Natural History 1999 Feature Section

What is the meaning of life? Is there a god? What is real? Is truth ever spelled with a capital T? The most fascinating questions about life cannot be answered. Spiritually, we may believe; empirically we may doubt. Always, we ask.

WHY ARE WE HERE?

Learning to ask those questions about life that have no answers, and to be comfortable not knowing is at least as important as purporting to know. Of course, we may never know why we are here, collectively. The very best we can do, it seems, is have a strong sense of individual purpose, and follow it. Now, as learned from the past, and carried into the future — the always. Regardless of the answers; regardless, really, of the questions. "Facts get in the way of truth," Cervantes said. Still, we ask.

WHERE DID WE COME FROM?

Geology, archaeology, and anthropology engage the past in more or less, and more and more, concrete terms. Scientific developments, the whole human endeavor of science, allows us to know more about where we came from, but no more about why we exist. The fact, or feeling, that these questions cannot be answered is intrinsically fascinating. So, we ask.

WHERE ARE WE GOING?

As we approach the year 2000, with its distractions and predictions of Y2K and other forms of doom and hope, we look back. People 2,000 years ago would never have predicted Y2K; we cannot predict the effects even now, less than a year away. How can we possibly know what will happen to our race in another 2,000 years? Still, we ask.

We share much with all the people who have ever lived. We listen, as we humans appear to have always done, to the pounding rhythms of music. The universal language, evolving with the species, has a common, deep root in the beating of the heart. Radio technology hasn't changed the beat, nor the purpose for music. We dance. We draw. We die. But before that, and throughout it all, we ask.

While gathering information for this book, I felt, as a human being, both spectacular and *speck*tacular while reading the work of Oklahoma's archaeologists, geologists, biologists, astronomers, and philosophers. At once, in awe of the significance and insignificance of humanity, in general and in particular.

I wish to thank, in particular, Robert L. Brooks and Leland Bement of the Oklahoma Archaeological Survey, Kenneth S. Johnson and Charles J. Mankin of the Oklahoma Geological Survey, Wayne Wyrick of the Kirkpatrick Planetarium, along with Don Wyckoff and the staff of the Sam Noble Museum of Natural History for help, not only with this edition of the ***Oklahoma Almanac***, but beyond that: for help answering the questions about where we have been, on our way to getting there. I also owe thanks to Elizabeth Beebe, John Stewart, Felton Stroud, and, most of all, to Bill Young for enthusiastic support of this project.

Because of these reflections about Oklahoma's origins, and my own, I will never feel the same way about a rock. I'll keep asking.

Ann Hamilton
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Natural History Oklahoma Almanac

INTRODUCTION

This place, the place now called "Oklahoma," has been home to a rich variety of life. It holds footprint remnants of dinosaurs along with the tracks of humanity's covered wagons. Oklahoma's geological and archaeological histories are as diverse and dramatic as those found anywhere on Earth. Picking up a rock that may be more than a billion years old or may contain a dinosaur fossil or an ancient faunal imprint is possible in all parts of the state. As possible as finding an arrowhead, spear point, or eagle's feather, or a piece of Columbian mammoth bone lying on top of rocks deposited in what was once a tropical ocean, and millions of years later a buffalo hunting ground, today a city.

During the span of geologic time, the area that is now Oklahoma has been built by a succession of events beginning in Precambrian time and continuing through the Paleozoic, Mesozoic, and Cenozoic eras. Oklahoma was once a vast field of volcanoes, and later a region completely covered by ocean waters, except for a few islands and low-lying coasts, before finally emerging as a part of the North American continent. This progression is explained in greater detail in the sections below, outlining each of the geologic eras.

In addition to changes on the planet, many astronomical phenomena have occurred since the formation of the Earth. Most have created no lasting effect on Oklahoma, or anywhere else on Earth, for that matter. And most occurred long before any human life existed in Oklahoma. Three types of events created either very long-lived geologic repercussions or generated great interest in and had effects on any people, animals, and plants living here at the time: asteroid/comet impacts, exploding stars called supernovas, and total solar eclipses. Information about these phenomena are also included in the sections below, describing Oklahoma's evolution.

The geologic history of Oklahoma began with the formation of granites and other rocks from molten material in Precambrian time. These rocks are at the surface in the Arbuckle Mountains, and they extend beneath the surface throughout most of Oklahoma as a "basement rock" on which younger deposits rest. Younger (Cambrian) igneous rocks crop out in the Wichita Mountains and are the "basement" in much of southwestern and south-central Oklahoma. Basement rocks are generally less than a mile below the surface in northeastern Oklahoma, but they are five or six miles deep in parts of western and southern Oklahoma.

Arbuckle Mountains — These Precambrian rocks (billions of years old) were eventually folded and faulted during the Pennsylvanian period to form the mountains.

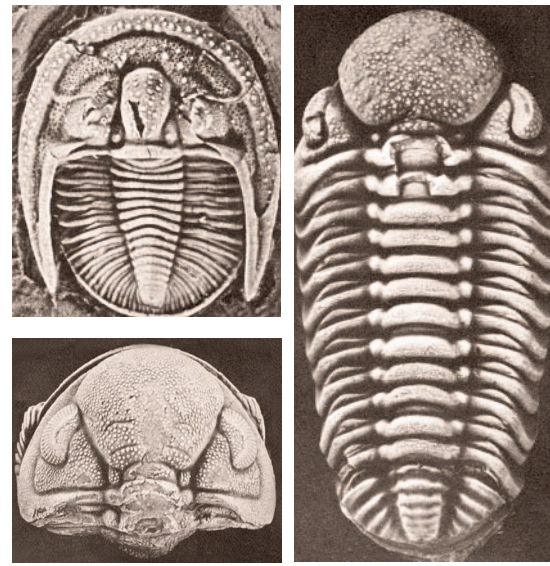
The Arbuckle Mountains contain Oklahoma's oldest rocks; the granites are 1,350,000,000 years old. Cambrian granites and rhyolitic lava rocks of the Wichita Mountains and western Arbuckle Mountains are much younger, about 535 million years old. (see Wildlife and Nature, Geology section)

Before the Arbuckle Mountains were thrust upward to immense heights, perhaps as much as 5,000 to 10,000 feet above the surrounding plains, and long before they were eroded to the low hills we see today, they were part of the floor of the tropical ocean that covered Oklahoma. Even today, enormous numbers of fossil invertebrates can be found in the strata of the Arbuckle Mountains. These invertebrates include trilobites, crinoids, brachiopods, corals, and molluscs.

During the "Great Ice Age," from about 1.65 *mya* until about 10,000 *ya*, ice sheets did not reach as far south as Oklahoma. The landscape of the region appeared much as it does today, but the climate and animal life were quite different.

World-wide cooling apparently began about 70,000 *ya*. The last continental ice sheets began accumulating and spreading when an important temperature decline occurred approximately 25,000 *ya*. By 17,000 *ya*, an ice sheet measuring almost a mile in thickness stretched from northeast Pennsylvania across much of Ohio, and across to South Dakota. During this time, it is likely that spruce, mastodon, ground sloth, giant beaver, tapir, horse, and deer lived here. Spruce forest most likely covered much of northeastern Oklahoma. Pine forests or parklands most likely existed in southeastern and west-central Oklahoma. Bison, camel, horse, and mammoth lived in this region.

A world-wide warming trend began about 14,500 *ya*. This caused significant changes in plant and animal distributions. Deciduous forest replaced spruce and grasslands became prevalent in the area by about 10,000 *ya*.



Trilobites are an extinct group of marine arthropods that are most closely related to modern horseshoe crabs Their name reflects the three-fold, length-wise division of their shield-like external skeleton into a central axial lobe, which covered the body, and two flanking pleural lobes, which protected the walking legs and associated gill branches. Most trilobites probably crawled over the sea floor and fed by ingesting sediment. Trilobites are among the oldest fossils found in Oklahoma and occur in rocks that formed as much as half-a-billion years ago. The photos are of species from the Haragan Formation of Coal County and are roughly 400 million years old. During that time, North America lay in the tropics, and the trilobites lived in warm, shallow seas that covered much of what was to become Oklahoma.

Although the Wisconsinan glacial ice did not extend into Oklahoma, glaciation did affect the state. Average summer temperatures were cooler than today, perhaps by as much as 5 to 10 degrees F; winter temperatures were somewhat warmer, with the average being above freezing. Near the end of the Wisconsinan glacial stage, 11,000 to 12,000 *ya*, western and central Oklahoma was a lush mixture of prairie grasslands and pine and oak woodlands. Toward the east, the land was progressively more forested, and southeastern Oklahoma and the Ozarks region in the northeast were densely forested.

While continental glaciers extended southward from Canada as far as northeastern Kansas, Oklahoma's surface was being sculpted by major rivers fed by meltwater from Rocky Mountain glaciers and by the increased precipitation associated with glaciation.

About 11,000 to 12,000 *ya*, as these last continental ice sheets were melting, the first human inhabitants of North America, Paleoindians, entered the Oklahoma area. Evidence suggests the Paleoindians hunted many animals, including the Columbian mammoths. Bones of mammoths and mastodons have been discovered in

many parts of Oklahoma, but especially in the west. Remains of both Columbian mammoth and Imperial mammoth have been found in Oklahoma.

As present-day Oklahoma developed, it was greatly modified through human activities. The Oklahoma of 100 years ago was quite different from the Oklahoma of today, and 1,000 years ago, of course, changes would be even greater. And, if we traveled through the Oklahoma of 10,000 years ago, when the first human inhabitants are believed to have been in Oklahoma, we most likely would not recognize some parts of our home, nor its original inhabitants.

The early hunters and their lives in Oklahoma have been brought to light with somewhat recent archaeological findings. Clovis spear points have been found in the Panhandle, Caddo County, and Marshall County. Folsom points have been located in Comanche, Caddo, and Marshall counties, along with other important artifacts; and Plainview points were found in McCurtain, Love, Jackson, and Mayes counties. Archeological sites from this period have been located and excavated in the state, allowing us to peer into the ways of these big game hunters and their methods and cultures.

Woodland occupations followed the western hunters, ranging from 2,000 to 1,200 *ya*, during which various hunting-gathering cultures evolved across the state, particularly in northeast, north central and south central parts of Oklahoma. Information obtained by archeologists suggests relatively permanent occupation by these cultures into post-Woodland time.

Village farming cultures began sometime around 1,200 *ya*, and lasted until 500 *ya*. In the western part of the state, evidence of many cultures near the Washita River and its tributaries have been found. These include the Custer, the Washita River, and the Antelope Creek phases of plains/village society.

In the eastern part of the state, phases include the Wister, Fourche Maline, and Harlan phases, along with perhaps the best known, the Spiro Phase. Two and a half centuries before Columbus sailed from Spain, the Spiro people had come and gone; no one is certain where they went. The Spiro people were the unrivaled artists of pre-Columbian North America. The western hunters and the Woodland and Village peoples are discussed in more detail in the sections below.

Oklahoma's written history begins with the exploration of the state by Europeans in the 16th century. Below is a more detailed outline of the evolution of the Oklahoma environment of today. This section of the ***Oklahoma Almanac*** was compiled from information obtained from the Oklahoma Archeological Survey, Oklahoma Geological Survey, the Oklahoma Museum of Natural History, Oklahoma Climatological Survey, and the Kirkpatrick Planetarium.

THE BIRTH OF THE PLANET

Sometime before time began, our region of space was filled with a cold cloud of gas and dust — a nebula. Many such nebulae exist in our Milky Way and in other galaxies throughout the universe. All stars are formed in such nebulae. The formation of our own sun is no exception: the gas and dust in the nebula were compressed and began to form a lump in the center of the cloud. Like everything else in space, the lump was spinning. As gravity continued to pull inward, the temperature and spin rate increased. Smaller condensations formed around the large central mass.

Fusion reactions tried to blow the mass apart, but gravity was too strong. The central mass became a new star, our sun. When fusion occurred, excess energy was given off as light and heat, as is the case today.

Not all of the material was pulled into the central star. Most of the leftover material collected into bodies much smaller than the star. These become the planets and moons of our solar system.

Even the planets and moons didn't use up all of the material in the nebula. What did not collect into planets and moons became asteroids and comets, potential candidates for collisions with Earth, the Moon and other bodies in the solar system. One of the most important such impacts occurred shortly after Earth formed, some 4.5 *bya*. Its effects are still around today.

Many of the objects in the early solar system were not in nice circular orbits like the planets today. One such object the size of Mars was in an orbit aimed at Earth. In the young Earth, the heavy materials like iron, nickel, and platinum sunk to the center to form the core of the planet. But the planet had not yet cooled enough to become solid. Its surface was molten rock.

About 4.5 *bya*, the Mars-sized object slammed into the young Earth, knocking it off center. Much of Earth's