

Map showing the American Great Basin. Primary locations mentioned in text include the Carson Sink (Stillwater Marsh), Malheur Lake, Great Salt Lake, Reese River Valley, and Gatecliff Shelter. Adapted from Larsen and Kelly 1995; reproduced with permission of the American Museum of Natural History.

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*The Lives and Lifestyles of  
Ancient Hunter-Gatherers: “Poor, nasty,  
brutish and short”  
in the American Great Basin?*

FOR ALL but the last ten thousand years or so, our species has depended solely on wild plants and animals for food. In some regions of the world, this lifestyle continued until very recent times. In the American Great Basin, a vast region encompassing much of the western United States—including most of Nevada and parts of Utah, California, Oregon, Idaho, and Wyoming—native peoples have always lived exclusively on wild plants and animals, at least until relatively recent times. The study of the skeletal remains of these natives—viewed in the context of environment and culture—offers us insight into the quality of life that is associated with hunting and gathering. In this chapter, we look at what the study of skeletons of early hunter-gatherers can tell us about our past.

I began thinking about ancient foragers long before I began to look at archaeological skeletons from the Great Basin. In the summer of 1973, I was fortunate to participate in the National Science Foundation’s Undergraduate Research Participation (URP) program, having been selected to work with David Hurst Thomas of the American Museum of Natural History on archaeological excavations that he was directing at Gatecliff Shelter, Nevada. Gatecliff is a deeply stratified archaeological site located in the

desert of central Nevada, the heart of the American Great Basin. In fact, it is one of the most deeply stratified sites in the Western Hemisphere. I was thrilled to be able to gain experience in an area of the world that I knew nothing about, and at such an important archaeological site. The summer before, I had worked with Smithsonian Institution physical anthropologist Douglas Ubelaker as an URP summer intern in his excavations of skeletons from a late prehistoric ossuary in southern Maryland and in follow-up laboratory analysis. Although I could have continued to work solely on bones, I decided that it was more important at this early stage of my education to see a wide range of archaeological settings, especially before making decisions about how I would focus my graduate studies that would be coming up in a couple of years. Prehistoric Indians used Gatecliff mostly as a living site, and it contained none of their skeletal remains. However, I knew that my experience doing archaeology at the site would give me new and valuable perspective on the ancient past. I was not to be disappointed. Although arduous—the desert is not an especially hospitable place, and the labor was intensive at times—the work in Nevada that summer was terribly interesting and exciting.

Thomas was keenly interested in the prehistoric settlement systems and lifestyles of the Great Basin Shoshone Indians. His work showed that the prehistoric Shoshoneans who lived in the Reese River valley of central Nevada moved about the landscape according to the season of the year and availability of wild foods. The seasonal round involved harvesting nuts from forests of piñon pine (*Pinus monophylla*) trees in the mountains in the autumn. Piñon pine nuts were a highly nutritious food staple for Great Basin Indians; these nuts are high in fat, carbohydrates, and protein, and they sustained the local populations through the long winter months. During the winter, people moved very little from their upland homes. Once Indian rice grass (*Oryzopsis hymenoides*) ripened in the summer, small bands of foragers moved out of their mountain communities onto the valley floors for the summer harvest. Because the food sources on the valley floors were scattered in isolated patches, the summer camps moved frequently from one location to another. The eminent cultural anthropologist Julian

Steward identified this pattern of resource exploitation and seasonal mobility in Indians living in the area in the 1930s. Forty years later, Thomas's innovative research confirmed the pattern, and he suggested that this way of life had lasted for hundreds, if not thousands, of years.

In working with Thomas at Gatecliff, I began to ponder the questions and issues raised by archaeologists interested in human adaptation. I asked myself, could the study of skeletal remains of these ancient populations inform our understanding of prehistoric lifestyles in the Great Basin? Thomas's research was compelling, but wouldn't it also be important to increase the comprehensiveness of the research and tie in the special knowledge gained by the study of ancient skeletons? As a lowly undergraduate working with a team of seasoned archaeologists, I kept these thoughts to myself until such time that I could contribute substantively to the ongoing discussion of prehistoric Great Basin lifestyles.

From my training in physical anthropology, I began to think a lot about variation in lifestyles and adaptation in prehistoric Great Basin (and other) people. Thomas's work suggested that the prehistoric Shoshone were highly mobile foragers, taking advantage of a wealth of nondomesticated plant and animal resources in different ecological settings. Archaeologist Robert Heizer and his students at the University of California at Berkeley had been studying prehistoric Indians from farther to the west in the Great Basin, having excavated such famous sites as Lovelock Cave and surrounding sites in the Humboldt Sink. Contrary to Thomas's model of Great Basin adaptation, Heizer contended that native peoples relied on resources associated with permanent and semi-permanent Pleistocene-remnant lakes of western Nevada (the lakes had long since disappeared in the central Great Basin). He believed that these populations lived fairly good lives, with plenty of plants and animals that lived along the margins of these lakes and associated wetlands. In contrast to the settlement pattern in central Nevada, native peoples in the Humboldt Sink region were apparently sedentary, with little individual or group movement—the lakes and their shores offered just about all anyone would need for a productive, if not healthy, existence.

After defending my doctoral dissertation at the University of Michigan in the summer of 1980, Thomas invited me to fly out to Nevada from Ann Arbor to see new excavations that he was conducting at a key western Great Basin site known as Hidden Cave, located almost within view of Heizer's research area in the Humboldt Sink. Overlooking the wide expanse of the Carson Sink, the site provides some tantalizing clues about Great Basin adaptation and lifestyle. Along with skeletal remains found by the earlier archaeologists excavating in the cave, Thomas's crews had found several dozen fragmentary bones and teeth that he wanted me to study.

#### HIDDEN CAVE: HINTS AT HEALTH AND LIFESTYLE

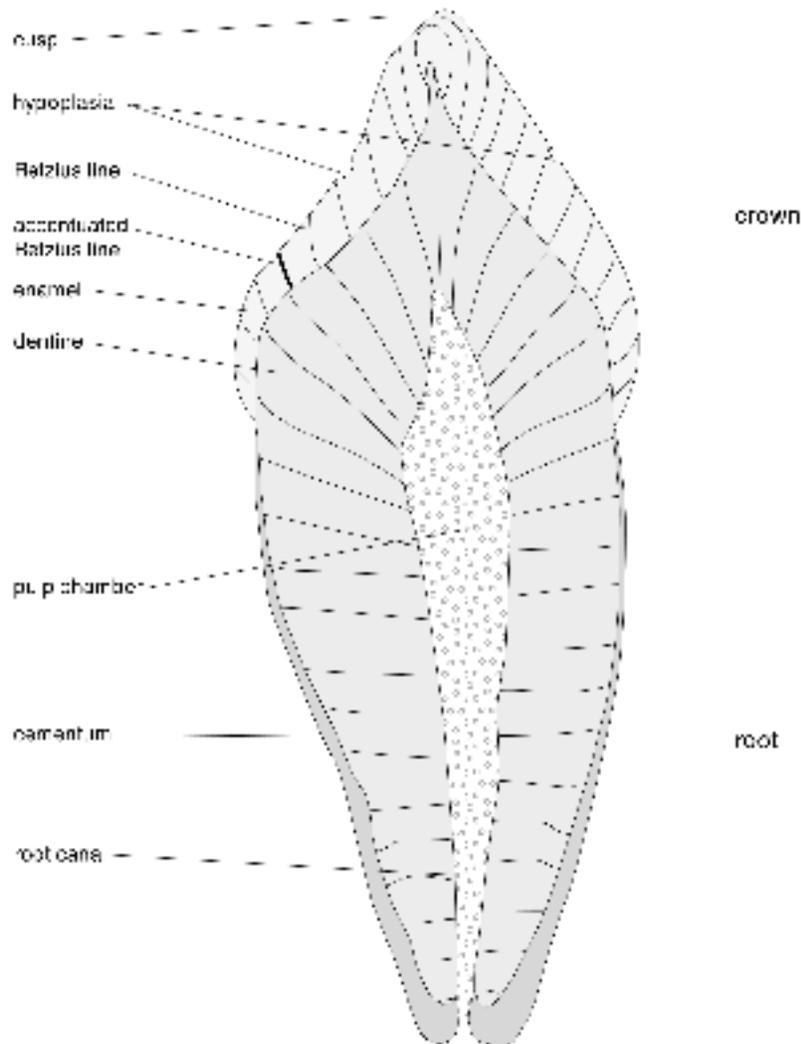
Hidden Cave had apparently functioned for storage of tools and other essentials—a so-called cache site—used by a group of native peoples known in historic times as the Toedökadö (translated, “Cattail eaters”), a local band of Northern Paiute Indians. The presence of the skeletal remains in the cave was puzzling, especially since they didn't appear to be from a formal burial context—all the skeletal elements were separate and disarticulated. Regardless of the context of the human remains, the discovery of bones and teeth refueled my earlier interest in addressing issues relating to prehistoric biocultural adaptation in the Great Basin. For the remainder of the summer, I studied the bones and teeth from Hidden Cave.

In particular, I looked at three indicators in teeth and bones that are highly informative about the quality of life: hypoplasias, porotic hyperostosis, and infection. Hypoplasias are grooves, lines, or pits in the teeth that reflect periods of time when, due to either poor nutrition or disease (or some combination thereof), the outer covering of the tooth—the enamel—stops or slows in its growth. The cells that normally create the enamel—called ameloblasts—fail, and the hypoplasia caused by arrested growth results. The teeth that I looked at from Hidden Cave had only a moderate number of hypoplasias.



Maxillary teeth with enamel hypoplasias (horizontal grooves) on incompletely erupted permanent central incisors. Hypoplasias reflect periods of physiological stress and poor growth. Photograph by Barry Stark; from Larsen 1994, and reproduced with permission of Academic Press, Inc.

I next looked at the skull fragments for evidence of iron deficiency anemia; if this had been present in the population, it would be represented by bone pathology called porotic hyperostosis or cribra orbitalia. These pathological conditions are areas of porous bone in the flat bones of the skull, such as the parietals (porotic hyperostosis) or in the eye orbits (cribra orbitalia). They are created when red blood cell production increases, causing the bone to become porous. The increase in red blood cell production occurs when iron, an element required for the production of red blood cells, is deficient. Red blood cells, among their other functions, are absolutely necessary for transport of oxygen to the various body tissues. Without it, the tissues—and the person—are unable to function properly. Iron depletion occurs either as a result of some deficiency in diet, or chronic diarrhea, blood loss, or in many settings, parasitic infection. A number of parasites—such as hookworm—bleed the human host, resulting in loss of essential iron stores. None of the skull fragments I looked at had pathology reflecting iron deficiency.



Cross-section of mandibular canine showing major parts of the tooth with enamel hypoplasia.

Last, I examined the bone fragments from Hidden Cave for presence of periosteal reactions. These reactions are abnormal growths on the periosteum, the outer surface of bones. Bioarchaeologists and paleopathologists are usually not able to provide a specific diagnosis—what caused the infection—but most are



Porotic hyperostosis (top) and cribra orbitalia (bottom) in juvenile skulls. These conditions can be caused by iron deficiency anemia. Photographs taken by Mark C. Griffin; bottom photograph from Larsen 1994, and reproduced with permission of John Wiley and Sons, Inc.



Adult tibia (middle) and left and right fibulae with periosteal reaction and inflammation, probably due to infection. The large hole in the tibia is caused by drainage of pus. Photograph by Mark C. Griffin.

caused by bacterial infections originating from the surrounding soft tissue. Usually, the tibia (lower leg bone) is involved because so little soft tissue separates the skin from the bone. Thus, if there is a cut or abrasion to the skin of the lower leg and an infection involving the skin and soft tissue ensues, the infection can then readily pass to the bone.

Periosteal reactions are commonly found in skeletal samples representing populations living in dense, crowded living situations where sanitary conditions may have been poor. My survey of the bone fragments—especially tibia fragments—showed no evidence of periosteal reactions. Thus, based on this limited sample, infection did not seem to be a problem for these early hunter-gatherers.

What *was* striking about the skulls and teeth of the Hidden Cave people was the sheer size of the faces and jaws, the very large areas

of muscle attachment for the chewing muscles, and the high degree of tooth wear and large numbers of chipped teeth. This pattern suggested to me that the masticatory complex was adapted for heavy chewing.<sup>1</sup> Lots of chewing demands big jaws, and heavy chewing of gritty, hard foods results in chipping and wear of teeth. Similarly, the postcranial bones, the area of the skeleton below the neck, were large and had big muscle attachment sites, indicating that these people must have led a highly active lifestyle. These were remains of people who didn't hang out around lake margins enjoying a sedentary lifestyle, which seemed to contradict Heizer's hypothesis about Great Basin adaptations and was more in line with Thomas's ideas. Based on this limited sample, I reached the tentative conclusion that the people I studied from Hidden Cave were healthy, but ate tough foods, and were physically active.

Independent of my work, Thomas came to a similar conclusion regarding the activity of these populations: He hypothesized that these people were highly mobile (the *limnomobile* hypothesis), in contrast to Heizer's *limmosedentary* hypothesis, which argued that wetland resources could provide sufficient food and other resources for a hunter-gatherer population. The limnomobile hypothesis argued that, although these wetlands offered plenty to eat and formed a kind of a "hub" of activity in the western Basin, fluctuations in food and other essential resources would have required travel to other areas—sometimes involving great distances. This is not just a local debate of concern only to Great Basin archaeologists. Rather, the debate is couched within the larger problem of the role of the environment in hunter-gatherer adaptations and how archaeologists go about documenting mobility and lifestyle in earlier societies. Unfortunately, I couldn't say much at the time—my work was based just on the tiny collection from Hidden Cave and it could provide only some very preliminary conclusions.

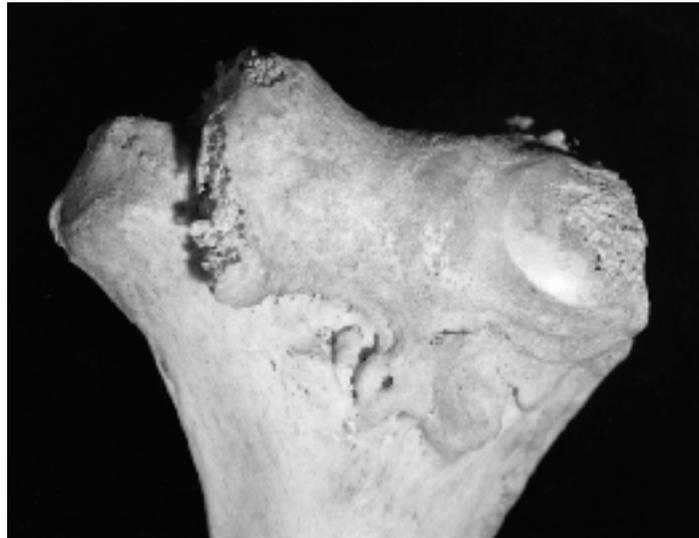
#### MORE SKELETONS AND MORE DEAD ENDS

Over the course of the year following the summer's research at Hidden Cave, I learned just about all there was to know about the bioarchaeology of the western Great Basin—what skeletons had been found, from where, and by whom. I also found the loca-

tions of existing collections of skeletons from sites in the Great Basin. From published and unpublished reports and by word of mouth from various archaeologists, I learned that there were many Great Basin remains in the collections at the Lowie (now Phoebe Hearst) Museum of Anthropology at Berkeley and at the Las Vegas campus of the University of Nevada. With a small grant from the American Museum of Natural History, I traveled to Berkeley and Las Vegas, aspiring to study skeletons in order to address unresolved issues about prehistoric native lifestyles in the Great Basin.

After spending about two months collecting data, I developed a fuller picture of the health, lifestyle, and activity levels for native peoples living in the prehistoric western Great Basin. Indeed, this study confirmed my earlier suspicions about health and activity in prehistoric Indians in this region. Based on my documentation of the skeletons, like the Hidden Cave material I had studied earlier, it became clear to me that health of these people was reasonably good, at least as can be determined from the absence of hypoplasias, porotic hyperostosis, and periosteal reactions.

On the other hand, the skeletons had an abundance of a pathological condition called osteoarthritis, something I was not able to identify in the Hidden Cave sample owing to the highly fragmentary nature of that collection. Osteoarthritis is highly revealing about lifestyle and workload. Although the disorder is somewhat influenced by climate, genetics, and other factors, workload and physical activity—what bioarchaeologists call the mechanical environment—best explain the presence of osteoarthritis. The bone surfaces of the joints of the skeleton (for example, the elbow or knee) are covered with a thin layer of a highly lubricated substance called hyaline cartilage. This lubrication facilitates ease of motion in the joints by greatly reducing the friction between the two (or more) bones making up articular joints. Early in adulthood, if not before, this cartilage begins to erode slowly. Simultaneously, along the margins of the joint, tiny spicules of bone begin to develop. If the erosion of the joint surface is severe enough, the bones making up the joint begin to rub against each other, and the surfaces become polished. Called eburnation (from the Latin *eburnea*, or



Top: Marginal lipping (osteophytes) on adult lumbar vertebra. Bottom: Eburnation on articular surface of humerus in the elbow joint. These are the classic symptoms of osteoarthritis in the skeleton. Photographs by Barry Stark; from Larsen 1987, and reproduced with permission of Academic Press, Inc.



Adult mandibular teeth showing occlusal grooves (Humboldt Lake Basin, Nevada). Grooves are caused by pulling some material across the surfaces of the lower front teeth, such as plant material or animal sinew. From Larsen 1985; reproduced with permission of John Wiley & Sons, Inc.

ivory), this polishing reflects severe wear and tear on the joint. Similarly, bony spicules can develop into large projections of skeletal tissue, sometimes causing joints to immobilize and fuse together (in the vertebrae, for example). Bioarchaeologists and paleopathologists have learned that lifestyle is the essential determinant of osteoarthritis—both in severity and in frequency—in human populations. In situations involving minimal physical activity (such as in sedentary modern Americans), the disorder is relatively rare, whereas in situations of high physical activity, the disorder can be quite prevalent.

The presence of so much osteoarthritis led me to conclude that the Great Basin people I studied had been physically active in life. Moreover, the bones were large and showed markings indicating large muscles. The teeth were highly worn, and in some of the adult males, the front teeth—the incisors and canines—had grooves worn into the chewing surfaces. This unique tooth wear

pattern indicated to me that these people—especially men—were using their teeth for more than just chewing food; they were also using their teeth as tools, perhaps for preparing plant fibers for construction of mats, baskets, and other material culture that ethnographers have identified in Great Basin Indians.

These were all interesting clues about the lives and lifestyles of prehistoric Great Basin people, but frankly, I was still at an impasse about building a solid bioarchaeological picture. Most of the skeletons I studied that summer were undocumented: There were almost no field notes associated with excavated remains, places of origin were largely unknown, there were no dates on the remains, and the majority of the bones were collected by amateur archaeologists with no formal training in fieldwork. In other words, I had lots of bones, but there was little contextual information I could use in the formal analysis that I had hoped to complete, making for frustrating work.

When I returned to campus in the fall to teach, I decided to put the project on hold indefinitely—or so I thought at the time. As things stood, the skeletons I had studied simply were inappropriate for the kind of scientific investigation that I was interested in doing.

#### DISASTER AT STILLWATER AND THE OUTCOME

A couple of years passed, and just as I was about to give up on doing serious work in this fascinating area of desert-west North America, there was a completely unforeseen development that would dramatically alter our understanding about the prehistoric Indians living in this setting centuries before the intrusion of Euroamericans. In 1985, the melting of record snowfalls in the Sierra Nevada mountains to the west had produced massive flooding throughout the wetland areas of the western Great Basin, including the Humboldt and Carson sinks. Extensive erosion due to water, wind, and ice literally scraped the top foot or so from the surface of the Carson Sink landscape, particularly in the area known as the Stillwater Marsh, an ecologically rich region cov-

ering some 150 square miles of the eastern Carson Sink. This erosion opened up a window on prehistoric land use patterns, exposing numerous archaeological sites and hundreds of human skeletons. A new chapter was about to be written on forager societies in this region of the world.

From the start, the archaeological community was completely unprepared for the extent of burial activity by prehistoric peoples living in the region. Before the floods, the region was known mostly from its caves and rock shelters. Following the floods, however, a whole new perspective on prehistoric native peoples was exposed. Many of the remains were isolated bones and teeth, but many were also partially or mostly undisturbed burials.

On the surface, the region looked like an archaeological disaster area. With sites, artifacts, and skeletons exposed to the harsh desert environment of the Great Basin, continued destruction of invaluable cultural and biological resources seemed inevitable. To add to the problem, unscrupulous nonprofessional collectors were beginning to visit the newly exposed sites and remove artifacts and bones for their personal collections. Something had to be done on a massive scale to protect the area from future destruction. Consequently, archaeologists Amy Dansie and Donald Tuohy of the Nevada State Museum and Anan Raymond of the United States Fish and Wildlife Service undertook a survey, excavation, and recovery of artifacts and bones from the newly exposed archaeological sites. Parts of the hundreds of skeletons scattered about the surface of the Carson Desert were carefully collected and taken to the Nevada State Museum for preliminary assessment and study by Sheilagh Brooks, a physical anthropologist at the University of Nevada, Las Vegas.

The fortuitous exposure of skeletal remains in the Carson Sink represented an important opportunity to address issues being debated by archaeologists regarding lifestyle and adaptation. The archaeological materials, including various living sites, storage and house pits, plant and animal remains, and human remains, offered a remarkable data source on the human ecology and behavior in the region. Importantly, the study of the Stillwater skeletons was

also key to addressing the broader issue of adaptive efficiency or “affluence” of hunter-gatherers. In his highly influential textbook published in the 1960s, archaeologist Robert Braidwood of the University of Chicago characterized forager lifestyles as “a savage’s existence, and a very tough one . . . following animals just to kill them to eat, or moving from one berry patch to another.”<sup>2</sup> About the same time, Richard Lee of the University of Toronto and Irven DeVore of Harvard University organized a conference in which various cultural anthropologists having firsthand experience with living foragers around the world reported on their findings relating to health, activity, diet, and other factors specific to hunting and gathering societies.

Collectively, these various anthropologists found that foragers may not have had it all that bad. This assessment was confirmed by Lee in his research among the Ju/’hoansi (!Kung). In contrast to Braidwood’s perspective, a different pattern characterizing foragers began to emerge—life appeared to be leisurely and bountiful for them. From this point on, anthropologists began to study modern hunter-gatherers from diverse settings worldwide. Far from being able to easily characterize forager lifestyles, this later work has shown that they are remarkably diverse: Some appear well off, others are highly stressed, and many lie somewhere between these two extremes. The bioarchaeological work in the Stillwater Marsh could potentially add a new and important contribution to the discussion about forager lifestyles.

#### THE STILLWATER PROJECT

Soon after Dansie, Tuohy, and Brooks completed their formal reports on their work in the Stillwater Marsh, archaeologist Robert Kelly approached the Nevada State Museum, the United States Fish and Wildlife Service (which oversaw the protection and control of the region), and the Fallon Paiute-Shoshone Tribe about the possibility of conducting more fieldwork. He proposed an additional archaeological survey, excavation of threatened human remains and sites, and a study of existing bioarchaeological col-

lections that would tie into his long-term study of prehistoric foragers in the Carson Sink. For his doctoral dissertation, Kelly had completed a large survey of the Carson Sink before the floods, and he had learned a great deal about prehistoric lifestyles in the region. Most of the survey was based on surface sites, and the new alterations of the landscape offered a chance to investigate the region more fully. As students, Kelly and I had worked together for a number of years on Dave Thomas's archaeological projects in the Great Basin and elsewhere, and on many occasions we had discussed how human remains could potentially broaden the understanding of prehistoric lifestyles and adaptations. We agreed that here was a project worth collaborating on.

Kelly and I received the necessary approvals from various state, federal, and tribal authorities to do the work we were proposing. We were ecstatic. Here was a chance to study a large, well-documented series of skeletons—this was unprecedented in the Great Basin. In the summer of 1987, my wife and I spent part of our honeymoon (I have a *very* understanding spouse) collecting data on skeletons excavated by Dansie and Tuohy and then housed at the Nevada State Museum research and collections facility outside of Carson City.<sup>3</sup> With funding from the National Science Foundation and our home institutions (at the time, I was at Northern Illinois University, and Kelly was at the University of Louisville), we completed a survey of the Stillwater Marsh, locating additional burials and archaeological sites. In agreement with the Fallon Paiute-Shoshone Tribe, only threatened burials—those with more than 50 percent of the skeleton already exposed by erosion—were excavated by our crews. The cooperation between archaeologists and Native Americans contributed to the success of the fieldwork, serving as a model for future work. In the following summer, along with physical anthropologists Dale Hutchinson and Christopher Ruff, we returned to Nevada to complete our data collection. This work resulted in a dream come true regarding the important place of bioarchaeology in addressing issues that I had begun to think about while an undergraduate student years earlier, digging at Gatecliff Shelter.

*Ancient DNA and Arrowheads: Who Were  
the Stillwater People?*

Bioarchaeological study of the Stillwater skeletons is somewhat complicated by both cultural and other factors that cloud the archaeological picture. For one, the skeletons are not from a tightly dated cemetery. Most skeletons are from isolated graves scattered throughout the marsh region. As such, we concluded that prehistoric peoples in the region did not bury their dead in formal cemetery areas, but rather, they interred their deceased in isolated areas of relatively high elevation (such as along crests of sand dunes). My guess is that, like many foragers, when someone died, the other members of the group buried the deceased wherever the group happened to be camped at the time. Some of the archaeological sites yielding human remains contained a relatively large number of skeletons—by Brooks’s count, one site had nearly sixty individuals. But even at that locality, there were no clear associations among individual burials—they were not part of a cemetery, planned or otherwise. The burials were simple: The remains of the deceased were placed in an oval-shaped pit with the body in a kind of fetal posture, whereby the arms and legs were drawn up toward the torso.

Also problematic for our study was the determination of the length of time that the Stillwater Marsh was used for burial and the identification of the origin of the people. Regarding the length of time that the region was used for burial of the dead, the half-dozen or so radiocarbon dates associated with individual burials, the few diagnostic artifacts that can be assigned to a specific time period (such as arrowheads) that were found in direct association with skeletons, and relative dating of archaeological sites indicate that the region was most heavily trafficked by native groups during the Reveille phase (1300 B.C.–A.D. 700), and less so during the following Underdown phase (A.D. 700–1300).

Regarding the population history—who were the people we were studying—it is fully within the realm of possibility that people from the earlier periods may be different from the people from

the later periods. Today, most of the native peoples living in the Great Basin are Numic speakers. In the 1940s and 1950s, social anthropologist Julian Steward and linguist Sidney Lamb suggested that Numic speakers originated in a southwestern Great Basin homeland in southeastern California and eventually spread throughout the Great Basin. Linguistic evidence suggests that the expansion and replacement of earlier groups took place at least one thousand years ago.

Analysis of ancient DNA offers important insight into population origins and the identification of the Stillwater people. DNA, or deoxyribonucleic acid, is the chemical found in cells of the body that presents the genetic code. The unraveling of this code provides all sorts of important information about genetic relationships among people, whom they derive from, evolutionary history, and geographic origins. The use of DNA has already been instrumental in identifying perpetrators of crimes and identities of deceased individuals. DNA analysis in bioarchaeology is still in its infancy, but promises to be a powerful tool for identification of population history. One of the first large-scale projects involved the analysis of ancient DNA extracted from the Stillwater bones. DNA was successively extracted from Stillwater skeletons by Frederika Kaestle of Yale University and coworkers Joseph Lorenz of the Analytical Genetic Testing Center and David Glenn Smith from the University of California, Davis. Their analysis indicates that if Numic people did move into the region, they likely did not replace populations living there.<sup>4</sup> Rather, this new molecular genetic information from the DNA analysis suggests that there may have been admixture between Numic and pre-Numic peoples; the genes identifying both groups of people are present in the Stillwater bones.

Thus, many generations of people possibly representing different genetic groups were likely buried in the Stillwater Marsh. It is entirely possible that the human remains from Stillwater that my collaborators and I have studied are not representative of a population or series of populations that we could use to address issues relating to bioarchaeology and human adaptation. However, research by both Sheilagh Brooks and my team of bioar-

chaeologists found a homogeneity of skeletal measurements, cranial shape, tooth wear patterns, and other data in the Stillwater series. This homogeneity suggests that the series can be regarded as a biological unit of study amenable to the kinds of questions raised here and the types of data analyses outlined in the introduction to this book.

The bioarchaeology of the Stillwater skeletons provides an independent means for evaluating and understanding behavioral patterns, land use, and adaptive efficiency in the western Great Basin. In the next chapter, I will address a series of questions fundamental to our understanding of the lives of ancient foragers in this and other regions of the world: What were the health and activity like in prehistoric western Great Basin foragers? Were the lifestyle and adaptive pattern of these foragers consistent with the Hobbesian portrayal of “poor, nasty, brutish, and short”? Or, was it more along the lines of the consensus that emerged among many anthropologists that far from being nutritionally deprived and subject to excessive workloads, foragers had adequate nutrition and were not subject to huge amounts of work—was life for hunter-gatherers bountiful, leisurely, and productive in this setting? Or, was it somewhere between these extremes? Closer to questions regarding native peoples in the Stillwater Marsh region of the Great Basin, were these populations tied to the marsh, living a sedentary and affluent lifestyle, or did they move about the landscape, extracting resources from both marsh and uplands settings, eating just enough to get by?

## NOTES

1. Mastication, or chewing, is one of the important “activities” of the skull that is discussed throughout the book. The masticatory complex refers to the area of skull anatomy involved in chewing, namely the muscles that are responsible for making the chewing motion, the bones that anchor the muscles, and the teeth coming into direct contact with the food. The muscles of the masticatory complex move the lower jaw, the mandible, in order to bring the teeth together in a chewing motion. Five different muscles are included in the chewing motion: temporalis, masseter, lateral pterygoid, medial pterygoid, and digastric. The two major muscles that account for most of the chewing

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power are the temporalis muscle and the masseter muscle. The temporalis is a large fan-shaped muscle that attaches on the side of the head and on the upper part of the mandible. The masseter attaches to the zygomas (cheekbones) and the bottom and back of the mandible. When the muscle contracts, it pulls the mandible in an upward and forward direction. If you clench your jaw, and touch the side of your head and the back of your lower jaw, you can feel these muscles contracting. When the masticatory muscles relax, gravity allows the mandible to lower, and when the muscles contract, the mandible is brought up for chewing.

The skull bones that provide the attachment sites for the masticatory muscles are the mandible, zygoma and other facial bones, and the temporal and parietal bones on the sides of the skull.

The teeth come into direct contact with the food when it is being chewed. Human beings have two sets of teeth. The first set is the deciduous (or milk) teeth, and includes the front teeth (incisors and canines) and back teeth (molars). By age ten to twelve, most or all of the deciduous teeth have been replaced by the permanent (or adult) teeth. In addition to having incisors, canines, and molars, the adult dentition also has premolars, the teeth located between the canines and molars in the jaws.

2. Braidwood 1967, p. 113.

3. The skeletons are now protected in an underground concrete vault on the reservation of the Fallon Paiute-Shoshone Tribe near Fallon, Nevada.

4. The study of genetic material extracted from ancient skeletons and other tissues is beginning to advance our understanding of past population history in ways that were not envisioned a decade ago. With a technology called polymerase chain reaction (PCR), scientists can amplify tiny fragments of (DNA), reconstructing key components of the genes of people and other organisms long deceased. This is a powerful new tool for testing hypotheses about ancestor-descendant relationships in the past and present, such as the origins of prehistoric and living populations in the Great Basin—or anywhere, for that matter. Some very rare mutations indicate common ancestry in ancient populations. For Native American populations, the study of ancient DNA has resulted in the identification of four distinct founding lineages or haplogroups, which may represent four separate waves or migration of populations from Asia to the New World.

The DNA study undertaken by Frederika Kaestle and her coworkers is one of the first to successfully analyze genetic material from a sizable sample of archaeological skeletons. The DNA extraction techniques are currently being worked out in a number of laboratories around the world. Kaestle and her team removed the protein from small samples of ground-up bone, the DNA was extracted from the deproteinized bone through a series of chemical and me-

chanical processes, and then it was subjected to PCR amplification. For the Stillwater bone sample (n=19), three of the four haplogroups identified in living Native American populations are represented by at least one individual each. The analysis reveals that some language groups can be eliminated as related (e.g., Zuñi, Yuman, Washo, Takic, Northern and Central Uto-Aztecan), and interestingly, the Stillwater series is statistically different from the far eastern Great Basin Fremont populations analyzed by physical anthropologist Dennis O'Rourke and coworkers (1999) at the University of Utah. Although the Stillwater molecular genetic study does not prove or disprove the Numic expansion hypothesis, it does serve to eliminate specific relationships. The study represents a landmark in our understanding of Great Basin population history.

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