A Paleo-Indian Bison Kill

By Joe Ben Wheat
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Some 8,500 years ago a group of hunters on the Great Plains stampeded a herd of buffalo into a gulch and butchered them. The bones of the animals reveal the event in remarkable detail.

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When one thinks of American Indians hunting buffaloes, one usually visualizes the hunters pursuing a herd of the animals on horseback and killing them with bow and arrow. Did the Indians hunt buffaloes before the introduction of the horse (by the Spanish conquistadors in the 16th century) and the much earlier introduction of the bow? Indeed they did. As early as 10,000 years ago Paleo-Indians hunted species of bison that are now extinct on foot and with spears. My colleagues and I at the University of Colorado Museum have recently excavated the site of one such Paleo-Indian bison kill dating back to about 6500 B.C. The site so remarkably preserves a moment in time that we know with reasonable certainty not only the month of the year the hunt took place but also such details as the way the wind blew on the day of the kill, the direction of the hunters’ drive, the highly organized manner in which they butchered their quarry, their choice of cuts to be eaten on the spot and the probable number of hunters involved.

The bison was the most important game animal in North America for millennia before its near extermination in the 19th century. When Europeans arrived on the continent, they found herds of bison ranging over vast areas, but the animals were first and foremost inhabitants of the Great Plains, the high, semi-arid grassland extending eastward from the foothills of the Rocky Mountains and all the way from Canada to Mexico. Both in historic and in late prehistoric times the bison was the principal economic resource of the Indian tribes that occupied the Great Plains. Its meat, fat and bone marrow provided them with food; its hide furnished them with shelter and clothing; its brain was used to tan the hide; its horns were fashioned into containers. There was scarcely a part of the animal that was not utilized in some way.

This dependence on big-game hunting probably stretches back to the very beginning of human prehistory in the New World. We do not know when man first arrived in the Americas, nor do we know in detail what cultural baggage he brought with him. The evidence for the presence of man in the New World much before 12,000 years ago is scattered and controversial. It is quite clear, however, that from then on Paleo-Indian hunting groups, using distinctive kinds of stone projectile point, ranged widely throughout the New World. On the Great Plains the principal game animal of this early period was the Columbian mammoth [see “Elephant-hunting in North America,” by C. Vance Haynes, Jr., in June 1966 issue of SCIENTIFIC AMERICAN Magazine]. Mammoth remains have been found in association with projectile points that are usually large and leaf-shaped and have short, broad grooves on both sides of the base. These points are

SITE OF THE KILL is 140 miles southeast of Denver. It is named the Olsen-Chubbuck site after its discoverers, the amateur archaeologists Sigurd Olsen and Gerald Chubbuck.
PROJECTILE POINTS found at the site show a surprising divergence of form in view of the fact that all of them were used simultaneously by a single group. In the center is a point of the Scottsbluff type. At top left is another Scottsbluff point that shows some of the characteristics of a point of the Eden type at top right. At bottom left is a third Scottsbluff point; it has characteristics in common with a point of the Milnesand type at bottom right. Regardless of form, all the points are equally excellent in flaking.
typical of the complex of cultural traits named the Clovis complex: the tool kit of this complex also included stone scrapers and knives and some artifacts made of ivory and bone.

The elephant may have been hunted out by 8000 B.C. In any case, its place as a game animal was taken by a large, straight-horned bison known as *Bison antiquus*. The first of the bison-hunters used projectile points of the Folsom culture complex: these are similar to Clovis points but are generally smaller and better made. Various stone scrapers and knives, bone needles and engraved bone ornaments have also been found in Folsom sites.

A millennium later, about 7000 B.C., *Bison antiquus* was supplanted on the Great Plains by the somewhat smaller *Bison occidentalis*. The projectile points found in association with this animal's remains are of several kinds. They differ in shape, size and details of flaking, but they have some characteristics in common. Chief among them is the technical excellence of the flaking. The flake scars meet at the center of the blade to form a ridge; sometimes they give the impression that a single flake has been detached across the entire width of the blade [see the illustration on opposite page]. Some of the projectile points that belong to this tradition, which take their names from the sites where they were first found, are called Milnesand, Scottsbluff and Eden points. The last two kinds of point form part of what is called the Cody complex, for which there is a fairly reliable carbon-14 date of about 6500 B.C.

Paleo-Indian archaeological sites fall into two categories: habitation and kill sites. Much of our knowledge of the early inhabitants of the Great Plains comes from the kill sites, where are found not only the bones of the animals but also the projectile points used to kill them and the knives, scrapers and other tools used to butcher and otherwise process them. Such sites have yielded much information about the categories of projectile points and how these categories are related in time. Heretofore, however, they have contributed little to our understanding of how the early hunters actually lived. The kill site I shall describe is one of those rare archaeological sites where the evidence is so complete that the people who left it seem almost to come to life.

Sixteen miles southeast of the town of Kit Carson in southeastern Colorado, just below the northern edge of the broad valley of the Arkansas River, lies a small valley near the crest of a low divide. The climate here is semiarid; short bunchgrass is the main vegetation and drought conditions have prevailed since the mid-1950's. In late 1957 wind erosion exposed what appeared to be five separate piles of bones, aligned in an east-west direction. Gerald Chubbuck, a keen amateur archaeologist, came on the bones in December, 1957: among them he found several projectile points of the Scottsbluff type. Chubbuck notified the University of Colorado Museum of his find, and we made plans to visit the site at the first opportunity.

Meanwhile Chubbuck and another amateur archaeologist, Sigurd Olsen, continued to collect at the site and ultimately excavated nearly a third of it. In the late spring of 1958 the museum secured permission from the two discoverers and from Paul Forward, the owner of the land, to complete the excavation. We carried out this work on summer expeditions in 1958 and 1960.

The Olsen-Chubbuck site consists of a continuous bed of bones lying within the confines of a small arroyo, or dry gulch. The arroyo, which had long since been buried, originally rose near the southern end of the valley and followed a gently undulating course eastward through a ridge that forms the valley's eastern edge. The section of the arroyo that we excavated was some 200 feet long. Its narrow western end was only about a foot and a half in depth and the same in width, but it grew progressively deeper and wider to the east. Halfway down the arroyo its width was five feet and its depth six; at the point to the east where our excavation stopped it was some 12 feet wide and seven feet deep. At the bottom of the

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**BISON STAMPEDE** was probably set off by the Paleo-Indian hunters' close approach to the grazing herd from downwind. Projectile points found among the bones of the animals at the eastern end of the arroyo (bottom) suggest that some hunters kept the bison from veering eastward to escape. Other hunters probably did the same at the western end of the arroyo.
The arroyo for its entire length was a channel about a foot wide; above the channel the walls of the arroyo had a V-shaped cross section [see top illustration on page 114].

Today the drainage pattern of the site runs from north to south. This was probably the case when the arroyo was formed, and since it runs east and west it seems certain that it was not formed by stream action. Early frontiersmen on the Great Plains observed that many buffalo trails led away from watering places at right angles to the drainage pattern. Where such trails crossed ridges they were frequently quite deep; moreover, when they were abandoned they were often further deepened by erosion. The similarity of the Olsen-Chubbuck arroyo to such historical buffalo trails strongly suggests an identical origin.

The deposit of bison bones that filled the bottom of the arroyo was a little more than 170 feet long. It consisted of the remains of nearly 200 buffaloes of the species *Bison occidentalis*. Chubbuck and Olsen unearthed the bones of an estimated 50 of the animals; the museum's excavations uncovered the bones of 143 more. The bones were found in three distinct layers. The bottom layer contained some 13 complete skeletons; the hunters had not touched these animals. Above this layer were several essentially complete skeletons from which a leg or two, some ribs or the skull were missing; these bison had been only partly butchered. In the top layer were numerous single bones and also nearly 500 articulated segments of buffalo skeleton. The way in which these segments and the single bones were distributed provides a number of clues to the hunters' butchering techniques.

As the contents of the arroyo—particularly the complete skeletons at the bottom—make clear, it had been a trap into which the hunters had stampeded the bison. Bison are gregarious animals. They move in herds in search of forage; the usual grazing herd is between 50 and 300 animals. Bison have a keen sense of smell but relatively poor vision. Hunters can thus get very close to a herd as long as they stay downwind and largely out of sight. When the bison are frightened, the herd has a tendency to close ranks and stampede in a single mass. If the herd encounters an abrupt declivity such as the Olsen-Chubbuck arroyo, the animals in front cannot stop because they are pushed by those behind. They can only plunge into the arroyo, where they are immobilized, disabled or killed by the animals that fall on top of them.

The orientation of the skeletons in the middle and lower layers of the Olsen-Chubbuck site is evidence that the Paleo-Indian hunters had initiated such a stampede. Almost without exception the complete or nearly complete skeletons overlies or are overlain by the skeletons of one, two or even three other whole or nearly whole animals; the bones are massed and the skeletons are contorted. The first animals that fell into the arroyo had no chance to escape; those behind them wedged them tighter into the arroyo with their struggles. Many of the skeletons are sharply twisted around the axis of the spinal column. Three spanned the arroyo, deformed into
before the author and his associates began work in 1958; this area is represented by the 20-foot gap in the deposit. The shallow inner channel at the bottom of the arroyo can be seen in the plan view (bottom); outlines show the locations of 13 intact bison skeletons.

an unnatural U shape. Ten bison were pinned in position with their heads down and their hindquarters up; an equal number had landed with hindquarters down and heads up. At the bottom of the arroyo two skeletons lie on their backs.

The stampeding bison were almost certainly running in a north-south direction, at right angles to the arroyo. Of the 39 whole or nearly whole skeletons, which may be assumed to lie in the positions in which the animals died, not one faces north, northeast, or northwest. A few skeletons, confined in the arroyo's narrow inner channel, face due east or west, but all 21 animals whose position at the time of death was not affected in this manner faced southeast, south or southwest. The direction in which the bison stampeded provides a strong clue to the way the wind was blowing on the day of the hunt. The hunters would surely have approached their quarry from downwind; thus the wind must have been from the south.

We have only meager evidence of the extent to which the stampede, once started, was directed and controlled by the hunters. The projectile points found with the bison skeletons in the deepest, most easterly part of the arroyo suggest that a flanking party of hunters was stationed there. It also seems a reasonable inference that, if no hunters had covered the stampede's western flank, the herd could have escaped unscathed around the head of the arroyo. If other hunters pursued the herd from the rear, there is no evidence of it.

Even if the hunters merely started the stampede and did not control it thereafter, it sufficed to kill almost 200 animals in a matter of minutes. The total was 46 adult bulls and 27 immature ones, 63 adult and 38 immature cows and 16 calves. From the fact that the bones include those of calves only a few days old, and from what we know about the breeding season of bison, we can confidently place the date of the kill as being late in May or early in June.

As we excavated the bone deposit we first uncovered the upper layer containing the single bones and articulated segments of skeleton. It was soon apparent that these bones were the end result of a standardized Paleo-Indian butchering procedure. We came to recognize certain "butchering units" such as forelegs, pelvic girdles, hind legs, spinal column and skulls. Units of the same kind were usually found together in groups numbering from two or three to as many as 27. Similar units also formed distinct vertical sequences. As the hunters had removed the meat from the various units they had discarded the bones in separate piles, each of which contained the remains of a number of individual animals. In all we excavated nine such piles.

Where the order of deposition was clear, the bones at the bottom of each pile were foreleg units. Above these bones were those of pelvic-girdle units. Sometimes one or both hind legs were attached to the pelvic girdle, but by and large the hind-leg units lay separately among or above the pelvic units. The next level was usually composed of spinal-column units. The ribs had been removed from many of the chest vertebrae, but ribs were still attached to some of the other vertebrae. At the top
of nearly every pile were skulls. The jawbones had been removed from most of them, but some still retained a few of the neck vertebrae. In some instances these vertebrae had been pulled forward over the top and down the front of the skull. When the skull still had its jawbone, the hyoid bone of the tongue was missing.

Like the various butchering units, the single bones were found in clusters of the same skeletal part: shoulder blades, upper-foreleg bones, upper-hind-leg bones or jawbones (all broken in two at the front). Nearly all the jawbones were found near the top of the bone deposit. The tongue bones, on the other hand, were distributed throughout the bed. About 75 percent of the single foreleg bones were found in the upper part of the deposit, as were nearly 70 percent of the single vertebrae. Only 60 percent of the shoulder blades and scarcely half of the single ribs were in the upper level.

The hunters' first task had evidently been to get the bison carcasses into a position where they could be cut up. This meant that the animals had to be lifted, pulled, rolled or otherwise moved out of the arroyo to some flat area. It seems to have been impossible to remove the bison that lay at the bottom of the arroyo; perhaps they were too tightly wedged together. Some of them had been left untouched and others had had only a few accessible parts removed. The way in which the butchering units were grouped suggests that several bison were moved into position and cut up simultaneously. Since foreleg units, sometimes in pairs, were found at the bottom of each pile of bones it seems reasonable to assume that the Paleo-Indians followed the same initial steps in butchering that the Plains Indians did in recent times. The first step was to arrange the legs of the animal so that it could be rolled onto its belly. The skin was then cut down the back and pulled down on both sides of the carcass to form a kind of mat on which the meat could be placed. Directly under the skin of the back was a layer of tender meat, the "blanket of flesh"; when this was stripped away, the bison's forelegs and shoulder blades could be cut free, exposing the highly prized "hump" meat, the rib cage and the body cavity.

Having stripped the front legs of meat, the hunters threw the still-articulated bones into the arroyo. If they followed the practice of later Indians, they would next have indulged themselves

EXCAVATION at the eastern end of the arroyo reveals its V-shaped cross section and the layers of sand and silt that later filled it. The bone deposit ended at this point; a single bison shoulder blade remains in place at the level where it was unearthed (lower center).

BISON SKULL AND STONE POINT lie in close association at one level in the site. The projectile point (lower left) is of the Scottsbluff type. The bison skull, labeled 4-F to record its position among the other bones, rests upside down where the hunters threw it.
BONES OF BISON unearthed at the Olsen-Chubbuck site lie in a long row down the center of the ancient arroyo the Paleo-Indian hunters utilized as a pitfall for the stampeding herd. The bones proved to be the remains of bulls, cows and calves of the extinct species *Bison occidentalis*. Separate piles made up of the same types of bones (for example sets of limb bones, pelvic girdles or skulls) showed that the hunters had butchered several bison at a time and had systematically dumped the bones into the arroyo in the same order in which they were removed from the carcasses. In the foreground is a pile of skulls that was built up in this way.
by cutting into the body cavity, removing some of the internal organs and eating them raw. This, of course, would have left no evidence among the bones. What is certain is that the hunters did remove and eat the tongues of a few bison at this stage of the butchering, presumably in the same way the Plains Indians did; by sitting the throat, pulling the tongue out through the slit and cutting it off. Our evidence for their having eaten the tongues as they went along is that the tongue bones are found throughout the deposit instead of in one layer or another.

The bison’s rib cages were attacked as soon as they were exposed by the removal of the overlying meat. Many of the ribs were broken off near the spine. The Plains Indians used as a hammer for this purpose a bison leg bone with the hoof still attached; perhaps the Paleo-Indians did the same. In any case, the next step was to sever the spine at a point behind the rib cage and remove the hindquarters. The meat was cut away from the pelvis (and in some instances simultaneously from the hind legs) and the pelvic girdle was discarded. If the hind legs had been separated from the pelvis, it was now their turn to be stripped of meat and discarded.

After the bison’s hindquarters had been butchered, the neck and skull were cut off as a unit—usually at a point just in front of the rib cage—and set aside. Then the spine was discarded, presumably after it had been completely stripped of meat and sinew. Next the hunters turned to the neck and skull and cut the neck meat away. This is evident from the skulls that had vertebrae draped over the front: this would not have been possible if the neck meat had been in place. The Plains Indians found bison neck meat too tough to eat in its original state. They dried it and made the dried strips into pemmican by pounding them to a powder. The fact that the Paleo-Indians cut off the neck meat strongly suggests that they too preserved some of their kill.

If the tongue had not already been removed, the jawbone was now cut away, broken at the front and the tongue cut out. The horns were broken from a few skulls, but there is little evidence that the Paleo-Indians broke open the skull as the Plains Indians did to take out the brain. Perhaps the most striking difference between the butchering practices of these earlier Indians and those of later ones, however, lies in the high degree of organization displayed by the Paleo-Indians. Historical accounts of butchering by Plains Indians indicate no such efficient system.

In all, 47 artifacts were found in association with the bones at the Olsen-Chubbuck site. Spherical hammerstones and knives give us some idea of what constituted the hunter’s tool kit; stone scrapers suggest that the bison’s skins were processed at the site. A bone pin and a piece of the brown rock limonite that shows signs of having been rubbed tell something about Paleo-Indian ornamentation.

The bulk of the artifacts at the site are projectile points. There are 27 of them, and they are particularly significant. Most of them are of the Scottsbluff type. When their range of variation is considered, however, they merge gradually at one end of the curve of variation into Eden points and at the other end into Milnesand points. Moreover, among the projectile points found at the site are one Eden point and a number of Milnesand points. The diversity of the points clearly demonstrates the range of variation that was possible among the weapons of a single hunting group. Their occurrence together at the site is conclusive proof that such divergent forms of weapon could exist contemporaneously.

How many Paleo-Indians were pres-
ent at the kill? The answer to this question need not be completely conjectural. We can start with what we know about the consumption of bison meat by Plains Indians. During a feast a man could consume from 10 to 20 pounds of fresh meat a day; women and children obviously ate less. The Plains Indians also preserved bison meat by drying it; 100 pounds of fresh meat would provide 20 pounds of dried meat. A bison bull of today yields about 550 pounds of edible meat; cows average 400 pounds. For an immature bull one can allow 165 pounds of edible meat, for an immature cow 110 pounds and for a calf 50 pounds. About 75 percent of the bison killed at the Olsen-Chubbuck site were completely butchered; on this basis the total weight of bison meat would have been 45,300 pounds. The *Bison occidentalis* killed by the Paleo-Indian hunters, however, was considerably larger than the *Bison bison* of modern times. To compensate for the difference it seems reasonable to add 25 percent to the weight estimate, bringing it to a total of 56,640 pounds. To this total should be added some 4,000 pounds of edible internal organs and 5,400 pounds of fat.

A Plains Indian could completely butcher a bison in about an hour. If we allow one and a half hours for the dissection of the larger species, the butchering at the Olsen-Chubbuck site would have occupied about 210 man-hours. In other words, 100 people could easily have done the job in half a day.

To carry the analysis further additional assumptions are needed. How long does fresh buffalo meat last? The experience of the Plains Indians (depending, of course, on weather conditions) was that it could be eaten for about a month. Let us now assume that half of the total weight of the Olsen-Chubbuck kill was eaten fresh at an average rate of 10 pounds per person per day, and that the other half was preserved. Such a division would provide enough fresh meat and fat to feed 150 people for 23 days. It seems reasonable to assume that the Paleo-Indian band was about this size. One way to test this assumption is to calculate the load each person would have to carry when camp was broken.

The preserved meat and fat, together with the hides, would have weighed about 7,350 pounds, which represents a burden of 49 pounds for each man, woman and child in the group (in addition to the weight of whatever other necessities they carried). Plains Indians are known to have borne loads as great as 100 pounds. Taking into account the likelihood that small children and active hunters would have carried smaller loads, a 49-pound average appears to be just within the range of possibility.

A band of 150 people could, however, have eaten two-thirds of the kill fresh and preserved only one-third. In that case the fresh meat would have fed them for somewhat more than a month. At the end the meat would have been rather gummy, but the load of preserved meat per person would have been reduced to the more reasonable average of 31 pounds.

One possibility I have left out is that the Paleo-Indians had dogs. If there were dogs available to eat their share of fresh meat and to carry loads of preserved meat, the number of people in the group may have been somewhat less. In the absence of dogs, however, it seems improbable that any fewer than 150 people could have made use of the bison killed at the Olsen-Chubbuck site to the degree that has been revealed by our excavations. Whether or not the group had dogs, the remains of its stay at the site are unmistakable evidence that hunting bands of considerable size and impressive social organization were supporting themselves on the Great Plains some 8,500 years ago.