



Trapper's cabin at Noorvik, Alaska, 1987. © R. Drozda.

A SYNOPTIC HISTORY OF PHYSICAL ANTHROPOLOGICAL STUDIES ON THE PEOPLING OF ALASKA AND THE AMERICAS

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Abstract: Because of Alaska's and the New World's geographic proximity to Siberia, coupled with a lack of New World pre-modern human fossils, social and natural scientists of every sort agree that Alaska was where humans first set foot in the New World. Agreement fades on most other considerations, be they the precise route(s), the exact timing, the homeland(s), the cultural inventories and diet, the number of migrants, their biological diversity and characteristics, and other considerations. Alaskan workers provided much of the key archaeological, paleo-environmental, linguistic, and physical anthropological evidence for what has come to be called the classic three migration model for the peopling of the Americas. This model has received much attention, not all favorable, but it remains the most parsimonious model when all forms of evidence are evaluated together. Since I was one of the contributors to the three migration model, I would like to review the physical anthropological and genetic evidence that favored three migrations, rather than one, two, four, or more. The main theoretical problem is deciding how variation should be partitioned and then substantiated.

Keywords: Peopling New World, Migration, Dentition

INTRODUCTION

More than half a century ago, Joseph B. Birdsell (1951) pointed out that the history of biological studies of Native Americans essentially began in the 1700's with the attempts at human racial classification by naturalists such as Buffon and Blumenbach. In this early phase of taxonomic inquiry about human variation, which would in time become part of physical anthropology, Birdsell noted that no serious subsequent workers doubted that the ancestors of Native Americans had originated in Asia. Furthermore, nearly all scholars assumed on various grounds a Beringian route of entry, even though the land bridge concept had yet to be scientifically developed until the twentieth century. Moreover, that route was narrowed down early in the American period of Alaskan natural history studies, when William H. Dall (1877) persuasively argued that the Aleutian Islands could not have been the route used to reach the New World.

The closeness of Alaska to Siberia suggested to many who thought about the origin of Native Americans, especially American Indian osteological specialist Aleš Hrdlička, (1925), that Alaska was where humans first set foot on American soil. Adding to the geographic proximity the strong resemblances he and others measured in facial and other anatomical features of Native Ameri-

cans compared with ancient and modern East Asians, as well as other Old World and Oceanic populations, left no room for doubt that a migration across Bering Strait had occurred. Furthermore, Hrdlička felt that the migration was relatively late because of the complete lack of pre-modern human fossils (or any anthropoids for that matter) in the Americas such as the heavy-browed big faced Neanderthals found in Europe. Thus, Hrdlička proposed both the source and the approximate timing of the colonization of the New World on comparative anatomical grounds alone. This was a considerable contribution to knowledge when it is recalled that earth scientists of his time did not know when the Pleistocene ended. But, what else can boreal physical anthropology tell us about the Siberian colonization of Alaska and the Americas?

I want to make only one point in this article. That point is that even after almost a century of research (Table 1), the physical anthropological evidence for the peopling of the Americas still suggests that only a few migrations need to be hypothesized to best explain human biological variation in North and South America. While Crawford (1998), as well as science writers Virginia Morrell (1990), and Tablita Powledge and Mark Rose (1996), have claimed there has been a major revolution in New World

migration studies, in fact, there is no such revolution when consideration is given to what has been proposed during the last 100 years of scientific research on the prehistoric colonization of the Americas (Table 1).

The peopling of the New World involves several fascinating issues, of which I will note only six, albeit number 6 is not as well developed:

- (1) Was there more than one party of colonizers? As Table 1 shows, most scholars interpret their biological evidence as saying yes.
- (2) How many were in that party or parties? This is difficult to answer, but low early prehistoric biological and cultural variation hints at only a few hundred founders, not thousands. Infant and childhood death rates, probably high as guessed at from the young ages of the very few Pleistocene human skeletal remains found in Siberia, would suggest the effective population size was even smaller.
- (3) What were the route(s) they followed? Physiographically, the Pleistocene Bering land bridge would have offered a wide interior rolling plane route characterized by windswept tundra-steppe and Arctic steppe, and an ice-pack scoured beach along the southern Beringian coast. Food, fuel, and fabrication material resources were likely scarce along both routes.
- (4) Where precisely was the ancestral homeland of Native Americans? Northeast Asia is a big place, but ultimately Mongolia and northern China are better bets than southeast Asia or Europe. No dental, genetic, or archaeological data even hint at an Ainu-Jomon affiliation.
- (5) Was there anything else besides climate factors that made the Beringian crossing so late in the worldwide dispersal of anatomically modern humans? Perhaps. As part of my Siberian studies, my Russian associates and I are exploring the possibility that large social carnivores such as wolves or hyenas inhibited population growth and expansion in Siberia (Turner et al. n.d.).
- (6) In addition to important questions about disease and Arctic life, anatomical adaptation to cold, etc., there are collateral issues including many

other questions of a non-physical anthropological nature (Derev'anko 1998; Meltzer 1993; Yesner 2001).

The "peopling" of the New World was precisely that if one adheres to Rouse's (1986) definitions of dispersal. "Peopling" to him meant a migration into a previously unoccupied area, which at one or another point in time would be most of the world. Aside from two or three candidate but controversial archaeological sites, there is very little evidence for a pre-Clovis peopling anywhere in the New World, especially the full range of evidence that satisfies multiple criteria for identifying an archaeological site as proposed by Willey and Phillips (1958). If there had been a pre-Clovis peopling of the New World, then the Clovis folk would represent a "migration" in Rouse's view, causing the extinction or near extinction of the earlier inhabitants, remnants of whom Lahr (1995) and others suggest survived in the far southern Fuegian and Patagonian region of South America. Rather than get bogged down in the speculative question of a pre-Clovis peopling of the New World, for which there are no skeletal remains older than 12,000 BP to assess the question, I will review only the question of *migration number* that can be proposed on multiple lines of abundant local and regional biological evidence. I want to do so because this question triggered an avalanche of discussion and research following a 1986 jointly-authored publication on the topic by Joseph H. Greenberg, Stephen L. Zegura, and me. Readers may know of this paper by one or another of the various names it has received: the "new synthesis," the "tripartite model," the "classic model," the "Greenberg theory," as well as some disparaging names I prefer not to repeat.

THE THREE MIGRATION HYPOTHESIS

The 1986 paper (Greenberg et al. 1986) outlined our independent findings from linguistics (JHG), blood group genetics (SLZ), and dental anthropology and archaeology (CGT). The variation and geographic divisions of each data set could be interpreted as having resulted from three separate colonizing waves of migrants. This was because Greenberg's three language families were unrelated, and hence, had to have been carried in by independent groups of speakers of Amerind, Na-Dene, and Aleut-Eskimo. The same applied to the dental evidence because local evolution could not explain all of the hemispheric variation and regional data clusters, nor could ecological conditions explain the substantial geographic correspondences in our four kinds of information. Independently, we identified three groups of languages, genes, teeth, and archaeological clusters. Each corresponded

Table 1. New World Migration Number Based on Physical Anthropological Data

Author(s) & Year	Migrations	Basis	Comments
1. Hrdlička 1925	4	Craniometry, anthroposcopy	Long heads first, then round-heads, Athapaskans third, Eskimos last or at same time as Athapaskans. No one in New World before 15,000 BP: marked homogeneity
2. Hooton 1947	>1	Osteology	Non-Mongoloids first, followed by several later groups, some being Mongoloid
3. Birdsell 1951	2?	Anthroposcopy	First were Amurians (archaic Caucasoids); later came Mongoloids (dihybrid theory)
4. Rivet 1957	2?	Anthroposcopy of living	South Americans from Australia via Anarctica; others by way of Bering Land Bridge
5. Howells 1967	1-2	Craniology	Earliest Indians were proto-Mongoloids; Mongoloid Eskimos possibly second wave
6. Stewart 1973	2	Anthroposcopy of living	Indians first, later followed by Aleut-Eskimos
7. Turner 1971	3	Dentition	Indians, Greater NW Coast (Na-Dene), Aleut-Eskimo
8. Alexseev 1979	?	Anthropometry of living	Old Siberians likely less Mongoloid than today; were more like American Indians
9. Laughlin et al. 1979	2	Osteology RBC	Indians, Aleut-Eskimos
10. Spuhler 1979	?	RBC	All North American Natives are one geographic race. Does not evaluate South Americans
11. Szathmary 1979	?	RBC	Szathmary unable to make a determination
12. Szathmary 1985	2-3	RBC	One migration gets south of Wisconsin ice sheet 27,000 BP (Algonguians etc); Athapaskans held north of ice sheet; An Asiatic Beringian group was source of Eskimos
13. Salzano 1985	?		Accepts pre-12,000 BP dates for South American migrants, some of whom possibly were pre-Polynesian Pacific peoples
14. Williams et al. 1985	3	GM	Amerind, Na-Dene, Aleut-Eskimo
15. Zegura 1985	2-3	Synthesis	Material culture suggests initial occupation of 40,000-12,000 BP; genetics indicates Indians first, then Na-Dene and Aleut-Eskimo, perhaps separately

Author(s) & Year	Migrations	Basis	Comments
16. Laughlin & Harper 1988	1	RBC, ecology, etc.	All New World people derived from migrants following south coast of Bering Land Bridge
17. Shields et al. 1992	>1?	MtDNA	All Beringians closely related, Alaskan and Siberian
18. O'Rourke et al. 1992	2?	RBC	Eskimos have separate origin from all Indians including Na-Dene
19. Steele & Powell 1992	?	Osteology of Paleoindians	Recent entry, but before modern cranial features fully evolved
20. Ossenberg 1992a, 1992b	>2	Osteology	Clusters Aleuts with Na-Dene Indians rather than with Eskimos. Sees 2 migrations, but does not discuss rest of North & South America
21. Schanfield 1992	4	GM	South Americans entered before 17,000 BP; North Americans ca. 10,000 BP; Na-Dene & Eskaleut later
22. Wallace & Torroni 1992	2	MtDNA	Amerind & Na-Dene; no discussion of Aleut-Eskimo
23. Torroni et al. 1992	2?	MtDNA	Amerind and Na-Dene founded separately
24. Jantz et al. 1992	?	Anthropometry of 19 th cen. Living (Boas)	No differences in all North Americans, but Na-Dene more like Aleut-Eskimo than like Macro-Algonquians
25. Shields et al. 1993	2	MtDNA	Early group with 9-bp deletion; all Circumarctic groups lack the 9-bp deletion. This evolution estimated started at 13,000-12,000 BP
26. Cavalli-Sforza et al. 1994	3	RBC	Amerind, Nadene, Aleut-Eskimo
27. Merriwether et al. 1995	1	mtDNA	One migration
28. Lahr 1995	2	Osteology	More than one group founded South America
29. Forester et al. 1996	3	MtDNA	Early arrivals lacking haplogroup B, 25,000-20,000 BP; haplogroup B arrive separately; Eskimo and Na-Dene share common ancestor in Beringia, spreading at 11,000 BP
30. Crawford 1998	3		Diuktai first to arrive at 40,000-30,000 BP; next were Na-Dene at 10,000-8,000 BP; last were Aleut-Eskimo at 4,500 BP

Author(s) & Year	Migrations	Basis	Comments
31. Brace 1999	2?	Craniology	Finds Jomonese like Indians of Tierra del Fuego; Athapaskans resemble Tibeto-Chinese
32. Neves et al. 1999	4	Craniology	Non-Mongoloids in South America first; go extinct with arrival of subsequent migrants
33. Powell & Rose 1999	2?	Osteology	Kennewick Man not like recent Indians, nor like any Holocene population
34. Torroni 2000	3	MtDNA	Two early migrations; one with haplogroup A, C, D; a second with halogroup B; these followed by ancestors of Na-Dene and Eskimo. First arrived 34,000-26,000 BP; haplogroup B arrived 15,000-12,000 BP; Na-Dene arrived 10,000-7,000 BP. Haplogroup X was an additional founding lineage with old relation to X in Europe
35. Chatters 2000	?	Osteology	Proposes multiple migrations for American Indians; Finds Kennewick similar to Ainu & Pacific Islanders
36. Crawford 2001	?	MtDNA	Aleuts like Chukchi, and are not from Kamchatka (a finding supporting W.H. Dall, W. Jochelson, A. Hrdlička, D. Jenness, W.S. Laughlin, C.G. Turner, others)
37. Steele & Powell 2002	?	Osteology	"early Holocene peoples contributed some of their genes to mid-Holocene populations, and plausibly to some more recent North and South American Indians as well"
38. Merriwether 2002	1	MtDNA	Haplogroup X possibly a second migration
39. Lell et al. 2002	2	Y chromosome	Indians from Lake Baikal; Athapaskans from lower Amur; no discussion of Aleut-Eskimo
40. Zegura 2002	2?	Y chromosome	Three migrations not correct; two more likely
41. Hammer 2002	3	Y chromosome	Indians, Na-Dene, Aleut-Eskimo
42. Turner 2002a	3	Dentition	Reaffirms 1971 position; finds Spirit Cave and Wizard Beach to be Sinodonts and not like Ainu, Jomonese, Polynesians, or Europeans
43. Zegura 2003	1	Y chromosome	Disavows his previous inferences

Author(s) & Year	Migrations	Basis	Comments
44. Zegura et al. 2003	2	Y chromosome	Two separate lineages from the Altai region
45. Turner 2003	3	Dentition	Reaffirms 1971 position with a new analysis and more data.

RBC denotes red blood cell antigens and other serum polymorphisms.

^a Zegura (2002) has noted that literally hundreds of papers have appeared that test or support the Greenberg, Turner, and Zegura (1986) synthesis. Undoubtedly more physical anthropological articles deal with the migration number than those listed above. Moreover, there is some ambiguity in the above citations with regard to exactly how many migrations the author(s) proposed. I have indicated this ambiguity with a question mark (?). If I have erred in missing key papers or interpreting the migration numbers reported herein, I would be grateful for these additions and corrections.

^{aa} Although Hammer was reported as having proposed the three migrations noted above, Zegura (personal communication) says it was a newspaper reporting error.

rather well in their geographic distribution. This multiple bodies of evidence-three wave theory was first published in a rather obscure and inappropriate outlet in Zagreb (Greenberg et al. 1985). To better place our views and get some reaction, we expanded that paper and submitted it to *Current Anthropology*, which published it in 1986 along with remarks from five commentators. Much to our surprise there followed a firestorm of reaction. We had apparently pushed the hot button of many Americanists studying language classification, human biological variation, adaptation, and the early prehistory of the Americas. Many of the initial comments were favorable, while others were rude personal attacks, such as one from a linguist that said Greenberg should be "shouted down." I was quickly accused of being only a "partial archaeologist," which was among the gentler of several appellations. How could three such mild-mannered and scientifically conservative academics cause so much emotion and agitation? I do not understand the psycho-dynamics of what our publication triggered, but I want to outline for you how I reached my three migration viewpoint, and then simply itemize the interpretations of several other researchers on the issue of biological evidence for the founding New World migration number (in Table 1). Before I do, however, it should be noted that Greenberg (1987, 1990), has set forth the evidence for his threefold New World language classification, as have I (Scott and Turner 1997). However, Zegura has twice revised his views, and most recently thinks that there was only one migration on the basis of Y chromosome data. This, of course, does not agree with the massive amount of genetic data assembled by Cavalli-Sforza et al. (1988, 1994) that conforms with the three-

wave hypothesis. Nor does one migration explain dental variation in the New World, or the possibility of a pre-Clovis group that might have gone extinct or been forced to the extreme southern tip of South America as seems to have happened with invasions in other parts of the world.

DENTAL MORPHOLOGY

As will be briefly discussed below, the dental morphology system that my Arizona State University students and I began developing in the early 1970's for the purpose of worldwide population comparisons of affinity and origins, including migrations, has proven to be quite satisfactory as a highly reliable source of diachronic and synchronic epigenetic information obtainable at low cost and minimal equipment needs (Scott and Turner 1997). While some of our inferences and interpretations of population history have sparked interesting discussions (Armelagos and Calcagno 2001; Laughlin 1986; Szathmary 1986), most have been met with considerable agreement. Interpretations aside, the methodology has been well received and is in wide use around the world.

A POSSIBLE THIRD MIGRATION TO THE NEW WORLD

In the late 1960's, my post-doctoral North American dental studies were not matching the generally accepted two-fold division of New World populations, namely Indian and Aleut-Eskimo divisions (Birdsell 1951). The samples that were showing unquestionable intermediacy between Aleut-Eskimos and Indians were initially

from living Navajos, who are Athapaskan-speakers belonging to the Na-Dene family of the Pacific Northwest and Alaska interior. This anomalous finding was reported at the Mexico City meeting of the American Association of Physical Anthropologists in 1969, followed by its publication in 1971. Subsequently, other Athapaskans and eventually other late historic and earlier archaeological assemblages from the greater Na-Dene language family area were studied, including far northern crania from Yukon River burials collected by Hrdlička. Thanks to a suggestion by Roy L. Carlson (personal communication), I eventually referred to these archaeological-derived and presumed Na-Dene speakers as Greater Northwest Coast, so as to dispel potential misunderstanding that I had a perfect language-dental correspondence. This renaming due to the language-archaeological correlation problem was not understood by geneticist E. Szathmary (1986:490) in her commentary on Greenberg et al. (1986). She also seemed unable to understand other diachronic issues in New World prehistory as seen in her unreserved acceptance of the alleged 27,000 BP Old Crow site, and a 21,000 BP date for Meadowcroft (Szathmary 1985:81). Old Crow “osteofacts” are no longer considered as having been made by humans (Haynes 2002), and Meadowcroft remains unconvincingly pre-Clovis to a number of workers (for review see Dixon 1999).

In 1981 I proposed that four scenarios might explain this Greater Northwest Coast intermediacy. Two involved migration models and two dealt with admixture. Figure 1 illustrates the four possibilities for explaining the intermediacy of the Greater Northwest Coast (Na-Dene) dental group. The top two models envision divergence in Siberia. The bottom two envision admixture in Alaska.

The four models are based on discovering three New World dental groups using trait frequency information as in the bar graph of Figure 2. Note how in most instances the Aleut-Eskimo traits have higher or lower sample means (dots) and ranges of means for various samples (bars) than do Indians, whereas Na-Dene/Greater Northwest Coast are generally intermediate.

In 1980 I started collecting Siberian dental observations in the former U.S.S.R., and I immersed myself in Russian literature about the anthropology and natural history of that vast region (Turner 1987a, 1987b). I eventually came to suspect that the greater Northwest Coast intermediacy had evolved in Siberia prior to the Beringian transit and was not a product of admixture in Alaska between proto-Aleut-Eskimo and Paleo-Indians. My Siberian experience could not reject a three migration scenario. In part, this is because most samples of Indian

teeth have a few traits with a slightly stronger dental resemblance to modern Europeans and European Cro-Magnons than do Aleut-Eskimos or Greater Northwest Coast people. Hence, I proposed that the proximate origin of the Paleo-Indian ancestors of modern Indians had been in the western portion of eastern Siberia as illustrated. These would have been the Arctic steppe or tundra steppe nomads who hunted live game and even scavenged dead or dying megafauna as exemplified in the West Siberian Upper Paleolithic find of the 18,300 year-old Tomsk mammoth site excavated and described by N.F. Kashenko (1901).

Figure 3 shows how New World dental samples cluster with those of the Old World. Eskimos, Aleuts, and NE Siberians are more like each other dentally than they are like Northwest Coast or all other American Indians. None are like Europeans. Because Aleut-Eskimo teeth have trait frequencies more like those of far eastern Siberians, I proposed their origin was from an Upper Paleolithic proto-maritime population in the lower Amur-Hokkaido region. This homeland proposal was influenced by the late Pleistocene archaeology of Primorye (Russian Far East) and Hokkaido greater geographic region; by William Laughlin (1963), Chester Chard (1974), Masakazu Yoshizaki (1963), Anatoly Derev'anko (1990), and Ruslin Vasilievsky (1984, 2001), all of whom envisioned the blade tool-making folk of northern Japan and lower Amur as ancestral to the Aleutian Anangula blade site. Moreover, the similar “hyper-Mongoloid” faces of the Aleut-Eskimos and the peoples of Kamchatka, Primorye, and Chukotka are well documented (Bowles 1977). Figure 4 shows the New World dental trichotomy and why North and South America are pooled.

Finally, the vast rumpled forest, forest-steppe and steppe region between the Lena and Amur rivers must have contained some human groups who were genetically and morphologically intermediate between the more western and the far eastern Siberians (Figure 5). Hence, the intermediate qualities of the Greater Northwest Coast dental pattern, in my view, is better projected back into Siberia, rather than hypothesizing that the branching occurred later in eastern Beringia-Alaska as inferred by Szathmary and Ossenberg (1978). I proposed that these proto-Na-Dene had their proximate homeland between the Lena and the Amur river basins. The Na-Dene are generally agreed to be a valid micro-taxonomic group. That is, they consist of a community of people whose languages, culture, genetic make-up, and archaeology differ in many ways from their surrounding neighbors. The issue is where and how did they form. Richard Scott (1991, 1994) has reviewed the Na-Dene question in con-

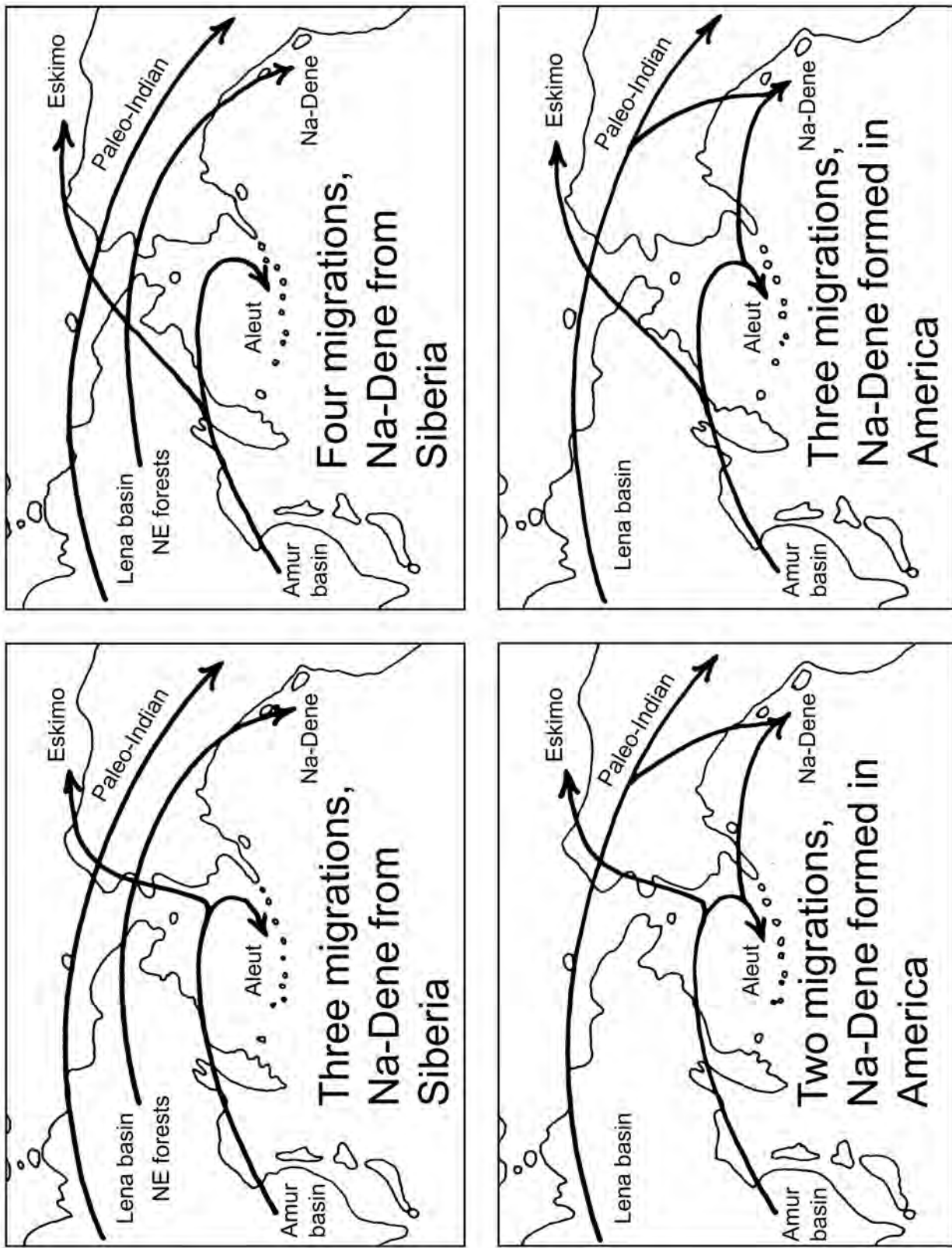


Figure 1: The original four models developed to explain the generally intermediate frequencies of the Na-Dene (Greater Northwest Coast) dental morphological traits. At the time of development, the general thinking was that there were only two migrations to the New World [Reprinted from Turner (1983)].

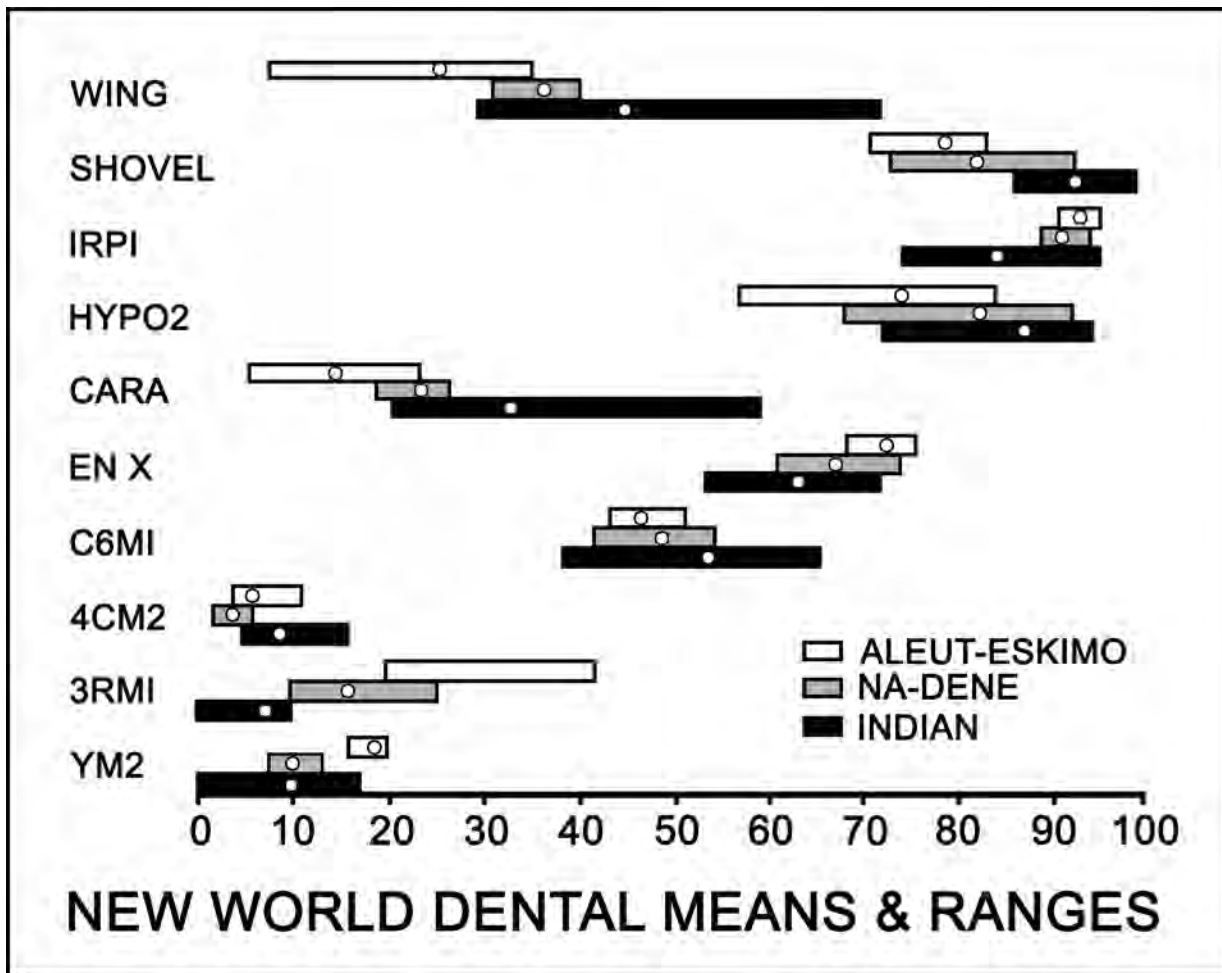


Figure 2: Ten of the 28 dental trait frequencies that early in the 1970's signaled the likelihood of three New World dental groups. The range of means for the Indian samples reflects in part their greater number of regional and local samples. North and South American Indian samples have been pooled because of their very small amount of inter-hemispheric difference. Total sample size is approximately 10,000 individuals, nearly all from archaeological excavations to avoid the problem of European and African genetic admixture.

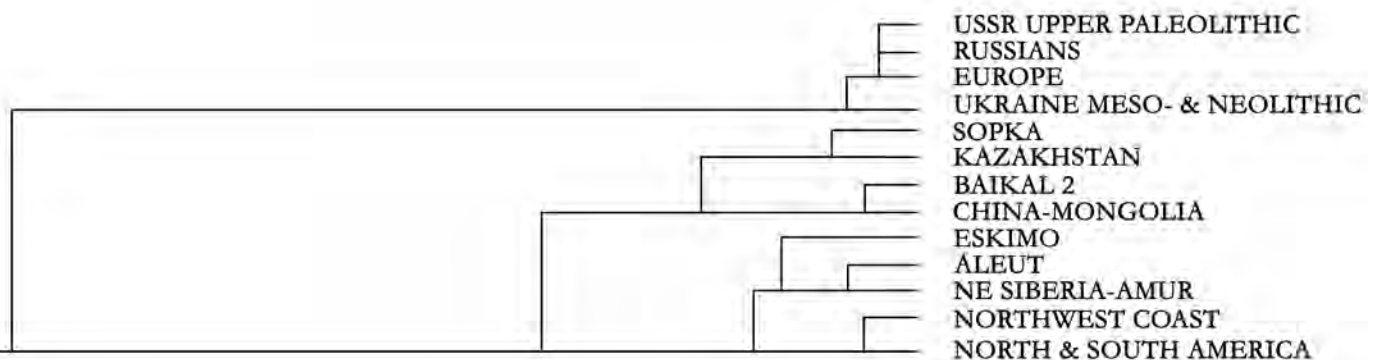


Figure 3: Dendrogram of New and Old World dental similarities based on Mean Measures of Divergence using 28 dental traits and clustered with Ward's method (CGT computer reference: American Indian origins #3). Note the marked difference between the Europeans ("U.S.S.R" Upper Paleolithic, modern Russians, Europe, and Ukraine Mesolithic and Neolithic) in contrast to the Asians and Americans. The Asians include Sopka (southwestern Siberia), Kazakhstan, Lake Baikal, and China-Mongolia. The Asians are less like the Europeans than they are like the Americans (Eskimo, Aleut, and North-South America). NW Coast refers to Greater Northwest Coast. NE Siberia-Amur contains mainly people from and near the eastern coasts of Primorye and Siberia, which hints strongly at an old Maritime connection, whereas the Greater Northwest Coast and Indian clustering suggests an interior crossing of Beringia as suggested in Figure 5 and the two upper models of Figure 1.

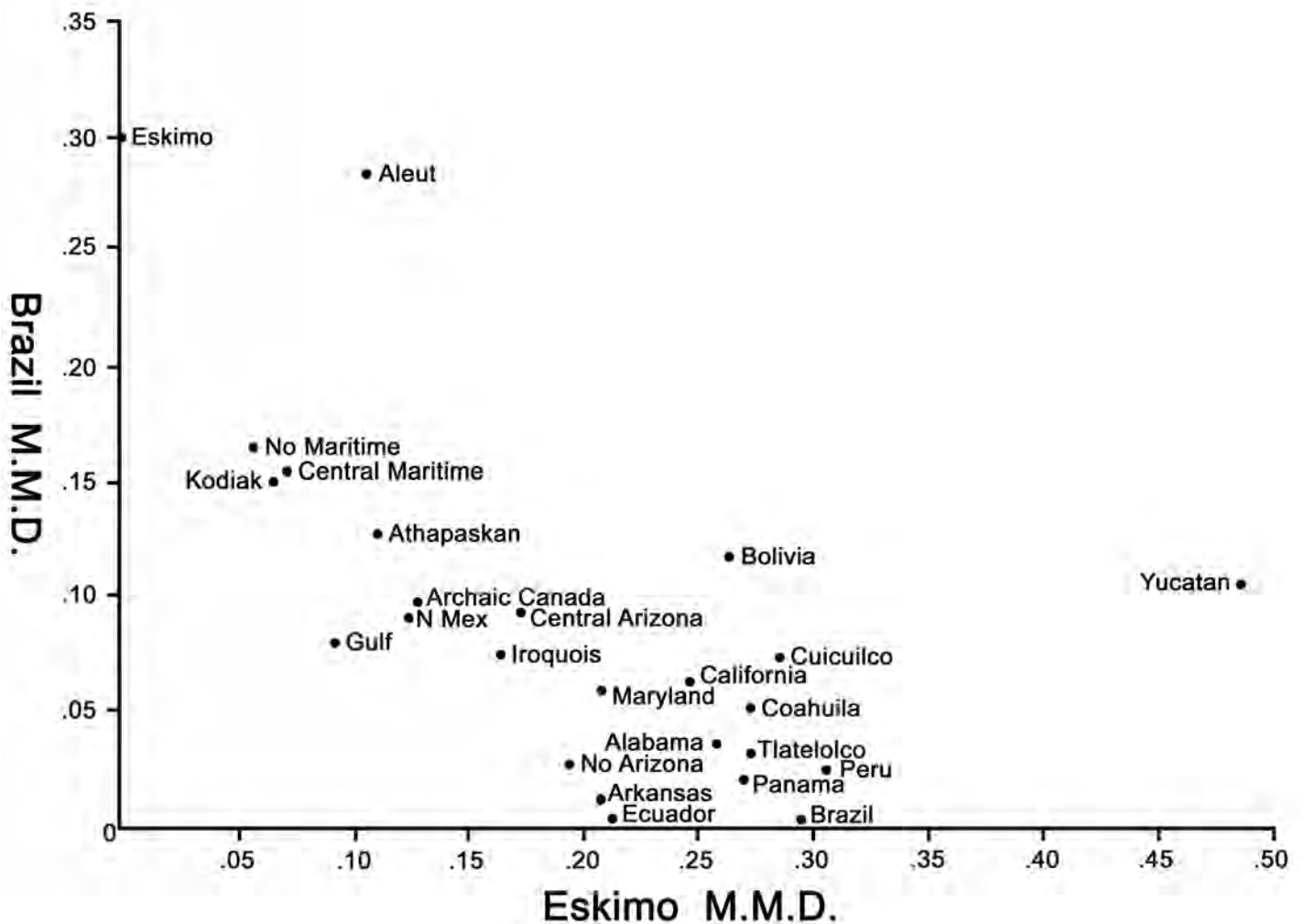


Figure 4: A two dimensional plot of several MMD values plotted against their pairing with far south (Brazil) and far north (Eskimo) samples. This plot suggests much of the same as the dendrogram of Figure 3, although only New World are used here. The overall sense is that Aleuts and Eskimos are relatively similar to one another and much less similar to all other New World samples to be positioned between the Aleut-Eskimos and all other North and South American Indians. Kodiak is mainly represented by the Uyak site, which I have interpreted to mean that it's inhabitants were as much like Greater Northwest Coast as they were Eskimo, if not more so. This is a controversial issue that has yet to be resolved (see Scott 1991, 1994).

siderable detail, and while we do not completely agree, our differences arise from how we interpret our individual analyses. Let me go into a little more detail with two specific dental traits.

Figure 6 is a crown trait named the Uto-Aztecan premolar by Donald H. Morris et al. (1978). Morris first found examples of the Uto-Aztecan premolar in living Southwestern U.S. Indians belonging only to that language family, and not in any other dentitions in our large worldwide collection at Arizona State University. Since then, expanded study has found this trait in low frequencies throughout prehistoric, historic, and living North and South American Indians. It has not been found in any Northwest Coast, Kodiak, Athapaskan, Aleut, or Inuit sample. It is one of several traits that distinguishes Native Alaskans from all other Native Americans. To date,

one Uto-Aztecan premolar has been found in Siberia. A.M. Haeussler (1996) discovered it in a cranium excavated from a Bronze Age Trans-Baikal site called Reka Iya. That sample and one other I found in an Australian Aborigine skull are the only two known for the entire Old World and the Pacific Basin. The Uto-Aztecan premolar is a rare Asian polymorphism that was probably limited to the Siberian ancestors of Indians. Thus, it usefully illustrates that there was likely a minimum of two migrations to the New World. Both migratory groups possessed what I call the Sinodont dental pattern, but one, the early Paleo-Indians, possessed (and the second, the later Alaskans, lacked) the rare gene(s) for the Uto-Aztecan premolar. This trait also suggests that Na-Dene was not formed as a hybrid population in the New World, otherwise I would expect to have found one or two examples by now in the Greater Northwest Coast dental group.

Figure 7 shows a three-rooted lower first permanent molar (3RM1), a trait that occurs primarily in Asian and Asian-derived populations such as Chinese, Japanese, Mongols, and to a lesser extent Ainu, Southeast Asians and Austronesian-speaking Pacific islanders. Worldwide, having two roots is the more common variant of this polymorphism. 3RM1 is rare to non-existent in nearly all known samples of African, west Asian, and European teeth. It occurs in about 5 percent of all North and South American Indians, including Paleo- and Archaic Indians such as Colorado's Gordon Creek, Florida's Melbourne, and Brazil's Lagoa Santa, among others. About 15 percent of Greater Northwest Coast peoples have 3RM1. Its frequency reaches 40 percent in some Aleut-Eskimo samples. Its frequency distribution is not supportive of the Aleut-Indian versus Inuit migration model proposed by Ossenberg (1992a, 1992b), on the basis of non-metric cranial traits. 3RM1 is one of several dental traits that individually and in combination suggest the possibility of a third migration to the New World. Now, let us take a look at the problem of migration number on the basis of other lines of biological evidence.

OTHER PHYSICAL ANTHROPOLOGY EVIDENCE

Table 1 tallies what researchers have been proposing for the number of migrations during the past 75 years based on physical anthropological evidence. To put these biological proposals in broader anthropological perspective, it should be noted that the number of migrations based on non-biological evidence reach into the hundreds in one linguist's view (Voegelin 1958). There are many more than three migrations based on archaeological inference (Meltzer 1989), and a constant flow of people and ideas

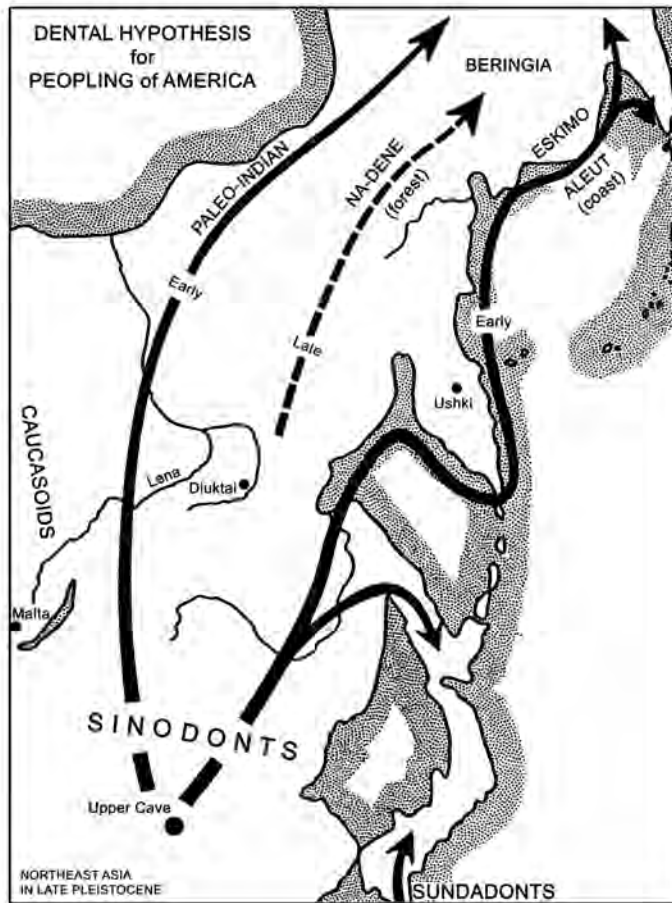


Figure 5: The three migration hypothesis as synthesized from Asian and New World dental morphology, archaeology, Pleistocene environment, linguistics, and blood group genetics. Reprinted from Turner (1986).

on the basis of ethnography (Fitzhugh and Krupnik 2001). In other words, the grouping or subdividing of human biological variation in the New World is generally regarded as being relatively less than that found in linguistics, archaeology, and ethnography. This is probably as it should be since culture was undoubtedly the first means of adaptation when the Arctic steppe-adapted hunting and gathering Siberians entered the new and different American environments (in Alaska alone, eight ecoregions are recognized today by Spencer et al. [2002]). As such, genetic adaptation was only minimally needed, perhaps only in the physiological realms of dealing with new plant toxins, new pathogens, and eventually Andean high altitude stress. Minor differences in New World faces, head forms, and robusticity

can be easily attributed to local sexual selection, effective breeding population size, and non-genetic bone modeling due to various masticatory activities depending on dietary practices and food types.

Table 1 shows that a three migration scenario is not an outlandish proposal. Of greatest importance is the fact that all of the proposals beginning with Hrdlička and ending this year with Zegura, suggest a small number of migrations, namely one to four. There are no proposals that I can find in the twentieth century literature that suggest on biological grounds anything greater than four migrations except for one scheme developed by Imbelloni (1938) for South America, and rejected by Newman (1951), as having been purely typological. We can excuse Imbelloni's proposal since it was made in the days when all variation was explained mainly by migrations (Adams et al. 1978). If there is any historical significance to Table 1 it would be this: Proposals prior to ours of 1986, and even afterwards, generally recognized that the New World had been colonized first by the ancestors of Indians, followed by the ancestors of Aleut-Eskimos

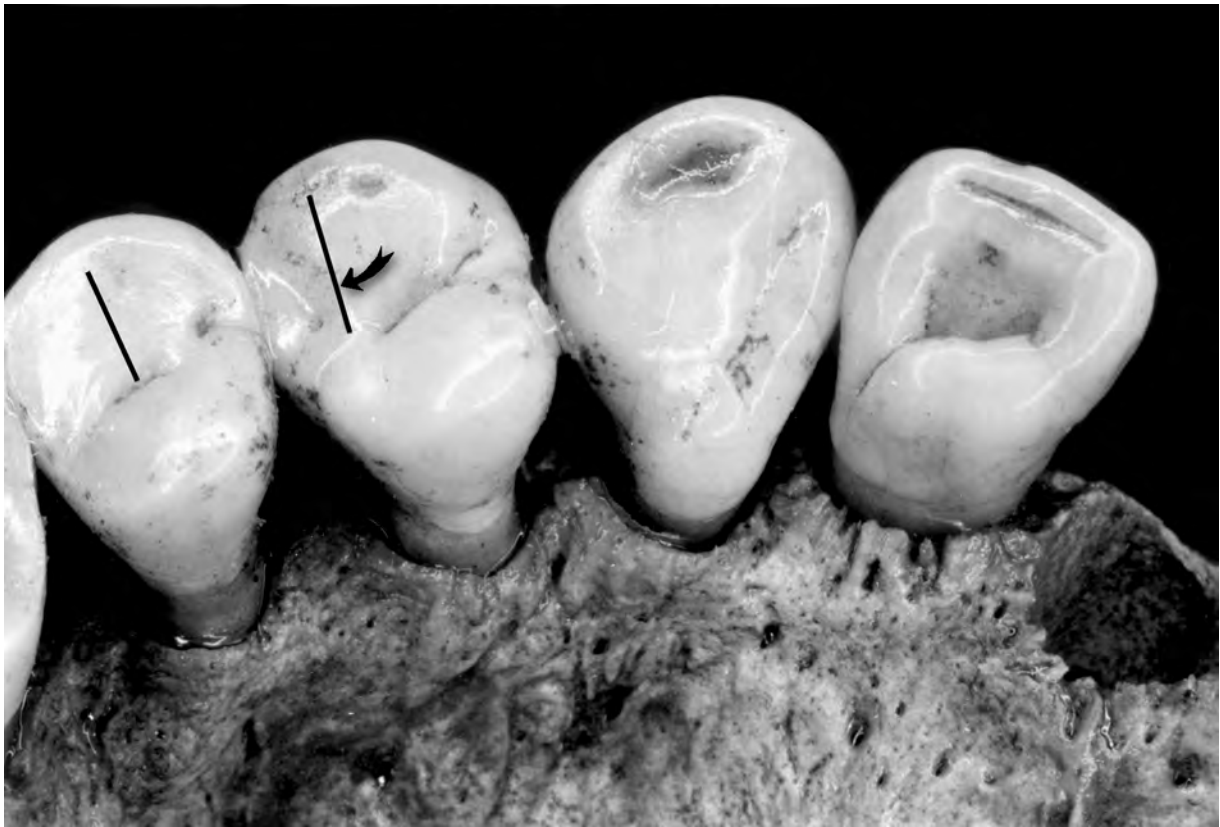


Figure 6: This image shows some of the adult teeth on the right side of a prehistoric American Indian upper jaw. The tooth on the far right is a second incisor with pronounced shoveling caused by the strongly raised ridges on each of the side borders of the tooth. Shoveling is very common in all New World populations as shown in Figure 2, but it differs slightly in frequency in the three New World dental groups. Shoveling is one of the defining characters of the Sinodont dental pattern, of which New World dentitions I have examined belong (Turner 2002a). The Uto-Aztec premolar discussed in the text is shown third from the right. This premolar variant is determined by the asymmetrical features of the large crown cusp next to the cheek, as compared with the normal buccal cusp in the second premolar shown at the far left.

(Laughlin 1975; Laughlin and Harper 1988), although not always explicitly so. This dual origin thinking used the proto-taxonomic terms of the 1930's to 1980's of proto-Mongoloids and Mongoloids, respectively. Linguistics also contributed to this dual origin thesis. Early on it was recognized that Aleut and Eskimo were related languages, that had no relationship with Indian languages. Moreover, the internal diversity in Aleut-Eskimo was much less than that of the Indian family, hence, Aleut-Eskimo-speakers had to have arrived from Asia later than the proto-Indian-speakers.

With the exception of Rivet (1957) and Salzano (1985), most other researchers envisioned colonization from northeastern Siberia. However, Rivet believed some of the far southern South American peoples and cultures had "primitive" characters brought by "primitive" Australians by an Antarctic route. Salzano's view seems to have been influenced by some of the South

American blood group frequencies that resemble those of Pacific Islanders. In addition to these exceptional views, and there are others, I would like to note there is also a strong tilt in South American studies towards the acceptance of very suspicious early dates as well as accepting cranial "primitiveness" in Fuegian-Patagonian crania as evidence of a non- or pre-Mongoloid migration to the New World (Lahr 1995), without the benefit of any genetic analysis on cranial morphology that might show the differences to be epigenetic rather than environmental (i.e., chewing stress).

The contribution of Alaskan archaeology to the colonization problem is substantial (more than 150 publications according to Workman [2003]). Thanks to the efforts of W. R. Powers and associates (Hoffecker and Elias 2003; Hoffecker et al. 1993; Powers et al. 1983), the Dry Creek site magnificently documents two distinctive cultural components, which I and others (Hoffecker

et al. 1993), view as possibly ancestral Paleo-Indian, and later, Paleo-Arctic or ancestral Greater Northwest Coast. The temporal and cultural duality of this stratified site is backed up by several well-dated single component sites (see various Alaska authors in West 1996). The unique Anangula Blade Site has steadily become accepted as ancestral Aleut as Laughlin and Marsh hinted back in 1951 (Dumond 2001). Thus, there is also a useful working hypothesis for three migrations based on the well-dated findings of cultural variation in Alaskan archaeology. However, this hypothesis could be replaced at any time with new Alaskan archaeological finds, i.e., Dixon (1999), Holmes and Crass (2003), and new understanding of paleoenvironments.

The biological evidence for the peopling of the New World unquestionably leans toward a few rather than many migrations. All of the physical anthropological and genetic studies going on today in Russia indicate that Siberia was the proximate homeland of all Native Americans (Shields et al. 1993; Zegura et al. 2003; others). Human remains in Siberia are extremely rare until Neolithic times. There are only a few upper Paleolithic sites such as Mal'ta, Afontova Gora, Denisova Cave, Okladnikov Cave, and Listvenka that have even a pittance of human bones and/or teeth. What little there is, however, is enough to rule out any port of entry other than Alaska for the initial immigration of Old World humans into the Western Hemisphere.

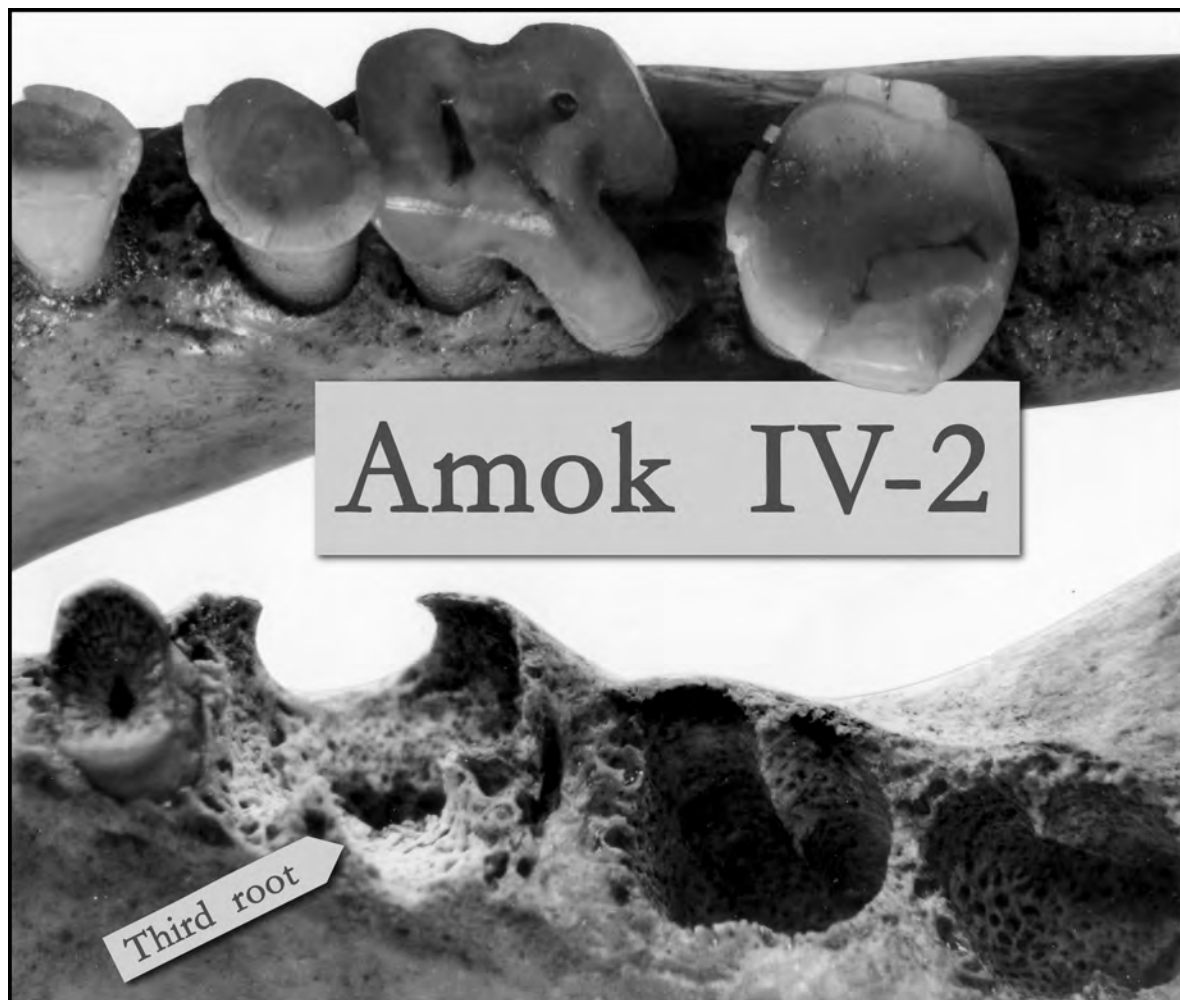


Figure 7: Shown is a three-rooted lower first molar, which is discussed in the text. The supernumerary third root projects toward the “k” in Amok. The lower toothless jaw illustrates how the three-rooted condition can be identified even when the entire tooth has been missing for several years. Reprinted from Turner (1971). This trait also helps define Sinodonty. It’s relatively low occurrence in Indians, in contrast to the Aleut-Eskimo and Greater Northwest Coast, suggests an ancestral Indian origin in the more western region of eastern Siberia where gene flow from European Cro-Magnon people may possibly have occurred. All known past and present-day Europeans generally lack the three-rooted lower first molar, having instead the two-rooted alternative to this dental polymorphism. The late Pleistocene relationships between Europeans and Asians are largely not understood (Turner 2002b).

PARTITIONING VARIATION

Finally, a few remarks need to be made regarding the theoretical problem of how to partition variation, which is at the heart of all systematics of nature. Greenberg (1999:17) discussed this problem in the framework of *lumping and splitting* as seen in linguistics and biology: “The lumping vs. splitting opposition, then, in biology rather refers to the fineness of distinction required to assign different taxa taxonomic status within recognized larger groups.” “Fineness of distinction” is at the heart of our issue here. How do we define and recognize a prehistoric migration? How much and what kinds of distinctiveness should be required in order to claim the number of migrations? Not only is this methodological concern not dealt with in Table 1, neither do most of the authors cited there define what they mean by the term migration, despite there being a massive sociological, anthropological, demographic, historical, economic, and natural historical literature on the topic of migration. Whether there was one or multiple waves of prehistoric colonists, or a continuous flow of immigrants into Alaska from Siberia must now be decided on how one defines migration in archaeological and paleoanthropological terms.

I would like to argue a little bit against the ethnographic view of Fitzhugh and Krupnik (2001:5), that dismisses migration theories:

It is ironic that many archaeologists, bio-anthropologists, and linguists continue to be impressed by three-stage models of New World prehistory (see Greenberg 1987; Turner 1988). There is hardly a possibility of single migration theories or scenarios of massive population or cultural transfers across the North Pacific, such as those advanced by the Jessup Expedition team a century ago.

This view is obviously oriented toward splitting rather than lumping.

In addition to being more heavily historical than scientific, the “continuous flow” idea is weak on the following grounds. First, a monothetic classification can be proposed with a single trait such as the Uto-Aztecan premolar that dichotomizes the New World into two groups that presumably represent two migrations. The same could be done with mtDNA haplogroup combinations, rare blood group alleles, and so forth as used by workers identified in Table 1. However, presence or absence of single characters can be profoundly influenced through time by population size and structure, neither of which

can be rigorously estimated thousands of years before the present. Alternatively, polythetic classification involves the use of several characters and their frequencies. Many characteristics, especially those with a polygenic mode of inheritance and apparent selective neutrality would better resist the vagaries of effective breeding population size and its potential for marked genetic drift and random changes in major gene frequencies. Years ago Denniston (1966), demonstrated that pronounced changes in blood group gene frequencies between generations took place in a Kodiak village simply on the basis of one man’s social and economic standing. This is, of course, part of the reasoning favoring genetically more complicated but environmentally neutral traits with minimal environmental plasticity. That is what all of the post-1986 workers identified in Table 1 have tried to do.

Second, the “continuous flow” view fails to explain why there are nodes or clusters of cultural, genetic, archaeological, and linguistic features that when formally analyzed produce some very satisfactory dendrograms of inter-group similarities and dissimilarities that are best explained by migration rather than any of the other three evolutionary processes—natural selection, mutation, and genetic drift. Among the better prehistoric cases in my experience, the two that stand out as best demonstrated are the migrations of mainland Asians to Japan beginning around 2000 B.C. (Turner 2003), and the Polynesian migration from Southeast Asia (Turner 2003).

The problem of defining a paleo-migration has been best addressed by Irving Rouse (1986). He identifies twelve fundamental concepts involved in dispersal theory. Most importantly one of these concepts “...breaks up migration into levels based chiefly on group size, and another weighs alternatives to migration” (Turner 1987c:460). Group size of the first Americans has generally been considered as relatively small. Given the paleoenvironmental reconstruction of the Bering land bridge, the assumption of small numbers of migrants is far better than imagining the Beringian migration as a flood of people, like, for example, that caused by the Irish potato famine, or the massive Latino migration into the U.S. today. These first Beringian migrants would have been actual migrants, not some wave-like pulse of gene flow or ethnographic diffusion. Their migration may have been highly punctuated, that is, within some period of several generations. The movements may have occurred as a result of natural population growth, or, and I feel more likely, as due to the chaos (usual storms, game herd movements, etc.) of the world’s harshest environment undergoing terminal Pliocene climate changes (Hoffecker and Elias 2003).

Rouse's weighting principle involves testing with independent data, which was the method used in the Greenberg et al. three migration proposal. Did we come up with any alternatives to migration as an explanation for our data sets? No. Alternatives were considered, especially local evolution within specific ecological contexts, but they were rejected on distribution and boundary considerations as less parsimonious than calling on migrationism. Did we come up with any alternatives to the three migration scenario? In part yes, because Zegura was not sure if his genetic data indicated two or three migrations. Since then he has fully opted out of the three migration scenario, as indicated in Table 1. Greenberg has passed away but among his last writings on this topic that I am aware of, he still adhered to the tripartite theory (Greenberg 1996). In addition to my own Siberian fieldwork, I continue to monitor newly published English and Russian language findings in physical anthropology, historical linguistics, archaeology, and reanalyses of existing data that might deal a death blow to the three migration model. The disagreement among anthropological geneticists about the number of migrations creates a tendency to want to table their entire enterprise until such time as they reach some sort of agreement on migration number (the same could be said of osteologists). When information on New World and Siberian archaeological, linguistics, and human biological variation information is evaluated for the combined effect, I feel it still points to the three migrations. However, being restricted herein to a review only of the physical anthropological data, a three migration scenario is certainly within the range of "few" proposed. But three migrations may be at the upper limit of the few needed to partition New World human variation into an historical classification that is acceptable by independent testing based on language, archaeology, ecology, and other factors.

CONCLUSIONS

In conclusion, I propose that we are approaching consensus for identifying the number of late Pleistocene-early Holocene Siberian migrations to the New World. The back-and-forth continuous stream notion has at best only a very little support in linguistics, archaeology, and physical anthropology despite the occasional successful historic boat trip from Alaska to Siberia. Such rare events can be viewed as simply "leakage" in incompletely closed population and cultural systems. In my view, one migration is simply not enough to explain the biocultural variation in the New World. A minimum of two is obligatory. Three are really needed to get the physical anthropological, genetic, archaeological, linguistic, and natural historical evidence to fit together. There seems little need to

hypothesize a fourth migration or one before Clovis, at least on the basis of presently existing evidence. I suggest they all occurred in late Pleistocene times during the tumultuous climatic and ecological changes that began 16,000 years ago. This interpretation is seemingly acceptable to at least one Alaska archaeologist, namely Fred West (1966). However, we need some Alaskan Pleistocene human remains. On this score, David Yesner has promised me a place near the front of the line to examine whatever human teeth and bones may eventually turn up at the Broken Mammoth site. There is reason to hope for this possibility because of the good preservation at this important 11,800 year-old site (Yesner 2001).

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