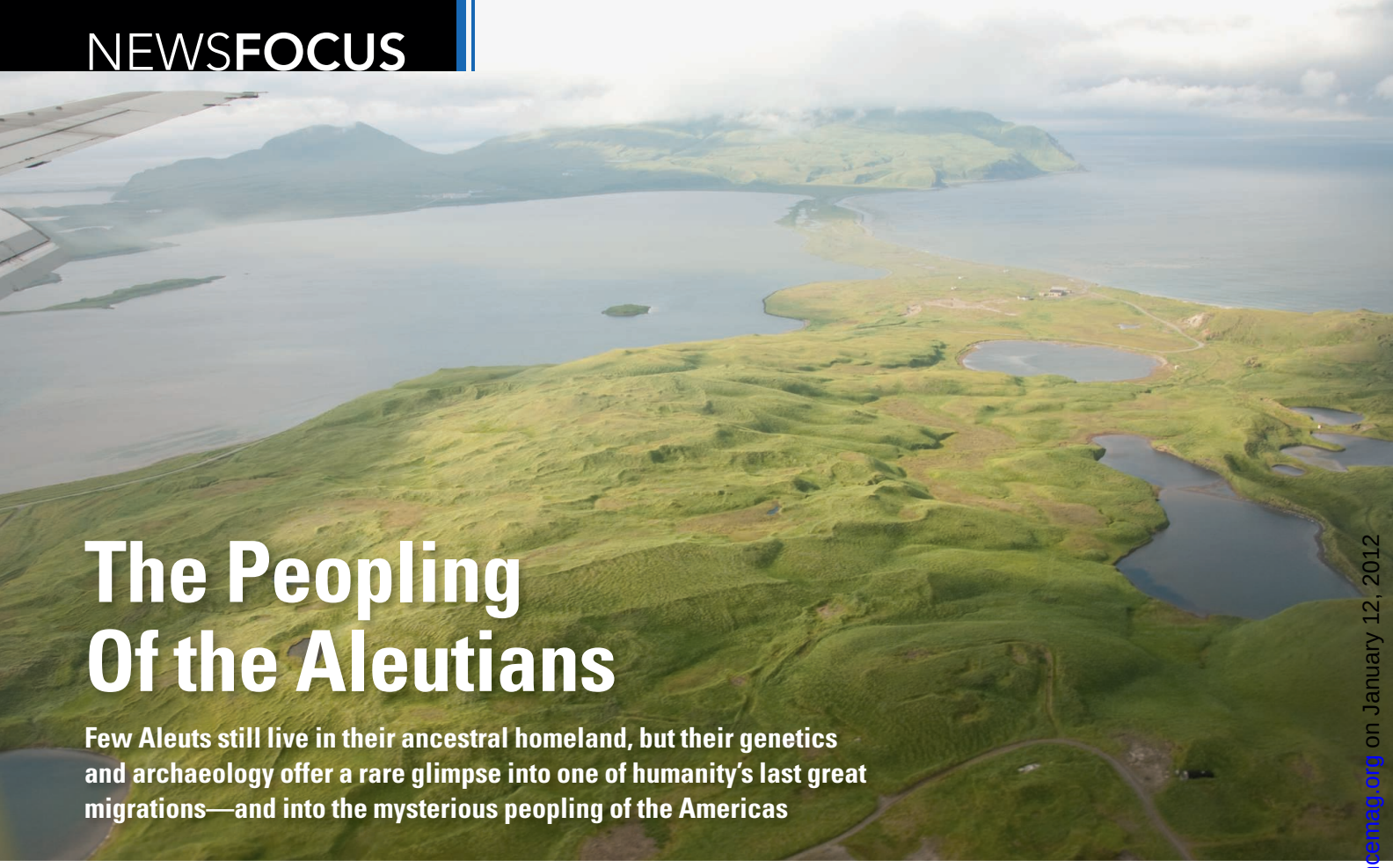

The Peopling Of the Aleutians

Few Aleuts still live in their ancestral homeland, but their genetics and archaeology offer a rare glimpse into one of humanity's last great migrations—and into the mysterious peopling of the Americas

ADAK ISLAND, ALASKA—Clam Lagoon, at the northern edge of this volcanic island, is a peaceful refuge from the wind-ravaged tides of the Bering Sea. Sea otters do the backstroke in its tranquil waters, and puffins and murrelets roost on the treeless shores. About 7000 years ago, kayak-paddling humans arrived here, setting up housekeeping on a bluff overlooking both the lagoon and the sea. Exceptionally well-adapted to maritime life, these first colonists promptly set about exploiting the local riches: They ate the otters and the birds, as well as seals and sea lions. They fished for cod and greenlings with hooks made from the birds' wing bones, and they made tools using obsidian brought from another island hundreds of kilometers away. Before long, a smaller group left Adak to colonize yet more islands to the west.

These people, the ancient Aleuts, began exploring the 2000-kilometer Aleutian archipelago—the world's longest—at least 9000 years ago. Because they had the islands to themselves for thousands of years, researchers say the archipelago is a living laboratory for studying human migratory behavior. "I don't think there is a better model than the Aleutians," says geneticist Michael Crawford of the University of Kansas, Lawrence.

Online
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Podcast interview with author Michael Balter.

Sadly, most of the Aleuts were evacuated from their ancestral islands during World War II, never to return. And yet Adak today has become the center of intense exploration into when, how, and why the Aleutians were peopled. Many of today's Aleuts can trace their ancestry back to the islands' first inhabitants, so "the Aleutians are a perfect storm of deep time depth," says Anna Kerttula de Echave, director of the National Science Foundation's (NSF's) Arctic Social Sciences Program, which funds much of the work in the islands. "Only in a few places on the globe do you find such a continuous record of human occupation."

The Aleuts' story also opens a window into the peopling of the Americas as a whole. The Aleuts descend from ancestors who lived in Asia at least 13,000 years ago, making them part of the great migrations across the now-submerged Bering Strait land bridge into North America. Their history is obviously distinct from that of the groups who continued farther south into continental North and South America. But because the Aleuts have been relatively isolated for so long, researchers can more clearly read their ancient prehistory from their genes and archaeology, a task more difficult farther south where internal migrations may have blurred the earliest records.

To some, the Aleuts' maritime adaptations strengthen the idea that the first Americans were sea travelers (*Science*, 4 March 2011, p. 1122). "The Aleutians show that a coastal route is entirely reasonable," says archaeologist Lucy Johnson of Vassar College in Poughkeepsie, New York. Others counter that the Aleutians were settled too late to have a bearing on the land-versus-sea debate. "I have great difficulty with this notion," says archaeologist Don Dumond of the University of Oregon, Eugene.

Either way, the story of the Aleutians reveals how maritime migrations work. "We are coming to understand the dynamics of island colonization," Crawford says.

Two waves

The written history of the Aleutians starts in 1741, when Russian explorers led by Vitus Bering discovered the Aleuts and changed their lives forever. At the time, the Aleuts were hunting sea mammals and living in rectangular huts. The Russians turned the Aleutians into a fur factory, pressing the Aleuts into servitude and moving them from island to island. Historians estimate that they numbered up to 16,000 in 1740, but by 1900, disease, starvation, and suicide had slashed

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Refuge from the winds. A narrow isthmus separates Adak's Clam Lagoon (*left*) from the stormy Bering Sea.

Digging deep. Archaeologists are finding clues across the Aleutians, including at Adak's Clam Lagoon (*left*) and on Kiska, where Veronica Lech of the Memorial University of Newfoundland holds an ancient sea cow rib.

their population by up to 90%.

The Americans who took over in 1867 were apparently more benign: By 1920, Aleut numbers began to bounce back, and they grew from about 3000 to 8000 by 1980.

Beginning in the late 1800s, scientists began to visit the Aleutians, and in the 1930s famed Smithsonian anthropologist Aleš Hrdlička gathered dozens of skeletons. Hrdlička concluded that the Aleutians had been settled by two consecutive groups: the original settlers, the Paleo-Aleuts, who had high and narrow skulls (dolichocranic), and the Neo-Aleuts, who had wider, rounder skulls (brachycranic).

That basic idea has been confirmed by more recent research. In new studies of 86 of Hrdlička's skeletons, ranging from 3400 to 380 years old, anthropologist Joan Brenner Coltrain of the University of Utah in Salt Lake City found that the skulls did indeed separate into these two groups, and that all skulls older than 1000 years were dolichocranic. The groups "appear genetically distinct," Coltrain says. "Paleo-Aleut [skulls] are typical of the earliest people to occupy the New World, like the Kennewick Man and the Spirit Cave Woman. They all look more European than Asian, perhaps because they descend from European populations that occupied the Siberian region."

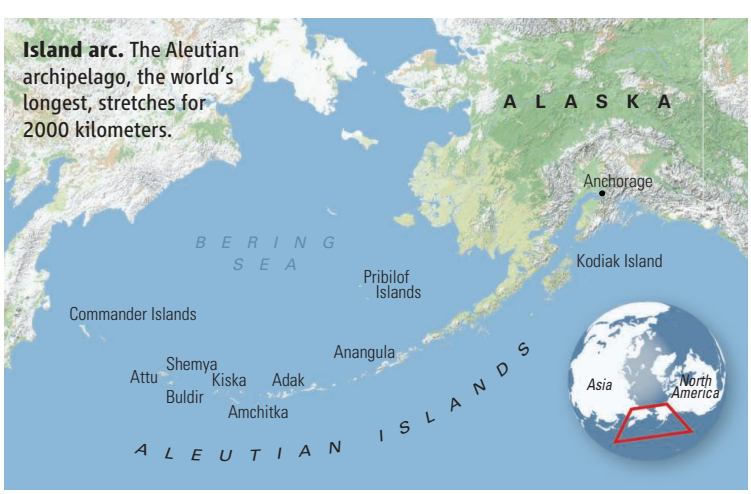
Recent genetic work confirms the distinction: Mitochondrial DNA (mtDNA) from 69 of Hrdlička's skeletons showed that Neo-Aleuts, like most modern Aleuts, descend from a common ancestor that carried genetic markers known as haplogroup D, according to recent work by University of Utah geneticist Dennis O'Rourke. But most Paleo-Aleuts were members of haplogroup A, as are most groups now living in Arctic North America.

Hrdlička argued that the Neo-Aleut populations came from the Alaskan mainland and replaced the Paleo-Aleuts. But Coltrain and others have found that the newcomers in fact coexisted with the original settlers. "The long-headed Paleo-Aleuts were still very much around" for several hundred more years, says anthropologist Richard Davis of Bryn Mawr College in Pennsylvania. About two-thirds of living Aleuts belong to haplogroup D and one-third to haplogroup A, according to work by Crawford and his co-workers, and they are presumed to be the result of admixture between Paleos and Neos. Crawford's research with modern Aleuts also suggests that they carry some Paleo-Aleut DNA, because their ancestors branched off from other Arctic peoples about 13,000 years ago—long before they colonized the islands, perhaps when they were still in Asia or Beringia.

The Neo-Aleuts were not only physically but also culturally distinct. For example, Davis says, after 1000 years ago, the archaeological record reflects a shift to more sophisticated stone tool types as well as changes in house styles from single to multiroomed structures. The Neo-Aleuts ate more big marine mammals such as sea lions and seals, while Paleo-Aleuts dined more on smaller animals such as birds and sea otters, according to an isotopic study of their bones that Coltrain published in the journal *Arctic* in 2010. "The Neo-Aleuts may have been more sophisticated technologically or more hierarchical in social organization," Coltrain says, possibly because they came from a "more complex and populous Alaskan peninsula setting."

Archaeologists are working all across the islands, and additional burials that might yield more ancient DNA are turning up as climate change accelerates coastal erosion, says archaeologist Debra Corbett of the U.S. Fish and Wildlife Service in Alaska. However, the Aleuts, like other Native American groups, are sometimes hesitant to allow research on skeletons (*Science*, 8 October 2010, p. 166). "Our policy is that if human remains are found, they must be immediately reburied," says Melvin Smith, archaeology coordinator for the Anchorage-based Aleut Corp., which represents native interests.

Nevertheless, Smith, who grew up on two of the islands, says archaeology helps native Aleuts to "better understand our own history and culture." And sometimes the corporation makes exceptions. For example, in a new edited volume, Corbett and her colleagues report on the 350-year-old remains of a child from one of the central islands, who was a member of haplogroup D like the Neo-Aleuts. Isotopic studies show that the child ate shellfish and sea birds and was infected with roundworms and tapeworms that often contaminate sea mammal meat.



Island arc. The Aleutian archipelago, the world's longest, stretches for 2000 kilometers.

From east or west?

Such recent burials offer clues to the lives of the Neo-Aleuts, but what of the ancient Paleo-Aleuts? Where did they come

CREDITS (TOP LEFT TO RIGHT): LYN GUALTIERI; COURTESY OF VERONICA LECH

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Bounty from the sea. With kayaks, the Aleuts colonized islands and exploited maritime riches, as seen in this 19th century painting by Henry Wood Elliott.

from, and when did they get here? For much of the 20th century, such questions went unanswered, as few researchers reached the remote archipelago. Then in 1942, after the attack on Pearl Harbor, the Japanese invaded the western islands of Attu and Kiska and put the inhabitants in concentration camps in Japan. In response, the Americans built a military base on Adak and evacuated nearly all the Aleuts to abandoned canneries in southeast Alaska. Only a few dozen families subsequently made it back to their native islands. "The Aleuts suffered tremendously," says archaeologist Dixie West of Kansas State University, Manhattan.

Investigations into Aleut prehistory came to a standstill. Then after WWII, the islands were caught up in the Cold War. Adak housed up to 6000 soldiers and sailors, and civilian access to the island was limited.

Finally, in the late 1990s, the base closed. Although no Aleuts had lived on Adak since the 1800s, some now settled there. Beginning in 1998, Corbett, West, and other archaeologists began to visit, eager to uncover the story of one of the last great peoplings of the world.

They began to tackle one of the most basic and yet controversial questions about the settling of the Aleutians: Were they colonized from west to east, or the reverse? If they came westward from Alaska, then they must first have crossed the Beringian land bridge to the Americas, making them part of that great migration. But if they came from Russia, then their southerly shortcut across the Bering Sea may have been independent of the larger Beringian migrations.

Some Russian archaeologists had argued that the first Aleuts entered the archipelago from the west, via the Commander Islands near Russia's Kamchatka Peninsula. (The far-western Commander Islands belong to Russia, while the rest of the Aleutians are U.S. territory.) But American archaeologists pointed out that the earliest known Aleutian archaeological site was radiocarbon-dated to 9000 years ago—and it is located in the east, on Anangula Island.

The old ways. Colonization disrupted Aleut culture (seen in painting, *left*), and WWII forced the children in this 1938 photo to leave their island. But some traditions, such as dancing regalia (*right*), have been preserved.

To resolve the issue, West, Corbett, and a handful of others began excavations and radiocarbon dating on the islands. They found that the western islands were first occupied about 3500 years ago, relatively late. Then in 2005, dates from radiocarbon and volcanic ash put fish bones on Adak, at site ADK-171 overlooking Clam Lagoon, at nearly 7000 years ago. This demonstrated a clear east-west pattern of migration. "It looks as though the Aleutians were occupied from the east," agrees paleoecologist Arkady Savinetsky of the A. N. Severtsov Institute of Ecology and Evolution in Moscow.

Recent genetic studies bolster the archaeological evidence. Despite the fact that few today live in the islands of their grandparents, Aleuts remember where they came from, and their memories have helped create a remarkably sharp portrait of geography and genes. Each island community had distinctive dance regalia, and an Aleut's origins can still be identified from the ceremonial costumes he or she wears today, explains Mike Swetzof, who was born on St. George Island and is now mayor of Adak.

Crawford's team has now analyzed mtDNA from more than 250 Aleuts from 11 islands as well as displaced Aleuts living in Anchorage and compared them with mtDNA from people elsewhere in the Arctic. The Aleuts bear little genetic resemblance to people of the Kamchatka Peninsula, as might have been expected had the islands been colonized from west to east. And the data show a striking correlation between the island that families originally came from and their maternally inherited mtDNA. "The Aleut populations are distributed spatially like beads on a necklace," Crawford and his co-workers wrote in 2010 in *Human Biology*. Indeed, the mtDNA haplogroups can be further subdivided into three groups, corresponding to the eastern, central, and western Aleutians, regions that also differ somewhat in cultural traditions, according to recent archaeological work. "This really blew my mind when you consider everything that has happened to the Aleuts," Crawford said. "The correlation between genetics and geography was phenomenal."

Ripan Malhi of the University of Illinois, Urbana-Champaign, agrees that there is a "very clear pattern from east to west in the mtDNA haplogroup" profiles. But he questions whether that is a relic of migrations that

CREDITS: (TOP) NATIONAL ANTHROPOLOGICAL ARCHIVES, SMITHSONIAN INSTITUTION [IMAGE 7119_13]; (BOTTOM LEFT TO RIGHT) PHOTO BY HULTON ARCHIVE/GETTY IMAGES; V. B. SCHEFFER/LIBRARY OF CONGRESS; LAURA GRABHORN

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took place as early as 9000 years ago or perhaps reflects more recent movements along the Aleutian chain. (The paternally inherited Y chromosomes don't show such a clear geographic pattern, probably because Russian men had children with Aleut women, researchers agree.)

Who are the Aleuts' closest relatives today? To date, no one has sequenced the whole genome of an Aleut, although researchers are working on it. But the mtDNA data cluster them with Siberians and the people of Russia's northern Chukchi Peninsula, which was once part of the Bering Strait land bridge. Aleuts show little mtDNA resemblance to Alaskan Eskimos, possibly refuting earlier assumptions that these groups separated relatively late, Crawford says. Comparisons of mtDNA from Aleuts, Eskimos, and Asian groups suggest that the Aleuts and Eskimos originally shared a common ancestor in Asia but went their separate genetic ways at least 11,000 years ago, probably while still in Asia; they may even represent separate migrations. "This suggests that there have been a lot of population expansions out of Beringia" and into the Americas, Malhi says (*Science*, 23 September 2011, p. 1692). "These populations had a dynamic history of extinction, admixture, and expansion."

Colonizing by kayak

One foggy Thursday last June, a team of archaeologists led by Diane Hanson of the University of Alaska, Anchorage, boarded the 3.5-hour flight to Adak, only to circle the island and turn back to Anchorage because of low visibility. They made it out the following Sunday, then hopped aboard the U.S. Fish and Wildlife Service ship the *Tiglax*—which provides a ferry service for researchers in the Aleutians—to a remote spot in western Adak, where they camped for 2 months, excavating prehistoric Aleut houses. This latest work, at an inland site, provides new evidence that the versatile ancient Aleuts exploited habitats all over the islands, not just on the coasts.

But there's no denying the power of the sea in Aleut life. And there's no doubt that whoever came to the Aleutians, and when, must have done it by boat. During glacial times, the easternmost islands were part of Beringia. But the rest of the Aleutians, including Adak, have been in open sea for more than 20,000 years.

The Aleuts encountered by the Russians were traveling between islands in kayaks and umiaks (larger open boats) made from driftwood or whalebone frames and covered with seal skins. Remains of such boats have been found at numerous Aleutian sites dating back about 2000 years; researchers assume that the first Aleuts had similar boats, although the evidence does not preserve over time. "The fact that we find obsidian on Adak that comes from an island 1000 kilometers to the east indicates that these folks were moving around and they weren't doing this by swimming or walking between the islands," West says. "Those seas were treacherous."

It's no surprise that the Aleutians were colonized after the rest of the Americas: Massive ice sheets blocked the way from the Alaskan peninsula to the Aleutians until about 9000 years ago, according to work in the 1970s. The Paleo-Aleuts "probably could have landed on glacial shores and spent the night," Johnson says. "But it wasn't a place they could live." Once the sea route was clear, however, the ancient Aleuts moved swiftly. "The earliest inhabitants we know of, at Anangula, camped virtually right on top of glacial till," Davis says. "This suggests that as soon as those small islets were clear of ice, hunters from the mainland came to exploit available resources right away." Indeed, some researchers say, the islands' abundant maritime resources might have provided sustenance as good as or better than that available on the mainland. "The Aleuts became adapted to a kind of life that was quite rich, richer than most of the terrestrial areas," Dumond says. "As the population grew, it dug itself in to that way of living."

New evidence suggests that the pulse of migrations from east to west may correlate with times when the sea was coldest and most productive. Three western Aleutian islands were apparently first occupied during a long cold spell that started 3350 years ago, according to a paper by Savinetsky in a 2010 edited volume. In a second volume just published, Savinetsky, West, and others report that about 13% of the fish species at Adak's 7000-year-old ADK-171 site were cold-loving saffron cod. This suggests that Adak, too, was first settled during a cold period.

Cold periods might also have dampened the wicked winds of the Bering Sea, say Savinetsky and West, who point to earlier work suggesting that cooling in the north Pacific may have occurred during periods of weakened cyclonic activity. "Did cooler temperatures mean weakened cyclonic activity, thus less high waves, and greater marine productivity?" West asks. If so, she says, "then perhaps folks were more likely to explore and find new places."

When the ancient Aleuts did go exploring, Crawford says, they probably did so in family groups, splitting off from larger island populations and setting up residence on islands farther west.

But why did they keep trekking westward, exploring new territory? No one knows for sure. Some researchers chalk it up to human nature—our "constant search for new lands and endless curiosity," says archaeologist Christine Lefevre of the National Museum of Natural History in Paris. Corbett says she wonders about it all the time. "I was on Adak one cloudless, sunny day. I climbed a mountain where I could look out at the other islands. I imagined all those villages and the people living in them, boats on the water, smoke coming out of the houses. This was really a populated landscape. And yet there was lots of elbow room on the Alaskan peninsula and in the eastern Aleutians. But people still kept aiming for the horizon. They kept moving forward." **–MICHAEL BALTER**

Frigid waters. Cold-loving cod (*inset*) hint that the Aleutians were colonized during cold spells.

CREDITS: MASAYUKI TORII; (INSET) KITTY MECKLENBURG/NOAA

Additional Reading

D. West *et al.*, Eds. *The People Before: The Geology, Paleoecology and Archaeology of Adak Island, Alaska.* British Archaeological Reports, Oxford (2012).

D. Corbett *et al.*, Eds. *The People at the End of the World: The Western Aleutians Project and the Archaeology of Shemya Island.* Aurora, Anchorage (2010).

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