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**The Lyons Serpent: Speculations
on the Indian as Geographer**

by

Joseph V. Hickey

and

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The Emporia State Research Studies

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The Lyons Serpent: Speculations on the Indian as Geographer

by Joseph V. Hickey*
and
Charles E. Webb

During the last few decades a number of archaeological discoveries have been made that reveal much about the astronomical talents of prehistoric and historic Native Americans. Possibly the most famous find of this type is the "Sun Dagger." Discovered by an artist on a remote hilltop in New Mexico, this site, which consists of carefully positioned stone slabs, seems to record solstices and equinoxes as well as lunar phenomena (Sofaer et. al., 1979). Many other southwestern sites also appear to have been used to identify summer and winter solstices. In the late 1930's, Parsons noted that at Zuni Pueblo, a religious official "determines the solstices by watching the sunrise from a petrified stump . . ., and the sunset in the summer from a hill below corn mesa . . ." (cited in Wedel, 1967:61). In addition to using natural features, some prehistoric Anasazi Indians, who inhabited Chaco Canyon in New Mexico until around 1250 A.D., may even have designed their buildings, including such features as windows and doors, to record important cycles of nature (Williamson, et. al., 1975).

Astronomical sites are not limited to the desert southwest, but occur on the Great Plains as well. In this vast region, imaginative Indians appear to have designed a variety of structures to record the rhythms of nature. Some stone configurations, known as "Medicine Wheels" now appear to have served as solar observatories. One of these, the "Big Horn Medicine Wheel" in northern Wyoming was found to mark not only the summer solstice sun, but

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certain stars of midsummer dawn as well (Eddy, 1977:150). Giant stone effigies created in the form of animals and humans may have served a similar purpose. Archaeologist Tom Witty noted that a boulder outline figure that is known to the people of northwestern Kansas as "The Penokee Stone Indian" is aligned in the cardinal directions, and "visibility to the heavens seems to have been critical in its overall construction plan" (Witty, 1978).

In 1967, Dr. Waldo Wedel of the Smithsonian Institution proposed that a number of earthen mounds, called "Council Circles" by local Rice County historians, may have been purposefully aligned to the summer and winter solstices. What was particularly significant about this find is that Wedel not only was able to determine when these features were built, but the exact identity of their creators. According to Wedel, the earthen mounds were constructed by a group of Indians known as Quivirans. He also suggested that the Rice County area was the probable region visited by Coronado in his famous 1541 expedition to the Great Plains (Wedel, 1942:1967).

In 1981, Dr. Clark Mallam of Luther College in Iowa identified a 160 foot serpent effigy only a few miles south of three of the Council Circles discovered earlier by Professor Wedel. Not surprisingly, after determining that the effigy was indeed manmade, Mallam began to explore the possibility that it too was built to record the cycles of nature. In 1982, Mallam visited the Emporia State University campus and presented his preliminary findings, including his hypothesis that the serpent effigy may have served as a calendrical device. While Emporia State Anthropologist, Joseph Hickey, found these ideas interesting, he became even more intrigued by another aspect of the site that Mallam had not explored—the site's geographic location. Hickey wondered if it were mere chance that the serpent effigy had been built very near the ninety-eighth meridian, a point in space that historian Walter Prescott Webb and others have identified as the major transition zone or boundary between Great Plains environments.

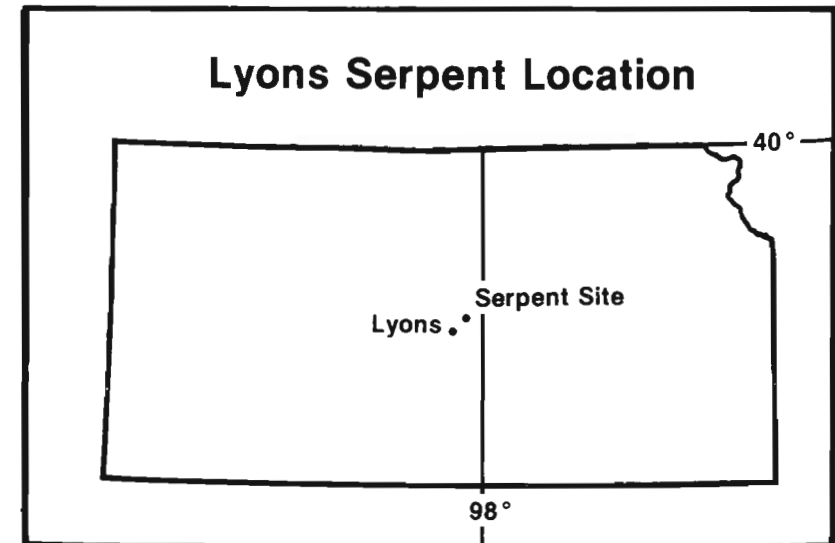
These ideas were later posed to geographer Charles Webb, who by coincidence was studying a computer readout of Kansas rainfall patterns. Much to Webb's surprise, the serpent effigy was found to be located at the dividing point between the two most important climate zones in Kansas — the humid and semi-arid climates. Assuming that this too was no accident, we decided to begin a more detailed examination of the relationship between the serpent effigy and its surrounding environment. Our analysis, presented in the

following monograph, suggests that plains researchers may have overlooked another important aspect of the Indians' scientific skills; it now appears that in addition to being accomplished astronomers, Native Americans may also have been the first practitioners of Applied Geography on the Great Plains.

Our study is divided into three main parts. In part one, we give the location of the serpent effigy, and provide a brief historical sketch of how the site was discovered. In this section, we also show that while a number of prehistoric or historic peoples could have built the serpent, the probable site architects were the Great Bend Aspect or Quiviran peoples. Part two examines the relationship between the serpent effigy and both the local and regional environments. Part three provides a number of tentative hypotheses concerning the meaning and function of the serpent effigy within the context of Quiviran culture.

Setting and Historical Background

The Lyons Serpent is located in Central Kansas at approximately thirty-eight degrees, twenty minutes north latitude and ninety-eight degrees, ten minutes west longitude. It is in the southeast margin of the Smoky Hills near the northern border of the Arkansas Lowland (Great Bend Prairie) to the south (Map I).

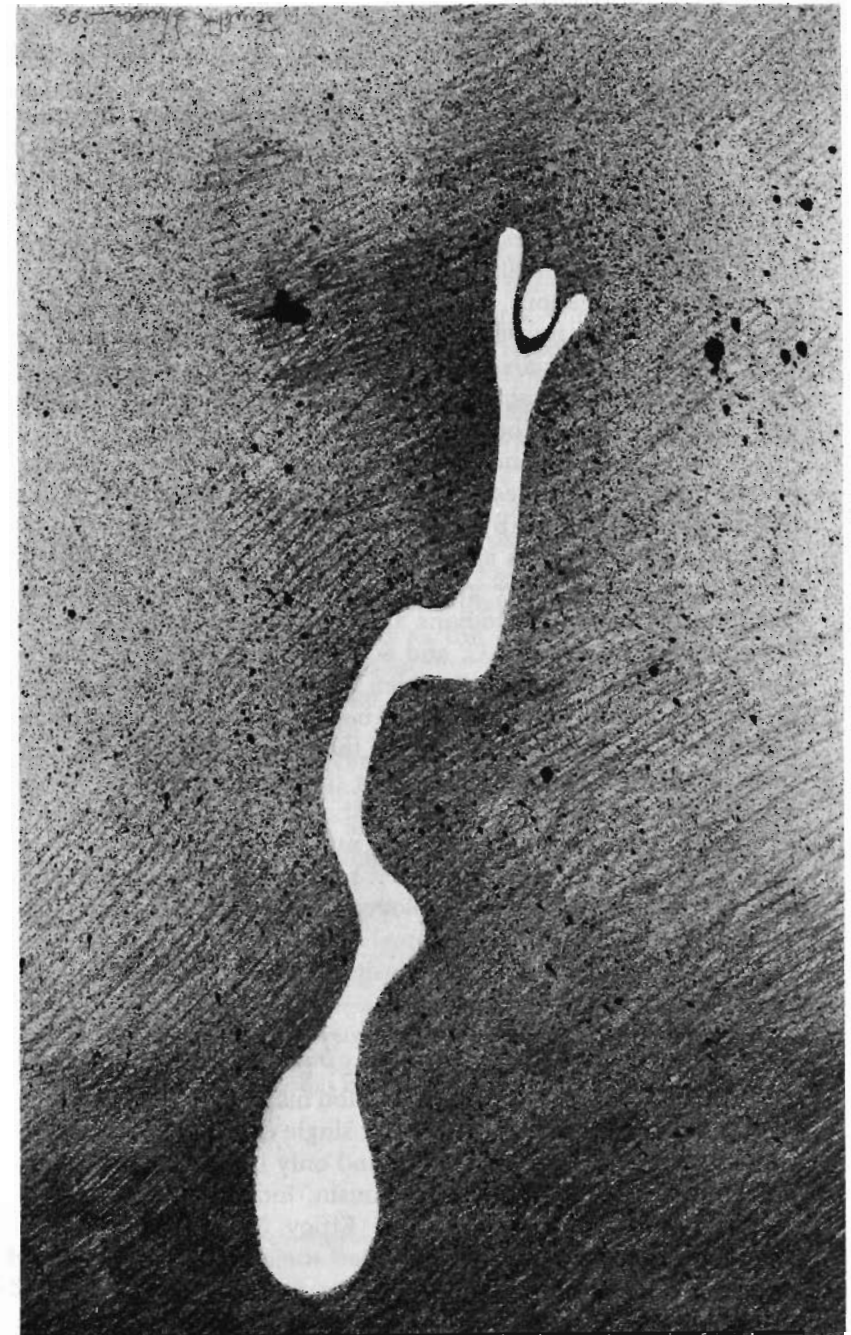


MAP I

Schoolteacher Faye McGuire and a group of her students are the first people known to have visited the site. In 1917, they traveled to a prairie ridge near the headwaters of the Little Arkansas River to study a relatively dense concentration of buffalo grass which a student had found earlier in a mysterious earthen depression. (Mallam, 1984:40). They decided that the 160 foot earthen depression was probably once an upland creek (Mallam, 1984:40). Robert Higgins, a Lyons farmer began to visit the site in 1938, and gradually he became convinced that the depression was "... not natural [(but)] ... had been constructed by humans" (Mallam, 1984:40). Higgins encouraged some of his neighbors to view the enigmatic feature and in the Summer of 1981, one of them, Todd LeClerc, introduced Archaeologist Clark Mallam to the site.

Mallam proved to be the ideal person to evaluate whether the depression was or was not man-made. Not only had he done archaeological work in the Lyons area a number of years earlier, but since moving to Luther College in Iowa, he had studied earthen forms similar to the Lyons feature that in many cases had proven to be Indian creations. When Mallam first visited the site in 1981, he found little more than a sinuous depression in the earth. But after liming the feature's interior, its serpentine form became obvious. The creature's jaws were the most striking characteristic of the effigy. They seemed to be holding an ovoid egg-like object. The jaws stretched wide, and true to nature, the upper jaw projected slightly over the lower jaw. The snake's bodily proportions also copied nature with some precision. The head and tail were relatively thick, as were the two body surfaces that appeared to touch the earth's surface, while the upper portions of the animal were tapered. (Illustration I)

With its form understood, Mallam began the process of identifying the site architects. In the Fall of 1982, he and his fellow workers cut a test trench directly through the center of the serpent, and digging began. After several days of work, a crew member noticed a soil discoloration and soon the effigy's construction plan was revealed. The site builders had apparently carved the 160 foot serpent to a depth of between 15 and 18 cm. (Mallam, 1984:56); they then appear to have halted their digging at a clay layer, and used the surplus earth to form the creature's sides, thereby giving the effigy its heavily contoured appearance. Unfortunately, no artifacts were found that could be used to date the site; only two chert flakes about the size of a person's fingernail were all that was discovered.



These Mallam hypothesized could have been used by Indians to sharpen digging sticks needed to cut out the thick prairie sods. (Mallam, 1984:34).

With no diagnostic artifacts, it became necessary to explore other kinds of evidence to determine the site builders' identity. At first, it was hypothesized that one of the nomadic Indian groups believed to have fashioned the hundreds of stone effigies on the plains may have been responsible for the Lyons serpent. Builders of stone effigies occasionally employed the serpent design and some of their artistic creations, including the Penokee Stone Indian, have been discovered in Kansas. But this possibility was soon ruled out. Their building materials and construction plans appeared so different than those used at the Lyons site, that it seemed unlikely that any relationship could be established between the two.

In terms of design and architectural plan, the Lyons serpent appeared more like those earthen effigies built by Woodland Indians (Adena-Hopewell), and by a people that followed them who are known to archaeologists as Effigy Mound People. Like the Lyons artists, both of the above groups fashioned animal effigies in the earth, with Woodland Indians fashioning their animal designs sometime between 600 B.C. and 500 A.D., and Effigy Mound Indians creating their works between 650 A.D. and 1350 A.D. The serpentine mounds of both peoples bear striking similarities to the Lyons serpent. This includes one of their most famous works, the Great Serpent Mound in Ohio; eight times larger than the Lyons work, and created with greater artistic precision, it nevertheless resembles the Kansas creature in numerous important details. Although they seem to have used it rarely, Effigy Mound People, like the Lyons artists, even employed the intaglio technique. This building method created an animal's form not by mounding earthen layers, but by doing the opposite - by creating a ditch or furrow in the earth.

Despite many similarities, the theory that Effigy Mound People or an earlier Woodland culture built the Lyons site was also found to have a flaw. By studying a distribution map of all known earthen effigies, it could be seen that with the single exception of the Lyons site, all other animal effigies are found only in the upper midwest in the present states of Iowa, Wisconsin, Indiana, Minnesota and Ohio. It seems possible that some Effigy Mound People or an earlier Woodland group could have left their home territories and traveled to the Lyons area to create the serpent intaglio. There is, of course, an even greater chance that instead of migrating to Lyons,

the ideas of these peoples influenced a group already living there. But, considering how prolific the moundbuilders were at producing earthen effigies, we must wonder why they or their imitators created only a single example of their work on the entire Great Plains and, of course, why they chose the Lyons area in preference to any other plains location?

Only one other possibility seemed to remain - that Great Bend Aspect or Quiviran Indians built the Lyons site. Quivirans are known to have lived in the vicinity of the Little Arkansas River where the serpent was found. Quivirans, who were a Caddoan speaking tribe, are not known to have created either stone or earthen effigies, but as was discovered by Dr. Waldo Wedel, they did build earthen mounds.¹ Three of them, the Tobias, Thompson and Hayes mounds are all located just to the north of the serpent effigy.²

During his field studies, Wedel discovered that the three earthen mounds were twenty to thirty yards in diameter, and ranged from 18 to 36 inches in height. All were surrounded by four oblong depressions that seemed to be positioned in semi-cardinal directions. These, Wedel identified as the probable remains of four semi-subterranean long houses that may have served as the "residences of the village elite, a class of leading families perhaps, with ritual functions as well . . ." (Wedel, 1967:59). Wedel made one other important observation. He found that two, and possibly all three Council Circles may have been built in some relationship to the others; further, they seemed to have been aligned in such a way that they recorded the summer and winter solstices. According to Wedel (1967:60):

In aboriginal times, . . . an observer standing some 70-75 yards south of the Tobias circle and looking east by 30° south, could have seen the Thompson and Hayes circle complexes in a single direct line. Moreover, at the winter solstice . . . such an observer could also have seen the sun rise where his line of sight across the Thompson and Hayes circles touched the eastern horizon, since in this latitude the mid-winter sunrise occurs at 30° south of east . . .

¹Ceremonial mounds and natural eminences are known to have had a special religious significance for many Caddoan speaking groups. For example, Bolton noted that "near the village of the Nvaedachos, one can see a little mound, which their ancestors erected in order to build on its summit a temple" (cited in Swanton, 1942:216).

²Wedel has remarked that Quiviran mounds (Council Circles) have a limited distribution. "Only five are on record, 3 in northern Rice County on the headwaters of the Little Arkansas River, and 2 in nearby McPherson county, 18 to 20 miles to the east and within 2 miles of the Smoky Hill River" (Wedel, 1967:54).

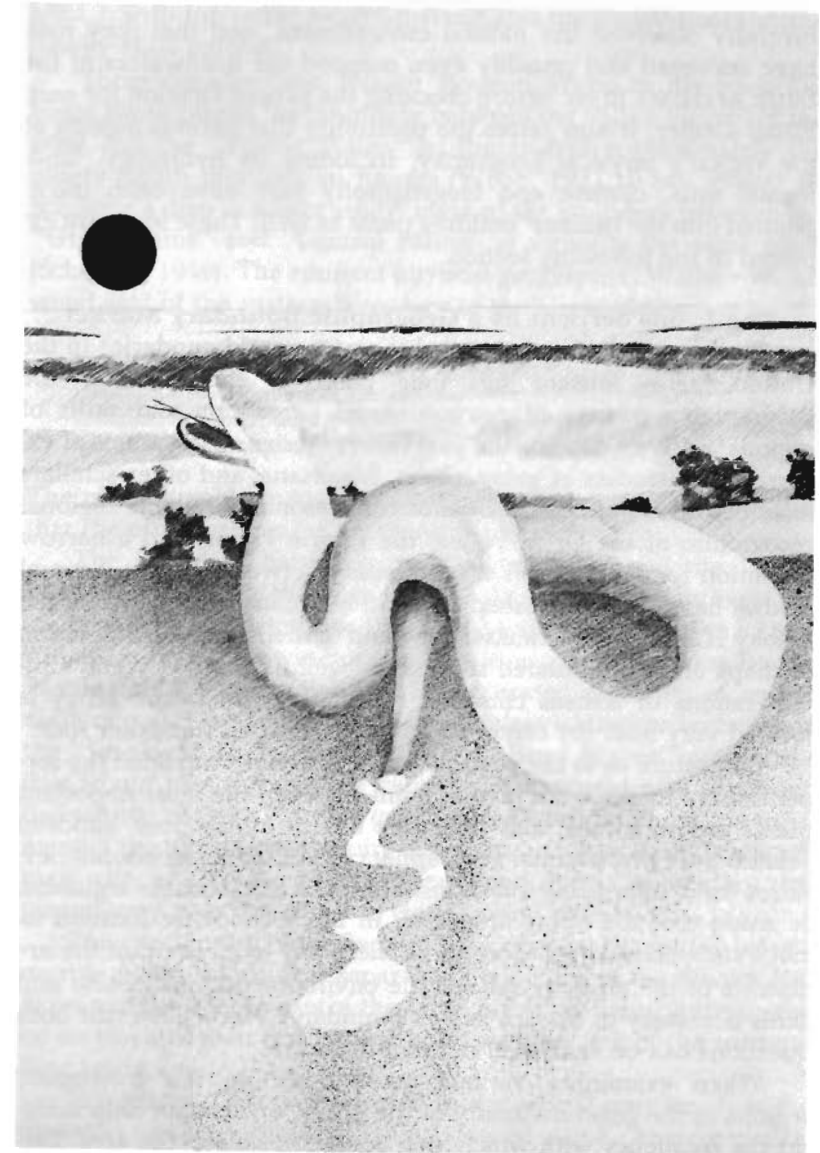
Wedel's observations appear to have had a major influence on Mallam's thinking when he began his study of the serpent effigy. Mallam remarks that during the early stages of his investigations, he sensed that the feature did not stand alone, but was "intentionally oriented to something" (Mallam, 1984:44). Then he remembered the three Quiviran Council Circles to the north. Standing near the serpent's head and looking north, Mallam wondered if it were possible that the serpent's mouth was oriented in the general direction of the Council Circles, and if this were the case, whether the angles of its jaws either bisected two of them or encompassed all three (Mallam, 1984:62).

In order to test this hypothesis, Mallam and Walt Ellis, a local dairy farmer, devised an elaborate plan. On December 22, 1982 during the winter solstice, they outlined the entire effigy in electric lights. Then lights (truck lights) were positioned on each of the three earthen mounds. Just as Mallam and Ellis had guessed, the effigy seemed to have been built in reference to the mounds: the light on the central mound (Thompson mound) fell directly within the serpent's jaws. The right or eastern jaw very nearly bisected the Hayes mound, while the western or left jaw pointed just slightly to the northwest of the Tobias mound (Mallam, 1984:64).

A final test was conducted the following summer, two weeks before the summer solstice on June 21st. Once again lights were placed on each of the mounds and around the effigy and earlier observations seemed to be confirmed. More intriguing was the discovery that the effigy builders may have aligned the serpent in such a way that on June 21st, just as the sun receded on the horizon, it fell directly within the serpent's jaws.³ This suggested that the ovoid object in the creature's jaw may not have been used to represent an egg, but rather the sun itself. This is a common metaphor among many Native American groups. To them, each year on the longest day of the year, the serpent literally swallowed the sun thereby threatening all life with extinction.⁴ With human assistance, however, the sun was magically renewed thus continuing the timeless cycle of death and rebirth. (Illustration 2)

³Mallam now believes that the right or eastern jaw of the serpent may also align with the rising of the sun on June 21st. (Mallam, 1985).

⁴The cosmic serpent or dragon bearing the sun in its jaws is a common mythical theme among many peoples. Campbell stated that this theme was even "represented in the 19th century flag of the Chinese Empire" (Campbell, 1983:212).



At present, the evidence suggests that Quiviran Indians built the Lyons Serpent. The effigy appears to have been aligned in some relationship to the three Council Circles to its north, and together the four cultural features may once have served as a celestial observatory which marked the natural and spiritual rhythms of Quiviran life. All of the above seems to suggest that the site architects carefully observed the natural environment, and that they may have surveyed and possibly even mapped the headwaters of the Little Arkansas River before choosing the proper location for each Ritual Center. It also raises the possibility that various aspects of the region's physical geography, including its hydrology, landforms, soils, climate and biogeography may have been incorporated into the Indians' building plans as well. These ideas are explored in the following section.

The Lyons Serpent as a Geographic Boundary Marker

The identification of geographic regions and boundaries in the United States interior has long posed a challenge for the geographer's powers of environmental perception and skills of regional analysis. During the past two centuries observations of explorers and studies of geographers, historians, and other scholars have provided sufficient evidence for reasonably reliable regional recognition of the Great Plains, the Prairie Plains, and a narrow transition zone that serves as a boundary between the two. Several studies have also established a logical boundary zone between the Smoky Hills and the Arkansas Lowland to their south. Examination of maps and accumulated studies, as well as Charles Webb's investigations of Kansas climates, reveal that the Lyons Effigy is located very near the center of this multi-faceted transition zone.

Conjecture as to the possibility that Quivirans intended the serpent effigy to mark the pivotal point between the most important plains environments, and that they did so almost four hundred years before professional geographers identified these boundaries, raises some interesting questions. First, can a reasonable argument be made that the effigy is indeed, in the appropriate location to mark such boundaries? Second, is there any evidence that the architects of the effigy possessed the environmental awareness and skills necessary to discern such a boundary? We believe that both questions can be answered in the affirmative.

When examining various maps depicting the geographic regions in the general vicinity of the effigy, one cannot help noticing the frequency with which map boundaries bisect the area. Ear-

ly in the twentieth century, George I. Adams attempted to refine the generalized boundaries of the Prairie Plains, Great Plains, and other physiographic regions of Kansas. His description of the western extent of the Flint Hills clearly places the serpent study area at a landform boundary. In reference to the Flint Hills division, Adams (1903:118) stated . . . "It blends along its western border with the Great Bend Lowland and the valley floors of the Smoky Hills upland."

Three decades later, Walter Prescott Webb in his book *The Great Plains* placed the boundary between the "High Plains" of the west and the "Prairie Plains" to the east at approximately the ninety-eighth meridian in Kansas (Webb, 1931:10-34). Walter H. Schoewe's map in a later study, marked the boundary between the "Great Plains" and "Central Plains" at virtually the same place (Schoewe, 1949). The eminent physical geographer, Wallace W. Atwood said of the eastern boundary of the Great Plains. . .

The eastern margin of this province is less well defined by topographic contrasts than are most of the physiographic boundary lines in North America. In many places it should be thought of as a zone, or transition belt (Atwood, 1940:253).

The physiographic maps that accompany Atwood's text indicated that the effigy area is in that transition zone.

The boundary between the "Smoky Hills" and the "Great Bend Lowland" to their south also passes directly through the study area, according to the Schoewe map (Schoewe, 1949: 275-277). Frye and Swineford in their study of the "Plains Border Physiographic Section," which incorporated elements of earlier maps of both Fenneman and Adams, portrayed the border between the "Smoky Hills Upland" and "Great Bend Prairie" with a line that would pass through the center of the serpent area (Frye and Swineford, 1949:71-72). The geographer Dixon Smith, in his treatment of the physical geography of Kansas, incorporated a landform map with a "'Smoky Hills' - Great Bend Prairie" boundary that passed very near the effigy as well (Smith, 1960:11-12).

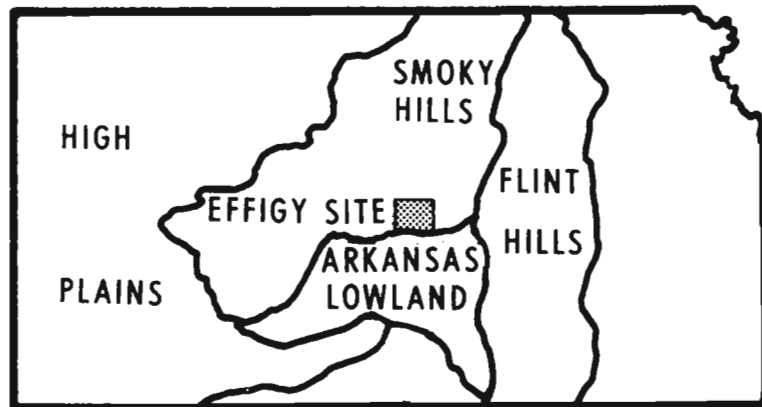
The specific site of the Serpent Effigy is near the mid-point of a narrow water divide that separates a tributary of the Smoky Hill River and the headwaters of the Little Arkansas River. It is situated on an elevated area that affords an expansive view of the surrounding landscape.

The Serpent, although located in a marginal position, is in the domain of the Smoky Hills. Since some environmental

characteristics of these hills tend to strongly influence our geographic perception of the effigy area, and probably the Indians' perceptions as well, it seems appropriate to investigate this region in more detail.

The Smoky Hills region is located in North-Central Kansas. It is bounded by the High Plains on the west, the Flint Hills on the east and the Arkansas Lowland (Great Bend Prairie) on the south (Map II). The area of our study is in the southern-most part of the region.

PHYSIOGRAPHIC REGIONS



MAP II

Several reasons have been suggested for the origin of the name Smoky Hills. Some authorities believe that a part of the region contains colored rock outcrops that cause a blue or smoky appearance when the area is viewed from a distance. Others refer to smoke from grass fires, frequent occurrence of dense ground fog, or haze associated with occasional temperature inversions as the source of the name. John Rydjord, author of *Kansas Place Names*, attributed the name to "smoke-like mists that settle in the valleys . . ." (Rydjord, 1972:23). All the phenomena mentioned are common in the Smoky Hills and collectively tend to create an illusion of plentiful atmospheric moisture.

The Smoky Hills present a varied and intriguing landscape to the viewer. Numerous mounds, buttes, escarpments, and valleys characterize the region's surface. The sedimentary structure of the area is comprised of colorful sandstones, limestones, shales, and clay. To the Native American agriculturalist, however, some of the

more impressive geographic traits may have been the streams and the relatively abundant supply of shallow ground water.

The Smoky Hill River and its tributaries, as well as the streams associated with the Little Arkansas drainage basin to the south, probably supplied adequate water for settlements during years of normal or near normal rainfall. In dry periods, when stream flow became intermittent or ceased, water could sometimes be obtained by digging into sandy stream beds. Pioneer settlers of the 19th century often spoke of plowing furrows in dry rivers to collect water for their livestock. Use of this technique has been attributed to both the advice of local Indians and to pioneer observations of bison searching for water.

Shallow aquifers (water bearing rock strata) in the area cause some small spring-fed streams to continue flowing even in drought periods. Evidence is also available that "buffalo springs" existed in the region. These springs were developed when large numbers of bison, circling in a limited area, penetrated the topsoil with their hoofs and permitted the seepage of water into circular surface pools. Some current Smoky Hill residents have reported the construction of farm ponds that maintain water supply during drought because they are deep enough to tap this shallow water source.

In reference to the number of springs in the area of the Little Arkansas headwaters, Clark Mallam (1984:66) has stated:

How many seeps and springs may have existed in the late prehistoric period cannot be determined. I do not think it an exaggeration, though, to estimate a figure of at least two hundred.

More than four hundred years earlier the explorer Coronado, in a letter to Viceroy Mendoza said of the area.

. . . for besides the land itself being very fat and black, [(it is)] well watered by the rivulets and springs and rivers . . . (Jones, 1937:37).

One of the most unique environmental aspects of the Lyons site is its pivotal climatic position. Walter Prescott Webb, historian and one of the foremost authorities on the Great Plains, placed this region in the climatic transition zone between the humid east and the dry plains. Webb (1931:17) noted that,

The distinguishing climatic characteristics of the Great Plains environment from the ninety-eighth meridian to the Pacific slope is a deficiency in the most essential climatic element—water.

Wallace W. Atwood also refers to climate in describing the boundaries of the Great Plains. He stated:

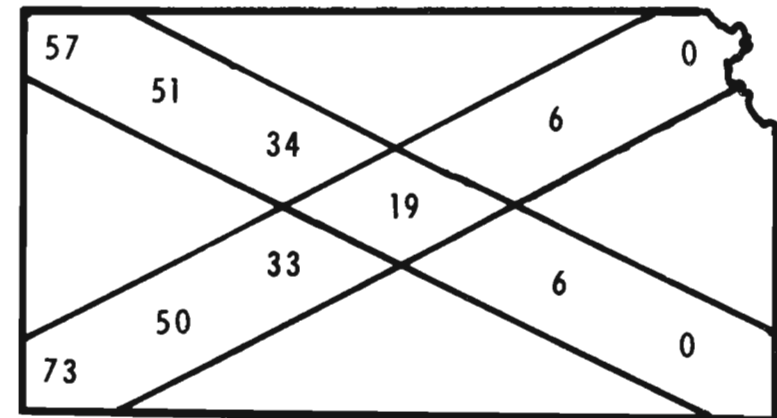
... The eastern boundary zone of the Great Plains includes much of the 20-inch rainfall line. East of that the rainfall is in excess of 20 inches, and to the west it is less than that amount. In the lands between the Central Lowlands and the Rocky Mountains the climate is semiarid . . . (Atwood, 1940:254).

Recent review of Kansas climatic data indicates the Lyons effigy is, indeed, near the center of a transitional zone that separates two major climate realms. Extensive examination of annual records for the period 1898 to 1983, shows a distinctive and rapid change of climatic characteristics east and west from the study area.

The two major climate systems of Kansas are the mid-latitude semi-arid climate in the western sector of the state, and two varieties of humid group climates that dominate the eastern counties. The semi-arid west normally averages from 15 to 20 inches of precipitation per year, but the annual evaporation rate exceeds annual rainfall. The more humid east, although subject to periods of either winter or summer drought, usually receives 30 or more inches of annual rainfall and has a greater rate of precipitation than evaporation. These two climatic areas are set apart by a complex transition zone that may periodically display traits of either region.

The Lyons area is positioned near the western margin of the humid group climates having relatively reliable spring or summer rain. It is, conversely, located near the eastern edge of the dry climate with its high frequency of semi-arid years. Annual statistics reveal that eighty-one percent of the years in this area are classified as humid. Forty-five percent are humid with winter drought, 31 percent are humid with summer drought, and five percent are humid throughout the year. Just 19 percent of the years experience semi-arid conditions that would sharply curtail agriculture. Only 50 miles southwest or northwest of the Lyons site the number of semi-arid years exceeds 34 percent and at a distance of 100 miles, dry years may be expected more than 70 percent of the time. By contrast, climate stations 50 miles southeast or northeast of the area have semi-arid years less than 6 percent of the time. At 100 miles distance, the eastern stations usually receive no semi-arid years at all (Map III).

SEMI-ARID YEARS



PER CENT

MAP III

Observation of natural vegetation lends support to the regionalization based upon climatic data. On the semi-arid High Plains of the west, we encounter short grass or "steppe" vegetation exemplified by Buffalo Grass. In the more humid Flint Hills to the east, tall grass prairie with its famed Bluestem pastures becomes the dominant feature of the landscape. Atwood noted the importance of vegetation in distinguishing the regional limits of the different plains areas. According to him:

Another important feature which helps distinguish the Great Plains from the Central Lowlands is afforded by the striking contrast in the vegetation of the two provinces. Throughout the United States and southern Canada, the Great Plains are essentially a region of short grasses, whereas the Central Lowlands are characterized by long grasses and woodlands (Atwood, 1940:254).

Between these two distinctive biomes lies the climatic transition zone. This area appears to be an ecotone and reflects some vegetative traits of each of the biomes that flank it. Short grasses in the area would represent a semi-arid influence. Tall grasses are indicative of humid group climates having winter drought. Wild cereal grains are often associated with humid group climates having summer drought.

It is interesting to note that sixteenth century explorers with the Coronado expedition described natural vegetation in the area that may still be observed today. Castenada's account of the Quiviran journey referred to wild "... rye grass and oats ..." (Hammond, 1940:263). Another member of the expedition mentioned the "savanna" (tall grass) near Quiviran settlements (Bolton, 1949:298).

Waldo R. Wedel's observations regarding tree growth in the prairies and western plains would seem to lend additional credence to the transitional position of the effigy area. Wedel (1961:39) stated:

In the prairie belt, where fires have probably helped the grasses hold their ground against trees, the latter occur as long, branching ribbons of forest extending far towards the west along the water courses ... Towards the west, these ribbons narrow, the thinning stands of timber are entirely restricted to the valleys, and such species as oak, hickory, walnut, and sycamore disappear. Beyond the ninety-ninth meridian, aside from the ubiquitous cotton-wood and willow, about the only species present are the elm, ash, hackberry, and the box elder, and these trees are greatly reduced in size and luxuriance of growth ...

Soil characteristics must also be considered as an integral part of the area's physical geography. Because we have thus far used a regional approach for the examination of both climate and vegetation, it seems logical to utilize a regional classification system to examine soils. Perhaps the most appropriate system of soil classification and regionalization, for our study, is that incorporated in the 1938 Yearbook of Agriculture (Baldwin, Kellog and Thorp, 1938:993-995).

Maps of the United States that employ this system portray the eastern one-third of the country as an area exemplified by soils of the "Suborder Pedalfer." This suborder is associated with humid climates having either forests or a forest-grassland transition. The Great Plains and much of the nation's western area are identified with the "Suborder Pedocal." This suborder is linked to arid, semi-arid (steppe), subhumid, and humid grassland transition areas. Each of the suborders mentioned are divided into "Great Soil Groups" to facilitate a more specific description of soils within that suborder. On the drier western margin of the "Pedalfer Suborder" we find the "Prairie Soil" group. At the wetter eastern margin of the "Pedocal Suborder," is the "Chernozem Soil" group. A traverse from the more humid east into the drier western plains would take us from the "Prairie Soil" region into the "Chernozem Soil" region.

Since these two "Great Soil Groups" are both transitional, the boundary between them may be somewhat indistinct. It can, however, be recognized by people with experience in either pedology or physical geography. Atwood (1940:259), for example, stated:

... A still more critical examination of this boundary zone in the United States and Southern Canada will disclose that it corresponds approximately to a most significant contrast in soils. To the east are the pedalfers, commonly dark brown in color, in which the ferrous minerals are present; to the west are the black pedocals, in which there is a limy layer beneath the surface ...

It is perhaps significant to note that maps in such widely accepted regional geography texts as *Regional Geography of Anglo America* by White, Foscoe and McKnight (1964:497) extend this soil boundary virtually through the center of the effigy site area.

Native animal distribution in the effigy area is more difficult to regionalize because of the relative mobility of many species and because of the decline in number of species during the past century. We may generalize that in years past the grazers such as bison and deer dominated the grassy uplands and frequented the riverine woodlands in search of water or refuge. Other species, such as otter and beaver would have been more common in the stream areas with their ribbons of forest.

Some other species normally associated with the area, many of which may be observed today, include rabbits, coyotes, wolves, badgers, opossum, raccoon, and muskrat. The area has had a wide variety of birds, including quail and prairie chicken. The larger streams yield edible fish and shellfish which were probably utilized by early inhabitants. An interesting sidelight concerning wildlife distribution may be found in a study by Robert Clarke (1959:11) which placed the present eastern boundary of the Prairie Rattlesnake region near the effigy location.

Although not a part of today's animal inventory, one of the most significant factors of the region's biogeography for the Quiviran geographer undoubtedly would have been the North American Bison (Illustration 3). Enormous herds of bison offered the utility of meat, hide, bone and horn. But, they may also have represented one of the Quivirans' greatest competitors for use of the land.



To evaluate the role played by bison, or any other virtually extinct animal in a region's biogeography poses a difficult problem for the contemporary geographer. Evaluation of bison becomes a study of selected historical and anthropological investigations. It involves inference, and speculation. Conceding these limitations, the following observations are offered concerning the relationship between bison and the geography of the Lyons serpent region during the Quiviran era.

Bison were reported by early explorers throughout much of North America. According to Garretson, Secretary of the American Bison Society (1938):

... At the time of the discovery of America the bison covered about one-third of the continent. The northern limit of its range was about 63° North Latitude while to the south it extended into Mexico as far as 25° North Latitude. To the west it spread as far as the Blue Mountains in Oregon, while in the east bison were abundant in the western portions of New York, Pennsylvania, Virginia and South Carolina, and Georgia... They were found on the whole of the Great Plains and much of the Rocky Mountains... (Garretson, 1938:15).

Garretson in his description of the bison's habitat and feeding habits, noted: "... Among the range grasses the buffalo seemed to prefer grama, buffalo, beard, bunch and bluestem grasses..." (Garretson, 1938:42). We should recall that in our treatment of vegetation in the effigy region, the site is located in a transition zone between the tall-grass prairie and the short-grass steppe. All of the grasses mentioned by Garretson may still be found in this area today.

Accounts by Coronado and his followers described bison and bison hunting in the area later identified as being close to the vicinity of the Lyons effigy. Bolton, in his book *Coronado, Knight of Pueblos and Plains* related:

... In terms of the modern map, this march of three or four days from the hunters camp to the settlement was northeastward to Great Bend, then eastward across several tributaries of the Arkansas River, on which the first Quivira villages were situated, in the vicinity of Lyons, Kansas... (Bolton, 1949:291)

Two hundred and seventy-eight years after Coronado's visit, another exploring expedition reported huge herds of bison in the same area. From Roe's *North American Buffalo* the following reference seems significant:

... Thomas Say, the naturalist, in his account of Captain Bell's journey down the Arkansas, in August, 1820 (detached from Long's expedition), wrote (August 9, 1820) "During these last few days past, the bison have occurred in vast and almost continuous herds, and in such infinite numbers as seemed to indicate the great bend of the Arkansas as their chief and general rendezvous" ... (cited in Roe, 1951:545).

In keeping with the theme of geographic regions and regional boundaries, we may now speculate on the bison factor. It appears obvious that the effigy area is not on a boundary between a bison and non-bison region. At its maximum extent during the Quiviran era, the distribution of the continent's buffalo population probably reached far beyond Quiviran awareness. It also seems highly unlikely that the peoples of this region would have recognized the fact that they were, indeed, in the geographic center of the bison habitat. What then of immediate geographic relevance may be associated locally with the bison? The most logical answer to this question may be linked to the movement of bison within the region itself.

The direction and "regularity" of buffalo migrations seems to be a topic of conflicting opinion among several authors. Hornaday and others offered theories related to regular north-south seasonal migrations of bison, while Roe devoted two chapters of his book to refuting those theories and replacing them with argumentation for "irregular" migrations (Roe, 1951). It appears that little can be gained by joining this debate. However, a review of some evidence from each school of thought may shed light on the nature of bison movements in the Lyons area.

That bison did migrate seems to be a relatively safe assumption. Evidence of trails and individual reports indicate that some of their migrations were in a north-south direction. It is difficult to imagine this large beast grazing its way from Canada to Mexico and back with the changing of seasons, (as has been suggested by some authors). Other evidence and reports identify east-west movements related to seasons, drought periods or other stimuli. Again, we have unanswered questions regarding the length and duration of these migrations. Regardless of distance or direction, the most important aspect of bison movements to native peoples would almost certainly have been their impact on the Indians' subsistence activities.

We have studies that lend credence to bison movement from grassland to woodland to take refuge from extreme winter cold. This movement would not only provide vegetative and topographic shelter, but place the animal within easy access of water. R. Grace

Morgan described this migration pattern in her 1980 paper which treated the movement of bison "... from exposed plains to wooded areas to seek shelter from winter storms..." (Morgan, 1980:144). Other bison forays into woodland sector may have been prompted by opposite conditions - by the search for water or in seeking relief from extreme heat. From Jaramillo's record of the Coronado journey to Quivira, Bolton (1949:287) noted:

... we continued on our way for more than thirty days, and we were among the cattle, on some days seeing more of them than others, depending upon the watering places we came to ...

The type of movements described here would have been of relatively short duration, and probably would have been considered a common occurrence by native Americans.

Winter visitations by bison seeking shelter from storms, although presenting some danger to people, would have been considered a great blessing by Indians living in riverine woodland settlements. The horticulturalists' crops would have been harvested and cached underground, and the beasts would have presented no major threat to them. On the other hand, the bison would have provided an opportunity to supplement the Indians' supply of meat and hides. A very different situation may have obtained in the summer; at that time buffalo searching for water or relief from extreme heat may well have been more active and ill tempered, and capable of great damage to unharvested crops.⁵ Assuming climatic conditions on the High Plains provided nominal precipitation and thus sustained streams, the summer incursions by bison may have been infrequent. Each of the situations proposed above would likely be important to Quivirans, but probably neither would have been sufficient to warrant the perception of a bison boundary.

There is a Bison-Indian scenario which explains why Quivirians may have wished to create a symbolic barrier between the domain of the bison and their own horticultural system. Prolonged severe drought on the High Plains which diminished the bison population, followed by extended pluvial periods with greatly enlarged herds could have created a situation in which bison would have been formidable competitors with Indians for the use of streams and stream valleys. The possibility of such long term

⁵This might explain why in the creation myths of many Caddoan groups the bison is often cast in the role of enemy.

periods of bison presence is discussed by Dillehay in a 1974 article. In reference to the Late Quaternary Bison Population, he stated:

Although much of the foregoing is inconclusive, evidence seems sufficient to suggest temporal and spatial contours for long-term changes in bison populations. Such changes may account for the lack of bison bones in archaeological and paleontological sites . . . Perhaps the most immediate consequences of the sequence of presences and absences is the realization that these changes might be characterized by successive large-scale, long-term bison population increases and/or range shifts stimulated by changing climatic conditions . . . (Dillehay, 1974:136).

Investigations such as Baerreis and Bryson's "Historical Climatology and The Southern Plains" also seems to lend climatological support to the concept of major periods of bison "presence and absence" on the Plains (Baerreis and Bryson, 1965).

Dolores Gunnerson has provided the most concise statements concerning Indian - bison relationships on the Central Plains during the Quiviran era, and the period that immediately preceded it. Gunnerson has remarked that before Quivirans and other large village tribes settled on the Central Plains, a people known to Archaeologists as Upper Republican and Smoky Hill peoples hunted bison and farmed the region's creek bottoms. Upper Republican peoples do not appear to have depended on bison as much as did Quivirans, and they seem to have extended their farming communities well beyond the ninety-eighth meridian. (Gunnerson:1972:1).

Droughts in the 1400s appear to have driven both bison and Upper Republican farmers off the Central Plains. While both returned sometime during the late 15th century, the bison appear to have reentered the area in numbers so great that it became impractical and perhaps even dangerous for village farming tribes to build substantial homes and plant fields in the heart of the bison's domain. According to Gunnerson, this might explain why after 1450 A.D. we find no major farming settlements west of the ninety-eighth meridian. (Gunnerson, 1972:2).

If we accept Gunnerson's premise that bison existed in exceptionally large numbers on the High Plains during the Quiviran era, then it becomes much easier to understand why Quivirans may have recognized the area surrounding the effigy as a boundary between the worlds of bison and horticulture. In the well watered prairies east of the ninety-eighth meridian, horticulture could have been practiced with minimal depredations by buffalo. Near or west

of the ninety-eighth meridian, however, the ribbons of forest along streams diminished, the valleys narrowed, and water became scarce thus making horticulture precarious. A much more serious threat, however, would have been the vast herds of thirsty bison which would have competed with horticulturists for scarce resources, and we believe, would have effectively blocked their expansion to the west.

In summary, the region in the vicinity of the Lyons effigy exhibits a number of environmental features that would have been impressive to a horticultural people. The climate of the region probably provided enough precipitation for nominal food production in approximately 80 percent of the years. Perhaps the smoke-like mists, streams and springs in the headwaters area of the Little Arkansas River helped create the illusion of a more humid environment than actually existed. Located on the fringe of this river system, the serpent may also have appeared as a last outpost of that river valley and its relatively reliable rainfall. The region north and west of the site would almost certainly have been recognized as a "hazard zone" by farmers dependent on significant amounts of spring and early summer rainfall, and given the vast herds of bison that are believed to have existed in this region, Quivirans almost certainly would have considered it the bison's exclusive domain.

Quiviran Economic and Socio-Political Organization

Based on Coronado's 1541 account and more than forty years of archaeological research, we know that Quivirans were a mixed horticultural and bison hunting people who inhabited permanent villages in the Arkansas River drainage basin in Central Kansas.

More specifically, the 1541 party . . . found the Wichita (Quivirans) living along two small tributaries of the Arkansas, probably (Cow Creek and the Little Arkansas River). Coronado then led his slow-moving troops for four or five days to what is described as the end of Quivira . . . where there was a larger river than the previous ones along which settlements had been seen. This is usually identified as the Smoky Hill (Wedel, 1982:119).

In many ways the region surrounding the effigy is an ideal habitat for a people with a dual subsistence strategy. The Arkansas Lowland south and east of the site is a productive agricultural region, while only a few miles to the north and west are the semi-arid Smoky Hills and High Plains which in Quiviran times, contained hordes of bison. While many Caddoan peoples, possibly even

Quivirans, considered themselves primarily horticulturalists, the evidence suggests that they actually shifted their economic emphasis back and forth between corn farming and bison hunting depending on environmental circumstances. Concerning the historic Wichita, who are believed to be the descendents of Quivirans, Bell and his co-authors have remarked:

... it is probably misleading to attempt to state which activity was the more important. Garden produce was a more dependable source of food ... [but] ... hunting produced food, but also hides and other needed materials ... In short, their subsistence activities were in large part complementary (Bell, et al., 1974:310).

Women were the main farmers among Quivirans, and it is likely they increased their production of corn, beans, and squash in wet years (Illustration 4). During his 1541 expedition, Coronado remarked that Quiviran farms were sizeable, and that they produced considerable agricultural surpluses. The main cultigen seems to have been maize, which provided two crops each year. According to Onate, who visited Quivira in 1601. "the stalks of the first crops harvested ... were as tall as that of New Spain and in many places even higher ..." (cited in Wedel 1982:122-123).

Although Spaniards seem to have been favorably impressed by Quiviran agriculture "they give the impression that the Indian economy rested chiefly on products of the hunt, particularly bison." (Wedel, 1982). Onate wrote that Quivirans utilized bison in large numbers, and Martinez described bison meat as their principal and best subsistence (cited in Wedel, 1982:122-123). At various times, Quivirans may have shifted their emphasis to upland bison hunting; they may have planted their fields and then migrated on foot to those areas where bison were concentrated. Archaeological sites in the Lyons vicinity, however, suggest that Quivirans may not have had to travel very far. In the Rice County area, cache pits left by Quivirans contained charred corn kernels; they also contained substantial quantities of bison bones (Wedel, 1961:106).

During cyclical droughts on the High Plains it is likely that bison migrated eastward into the Smoky and Flint Hills. There is considerable historic evidence of these migrations and during drought periods in the west, the Smoky and Flint Hills with their lush grasslands and numerous upland aquifers, would have provided an ideal habitat for bison. While it is possible bison may have attempted to avoid Quiviran hunters as the animals moved east, it is

more likely that during droughts the buffalo's need for water overwhelmed any normal concern for safety, and it is therefore possible that vast herds of bison regularly grazed in the vicinity of Quiviran settlements.



As noted earlier, a number of researchers have also suggested that bison may have greatly increased in importance among Quivirans in the 15th and 16th centuries. Preliminary evidence suggests that there may have been a shift of herds into the Central Plains (and the vicinity of the Smoky Hills) and a bison population explosion may have occurred. Because of the relative ease of bison hunting, Quivirans may have temporarily shifted their economic emphasis away from agriculture and more towards bison.

The Coronado expedition reported that they visited numerous Quiviran villages, and that villages (hamlets) were each separated from others by short distances. Jaramillo wrote: "There were, if I recall correctly, six or seven settlements, at quite a distance from one another, among which we traveled for four or five days . . ." (cited in Winship, 1896:590). On the basis of the Coronado expedition figures, Bell and his associates conjecture that there were probably "less than 25 villages, perhaps between 15 and 20, grouped into settlements as described by Jaramillo," (Bell et al., 1974:341). Two other researchers, Newcomb and Field (1967:341), have estimated that the total Quiviran population during the 16th century may have been between 15,000 and 33,000 Indians.

As among most historic plains farmers, the village was probably the basic unit of Quiviran social organization. Ethnographer Preston Holder, has remarked that in all the changing circumstances, the village as a functioning unit never disappeared among Caddoan speaking groups (Holder, 1970:35). Each Caddoan riverine village was a discrete territorial unit with its own body of customs, traditions and leadership (Holder, 1970:35). In any village there was a fundamental hierarchical ranking. Essentially, there were two groups of men, those with high rank (the hereditary elite), and those without rank (commoners) (Holder, 1970:36). The Caddoan stratification system appears to have been relatively weak for its economic foundation was marginal. It may be termed nascent class stratification as has been suggested by Holder (Holder, 1970:37). Nevertheless, while not all families were able to maintain rank over the generations, it is likely a small core of leading families, whose rank was assured by religious sanctions, persisted through time (Holder, 1970:36-37).

There is little information that describes Quiviran socio-political organization during the 16th and 17th centuries. In 1601, Onate described one settlement that he visited as having two chiefs, one of whom was more important than the other (Wedel, 1982:123). The Onate party took a chief named Catarax hostage,

and Onate noted that it was remarkable how his people obeyed and served him during his captivity (cited in Wedel 1982:123). Martinez, another member of the Onate expedition also mentioned that "whenever he [Catarax] was asked a question he always asked his companion to answer" (cited in Wedel, 1982:123).

By the 18th century, Wichita villages were ruled by a chief and sub-chief according to ethnographer, George Dorsey. Below the chiefs were "the Medicine Men, who were also priests of certain ceremonies, one of their number being known as the curer or announcer." (Dorsey, 1904:6-7). The final ranked group were labeled servants and their duty "was to do the bidding of the chiefs and of the medicine men, especially in time of ceremonies. After years of apprenticeship they became medicine men" (Dorsey, 1904).

Relationships among Quiviran village or hamlet chiefs is unknown. Among some historic Caddoan groups, there seems to have been some ranking of village chiefs, and for some there may have been an overall priestly ruler. Helen Tanner mentioned that if a village chief's tribe were a large one, there were usually subordinate officials who assisted him. (Tanner, 1974). It was also reported to Bernard La Harpe, who visited the Wichita from 1718-1720, that the "TOUACARO" were most respected and were the highest ranking band (cited in Wedel, 1982:126). In La Harpe's account it was also noted that a "Touacaro chief who, having been informed of La Harpe's imminent arrival, led a group of chiefs to meet the approaching visitors . . ." (cited in Wedel, 1982:126).

In the absence of central authority, some Caddoan groups may have reduced the threat of inter-village conflict by ranking village leaders as suggested above. Others, including Quivirans, may have achieved the same objective by other social means. Some early accounts tell of regular visitations among families living in contiguous villages, and this too may have been used to promote social cooperation. Marriage exchanges among families living in different villages, especially among the hereditary elite, may have achieved a similar effect. Participation by the elite of each village in joint rituals (a kind of cult community), may also have served to reduce tensions among those independent village groups that shared a common territory. The possibility that this was, in fact, one of the primary functions of the serpent effigy in Quiviran society is explored in the following section.

The Serpent and its Symbolic Meanings

The serpent is part of the myths and legends of many western and non-western peoples. Although the serpent may be used to express a variety of meanings, it is often employed to represent primal chaos, disruption and dissolution. It may also be used to symbolize the opposite forces of wisdom, fertility and renewal. An obvious phallic symbol, the serpent is commonly used to represent the powers of procreation and birth. For example, in both the Hebrew legend as outlined in Genesis, and the Ashante creation myth, it was a serpent which imparted to humans the secret of life. Likewise, the serpent Ananta, with its multiple heads, floated on the waters of Nara and bore the sleeping god Vishnu (LanWorn, 1972:8).

In Native American mythology, the serpent is often associated with water. Its sinuous movements make it a convenient symbol of water, as well as for rivers and streams that wind their way across the landscape. Its use as a water symbol, may also be derived from simple meteorological observations. Native Americans noticed that "lightning was like a serpent, striking both downward and upward, and that plants after rain strove upwards from the earth to the sky to bear fruit." (Burland, 1968:64). To the Hopi, the serpent's form was so similar to lightning that it was made a messenger to the gods of rainfall and fertility.⁶

Some southeastern tribes considered the rainbow a giant serpent in the sky. They called it "the cutter off of the rain" (Swanton, 1942:773). Swanton remarked that because of the serpent's close association with rainfall, many southeastern Indians would not willingly kill a rattlesnake, "because as masters of waters they had the power to either bring or withhold rain" (Swanton, 1942:773).

There are many similarities in the ritual and belief systems of Native Americans who lived in an area that extended from Florida west across the southeastern portions of the United States all the way to the Central Plains. This includes the Indians' cultural understandings about serpents. Throughout this vast area, the serpent was commonly associated with water, springs and seeps, caves and other openings in the earth. To most Indians in the southeastern cultural area, the underworld habitat of snakes was an ambiguous world. It was a world of evil monsters and a source of mortal danger, but it was also the source of water, fertility and the means of coping with evil (Hudson, 1976:166).

⁶Among many Native Americans the moon is also associated with rain and fertility (Hudson, 1976:126).

Charles Faulkner and his co-workers recently discovered a number of mud glyphs, many in the form of snakes, in a cave in southeastern Tennessee. Their research suggests that the association of snakes, deep caves and the underworld, so important in the mythology of historic southeastern tribes, may be a relatively recent development. According to Faulkner and his co-authors (1984:359):

Caves were visited by late Archaic and early Woodland Indians, but there is little evidence that they used them for ritual purposes . . . By the Middle Woodland, about 2,000 years ago, however, prehistoric mining . . . of deep caves . . . dropped off . . . [and] . . . the function of caves had changed and some had become ritual sanctuaries . . . Caves then may have been viewed as awesome or even dangerous places, perhaps places of death or avenues to the underworld.

To one southeastern people, the Cherokee, underwater monsters were believed to live at the very margin or boundary of the human world. (Hudson, 1976:145)⁷ According to Cherokee myth, serpents lived in rivers, lakes, and waterfalls. They also lurked around lonely spots like mountain passes, and they often caused great misfortunes for people (Hudson, 1976:131). The Cherokee also held certain beliefs about serpents that seemed to contradict the above notions. To the Cherokee, serpents could kill, but they were also responsible for nourishing and saving the human race.

The most horrible of all Cherokee monsters was "UKTENA," a mythical serpent who was believed to inhabit deep pools of water, and who had the power to control all living plants and animals (Hudson, 1976:145). According to legend, Uktena was a man who had been transformed into a snake and given the task of destroying the sun (Hudson, 1976:145). Uktena failed in this mission, but legend holds that the rattlesnake, the chief of all snakes, who also had once been a man, succeeded; this act is believed by the Cherokee to have saved the human race and all living creatures from extinction (Hudson, 1976:166).

Serpent motifs, engraved in shell and pottery, have a relatively long history of popularity among Indians of the southeastern archaeological area. This tradition "goes back at least to Hopewellian times at or near the beginning of the Christian era, if not before" (Phillips and Brown, 1978:157). Serpents were also popular motifs on cups, bowls, and pipes during Mississippian times (800 A.D.

⁷Medieval cartographers also used serpents or dragons to represent the boundaries of the known world.

-1550 A.D.). Interestingly, the builders of Spiro mound in Oklahoma (700 A.D. - 1350 A.D.), who some archaeologists consider were the probable ancestors of the Wichita and other Caddoan speaking groups, preferred the serpent motif to all other designs. According to Phillips and Brown (1978:133), "if one were to attempt a table of frequencies of occurrence of the various animals favored as subject matter by the artists of Spiro, there is no doubt that snakes and birds would head the list, and in that order."

The serpent was also important in the belief and ritual systems of historic Caddoan speaking tribes, who by the 17th Century had established settlements from Louisiana north to the Dakotas. Europeans who visited Caddoan villages during the 18th and 19th centuries, have made numerous references to the role of serpents in the Indians' religious rituals. For example, Father Espinosa, a missionary to the Hasinai tribe during the early 18th century, mentioned that "a huge misshapen serpent with horns," played an important role in the Hasinai origin myth (cited in Swanton, 1942:210). European visitors also reported seeing serpent effigies in some Caddoan temples. A Frenchman who visited the Acolapissa and Nat-chitoches peoples in the 18th century, noticed that inside one of their temples "there were figures of dragons, serpents, and toads enclosed in three coffers" (cited in Swanton, 1942:155).

Father Isidro Espinosa also mentioned that some Caddoan medicine-men wore "curious necklaces of serpent skins" and these seemed to have been associated in some way with the priestly control of agriculture (cited in Swanton, 1942:220). Espinosa remarked "these shamans have fixed very firmly in the minds of these Indians the belief that if any part of the crop, large or small, either ears or stalks, is cut before their prayers are made, the guilty one will certainly be bitten by a snake" (cited in Swanton, 1942:227).

Relatively little is known about the complex belief and ritual systems of the historic Wichita tribe. George Dorsey, the curator of Anthropology at the Field Columbian Museum in Chicago during the early 20th century, recorded numerous Wichita myths which given the importance of serpents among other Caddoan groups, contain surprisingly few references to the creature. Dorsey's collection included only one minor myth that concerned a serpent - "The coyote and the smallest snake," a story which tells of the consequences of boasting (Dorsey, 1904:289). Dorsey's myths do, however, include many references to water monsters who act very much like serpents in southeastern mythology, and these may in fact be serpents.

More is known about the belief system of the Pawnee, including the South Band Pawnee, whom the Wedels (1976:13) have suggested may also be descendents of the Quiviran people. Among the Pawnee, the serpent played a key role in ceremonial life. Weltfish noted that the central character in the Pawnee's thirty day ceremony was a sixty foot serpent-like water monster (Weltfish, 1965:274). The serpent seems to have been associated with water and fertility, for at the conclusion of the ceremony, the cult doctors carried the serpent to the edge of the water, and there as it lay along the shore it was given offerings. According to Weltfish (1965:315), "Each girl carried a gift of calico to give and the mother said, 'you serpent, are going to rest here under water. I want my children to grow up and have many children when they get married' . . ."

Given the close association between serpents and springs, it may be worth mentioning that one of the Pawnee's most holy springs was located in the Smoky Hills near the present town of Glen Elder, Kansas. According to Hyde (1951:67), in 1870 a Pawnee named Fighting Chief, told a Captain North that:

there was a spring called 'Pahowa' . . . on top of a hill, [with] the water ten to twelve feet down in a hole, and the Pawnee used to go there to make sacrifice . . . If there was a great gathering of people, gifts were cast into the spring, (and) 'Tirawa' was pleased and caused the spring to overflow . . . and when this occurred the people rejoiced, the women bathing their children in the sacred water and praying to Tirawa to bless them and give them a good life.

Speculations on the Meaning and Function of the Serpent Effigy in Quiviran Culture

While uncertainties remain concerning the identity of the effigy builders, and our knowledge of Quiviran society is not as detailed as we would like, we believe that the archaeological and historical data are sufficient to begin constructing models of Quiviran culture. The cultural ecological approach which recognizes belief and ritual systems as being directly related to a society's adaptive needs provides the framework for the following analysis. In addition, two ethnographic cases are presented which describe the role of rainfall shrines and rituals in other parts of the world. It is hoped that these examples will offer some insight into how the effigy may have functioned in Quiviran society.

There are many reasons to suggest that the Lyons Serpent was a boundary marker which was used metaphorically as an expression of the priestly control over rainfall and agricultural production. In fact, the effigy may have marked the exact location from which the Quiviran priesthood derived its sacred power. The effigy's most revealing characteristic may be its geographic position. At first glance, the serpent's location seems random and meaningless. Situated on one of numerous Smoky Hill ridges it appears lost in a sea of prairie. But the choice of this particular hill was probably not accidental, for the effigy is located at the geographic border of the Smoky Hills, and Arkansas Lowland. It is situated roughly between the tall grass prairie where rainfall is reliable, and the High Plains where it is not. The evidence suggests that the Quiviran priesthood chose this particular point in space to mark the boundaries of their two most important worlds - the worlds of farming and permanent villages to the east, and the bison domain to the west.

Certain characteristics of the environment seem to support the connection between the Lyons Serpent and the priestly control of water. Much of the Smoky Hills consist of semi-arid upland. To pioneers, it was the "Great American Desert." In this area rainfall fluctuates considerably, and while agriculture is possible in places, it is risky. Pioneers very rapidly decided that large portions of the Smoky Hills could not be farmed, and many of the hills, including the region surrounding the Lyons Effigy, were never plowed and remain virgin prairie. But, scattered about the Serpent Effigy there are a number of unexpected springs, where farming, at least on a small scale, was possible. Like oases in the desert, springs highlight the lack of water in the Smoky Hills region, and reinforce the important boundary between the rainfall domain to the south and east, and the steppes to the north and west.

There are abundant perennial springs surrounding the Serpent Effigy, and probably hundreds of other surface springs that appear only during late spring and early summer months. These springs may also have played a role in Quiviran ritual, especially those concerned with the agricultural cycle. Because of their predictability and differential rate of flow during the early summer, upland springs could have served the Quiviran priesthood as a kind of agricultural calendar and analysis of rainfall patterns in this area seem to support this view.

TABLE I
Average Rainfall in the Smoky Hills (Effigy Area)

January	.67"
February	.97"
March	1.71"
April	2.52"
May	3.31"
June	4.37"
July	3.62"
August	2.94"
September	3.37"
October	2.01"
November	.95"
December	.90"

Most springs in the Smoky Hills region dry up during the winter months (November 1 -March 31) when rainfall totals 5.20" (Table 1). In early May during first planting, local springs begin to reappear as rainfall increases (averaging 3.31" per month), and due to relatively heavy June rains (4.37") they probably reached their maximum flow about the time of the summer solstice on June 21. By the end of June, surface pools begin to disappear and even the flow of perennial springs is reduced. While average rainfall for July and August is not greatly different than that of spring rains, the nature of the precipitation is. During the late summer, rains often come in torrential downpours followed by relatively long periods of drought. Because of runoff, these rains rarely replenish subsurface pools and by late August, when the first green corn was harvested, most springs in the vicinity of the effigy were probably dry holes.

The peculiar design of the Lyons effigy may also provide an important clue as to its meaning. In contrast to most effigy mounds which were constructed by mounding earthen layers, the Lyons effigy is an intaglio; it was built by creating a ditch or furrow in the earth. While this feature might have had little meaning in some environmental contexts, it probably had major symbolic significance among Quivirans living in the Smoky Hills, for furrowing is the exact manner in which bison (and possibly the Indians themselves) released water from creek beds and upland aquifers during drought years. Whether the serpent was constructed directly over an aquifer and literally contained water, or occasionally collected

moisture was probably unimportant in Quiviran cosmology.⁸ The priesthood only had to mimic the actions that bison used to create water to symbolically achieve the same effect, and in the dry Smoky Hills, the results of these actions must have been potent expressions of the priesthoods' sacred authority.

Finally, the priesthood may have even integrated the smoke-like mists into their complex religious ideology. To Quivirans, the smoke of the Smoky Hills may have been the fine mist or haze that hangs over the region, and which periodically becomes so dense that it blocks out the sun. The mist line extends from approximately the Arkansas River Lowland across the Smoky Hills (the rainfall domain) to the very edge of the High Plains (the bison domain), then it ends abruptly. Like the anomalous springs, the clouds of moisture do not appear to belong in this semi-arid world, and in the minds of Quiviran farmers they may have been additional evidence of the hereditary elite's ability to create water, the most essential commodity on the plains.

The preceding discussion raises an obvious question. Why would the Quiviran priesthood find it necessary to establish a boundary between the worlds of bison hunting and agriculture? That is, what practical advantages could be gained by constructing an effigy and ritually maintaining that at a particular location in the Smoky Hills one world ended (the bison domain), and another began (the world of rainfall and horticulture)? We believe that the answer can be found in the shifting and uncertain nature of the Smoky Hills environment, and the close identification of Quiviran leaders with only one of the above domains — the world of permanent villages and horticulture.

The evidence suggests that Quiviran priests may have constructed the serpent effigy to resolve the unstable nature of the Smoky Hills environment. In this area arid and wet cycles alternated, and both farming and bison hunting were often equally rewarding. In effect, the Lyons Effigy and other sacred evidences of the rainfall world (springs, mist) may have been used to establish a permanent rainfall line, thus denying the uncertainty of nature. To

⁸While visiting the site in March of 1983, Charles Webb noticed that a light rain rapidly filled a depression near the serpent's jaws. If this proves to have been the site builder's intention, it would provide further evidence of their architectural talents. By calculating the diameter of the depression near the serpent's mouth, and the general slope of the land, the site builders, like modern pond makers, could have calculated how much rainfall would have been needed to fill the area — especially for the annual summer solstice ceremonial on June 21st. The creation of a glimmering pool in or near the serpent's jaws every year during the summer solstice would have greatly enhanced the illusion that the disc in the creature's mouth was indeed the sun itself.

Quivirans, the effigy may have proclaimed that to the west and north was the world of the bison, and to the east and south existed the permanent world of rainfall and farming villages. Most importantly to the hereditary elite, this symbolic barrier marked the exact boundaries of their influence and power. West of the effigy in the bison domain their authority was tenuous and uncertain, but to the east, in what they defined as the permanent rainfall zone, their power reigned supreme.

The use of the Serpent Effigy to ritually divide environmental domains is consistent with our knowledge of Caddoan ideology. According to Holder, there was a deep grained dualism running through the Caddoan religious system which divided the "forces of reproduction and disintegration, elements of construction and destruction, and the powers of life and death" (Holder, 1970:51). To these, we might add the opposed worlds of bison and agriculture. In Caddoan ideology a marginal world in which both existed may have been impossible.

Holder notes that Caddoan priests primarily presided over the world of rainfall. The priesthood "were concerned with life in all its aspects: the miracle of reproduction, the growing crops and the perpetuation of village life" (Holder, 1970:51). To Caddoan speakers, "Society was tied to the earth. Corn was its protector . . . (and) the fields and river bottoms were their insurance" (Holder, 1970:66).

Rituals involving rainfall and agricultural production were the most important part of the annual round of activities and all were intimately associated with priestly power (Dorsey, 1904:4). Hyde noted that in the south, Caddoans began the manipulation of rainfall in February when priests predicted the amount of rainfall and general crop - growing conditions for the upcoming year (Hyde, 1951:11). According to Hyde (1951:11):

. . . these Indians could not perform the simplest task without the supervisory aid of their priests, who had charge at the time of seed planting, watched the skies during the growing season, pretended by conjuring feats to drive away tempests and other dangers to crops, and took a leading part in the harvest ceremonies.

Beyond agriculture and the village there was another, potentially dangerous world — the domain of the bison. While historic Caddoan speakers included the great communal bison hunt and other bison hunts in their rituals, much of this world existed at the very edge of their sacred authority. In a sense, the priesthood may

have attempted to control bison, but they could offer no guarantees of success, for their powers were largely confined to those areas in which rainfall was predictable and village life stable.

While extremely productive, the most dangerous world for the Quiviran hereditary elite may have been located directly at the point where the Arkansas Lowland merges with the Smoky Hills. This region contained abundant resources, which allowed a relatively dense concentration of farming villages or hamlets. But, because each village leadership was independent of the others, the rights of each may have been uncertain. Based on Caddoan ethnographies, it seems likely that the hereditary elite in each village could have claimed sacred rights to their habitation and garden areas, and these would probably not have been contested. However, it is unlikely any one group would have been able to assert rights to the nearby Smoky Hills, or if they did, it is doubtful any village would have been large or strong enough to defend its claims.

The "unowned" territory immediately surrounding Quiviran villages, with its hordes of bison and other upland resources may have posed the most serious threat to Quiviran intervillage harmony. During hunting forays into the nearby hills, or during periodic droughts when rainfall zones broke down and upland bison hunting became the major subsistence strategy, the entire region could have been hotly contested, as hunters from each independent village migrated to the others' territories in pursuit of their own economic self interest.

The Serpent Effigy may have offered Quivirans an effective means of reducing this threat. As a symbol of rainfall, it could have been used to extend the boundaries of the farming domain to include large portions of the disputed uplands, and, in fact, the effigy may have been located directly at the point of maximum tension among various competing villages. The construction of an Effigy in the Smoky Hills may have resolved questions of land ownership, for in Quiviran ideology the Serpent would have transformed the uplands into a rainfall domain where village land usage rights were clearly determined.

Two ethnographic examples, both from Africa, show how ritual centers (rainfall shrines) could serve the purpose of organizing small independent villages into larger corporate communities. Elizabeth Colson in *The Plateau Tonga of Northern Rhodesia*, remarked that Plateau Tonga society was never an organized state, nor did it possess age-grades, secret societies or stratification of any

kind. According to Colson, it is only in rain rituals and their associated shrines that the Tonga showed a half-hearted grouping towards the establishment of a larger community than that which existed in the village or in the ties of kinship (Colson, 1962:84-85). Colson's study revealed that each rain shrine usually held sway over four or five villages and "on the two or three days a year when the rain rituals were being enacted, a general district peace was imposed in the name of the shrine, which overrode the customary rights of kin groups . . ." (Colson, 1962:84-85).

Ernest Gellner's study of Berber sociopolitical organization provides a second example of how, in the absence of central authority, ritual centers may serve to organize autonomous and potentially competitive social groups. In his book, *Saints of the Atlas*, Gellner described how nomadic Berber lineages annually migrated to summer pastures in the Atlas Mountains where they, along with some permanent residents, competed for scarce resources. The problem of how to maintain order between the annual visitors and permanent inhabitants, and the problem of what to do with the most isolated of deep gorges where the only water, timber and irrigable land can be found, have the same solution, according to Gellner.

The Berber solution is to create at the margins of competing social units a holy shrine (a rainfall shrine) and a group of

professionally neutral, obligatory pacific, saints-arbitrators in the narrow gorge closest to the point of maximum friction, of the greatest movement of transhumants, and near the meeting point of the four largest tribal groups of the Central High Atlas. (Gellner, 1969:34).

It seems likely that the Serpent Effigy served a similar role in Quiviran society. During annual ceremonies, the elite from various villages surrounding the effigy could have met and validated sacred right to bottom-land areas. More importantly, at these ceremonials the combined priesthood could have readjusted village and upland territories to conform to environmental shifts, differential village productivity and demographic change. From this perspective, rainfall rituals at the Serpent Effigy may have insured continuity in the pursuit of long term economic strategies, especially those involving the direction and coordination of village movements and village hunting activities in the surrounding uplands.

Because Quiviran society appears to have been a stratified society, we must also consider the possibility that the effigy and its associated rituals were not necessarily meant to benefit Quiviran

society as a whole, but rather its upper classes. In the uncertain Smoky Hills, the ritual distinctions between the bison and agricultural sectors may have been especially important to the hereditary elite, for much of their wealth, prestige and power may have been derived from ancient traditions of farming and village life - not from bison hunting.

To the hereditary elite whose privileges were primarily tied to the land, it may have been critical that the boundaries between the farming and bison sectors were clear. In a sense, Quiviran leaders may have needed to know that they lived in a "rainfall world," for only in that domain were their sacred paraphernalia and ritual powers effective. In a transitional environment where farming and bison hunting were equally productive, both the necessity and value of an elite may have been questioned. On the other hand, if a permanent rainfall line could be determined, even a symbolic one in which it was understood that the priesthood's powers prevailed, their authority could not be challenged.

Conclusion

Archaeological investigations of the Serpent Effigy and other ceremonial features in the Lyons area, have provided evidence that Quiviran Indians were skilled astronomers. Our examination of the effigy in relation to its geographic location suggests that this is only one aspect of the Indians' scientific talents. The serpent's position at the boundary between the major physiographic, climatic, hydrologic, soil, and biogeographical regions of the Great Plains strongly implies that they were accomplished practitioners of Applied Geography as well. Our study has focused on a number of geographic variables that may have been important in the Indians' choice of site location, but other environmental considerations may also have been incorporated into their overall construction plan. These factors and the relative importance of each should be the focus of future investigations.

The Lyons example may provide additional clues as to the meaning and function of effigy mounds in other regions of the United States. Effigy mounds and their meanings have had a long history of scholarly debate. In the early 19th century, some amateur archaeologists described effigies as the creations of various "vanished tribes," who were unrelated and in most ways superior to Native American peoples. Twentieth century scientists

have largely dispelled such myths; effigy mounds are now judged to have been built by a number of prehistoric Indian groups during the last 2000 or so years. Why they were built remains a mystery. Early scholars considered them burial mounds. Others thought effigy mounds once served as prehistoric clan totems, "property marks . . . erected on every plantation owned by a certain clan" (Radin, 1923:79).

In the last decade or so, anthropologists have begun to view effigies more in political and metaphorical terms. One modern interpretation suggests that effigy mounds may have functioned as institutional devices for maintaining unity among and between territorially distinct groups of hunter-gatherers (or incipient horticulturalists). More recently, Clark Mallam (1982:62) has suggested that mounds were not only boundary markers, but may also have served as metaphorical expressions of the Indians' relationship to nature, i.e. they were symbols of harmony and balance between the Indians and all other elements of their universe. Underlying both theories is the suggestion that during major periods of mound building, Indian hunter-gatherers may have experienced considerable population growth with concomitant problems of environmental destruction and social conflict. From this perspective, effigy mounds could have served a dual function. On the one hand, they may have enabled expanding social units to maintain unity despite growing territorial divisions. On the other, effigy mounds (and their metaphorical meanings) may have allowed Indian hunters to maintain traditional views of the environment and their place in it, despite the fact that they were regularly upsetting the ecological balance.

While the above theories offer a number of plausible explanations for effigy mound construction, they raise almost as many questions as they provide answers. Particularly problematic is the assumption that effigy mounds had similar functions from 600 B.C. to 1300 A.D., and in both the Eastern Woodlands and the Great Plains environments? The discovery of the Lyons serpent raises an additional concern. Can we assume that peoples at different levels of socio-political organization, in this case Quiviran farmers and prehistoric Woodland hunter-gatherers, constructed effigies for the same reasons? Also, what social functions did they serve? Effigy mounds are often described as promoting unity among social groups. What social or political units were involved? Were they groups of former kinsmen, who because of expansion and territorial separation were no longer able to use kinship as a cohesive

force? Or were effigies created at the margins of unrelated, expansionist peoples to reduce conflict?

Finally, should we continue to view effigy mounds as being built for the good of society (social cohesion), or should we interpret them as being particularly useful to a religious and political elite that seems to have emerged during the major period of effigy mound construction? In order to understand the symbolic meanings of the Lyons effigy, and other effigies as well, it may be important that researchers begin to recognize that in stratified societies, a religious elite, not society in the abstract, probably originated the idea of the effigy, supervised its construction, controlled ritual activities, and generally manipulated its metaphorical meanings to promote their definition of the physical, social and spiritual universes.

In the preceding study, we have proposed a number of tentative hypotheses concerning the meaning and role of the Serpent Effigy in Quiviran ritual, and about Quiviran society in general. Are these hypotheses valid or should they be discarded like earlier speculations? Only future research can provide the answers. In order to decipher the true meaning and functions of the effigy, a multi-disciplinary effort may be needed. A reexamination of Quiviran ceremonial sites in both Rice and McPherson counties may also be in order. Further refinement of our models, and archaeological projects with a clear research design should add much to our knowledge of Quiviran society, and to our understanding of other Plains Indian cultures as well.

References

- Adams, George I. 1903. "Physiographic Divisions of Kansas." *Transactions of the Kansas Academy of Science*, 13: 109-123.
- Atwood, Wallace W. 1940. *The Physiographic Provinces of North America*. Boston: Ginn and Company.
- Baerreis, David A. and Reid A. Bryson. 1965. "Historical Climatology and the Southern Plains: A Preliminary Statement." *Oklahoma Anthropological Society. Bulletin* 13:69-75.
- Baldwin, Mark, Charles E. Kellog, and James Thorp. 1938. "Soil Classification, Soils and Men." *Yearbook of Agriculture*. Washington, D.C.: U.S. Department of Agriculture, pp. 993-995.
- Bell, R. E., E. B. Jelks, and W. W. Newcomb. 1974. *Wichita Indian Archaeology and Ethnology: A Pilot Study*. New York: Garland Publishing Company.
- Bolton, Herbert E. 1949. *Coronado, Knight of Pueblos and Plains*. New York: Whittlesey House.
- Burland, Cottie A. 1968. *North American Indian Mythology*. New York: Paul Hamlyn.
- Campbell, Joseph. 1983. *The Way of the Animal Powers*. London: Summerfield Press.
- Colson, Elizabeth. 1962. *The Plateau Tonga of Northern Rhodesia*. Manchester: Manchester University Press.
- Dillehay, Tom D. 1974. "Late Quaternary Bison Population Changes on the Southern Plains." *Plains Anthropologist*. 19(64): 180-196.
- Dorsey, George A. 1904. *Mythology of the Wichita*. Washington, D.C.: Carnegie Institution of Washington, Publication 21.
- Eddy, John A. 1977a. "Probing the Mystery of Medicine Wheels." *National Geographic* 51 (1):140-146.
- _____. 1977b. "Medicine Wheels and Plains Indian Astronomy." In *Native American Astronomy*, edited by Anthony F. Aveni. Austin: University of Texas Press. pp. 147-170.
- Faulkner, Charles H., Bill Deane and Howard H. Ernest, Jr. 1984. "A Mississippian Period Ritual Cave in Tennessee." *American Antiquity* 49(2): 350-360.
- Frye, John C. and Ada Swineford. 1949. "The Plains Border Physiographic Section." *Transactions of the Kansas Academy of Science*, 52 (1): 71-81.

- Garretson, Martin. 1938. *The American Bison*. New York: The New York Zoological Society.
- Gellner, Ernest. 1969. *Saints of the Atlas*. Chicago: University of Chicago Press.
- Gunnerson, Dolores A. 1972. "Man and Bison on the Plains in the Protohistoric Period." *Plains Anthropologist*, 17: 1-10.
- Hammond, George P. and A. Rey. 1940. "Narratives of the Coronado Expedition. 1540-1542. Albuquerque: University of New Mexico, Coronado Historical Series, Vol. II.
- Holder, Preston. 1970. *The Hoe and the Horse on the Plains*. Lincoln: The University of Nebraska Press.
- Hudson, Charles M. 1976. *The Southeastern Indians*. Knoxville: The University of Tennessee Press.
- Hyde, George E. 1951. *Pawnee Indians*. Denver: University of Denver Press.
- Jones, Paul. 1937. *Coronado and Quivira*. Lyons: The Lyons Publishing Company.
- Kehoe, Alice and Thomas Kehoe. 1982. "Solstice Alignment and Boulder Configurations in Saskatchewan." *Canadian Ethnology Service*, Paper 48.
- La Barre, Weston. 1969. *They Shall Take Up Serpents*. New York: Schocken Books.
- LanWorn, R. A. 1972. *The Book of Reptiles*. London: Hamlyn Publishing Company.
- Mallam, R. Clark. 1982. "Ideology From the Earth." *Archaeology*, 35 (4): 60-64.
- _____. 1984. "The Serpent: A Prehistoric Life-Metaphor in South Central Kansas." *Journal of the Kansas Anthropological Association*, 5 (2): 37-84.
- _____. 1985. Personal Communication.
- Morgan, R. Grace. 1980. "Bison Movement Patterns on the Canadian Plains." *Plains Anthropologist*, 25(88): 143-160.
- Phillips, Philip and James A. Brown. 1978. *Pre-Columbian Shell Engravings*. Massachusetts: Peabody Museum Press.
- Radin, Paul. 1923. *The Winnebago Tribe*. 37th Annual Report of the Bureau of American Ethnology. Washington, D.C.: U.S. Government Printer.
- Roe, Frank Gilbert. 1951. *The North American Buffalo*. Toronto: Toronto University Press.
- Rydjord, John. 1972. *Kansas Place Names*. Norman: The University of Oklahoma Press.
- Schoewe, Walter H. 1949. "The Geography of Kansas." *Transactions of the Kansas Academy of Science*. 52 (3): 261-333.

- Smith, Dixon. 1960. "The Physical Geography of Kansas." *Heritage of Kansas*. 4 (1).
- Sofaer, A., V. Zinser and Rolf M. Sinclair. 1979. "A Unique Solar Marking Construct: A Unique Archaeoastronomical site in New Mexico marks the Solstices and Equinoxes." *Science* 206 (4416): 283-291.
- Swanton, John R. 1942. *Source material on the History and Ethnology of the Caddo Indians*. Bureau of American Ethnology Bulletin 132. Washington, D.C.: U.S. Government Printing Office.
- Tanner, Helen Hornbeck. 1974. *The Territory of the Caddo Tribe of Oklahoma*. New York: Garland Publishing Company.
- U.S. Department of Commerce. *Weather Bureau, Climatological Data, Kansas Annual Summaries: 1898-1983*.
- Webb, Walter Prescott. 1931. *The Great Plains*. New York: Gosset and Dunlap Publishers.
- Wedel, Mildred Mott. 1982. "The Wichita Indians in the Arkansas River Basin." In *Plains Indians Studies*, edited by Douglas H. Ubelaker and Herman J. Viola. Washington, D.C.: Smithsonian Contributions to Anthropology, No. 30. pp. 113-134.
- Wedel, Waldo R. 1942. "Archaeological Remains in Central Kansas and their Possible Bearing on the Location of Quivira." *Smithsonian Miscellaneous Collections* 101 (7): 1-24.
- _____. 1959. "An Introduction to Kansas Archaeology." Bureau of American Ethnology, Bulletin 174. Washington, D.C.: U.S. Government Printing Office.
- _____. 1961. *Prehistoric Man on the Great Plains*. Norman: University of Oklahoma Press.
- _____. 1967. "The Council Circles of Central Kansas: Were they Solstice Registers?" *American Antiquity* 32(1): 54-63.
- _____. 1977. "Native Astronomy and the Plains Caddoans." In *Native American Astronomy*, edited by Anthony F. Aveni. Austin: University of Texas Press. pp. 131-145.
- _____. 1979. "Some Reflections on Plains Caddoan Origins." *Nebraska History* 60 (2): 272-293.
- Wedel, Waldo R. and Mildred M. Wedel. 1976. "Wichita Archaeology and Ethnohistory." In *Kansas and the West*, edited by Forest Blackburn, Robert W. Snell and Homer E. Socolofsky. Topeka: Kansas State Printer. pp. 8-20.
- Weltfish, Gene. 1965. *The Lost Universe*. New York: Basic Books, Inc. Publishers.

- White, C. L., E. J. Foscue, T. L. McKnight. 1964. *Regional Geography of Anglo-America*, 3rd Edition. New Jersey: Prentice-Hall, Inc.
- Winship, George. 1893. *The Coronado Expedition. 1540-1542*. Bureau of American Ethnology Fourteenth Annual Report 1892-1893, Part I. Washington, D.C.: U.S. Government Printing Office.
- Williamson, Ray A., Howard J. Fisher, and Donnel O'Flynn. 1977. "Anasazi Solar Observatories." In *Native American Astronomy*, edited by Anthony F. Aveni. Austin: University of Texas Press, pp. 203-218.
- Witty, Thomas. 1978. "The Penokee Stone Indian." *Kansas Anthropological Association Newsletter*, 23(6).

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