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Aleuts: Ecosystem, Holocene History, and Siberian Origin

Soviet and U.S. scientists join in a study of the origins of the first Americans.

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When the Russians discovered the Aleutian Islands in 1741, they properly used the Aleut word *Alaska* to designate the larger mainland to the east. The Aleut point of view is useful in understanding the actual history of the Aleutians and the Aleutian ecosystem. The Aleutians are the principal focus, and present-day Alaska is simply a map inset (Fig. 1). A significant part of the human and faunal components of the Aleutian ecosystem is related to Beringia of which the eastern Aleutian Islands were at an earlier time a southwestern extension.

Beringia, the Bering Land Bridge, was a large and broad area, extending at least 1200 km from north to south (*1, 2*). It was breached some 13,000 years ago and inundated over much of its area by 10,000 years ago. The ancestors of the American Indians may have already passed through the interior on their way into North America, but the ancestors of the Aleuts and the Eskimos migrated along the richer coastal route. Nine thousand years ago, sea level was some 30 m lower than today, and there was a different configuration of island clusters. Human occupation spans 8700 years inside Nikolski Bay, Umnak Island. It has always been a coastal occupation, and therefore the archeological sites reflect the sea levels contemporary with the people who extracted their living from the sea.

Aleuts discovered the Aleutian Islands and 8700 years later the Russians discovered the Aleuts. In fact, the Russians discovered a flourishing resident population which had much earlier migrated from the same place the Russians themselves had sailed from. The ancestors of the Aleuts had walked around the southern coast of Beringia, taking to boats where necessary, and entered the eastern Aleutians from the east. The Aleuts numbered some 16,000 and occupied the entire area from Port Moller on the Alaska Peninsula and the Shumagin Islands at the eastern margin of their domain to Attu Island at the western end of the chain, a linear distance of 2000 km.

The Aleuts had their own race, language, and culture. Their intellectual achievements went unnoticed, but their mastery of *baidarka* (Eskimo *kayak*) hunting of whales and sea otters was well documented for it was economically important and fascinating to watch. The Aleuts had many kinds of baidarkas, as well as the large open skin boat, the *baidar* (Eskimo *umiak*). In addition to their original one- and two-hatch versions, after 1764 they fabricated a three-hatch model to transport administrators. They made the keelson of two or three pieces instead of one (the long member running down the middle inside) in order to provide flexibility in the turbulent seas on which they hunted. For short distances they could spurt fast enough to catch some birds, albatross or shearwater, on the water, and they made 18- and 20-hour trips without landing. Their skill in sea otter hunting earned them a monopoly which was never usurped. No Caucasian ever learned to hunt from a baidarka. Consequently, the Russians employed Aleuts for sea otter hunting and transported them as far as the Channel Islands off Santa Barbara, California.

This skilled use of the baidarka required an early and systematic childhood training, which involved stretching the tendons of the shoulder for casting harpoons with a throwing board and the tendons of the back and legs for sitting in the baidarka, as well as training in navigation and in animal behavior. It was impossible for even the most obtuse observer to overlook the dramatic hunting of whales, sea lions, seals, and sea otters. However, the accomplishments of the Aleuts in marine technology, hunting, and navigation were matched by the less obvious development of a sophisticated knowledge of human anatomy (*3, 4*). They conducted autopsies on humans and comparative anatomy on the sea otter (also a tool-using mammal), practiced acupuncture, developed a good knowledge of health and medical practices with much skill in the delivery of the newborn, and prepared mummies.

Their orientational abilities were reflected in their system of naming internal anatomical parts, navigation, making maps, and making models of boats and animals. A. Chamisso, a naturalist on the Kotzebue Expedition and also a poet (author of *Peter Schlemihl*), asked some Unalaska Aleuts to carve wooden models of whales and give their uses. He then reproduced the models in plates and published his study (*5*). Interestingly, even the baidarka models are faithful replicas of the full-size boats, complete with two- or three-piece keelson. They may be seen in the Museum of Anthropology and Ethnography in Leningrad. The Aleuts' orientational abilities were necessarily related to their experiential and performance world. Baidarka hunting on the open sea required balancing on a moving and permeable surface and harpooning a partially exposed sea mammal who was also in constant motion.

The Aleuts also adopted and adapted European cultural innovations quickly. They learned to play chess and played at high speed, and they accepted with equal

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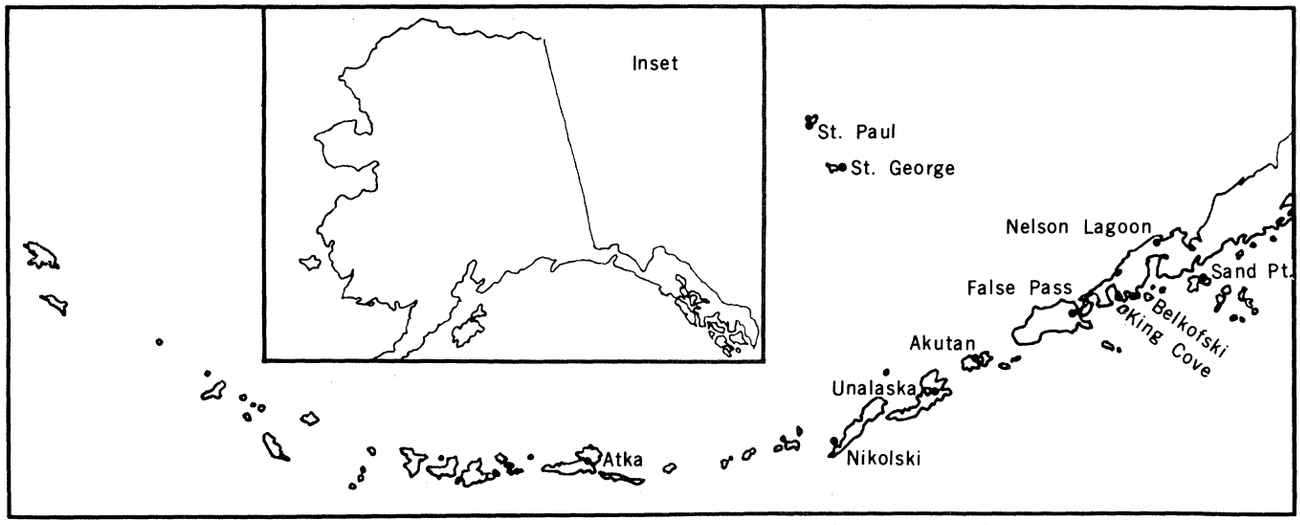


Fig. 1. Map of the Aleutian Islands and (inset) Alaska. [Modified from a map in the 1972 annual report of the Aleut Corporation, Anchorage, Alaska]

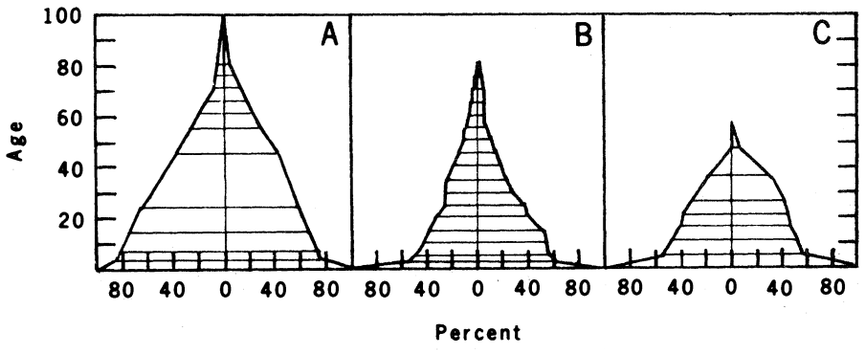


Fig. 2. Age distribution of Aleut and Eskimo populations. (A) Aleuts of the Fox Islands [Unalaska Island, 1822–1836; data from Veniaminov (*3*)]. (B) Aleuts of the Commander Islands (1902–1917) and (C) Eskimos of Southampton Island, of Hudson Bay [until 1903; data from Laughlin (*13*)]. [Modified from Rychkov and Sheremetyeva (*10*)]

speed and skill the Aleut alphabet which a Russian Orthodox priest, I. Veniaminov, prepared for them. Within 3 years of acquiring the alphabet, one Aleut wrote a book and many others, men and women, took to writing diaries and letters.

The achievement of a large population and a sophisticated culture is related to the nature and productivity of their environment and to their extended length of life. The Aleuts have sampled their ecosystem in great detail and are accurately described as the key species in it. They are a classic example of man in the ecosystem and their population structure is an expression of good management of natural resources, for no species became extinct during their stewardship of the area.

Population Structure

Population structure is an interesting expression of the way in which the Aleuts adapted to their ecosystem. The total population of the Aleuts at the time of the Russian discovery, 16,000, indicates the carrying capacity of this environment, as does the population of sea otters (50,000) with which they competed for the sea urchins (*6*). The human population was divided into three breeding isolates, separated by distance and dialectical barriers. Population density averaged more than one person per square habitat kilometer of maritime exploitation area, and was uniform over all three isolates, although the

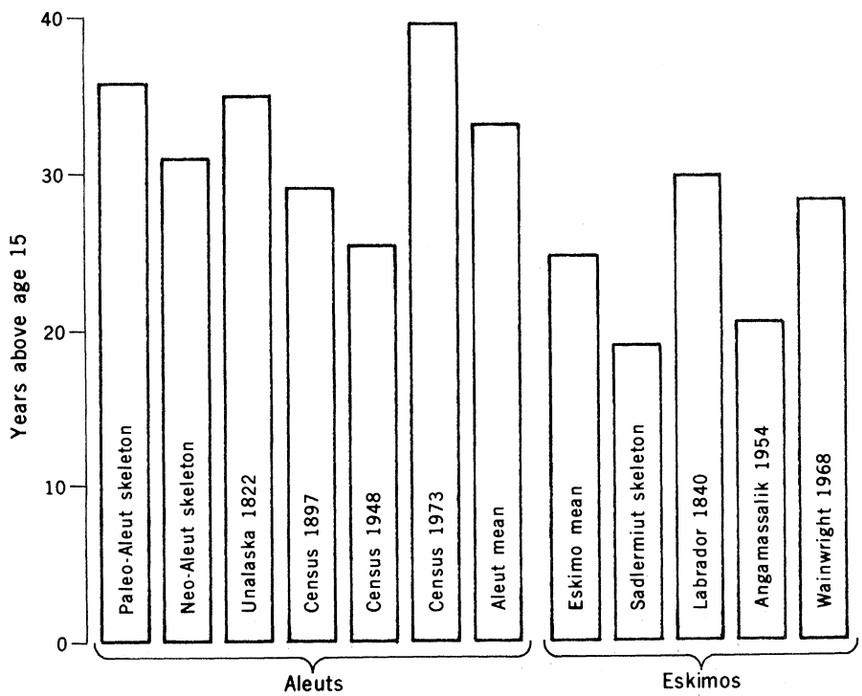
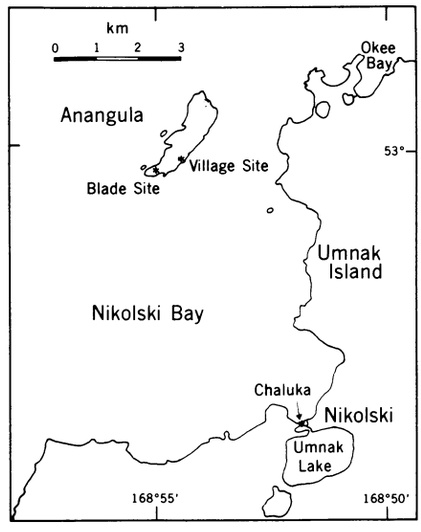


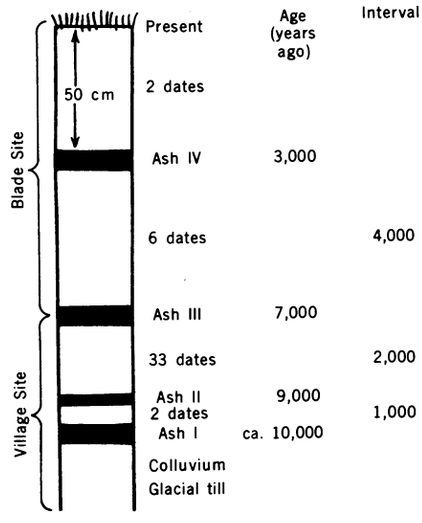
Fig. 3 (left). Life expectancy of males at age 15. If a male survives to age 15, the bar indicates the additional number of years he may expect to live. The scale on the left begins with age 15. [Courtesy of A. B. Harper]

population within isolates increased from west to east. In the western Aleutians (Attu and other islands) the human population was about 1000, in the central islands (Atka, Adak, and others) about 5000, and in the east (Umnak, Unalaska, Akutan, the Shumagin Islands, and Port Moller) about 10,000 (*7*). The larger number of Aleuts in the east is related to the length and complexity of coastline. Because of the large size of the eastern population natural selection was a more important agency than genetic drift, whereas the small number of western Aleuts permitted more chance fluctuations in the transmission of traits between generations. The succession of Paleo-Aleuts by Neo-Aleuts in the eastern area reflects this potential for change.

A large number of skeletons excavated in the Aleutians showed advanced age in the closure of their vault sutures and in the phases of the pubic symphyses of their pelvic bones (*8, 9*). The skeletal evidence is especially valuable in showing how long the Aleuts lived before they were exposed to European diet and living conditions. The earliest record, maintained by Veniaminov (*3*), gives the age at death of 411 persons and is an excellent sample for a 10-year period (Fig. 2). The information from several such sources indicates that the Aleuts tended to live longer than comparable groups of Eskimos, as they do today. Assuming that length of life is primarily affected by diet, exercise, health practices, and the cultural value placed on newborn and aged persons, the Aleut achievement of longevity is a population response developed within this ecosystem rather than a genetically inherited pattern.

Analysis of the length of life can be made in several ways. One kind of analysis (Fig. 3) shows the life expectancy of males who have reached age 15. The shortest life expectancy, indicated for the year 1948, reflects the evacuation of the Aleuts during World War II to Japan and to southern Alaska, during which many of the older persons died. The same tendency toward heightened life expectancy is seen in the Aleuts of the Soviet Commander Islands





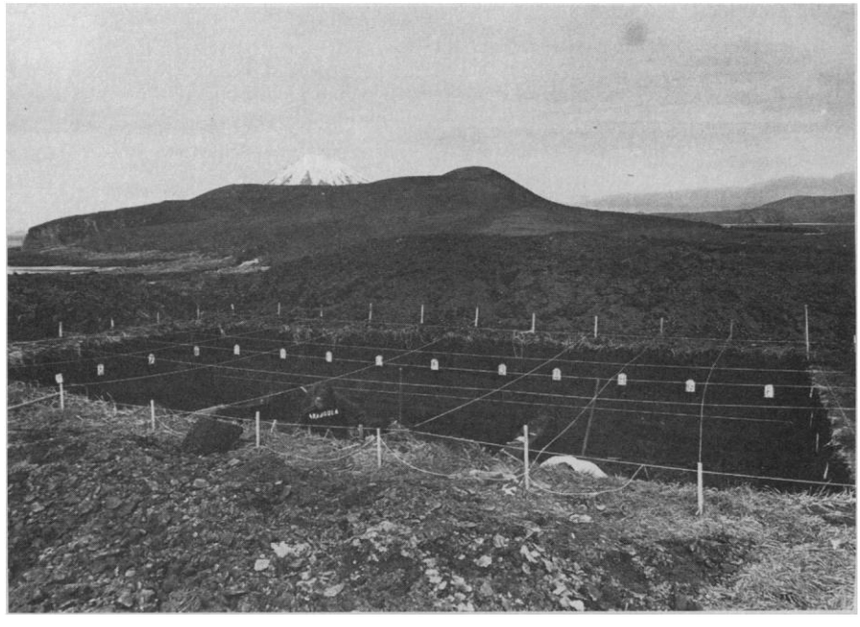


Fig. 4 (top left). Map of Anangula Island and Nikolski Bay. Fig. 5 (middle). Anangula Blade Site excavation pit in 1974. Mount Vsevidoff, Umnak Island, is seen to the northeast. Fig. 6 (top right). Sequence of major ashfalls, Anangula Island. Only the radiocarbon dates from the Blade Site and the Village Site are indicated. Major vulcanism appears to be decreasing, and the interval between successive ashfalls appears to be doubling. Fig. 7 (bottom). The low southern tail and the silhouetting wave-cut terrace of Anangula Island. Anangula Island was formerly the northern arm of Nikolski Bay. It is 9 km by boat from Anangula to Nikolski village.

(*10*). Studies made in 1948 and 1973 showed a significant increase in hypertension in the 25-year period, but even so the length of life is greater for the Aleuts than for comparable groups of Eskimos (*11–13*). Infant mortality is lower and the survivors survive longer. From this kind of population profile it may be argued that long life is in itself a better management policy for natural resources than short life. The total consumption per body weight is less, and there is less wastage.

The earlier observations (*13*) that the Aleut environment had many simultaneous and alternate niches to exploit, and that cohorts of both sexes from age 6 on could make some contribution to their own dietary needs, can now be extended. The strandflats were important for collecting invertebrates (octopuses, sea urchins, limpets, and mussels) and marine algae; the beaches, strandflats, and marine terraces for handline fishing by women; and the calm protected bays for fishing from boats by aged men. Children, women, and aged and disadvantaged persons could collect marine resources which would be denied them if there were winter ice, as in the more arctic regions. In an arctic village such as Wainwright, Alaska, a relatively small percentage of the total population, the able-bodied male hunters, supports the entire community during the winter by ice hunting and related activities requiring high energy expenditure, much equipment, and usually superb physical condition.

Fig. 8. Tool cluster in the Anangula Blade Site. Such clusters often represent the manufacturing station of a single person, and their position indicates absence of rolling or redeposition.

The marine ecosystem is related to the human population in still another way. There is a basic interaction among three key species—humans, sea otters, and sea urchins. Both the sea otters and the Aleuts eat large numbers of sea urchins, and the Aleuts eat sea otters as well. Because of inherent characteristics of their life tables, the populations of sea otters and of sea urchins would oscillate if each existed independently. The addition of the human species into this system damped these oscillations (*14*). Therefore, the human population should be considered a fundamental part of the ecosystem rather than an intrusive phenomenon. It is likely that the hunting and collecting activities of the Aleuts exercised a moderating influence on population fluctuations in the other resident species, sea otters, sea lions, and sea urchins, over the millennia.

Table 1. Anangula Blade Site dates based on 33 specimens from between ashes II and III and two specimens directly on the ash II interface and below. The first specimen, GX 2232, is included to indicate the size of the ash III hiatus. Letter prefixes to specimen numbers denote the laboratory where the analysis was performed. Abbreviations: S.D., standard deviation of the mean; S.E., standard error of the mean.

Specimen	Date (years ago)		Specimen	Date (years ago)	
	Libby half-life (5570 years)	Penn half-life (5740 years)		Libby half-life (5570 years)	Penn half-life (5740 years)
0. GX 2232	6600 ± 320	6798 ± 330	23. P 1104	8129 ± 96	8373 ± 99
	Hiatus (ash III)		24. SI-2182	8140 ± 485	8384 ± 500
1. P 1836	6992 ± 91	7202 ± 93	25. GX 2240	8170 ± 240	8415 ± 247
2. P 1835	7000 ± 91	7210 ± 93	26. P 1103	8173 ± 87	8418 ± 90
3. GX 2233	7070 ± 240	7282 ± 247	27. SI-2179	8235 ± 125	8482 ± 129
4. GX 2235	7120 ± 240	7334 ± 247	28. GX 2239	8280 ± 220	8528 ± 227
5. GX 2241	7175 ± 240	7390 ± 247	29. GX 2231	8290 ± 240	8539 ± 247
6. GX 2237	7180 ± 250	7395 ± 258	30. SI-2176	8390 ± 95	8642 ± 98
7. GX 2243	7260 ± 320	7478 ± 330	31. I 715	8425 ± 275	8678 ± 283
8. P 1108	7287 ± 87	7506 ± 90	32. GX 2809	8435 ± 500	8688 ± 515
9. SI-2177	7360 ± 100	7581 ± 103	33. GX 2230	8480 ± 350	8734 ± 361
10. GX 2246	7395 ± 160	7617 ± 165		*Hiatus (ash II)*	
11. SI-2180	7600 ± 100	7828 ± 103	34. SI-2178	9055 ± 95	9327 ± 98
12. P 1107	7657 ± 95	7887 ± 98	35. GX 2244	9805 ± 480	10099 ± 494
13. W 1180	7660 ± 300	7890 ± 309	Summary (specimens 1 to 33)		
14. P 1102	7701 ± 93	7932 ± 96	Range	6992–8480	7202–8734
15. P 1837	7793 ± 116	8027 ± 119	Actual span	1488	1532
16. I 1046	7796 ± 230	8030 ± 237	Mean	7785	8019
17. GX 2234	7870 ± 260	8106 ± 268	S.D.	460.5	474.3
18. SI-2181	7885 ± 335	8122 ± 345	S.E.	80.5	82.6
19. SI-2175	7920 ± 100	8158 ± 103	Statistical range*	6864–8706	7070–8968
20. P 1105	7932 ± 497	8170 ± 512	Statistical span	1842	1898
21. GX 2229	8055 ± 160	8297 ± 165			
22. GX 2238	8060 ± 240	8302 ± 247			

*± 2 S.D.

Nikolski Bay Focus

Much of the work in the Aleutians has centered in and around Nikolski Bay on Umnak Island (*15*). Nikolski Bay (Fig. 4) is unique in the entire Bering Sea because it contains within it an unusually complete record of an interdigitated combination of events that begin with the Holocene some 10,000 years ago. The major events are: (i) rising sea level, indicated by marine terraces, strandflats, and the human occupational materials of the archeological sites; (ii) tectonic uplift, which raised the terraces and sea bottom and thereby greatly expanded the areas where invertebrates could be collected and preserved the oldest archeological sites from destruction by encroaching sea level; (iii) volcanic ashfalls, which can be dated by archeologically derived radiocarbon specimens and serve as common horizon markers between archeological sites at different elevations on different sides of the bay; and (iv) continuous human occupation around the bay. There are large archeological sites with a high density of artifacts going back to the initial occupation, and statistically significant numbers of faunal remains and human skeletons have been added over the last 4000 years. The time depth recorded at Nikolski Bay indicates both the stability of the ecosystem and the stability of the Aleuts as essential components of the ecosystem.

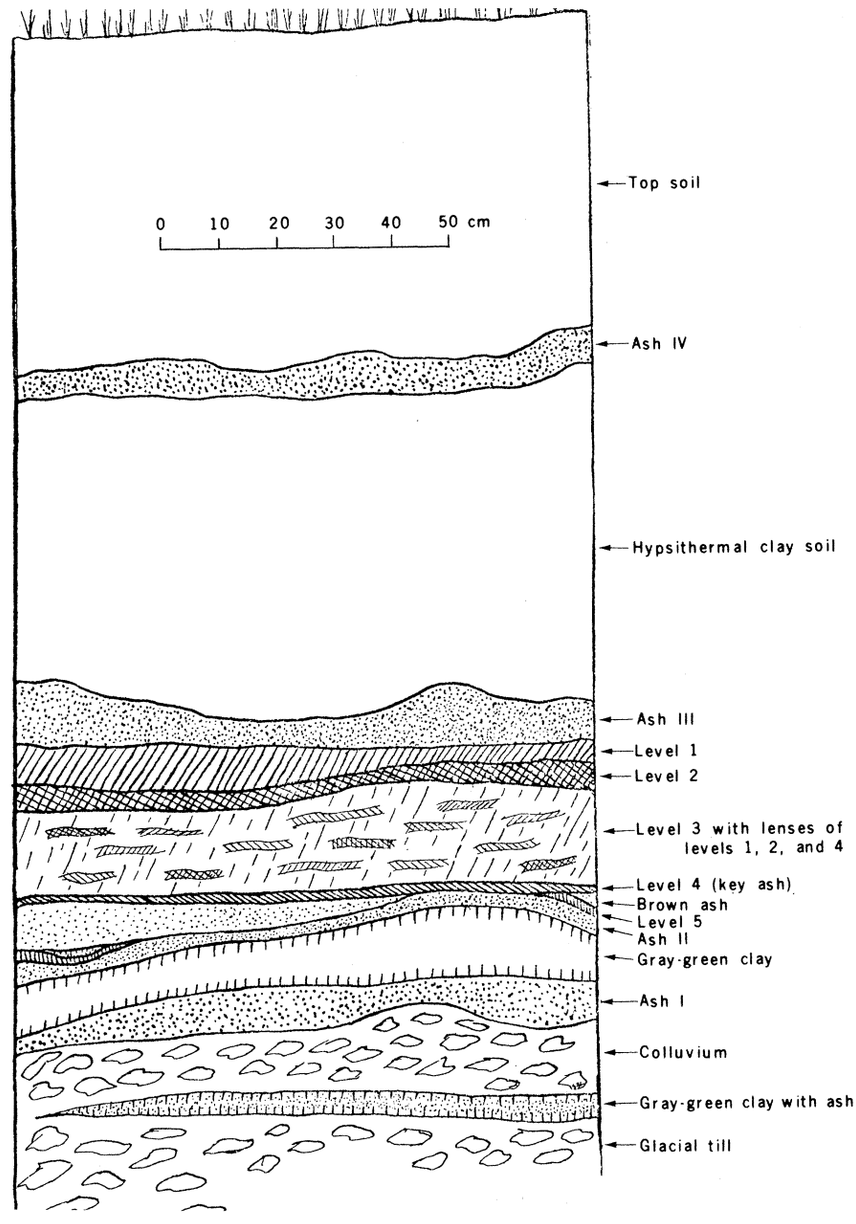
Four major ashfalls since deglaciation are recorded at Nikolski Bay; these are numbered, from earliest to latest, ashes I, II, III, and IV. In an earlier study (*16*) three radiocarbon specimens were excavated from the old Blade Site (Fig. 5) on the low southern tip of Anangula Island. The specimens, which lay between ashes II and III, were dated by Libby half-life at 8425 ± 275, 7990 ± 230, and 7660 ± 230 years ago—a span of 765 years. Our objec-

tive in Nikolski Bay has been to determine how long people lived in a particular place and when they changed their artifact styles or established occupation at another place. The ashfalls are sterile events, useful as common markers between sites but not productive of the organic material needed for dating. To determine the relation of Aleut occupation to sea level it was necessary to know when and for how long they occupied the Blade Site.

Measuring a span or interval of time requires many specimens (*15*), exactly how many depending on how certain the researcher wants to be. Employing 200-year intervals for a 2000-year span, 50 dates are needed for 98.6 percent certainty that all 200-year partitions of the total span have been sampled, and 30 specimens are needed for 90.3 percent certainty. Five dates yield a certainty of only 15.4 percent. With many specimens one can also calculate a mean and the standard deviation in radiocarbon years. The mean is not useful since we are not concerned with an isolated moment in time, but standard deviations indicate how much confidence may be placed in the dates.

Figure 6 illustrates one of the interesting and potentially significant results of dating the four major ashfalls. The intervals between them have successively doubled. The first interval, between ashes I and II, is 1000 years or less; the second, between ashes II and III, is 2000 years; and the third, between ashes III and IV, is 4000 years. If the intervals continue to double a future ash V should thus fall 8000 years later. We have enjoyed 3000 ash-free years, and we may anticipate an additional 5000 if the periodicity illustrated in Nikolski Bay is the result of systematic forces, such as tectonism.

Hopkins (*17*) recently suggested that the beginning of the Holocene Epoch (the end of the Pleistocene) should be set at 10,000 years ago. Although a few Anangula dates approach 10,000 years, the oldest date from this region is 10,099 ± 494 years ago. Thus, I think it reasonable to use 10,000 years for the Pleistocene-Holocene boundary. Although the sample space between ashes II and III has not been exhausted, the 33 dates obtained for the interval pro-



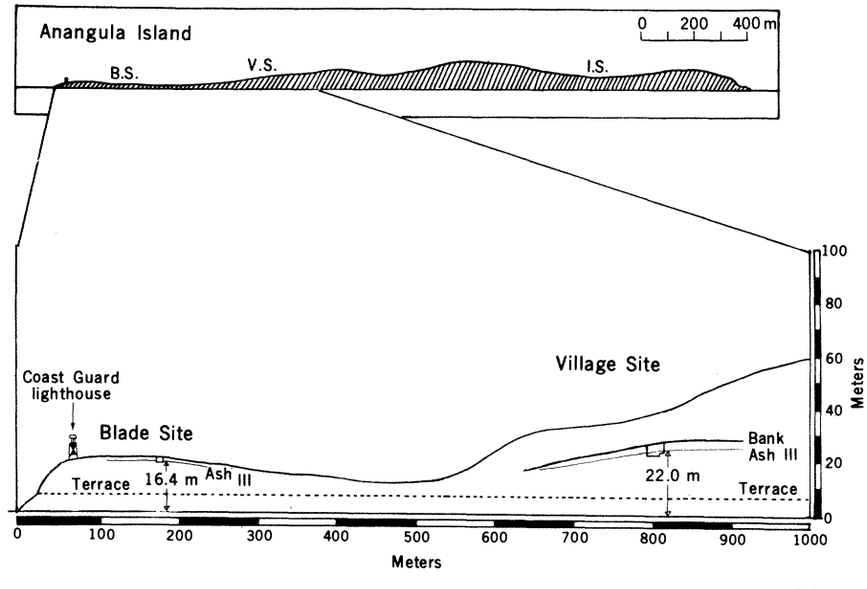


Fig. 9 (top). Stratigraphic section of the southwest wall, Anangula Blade Site, 1974. Fig. 10 (bottom). Anangula Island (Ananiuliak on U.S. Coast Guard charts). The Blade Site on the low southern tail was occupied first (8700 to 7200 years ago); then the occupants moved to the 6-m-higher elevation of the Village Site in response to rising sea level. The dotted terrace line shows the high point of wave action prior to tectonic uplift of the entire island. The solid baseline is the present mean sea level. The site on the neck of the island is Ikchigh Site (*I.S.*).

Table 2. Dates for Anangula Blade and Village sites based on specimens obtained in the 1974 U.S.–Soviet study. Specimens were dated by R. Stuckenrath of the Radiocarbon Laboratory at the Smithsonian Institution, on the basis of the Libby half-life (5570 years). Specimens between ash IV and ash III represent the transition culture.

Specimen	Date (years ago)
Village Site	
SI-2183	995 ± 65
Ash IV (3000 years ago)	
SI-2169	4510 ± 115
SI-2171	4550 ± 125
SI-2170	5180 ± 100
SI-2172	5340 ± 80
SI-2173	5750 ± 65
SI-2174	5920 ± 80
Ash III (7000 years ago)	
Blade Site	
SI-2177	7360 ± 100
SI-2180	7600 ± 100
SI-2181	7885 ± 335
SI-2175	7920 ± 100
SI-2182	8140 ± 485
SI-2179	8235 ± 125
SI-2176	8390 ± 95
Ash II (9000 years ago)	
SI-2178	9055 ± 95

vide at least 90 percent certainty that it has been adequately sampled and, therefore, that the ashfalls have been reliably dated (Table 1).

Human occupation of the Blade Site lasted more than 1500 years. The people moved from there to the higher Village Site (Fig. 4), but we cannot be certain that they did so at only one time. They may have moved gradually, in response to the rising sea level, and continued to use the Blade Site for summer activities while their winter village was already centered at the Village Site.

It should be noted that all the dates given in Fig. 6 are from the Blade Site and the Village Site on Anangula Island. Although the Village Site dates are congruent with a date of 3000 years ago for ash IV, they do not themselves provide the date. Ash IV was dated in the Chaluka archeological site on the other side of the bay. Because the 4000 years of cultural deposits at Chaluka begin well above ash III, the underlying stratigraphy, which is the same as for Anangula Island, could not be dated by Chaluka materials. No one archeological site can provide a type section for the entire Holocene Epoch because the Aleuts had to adjust their occupation to a rising sea level and to tectonic uplift. However, a reliable composite stratotype can be based on data from the three sites on Nikolski Bay. Ash I, well marked in all three sites, appears to be the first dramatic event after deglaciation.

New Findings of the Joint U.S.-Soviet Team on Anangula

A team of five Soviet archeologists under the direction of Academician A. P. Okladnikov, director of the Institute of History, Philology, and Philosophy, Academy of Sciences, Novosibirsk, worked with the University of Connecticut party on Anangula Island for 5 weeks in the summer of 1974. We shared a mutual interest in events concerning human migration from Siberia into the New World over the former Bering Land Bridge. It was our belief that experienced scientists of the two nations, excavating side by side and examining the same artifacts and stratigraphy, could secure original data and significantly improve the evaluation of the data. The Soviet scholars knew where the first Americans came from and wanted to know more about where they went, and the Americans knew where they went and wanted to know more about where they came from. Because the shores of the Bering Sea are occupied exclusively by these two nations it was quite natural that scholars from both should combine their knowledge in original research to solve the scientific problems common to them. The delineation of Asiatic traits was one major overall objective, and the dating of the trait assemblages was another. These two objectives embrace the origins and affinities of the Aleuts, Eskimos, and Indians. Another eventual benefit is determining the tempo of human evolution and the biological and cultural adaptations of the early immigrants.

Our excavations in the Blade Site on Anangula Island (Figs. 7 and 10) produced 9678 cataloged artifacts together with tool complexes, house depressions, and a new suite of specimens for radiocarbon dating. The artifacts included blades and the cores from which blades had been struck, Levallois tradition blades, retouched and pointed blades, burins made on blades, obsidian scrapers, pebble tools, rubbing stones with red ochre, lava abraders used to shape harpoon or spear shafts, line weights, a large lamp, and a stone dish. In all cases where retouch (flaking) occurred on the tools, it was confined to the margins of only one surface. This is a classic unifacial core and blade industry. Complexes of tools, many of which appeared to be one-man factory stations, were illustrative of what tools and manufacturing products were naturally associated with each other (Fig. 8). These are also important in demonstrating that there has been no redeposition or rolling of artifacts. There has been, however, considerable compression of the five levels between ashes II and III so that individual culture-bearing levels cannot be satisfactorily separated by radiocarbon dates (Fig. 9).

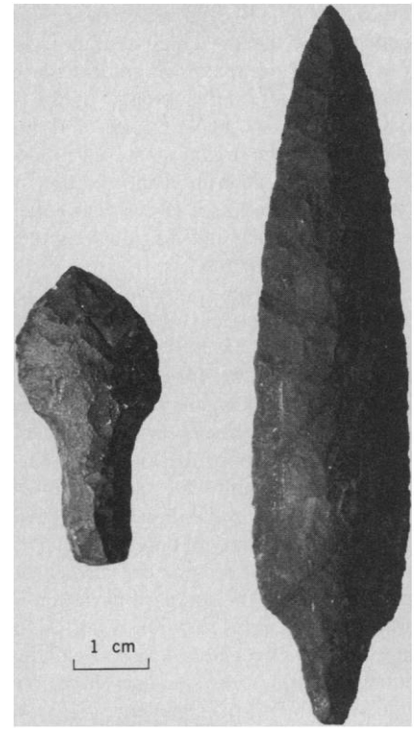


Fig. 11. The smaller point is like those from Ushki, Kamchatka. It is flaked on both surfaces (bifacial) and is made from a blade. The long stem is a generic characteristic. Another kind of bifacial point found in the Transition Culture has an absolutely and proportionately shorter stem.

The density of stone tools is unusually high (more than 100 per square meter) because the inhabitants entered the area with a complex culture and lived there a long time, more than 1500 years. With only 1 percent of this 25,800-m^2 site excavated, but with samples from the margins as well as the center of the site, we estimate that it contains more than 2.9 million stone tools. More than 10,000 were excavated from 87 m^2 in 1974.

A consequence of the long period of occupation on the low tail of Anangula is the influence of the rising sea level. Sea level, which was some 30 or 32 m lower 9000 years ago, eventually forced the people to move uphill to a higher and more protected site half a kilometer to the north—the Village Site (Fig. 10). During the occupation, there were numerous volcanic ashfalls—so many, in fact, that no distinct soil horizon appears although cultural level 2 is quite dark. Forty percent of the specimens submitted for radiocarbon dating at the Smithsonian Institution, Washington, D.C., consisted of humates. The low tail of Anangula is unsuitable for occupation today, and had become so by about 7000

years ago, because of drenching by winter storm surges. The margins of the Blade Site have been eroded by wave action, and the entire site would have been destroyed had not tectonic uplift raised the island several meters after the people left. It could have been used for collecting eggs and birds, but not for year-round habitation. The wave-cut terrace silhouetting the island, only 5 m below the shoulder of the site, records the sea level attained before uplift.

After securing the tools from the Blade Site, Okladnikov and I moved uphill to the Anangula Village Site to investigate the south end nearest the Blade Site. Previous test excavations had indicated a maximum age of 3000 years ago farther up the Village Site, and artifacts similar to the Chaluka series had been found there. The elevation of the Village Site ranges from 22 m above sea level at the southern end to 36 m at the northern end. It is a particularly interesting village because the associated burial structures (*umqan*), with their large drainage ditches, are still intact behind it. These features have yielded multiple burials whose associated artifacts suggest a recent age of only a few hundred years. Old house pits (*barabaras*) indent the surface of the mound, partially obscured by a remarkably dense growth of aconite (*Delphinifolium* or monkshood).

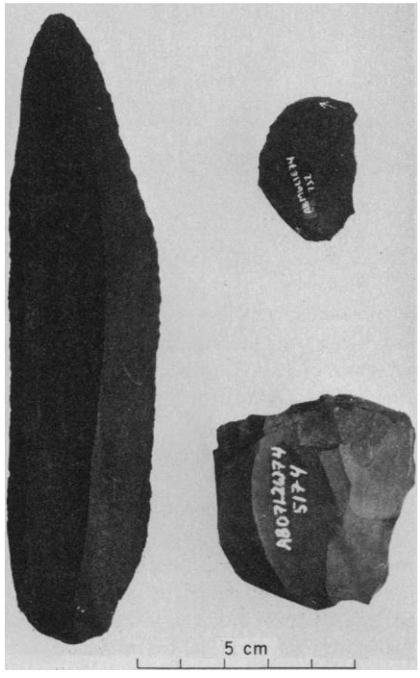
We excavated on the eastern shoulder overlooking Nikolski Bay, where there had been some erosion and slumping of midden materials onto the marine terrace 22 m below. Okladnikov promptly found a typical Anangula prismatic blade and then an Ushki point (Fig. 11). The Ushki point is a stemmed and bifacially flaked point made on a blade. It is similar to those found at Lake Ushki on the Kamchatka Peninsula of Siberia by N. N. Dikov, a former student of Okladnikov. R. Vasilievsky, who had worked much of the Sea of Okhotsk including Sakhalin Island, noted other similarities to the artifacts of that region such as the twisted "propellor" blade. The artifacts recovered in the next few days indicated that this was indeed a transition culture, with elements of the old blade culture persisting and with the addition of bifacially chipped points, knives, and scrapers. The burins, cores, and blades of the blade culture continue; but without the Levallois tradition. All the radiocarbon dates are older than 4500 years and are thus transitional between Chaluka, dated at 4000 years, and the Blade Site (Table 2).

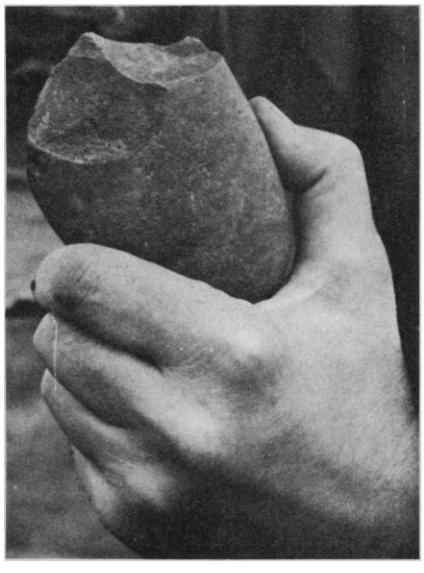
Okladnikov has identified seven Asiatic elements among the tool types found in the Blade Site. This configuration of seven traits clarifies the nature of the Anangula culture and its relationship to Asia. First are the Levallois tradition blades. These are large blades, up to 20 cm in length. They most commonly display two blade scars, sometimes three, on the dorsal surface. When they have been retouched or pointed, the retouch was confined to the margins of the dorsal surface (Fig. 12). Second is the torzovi core, earlier known as the Gobi or frontal core. This kind of core has many characteristics and much variation in size. The fluting, the scars where blades have been removed, is usually restricted to the front end, although sometimes both ends are fluted. The entire surface is never fluted as in a polyhedral core. The striking platform tends to be oval in cross section and usually at right angles to the vertical axis of the core. Even the small ones, only 2 to 3 cm in height, display the restricted blade removal area and the occasional flaking of a posterior ridge. They appear to be designed so that the small inferior end could fit comfortably between the fingers or toes (Fig. 13). Third, the pebble tool tradition is evident (Fig. 14). These are typically Paleolithic-style tools characteristic of northern Asia. We also found a large number of them on the exposed surface of an older horizon of a site overlooking the Bering Sea near Nikolski. Fourth are Mousteroid points (Fig. 15). These are roughly triangular with some step flaking on the margins of one surface. Fifth is the large "Siberian scraper," which has some step flaking on the margins of one surface. Sixth, angle or diagonal burins, similar to those of Araya, Japan (*1*, p. 437), occur. These are usually made on blades that have been snapped and then burinized at an angle across the snapped end. Seventh, transverse burins are present. These burins, also variable in size, may have more than one facet, and they are often double-ended. In addition, they may be retouched on the surface of one or two margins and therefore used as a combination tool (Fig. 13).

Fig. 12. R.F. Laughlin and Academician A. P. Okladnikov holding a Levallois tradition blade. This is one of the seven Asiatic traits identified by Okladnikov.

Some 400 burins were recovered in the U.S.–Soviet excavations. Their uses are unknown, but they may have been used to work skins, both bird and sea mammal. The transverse ventral edge is more often used than the corner. An interesting aspect of burins is their indication of the handedness of the fabricator. If the blade is held with the flat ventral surface toward the fabricator, a facet at the left end indicates a left-handed burinizing blow, and one at the right end indicates a right-handed burinizing blow. A preliminary analysis indicates that slightly more than 53 percent were burinized with a right-handed blow, and 8 percent were burinized with a right-handed blow at one end and a left-handed blow at the other. Burins appear to be a constant satellite of the torzovi core, and their association is itself an important characteristic (*18*).

The Soviet scientists have worked extensively in Mongolia as well as in all of Siberia. After the Aleutian study we examined the Gobi collections made by N. C. Nelson in Mongolia in the 1920's, which are now at the American Museum of Natural History in New York. The identity of artifacts is in some cases remarkable. However, the extent of similarity remains to be quantified and assessed. What we now possess is a configuration of Asiatic traits identified by Siberian experts in a large and old Alaskan coastal site. This is the first time a Soviet archeological team has worked with an American team in an original investigation of an American site (*19*).





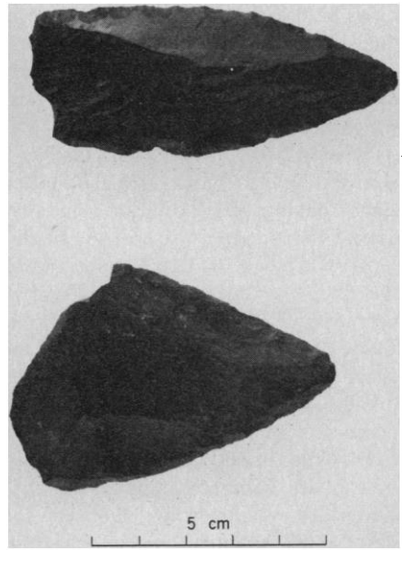


Fig. 13 (left). Core, blade, and burin. The core (lower right), from which blades were struck is a torzovi core, similar to those found in the Gobi Desert and Siberia. The large prismatic blade (left) is not from a torzovi core. It is another example of a Levallois tradition blade. The burin (upper right) is made from a segment of a blade. Transverse blows have been struck at either end, indicated by the arrows. One burin spall was struck off by the right hand, and the other by the left hand. These burins are especially common around the Sea of Okhotsk, including Hokkaido. Fig. 14 (bottom left). Pebble chopping tool. These occur in high frequency around Nikolski Bay. Fig. 15 (bottom right). Mousteroid points. The triangular shape and basal scar of a previously removed flake were deliberate design features of these tools. The marginal flaking on one surface, often steep, is a secondary feature.

Summary and Conclusions

An original objective of these multidisciplinary studies was to determine the position of the Aleuts in the Aleutian ecosystem with time depth. This has been done in a variety of ways (*7, 14, 20, 21*). One of the most useful approaches is the construction of life expectancy tables. The greater longevity of Aleuts compared with Eskimos represents an effective biological and cultural human adaptation within this ecosystem. The Aleuts defined their ecosystem by expanding to the limits of the area they could effectively exploit with their complex technology, population structure, and population deployment system. Their intellectual achievements played a tangible role in their longevity in the pre-Russian period, and their sophisticated knowledge of human anatomy is both a causal and a consequential correlate of their longevity. From the Aleut point of view, the food resources were diverse, abundant, and accessible, and they also provided fabricational materials necessary for their complex material culture. The Aleuts successfully hunted the world's largest range of sea mammals, from the sea otter to the whales. At the same time, extensive use of invertebrates easily available on the ice-free strandflats enabled disadvantaged sectors of the population to make important contributions to their own food supply and thus improve life expectancy.

The rich food and fabricational materials antedate the Holocene history of Nikolski Bay and the arrival of the ancestral Aleuts. The natural resources of this area are fundamentally related to the former peninsular extension of Beringia and the permanent upwelling system in Samalga Pass (*22*). Sea otters, seals, and sea lions were present when the first Aleuts came to the area. Nikolski Bay has been an ideal place to obtain samples representing the entire Holocene Epoch. The earliest Asiatic migrants came from Siberia and traversed the southern coastline of Beringia. They established a large and permanent village on the northern arm of Nikolski Bay and remained there while expanding to the far ends of the Aleutian domain in the sixth millennium of their residence.

The record of cultural change spans a lithic revolution. It begins with a conservative unifacial core and blade industry that preserves several Asiatic traits but includes stone lamps, dishes, an image of the deity, and the use of red ochre. Between 7000 and 6000 years ago bifacially flaked and stemmed points appear, with some continuing elements of the old unifacial industry. This transition culture continues to about 4500 years ago, when the standard sequence seen in the old midden of Chaluka takes form. This culture continues, adding and subtracting various elements but always maintaining a distinctive configuration through time, to the present Aleuts, whose connection with the first Anangula settlement includes having remembered an older Aleut designation, "the place of the blades," and collecting eggs on its flanks.

The dating of events inside Nikolski Bay and the identification of the Asiatic elements do throw light on human migration from Siberia into Alaska. The Aleuts and

Eskimos may well have been a part of a single population system of Bering Sea Mongoloids who expanded along the Siberian coasts and across the southern Beringian coasts. The population that reached Nikolski Bay became Aleuts. Those closer to the old mouth of the Kuskokwim River and further north became Eskimos. The rise of sea level presented no problems to marine-adapted people. Instead it presented more opportunities in the form of more coastline to exploit. The ancestors of the American Indians migrated earlier through the interior of Beringia.

The double-thumb hypothesis of Hrdlička (*23*) is useful now for interpreting human migration into the New World. He suggested that if the Eskimos were physically related to the Indians as the thumb of one hand is to the fingers, then a second thumb is necessary to represent the Aleuts, who are also distinctive. The Bering Sea Mongoloids as a group (Aleuts, Eskimos, Chukchi, Koryaks, and probably Kamchadals) are distinguished from the Indians by both genetic traits such as the presence of blood group B, which is absent in the Indians, and morphological configurations such as the unusually broad, low ascending portions of the mandible. This magnitude of difference fits very well with a geographic difference in point of origin, separate route of entry into the New World across Beringia, and the maintenance of separation by many geographic, economic, and cultural barriers.

Earlier investigators in the Aleutians compiled invaluable bodies of information. The Russian W. J. Jochelson worked in the Aleutians and the American A. Hrdlička in Siberia. The problems common to both sides of the Bering Sea have now been studied by Soviet and American scholars at the same time, in the same place, and with the same specimens. It has been pleasant and informative to work directly with the Siberian authorities on Siberia in the Aleutians.

In summary, I submit the following eight conclusions:

1) Increased longevity, rather than rapid population turnover, served as a major form of population adaptation and resource management among the Aleuts. Because people lived longer, genetic and cultural wastage was minimized.

2) Cranial vault change, from narrow to broad, has been the result of evolution within the population.

3) The Aleuts have continuously occupied Nikolski Bay, Umnak Island, for 8700 years. During this time sea level has risen and the coastline configuration has changed.

4) Siberian characteristics of the Anangula core and blade industry have been identified, and a transition culture, which links the earliest Anangula tool tradition with the later Aleut culture of Chaluka, has been discovered.

5) Organic remains of human occupation have been used to precisely date geological events of the Holocene Epoch for 8700 of its 10,000 years. Major volcanic eruptions occurred, at exponentially increasing intervals, 10,000, 9000, 7000 and 3000 years ago.

6) The earliest Aleut culture has preserved its Asiatic template because of the coastal entry route from Siberia and subsequent isolation of the population. The abundant lithic remains indicate a complex and diverse material culture.

7) The known similarity of Aleuts to Asiatic populations plus our Holocene time scale suggest a slower rate of human evolution than was assumed when a later date of entry into the Aleutians was accepted.

8) In the broadest perspective, these findings are relevant to understanding the entry of man (Aleuts, Eskimos, and Indians) into the New World in that other migrant populations originating in Siberia may also have entered the New World with a sophisticated and complex culture.

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