# THE RUSSIAN-AMERICAN PERIMORTEM TAPHONOMY PROJECT IN SIBERIA: A TRIBUTE TO NICOLAI DMITRIEVICH OVODOV, PIONEERING SIBERIAN VERTEBRATE PALEONTOLOGIST AND CAVE ARCHAEOLOGIST

**Christy G. Turner II**
Arizona State University, 2208 N. Campo Alegre Dr., Tempe, AZ 85281-1105; chrstyghturner@netzero.com

## ABSTRACT

This account describes ten years of data collecting, travel, personal experiences, analyses, and report writing (a list follows the text) on the subject of "perimortem" (at or around the time of death) bone damage in Ice Age Siberia. In the telling, emphasis is given to Nicolai D. Ovodov's role in this long-term project, and his earlier contributions to Siberian cave and open-site archaeology. This is more a personal story than a scientific report. Observations made on the bone assemblage from 30,000-year-old Varvarina Gora, an open-air site east of Lake Baikal that Ovodov helped excavate in the 1970s, illustrate our research.

**KEYWORDS:** taphonomy, Late Pleistocene Siberia, cave hyenas

## INTRODUCTION

Former Alaska Governor Sarah Palin has reportedly said that Russia is just outside her back door in Wasilla. I don't know which way that door actually faces, but she has a point. Russia is close to Alaska geographically, historically, prehistorically and in other ways. Alaska scholars should know as much about Russia as my Southwest U.S. colleagues have to know about Mexico.

The scholar I will talk about here is almost totally unknown outside Russia. His name is Nicolai D. Ovodov. Let me set the stage for this story. Experimental replication is generally not possible in archaeology, but statistical procedures and analogy can be used for scientific inference, and they often approximate experimentation. This methodological restriction should prompt more contextual information, which patently means some accounting about the analyst(s) involved. That is what I will try to do here. After all, knowing the backgrounds of scientists is often useful in evaluating the conclusions they reach from their studies. Credibility is linked with reputation.

The reason for our taphonomy study is simple. We wanted to see first-hand the damage to bone caused by human butchering compared with chewing by nonhuman animals, particularly that of large carnivores, especially cave hyenas, *Crocuta spelaea* (Fig. 1). Remains of these creatures show that they roamed in Siberia as far as 55° N, almost the same latitude as Ketchikan. This research was a natural next step in my interests in cannibalism (Turner and Turner 1999), the peopling of the New World, and the idea that something more than cold was involved in the very late human crossing of Beringia, especially in light of the fact that most of the Old World, and even Australia, was colonized by anatomically modern humans at least 40,000 years ago. Our study explores the possibility that packs of perhaps one hundred huge night-hunting hyenas might have served as a barrier to Beringia due to their predation on humans or human food resources in a patchy environment (Fig. 2). Such predation may have inhibited human population growth in small groups, and

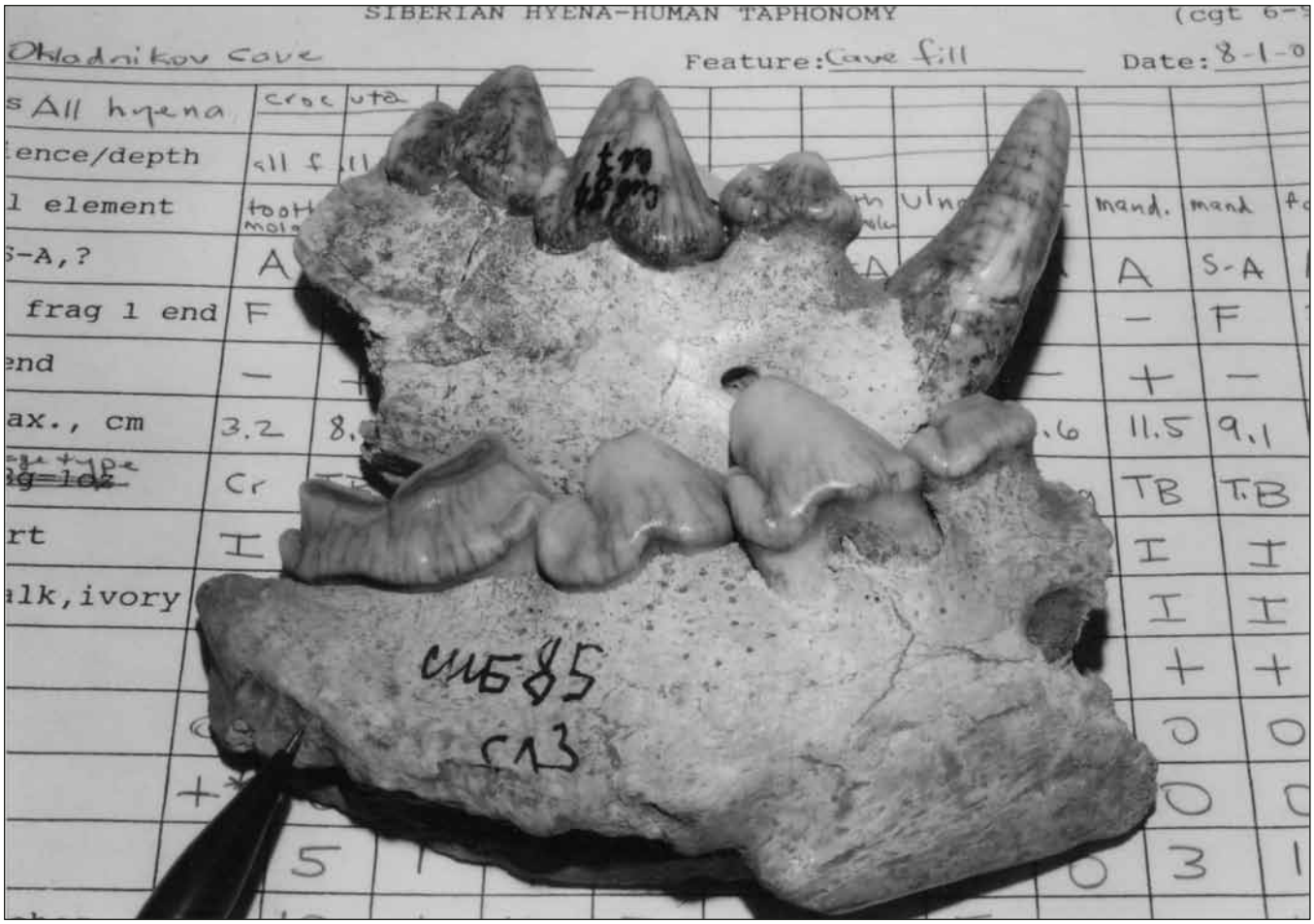


*Figure 1. Hyena mandible fragments from Okladnikov Cave, shown against background of a data sheet. Hyenas were cannibalistic. The pencil points to a tooth notch. Lower piece is 10.5 cm long (CGT neg. 8-3-00: color 6).*[1]

natural expansion into a rich but environmentally harsh and challenging Siberian Ice Age (i.e., quote by Hans Kruuk to follow).

A different "animal barrier" model was proposed by Valerius Geist (1989). He suggested that very large Alaskan predators, such as the giant short-faced bear, kept Siberians out of Alaska until the carnivores went extinct. Carnivore extinction is an important component to both models, as are the large predators themselves. Both models imply that cold alone was not responsible for the late colonization of the New World compared with the much earlier occupation of the Old World. The hyena model is more parsimonious because Ice Age Siberian archaeological sites often contain hyena remains, which shows that humans and hyenas dwelled in the same territory, whereas there is no such record that I know of for Late Pleistocene Alaska. Recently, Geist and his Russian co-authors, L. Baskin, I. Okhlopkov, and I. Spilenok, reviewed possible antipredator mechanisms (Geist et al. n.d.). Our project has not given much consideration to this matter except for our thoughts on the importance of dogs for a variety of purposes: sentinels, defense, transportation, hunting, and even serving as food in crisis situations. However, we may have only one Late Pleistocene dog, should future morphological reanalysis and DNA study show that the remains found many years ago in Afontova Gora II are those of a small wolf, not a dog (Astaknov 1999).

It took the skills of three very differently trained individuals to carry out this project. First, a vertebrate paleontologist and pioneering cave archaeologist, who incidentally speaks only Russian. This researcher is Nicolai D. Ovodov. I think of Nicolai as being a "bioarchaeologist"

1. ID notation applies to photographs in this article. CGT neg. 8-3-00: color 6 refers to Christy G. Turner negative, August 3, 2000: frame # color 6.


***Figure 2. Photo set-up to illustrate size and power of hyena jaws. Top piece is a rhinoceros humerus, cracked open by a hyena. Middle is a late prehistoric humerus from a human female from a Neolithic Altai foothills cemetary. Bottom is a young hyena mandible fragment, 10.0 cm in length. The potential hazard to humans by hyenas is easy to envision here. The rhinoceros piece came from Proskuryakova Cave, squares 15–16, 0–30 cm deep. The hyena mandible is from excavations at Razboinich'ya Cave in 1989, small trench 8. Both caves are in the Altai Mountains of Siberia (CGT neg. 8-11-99: color 2).***

in the usage of the term by my colleagues at Arizona State University (Turner 2007). There, on the one hand, it refers to archaeology and faunal correlates, as exemplified by the work of Katherine Spielmann. This approach fits Nicolai's research. On the other hand, bioarchaeology refers to concerns about human skeletal remains and archaeology, a combination that I have dealt with long before the term was coined. This orientation is best exemplified in Alaska by the work of the late William S. Laughlin. Secondly, we needed a Russian-English translator familiar with scientific terms who was also field savvy. This person is Olga V. Pavlova. Lastly, we needed someone experienced in perimortem bone damage, i.e., me.

I first met in person the other team members of this project, Nicolai and Olga, in Siberia, January, 1984, although I had unknowingly photographed Olga as she was simutaneously translating for Robert Ackerman (English to Russian) and Ruslan Vasilevsky (Russian to English) at an international Pacific Science Conference held in Khabarovsk in late summer, 1979. Five years later, accompanied by my youngest and anthropologically trained daughter, Korri Dee, we had traveled to Novosibirsk to examine prehistoric human dental remains in the collections of the Institute of Archaeology and Ethnography (formerly, IHPP), Academgorodok, Novosibirsk. These dental studies, permitted by the institute director, academician Anatoly P. Derevianko, were part of my long-term study on the ancestral origins of Native Americans and peoples of Oceania (Turner 1992, 1998). Our first meeting occurred in Nicolai's top floor osteology lab, which

was located down the unheated dark hallway from the cold lab space we had been provided for our dental examinations. Nicolai was a very interesting person. Born in 1939, he never talked about his youth. Still, he was friendly, hospitable, gentle, with greying hair and a rather typical Slavonic appearance: blue eyes, weather-beaten masculine face. Nicolai was no stranger to cheap cardboard-tubed Russian cigarettes and all grades of vodka. He was very knowledgeable about mammalian osteology and Pleistocene fauna; piles of excavated bones reached to the ceiling of his cluttered little dusty lab. In the lab, near the ceiling on the highest shelf, sat a shiny silver samovar and a time-stained rhinoceros skull—symbols of where part of my future lay. Despite the clutter, most of the faunal remains collected during forty years of archaeological and paleontological research were kept in a multitude of boxes shelved in a large unheated attic storeroom (Fig. 3). A weathered handmade wooden bird feeder was outside one window of his lab, on which Nicolai placed bits of old bread, slices of tiny withered apples, and fatty sausage for small winter birds. As I was to learn in the future, Nicolai cared deeply for animals large and small (Fig. 4). He cared also for people. After we began our joint research project in 1998 and were working in his lab, all sorts of people would pop in to see him. All this daily traffic suggested that he was one of the most popular members of the institute, possibly even more than the charming women translators and editors in room 318. As Nicolai and I were both interested in old bones and teeth, we immediately struck up a friendship that has lasted to the present day.

***Figure 3. Nicolai Ovodov and Olga Pavlova in the IAE attic osteology storeroom. Hundreds of boxes filled with bone fragments and teeth are kept in this room (cgt neg. 7-30-99:15 A).***

Olga Pavlova is a petite woman, on occasion somewhat remote. Her knowledge of Russian and English literature is staggering. Her accent is pure magic. She has a Russian saying for all sorts of occasions, which always starts out as: "Vee Russians have a sayying. . . ." Olga had been assigned to help Korri and me with written and verbal translations, and she was also a wonderful hostess, bringing us snacks for lunch, inviting Korri and I for dinner at her home, and other kindnesses. Friendship with Olga eventually led to our 2004 marriage in Novosibirsk, eight years after my first wife, Jacqueline, died of cancer. Our wedding dinner party at "Zhili-Byli" ("once upon a time") was honored with Alexander Konopatski, also bilingual, serving as master of ceremonies. Two of the room 318 editor-translators, Elena Pankeyeva and Olga Volkova, helped Olga select a beautiful evening dress. These comments all mean, of course, that our team was greater than the sum of its parts. Ours was not a 9 to 5 operation.

At that first meeting in 1984, Nicolai had laid out on a table the skull bases of several Late Pleistocene saiga antelopes whose gnawed occiputs and horn cores were all that remained. The uniformity of the damage was striking, so much in fact that it undermined my belief that patterned damage to bones was evidence of human manipulation. Nicolai explained that the damage was most likely done by young wolves. Nicolai's work and his faunal collections would eventually shatter many of my beliefs about human prehistory, including my concern that some Siberian archaeology was questionable because workers had not taken into account the stratigraphic disturbances, behavior, and presence of large carnivores that we soon recognized on the basis of our perimortem taphonomic research. For example, we determined that Okladnikov Cave in the Altai Mountains was used as much by hyenas as by Late Pleistocene humans. Human occupation of the cave had to have been discontinuous. More stark was the archaeological find by Alexander Postnov in Ust-Kan Cave that Upper Paleolithic blade tools were deeper in the statigraphic profile than the Mousterian-like artifacts. We proposed a simple bioturbation explanation rather than less parsimonious cultural scenarios (Turner, Ovodov, and Pavlova 2001). Hyena presence was abundant in Ust-Kan (Fig. 5). The reversed statigraphy had to have been the result of hyena disturbances. Discontinuity of occupation is a safe inference. Living with hyenas at Ust-Kan or anywhere else would have been dangerous. Consider accounts of humans and hyenas today in Africa. Hans Kruuk (2002:64) writes:

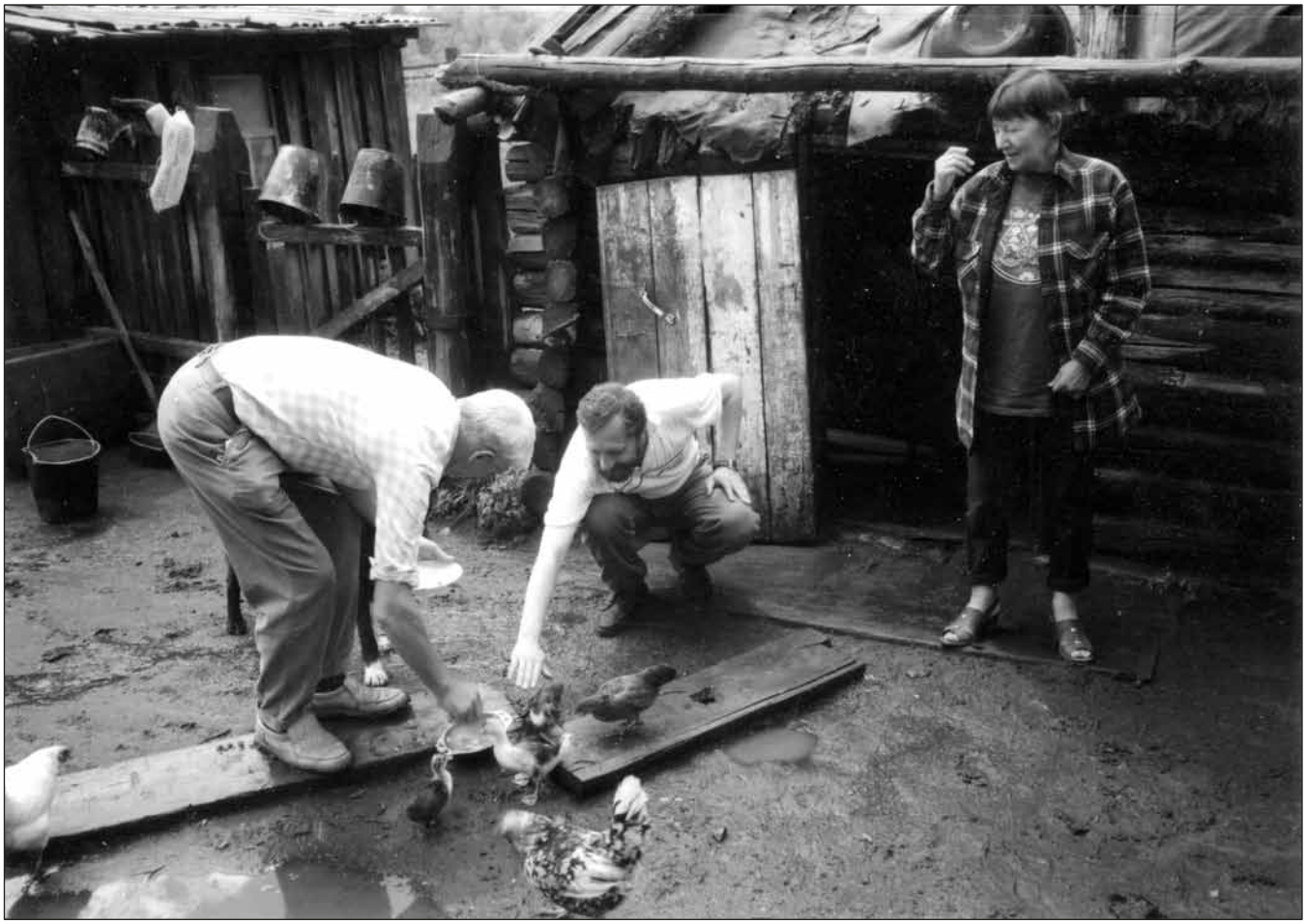

***Figure 4. L to R, Nicolai Ovodov (IAE archaeologist), Sergei Markin, and Olga Pavlova at the pre-Russian style of residence belonging to Karakol villager Galina Urosova. The men are giving young chickens and the mother hen bread crumbs following a torrential afternoon rain storm in the Altai Mountains. The doorway behind Olga leads into a large circular cribbed-roof hogan-like log structure (cgt neg. 7-10-99:19).***

> The spotted hyena is, despite its [scavenger] reputation, a large, wolf-like predator, often hunting the African plains and even the forests in packs . . . they have a considerable crime record . . . hyenas are also killers of people. . . . In Malawi . . . they killed and ate 27 people over 5 years. Many . . . of the victims were children.

In addition, the Okladnikov Cave people were more likely to have been Neandertals than anatomically modern humans. This inference was first proposed on the basis of my examination of the few ancient teeth found in Okladnidov and Denisova caves (Turner 1990). This inference would be confirmed seventeen years later by DNA analysis of human bone fragments from these caves (Krause et al. 2007). Elsewhere (Turner 2008), I have commented on the issue of Neandertals and possibly even earlier hominids in Siberia.

We would eventually determine that most excavated Siberian Pleistocene archaeological cave and open-air sites we studied were also used or scavenged by cave hyenas (statistical inference).

These seemingly pristine sites unquestionably had their statigraphic levels disturbed or blurred, leading to inferences that there had been cultural continuity from Middle to Upper Paleolithic traditions rather than external cultural replacement. This finding of human and hyena site use leads to fascinating questions about how humans and hyenas got along together. Not well, Ovodov (1987) imagines. I agree. The miniscule amount of human skeletal remains in Late Pleistocene Siberia demands explanation. I suspect that much of the explanation, whenever it is proposed, will involve hyena behavior as much as mortuary practices. There are grounds for this speculation. For example, Alan Mann (pers. comm., September

*Figure 5. Faunal remains from Ust-Kan Cave, Altai Mountains. Top two pieces have breakage but no other damage. All other pieces have been digested to some degree, including the hyena tooth (middle left). The tooth also has tooth dints, indicating that it had been chewed as well as swallowed and partly digested. The large cranial fragment (lower right) is also partly digested. The cave in which these pieces were found by Alexander Postnov and his field crew is located in a limestone butte high above the surrounding sagebrush-covered valley floor. Scale in cm (cgt neg. 9-20-00:33).*

13, 2007) found in his excavations at Les Pradelles, a Middle Paleolithic Mousterian site in the Charente, France, a number of Neandertal teeth "that were clearly eaten by hyenas and then regurgitated." Les Pradelles also produced numerous hyena bones, teeth, and their distinctive round, white scats.

In 1987 I returned to Novosibirsk, this time with my late wife, Jacqueline, to continue the human dental examinations. With the recommendation and support of Anatoly Derevianko, Jacqueline and I were offered the opportunity to visit the ongoing Institute of Archaeology and Ethnography (IAE) excavations in the Late Pleistocene Altai cave sites. A permanent field camp had been established near one site, Denisova Cave, and Nicolai was there studying newly excavated faunal remains on our arrival in early June 1987. Olga Pavlova accompanied us to be our translator and hostess. Through her excellent language skills, we learned a great deal about past and ongoing excavations and scientific research in this region from IAE archaeologists Sergei Markin, Vyacheslav Molodin, Yuri Grichan, and others. Also, we learned that it was Nicolai, with his scientific interest in caves, who had explored and first tested the now famous Denisova and Kaminnaya archaeological cave sites (Okladnikov and Ovodov 1972).

Nicolai's excavations in another Altai cave, locally called Razboinich'ya (Deserter's Cave), turned up no evidence that humans had ever occupied the cave, although Ovodov found evidence suggestive of a ritual involving a dog's head had been performed deep in the cave at least 14,000 years ago, and possibly 30,000 BP (Ovodov and Kuzmin 2006). Nicolai's identification of this complete skull as being that of a dog means it is among the oldest, if not the oldest, dogs known in Siberia, and perhaps in the entire world.

The huge faunal assemblage from Razboinich'ya would be the foundation for our project's identification

of a carnivore perimortem bone damage signature. I was aware of numerous studies that had identified carnivore bone damage, including that of hyenas in Africa and Israel. But, remember, we wanted to see this damage first hand, and for statistical reasons, lots of it. Moreover, the Razboinich'ya and other cave hyena assemblages provide a solid basis for inferences about hyena life, including their cannibalistic behavior (Ovodov and Martynovich 2005).

Nicolai's cave discoveries of Altai Pleistocene fauna and associated stone artifacts ignited a major program by the IAE archaeologists and other specialists, who have published scores of articles and books following his Altai discoveries. Few of these acknowledge Nicolai's pioneering work, and none has recognized the vastly important comparative value of the Razboinich'ya Cave faunal assemblage that accumulated with remarkable preservation for at least 40,000 years because the limestone cave was alkaline, dry, cold, dark, geologically stable, and remote.

During that 1987 field trip, Nicolai urged us to visit Razboinich'ya in the forested mountains above Kaminnaya Cave and 3 km away. Several seasons of excavations by Nicolai and his associates, including avian paleontologist Nicolai Martynovich, showed that the major large inhabitants were cave hyenas (Ovodov and Martynovich 2005). This interpretation was based on the many hyena bones and the hundreds of distinctive round white coprolites, many containing incompletely digested bone and tooth fragments. Although we tried, the weather turned too bad to reach Razboinich'ya Cave. Despite this disappointment, it was immediately apparent that here was an excellent opportunity to differentiate bone damage caused by carnivores and humans in archaeological cave deposits and to help recognize bones that might have been introduced into archaeological sites by hyena occupants. We began to doubt the general assumption that all bone found in an ancient archaeological site was the result of human foraging.

Given the mixed human and hyena use of the Siberian archaeological sites we had studied, I wondered about the sourcing of site contents at an international field conference held at Nicolai Drozdov's Kurtak camp on the Yenisei River reservoir. One thought that might help to infer what Late Pleistocene Siberian humans were actually hunting or scavenging would be to count as "human-procured" only those bones that had all or most of the human damage signature. Derevianko, who briefly attended the conference, was unimpressed with this suggestion as our team was sorting the thousands of small bird and rodent bones and teeth recovered from screening sediments from our premeeting excavation far to the south at Dvuglazka Cave. I thought that distinguishing carnivore versus human perimortem damage to bone would allow a better assessment of how much the archaeological caves had been used by carnivores. Knowing this would allow us to estimate continuity of human occupation. Discontinuity would, it seems to me, allow for the unimpeded entry of Upper Paleolithic modern humans from Europe and East Asia, as cultural remains and human teeth suggest actually happened. For example, blade tools, busty and full-hipped female figurines, and European-like teeth from the site called Mal'ta suggests to me a Cro-Magnon presence near Lake Baikal at least 22,000 years ago. In a cave near the Sea of Japan, called Geographic Society Cave, excavated by Ovodov, chopping and flake tools like those found in China were unearthed (Fig. 6) (Okladnikov and Kirillov 1980; Okladnikov, Vereschagin and Ovodov 1968; Ovodov 1977). He also found hyena remains, which means that cave hyenas once hunted and scavenged across Eurasia, from the Atlantic to the Pacific oceans in Late Pleistocene times. Their numbers must have varied from region to region depending on food resources and other factors, including competition from humans. Yes, there were packs of other social predators (wolves) throughout the same territory, but humans domesticated wolves, not hyenas. A daytime attack by a huge but solitary cave bear or cave lion might have been repulsed, but it is hard to imagine how a small group of Paleolithic Siberians could have saved themselves against a many-jawed stalking pack of fifty to one hundred nocturnal predators.

The rarity of hyena images in the remarkably realistic European Upper Paleolithic rock and mobile art (Guthrie 2005), when compared with numerous images of other carnivores such as bears and lions, was not due to their scarcity, because hyena remains are common in European cave sites. Instead, perhaps like in parts of Africa today, hyenas were viewed as evil spirits. Kruuk (2002:187) wrote:

> The animal involved in witchcraft more than any other is the spotted hyena, a species which generally is utterly loathed throughout the [African] continent.... This loathing goes beyond feelings based on mere ecological competition.... Aren't the animal's weird laughing noises and its slinking nocturnal movements around one's house (often followed by some disaster to the occupants) almost proof that in some devilish way it is under control of supernatural powers?

Despite this loathing, a few hyena images appear in African cave art (Kruuk 2002:196).

These lines of reasoning and inference became the basis of our long-term perimortem taphonomy project, though it shifted slightly from a technical emphasis on bone damage and cannibalism to curiosity about the relationship between hyenas and human migration to the New World (e.g., Turner, Ovodov and Pavlova 2005). We never gave up on the cannibalism focus, because we had a few bits of human bone with damage that suggested cannibalism might have occurred. I have to say "might" because carnivore damage in most of our human remains is so prevalent. One site where human cannibalism might have occurred is a cave that Nicolai helped excavate, and which he named Yelenev Cave. It is located in a high limestone cliff overlooking the Yenisei River a few km upriver from Krasnoyarsk. Five Mesolithic-Neolithic (10,500–8,500 BP) individuals could be identified with certainty based on sixty-five pieces of bone and teeth. Bone damage included perimortem breakage, cut marks, burning, anvil abrasions, end-polishing, and many missing vertebrae—the six key features of cannibalism based on prehistoric Mexican and Southwest U.S. assemblages. The Yelenev Cave human assemblage is the best case of possible cannibalism in prehistoric Siberia (Turner, Ovodov and Pavlova 2003). The dental morphpology of these individuals suggests a mix of Asian and European characteristics. While other cases of possible cannibalism exist, provenience information is inadequate, making it impossible to determine whether cannibalism occurred in Late Pleistocene Siberia.

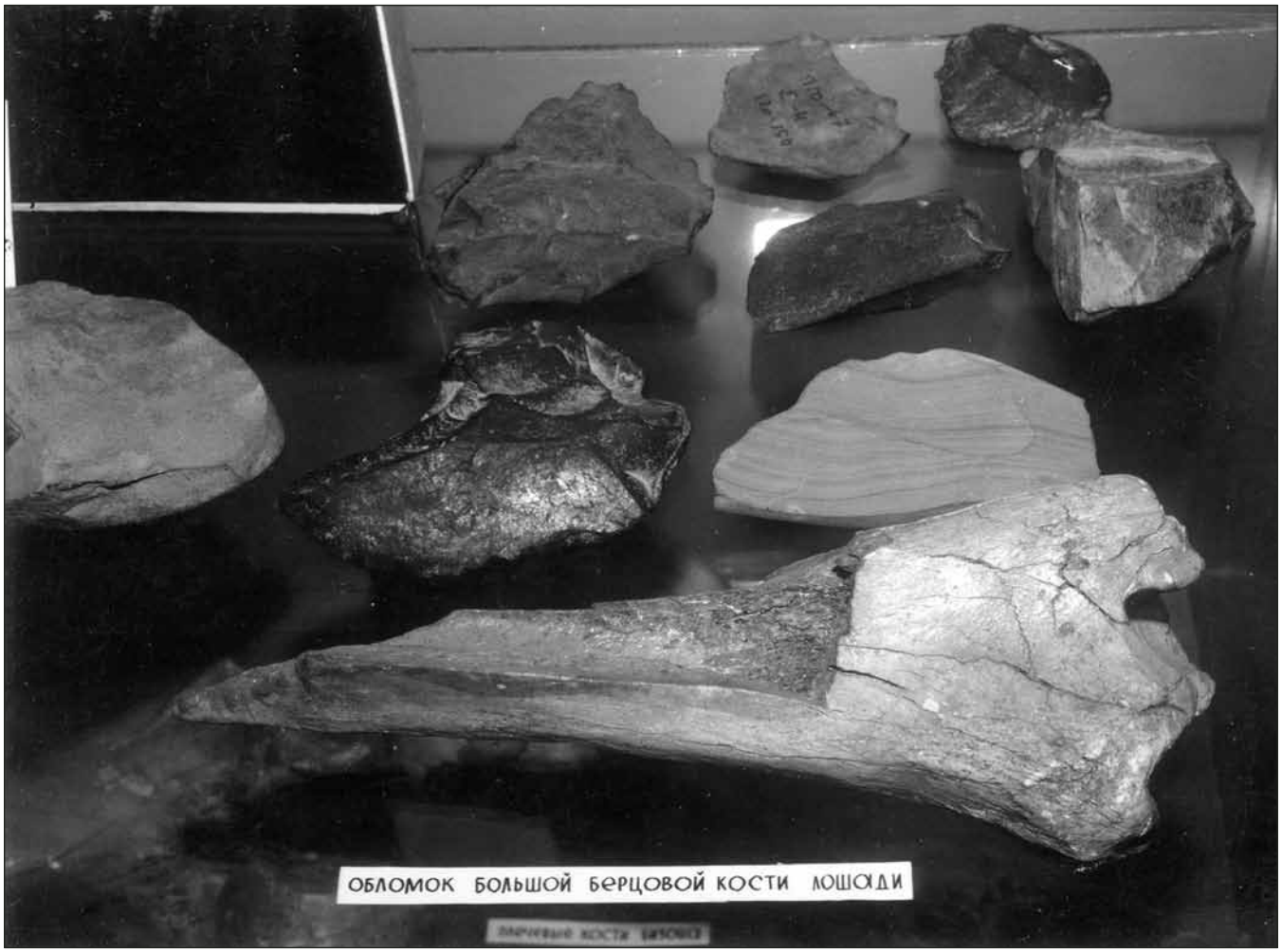


*Figure 6. Examples of Geographic Society Cave bone and stone artifacts excavated by Nicolai Ovodov, 1966–67. Horse tibia has polishing at pointed end. Locked cabinet in old IAE museum, hence no scale. Cave hyena remains were also found here. The cave is near Nakhodka, a port on the Sea of Japan (cgt neg. 6-8-87:29).*

Since 1998 Nicolai, Olga, and I have made taphonomic damage observations on thirty bone assemblages collected in open and cave archaeological and paleontological settings (e.g., Turner, Ovodov, and Pavlova n.d.). We sorted through at least one million pieces of bone and did a detailed study on more than 9,000 pieces (each taking 20 minutes or more to record) until our final year of data collecting in 2006 when, at the invitation and with much help from archaeologist Nicolai Drozdov and his associate, Eugene Artemiev, we examined newly excavated faunal remains from Afontova Gora, a famous site complex located on the left bank of the Yenisei River (Astakhov 1999) near the center of Krasnoyarsk.

Throughout the project Nicolai did most of the faunal identifications. Olga did all the translating and made the travel and lodging arrangements. (She once insisted in a huge eight-story run-down student dorm we were staying in that my mattress was no good and demanded a better one from the manager. I got the mattress, and we even were given two little bars of soap and a nearly empty roll of toilet paper). I made the taphonomic observations, often double-checking with Nicolai to see if he agreed with me on one point or another, and I did the macro-photography. Our selection criteria were (1) a bone piece had to be at least 2.5 cm in maximum diameter, and (2) it had to exhibit minimal root damage. We generally did not study loose teeth. We came to realize that whole bones rarely had any perimortem damage, so we only sampled these in each assemblage. This selectivity means that our measurement data are biased towards smaller mean size, although not significantly since we excluded from study the very small pieces of bone. Our examinations were carried out in museum and field settings and, wherever possible, with standardized lighting. For the former we studied collections in archaeological and paleontological institutions in Moscow, Novosibirsk, Tomsk, Krasnoyarsk, Irkutsk, Vladivostok, and Kiev. We visited several sites in the Altai Mountains and along the Yenisei River and in its vast catchment basin. We visited work in progress on the southern forested shore of Lake Baikal, and to the east near the dry steppic Ulan-Ude. Our lodging ranged from short-term furnished apartment or hotel rentals to mosquito-stricken tents. Meals included dishes in institutional cafeterias, small restaurants, and food we cooked in apartments, to starchy and pasty dishes prepared in field camps. Always, regardless of the situation, vodka was at hand.

Our three-person team got along together remarkably well. Of course, there were moments of discontent, just as there are in any long-term relationships. Our relations with other archaeologists, geologists, biologists, and related specialists were cordial. Everyone knew Nicolai. We had few setbacks. Only once were we denied access to a museum collection and only once did we have an accident. That occurred when I slipped and fell while descending a high boulder-covered Bronze Age burial mound. One year when I was passing through customs and security at an airport for a flight back to Moscow, I was stopped by a soldier checking documents and passports. He noticed that I had failed to register with the militia in this city and therefore I could not board the aircraft with my faulty credentials. We argued for quite a while until he telephoned his superior who told the guard to let me pass. The soldier muttered in simple English that I would never get back into Russia again. That threat never materialized, although after that incident I made certain to register with the local militia wherever we traveled. Few Siberian banks would exchange rubles for traveler's checks or dollars. I once wrote the wrong date on ten $100 traveler's checks. The bank clerk refused to accept them. With this loss of a month's funding, our travel expenses were tightened considerably. Still, we had enough money to travel for the project that summer. Anyone considering travel in Siberia can count on some banks having ATM service, but the exchange rate is costly. On the whole, I found it best to travel with half the summer's money in traveler's checks and half in new $100 bills.

Travel in Siberia is difficult. Seasoned world travelers can figure things out, but without some Russian language ability one is lost. With the exception of the southern Lake Baikal region (backpacking trekkers) and Vladivostok (Chinese), Siberia has almost no foreign tourists. There is little danger of bumping into a gaggle of loud New Yorkers. Nevertheless, Siberians love to travel, and there are numerous inexpensive tour and express bus companies that operate out of every city. Along their routes there are highway pull-outs and rest stops that are filled with umbrella-protected, out-of-doors vendors and small cafes and stalls selling all sorts of beverages, cigarettes, candy, baked goods, and fast foods. The best are *shashliks*—bite-size chunks of juicy meat, usually beef, on skewers seared over hot wood coals in smoky half-barrel-shaped waist-high steel BBQ grills, and served with spicy tomato and garlic sauce that varies in flavor from vendor to vendor. When several buses and tourist cars pull into one of these roadside rest stops at the same time there is a frantic and festive air. Cigarettes are lit, photos are snapped,

and snacks are purchased. At these stops, Nicolai would have his cigarette and whatever I had ordered to eat. This was usually a flavorless mushy gray hot dog and cheeseless macaroni (all the kitchen had left by noon), and a beer. Olga would order hot tea with lots of sugar and a small tort. She detested paper cups, and always sought out a vendor who sold tea in glasses or pottery cups. She had a very strong attitude about purchases: If it cost more, it must be better. This classy aristocratic behavior worked, and low class vendors always went out of their way to fulfill her requests. I never ceased to be amazed at how such a small woman could get so much respect from the huge apron- and scarf-wearing babushkas.

Travel by bus was fun and, like today's airlines, one paid a small fee for baggage if the driver thought he could extract it from a passenger. Train travel is even more exciting. The express trains have scheduled stops of about 20 minutes at the larger stations. Most passengers get off the train to purchase food and beverages from a score or more of enterprising elderly women vendors waiting on the station platform. The neatly uniformed female conductors stand at the steps of their cars to guard them from unticketed persons. I got the impression that not only did many Siberian scientists know Nicolai, but so did a number of the pretty conductors serving on the vast Trans-Siberian railroad system. At these stops it is like a circus with fabulous photo ops. There are sad moments also. I once watched a tiny old woman offering homemade pickles for sale that no one was buying. While queuing is not a Russian national practice, everywhere we traveled the crippled, blind, or very old were given special attention. Respect for those less fortunate is part of the national character. Olga rarely passed a sidewalk beggar without giving a few coins. (A five ruble coin, about 15 cents, would buy a half loaf of bread.)

Nicolai was an excellent field worker as well as being a well-read scholar. His knowledge of the history of Siberian natural science, the workers, sites, theories, and a warehouse of anecdotal information is astounding. He worked closely with Academician A. P. Okladnikov at sites such as the famous Geographic Society Cave, near Nakhodka, and Varvarina Gora, several km from Ulan-Ude and east of Lake Baikal. Okladnikov captured Nicolai's personality perfectly by calling him "the cat that walks alone." This remarkable cat has walked many, many kilometers, and many years with Olga and me. At this writing we are putting the finishing touches on a lengthy book that describes the findings and interpretations that have come out of our Siberian bioarchaeology. Alone, none of us could have generated this book, but together our team has added significantly to the field of Siberian taphonomy, the term coined by the Russian paleontologist I. A. Yefremov for the study of postmortem events and their causes.

To some degree our work is paralleled by that of a graduate student named Patrick Wrinn, whose University of Arizona dissertation supervisor is Regents' Professor John W. Olsen, a famous archaeologist specializing in the Paleolithic of East Asia. However, we and Wrinn differ in our objectives. We are focused on synchronic bone damage in several assemblages aimed at statistical inference. Patrick is more concerned about diachronic faunal change in fewer sites, changes that might have occurred during the Middle to Upper Paleolithic transition. We gave up on all but the grossest stratigraphic provenience after it became blindingly obvious that hyena disturbances were blurring the borders of stratigraphic horizons. On a site visit to Kara-Bom, even Denisova field supervisor Michael Shunkov admitted that this open site had been heavily disturbed. Our earlier taphonomy study of the Kara-Bom faunal remains supported this.

To give readers a sense of our work, I present our findings for Varvarina Gora, one of the thirty studied assemblages. I chose this particular assemblage because of Nicolai's involvement in its initial excavation with Okladnikov and Konopatski, and his subsequent impeccable identifications of the faunal remains (Ovodov 1987). The point I want to get across is that Nicolai was one of the twentieth-century pioneers in Siberian Paleolithic bioarchaeology, cave archaeology, and ecology. He is hardly known outside Russia due to the language barrier. He is one of the Russians that Alaska zooarchaeologists and others should be aware of.

For the following text, definitions for the twenty-six characteristics listed in the "findings" are provided in Turner et al. (2001).

## THE VARVARINA GORA SITE

### BACKGROUND

Varvarina Gora (Barbara's Hill) is east of Lake Baikal, on the border between dry steppe and hillside conifer forests at 51°38' N and 108°10' E (Lbova 2002:153; Lbova et al. 2003; Vasil'ev et al. 2002:528). It is upriver from another open Paleolithic site, referred to as Kamenka (Stone) by its excavator, Ludmila Lbova (1994, 1996; Lbova et al. 2003),

who has described and illustrated both sites in great detail. We studied the Kamenka faunal assemblage stored in Ulan-Ude and the Varvarina Gora assemblage housed in Novosibirsk. Varvarina Gora contained the accumulation of artifacts and faunal refuse left about 30,000 years ago by Levallois technique tool-makers and later by blade-making Upper Paleolithic hunters and their families who camped several times at the site, probably for many generations judging from the amount of refuse. One reaches Varvarina Gora by turning off a dusty dirt road connecting a remote and strangely out-of-place rusty factory town called Zaigraevo with a distant village by the name of Sara Bryan. At the turn off, a lightly used track winds uphill around burnt tree stumps and new-growth forest, soon reaching Varvarina Gora. The site is located on the lower southern slope of a conifer-covered hill overlooking the distant left bank of the northward-flowing Bryanka River. Stone artifacts had been discovered by workmen constructing a power line in 1961; the holes for some poles had been dug into the ancient site. News of the discovery of stone artifacts and bones was sent by E. A. Khamzina and D. D. Bazarov to A. P. Okladnikov, who began a multiyear excavation program at Varvarina Gora in 1973 that lasted until 1977 (Lbova 2002; Okladnidov and Kirillov 1980). During our site visit on July 8, 2003, guided by Lbova, the forest was plagued by swarms of large biting black flies that attacked our faces and eyes. Were these dreadful insects present when ancient Varvarina Gora was occupied? Nicolai recalls that they were such a severe problem when he and Alexander Konopatski helped Okladnikov conduct the original excavations that smoky fires had to be kept burning every day.

Ludmila Lbova (2002, and elsewhere; Lbova et al. 2003) discusses Okladnikov's finds, as well as her own subsequent additional excavation. She illustrates the more recent level (Layer 1) and typically Upper Paleolithic artifacts recovered from the approximately 110 $m^3$ of the total volume excavated at Varvarina Gora, as judged from her site maps (Lbova et al. 2003). Stratigraphic and archaeological evidence initially indicated a single major component (Okladnikov and Kirillov 1980; all cited in Ovodov 1987), but Lbova's re-excavations in 1986, 1992, and 1993 showed that there was also a later (Layer 1) 17,000 BP occupation by people who produced microblades and wedge-shaped cores. This later occupation overlay the earlier occupation dated 28,000 to 34,000 BP (Lbova, pers. comm., July 8, 2003). Vasil'ev et al. (2002:528) list all the published dates for Varvarina Gora, which I have simplified to 30,000 BP for ease of recall. Ovodov (1987) identified the species and estimated minimum number of individuals (MNI) in the faunal assemblage from the Okladnikov excavations at Varvarina Gora. He identified fox, wolf, bear, horse, rhinoceros, reindeer, bison, gazelle, and goat—mainly a steppe assemblage. Note these identifications were made from the larger pieces of bone, whereas our study focused on the smaller and largely unidentifiable pieces. Due to a lack of time and cash (we could find only one bank in Ulan-Ude that would exchange rubles for traveler's checks, and then only one check per day), we did not examine the more recent faunal remains recovered by Lbova. Following will be some comparisons with the Kamenka site, where dates range from 25,000 to 30,000 BP, maybe some centuries after Varvarina Gora Layer 2. Most of the dates from both sites are based on bone. Readers who are literate in Russian and are interested in these two sites should see Lbova et al. (2003). Artifacts are well illustrated by line drawings for anyone wanting to infer culture-historical reconstructions for these and other Cis-Baikal sites.

## FINDINGS

**1. Provenience:** All of the specimens we examined were curated in the Institute of Archaeology and Ethnology, Novosibirsk. These are from Level 2, excavated in the 1970s. While some small pieces had no provenience labels, they were always bagged with whole or mainly whole pieces that were labeled for year of excavation and section number. The dates include 1973, 1974, 1976, and 1977. The specimens had been sorted into bags of identifiable species and unidentifiable pieces. In addition to section numbers, some pieces also were numbered for Ovodov's paleozoology catalogs. Hence, our observations are based on the excavations led by Okladnikov and do not include the later work directed by Lbova. We examined 864 pieces, disregarding most unmodified loose teeth and foot bones. Our total was at least one quarter of the collection. The excavations in the 1970s did not find the microblade horizon, so there was no reason not to pool our observations. They essentially all came from the same level.

**2. Species:** (Latin names are in the appendices of this article and our book in progress) All 864 pieces were assessed for species determination (precise or general, i.e., specific name or big or small mammal, etc.). "Indeterminable" pieces made up 18.6% of the total, a value not too dissimilar from that of the Kamenka site (21.9%, 552 pieces).

Gazelle (32.3% pieces) was the most commonly represented identifiable species, followed by horse (17.1%). Rhinoceros (6.0%), goat-sheep (4.4%), wolf (1.6%), bison (0.2%), hare (0.1%), and mammoth (0.1%) are also represented. The relatively large percentage for rhinoceros is due to a single animal at Varvarina Gora. It had cut and chop marks indicating butchering. This creature was very large and would have been difficult to move from the place of killing to a camp elsewhere. Hence, we suspect that the rhinoceros carcass itself was what determined why the Varvarina Gora people camped where they did. On the other hand, as Alaska campers well know, it is unwise to bed down with one's grub nearby, which might attract bears. In 1987 Ovodov also identified marmot, red fox, corsak or steppe fox, bear (a single tooth), yak, screw-horned antelope (three pieces of horn), and found a few pieces of bird bone that he did not identify. He remarked that the mammoth reported by Okladnikov was represented by ivory objects only. Ovodov felt that the mammoth presence at Varvarina Gora was not the result of human hunting.

**3. Skeletal elements:** Our element sample size was 864 pieces. Nonspecific long bone pieces were the most common (12.4%), followed by rib pieces (11.6%). These values are nearly identical to those at Kamenka (12.7% and 11.4%, respectively), although there are not quite as many cranial pieces at Varvarina Gora (8.3%) as we identified at Kamenka (12.5% **out of a total of 552 pieces at Kamenka**). Still, these similarities are enhanced by the presence of penis bones in both sites and almost nowhere else in our other assemblages.

**4. Age:** Our sample size for age assessment was 864 pieces. Adults were about five times more common than subadults. This age ratio is nearly identical to that found at Kamenka, so all the comparative comments here apply there as well.

**5. Completeness:** We had 863 observable pieces. Complete pieces (3.4%) were similar in number but fewer than at Kamenka (8.7%); however, considering that we may have excluded from study proportionally more Varvarina Gora complete bones. Certainly the ratio of one-ended to no-ended pieces in the two sites is similar, although there is a slightly significant statistical difference ($\chi^2 = 5.4$, 1 d.f., $0.01 < p < 0.05$). Varvarina Gora does not stand out for completeness when compared with our other assemblages.

**6. Maximum size:** The average size for 847 observable pieces is 9.0 cm. This is larger than the mean for Kamenka (6.5 cm), which is entirely attributable to the several very large pieces of the rhinoceros found at Varvarina Gora. Removing those pieces reduces the Varvarina Gora mean considerably. However, with the rhinoceros pieces included, Varvarina Gora has a mean maximum diameter that is in the upper half of the size range for all our assemblages.

**7. Damage shape:** We evaluated this variable on the basis of 862 pieces. Most frequent were long bone fragments (30.3%) and long bone flakes (13.8%). The number of long bone splinters was significantly less ($\chi^2 = 98.8$, 1 d.f., $p < 0.001$) at Varvarina Gora (3.4%) than at Kamenka (11.4%). The suggestion by Germonpré and Lbova (1996:44) that the Kamenka splinters "could be the by-products of bone tool manufacturing" is reasonable but would have been strengthened had Varvarina Gora had a similar proportion of splinters, given many other taphonomic similarities in the two assemblages. Another consideration is that splinters were a stage in the production of tailoring needles, which were a well-established item in the Upper Paleolithic tool kit, much more so than in the Middle Paleolithic. Evidence for these fine needles (eyed or knobbed) is largely lacking for earlier time periods, but Varvarina Gora Layer 2 is about the same age as Kamenka, so bone splinters in the two sites could represent seasonality, dating errors, or other differences. We are inclined to view the splinter differences as due to temporal or cultural differences.

**8. Color:** Color was assessed in 862 pieces. Almost all of the pieces were ivory-colored (99.2%). Pieces that were burned or possibly burned (brown or black) made up only 0.7% of the total. One was a partly burned, mostly horse vertebra. This vertebra is the only piece that suggests roasting, although it more likely represents accidental burning. The occurrence of ivory-colored pieces in Varvarina Gora and Kamenka (98.9%) is identical. Compared with our other assemblages, Varvarina Gora is at the very upper end of the ivory-colored range.

**9. Preservation:** Quality could be evaluated in 863 pieces. While the majority of pieces were ivory hard (65.3%), there were many pieces of chalky and intermediate quality. There is a highly significant quality difference between Varvarina Gora and Kamenka ($\chi^2 = 1{,}270.3$, 1 d.f., $p < 0.0001$). The preservation difference is due to Varvarina

Gora's coarser-grained sediments, southern exposure, and hillside slope, conditions the combination of which must have led to more humic acid percolation, more and deeper ground freezing and thawing, and a longer period of surface weathering before final burial. In addition, the many highly weathered rhinoceros bones indicate that they had been exposed to surface weathering for a relatively long period of time. Preservation at Varvarina Gora is much like that of other open sites. Kamenka, however, has unusually good preservation for an open site.

**10. Perimortem breakage:** We were able to assess 862 pieces for perimortem damage. Like nearly all of our faunal assemblages, Varvarina Gora has a very high frequency of perimortem breakage (97.0%). This amount of breakage is only slightly more than that found at Kamenka (94.7%). The difference is just barely statistically significant ($\chi^2 = 4.95$, 1 d.f., $0.01 < p < 0.05$). Given the previous discussion of the very significant bone quality differences (i.e., arising from environmental and depositional history) between Varvarina Gora and Kamenka, we feel that the manner in which these ancient humans extracted nutrients from game animals and their use of bone for tools was effectively the same in both sites. This view is backed up by the lack of color difference in these two assemblages, i.e., little or no evidence for roasting that would scorch or blacken bone.

Compared with our other assemblages, Varvarina Gora is not unusual with respect to perimortem damage.

**11. Postmortem breakage:** We evaluated 862 pieces for postmortem damage. Of these, 9.6% showed postmortem breakage. Much of this happened in the excavation of the adult rhinoceros, most of whose skeleton was crumbly and chalky due to weathering and poor subsurface preservation. Even so, there is much more postmortem breakage at Varvarina Gora than at Kamenka (1.1%). The difference is so large that there is no need for a formal statistical comparison.

**12. End-hollowing:** Due to the large number of pieces without anatomical ends, we could assess only 418 pieces for end-hollowing. End-hollowing occurs in 1.2% of the Varvarina Gora sample, a value not significantly different from that of Kamenka (0.8%) ($\chi^2 = 0.19$, 1 d.f., $0.5 < p$). Hence, discussion of Kamenka regarding our objective of developing multiple criteria for defining carnivore damage applies here also. By itself, end-hollowing does not suggest much carnivore activity at these two sites.

Compared with our other assemblages, especially those where there had been an unquestionable presence of hyenas, Varvarina Gora end-hollowing is decidedly at the very low end of the range of occurrence. Wolf bone was present at Varvarina Gora; however, wolves may not have caused end-hollowing. Ovodov (1987) suggested that the type of wolf elements and their breakage implies that these animals may have been hunted for their fur and for food. On the other hand, carnivores that caused the end-hollowing are likely not represented in the Varvarina Gora assemblage, so scavenging wolves and foxes could still have produced the small amount of end-hollowing.

**13. Notching:** Our sample for notching consisted of 856 pieces. Of these, 5.7% had one or more notches. The most frequent number of notches per piece was one (4.2%). Occurrence and intensity of notching is less than at Kamenka (9.8% occurrence). Although the difference is statistically significant ($\chi^2 = 8.3$, 1 d.f., $0.001 < p < 0.01$), we do not believe that it signals any special cultural or taphonomic importance because chalky pieces with crumbly edges would not be scored as notched in the face of uncertainty caused by possible postmortem damage.

Compared with our other assemblages, notching at Varvarina Gora is unexceptional for an open site. It clearly had less notching than the amount associated with hyenas and other carnivores.

**14. Tooth scratches:** We were able to assess the occurrence of tooth scratches in 703 pieces. Only 1.9% had one or more scratches. The most frequent number of scratches per piece was five (0.4%), but two pieces had more than seven scratches. Occurrence and intensity of tooth scratches is slightly less than at Kamenka (2.8% occurrence), but the difference is not statistically significant ($\chi^2 = 1.1$, 1. d.f., $0.2 < p < 0.5$). As far as tooth scratches alone indicate carnivore activity, bone refuse at the two sites was processed similarly by scavengers.

Compared with our other assemblages, Varvarina Gora tooth scratching is unexceptional for an open site and has much less than the carnivore cave sites.

**15. Tooth dints:** A total of 682 pieces could be evaluated for tooth dints. Only 1.9% had one or more dints. The most frequent number of dints per piece was three (0.6%),

and only one piece had more than seven dints. Occurrence and intensity of tooth dints is less than at Kamenka (3.3%), but the difference is not statistically significant ($\chi^2$ = 2.4, 1 d.f., 0.05 < $p$ < 0.2). Our comments for tooth scratching apply equally to tooth dinting; namely, there is only a small amount of carnivore damage that can be inferred for Varvarina Gora.

**16. Pseudo cuts:** We could identify no examples of pseudo cuts in 689 usable pieces. This again reflects minimal carnivore processing of Varvarina Gora bone refuse.

**17. Abrasions:** In 686 pieces, only 0.4% had one or more abrasion grooves per piece. This is practically the same as seen at Kamenka (0.2%). We earlier proposed bone breakage for marrow extraction was accomplished using nonabrasive hammers and anvils such as bone, antler, or wood instead of gritty abrasion-producing hammer stones and anvil stones. Stone could have been used for bone breakage, but it would have had to have been fine-grained so as not to leave abrasion grooves. A low frequency of abraded pieces is characteristic of all the assemblages in our study. Given the generally coarse- to medium-grained stone sources that we have noticed in all the site localities visited, there seems to be a reasonable basis for proposing that stone was not the preferred material in the perimortem breakage that also characterizes all of our assemblages.

**18. Polishing:** A total of 834 pieces could be assessed for polishing. Polishing was very common in Varvarina Gora (96.0%). At Kamenka there was less (90.0%), the difference of which is statistically significant ($\chi^2$ = 20.19, 1 d.f., $p$ < 0.001). The difference is attributable to slope, where some polishing was possibly caused by bone movement downhill, since the amount of slope at the time of deposition seems to have been a few degrees greater at Varvarina Gora than at Kamenka. Also, because the proportion of chalky pieces is greater at Varvarina Gora than at Kamenka, bone refuse at Kamenka was better protected from weathering, which implies less time passed before burial, and once buried the perimortem and postmortem polishing processes were less energetic. Compared with our other assemblages, Varvarina Gora is decidedly at the upper end of the range for polishing. This range does not break down as neatly for open versus cave sites as do some other variables.

**19. Embedded fragments in bone:** We were able to assess embedding in 858 pieces. There were very few pieces that had embedded fragments (0.9%). Of these, having two embedded fragments was most common (0.3%). There were no pieces with more than four embedded fragments. Kamenka had a similarly low occurrence of pieces with embedded fragments (1.5%). Compared with our other assemblages, Varvarina Gora is at the low end of the range for embedded pieces. In all assemblages, embedded fragments are most frequently found in tooth dints. Together, they suggest minimal carnivore scavenging at Varvarina Gora.

**20. Tooth wear:** We evaluated tooth wear on thirty-six maxilla and mandible fragments. Individuals we considered to be young made up 13.9% of this total. Kamenka had almost half this amount, but both assemblages are too small for meaningful chi-square comparisons. Compared with our other samples, Varvarina Gora would appear to be at the low end of the range for the presence of (dentally) young individuals.

**21. Acid erosion:** We assessed 864 pieces for acid or enzymatic digestive erosion. Only 0.5% of this total had acid erosion. Of the four eroded pieces, three were highly rounded like water-worn pebbles. The fourth was highly eroded but felt gritty rather than greasy. None is exhibit digestive damage like that seen in the hyena cave assemblages. In addition, there were two other pieces that were corroded on one surface as if they had been in the process of dissolving by some agent other than stomach acid. These two were not considered to have digestive damage. The 0.5% acid-eroded pieces are somewhat less than what occurred at Kamenka (1.3%), but not significantly so ($\chi^2$ = 2.85, 1 d.f., $p$ > 0.08). Compared with our other assemblages Varvarina Gora is at the low end of the range for acid erosion. This suggests that there was very little, if any, hyena presence. We noticed no caves or rock shelters in the vicinity, which could have limited the number of hyenas in the region.

**22–24. Rodent gnawing, insect damage, and human bone:** Varvarina Gora had no examples of these three variables.

**25. Cut marks:** We assessed 714 pieces for cut marks. Fully 8.8% of all pieces had one or more cut marks. The number of cuts per cut piece range from one to more than seven.

The largest number of cut marks on a given Varvarina Gora piece is fifteen. There is one 15.8-cm-long piece of a distal end of an adult horse humerus with five ultra-fine cut marks varying from 2.0 to 5.0 cm in length. The piece is extraordinarily well preserved, equal to that found in cave sites, suggesting that other very fine cut marks may have been erased from less well-preserved pieces. This in turn suggests that we have to some degree underestimated cutting at Varvarina Gora and perhaps at other open sites where preservation is not as good. Kamenka has a slightly higher frequency of cut marks (9.5%), but the difference is not significant ($\chi^2 = 0.18$, 1 d.f., $p > 0.3$). As discussed above, Kamenka bone was excellently preserved, so if we had undercounted cut marks it does not show up in these two neighboring sites with notable preservation differences. Compared with our other assemblages, Varvarina Gora is more or less in the middle of the range for cut mark frequency.

**26. Chop marks:** There were 747 pieces that could be evaluated for chop marks. Of these, 13.8% of all pieces had one or more chop marks. Of chopped pieces, the majority (8.6%) had only one chop mark. Two chop marks were less common (2.9%) and only a few pieces had three to six. The occurrence of chop marks at Kamenka was less (8.6%), and most of these were pieces with only one chop mark. The frequency difference in the occurrence of chop marks at Varvarina Gora and Kamenka is significant ($\chi^2 = 8.94$, 1 d.f., $p < 0.005$). We suggest that this difference is due to Varvarina Gora having proportionally more pieces of large mammals (horse, rhinoceros, and large unidentifiable species, i.e., larger than a wolf) than Kamenka. Certainly the large mammal pieces at Varvarina Gora have more chop marks than do pieces of smaller mammals. Moreover, Varvarina Gora shows a large number of pieces with associated chop marks and notching. It would seem that gaining access to the marrow cavity of large mammals such as horse and rhinoceros was more commonly accomplished by the use of large heavy sharp-edged stone artifacts like the Varvarina Gora and Kamenka cores illustrated by Lbova (2002:65–66) than by hammering with a piece of bone, horn, or wood. Conceivably, the choice of material illustrates ancient awareness of the "stiletto heel effect"—where a great deal of kinetic energy can be focused on a small area causing great damage that might not occur when the impacting surface has more area. Compared with our other assemblages, Varvarina Gora is in the upper part of the range for chop mark frequency.

## DISCUSSION

Varvarina Gora is in the same river valley and of about the same time period as Kamenka. Both sites are located on the lower slopes of low hills adjacent to the valley. Both were repeatedly used, open steppe sites. The use of Varvarina Gora took place around 30,000 years ago, a time relative warmth during the Late Pleistocene. Later, both show similar Upper Paleolithic tool types that the occupants used to hunt and process the same sorts of game animals. These were mainly gazelles and horses. The natural- and human-caused perimortem bone damage of both sites is remarkably similar, with the exception of Varvarina Gora having gone through less favorable conditions for bone preservation than the exceptionally well-preserved assemblage Lbova recovered from Kamenka. The occurrence of chopping at Varvarina Gora is greater than at Kamenka, which reflects the larger proportion of big animal bone pieces at Varvarina Gora. The perimortem taphonomic characteristics of Varvarina Gora are broadly like those of our other open sites. Carnivore damage was slight, and there is no evidence of hyenas. There are no known caves near Varvarina Gora or Kamenka, which may explain the absence of hyenas.

One possible cause of human damage to bone relates to cooking. If meat had been cooked, it must have been mainly by stone boiling because the evidence for roasting is weak to nonexistent. As elsewhere in this project, perimortem processing was intensive; that is, most bones were broken, and broken into many small pieces with an average maximum diameter of only 9.0 cm, a value that would be smaller had our protocol not excluded from study pieces smaller than 2.5 cm in diameter. Still, small average piece size, coupled with frequent polishing, points to meat having been cooked. Preparing soups, stews, and rendering for fat could have involved the use of leather bags, wooden bowls, or tightly woven baskets into which were placed water, heated stones, and pieces of smashed bone with adhering ligament, muscle tissue, and fat. Carved stone bowls (like those used by historic Inuit women) are another possibility, although neither stone cooking pots nor stone lamps have been found. Low heat cooking would melt fat in muscle tissue and marrow in bone. Low heat cooking would not have destroyed vitamins as would have roasting, nor would melted fat dripping into a fire have been wasted. The considerable amount of perimortem bone breakage probably means that roasting pits were not used for cooking in all of our Late Pleistocene

assemblages. Stone-boiling seems to be the most likely means of cooking. Flavor-enhancing plants like wild onion could have been added. This suggestion has to remain as speculation because plant residues have not been identified in any of our assemblages. Moreover, the amount of charcoal found with these assemblages is small, making even the argument for cooking somewhat tentative were it not for the small average piece size and the considerable surface polishing.

In our book in process (Turner, Ovodov, and Pavlova n.d. [see list of project reports that precedes the bibliography]) we spend considerable time on the subject of Siberian hyenas. There, we show that the Late Pleistocene distribution of cave hyenas extended all the way from western Europe (many cave sites) to the Sea of Japan (Geographical Society Cave), with examples in between and as far as 55° N latitude. The evidence is abundant for hyenas having once lived in Siberia and having frequented archaeological sites. Their absence in Varvarina Gora (also Kamenka) is based on 864 pieces used for species identification at Varvarina Gora, none of which was with any degree of certainty hyena. Perhaps, as mentioned above, a lack of suitable denning shelter was the cause. Although some hyena remains have been found to the east in the Yenisei River basin they appear to have been less common there than elsewhere in southern Siberia. If hyena packs did constitute a kind of barrier to Beringia, then that barrier might have been weakest in the region east of Lake Baikal. Interspecies competition between humans and hyenas and the killing of humans for food would have limited human population size and human expansion northward where there would have been no competition for resources from other humans, as there would have been in the south (e.g., Turner n.d.; Turner, Ovodov and Pavlova 2005).

In our book in progress we also consider the rarity of Late Pleistocene human remains in Siberia, which is markedly in contrast to the abundant and well-preserved faunal remains. Not until Mesolithic-Neolithic times, after hyenas had gone extinct, do human remains become relatively common. We propose that hyenas were partly to blame for the rarity of human remains. Whatever the reason(s), Alaska seems not to have been reached by humans until after hyenas had disappeared from the Siberian landscape.

In sum, our ten-year taphonomic study of faunal remains in Late Pleistocene Siberia has added a new dimension to the use of perimortem bone damage for archaeological interpretation, among them stratigraphic disturbance, food preparation, human-hyena competition, discontinuity of site occupation, carnivore introduction of faunal remains into archaeological sites, and the late arrival of humans to Beringia. Bone exhibiting cut and chop marks, burning, and other forms of human damage differ so much from carnivore damage that very interesting site-specific and regional stories can be suggested using our damage criteria along with whatever can be inferred from stone, bone artifacts, and other cultural remains.

Lastly, it is my hope that Alaskan researchers will search out the published research of Nicolai Ovodov. It was his immense personal knowledge of Late Pleistocene Siberian vertebrate paleontology, cave archaeology, and natural history that made this project possible. *Spasibo*, Nicolai. Acquiring this literature will not be easy. The IAE library still uses a file card cataloging system without subject cross-referencing. I have tried to Google various topics and authors, but only rarely does a Siberian researcher show up on any of my searches. In my view, if you want to know something about Siberian anthropology, you need a contact who can help you visit Siberia. My initial contact was Serg Arutiunov, who in 1979 helped me get a foot in the door of the gigantic closet of Russian scientific knowledge.

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## PERIMORTEM TAPHONOMY PROJECT REPORTS

Turner, Christy G. II

n.d. Perimortem Taphonomy of Siberian Hyenas and Humans. Final report to National Geographic Committee for Research and Exploration and the Wenner-Gren Foundation for Anthropological Research, October 2001.

Turner, C. G. II, N. D. Ovodov, N. V. Martynovich, A. P. Derevianko, N. I. Drozdov, and O. V. Pavlova

2000 Perimortem Taphonomy of Late Pleistocene Siberian Faunal Assemblages from Natural and Cultural Settings. In *International Scientific Conference Paleogeography of the Stone Age. Correlation of Natural Events and Archaeological Cultures of Paleolithic Period of Northern Asia and Adjoining Territories*, *July 22–31, Kurtak, Novosyelovo District, Krasnoyarsky Krai,* edited by N. I. Drozdov, pp. 70–71, Krasnoyarsk Pedagogical University, Krasnoyarsk.

Turner, Christy G. II, Nicolai D. Ovodov, Nicolai V. Martynovich, Olga V. Pavlova, Anatoly P. Derevianko, and Nicolai I. Drozdov

2001 Perimortem Bone Taphonomy of Late Pleistocene Human and Hyena Refuse Deposits in Siberia. *Current Research in the Pleistocene* 18:88–90.

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

2001 A Comparison of Perimortem Taphonomy in Siberian Pleistocene Faunal Remains from Open (Ust-Kova) and Cave (Ust-Kan) Sites. In *Program of Work of the International Scientific Symposium: Current Scientific Problems of the Eurasian Paleolithic Dedicated to the 130th Anniversary of the Discovery of the First Paleolithic Site in Russia, "The Military Hospital," in 1871*, edited by A. P. Derevianko and G. I. Medvedev, pp. 421–423. Irkutsk Laboratory of Archaeology, Irkutsk State University, Irkutsk.

2003 Perimortem Taphonomy and Dental Affinity Assessment of the Human Skeletal Remains from Yelenev Cave, Krasnoyarsk Territory, Siberia. *Archaeology, Ethnology and Anthropology of Eurasia* 1(3):49–57.

2005 Siberian Hyenas, Other Carnivores, Cannibalism, and the Peopling of the New World. Paper presented at the 32nd annual meeting of the Alaska Anthropological Association, March 10–12, Anchorage.

n.d. Animal Teeth and Human Tools: A Perimortem Taphonomy Odyssey in Ice Age Siberia. MS in preparation.

## REFERENCES

Astakhov, S. N.
1999 The Yenisey Palaeolithic: The Palaeolithic Sites of Afontova Gora Locality in Krasnoyarsk. The Russian Academy of Sciences, Institute for Material Culture History. Evropeyskiy Dom, Saint Petersburg [in Russian].

Geist, Valerius
1989 Did Large Predators Keep Humans out of North America? In *The Walking Larder: Patterns of Domestication, Pastorialism and Predation*, edited by Juliet Clutton-Brock, pp. 282–194, Unwin Hyman, London.

Geist, Valerius, L. Baskin, I. Okhlopkov, and I. Spilenok
n.d. Wolves, Bears and Human Anti-Predator Adaptations. Paper prepared for presentation in Moscow, August 2009.

Germonpré, Mietje, and Ludmila Lbova
1996 Mammalian Remains from the Upper Paleolithic Site of Kamenka, Buryatia (Siberia). *Journal of Archaeological Science* 23:35–57.

Guthrie, R. Dale
2005 *The Nature of Paleolithic Art*. University of Chicago Press, Chicago.

Krause, Johannes, Ludovic Orlando, David Serre, Bence Viola, Kay Prufer, Michael P. Richards, Jean-Jacques Hublin, Catherine Hanni, Anatoly P. Derevianko, and Svante Pääbo
2007 Neanderthals in Central Asia and Siberia. *Nature* 449:902–904.

Kruuk, Hans
2002 *Hunter and Hunted: Relationships Between Carnivores and People*. Cambridge University Press, Cambridge.

Lbova, Ludmila V.
1994 Problems of Seasonal Inhabitation at the Kamenka Paleolithic Site, Trans-Baikal. Cultural Traditions of Peoples of Siberia and America: Continuity and Ecology. Abstracts of International Symposium, Chita, pp. 86–87 [in Russian].
1996 The Paleolithic Locality, Varvarina Gora. In *New Paleolithic Sites of the Trans-Baikal. International Archaeological Congress*, pp. 11–23. Chita State Pedagogical Institute, Chita [in Russian].
2002 The Transition from the Middle to Upper Paleolithic in the Western Trans-Baikal. *Archaeology, Ethnology, & Anthropology of Eurasia* 1(9):59–75.

Lbova, L. V., I. N. Rezanov, N. P. Kalinykov, V. L. Kolomiets, M. I. Dergacheva,, I. K. Fedeneva, N. V. Vashnukevich, P. V. Volkov, V. V. Savinova, B. A. Bazarov, and D. V. Namsaraev
2003 Environments and Man in Neopleistocene (Western Trans-Baikal and Southeast Cis-Baikal). Publishing House of Buryat Scientific Center of Siberian Branch of Russian Academy of Sciences, Ulan-Ude [in Russian].

Okladnikov, A. P., and I. I. Kirillov
1980 The Southeastern Trans-Baikal Area in the Stone and Bronze Epoch. Novosibirsk [in Russian].

Okladnikov, A. P., and N. D. Ovodov
1972 A New Paleolithic Site in the Altai, with the Levallois Technique of Treating Stone. Altaica: Tezisy Dokladov Konferentsii, 3–6 Barnaul [in Russian].

Okladnikov, A. P., N. K. Vereschagin, and N. D. Ovodov
1968 The Discovery of a Paleolithic Cave in Primorie. News of the USSR Academy of Sciences No. 10 [in Russian].

Ovodov, Nicolai D.
1977 Late Anthropogene Mammalian Fauna in the Region South of Ussurijsk. In *Fauna and Systematics of Verterbrates of Siberia*, pp. 157–176 (editor not identified), Nauka, Novosibirsk [in Russian].
1987 Fauna of the Paleolithic Settlements Tolbaga and Varvarina Gora in West Cis-Baikal. In *Environments and Ancient Man in the Late Anthropogene*, pp. 122–140 (editor not identified), Ulan-Ude [in Russian].

Ovodov, Nicolai D., and Ya. V. Kuzmin
2006 Did Neandethals Have Dogs? In *Almanac "Eniseiskaya Provinitsiya"* 2:171–177 (editor not identified), Krasnoyarsk [in Russian].

Ovodov, Nicolai D., and Nicolai V. Martynovich
2005 Some Oddities in the Behavior of Cave Hyenas (*Crocuta spelaea* Goldf.). In *Problems of Archaeology, Ethnography, and Anthropology of Siberia and Adjacent Territories* 11 (Part 1), edited by A. P. Derevianko, pp. 181–183. Institute of Archaeology and Ethnography, Novosibirsk [in Russian].

Turner, Christy G. II
1990 Paleolithic Teeth of the Central Siberian Altai Mountains. In *International Conference on Chronostratigraphy of the Paleolithic in North,*

*Central, East Asia and America*, compiled by N.M. Shakhmatova (pp. 239–243). Institute of History, Philology, and Philosophy, Siberian Branch of the Academy of Sciences of the USSR, Novosibirsk.

1992 New World Origins: New Research from the Americas and Soviet Union. In *Ice Age Hunters of the Rockies*, edited by D. J. Stanford and J. S. Day, pp. 7–50, Denver Museum of Natural History and University Press of Colorado, Niwot.

1998 An Update on the Dental Anthropological Interpretation of the Peopling of Siberia and the Americas. In *Pleistocene Paleoecology and Stone Age Cultures of Northern Asia and Adjoining Territories*. *Proceedings of the International Symposium,* edited by A. P. Derevianko, pp. 180–188, Institute of Archaeology and Ethnography. Novosibirsk [in Russian].

2007 *Bioarchaeology*. Institute of Archaeology and Ethnography, Novosibirsk.

2008 Review of *Archaeology, the Paleolithic of Northeast Asia, a Non-Tropical Origin for Humanity, and the Earliest Stages of the Settlement of America* by Y. A. Mochanov and S. A. Fedoseeva. *Canadian Journal of Archaeology* 32:285–288.

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

2001 Working Definitions for Perimortem Taphonomy of Natural and Anthropogenic Bone Damage in Late Pleistocene and Holocene Siberia and Primoria. *Archaeology, Ethnology and Anthropology of Eurasia* 4(8):21–29.

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

2003 Perimortem Taphonomy and Dental Affinity Assessment of the Human Skeletal Remains from Yelenev Cave, Krasnoyarsk Territory, Siberia. Archaeology, *Archaeology, Ethnology, & Anthropology of Eurasia* 1(3):49–57.

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

1999 *Man Corn: Cannibalism and Violence in the Prehistoric American Southwest*. University of Utah Press, Salt Lake City.

Vasil'ev, Sergey A., Yaroslav V. Kuzmin, Lyubov A. Orlova, and Vyacheslav N. Dementiev

2002 Radiocarbon-based Chronology of the Paleolithic in Siberia and Its Relevance to the Peopling of the New World. *Radiocarbon* 44(2): 503–530.

## APPENDIX

Common and Latin names of animals mentioned in text.

Bear. *Ursus* sp.
Bison. *Bison priscus*
Red Fox. *Vulpes vulpes*
Corsak or Steppe Fox (Corsak). *Vulpes corsac*
Gazelle. *Procapra gatturosa*
Goat. *Capra* sp.
Hare. *Lepus* sp.
Horse. *Equus* sp.
Marmot. *Marmota bailbacina*
Reindeer. *Rangifer tarandus*
Rhinoceros. *Coelodonta antiquitalis*
Wolf. *Canus lupus*
Yak. *Poephagus bikalensis*