Envision being on a Bering Sea island where hundreds of screeching sea birds are soaring high above and diving out of the mist into the sea around you. You stand on the edge of a high wet tundra-covered ashy cliff overlooking a coast line where near shore, seals, sea lions, sea otters, and whales can occasionally be seen feeding in these remarkably rich northern waters. This scene is duplicated in the multitude of bays, inter-island passes, and offshore wave-pounded sea stacks throughout the north Pacific’s Aleutian Islands, the coast of Siberia’s Kamchatka Peninsula, and the Kurile Islands — all part of the North Pacific Rim of Fire. The scene is the backdrop for my story that begins in the summer of 1962 when I was the doctoral graduate student field supervisor for a University of Wisconsin-NSF archaeological-ecological expedition to the Aleutian islands. This wild treeless volcanic archipelago stretches 1,000 stormy miles from the Alaska mainland to a cluster of small islands far from the eastern coast of Kamchatka. The island chain divides the cold Bering Sea from the warmer north Pacific Ocean — a situation that generates dense chilling fog much of the year. In fact, the U.S. Coast Pilot warns that these are some of the most dangerous waters in the world. The 1962 expedition was part of a long-term scientific effort to understand the colonization of the New World, an effort that extends back into the mid-1800s when the American naturalist William Healy Dall carried out the first stratigraphic and explicitly evolutionary archaeological excavations in the New World. My trip that summer was the first of many that would take me to Alaska over the next 45 years. Why go there? Well, I was intrigued with the issue of how the New World was colonized by humans, and since all human evolution took place in the Old World, Native American beliefs notwithstanding, the initial route from the Old to the New World had to have been from Siberia to Alaska as every line of evidence indicates.
Part of our 1962 excavation was trenching a huge refuse mound that had been continuously settled upon by Aleuts for 4,000 years. Aleuts are close relatives of the better known Eskimos. There may have been 15,000 Aleuts when discovered by a Czar-ordered Russian exploratory expedition in 1739, led by Commander Vitus Bering. At the time of European contact, the Aleuts constituted one the largest non-agricultural populations in the New World. From the grassy summit of this 50 foot high accumulation of refuse one looks upon the often stormy, icy cold, and fog-shrouded Bering Sea. Today, this sea has 300 feet of water atop the sea floor that was a land bridge connecting Siberia and Alaska at the end of the last Ice Age. It was across this Bering land bridge that the ancestors of most Native Americans drifted into the New World 13,500 years ago — some may have boated along the southern ice-fringed coast of the land bridge, but only as far as the Alaska Peninsula because of massive glaciers grinding their way into the Pacific Ocean from their mountainous origins in the Alaska Range. These tiny pioneering bands of hunters and their families reached Alaska unknowingly because the animal and plant life of the Alaska mainland was much the same in Siberia and on the land bridge — a vast cold dry grass and sagebrush plain called Beringia or Arctic Steppe.

This northern Ice Age community is also called “Mammoth Steppe” in reference to the largest species in the Ice Age community. Many of the plant and animal species of this community were distributed from the unglaciated regions of eastern Europe, across all of Russia, Mongolia, and northeastern China to the base of the mile-thick continental ice sheet that lay heavily across all of Canada and southern Alaska. In addition to the mammoth, there were large herds of horse, bison, various deer, sheep, gazelle, and more solitary beasts like the wooly rhinoceros, cave lion, cave bear, and south of the Arctic Circle, packs of hyenas and other less cold-tolerant species.

That summer I dreamed of one day conducting anthropological research in Siberia in order to further understanding of how the New World was first colonized. Despite the Cold War between the U.S. and the Soviet Union, I eventually reached Siberia in 1979. I was
prepared to carry out bioarchaeological research on the basis of two methodologies I had learned and had advanced: (1) Due to the great expense involved in shipping archaeological artifacts and non-cultural samples from the Aleutians to Wisconsin and in later years to ASU, I had to reduce the volume of our archaeological recovery. Rather than sending every single bone or marine shell that we dug up, I decided to save only bone, stone, and shell refuse that had some sign of Aleut modification or utilization plus all bird and mammal skulls. In this way I became experienced in identifying cut marks and other form of damage or modification. (2) I and my ASU students developed a protocol for systematically observing human dental morphology in a highly standardized manner. Using this protocol, I had studied thousands of prehistoric Native American teeth, which made me familiar with their dental characteristics. To a large degree, dental morphology is inherited. Between-group dental comparisons provide a non-destructive way to easily and inexpensively estimate their degree of relatedness. With this data base I could search through Siberian archaeological collections looking for a match that would help identify the more precise homeland of ancestral Native Americans.

I made six additional research trips to the Aleutian islands, but also carried out summer-long bioarchaeological studies in museums and archaeological sites in North and South America, western Europe, Japan, Australia, Oceania, and Southeast Asia from 1962 to the present day. Much of this huge data base was eventually published with one of my ASU PhD graduate students (Scott and Turner 1997).

It was during one of these museum studies that I became very interested in human taphonomy. The term taphonomy was coined in 1940 by a Soviet paleontologist named I. A. Yefremov. He intended the term to mean the study of depositional and post-depositional processes that affect the condition and location of animal and plant matter after death. In one sense, taphonomy is a kind of detective work on the remains of prehistoric life. I had long been interested in what could be learned from studying prehistoric human bones and teeth. The interest grew sharply when I came across a human skeletal assemblage containing parts of at least 30 people that had been
severely cut and broken into many small pieces, some pieces of which were also burned. My previous experience in 1958-1961 as a member of the Museum of Northern Arizona’s Glen Canyon archaeological project on the Colorado and San Juan rivers told me that the butchered, broken, and burned human skeletal remains were strikingly like the processed remains of prehistoric game animals that we recovered from caves and rock shelters in the canyons of what is now Lake Powell. After a year of studying the remains, and conducting a year-long taphonomy and forensic literature review of all the possible ways that human remains could become damaged in this fashion, I and one of my ASU graduate students concluded that the humans might possibly have been cannibalized. Since that original study, my late wife, Jacqueline, and I worked off-and-on for 30 years on several other similar cases in the Southwest and Mexico. These studies culminated in our 1999 book, *Man Corn*. Needless to say, the book so strongly challenged the conventional wisdom about the prehistoric Anasazi being gentle peaceful that we were cursed by Indians, archaeologists, other scholars, New Age types, and the politically correct Santa Fe crowd. Since the publication of our book, there have been further discoveries of butchered and cooked human assemblages in the Four Corners region of the Southwest, and we have been vindicated.

During that long but intermittent study, we were aware that carnivores were also involved in damaging some of the human bones, but we were never exactly certain about who or what caused each and every damage mark. We needed prehistoric skeletal assemblages that were produced solely by carnivores in order to develop a carnivore damage signature. We could not identify any such collection in North or South America.

The opportunity to study assemblages of carnivore food refuse came about as part of the Native American origin studies I began in 1979 in the former USSR. During a 1984 mid-winter research trip to Novosibirsk, Siberia, my daughter, Korri Dee, and I met by chance a vertebrate paleontologist named Nicolai D. Ovodov. He showed us some of the excavated bones and teeth of ancient horses, mammoths, sheep, bison, rhinoceros, and various other species that had lived
12,000 to 40,000 years ago in Siberia. Most striking of these was the uniform and patterned way that large carnivores damaged bones.

Fig. 1. The uniformly damaged saiga antelope crania seen first in 1987 that stimulated this taphonomic study in Siberia. (All photos by the author).
Repeated and similar damage is normally a criterion for identifying human activity. However, this bone damage was caused by wolves, cave bears, cave lions, and cave hyenas. The latter were especially interesting, one reason being that their remains were always found broken, chewed upon, and covered with tooth marks indicating that cave hyenas were cannibalistic. One hyena den located in the forested limestone Altai Mountains near Mongolia was especially rich in bones that hyenas had carried into the cave over a period of some 40,000 years. Called Razboinich’ya (which in Russian means “refugee” cave in reference to three young men who hid in the cave for more than a year in order to avoid being drafted into the Soviet army during World War II), this deep, dry, near-freezing hyena den had been excavated over several summers by Ovodov and his associates. After an unsuccessful attempt to reach the cave in 1987 because of stormy mountain weather, we were successful twelve years later. When far back in the pitch black cave I experienced a strange sensation. I thought I heard the throaty coughing of some large animal. We had been studying hyena bone damage since the beginning of the summer, so these terrifying creatures were much on my mind. As it turned out, the sound came from heavy-smoker Ovodov coughing in a side branch of the main cave.

The large amount of very well preserved faunal remains that Ovodov recovered from Razboinich’ya gave us the baseline we needed for developing a carnivore bone damage signature. Ours turned out to be similar to others developed earlier, especially in southern Africa by C. K. Brain (1981). Ever since reaching Razboinich’ya, in addition to my dental anthropological studies on the colonization of the New World, in the back of my mind swirl vivid images of Ice Age Siberian people and their relationship to large carnivores, especially the huge and powerful socially-organized night-hunting hyenas whose massive jaws and teeth had easily cracked open even heavy and dense rhinoceros leg bones.

During the dozen or so research trips I made to the USSR, later named the Russian Federation, I came to realize that there was a taphonomic problem of immense proportion lurking in the Pleistocene prehistory of Siberia and the New World. Simply put, it is
this: Despite the archaeological excavation of many Ice Age open and cave sites both in ancient forest and steppe environments, and despite the excellent preservation of game animal bone refuse in many of these sites, almost no Ice Age human remains have been found — at most a quart or two of teeth and small bone fragments (Broken up, a complete adult human skeleton probably would fill 10-15 quart-sized containers.) Why? Explanations that come to mind include: First, the Pleistocene dead were buried, abandoned, or cremated away from all the habitation sites that the Russian archaeologists had excavated. The few bits of human bone and teeth found in the habitation sites suggest extra-mural burial was not always practiced, if it was practiced at all. Second, there might have been widespread human cannibalism. This was the conclusion reluctantly reached in the late 1990s by one of Russia’s best known anthropologists, the late Academician Valery Pavlovich Alexeev. Thanks to the experience gained in the *Man Corn* research, I have recognized a few scraps of human bone that could be tentatively suggested as having been cannibalized (Turner, Ovodov, and Pavlova 2003).
Fig. 2. Siberian human skeletal remains whose perimortem damage that might have been caused by cannibalism.

I am doubtful about this possibility as having been a major cause of the missing bone. Third, carnivorous scavengers might have dug up and consumed the humans buried in the habitation sites. There is
more direct and circumstantial evidence for this possibility than any other explanation. So, as the reader may suspect, two very different problems are beginning to converge: The colonization of the New World, and the bone damage signatures of large Siberian carnivores.

Since 1998 vertebrate paleontologist Ovodov, translator Olga Pavlova, others, and I (bioarchaeologist) have been studying the animal bones excavated from 30 Ice Age archaeological and paleontological sites in Siberia. We have gone through at least one million pieces of late Pleistocene bone curated in various Siberian institutions. We have visited archaeological and paleontological sites near or within the river basins of the Ob, Yenisei, and Angara. Our studies have also taken us to Ice Age sites and collections excavated east of Lake Baikal and post-Pleistocene collections excavated near the Sea of Japan. Much of our study and visitations have been in the Altai Mountains, near the Russian-Mongolian border. We have been supported for this taphonomic research by the National Geographic Society, the Wenner-Gren Foundation for Anthropological Research, my Regents’ Professor account, and the Siberian Branch of the Russian Academy of Sciences. We are indebted to a number of researchers for their help, most notably Academician Anatoly P. Derevianko, Director of the Institute of Archaeology and Ethnology, Novosibirsk. What have we learned and what are our plans for this information?

As for plan, we are in the final stages of analysis and writing a book-length monograph tentatively titled *Animal Teeth and Human Tools: A Taphonomic Odyssey in Ice Age Siberia*. A generous grant from the Emeritus College will enable the book to be copiously illustrated with photographs and line drawings of our findings and travel. Our major findings and working hypotheses are these:
1. The bone damage signatures of Siberian humans and carnivores can each be readily distinguished by a suite of taphonomic features (Turner et al. 2001a, 2001b). For example, in a bone assemblage, human damage characteristically includes stone tool cut marks, breakage of limb bones in the mid-shaft portion,

Fig. 3. Humans damage long bones to get at marrow by smashing the mid-shaft portion and leaving the ends intact. These bones are Ice Age reindeer tibiae.
smashing striations, and wide hammer-stone notches on fractures, among other features including rare pieces of accidentally burned bone. Carnivores, on the other hand leave tooth striations and puncture marks.

Fig. 4. Carnivore chewing marks that resemble poorly preserved stone tool cut marks. We refer to these as pseudo-cuts. They can resemble stone tool cut marks so closely, that by themselves, they would likely be misidentified.
Fig. 5. Two small pits caused by carnivore teeth. Pitting is not present in human damaged bone.
They chew at bone ends, creating rounded and polished hollowed ends.

Fig. 6. End-hollowing. Damage to long bones by carnivores occurs at the ends of the bones as the animals chew away in their effort to get at the marrow. This, and several other damage features define the carnivore bone damage signature.
but rarely do they damage the mid-shaft region. They leave small notches on fractures. Using carnivore assemblages such as Razboinich’ya, we can be certain that hyenas ransacked human cave refuse in search of bone fragments from which they not only could extract marrow grease by cracking open bones, but also bone protein. They obtained the latter by swallowing many bone fragments, which their digestive system was capable of dissolving. Fragments that pass through the entire length of their intestinal tract are highly eroded and so highly polished that they have a slippery feel. We refer to these partly digested bone fragments as *stomach bones*. They are very common in paleontological sites where hyenas had dens, and are present in the Ice Age archaeological sites, but not in post-glacial animal dens or human encampments because at the end of the Ice Age, Siberian hyenas became extinct along with mammoth, rhinoceros, and many other mega-fauna.

2. Ice Age cave hyenas were distributed longitudinally all over Siberia and latitudinally as far as 55° north (about the latitude of the U.S.-Canadian border). Actual hyena skeletal remains and their damage signature occur in many Siberian Ice Age archaeological and paleontological sites below 55°. Siberian people and hyenas were patently aware of one another. Ice Age human skeletal remains are rarely found despite the excellent preservation of non-human animal remains.

3. At the end of the Ice Age, about 12,000 years ago, hyenas went extinct along with northern mega-fauna such as mammoth, rhinoceros, bison, and many other species. The Arctic Steppe was replaced by forests in most of Siberia, and treeless tundra in the far north. From this time on, buried human remains are commonly discovered in Siberian habitation sites.

4. The inverse relationship between hyenas and human remains leads us to the hypothesis that the number of Siberian humans may have been held down by hyena and other carnivore predation, as well as by cold climate and patchy food resources in the steppe and forest-steppe eco-systems. Just as there are hyena attacks on children and elderly adults today in Africa and India, so must have been their predatory
behavior during the Ice Age. Toddlers wandering away from camp would have made easy pickings for a packing of prowling Siberian hyenas. Opportunistic predation would have been an added measure of human population control that would have slowed down the natural expansion northward of a growing population. There is very little evidence of human presence north of the Arctic Circle until the very end of the Ice Age.

5. Humans reached Alaska about 13,500 years ago, a time shortly after a domesticated dog skull was left in the Razboinich’ya hyena cave. The stratum in which Ovodov found the dog skull dates about 14,000 years ago. Northeast Asian wolves were seemingly the first wild animals that humankind domesticated. The resulting dog may represent the “invention” that enabled humans to expand into Alaska by guarding human encampments from marauding packs of hyenas or wolves, or solitary bears and lions. The dogs could have also served as aids in transporting the considerable camping gear needed to live in the high Arctic (tents, tent poles, bedding, emergency food, clothing, tools, weapons, etc. — the multitude of material culture items used and needed by Eskimos is well known). Because of the preponderance of hyena remains in Ice Age Siberian archaeological sites in contrast with the lesser number of cave lion, cave bear, and wolf remains, we feel that hyenas played a significant role in the delayed settlement of Alaska. There were anatomically modern humans in Siberia at least 20,000 years ago, and more archaic forms even earlier. In addition to opportunistic predation, hyenas may have entered camps and dragged away the weak or those in deep in sleep. They could also have scavenged the carcasses of large animals that human hunters had killed, thus denying the humans the entirety of their hunt. Numerous scenarios can be produced by analogy with hyena activity in their modern range that includes Africa, India, and the Near and Middle East. Such scenarios are allowed by the taphonomic demonstration of hyena abundance in Ice Age Siberia. It is curious that hyenas have lived for millions of years in the Old World, and still do in the above mentioned regions. However, in northern Eurasia they seem to have met their match with the coming of anatomically modern humans, their dogs, and technological inventions unknown to the earlier archaic humans. A very marked
cold snap at about 15,000 years ago, called the Late Glacial Maximum, may also have played a role in their extinction. As the exact story unfolds about the cave hyena extinction, one inference seems solid: Humans did not disperse into the New World until these powerful social Siberian predators went extinct.

6. One curious finding that came out of our taphonomic study is the very low frequency of burned bone. The few fragments that are burned suggest that they fell into campfires accidently. No pieces suggest the roasting of meat. Some other form of cooking and grease-rendering must have been practiced such as light boiling in skin bags filled with water heated by hot stones. Unfortunately, for this explanation, very few stones have been found showing thermal damage. Perhaps most meat was eaten raw, as was done by historic Eskimos.

The Emeritus College grant will allow voluminous illustrations of how game animals were processed by ancient Siberian humans and hyenas. These heretofore unsuspected stalking hazards are hypothesized as having slowed down human population expansion—expansion that in the northeasterly trek across Beringia brought the ancestors of Natives Americans into a hunter’s paradise filled with game animals totally naive about human behavior. Once past the Siberian hyena barrier, the New World was rapidly filled with humans who found an abundance of food, no enemies, no contagious diseases, and very few social carnivores. We add to this scenario the dog which along with the fine tailoring needle may have been two important inventions that helped late Pleistocene Siberians to reach the New World.

This story began in the Aleutian Islands of Alaska, so perhaps I should return there for my ending. There, as in Siberia, thousands of animal bones were recovered in our excavations. All were from sea mammals, marine fish, marine birds, and marine shellfish. There were apparently no terrestrial animals in the prehistoric Aleutian Islands. The Aleuts were a maritime people whose roots seem to go back to the late Pleistocene Siberian Pacific coast and the lower reaches of the Amur River, which empties into the ocean north of Japan. These
Amurians must also have encountered hyenas because their distinctive bones and teeth have been found in a small late Pleistocene near-coastal cave site north of Vladivostok excavated by Ovodov in the mid-1960s. Ancestral Aleuts, like ancestral Indians, entered the New World late relative to other parts of the world (Australia, for example, was reached 50,000 years ago). Yes, terrible cold was undoubtedly a factor in the tardy settlement of the New World. But it alone does not explain why even the food-rich marine Aleutian Islands were seemingly settled so late also.

References

Anonymous


Brain, C. K.


Turner, Christy G. II, and Jacqueline A. Turner


Turner, Christy G. II, Nicolai D. Ovodov, Nicolai V. Martynovich, Olga V. Pavlova, Anatoli P. Derevianko, and Nicolai D. Drosdov


Turner, Christy G. II, Nicolai D. Ovodov, Nicolai V. Martynovich, and Alexander N. Popov.


Turner, Christy G. II, Nicolai D. Ovodov, and Olga V. Pavlova