)	33.2 (39)	33.8 (76)	30.9 (80)	31.6 (78)	31.4 (83)	33.4 (94)	34.7 (67)	29.7 (144)

Table 1. Means on right hand pressure, measured in kilograms, for Old American whites and Native Americans. Figures in parentheses are numbers of persons in each age or sex group sample. Data from Gifford (1926) and Hrdlicka (1908, 1925).

		Old American	Northern California	Central California	Apache	Pueblo	Hopi	Zuni	Mohave Yuma	Maricopa	Papago Pima
Male	24-29	37.2	52.7	41.7	42.9	38.8	37.6	38.3	38.7	39.9	35.7
		(86)	(3)	(3)	(28)	(15)	(21)	(19)	(23)	(7)	(32)
	30-39	37.0	45.7	38.5	43.9	39.1	36.1	36.4	41.5	38.1	36.3
		(61)	(9)	(2)	(7)	(16)	(16)	(17)	(11)	(11)	(23)
	40-49	35.7	41.8	34.2	41.5	35.6	33.6	35.2	33.3	43.1	33.4
		(45)	(5)	(6)	(10)	(11)	(4)	(9)	(9)	(12)	(22)
	50-59	34.0	36.5	39.1	32.1	33.0	27.8	28.1	30.8	32.9	28.9
		(33)	(6)	(9)	(5)	(11)	(8)	(12)	(21)	(7)	(12)
	Mean	36.0	44.2	38.4	40.1	36.6	33.8	34.5	36.1	38.5	33.5
		(225)	(23)	(20)	(50)	(53)	(49)	(57)	(64)	(37)	(89)
Female	22-29	21.1	26.4	26.7	25.5	22.9	23.1	25.6	22.4	27.5	20.3
		(70)	(7)	(3)	(11)	(14)	(7)	(5)	(5)	(6)	(15)
	30-39	20.0	25.4	28.0	25.9	22.1	22.8	22.6	20.9	25.7	20.1
		(68)	(9)	(6)	(5)	(5)	(10)	(6)	(10)	(12)	(15)
	40-49	19.4	17.3	26.0	24.1	19.5	22.3	22.3	23.9	21.7	19.1
		(32)	(3)	(1)	(8)	(6)	(5)	(6)	(8)	(5)	(14)
	50-59	15.1	22.5	24.6	24.5	18.8	19.3	20.2	18.8	17.1	16.2
		(26)	(8)	(5)	(2)	(3)	(7)	(13)	(6)	(7)	(13)
	Mean	18.9	22.9	26.3	25.0	20.8	21.9	22.7	21.5	23.0	18.9
		(196)	(27)	(15)	(26)	(28)	(29)	(30)	(29)	(30)	(57)
Overall Mean		27.4	33.5	32.3	32.5	28.7	27.8	28.6	28.8	30.7	26.2
		(421)	(50)	(35)	(76)	(81)	(78)	(87)	(93)	(67)	(146)

Table 2. Means on left hand pressure, measured in kilograms, for Old American whites and Native Americans. Figures in parentheses are numbers of persons in each sex or age group sample.