

soil particles carried away to streams and rivers. In this way, hills and mountain areas were being worn down, and sediment transported to the sea or temporarily deposited on river banks and in the bottoms of rivers and lakes. Sand, silt, clay, and gravel deposits of Pleistocene and Holocene rivers and lakes are unconsolidated and are typically 25 to 100 feet thick. Finding Pleistocene terraces 100 feet to more than 300 feet above modern flood plains attests to the great amount of erosion and downcutting performed by major rivers in the past one million years.

Forty thousand years ago, during the Pleistocene Epoch, an asteroid 80 feet in diameter and weighing 63,000 tons collided with Earth 40 miles east of what is now Flagstaff, Arizona. Moving at 36,000 miles per hour, the iron-nickel asteroid struck with the energy equivalent of a 1.7 megaton nuclear bomb. By comparison the nuclear bombs used in World War II had only about 20 kilotons, only 1/80th as much energy as the asteroid. Although there is no evidence of humans in the area at this time, whatever species may have been living here would have felt the effects of such a massive explosion.

Taking only seconds to travel through Earth's atmosphere, the asteroid struck the desert ground. It lasted only a fraction of a second longer after impact. On impact, the momentum of the flight caused the asteroid and surface rocks to compress to only a tenth of their original size. A powerful shockwave traveled back up through the asteroid with so much energy, the asteroid and the ground around it for more than half a mile was partially melted and shattered. The debris blasted out of the crater just like the blast of a nuclear bomb, scattering red-hot pieces of the asteroid and melted limestone and sandstone rock from Earth as far as eight miles from the impact site. The Barringer Crater, as it is known today, is the youngest and best preserved large meteorite crater on Earth.

Holocene environments are characterized by the development of climates and consequent distribution of plants and animals as we now know them, but they were neither homogeneous nor continuous. Marked environmental changes occurred during the last 14,000 years, and various climatological periods have been identified: anathermal, from 10,500 to 7,000 *ya*, when an increasingly warm, decreasingly moist climate predominated; alithermal, from 7,000 to about 4,000 *ya*, when a warm, arid climate was prevalent; and medithermal, from 4,000 *ya* to present, when moderate temperatures and drought cycles predominated. Many of the Holocene records for Oklahoma come from the Washita River Basin in Grady, Caddo, and Washita counties.

Astronomical phenomena that would have been readily noticed by any people living in Oklahoma during the Holocene Epoch were exploding stars called supernovas. Stars at least ten times more massive than our sun end their lives in huge explosions that may literally tear the star apart. These are visible from vast astronomical distances, even if the progenitor star was never visible to Earthly inhabitants. These can be visible even in the daytime sky, and are often visible at night for periods of months or years.

Observations of other galaxies suggest that our Milky Way should produce one such supernova every one hundred years or so. In all of written history, though, only five have been recorded: in 1006, 1054, 1181, 1572 (Tycho Brahe's Star) and 1604 (Kepler's Star) although two other records from Chinese history in 185 and 393 may also reflect supernova events.

The 1054 supernova was especially well recorded. Chinese astronomers first noticed what they called a "guest star" on July 4th, 1054, just as the sun set, in the constellation we call Taurus, the bull. The object was so brilliant, it was visible in daylight for two months, and was visible at night for two years. On July 5th, a thin crescent Moon rose very close to the supernova. This sight may have been recorded by prehistoric



Petroglyphs found in Cimarron County.

people living in America. Petroglyphs, rock drawings, in the Four Corners region of New Mexico show numerous drawings of a bright star near a thin crescent Moon. One such petroglyph also includes a human hand, probably for scale to indicate just how close the two objects appeared in the sky. Although no such evidence exists, the people living in Oklahoma at the time would surely have marveled at the incredible sight in the night sky.

Perhaps the most breathtaking astronomical sight is a total solar eclipse. The bright disk of the sun disappears as the Moon covers it, revealing the sun's petal-like corona. During a total solar eclipse, bright stars and planets are visible in the nearly black sky. During the few minutes of totality, the temperature may drop as much as 20 degrees or more. Studies of animal behavior indicate that animals begin roosting and other nighttime behaviors, only to appear "puzzled" when the sun reappears a few minutes later.

Some ancient cultures believed that an eclipse occurred when a dragon or other evil creature began eating the sun. They would often shout, bang sticks and stones together, or even throw objects into the sky in an attempt to scare the beast, or at least cause it indigestion so it would regurgitate the sun. Early inhabitants of Oklahoma may have taken similar actions during an eclipse.

During the past two millennia, thirty solar eclipses transpired for people living in Oklahoma in which the sun was more than 96 percent blocked. Although only one, July 21, 1618, was a completely total eclipse, there were six others that covered 99 percent of the sun. From 1,700 to 1,300 *ya* a particularly large number of substantial (40 percent or greater) eclipses occurred in the state, sometimes as frequently as two a year. We can only guess what concerns inhabitants of Oklahoma felt during those three centuries when the sun disappeared so frequently.

Humanity

Substantial evidence exists to demonstrate the first people were in Oklahoma by 11,000 years ago, and more than 600 generations of Native Americans have lived here.

PALEOINDIAN (12,000 TO 8,000 YA)

More than 16,000 archeological sites are recorded for the state, and they are estimated to represent a small percent of the actual number of prehistoric occupations. Some of these sites pertain to the lives of Oklahoma's original settlers—the Wichita and Caddo, and perhaps such relative late comers as the Kiowa Apache, Osage, Kiowa, and Comanche. All of these sites comprise an invaluable resource for learning about Oklahoma's remarkable and diverse human heritage.

Given the distribution and ages of studies sites, Oklahoma was widely inhabited during prehistory. Among the earliest people were those who came and resided here at the end of the last ice age, about 11,500 *ya*. These earliest cultures are: Clovis, 12,000 to 11,000 *ya*; Folsom, 10,800 to 10,000 *ya*; and Plainview, 10,000 to 8,000 *ya*. Named after the Southern Plains locations where their distinctive artifacts were first discovered, these artifacts are the material goods of Native American bands who occupied adjacent parts of Oklahoma, Texas, and New Mexico in different ways. All are so far back in prehistory that they cannot be linked directly to any historically known tribes.

Oklahoma has several good examples of places once occupied by these earliest people. The oldest site, Cooperton in Kiowa County, shown by radio-



Clovis



Folsom



Clovis

Spearpoints — Found along the Arkansas River in Tulsa county.

carbon dating to be 17,000 to 21,000 years old, consisted of a single Columbian mammoth skeleton. At the Domebo Site in Caddo County, three Clovis-type spear points were found among the ribs and vertebrae of a Columbian mammoth.

In Harper County, in northwestern Oklahoma, a major Folsom-age bison kill was uncovered near Ft. Supply. Called the Cooper site, this location resulted from Folsom hunters trapping and spearing bison herds in a deep gully on three separate occasions, and has yielded extensive bone and lithic materials to archeologists. The three kill deposits provide the opportunity to study hunting and butchering practices as revealed by stone tools and bone alteration and to further understanding of Folsom lifeways.

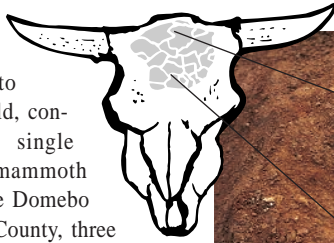
An estimated 29 animals were removed from the upper kill deposits. In addition to the bison remains, the excavations uncovered projectile points, butchering tools and resharpening flakes. Butchering tools consist of large flake knives that were minimally unifacially retouched. Most of the flaking was probably to resharpen tool edges. Several fist-sized cobbles were recovered from all three kills. These cobbles were probably used in the skinning process to pound the hide away from the carcass.

The middle kill layer consisted of articulated skeletons of mature cows, calves, and juveniles. As in the upper kill, no mature bulls were identified among the estimated 29 animals. In addition to the skeletal remains, seven Folsom projectile points, two butchering tools, and numerous resharpening flakes were recovered, as well as the cobbles as found in the other layers.

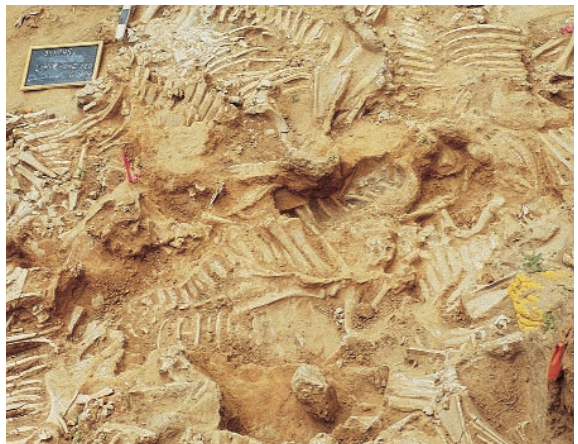
The lower kill episode contains a minimum of 20 mostly articulated skeletons from mature cows, calves, and juvenile bison.

Seasonality studies show all three kills took place during the end of summer/early fall. This indicates at least one year separated the two earliest kills. Further, it is estimated that the bone deposits excavated represent half of the animals killed in each episode. The extent of weathering of the bone surfaces, trampling, and the low to moderate amount of sedimentation suggest all three kills could have occurred during a 10- to 15-year period. The presence of butchering tools within the bonebeds and limited butchering marks on the bones indicate that muscle removal was the major form of butchering at the site.

Among the most interesting aspects of this site is a bison skull from the lower bonebed which had a red



Painted bison skull, found at the Cooper site in Kiowa County, provides scientists a rare opportunity to study possible ritual aspects of bison kills. (Leland C. Bement, Oklahoma Archeological Survey) The Cooper bison skull is the first new world Paleoindian example in the art and non-mortuary ritual context. (Note: art on skull digitally enhanced for visual reference.)



The Cooper site contains three identifiable bison kills of Folsom age in the same gully. Until discovery of the site, topics such as tool variability, butchering practices and herd composition had to rely on comparisons of separate sites. (Leland C. Bement, Oklahoma Archeological Survey)

zigzag line painted on its frontal. This skull appears to have been used in a ritual conducted during preparation for the second kill. The success of the second kill is amply indicated by the large number of bison skeletons overlying the painted skull, and the extensive damage to the painted skull by trampling. The red pigment is thought to be hematite, the use of which has been observed at several Paleoindian sites. Three contexts of ochre use have been identified in Old World Upper Paleolithic and New World Paleoindian sites: burials, art and non-mortuary ritual contexts, and domestic contexts. The Cooper bison skull is the first new World Paleoindian example in the art and non-mortuary ritual context.

Perhaps a thousand years after the Folsom people, hunters using the Plainview-style spear point killed a small herd at what is now called the Perry Ranch site in Jackson County. It is apparent that bison hunting was one of the first human endeavors in Oklahoma.

Lithic (stone) materials of Oklahoma had wide influences on cultural developments in the area. Used as trade goods, a number of caches of these materials have been found in the state. In the James Hemming cache near Carnegie, materials from the Florence chert, Kay County quarries, Foraker chert, Edwards Plateau of Texas, Grandfalls chert from northeast Oklahoma, alibates chert from near Amarillo, Texas, and Obsidian, probably from Jemez, New Mexico, were found. Chert resources were high in significance among various tribal groups.

Oklahoma's prehistoric peoples maintained themselves through at least 600 generations. Most archaeological finds of early specialized hunters are confined to the western part of the U.S., and in Oklahoma, only in the western portion of the state.

ARCHAIC (8,000 TO 2,000 *ya*)

Western Oklahoma

Foraging was the most important activity between the end of the Wisconsin glaciation and the beginnings of agriculture. Foraging, referred to as the Archaic Period, may have begun by about 9,000 *ya* and lasted until the start of the Christian era, as late as 1,500 *ya*. Archeological sites have yielded many clues about these cultures, including the use of quartzite in all Archaic related sites for western Oklahoma. These findings seem to suggest the earliest foraging cultures were derived from the big game hunting groups. Archaic foragers span nearly 60 percent of the time humans have been known to be present in the state.



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Currently, professional and avocational archaeologists are documenting a previously unknown hunting-gathering people who lived in the state 5,000 *ya*. Called the Calf Creek culture, these people left important camps in Murray, Garvin, Caddo, and Kay counties, and further into eastern Oklahoma, in Tulsa, Muskogee, and Haskell counties.

The Summer culture, whose artifacts were found in Mangum Reservoir, apparently specialized in hunting bison. They used a site in the Lake Texoma area as an intermittent campsite for a long period of time.

Eastern Oklahoma

From 8,000 to 2,000 *ya*, eastern Oklahoma was inhabited by hunting/gathering people. Archeological information indicates the hunter-gather related contexts fall between 9,400 and 2,000 *ya*. Archaic deposits include the Packard site in Mayes County, the oldest at 9,400 years old, and Pumpkin Creek site in Love County (south-