

Northern Kentucky Views Presents:

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## Big Bone Lick, Kentucky

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## BIG BONE LICK, KENTUCKY

A Pictorial Story of the Paleontological Excavations at this Famous Fossil Locality from 1962 to 1966

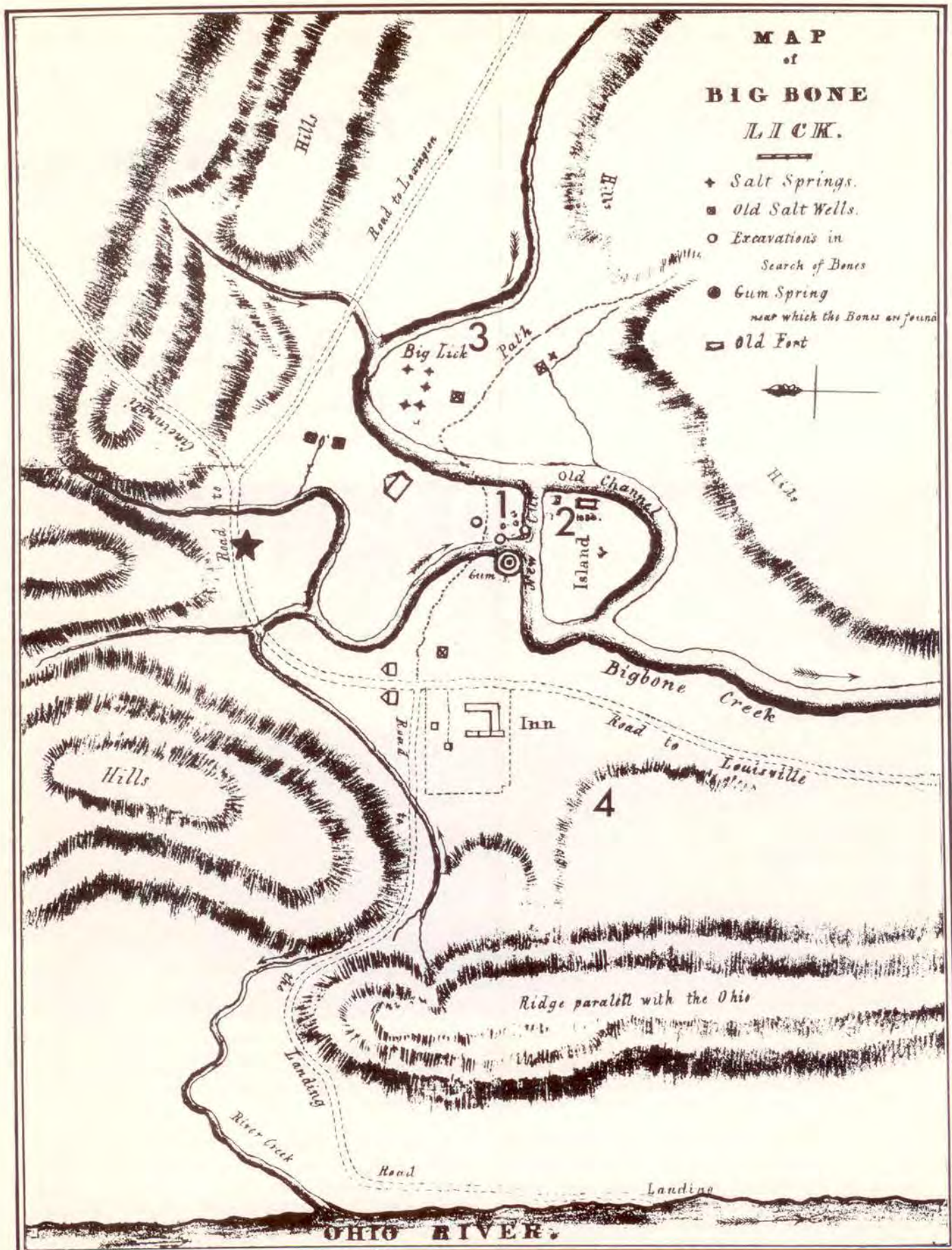


*Big Bone Creek Valley in Boone County, Kentucky, looking east from Mastodon Hill. This world-famous fossil locality dates back to 1739, when the site was first discovered by early French explorers. The extensive paleontological excavations of the University of Nebraska State Museum were carried on from 1962 to 1966 in the area shown in the center of the picture. The William P. Behringer Memorial Museum, Covington, Kentucky; the Kentucky State Department of Parks; the United States Geological Survey; and the Big Bone Lick Historical Association cooperated with the Museum in this project.*

Big Bone Lick was the first widely known collecting locality for vertebrate paleontology in North America. Some of the foundations for the science of vertebrate paleontology in the New World were built there at the beginning of the 19th Century. Many of the Pleistocene (Ice Age) mammals, so well known in Nebraska, were first recorded from Big Bone Lick. Still very little precise scientific information was known about this famous locality until the 1960's.

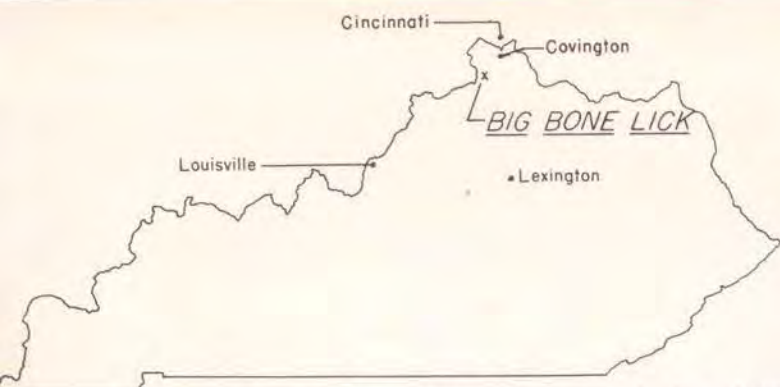
Big Bone Lick, a swampy area surrounding salt and sulfur springs, is located at the confluence of Big Bone Creek and Gum Branch in Boone County, Kentucky, some 20 miles south and west of Cincinnati, Ohio, and about two miles east of the Ohio River. This well-known fossil locality is now largely included in the Big Bone Lick State Park, which has been developed by the Commonwealth of Kentucky during the past six years.





Map of Big Bone Lick area, copied from original published in 1831 (Monthly American Journal of Geology and Natural Science, Vol. 1, No. 4). Location of present village of Big Bone is shown by the star; paleontological excavation sites of 1962-1966 are indicated by numbers 1, 2, and 3; and Mastodon Hill is designated by number 4.





Outline map of the State of Kentucky, showing location of Big Bone Lick. Over the centuries animal came here to "lick" the mud and drink the waters which contained salts and minerals. Many of the animals were trapped and their bones are a grim reminder of their fate.

The first white men to visit the Big Bone Lick area apparently were some French soldiers from Fort Niagara who were under the leadership of Major Charles LeMoyne de Longueuil,<sup>1</sup> the Commander of French and Indian troops in Canada. In 1739, Major Longueuil found many large bones and teeth at the edge of a marshy area and made a small collection of the fossils, some of which are still preserved in the Musée National d'Histoire Naturelle in Paris, France.

Present day Gum Spring flows through an old hollow sycamore log, which was placed there as a casing by early settlers. Gum Spring, located in center of the 1831 map to the left, is an odoriferous salt-sulfur spring, but it has attracted large mammals including man for many thousands of years. Bones of various animals have been found in abundance near the spring since 1739.



Since the days of Longueuil several large and many small collections of late Pleistocene and modern bones have been made at Big Bone Lick. Although thousands of bones were reported to have been collected in the early days, few found before 1807 have survived.

President Thomas Jefferson, one of the founders of Vertebrate Paleontology in the United States, had been interested in Big Bone Lick for many years prior to 1807. Fossil bones had been brought to him in Washington, D. C., from this fossil locality.

Information also had reached President Jefferson that the Indians reported that their ancestors had seen the last of the mastodons leaving Big Bone Lick going west, over a hill now known locally as Mastodon Hill. Jefferson thought that perhaps some of these mastodons and other prehistoric creatures might still be living in western United States. He had instructed Lewis and Clark in 1803 to be sure to record all of the fauna in their journals and to be especially alert to see if any of the prehistoric monsters were still alive in the Louisiana Territory. When the explorers failed to note any of these animals, President Jefferson sent William Clark with a party of ten men to Big Bone Lick to collect fossils and record the natural history of this interesting locality. The Clark-Jefferson Expedition seems to have been the first organized paleontological expedition in the New World. President Jefferson's interest in fossils had been well known for some time, and only a year prior to the sending of the expedition to Big Bone Lick young William Cullen Bryant, a critic of the President, had strongly suggested the following to Jefferson in his poem, "The Embargo": "Go, wretch, resign thy presidential chair—, where the Ohio rolls his turbid stream [go] dig for huge bones, thy glory and thy theme."

The Clark-Jefferson expedition to Big Bone Lick near the turbid Ohio River was very successful and some 300 bones were obtained and shipped to Washington. In 1808 they were installed in the White House so that President Jefferson and others could study them. For several months the collection was examined by Jefferson and Caspar Wistar, one of the foremost anatomists of that time. The collection was then divided into three parts: one for the American Philosophical Society (now preserved in the Academy of Natural Sciences of Philadelphia); one for the Musée d'Histoire Naturelle de France in Paris (still preserved in that institution); and a smaller one for the President's personal collection, which was later lost.

The Clark-Jefferson collection of bones and a few exceptionally good specimens collected and preserved by others during the early years of the 19th Century have provided the basis for most studies of the Big Bone Lick fauna. Since the time of Jefferson and prior to 1962, perhaps the largest collection made at Big Bone Lick was that of N. S. Shaler, in 1868, for the Museum of Comparative Zoology at Harvard College. Although Shaler tried to determine a strat-

<sup>1</sup> Longueuil is also spelled "Longueil" by some writers (Jillson, 1936, p. 1).





Historical site marker along the road at Big Bone Lick State Park. Hundreds of thousands of people visit the State Park each year.

igraphic succession at the site no field records associated with the collection have been found. It appears, however, that a depth of only eight feet was reached in the excavations, and most of the bones recovered were those of the recent species of bison, *Bison bison*. In 1923 O. P. Hay, a specialist on the Pleistocene faunas of North America, reported that: "Notwithstanding the amount done at Big Bone Lick, the geology of the locality and especially of the bone-bearing levels is not well known. Most persons who have labored there were interested almost wholly in getting as many bones as possible and then in getting away." This statement still aptly summarized the state of scientific affairs at the locality until the early 1960's. The staff of the University of Nebraska State Museum became interested in Big Bone Lick in the 1930's, when it was decided that the Museum's paleontologic research program would be directed toward Late Tertiary and Quaternary mammals. In the Great Plains too, little was known of the faunal sequence of the Pleistocene (Ice Age). As the sequence was gradually worked out in the Nebraska region it became apparent that there must be many misconceptions and errors in observation concerning the association of the fossils at Big Bone Lick. Eight brief trips were made by C. Bertrand Schultz to Big Bone Lick to assess the site and to see if anything could be learned by reconnaissance or a surface study of the area, but it was so overgrown with vegetation that little could be learned. It became apparent after some test pits were dug in 1959 by Ellis Crawford of the William Behringer Museum of Covington, Kentucky, Frank C. Whitmore, Jr., of the United States Geological Survey, Washington, D. C., and Bertrand Schultz that only by extensive excavations could the geologic and paleontologic history of the area be determined with any certainty.

One of the paleontological problems that confronted the researchers was the association of the various species of bison, namely *Bison bison*, *Bison antiquus*, and *Bison latifrons*. All three had been reported in various publications as having been associ-



Mobile exhibit showing bones from Big Bone Lick at State Park. Mastodon Hill is shown in distant background to the left of the exhibit.

ated with each other in the same deposits at Big Bone Lick. The exact origin of the type specimens of the musk oxen (*Bootherium bombifrons*), the large ground sloth (*Mylodon harlani*), and the tapir, (*Tapirus haysii*) also was not known. The remains of other animals had been collected, but much of the information concerning the age of the bones, which had been recorded up to that time, seemed to conflict with the evidence more recently gathered in the Central Great Plains area. It seemed necessary to plan a five-year project and get it started as soon as possible. The lack of stratigraphic control at such an important collecting locality made it necessary to make new collections.

The stratigraphic history of the Big Bone Lick area, before modification by human activities during the past two centuries, corresponds very closely to that of the nearby valley of the Ohio River to which Big Bone Creek is a tributary. Although glacial tills (Nebraskan, Kansan, Illinoian) crop out near the locality, the bone-bearing deposits are entirely related to events during and subsequent to the Wisconsin glacial age. Since 1959 Louis L. Ray has been studying the geomorphology and Quaternary stratigraphy in this region of the Ohio River Valley. His studies of the adjacent Ohio Valley have been coordinated with his work at Big Bone Lick.

The first University of Nebraska field party arrived at Big Bone Lick in July of 1962. The area of Big Bone Creek and Gum Branch was mapped in the general vicinity of the bone deposits. A rod and plane table were utilized in the mapping, and a U.S. Coast and Geodetic Survey bench mark was used to establish the correct elevations.

Site No. 1, indicated on the accompanying 1831 map, was opened first in 1962. This became University of Nebraska Collecting Locality KEN-1 in the field records, and was excavated during all five years of the project. This locality is in the lower terrace of post-Tazewell age and is located directly north of Big Bone Creek and east of the mouth of Gum Branch. From the terrace surface, 10 feet above the level of Big Bone Creek, approximately 7 feet of barren surficial ma-





An exhibit in the University of Nebraska State Museum showing the development of the horn-cores of the bison since middle Pleistocene times. The skulls have gradually diminished in size since the bison first migrated to North America from Asia. The large form of bison (*Bison latifrons*) at the bottom of the exhibit was first found and described from a locality near Big Bone Lick in Boone County, Kentucky. The skull next to the top of the exhibit is that of *Bison antiquus*, which was first found and described from Big Bone Lick. Modern bison skulls (*Bison bison*), similar to the one shown at the top of the display, are commonly found at Big Bone Lick, but in later deposits than those which contain the remains of *Bison antiquus*. The bones of *Bison latifrons*, the middle Pleistocene form, do not occur at Big Bone Lick.

terial was removed by bulldozing an area 130 by 80 feet. This area then was surveyed and laid off into a grid of 10-foot squares. Excavation was begun in one square at a time, but as work progressed, several squares were excavated simultaneously. Faces of the walls or sides of the excavations were kept smooth and were photographed, sketched, and sampled. Bones, shells of invertebrate animals, plant remains, and sediment samples were collected and located by grid square number, position in square, and depth below ground surface. A description of the character of the alluvium also was recorded.

Bones at Site No. 1 were encountered at three faunal zones below the terrace surface, namely zones A, B, and C.

Zone A is a buff-brown, mottled silt layer located 7 to 8.5 feet below the surface of the terrace. This zone included evidence of the following animals: domesticated dog (*Canis familiaris*), domesticated cow (*Bos taurus*), modern bison (*Bison bison*), domesticated pig (*Sus scrofa*), white-tail deer (*Odocoileus virginianus*), and domesticated horse (*Equus caballus*). Associated with these modern native and domesticated animal bones were fragments of crockery and china, bricks, worked building stones, hand hewn wood, logs and branches of trees, seeds, and occasional reworked

bones of extinct animals. It appears that some 7 to 8.5 feet of silt has been deposited in Big Bone Creek valley since the early part of the 19th Century.

Zone B is a dark gray to dark brown humic silt and sand located from 8.5 to 11 feet below the terrace surface. Bones recovered in this zone represent: modern bison (*Bison bison*), wapiti or American elk (*Cervus canadensis*), and modern deer (*Odocoileus* sp.). The fragmentary bones of the following extinct animals also were encountered in this zone, but these appear to have been derived from the underlying clayey silt and reworked by stream action: Mammoth (*Mammuthus* sp.), mastodon (*Mammut americanus*), musk ox (*Ovibos* sp. or *Bootherium* sp.), bison (*Bison* cf. *antiquus*), caribou (*Rangifer* sp.), and horse (*Equus* cf. *complicatus*). The bones of the modern bison (*B. bison*) are very abundant at this level and are associated with wood, roots, nuts, leaves, broken shells of large mollusks, and pieces of flint.

Zone C is a blue-gray sandy silt layer located from 10 to more than 15 feet below the surface of the terrace. Bones found in this zone represent: giant ground sloth (*Myiodon* sp.), mastodon (*Mammut americanus*), large bison (*Bison antiquus*), musk ox (*Bootherium* sp.), giant moose-like deer (*Cervalces scotti*), caribou (*Rangifer* sp.), and horse (*Equus* cf. *complicatus*). Not

Drilling rigs, both rotary and core types, were successfully used in 1962 by the paleontological expedition to determine the thickness of the various Pleistocene (Ice Age) deposits above the bed rock in the valley of Big Bone Creek.



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Detailed contour mapping of the site was made by rod and plane table methods in 1962 before the extensive bulldozing of the sites was commenced. The bulldozers were used to remove the overburden which covered the bone layers.

all of the bones from this zone have been studied and identified. The dark greenish-gray to bluish-gray clay under Zone C contains occasional bones and extends to 29 or more feet below the terrace surface.

Site No. 2 (KEN-2) is in the higher terrace of post-Tazewell age, the surface of which is approximately 22 feet above the normal water level of Big Bone Lick, just south of Gum Spring and Site No. 1 (KEN-1). In 1962 the face of the exposure of the terrace-fill was cleared of vegetation for 80 feet along Big Bone Creek, and the site was tied into the 10-foot grid system established in Site No. 1. Some bones were excavated from the profile and the stratigraphic evidence was studied and recorded. The overburden was removed from this site in 1963 and it was worked during the summers of 1963 to 1966 inclusive. The bones occur in a single zone ranging from 12.5 to 16.6 feet below the terrace surface. The bone-bearing layer is an iron-stained, calcareous, gravelly sandy silt, 1 to 3 feet thick, which unconformably overlies a "blue" clayey silt. The faunal assemblage included the following: giant ground sloth (*Myiodon* sp.), bear (*Ursus* sp.), mastodon (*Mammuth americanus*), mammoth (*Mammuthus* sp.), bison (*Bison antiquus*), musk

Backhoes were used to remove some of the overburden and also to keep the fossil quarry areas free of extensive dump piles resulting from hand excavations.



ox (*Bootherium* sp.), giant moose-like deer (*Cervalces* sp.), deer (*Odocoileus* sp.), and horse (*Equus* cf. *complicatus*).

Site No. 3 (KEN-3) was opened in 1966. It was not too productive paleontologically but important geologic data were obtained. The main part of the site is an erosional remnant of the same fill as Site No. 2 (KEN-2). Near the surface and to the north and west toward the spring area ("Big Lick" springs on the 1831 map), deposits similar to the historic level in site No. 1 (KEN-1) were encountered overlapping the older deposits. An early pioneer salt works and associated historic objects were found, including a fairly well preserved hogshead (barrel) of the early 1800's.

No bones or teeth of very small mammals were found during the 1962 to 1966 excavations, although an extensive screening program was carried on each year. Several types of screens were used, including the square box types commonly used by vertebrate

Site No. 1 (shown on 1831 map), designated in records as University of Nebraska State Museum Collecting Locality KEN-1, was laid out in 10-foot squares in 1962. This grid system was later extended to include the other sites. Each specimen collected was precisely located stratigraphically and geographically in relation to the square in which it was found.







*Much of the excavation at Site No. 1 was at or below water level, thus making work very difficult. Water constantly seeped into the excavation areas. Note that the bone shown in the picture below the trowel is partly submerged in water.*

paleontologists during the past ten years. The running water of Big Bone Creek between sites No. 1 and No. 2 made it convenient for the screening projects.

*Much time was spent in studying and recording the profiles exposed in the sides of each 10-foot square in Site No. 1. Precise stratigraphic records were kept for each specimen recovered. The large hoe in the picture was used to prepare the profiles for study.*



*An electric power line was brought to the excavation areas so that a sump pump could be used to keep the water table at a low level. The excavations thus could be carried on under comparatively dry conditions, and the scientific evidence could be more readily recovered and interpreted.*

In addition to major excavations at Big Bone Lick numerous test holes were drilled by both rotary (auger) and core methods. The drilling equipment

*Close-up view of the same profile shown in the picture to the left. Bones and wood can be seen in a former depression in an area near Gum Spring. The pick, tape, and notebook, as well as a camera, were used in obtaining and recording the geological events shown in the profile.*







*Cow bones and a fragment of a skull of a domesticated dog were found in 1966 preserved eight feet below the surface of the terrace in a 10-foot square in Site No. 1.*



*A hand hewn board was found directly below the cow and dog bones mentioned above. An old early 19th Century shoe and some old logs and limbs of trees also were found associated with the board in this square.*

*Modern bison bones dating back several hundreds of years were found in the stratigraphic level below historical items such as mentioned above. Various fossil bones were found in a blue-gray silt and silty clay immediately below the bison bones.*



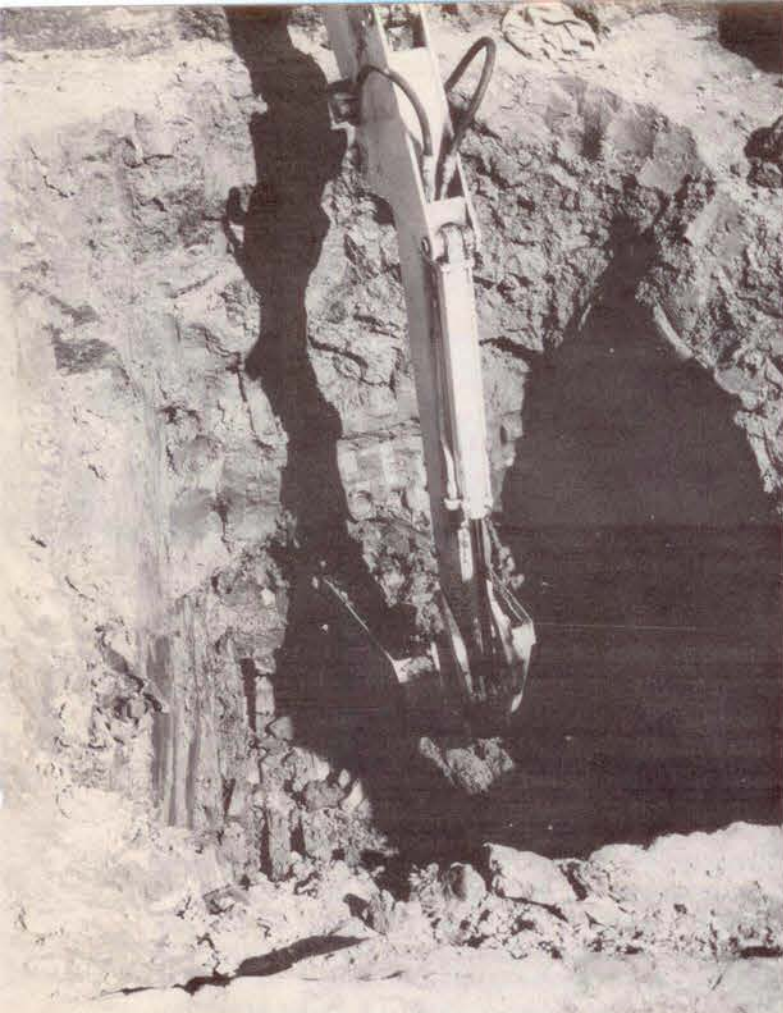
and operators were furnished by the Commonwealth of Kentucky through the Department of Parks and Department of Roads. Samples from the various stratigraphic zones in the test holes were preserved for analysis and for examination of microfauna and microflora. Wood was collected for carbon-14 analysis. Also in strategic areas where more subsurface data were needed, the backhoes were used to excavate large test holes, 4 feet wide, 6+ feet long, and some 10 feet deep. All test holes were plotted on the topographical map which was made of the area. The map, which has a scale of 1 inch to 100 feet with a 1-foot contour interval, also has all collecting localities plotted on it as well as the location of the temporary bench marks which had to be established.

The extensive field studies at the Kentucky locality, which commenced in July 1962, will be completed in June 1967, and a monographic report will be published on the results of the project. The research work at Big Bone Lick for the five year period was carried on by the staff members of the Division of Vertebrate Paleontology, University of Nebraska State Museum in cooperation with the William P. Behringer Memorial Museum, Covington, Kentucky; the Big Bone Lick Historical Association; the Kentucky State Department of Parks; and the United States Geological Survey. The principal investigators were C. Bertrand Schultz and Lloyd G. Tanner from the University of Nebraska; and the associate investigators were Frank C. Whitmore, Jr., and Louis L. Ray of the United States Geological Survey, and Ellis C. Crawford of the William P. Behringer Museum. The work for the first season was financed chiefly by the American Philosophical Society of Philadelphia, the

Screening for small bones, also for shells of snails and other invertebrates, and for seeds and nuts. The sediments associated with the larger bones at the excavation sites were examined for small fossils and other items of scientific interest. These sediments were taken from the excavation sites and put into a series of screens immersed in the flowing water of Big Bone Creek between Sites No. 1 and No. 2. The fine textured sediments gradually washed away by the moving water passing through and over the screens leaving a coarse concentrate of small pebbles, rocks, bone fragments, shells, and vegetable material. The concentrate was then dumped into the large square screens to dry. The dried material was later carefully examined for items which might be of scientific importance. The provenience of each screen load of material was carefully recorded.



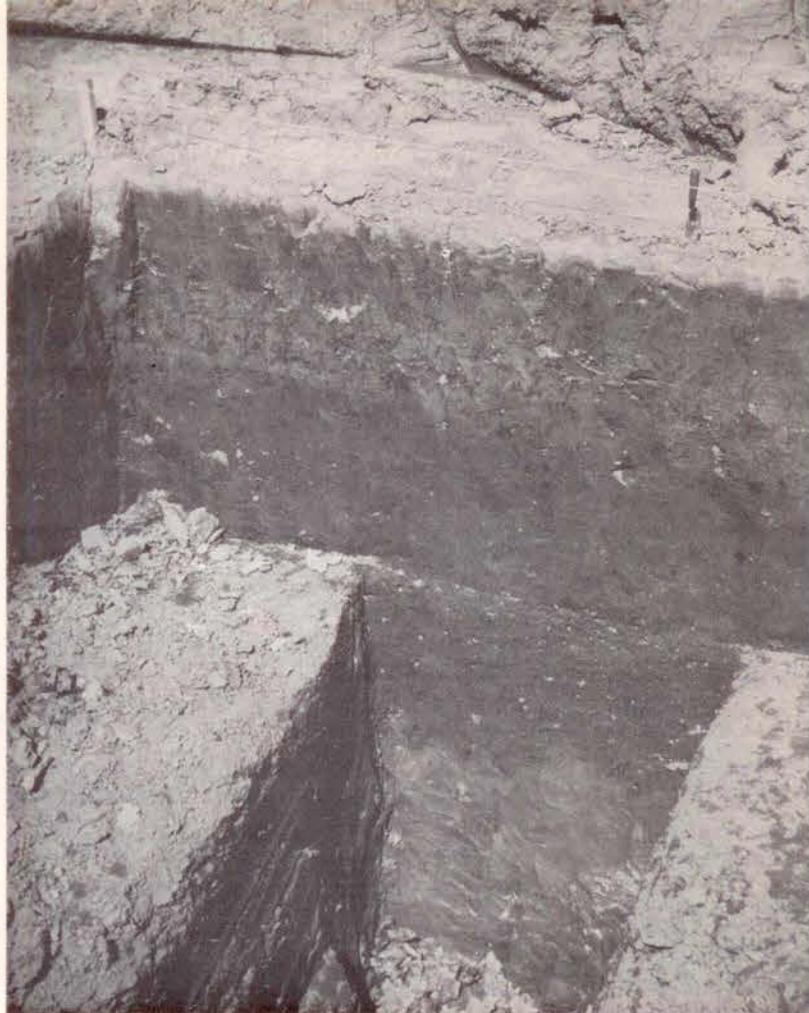
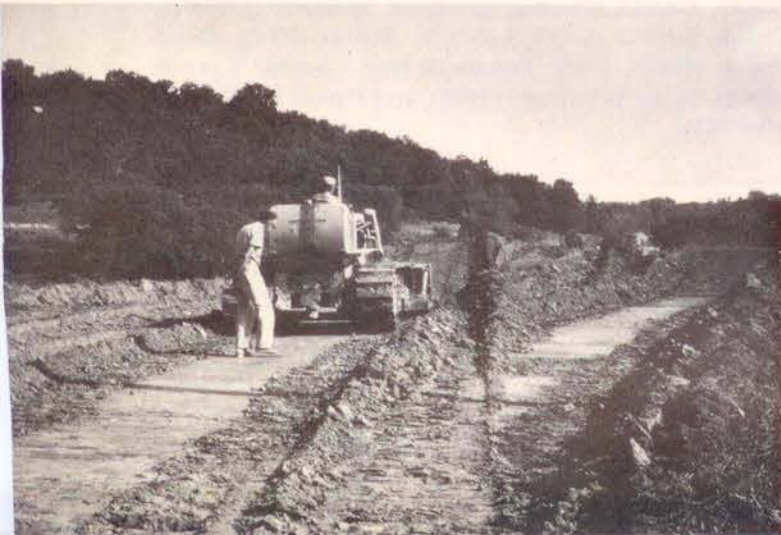




*The backhoe was used to dig deep test holes below the regular bone levels in order to see how deeply the bones occurred at Site No. 1. The backhoe also was used for digging test holes at various places in Big Bone Creek valley to determine the extent of bone accumulations and stratigraphic layers.*

University of Nebraska Research Council, and the Benjamin and Rachael Maiben Paleontological Fund of the University of Nebraska Foundation. During the following four years the work was financed primarily by the National Science Foundation. Small grants for special associated investigations also were made by the University of Nebraska Foundation (Mai-

*A bulldozer was used to remove the overburden at Site No. 2 (KEN-2), south of Gum Spring and Site No. 1 (KEN-1). One or more of the members of the paleontological expedition constantly followed the bulldozer to see if any historical, archaeological, or paleontological objects were encountered.*



*Test hole dug with backhoe at Site No. 1 in 1966. The sides of the test hole were later smoothed down with shovels and trowels in order to study the different colors and textures of the fine grained sediments.*

ben Fund) and the University of Nebraska Research Council. The United States Geological Survey furnished funds to Frank C. Whitmore and Louis L. Ray for their research work. The Kentucky State Department of Parks furnished bulldozers, backhoes, and test-hole drilling equipment and some manpower

*A mastodon tooth (Mammut americanus) was found during the bulldozing operations near the surface in the historic layer. Apparently someone had found the mastodon tooth along Big Bone Creek early in the 19th Century and had left it on the high 22-foot terrace south of the creek, perhaps at the old fort which stood there. See the 1831 map for locations of the Fort and Site No. 2.*







Three of the 10-foot squares which were excavated in 1966 at Site No. 2. A tusk and a partial lower jaw of a mastodon (*Mammut americanus*) are shown to the left of the nearest square just below and in front of the photographer.

A tooth of a mammoth (*Mammuthus primigenius*) and various fossil bones exposed in an iron-stained, calcareous, gravelly, sandy silt some 15 feet below the top of the terrace in Site No. 1. The tooth and the bones are more than 10,000 years old at this site.



Site No. 3 (KEN-3) was first extensively excavated in 1966. The bulldozer in the foreground was used to remove the major portion of the overburden. The main part of the site was the same age as that of Site No. 2, but more recent sediments were encountered just below the surface. An early pioneer salt works and associated historical objects were found. These were preserved for the Big Bone Lick State Historical Museum which will be constructed at the State Park in the near future. A fence was constructed behind the site to allow visitors to watch the excavation process without interfering with it.

during the five years of the excavations. Roger Arnold, Superintendent of Big Bone Lick State Park, and William Fitzgerald and Bruce Ferguson of the Big Bone Lick Historical Association, Woods Miller and J. D. Moore of Big Bone, Daniel Roberts of Walton, Wallace Lucas of Florence, George Lyon of Frankfort, and numerous other persons provided help in many ways.

The various assistants who aided in the Big Bone Lick project include the following: Edward C. Black (1964-65), John W. Carson (1963), R. A. Cochran, II (1962-63), Donald Cox (1962-63), David Dahms (1965), Gary W. Dickerson (1966), Joseph W. Emmons (1965-66), Jack W. Flynn (1965-66), Ronald E. Gall (1963), Ronald Graziano (1964), Nathaniel B. Haynes (1962-64), Wayne M. Isaacs (1964), Arthur W. Johnson, graduate assistant (1965), Robert D. Luken (1964), Jonathan C. MacDowell (1966), Ronald Marquart, graduate assistant (1966), Jimmie J. Miller (1963-66), Robert E. Moore (1966), Lee J. Otte (1966), Gerald Petsche (1962), Thomas L. Piercefield (1962-63), W. H. Pile, Jr. (1962), Charles F. Piner (1965-66), Michael Ricketts (1965), Barry D. Rider (1966), Virgil Rowe (1964), Gerald Schaber, graduate assistant (1962-64), Donna Schultz (1966), Lewis R. Setters (1965), Gayle Smith (1966), Jerry Tanner (1966), Charles Tongret (1964), Susan Whitmore (1965), and Darrol C. Worstell (1962-63).

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*A mastodon lower jaw found in an upside down position at locality KEN-3 prior to the 1962 excavations. Collections made during this time were limited to fossils which were exposed eroding out of the banks along Big Bone Creek.*



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*The photographs of the Big Bone Lick area used in this article were taken by the following persons: Ran Cochran (Cincinnati Inquirer), p. 11; Jerry Petsche (University of Nebraska), p. 6 (lower left), p. 7 (upper left); and C. Bertrand Schultz, p. 1, 3, 4, 5, 6 (upper left and lower right), 7 (upper right and lower left and right), 8, 9, 10.*