1. NAME AND LOCATION OF PROPERTY

Historic Name: Big Bone Lick Site

Other Name/Site Number: Big Bone Lick State Historic Site

Street and Number (if applicable)**:** Route 338

City/Town: Union **County:** Boone **State:** KY

2. SIGNIFICANCE DATA

NHL Criteria: 1

NHL Criteria Exceptions:

NHL Theme(s): VI. Expanding Science and Technology
3. scientific thought and theory

Period(s) of Significance: 1739-1868

Significant Person(s) (only Criterion 2)**:**

Cultural Affiliation (only Criterion 6)**:**

Designer/Creator/Architect/Builder:

Historic Contexts: XIII. Science
C. Biological Sciences
3. Paleontology

3. WITHHOLDING SENSITIVE INFORMATION

Does this nomination contain sensitive information that should be withheld under Section 304 of the National Historic Preservation Act?

___ Yes

_X_ No

4. GEOGRAPHICAL DATA

1. **Acreage of Property:** 205 acres

2. **Use either Latitude/Longitude Coordinates or the UTM system:**

   Latitude/Longitude Coordinates (enter coordinates to 6 decimal places)**:**
   Datum if other than WGS84:

	Latitude:	Longitude
Point A	38.885484	-84.737883
Point B.	38.884548	-84.738204
Point C.	38.885323	-84.744049
Point D.	38.883145	-84.754086
Point E.	38.876257	-84.751665
Point F.	38.876456	-84.754070
Point G.	38.881297	-84.756664
Point H.	38.887698	-84.756355
Point I.	38.888919	-84.747592

   See also attached map of Big Bone Lick State Historic Site National Historic Landmark Boundary.

3. **Verbal Boundary Description**:

   The Big Bone Lick Site is comprised of 205 acres that correspond to the Big Bone Creek Valley within Big Bone Lick State Historic Site. The boundary begins at the northeast corner of Big Bone Lick State Historic Site. The boundary extends (clockwise) south along the east park property line to Point B. At Point B, the southern border turns northeast and follows the south edge of the floodplain on the south side of the creek to Point C. At Point C, the boundary continues west and follows the 500 ft (152.4 m) elevation contour line as it winds around the base of the adjacent upland. This contour forms the upper edge of the stream terrace (Points C, D, E). At Point F the boundary crosses Big Bone Creek and then follows the west edge of the Creek (also Park property line) northwest to Boat Dock Road (noted as Route 1925). The boundary then follows the east side of Boat Dock Road north to the intersection with Route 338, through Point G to Point H. At Point H, the boundary turns east and follows the south side of Boat Dock Road back to Point A.

The boundary is also indicated on the attached USGS quadrangle map of the Big Bone Lick State Historic Site.

4. Boundary Justification:

The area contained within the proposed boundary represents areas related to continuous use over time of the mineral springs located at Big Bone Lick. The boundary of the National Historic Landmark has been determined by the extent of the areas around the lick which have been subjected to paleontological survey and study over time and the extended valley within the State Park property which has the potential to contain other significant resources.

5. SIGNIFICANCE STATEMENT AND DISCUSSION

INTRODUCTION: SUMMARY STATEMENT OF SIGNIFICANCE

Big Bone Lick Site is eligible under NHL Criterion 1 because of the unique significance and major contributions that fossils from the site have made toward the development of paleontology as a science, both nationally and internationally in the late eighteenth and early nineteenth centuries. Not only has this location long been considered a world-class collection site for large Pleistocene epoch mammal fossils (ca. 2.6 million years to 11,700 years before present), but it also is the first nationally recognized site for fossil collection from which the fossils were scientifically studied. Big Bone Lick has been referred to as the birthplace of vertebrate paleontology in North America. Vertebrate paleontology is the study of ancient animals that have a spine (vertebral column), most often seen or found as fossilized remains. The finds at Big Bone Lick in early modern studies of geology and vertebrate paleontology and their relationship as developing scientific fields in the United States and the world is of immense importance. The fossils themselves played a significant role in the development of scientific thought regarding the idea of extinction and the fossil beds at Big Bone Lick have produced the type specimens for at least four Pleistocene epoch mammals, including Harlan's musk ox (*Bootherium bombifrons*), American bison (*Bison antiquus*), American mastodon (*Mammut americanum*), and stag moose (*Cervalces scotti*) Often referred to as the "first major New World fossil locality known to Europeans," collections from Big Bone Lick influenced many of the important scientific minds of the period, such as Thomas Jefferson, Benjamin Franklin, Georges Cuvier, Charles Lyell, and Nathaniel Southgate Shaler. The period of significance is from the first recorded European visit in 1739 to the last known major nineteenth century digging expedition in 1868. This is the period when Big Bone Lick was most active in its nationally significant contributions to scientific knowledge and aided in the creation of the field of paleontology.

SITE HISTORY

Big Bone Lick first attracted scientific interest because of the abundance of fossilized remains that could be found there. The first recorded European visitor to the site, Captain Charles Le Moyne de Longueuil, Baron de Longueuil, remarked on the presence of the fossils in 1739.[1] De Longueuil was the commander of a military expedition from Montréal in New France and it was his Native Americans guides, probably Algonquian-speaking Abenaki men from what is now eastern Canada, who brought the fossils to his attention.[2] He then sent fossils to Paris and elsewhere in Europe. Other early Europeans who were aware of the site were explorer Christopher Gist and Shawnee captive Mary Draper Ingles. Gist obtained teeth taken from the site in 1751 from a man named Robert Smith; apparently Gist never made it to the site.[3] Mary Draper Ingles was taken captive by the Shawnee Nation in 1755 and brought to Big Bone Lick to collect salt. She noted in her recollections of her captivity that Frenchmen were present at the lick.[4]

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[1] William Cooper, "Notices of Big-Bone Lick," *Monthly American Journal of Geology and Natural Science*, 1, no. 4 (October 1831): 158-174 and 1, no. 5 (November 1831): 205-216.

[2] Adrienne Mayor, *Fossil Legends of the First Americans* (Oxford and Princeton: Princeton University Press, 2005), 5-7. Mayor's work examining how Indigenous knowledge about prehistoric fossils informed the early development of the Western science of paleotology includes an extended discussion of the Native American role in discovering Big Bone Lick.

[3] Paul Semonin, *American Monster, How the Nation's First Prehistoric Creature became a Symbol of National Identity* (New York and London: New York University Press, 2000), 94; B. Jo Stokes and William H. Lowthert, IV, *Phase I Archaeological Survey of Big Bone Lick State Park, Boone County, Kentucky* (Lexington: Kentucky Archaeological Survey Report, 1998).

[4] Lewis Collins, *Historical Sketches of Kentucky* (Frankfort: Kentucky Historical Society 1882); Joan Vannorsdall Schroeder, "An Extraordinary Woman, and Equal to any Emergency: Mary Draper Ingles' Return to Virginia's New River Valley," *Blue Ridge Country* (March 1, 1998). https://blueridgecountry.com/archive/favorites/mary-draper-ingles/#sthash.2FJk7MKn.qjtu.

Fur trader, land speculator, scout, and Indian agent Colonel George Croghan conducted the first intensive removal of bones for scientific purposes in 1765 when he stopped at Big Bone Lick for the explicit purpose of removing bones.[5] Croghan had to return the following year as the 1765 collection was lost during an attack.[6] In 1767, he shipped to London many specimens obtained during his second visit to William Petty, 2nd Earl of Shelburne, who later became Home Secretary in Great Britain, and to Benjamin Franklin, who lived in London during this period.[7] Croghan sent them as gifts, as he was a friend of Franklin.[8]

In 1773, Virginia surveyor James Douglass stopped at Big Bone Lick and reported around ten acres of bare ground with a creek running through the middle of it. He noted animal trails coming in from different directions. He and his companions reportedly built a tent out of rib bones and noted teeth and tusks on the ground surface.[9] Humphrey Marshall, one of colonial America's most noted botanists, expressed the intense curiosity and speculation by late eighteenth-century naturalists and explorers about the large bones being unearthed at Big Bone Lick. Marshall stated that Douglass stopped off to see the large bones "of which fame had said so much, the learned risked so many conjectures, and everybody knew so little."[10]

By 1778, the area was known as Big Bone Lick, having been so named by a cartographer.[11] Early reports by Longueuil and others spurred intense interest in the mysterious fossilized bones being brought to the eastern United States. No one had been able to identify the animals from which the bones originated. North America had no living elephant species, yet tusks that resembled elephants were being found. Naturalists such as James Wright and John Bartram of Philadelphia paid for collections from the site. Wright and Bartram also sent collections from Big Bone Lick and other sites to collectors in England who frequently requested samples of fossilized bones. Other collections made their way to George Washington, the American Philosophical Society in Philadelphia, and later to Thomas Jefferson.[12] Over the next thirty years, these collections from the site also spurred intense debate involving the prominent naturalists and botanists of the day (as discussed further below).

In 1795, future president William Henry Harrison collected thirteen large wood casks of bones at Big Bone Lick.[13] However, Harrison's collection, like the first of Croghan's collections, was lost somewhere on the Ohio River, sunk in boat accidents.

Thomas Jefferson took an interest in Big Bone Lick after hearing of the large collections of huge bones removed from the site, and began corresponding with General George Rogers Clark, then stationed in Kentucky, concerning the lick.[14] Although Clark knew the area and had been to Big Bone Lick, it was his younger brother, William Clark, recently returned from his famed exploration of the northwest with Meriwether

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[5] Semonin, *American Monster*,107; A. M. Yealey, *Big Bone Lick* (1960), on file with the Boone County Public Library, Florence, Kentucky.
[6] Cooper, "Notices,"158-174
[7] Willard Rouse Jillson, *Big Bone Lick: An Outline of Its History, Geology, and Paleontology* (Louisville: Standard Printing Co., 1936; reprinted Rabbit Hash Historical Society, 1998]; Edward M. Kindle, "The Story of the Discovery of Big Bone Lick," *The Kentucky Geological Survey Series: Vein Deposits of Central Kentucky and other Papers*, Series VI, Vol. 41 (1931): 199-200.
[8] National Archives and Records Administration, Founders Online, "List of Fossils sent by George Croghan to the Earl of Shelburne and Benjamin Franklin, 7 February 1767," originally printed in The Royal Society, *Philosophical Transactions*, LVII, Part I (London: 1768), 467, https://founders.archives.gov/documents/Franklin/01-14-02-0019.
[9] Humphrey Marshall, *The History of Kentucky* (Frankfort: 1812; reprinted 1971), 85-97.
[10] Marshall, *The History of Kentucky,* 85-97.
[11] Jillson, *Big Bone Lick*, 199-200.
[12] Stanley Hedeen, *Big Bone Lick: The Cradle of American Paleontology* (Lexington. University of Kentucky Press, 2008); Semonin, *American Monster*; Georges Gaylord Simpson, "The Beginnings of Vertebrate Paleontology in North America," *Proceedings of the American Philosophical Society* 86, no. 1 (September 25, 1942): 130-188.
[13] Cooper, "Notices;" Jillson, *Big Bone Lick*, 199-200; Semonin, *American Monster*; Stokes and Lowthert, *Phase I Survey.*
[14] Jillson, *Big Bone Lick,* 199-200.

Lewis, who visited Big Bone Lick to collect fossils for the President in 1807. Another visitor shortly after the turn of the nineteenth century was Dr. William Goforth of Cincinnati. In 1804, Goforth led an excavation that removed approximately five tons of bones. The bones were displayed in England by Thomas Ashe, and after that their existence and whereabouts are not mentioned in historical documentation.[15]

Throughout the nineteenth century, Big Bone Lick was known around the world as a premier paleontological site, prompting visits by Sir Charles Lyell, the father of modern geology, and later by Harvard geologist Nathaniel Southgate Shaler.[16] Many naturalists and other early scientists recognized the Big Bone Lick locale as a very important source of bones, especially those of the *American incognitum* (early term for the mastodon).[17]

So many collecting expeditions had been made in the eighteenth and early nineteenth centuries that Constantine Rafinesque noted that, by 1821 the property owner refused to grant excavation permission to collectors.[18] After 1821, only four other major nineteenth-century digging expeditions are known, William Cooper (ca. 1828), William Bullock (ca. 1828-1830), Captain Benjamin Finnell (ca. 1830), and Nathaniel Shaler in 1868.[19] Bullock was an English naturalist and antiquary who relocated temporarily to northern Kentucky. Finnell lived nearby and collected fossils at the site. Cooper wrote the 1831 "Notices of Big-Bone Lick," listing known site investigations to that date and included a map of the Big Bone Lick vicinity.[20] However, after Shaler's visit in 1868, it would be nearly a century before paleontologists and geologists returned to Big Bone Lick.

Local citizens lobbied Kentucky State Parks in the late 1950s for creation of a park. They formed the Big Bone Lick Historical Association and bought sixteen acres of land in 1958, donating it to the state to create Big Bone Lick State Park in 1960. Over the next thirty years the Commonwealth of Kentucky purchased additional surrounding land to create the current park boundary. The proposed Big Bone Lick NHL consists of 205 acres of the state park.

From 1961 through 1966, the University of Nebraska, US Geological Survey, Behringer-Crawford Museum of Covington (Kentucky), Big Bone Lick Historical Society, and Kentucky State Department of Parks conducted a continuous excavation program that primarily recovered bones to be used in taxonomic studies (taxonomy is the study of and classification of organisms, including naming and describing), similar to the studies conducted in the eighteenth and nineteenth centuries.[21] From 1962 to 1966, they excavated in three areas near Big Bone Creek, Gum Branch, and the confluence of the two waterways. These excavations recovered over two thousand specimens of faunal material now housed at the University of Nebraska. They were able to clarify species identifications and add significant information on the geology and taphonomy of the site. The KEN-1 locale, for example, produced stratified deposits that reached Pleistocene fossils 3.3 m (11 ft) below the current ground surface.

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[15] Jillson, *Big Bone Lick,* 199-200; Stokes and Lowthert; Cooper, "Notices."
[16] Jillson, *Big Bone Lick,* 199-200.
[17] Semonin, *American Monster.*
[18] Constantine S. Rafinesque, "Visit to Big Bone Lick in 1821," *Monthly American Journal of Geology and Natural Science* I, no. 8 (February 1832): 355-358.
[19] Collins, *Historical Sketches*; Cooper, "Notices;*"* Jillson, *Big Bone Lick,* 199-200. Shaler excavated almost two thousand pounds of bone from the site in the late 1860s, now curated at the Peabody Museum at Harvard.
[20] Cooper, "Notices."
[21] C. Bertrand Schultz, Frank C. Whitmore, Jr., and Ellis C. Crawford, "Big Bone Lick, Kentucky: A Pictorial Story of the Paleontological Excavations at this Famous Fossil Locality from 1962 to 1966," *Museum Notes* 33 (March 1967); Lee J. Otte, *Proposal for preparation of Summary Document and Development of Comprehensive Investigative Program for Big Bone Lick State Park, Boone County, Kentucky,* submitted to the Boone County Fiscal Court by the Friends of Big Bone Lick (2000), on file at the Boone County Fiscal Court, Burlington, Kentucky.

More recent investigations have included archeological surveys and excavations and limited paleontological testing.[22] Big Bone Lick continues to attract paleontological and archeological interest for future research, particularly with respect to identifying possible relationships with Paleoindian culture.[23]

HISTORIC CONTEXT AND THEMES

The history of paleontology in the United States began in the eighteenth century with the collection of fossils by French explorers and their Native American guides and other expeditions that followed. Liggett et al. notes that the development of paleontology as a science became linked to exploration and expansion because these fossil collections contributed significantly to developing ideas on extinction, changing climate through time, and descriptions of previously unidentified animal species.[24] From the beginning of the United States as a nation, scientific inquiry was important to the study of newly acquired land. Explorations into new territories, including Kentucky and the Big Bone Lick area, collected fossils, plants, and animals throughout the latter eighteenth and into the nineteenth centuries. The Big Bone Lick collections played a crucial part in the development of the science of paleontology.

Building on the work of other paleontologists, George Gaylord Simpson divided the history of paleontology discipline in the United States into six distinct phases: Pre-Scientific Period (prior to 1762); Proto-Scientific Period (ca. 1762-1799); Pioneer Scientific Period (ca. 1799-ca. 1842); First Classic Period (ca. 1842-ca. 1865); Second Classic Period (ca. 1865-1895); and Modern Period (post 1895). [25]

Big Bone Lick's national significance under Criterion 1: Expanding Science and Technology under development of scientific thought and theory lies primarily in its association with the first three of Simpson's historic periods.

Pre-Scientific Period (prior to 1762)

"The first fossil discoveries were made. Toward the end of the period bones were collected and sent to Europe. No truly scientific study of them had been made." ---George Gaylord Simpson[26]

Big Bone Lick first attracted scientific interest because of the abundance of Pleistocene and Holocene (together comprising the two epochs of the Quaternary Period, the third and last of the three periods of the Cenozoic Era) faunal remains that could be found there.[27] The first recorded European visitor to the site, Captain Charles Le

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[22] See examples in the Bibliography, including Donald A. Miller and Ken Duerksen, "Excavation of a Prehistoric Feature at Big Bone Lick, Boone County, Kentucky," in *Current Archaeological Research in Kentucky: Volume Three* (Frankfort: Kentucky Heritage Council, 1995), 131-160; Stokes and Lowthert; William Hughes Lowthert, IV, *Resource Use and Settlement Patterning Around the Saline Springs and Salt Licks in Big Bone Lick State Park, Boone County, Kentucky,* Master's thesis (Lexington: Department of Anthropology, University of Kentucky, 1998); etc.

[23] Glenn W. Storrs, Robert A. Genheimer, and Stanley E. Hedeen, "In the Footsteps of Lewis and Clark – New Zooarchaeological Excavation at Big Bone Lick, Kentucky [poster]," (Cincinnati: Ninth North American Paleontological Convention, June 21-26, 2009).

[24] Gregory A. Liggett, S. Terry Childs, Nicholas A. Famoso, H. Gregory McDonald, Alan L. Titus, Elizabeth Varner, and Cameron L. Liggett, "From Public Lands and Museums: The Foundation of U.S. Paleontology, the Early History of Federal Public Lands and Museum, and the Developing Role of the U.S. Department of the Interior," in *Museums at the Forefront of the History and Philosophy of Geology: History Made, History in the Making*, Gary D. Rosenberg and Renee M. Clary, eds. (Geological Society of America, 2018), 312, https://doi.org/10.1130/2018.2535(21).

[25] George Gaylord Simpson, "The Beginnings of Vertebrate Paleontology in North America," *Proceedings of the American Philosophical Society* 86, no. 1, Symposium on the Early History of Science and Learning in America (September 25, 1942): 131.

[26] Simpson, 131.

[27] National Park Service, "Quaternary Period—2.58 MYA to Today," https://www.nps.gov/articles/000/quaternary-period.htm (accessed May 12, 2023).

Moyne de Longueuil, sent fossils from Big Bone Lick (and possibly other sites along the Ohio) to France for study.[28] These fossils prompted the naming of an unknown animal species (mastodon) referred to as the "Animal of the Ohio" and spurring intense interest in Big Bone Lick.[29]

Other expeditions along the Ohio River during and after the 1750s also stopped at Big Bone Lick, collecting fossils including tusks, teeth, and long bones of elephant-like animals that would later be recognized as mastodons and mammoths. These collectors were not undertaking systematic collections and the fossils were ultimately distributed among men in the eastern United States and sent to London and Paris. The exportation of these bones from Big Bone Lick to museums in France and Great Britain greatly increased knowledge of these extinct creatures.[30]

Big Bone Lick's significance during the pre-Scientific period lies in the interest created by fossils sent back to the eastern United States and Europe from the Ohio River Valley and Big Bone Lick in particular. These unidentified fossils generated much discussion among well-known scientific men of the day and provided new avenues for research and debate. For example, a 1756 report by French scientist Jean-Étienne Guettard is an early published reference that included a drawing of two molars identified as being from Big Bone Lick and may be the first illustration of a vertebrate fossil from the US.[31]

Proto-Scientific Period (c. 1762-1799)

"In 1762 Daubenton read a paper on American fossils treating them for the first time in what deserves to be called a scientific way. Vertebrate paleontology was not yet a true science, but basic methods were being invented and sporadically applied." ---George Gaylord Simpson [32]

Big Bone Lick fossils are highly significant in the history of vertebrate paleontology during the Proto-Scientific period. These fossils generated a lively discussion among early paleontologists and other well-known scientists as to the nature and form of the animals represented. Extensive correspondence and articles from this period highlight the intense debate and centered on the part played by the elephant-like fossils collected from Big Bone Lick. Most of the well-known botanists and naturalists of the eighteenth century would study them over the next several decades.

Simpson identifies Louis-Jean-Marie Daubenton's paper in 1762 as the beginning of the proto-scientific period. Daubenton compared a femur sent to France by Longueuil from Big Bone Lick with those from Siberia and Africa, marking an early use of the comparative method for fossil identification, one of the four basic principles in the methodology of vertebrate paleontology.[33] Simpson described the other three principles as: "that fossils may and usually do represent extinct species, that they occur in definite, temporal sequence, and that they record evolutionary phylogenies."[34]

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[28] Although the narrative of discovery by Longueuil permeates the popular understanding of Big Bone Lick, Mayor presents a compelling case that it was a hunting party of his Native American troops who discovered Big Bone Lick and brought the fossil specimens back to where their commander was encamped. Mayor, 7-9.
[29] John D. Godman, *American Natural History* Vol. 2 (Philadelphia: H.C. Carey and I. Lea. R. Wright printer, 1826), 206.
[30] See, for example, Simpson, 130-188; Hedeen, *Big Bone Lick;* Cooper, "Notices."
[31] Hedeen, *Big Bone Lick,* 35.
[32] Simpson, 131
[33] Ibid.
[34] Ibid., 145. These additional principles developed later: extinction studies at the latter end of this period; temporal sequence in the early nineteenth century; and evolution later in the nineteenth century.

Peter Collinson, an eighteenth-century London botanist and merchant, played a central role in correspondence between English and American naturalists.[35] Collinson presented the first technical monograph on Big Bone Lick fossils to the British Royal Society on November 26, 1767, noting differences among the teeth and the resemblance of at least some of the fossils to elephants.[36] In another presentation in December 1767, Collinson compared the fossils with those of modern elephants.[37] He concluded that some molars (later identified as belonging to the mammoth) were more similar to modern elephants, while other molars were very different, indicating a new, as yet undefined, species of elephant (the mastodon). Collinson was correct in stating the specimen was likely that of a browser who fed on young shoots, leaves, and twigs, based on its teeth, but he stopped short of declaring the animal extinct. This and similar papers and articles highlight the important role of fossils from Big Bone Lick during the proto-scientific beginnings of the field of paleontology. The scientific debate created by these fossils led to discussions and hypotheses on taxonomy, climate change over time, and extinction. Thus, fossils from Big Bone Lick were integral to the development of the emerging field of vertebrate paleontology.

Respected and well-known naturalists of this period weighed in on the discussion of the type of animal belonging to the jagged molars, positing variously hippopotamus, carnivorous elephant, or some unknown giant species as yet unidentified. French naturalist Georges-Louis Leclerc, Comte de Buffon, believed it to be a hippo. In 1777, Dutch anatomist Petrus Camper rejected Buffon's hippo hypothesis as well as British doctor William Hunter's claim that the animal was carnivorous, instead believing it to be a variety of elephant. By 1778 Buffon began arguing that the animal, whatever its nature, had to be extinct, one of the first mentions of this possibility.[38] These late eighteenth-century debates finally discerned that the Big Bone Lick fossils represented two different large creatures. Thomas Jefferson, George Turner, and others agreed on this fact while disagreeing on whether the creatures were extinct, carnivorous, elephant-like, or hippo.

On January 21, 1796, Georges-Léopold-Chrétien-Frédéric-Dagobert, Baron Cuvier, zoologist at the Muséum National d'Histoire Naturelle in Paris, presented his paper "Memoir on the species of living and fossil elephants" to the National Institute of Sciences and Arts.[39] The Big Bone Lick fossils collected up to this time were an integral part in Cuvier's research wherein he also described the differences among modern elephants, fossils from Siberia, and this new species from North America. Gregory Liggett and others described how "with careful anatomical work and reasoning, Cuvier articulated the best evidence for extinction presented to date."[40] The museum in Paris continued to request additional fossils from Big Bone Lick to augment Cuvier's research and, in 1796, the museum exchanged specimens with Charles Willson Peale's American Museum in Philadelphia.[41]

Georges Cuvier, Benjamin Franklin, Peter Collinson, Petrus Camper, and others secured America's place in paleontology, and science in general, using their knowledge and study of the bones recovered from Big Bone Lick. As Paul Semonin states in his book *American Monster*, Big Bone Lick fossils played a seminal role in the development of scientific thought, especially regarding the evidence for extinction and the development of the

[35] Social Networks and Archival Context [University of Virginia Library/National Archives and Records Administration], "Collinson, Peter, 1694-1768," https://snaccooperative.org/ark:/99166/w6td9zxh.
[36] Peter Collinson, "An Account of Some Very Large Fossil Teeth Found in North America," *Philosophical Transactions* 57, (1767): 464-469, quoted in Jillson, *Big Bone Lick*, 9.
[37] Collinson, quoted in Hedeen, *Big Bone Lick*,48.
[38] Hedeen, *Big Bone Lick,* 53-55.
[39] Georges-Léopold-Chrétien-Frédéric-Dagobert, Baron Cuvier [Georges Cuvier], "Mémoire sur les espèces d'Éléphans tant vivantes que fossiles," *Mag. (or Rev.) Encycl*., 111, no. 12, an IV [1796]: 440- 445, in Hedeen, *Big Bone Lick,* 76; Jillson, *Big Bone Lick.*
[40] Liggett et al., "From Public Lands," 313.
[41] Hedeen, *Big Bone Lick,* 76.

science and methodology of paleontology.[42] In 1796, Georges Cuvier had concluded, "it is only with the help of anatomy that geology can establish in a sure manner several of the facts that serve as its foundations."[43] This was written as geology was just emerging as a new field of study. Cuvier's study of anatomy in conjunction with geology would effectively become the field of paleontology.[44]

Pioneer Scientific Period (c. 1799-1842)

"In 1799 the first able technical study by an American (Wistar) was published. In Europe this was the epoch of Cuvier, who organized the subject as a true and defined science. Harlan and others in America applied Cuvierian methods and theories to increasingly large collections of fossils. The date 1842 is arbitrary, chosen partly because of the even century since elapsed, but it marked the approximate end of Harlan's career and shortly preceded the beginning of Leidy's."
---George Gaylord Simpson[45]

During this period, fossils from Big Bone Lick were also highly significant as vertebrate paleontology continued to develop into a separate field of study apart from geology and anatomy. Cuvier in Paris and Caspar Wistar and Richard Harlan in the United States, among others, examined, compared, and defined newly recognized species based on fossils from Big Bone Lick. Using these fossils, their recognition of extinction and the processes associated with it continued to evolve, as did their understanding of stratigraphy and its association with temporal sequence. Cuvier first identified these fossils as a separate species of extinct elephant in 1806, different from *Mammuthus primigenius* (Siberian or wooly mammoth), largely based on fossils recovered from Big Bone Lick. He then properly described the species and gave it the name *Mammut americanum* (American mastodon).[46]

Thomas Jefferson served as President of the American Philosophical Society from 1797 to 1814. In that role he served as a patron of science and "encouraged the study of vertebrate paleontology."[47] Based on Jefferson's influence, the search for large fossil bones became a "key part of the institution's official collecting strategy."[48] Jefferson organized multiple collecting expeditions to Big Bone Lick and considered the retrieval of fossils from Big Bone Lick to be a part of Lewis and Clark's objectives for their expedition to the West.

Meriwether Lewis did stop at Big Bone Lick in 1803, but his collection was lost. In 1807, William Clark collected and returned boxes full of fossil specimens to Thomas Jefferson.[49] Jefferson kept some specimens for himself, sent some to Cuvier in Paris, including mastodon fossils, and donated specimens to various American institutions.

Caspar Wistar, an American physician and anatomist, succeeded Thomas Jefferson as President of the American Philosophical Society in 1814. Wistar had previously published on *Megalonyx jeffersonii* (Jefferson's ground sloth) in 1799. He and others continued to use Big Bone Lick fossils housed at the Academy of Natural Sciences in Philadelphia (now the Academy of Natural Sciences at Drexel University), most of which had been

[42] Semonin, 7-9.
[43] Cuvier (1796), in Semonin, 302.
[44] Mayor also notes the influence of Indigenous American fossil lore on Cuvier and other prominent early figures in the development of paleontology. See *Fossil Legends*, xxiv-xxvi.
[45] Simpson, 131.
[46] Cuvier (1806), quoted in Hedeen, *Big Bone Lick,* 97; Semonin, *American Monster*.
[47] Simpson, 156.
[48] Patrick Spero, Abigail Shelton, and John Kenney, "The Other Presidency: Thomas Jefferson and the American Philosophical Society," *Proceedings of the American Philosophical Society* 162, no. 4 (December 2018): 339.
[49] Earle E. Spamer and Richard M. McCourt, "Big Bone Lick: Collecting Fossils for Thomas Jefferson" (Lewis and Clark Trail Heritage Foundation, n.d.) https://lewis-clark.org/the-trail/down-the-ohio/big-bone-lick/ (accessed May 12, 2023).

donated through the efforts of Jefferson, to define new species of extinct mammals.[50]

The site was significant to geological science as well as biological science. Notably, Sir Charles Lyell and other European geologists were influenced by the discoveries at Big Bone Lick. Lyell visited the valley in 1841 with the Kentucky State Geologist, David Dale Owen. In his report of his travels in the United States, Lyell referred to Big Bone Lick as "a place of great geological celebrity."[51]

Cuvier and Wistar were among the pioneers who had laid the foundation of the science of paleontology based on comparative analyses and recognition of extinction as a natural process. Richard Harlan was an American physician who was also the leading expert on fossil vertebrates from the 1830s until his death in 1843. Harlan may have effectively been the first career vertebrate paleontologist and served as a professor of comparative anatomy at the Philadelphia Museum after 1821.[52] Harlan applied Cuvier and Wistar's methods and his own most important contributions to paleontology "were in the fields of objective description, nomenclature and taxonomy."[53] The application of Linnaean or binomial nomenclature (consisting of two-word Latin names to indicate genus and species) to American vertebrate fossils began with Harlan. His work included classifying Big Bone fossils including holotypes (original type specimens upon which the names of new species is based) for *Bootherium bombifrons* (Harlan's musk ox) and *Cervalces scotti* (stag moose). Although these names were later changed, Harlan classified them correctly.[54]

Based on samples from the Academy of Natural Sciences in Philadelphia collections, another fossil species ultimately defined based on type specimens originating at Big Bone Lick was the *Bison antiquus* (American bison). Significantly, three American mastodon mandibles with teeth held in the Academy of Natural Sciences collection are further considered the holotype for the ancestor of the American mastodon, described as *American incognitum* at the time.[55] American naturalist John D. Godman stated that Big Bone Lick was one of the earliest locales for the discovery of those fossils.[56] The site also may be considered one of the original fossil locations for the American mastodon, in addition to its importance in the history of paleontology.

COMPARATIVE ANALYSIS

Comparable Pleistocene Fossil Sites (not designated National Historic Landmarks)

Comparable properties to Big Bone Lick Site were selected based on equivalent records of Pleistocene megafauna and the presence of matching biotic themes discovered at these sites. Sites from adjacent natural regions were included in the evaluation since it was determined that there are no sites comparable to Big Bone Lick in the Interior Low Plateaus Natural Region.[57] Seven regional sites were identified that appear to fit the general selection criteria; however, only three sites best represent the natural features under consideration and

[50] Simpson, quoted in Hedeen, *Big Bone Lick*, 101,104-110.
[51] Jillson, 106.
[52] Simpson, 161.
[53] Simpson, 162.
[54] J. N. McDonald and C. E. Ray, "The autochthonous North American musk oxen *Bootherium*, *Symbos*, and *Gidleya* (Mammalia: Artiodactyla: Bovidae)," *Smithsonian Contributions to Paleobiology*, 66 (1989): 1-77. N.B.: For many years, paleontologists thought at least two different types of woodland muskoxen were present in the Midwest 14,000 years ago. The two types were a form with larger, heavier horns with an oval cross-section (*Symbos cavifrons*) and a form with smaller, more slender horns with a rounder cross-section (the original *Bootherium bombifrons*). Now many paleontologists agree that these two forms represent the male and female of a single species (correctly named *Bootherium bombifrons*).
[55] Simenon, *American Monster*; Godman, *American Natural History*.
[56] Godman, *American Natural History,* 237.
[57] The Interior Low Plateaus Natural Region includes portions of Kentucky, Indiana, Ohio, Illinois, Tennessee, and Alabama.

were used for comparison with Big Bone Lick.

The three sites--Mastodon State Historic Site, Megenity Peccary Cave and Prairie Creek Site--were originally identified during the nomination of Big Bone Lick as a National Natural Landmark, designated in 2009, in consultation with National Park Service program staff. The criteria used for selecting comparable sites included: a) the extent of the paleontological discoveries made at a site; b) the contribution of these discoveries to the advancement of the science of paleontology; and c) the nature, variety and uniqueness of the flora and fauna currently at the site.[58]

Mastodon State Historic Site and Big Bone Lick have been the locations of major paleontological excavations in the past and specimens from these sites are on display in major museums in the United States and Europe. Megenity Peccary Cave in Crawford County, Indiana, and the Prairie Creek Site in Daviess County, Indiana, have both produced collections of Pleistocene mammals although under differing conditions.

Mastodon State Historic Site (Kimmswick Bone Bed), Jefferson, Missouri (owned by the State of Missouri), National Register of Historic Places (listed November 5, 1980, NRIS 80002371)

Mastodon State Historic Site contains an important archeological and paleontological site, the Kimmswick Bone Bed. Bones of mastodons and other now extinct animals were first found here in the early 1800s. The area gained fame and notoriety in 1830 when Albert Koch excavated and displayed many of the bones he found there. Albert Koch was a St. Louis entrepreneur and operated a museum in that city. He used bones from this and other sites to create a display creature that was half real and half fantasy which he named the *Leviathan missouriensis.* The British Museum later acquired the collection and assembled the true animal, the American mastodon, which is still on display at the museum. Excavations in the early 1900s also revealed a great number of well-preserved bones and the area became known as one of the most extensive Pleistocene bone beds in the country. Bones from more than sixty mastodons reportedly were taken from the pit, but there is little record of their excavation and current location. Archeological history was made at the site in 1979 when excavations of the bone bed by the Illinois State Museum uncovered a stone spear point made by Paleoindian hunters in direct association with mastodon bones.[59] This was the first conclusive evidence of the coexistence of these people with mastodons in eastern North America.

After more than 150 years of collecting, the Kimmswick Bone Bed has been extensively disrupted. The character of the deposits has been thoroughly changed by previous excavations, highway construction, and quarrying. The 431.14-acre site currently is managed by the Missouri Department of Natural Resources State Parks and Historic Sites and is listed in the National Register of Historic Places.

Megenity Peccary Cave, Crawford County, Indiana (private ownership, not designated)

Megenity Peccary Cave contains the longest and most diverse record of late Pleistocene and Holocene vertebrate remains excavated to date in the region. However, although the site has provided a large number of fossils species, none of the fossils found to date have made a major contribution to the paleontological record. Ages range from Sangamonian interglacial into Holocene times, but the greater part of the vertebrate record dates to 25,000-35,000 BP based on radiocarbon dating. Long-term accumulation of remains of sheltering *Platygonus compressus* (flat-headed peccary) – over 500 individuals – are accompanied by occasional remains

[58] Jeannine Kreinbrink and John Rockaway, *Big Bone Lick State Park* National Natural Landmark Nomination. (Washington, DC: US Department of the Interior, National Park Service, 2007).
[59] Missouri State Parks, "Historic Site History at Mastodon State Historic Site," https://mostateparks.com/page/54983/historic-site-history.

of the large predator *Aenocyon dirus* (dire wolf). Only one complete skull of either a peccary or a dire wolf, however, occurred intact. Remains of other extinct animals include *Geochelone* sp. (tortoise), *Tapirus* sp. (tapir), *Mylohyus* sp. (peccary), *Dasypus bellus* (beautiful armadillo), *Panthera onca* (jaguar) and horse (species undetermined). Extralimital mammals (mammals which no longer occur in the region) include *Microtus xanthognathus* (Taiga vole), *Synaptomys borealis* (northern bog lemming), *Sorex arcticus* (arctic shrew), *Clethrionomys gapperi* (southern red-backed vole), *Phenacomys intermedius* (western heather vole), *Lepus americanus* (snowshoe hare), *Martes pennanti* (fisher), *Geomys bursarius* (plains pocket gopher), and *Spermophilus tridecemlineatus* (thirteen-lined ground squirrel).[60]

A more than twenty-year cave excavation plan – which includes most of the limestone cave – is nearing completion as of 2024. Materials are reposited at the Indiana State Museum, Indianapolis, and a ten- to fifteen-year analysis of the collection will follow. The Nature Conservancy purchased twenty-six acres between 2010 and 2012 to protect the cave and surrounding land. The Conservancy continues to support the Indiana State Museum's work at the site.[61]

Prairie Creek Site, Daviess County, Indiana (privately owned), National Register (listed May 12, 1975, NRIS 75000013)

Prairie Creek Site remains began to accumulate as sediments started filling glacial Lake Prairie Creek, which had been formed by the blocking of Prairie Creek, a tributary of the West Fork of the White River, with valley train sediments (stratified deposits of gravel, sand, silt, and clay). Bone and sediments accumulated in the lake from about 13,000-21,000 BP (Zone D), after which time the dam was breached and sediments and bones were redeposited a mile or so downstream in the bed of Prairie Creek. One radiocarbon date on a spruce log of undetermined provenance gave an approximate age of 14,010 BP. The site has also produced a Paleoindian archeological component.[62]

Holocene sediments, biotic remains, and archeological debris thereafter accumulated on top of the redeposited materials (Zones A and B). The site included a prolific array of fishes, amphibians, reptiles (both turtles and snakes), birds, and mammals. Zone D extinct mammals included Jefferson's ground sloth, the beautiful armadillo, dire wolf, *Castoroides ohioensis* (giant beaver), an unknown horse species, *Mylohyus nasutus* (long-nosed peccary), *Bison antiquus* (ancient bison), *Cervalces* (stag moose) or *Alces* [modern moose], and American mastodon.

The small mammal and herptile remains have been published upon, and manuscripts on the fishes, birds, and mammals are in preparation.[63] Although the site is located on private property, the faunal specimens are reposited at the Indiana State Museum in Indianapolis.

The Prairie Creek Site may be the most comparable site in terms of setting, as remains were deposited in a

[60] R. L. Richards, "*Microtus xanthognathus* and *Synaptomys borealis* in the late Pleistocene of southern Indiana," *Proceedings of the Indiana Academy of Science* 98 (1988): 561-570; R. L. Richards, "Quaternary occurrence of the fisher, *Martes pennanti*, in Indiana". *Proceedings of the Indiana Academy of Science* 98 (1988): 571-580.
[61] The Nature Conservancy, "Peccary Cave," (2023), https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/peccary-cave-1/.
[62] Curtis H. Tomak, "Prairie Creek: A Stratified Site in Southwestern Indiana," *Proceedings of the Indiana Academy of Science* 84 (1974): 65-68; William Fred Limp, *Prairie Creek Site,* National Register of Historic Places Nomination (Washington, DC: US Department of Interior, National Park Service, 1974).
[63] R. L. Richards, "Small mammals of the Prairie Creek Site, Daviess County, Indiana," *Proceedings of the Indiana Academy of Science* 101 (1992): 245-278; Alan J. Holman and Ronald L. Richards, "Herpetofauna of the Prairie Creek Site, Daviess County, Indiana," *Proceedings of the Indiana Academy of Science* 102 (1993): 115-131.

lacustrine (lake-related) environment. However, fossils were redeposited downstream in the bed of Prairie Creek after the dam creating the lake was breached following glacial ice retreat from the drainage system about 13,000 years BP.[64]

Summary Analysis

Big Bone Lick is the only one of the comparable Pleistocene fossil sites where recovered fossils made significant contributions to the development of vertebrate paleontology during the late eighteenth and early nineteenth centuries. Two of the three other sites presented are better known for archeological associations of late Pleistocene animal bones with Native American artifacts (Prairie Creek and Mastodon/Kimmswick Bone Bed). Those sites are listed in the National Register for these associations. Eighteenth-century exploration of Big Bone Lick provided numerous fossil specimens that played a seminal role in establishing key, foundational components of the discipline of vertebrate paleontology, including comparative species analyses and evidence for extinction. None of these other sites played such a part, despite their troves of fossil remains.

Comparable Fossil Sites (designated National Historic Landmarks)

Big Bone Lick Site is comparable to five National Historic Landmark properties designated for their association with the history of geology and/or paleontology in the United States and the advancement of geology and/or paleontology as a science. These NHL properties include sites from the much earlier Silurian, Cambrian, Pennsylvanian, and Late Cretaceous geologic periods. All were first documented in the nineteenth century. The researchers who studied at these sites provided significant data on fossil types and time periods and established these sites as nationally or internationally significant. Four of the sites are invertebrate fossil sites and one is a vertebrate fossil site, the *Hadrosaurus Foulkii* Leidy Site. [65]

Hadrosaurus Foulkii Leidy Site NHL, Haddonfield, Camden County, New Jersey (designated October 12, 1994), Late Cretaceous Period (circa 100-66 million years ago)

The *Hadrosaurus Foulkii* Leidy Site was designated as a National Historic Landmark because it produced the first relatively complete dinosaur skeleton found in North America. Its discovery in 1858 resulted in revolutionizing the scientific and popular understanding of dinosaurs."[66] Joseph Leidy, the preeminent contemporary American paleontologist, described the skeleton and, in the 1860s, supervised its reconstruction and assembly at the Academy of Natural Sciences in Philadelphia. This was the first dinosaur skeleton put on public display anywhere in the world. This site is nationally significant because, as Dr. John H. Ostrom, with the Peabody Museum of Natural History, Yale University, concluded in 1970: "The Haddonfield site is one of great scientific and historical importance because it is the source of the first (reported) articulated dinosaurian remains found in the western hemisphere."[67]

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[64] Gordon S. Fraser and Henry H. Gray, "Quaternary evolution of the Prairie Creek Lake basin, Daviess County, Indiana," *Indiana Geological Survey Special Report* 53 (1992): 16, https://scholarworks.iu.edu/dspace/handle/2022/27224.

[65] Several other fossil sites managed as part of the National Park System are recognized as nationally significant. Agate Fossil Beds National Monument (Nebraska) recognizes excavations of early Miocene mammal fossils conducted here in the early decades of the twentieth century. Fossil Butte National Monument (Wyoming) is known for the fossil remains associated with an early Eocene freshwater lake. Florissant Fossil Beds National Monument (Colorado) preserves the fossil remains of a late Eocene lake and forest ecosystem, Ashfall Fossil Beds (Nebraska) is a state-managed site that was designated a National Natural Landmark in 2006. Excavations of remarkably complete Miocene mammal fossils including extinct rhinos and horses began here in the 1970s.

[66] Letter, John W. Bond to John P. Wiley, Jr., dated March 28, 1994, on file with the National Archives and Records Administration, New Jersey NHL *Hadrosaurus Foulkii* Leidy Site, NAID: 135813644.

[67] John H. Ostrom, "Report to the National Park Service on Mesozoic Vertebrate Paleontological Sites for Possible Inclusion in the Registry of Natural Landmarks," (New Haven: Peabody Museum of Natural History, Yale University, 1970), 85, quoted in John W.

Petrified Sea Gardens NHL, Saratoga Springs, Saratoga County, New York (designated January 20, 1999), Cambrian Period (541-485.4 million years ago)

The Petrified Sea Gardens NHL is the location of some of the finest examples of domed stromatolite fossils located in the world. Stromatolites are some of the most ancient forms of marine life. The creatures formed reef-like structures, now exposed in the Hoyt Limestone formation in New York state. This is the first site where researchers "recognized, described, and interpreted" stromatolites in North America, based on a discovery by John Steele in 1825.[68] The origins of these fossils had puzzled geologists for a long time. Fourth State Paleontologist of New York Winifred Goldring in 1937 conducted extensive research at the site and her research provided significant understanding of the Cambrian environment. Specimens from Petrified Sea Gardens still serve as the standard for fossil stromatolites.

Soldiers' Home Reef NHL, Milwaukee, Milwaukee County, Wisconsin (designated November 4, 1993), Silurian Period (443.8-419.2 million years ago)

Soldiers' Home Reef NHL is nationally significant in the history of the science of geology as the site of the first recognition and documentation of fossil reefs in North America.[69] It is also among the first in the world. The site is also significant for its association with nationally recognized geologists. Increase A. Lapham, preeminent nineteenth-century Wisconsin engineer, archeologist, meteorologist, and scientist, first documented the site in the 1830s and James Hall first recognized the formations at the site as fossil reefs in 1862.[70] Of three fossil sites used to define the fossil reef concept, Soldiers' Home Reef is the only site that remains extant. The site continues to be significant in the understanding of fossil reefs and to understanding the development of geology as a scientific discipline in the United States.

Schoonmaker Reef NHL, Wauwatosa, Milwaukee County, Wisconsin (designated September 25, 1997), Silurian Period (443.8-419.2 million years ago)

Schoonmaker Reef NHL is a fossil reef site that played a nationally significant role in the recognition of "rock hills" as remnants of Silurian Period fossil reefs. Schoonmaker Reef site had been partially quarried, freeing up large quantities of fossils. Along with Soldiers' Home Reef, identification and description of these fossils were essential to allowing eminent nineteenth and early twentieth-century geologists, including James Hall, T. C. Chamberlin, A. W. Grabau, and R. R. Shrock, to fully define and develop the concept of fossil reefs.[71] The continuous use of the fossil site for educational purposes led to the founding of a prominent geological association, the National Association of Geology Teachers, after an October 1937 field conference visit to the site by five geology teachers.

Bond, *Hadrosaurus Foulkii Leidy Site* National Historic Landmark Nomination (Washington, DC: US Department of the Interior, National Park Service, 1993), 9.

[68] Joanne Kluessendorf, *Petrified Sea Gardens* National Historic Landmark Nomination (Washington, DC: US Department of the Interior, National Park Service, 1993), Sec. 8, 1.

[69] Joanne Kluessendorf and Donald D. Mikulic, *Solders' Home Reef Site* National Historic Landmark Nomination (Washington, DC: US Department of the Interio, National Park Service, 1993).

[70] Lapham served as Wisconsin state geologist 1873-1875, founded the Wisconsin Natural History Association, and served as a charter member of the Wisconsin Academy of Science, among other accomplishments.

[71] Joanne Kluessendorf and Donald D. Mikulic, *Schoonmaker Reef* National Historic Landmark Nomination (Washington, DC: US Department of the Interior, National Park Service), 6.

Mazon Creek Fossil Beds NHL, Morris, Grundy County, Illinois (designated September 25, 1997), Pennsylvanian Period (323.2-298.9 million years ago)

Mazon Creek Fossil Beds NHL is nationally significant because the site contains rare Pennsylvanian Period land plants and small terrestrial animals such as spiders, insects, and amphibians.[72] The site is well known because the fossils are very well-preserved specimens of common species, which is extremely rare in the geologic record. Mazon Creek is one of the five best known Pennsylvanian sites in the world for studying the best and earliest land plants and animal fossils. The site is highly significant to the history of paleobotany as a scientific discipline. Mazon Creek is an invertebrate fossil site that has provided information on a different subfield of paleontology from Big Bone Lick.

Summary Analysis

These five NHL properties are nationally significant for contributions to the science of geology and/or paleontology. All five sites were designated for their association with the history of geology and the researchers who studied at these sites provided significant data on fossil types and time periods. All were first documented in the nineteenth century. However, Big Bone Lick was first documented in the eighteenth century, so it is one of the earliest recognized fossil sites in the United States.

Only one of these NHLs, the *Hadrosaurus Foulkii* Leidy Site, is a vertebrate fossil site like Big Bone Lick. The other four sites are invertebrate fossil sites that provided information on a different subfield of paleontology. Because of its early documentation and study, Big Bone Lick is highly significant for its contributions to the nascent science of vertebrate paleontology.

Researchers at each of these NHLs used site-specific information to move the science of geology and paleontology forward. Each is significant because they are recognized as the earliest documented sites for their fossil types in the United States. These five properties include specimens from the Silurian, Cambrian, Pennsylvanian and Late Cretaceous periods. By comparison, Big Bone Lick contains at least four fossil type specimens from mammals of the late Pleistocene era, a period not represented in existing NHL properties related to the history of paleontology.

Conclusion

For over 250 years, Big Bone Lick has been known as a significant paleontological resource. Often referred to as the "birthplace of American Paleontology," it is recognized as the "first major New World fossil locality known to Europeans" with global notoriety as "a place of great geological celebrity" throughout the eighteenth century.[73] The fossil site gained the attention of US presidents and influential political leaders, scientists, explorers, and others. Further, the chronology associated with Big Bone Lick coincided with early exploration of the United States and the discovery of resources that reshaped scientific perspectives and fueled interest in the broader American continent. Fossils obtained from Big Bone Lick's eighteenth-century excavations may be seen today in the leading museums of Europe and the United States. Paleontological studies of specimens recovered from Big Bone Lick led to the definition, during the early nineteenth century, of at least four type specimens of large vertebrates, including the mastodon and mammoth, and even today, the site continues to add significant information on species identification to the paleontological record. In addition, studies of Big Bone

[72] Joanne Kluessendorf, *Mazon Creek Fossil Beds* National Historic Landmark Nomination (Washington, DC: US Department of the Interior, National Park Service, 1995).
[73] Jillson, *Big Bone Lick*, 106.

Lick fossils from extinct species were instrumental in the development of the science of paleontology and the concepts leading to the development of the theories of extinction and evolutionary processes. It has been a site of major scientific importance for hundreds of years and continues to add new information about the Pleistocene paleontological period in the mid-continental United States. The site's association with early scientific expeditions and debates, and with the evolution of American paleontological science, makes Big Bone Lick nationally significant in the history of science in the United States.

6. PROPERTY DESCRIPTION AND STATEMENT OF INTEGRITY

Ownership of Property	Category of Property
Private:	Building(s):
Public-Local:	District:
Public-State: X	Site: X
Public-Federal:	Structure:
	Object:

Number of Resources within Boundary of Property:

Contributing	Noncontributing
Buildings: 0	Buildings: 4
Sites: 1	Sites: 0
Structures: 0	Structures: 4 (two picnic shelters, one waste-water treatment plant, one bison shelter)
Objects: 0	Objects: 2 (children's play equipment)
Total: 1	Total: 8

PROVIDE PRESENT AND PAST PHYSICAL DESCRIPTIONS OF PROPERTY

Big Bone Lick Site is situated in southwestern Boone County, Kentucky, in a broad valley flanked by steep hills. The 525-acre State Historic Site is located 25 miles (40 km) southwest of Cincinnati, Ohio, in the Interior Low Plateaus Natural Region. Over two miles (3.2 km) of Big Bone Creek flows through a broad valley within the park boundary. Gum Branch flows southward out of the nearby dissected hills and joins Big Bone Creek just as the latter stream turns southward. Found along the stream valley and especially near its confluence with Gum Branch are saline springs that flow out onto the ground surface. These mineral springs are created by water flowing through the underlying Ordovician formations where trapped salts are dissolved and carried, in solution, to the surface. The salt and mineral springs are surrounded by buried layers of fossilized bones that date to the Pleistocene period.

An understanding of the natural setting and geological history of the Big Bone Valley is important when evaluating the significance of the Big Bone Lick Site. Pleistocene bone beds are a rare occurrence in the Interior Low Plateaus Natural Region of the central United States. They are characterized by dense concentrations of fossilized and/or mineralized bone. Often found in lacustrine (lake related), alluvial (flood related), or other water laid-down sediments, these deposits are often buried and inaccessible for collection. Some fossil locales are found in caves, others buried in gravel deposits along major river valleys. At Big Bone Lick, however the fossil beds are found buried along the stream valley in clay and silt deposits that date to the Pleistocene period, and especially the late Pleistocene dating to approximately 20,000-10,000 BP.

The buried terraces at Big Bone Lick still contain extensive bone beds along both sides of Big Bone Creek and Gum Branch. Big Bone Lick appears unique for its combination of salt springs and associated Late Pleistocene bone beds and is one of the best remaining examples of natural features representing landforms associated with

the work of glaciers and features associated with the Late Pleistocene in the Interior Low Plateaus natural region.

The Interior Low Plateaus Region is an unglaciated area of gently dipping Paleozoic age (541-252 million years ago) sedimentary rocks with relatively moderate relief that resulted from the entrenchment of the drainage systems that occurred prior to, during, and after the Pleistocene glacial advances. Although sandstone and shale occur throughout the region, much of the area is underlain by limestone. Karst topography is well developed where these formations are near the surface, resulting in sink holes and caves.

The site of Big Bone Lick is on the outer (northern) edge of the Interior Low Plateaus Province in the Outer Bluegrass sub-section. This region is more highly dissected and characterized by deeper valleys than the other sub-sections, primarily because of the near proximity of the entrenched valley of the Ohio River, and because the bedrock in this area is mostly composed of alternating layers of Ordovician limestone and shale. These rocks are more easily eroded than the other sedimentary formations.

These sedimentary formations were deposited in shallow saltwater seas during the Late Ordovician Period approximately 400 million years ago.[74] Deposits of saline water lie below these formations at variable depths in Kentucky, ranging from 50 ft (15 m) to over 2000 ft (610 m) below the current land surface. In the local region, depths to saline rich water average about 100 ft (30.5 m) below the major valley bottoms. Mineral springs are created by water flowing through the underlying Ordovician formations where the trapped salts are dissolved and carried, in solution, to the surface.[75] Solutions of salt from the rocks or residual salts of connate water in the deeper formations alter the chemical quality of the water.[76] Connate water refers to liquids trapped within sedimentary rocks.

Saline groundwater from these deeper formations flows up through the bedrock to emerge at the surface as salt springs occurring in the lacustrine deposits in Big Bone Valley. A series of these springs are currently found along the deeply eroded stream valleys, especially near the confluence of Big Bone Creek and Gum Branch. The majority of springs are located within an approximately 80-acre area around this confluence. This entire area is now included within the limits of Big Bone Lick State Historic Site.

After the retreat of the Wisconsin glaciation, large Pleistocene vertebrates who needed salt as part of their diet were attracted to these naturally occurring salt springs. Many animals were either killed or died entrapped in the marshy ground there. Complicated cycles of lacustrine and alluvial deposition buried the bones of many animals and bone layers have been found to depths of 30 ft (9 m) below the present ground surface. Later cycles of erosion along Big Bone Creek have since eroded and reworked these sediments, exposing fossilized bones to early collectors.[77]

Sometime before 10,000 years ago, Native Americans followed animals to the springs, both for hunting and as a source for salt for their diet as well. Later, the salt springs continued to provide a source of salt for animals

[74] Stokes and Lowthert, *Phase I Archaeology Survey.*
[75] Richard Boisvert and Steven Cordiviola, "A Distributional Analysis of Kentucky Salines," Paper presented at the Kentucky Academy of Sciences Annual Meeting, Ashland, Kentucky, 1982.
[76] H. T. Hopkins, *The Fresh-Saline Water Interface in Kentucky* (Lexington: Kentucky Geological Survey, University of Kentucky, in cooperation with US Department of the Interior, United States Geological Survey, 1966).
[77] Schultz et al.; Richard A. Davis, "Big Bone! Kentucky's Original Stick-In-The-Mud," *Rocks and Minerals* 56, no. 3 (1981):114-118; Kenneth Tankersley, "The Potential for Early Man Sites at Big Bone Lick, Kentucky," *Tennessee Anthropologist* 10, no. 1 (Spring 1985): 27-49; Kenneth B. Tankersley, Michael R. Waters, and Thomas W. Stafford, Jr., "Clovis and the American Mastodon at Big Bone Lick, Kentucky," *American Antiquity* 74, no. 3 (2009): 558-567; Tankersley, "The Potential for Early Man," 27-49: Tankersley et al., "Clovis and the American Mastodon," 558-567.

present in the area during the early European settlement period in Kentucky, circa 1750s onward. Animals would come to lick the soil to get the salt required for their diet, thus these sites were referred to by the early European settlers as "licks." There are a number of similar "licks" around Kentucky, but none are associated with significant deposits of fossilized bones.

These stratified layers are defined as late Pleistocene terraces composed of lacustrine clayey silt with a later Holocene floodplain.[78] Bone layers were uncovered to depths up to 30 ft (9 m) below the current ground surface on these terraces. All contain concentrations of disarticulated bones or loose bones found together, but not connected as in a skeleton. Backwater alluviation (water from floods) in the Big Bone Valley occurred during the Tazewell Advance of the Wisconsin glaciation. This period culminated about 18,500 years ago.[79] Terrace 2 produced disarticulated remains of late Pleistocene fossils and an uncalibrated radiocarbon date of 17,200 +/- 600 BP (W1617). Terrace 2 has produced a series of four radiocarbon dates from both wood and bone that date to the late Pleistocene. The uncalibrated range is from 10,600 +/-250 to 12,210 +/-35 BP; calibrated, the range is minimum 11,714 to maximum 14,179 years.[80] Paleoindian period (before 10,000 BP) artifacts may have been recovered from these same layers but cannot be directly associated with the Pleistocene remains due to mixing of the deposits. One dated fragment of mastodon bone may exhibit a cut mark, but its nature is not conclusively defined.

Paleontological expeditions to the Big Bone Valley have impacted portions of the Pleistocene bone-bearing beds. These include the late eighteenth and nineteenth century collecting expeditions and one twentieth-century series of excavations. Early descriptions of expeditions speak of hand-dug holes that average about 20 ft (6 m) in diameter and may have extended to 10 ft (3 m) deeper. The exact locations of the earlier excavations are uncertain but were most likely in the vicinity of Gum Branch and Big Bone Creek. Twentieth-century excavation locations are better documented and include three areas:

KEN 1, southern end of site 15BE279, 895.4 m^2
KEN 2, within site 15BE449, about 500 m^2
KEN 3, within site 15BE269, 2,347.4 m^2

From 1962 to 1966, teams from the University of Nebraska excavated an 80 x 130 ft (24.2 x 37 m) area described as KEN-1 in the southern end of what was later designated Site 15Be270. Faunal materials were documented in three zones (A, B, and C) between 7 and 15 ft (2.1 and 4.5 m) below the ground surface in KEN-1.[81] Zone A (7 to 8.5 ft/2.1 to 2.6 m) contained the remains of domesticated animals (dog, pig, cow, and horse), modern bison, and white-tail deer, along with "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."[82] Zone A was interpreted as dating to the nineteenth century. Zone B extended from 8.5 to 11 ft (2.6 to 3.3 m) and included the remains of American elk and modern bison and deer. Precontact artifacts dating to the Middle Woodland were recovered from Zone B and are curated at the Behringer-Crawford Museum in Covington, Kentucky.[83]

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[78] Tankersley et al., "Clovis and the American Mastodon," 561.
[79] Schultz et al., *Big Bone Lick.*
[80] Tankersley et al., "Clovis and the American Mastodon," 562.
[81] Lowthert, *Resource Use and Settlement Patterning Around the Saline Springs and Salt Licks in Big Bone Lick State Park, Boone County, Kentucky*; Schultz et al., *Big Bone Lick.*
[82] Schultz et al., *Big Bone Lick.*
[83] Lowthert, *Resource Use and Settlement Patterning Around the Saline Springs and Salt Licks in Big Bone Lick State Park, Boone County, Kentucky.*

Schultz, et al., observed that "the bones of the modern bison are very abundant at this level and are associated with wood, roots, nuts, leaves, broken shells of large mollusks, and pieces of flint." The deepest stratigraphic layer documented in KEN-1 (Zone C) extended from 11 to over 16 ft (3.3 to 4.8 m) deep.[84] The remains of the following animals were recovered from Zone C: giant ground sloth, mastodon, ancient bison, musk ox, stag moose, *Rangifer tarandus* (caribou), and horse. Lowthert's study notes that artifacts recovered from the interface between Zones B and C in unit KEN-1 date to the Late Archaic (5,000-3,000BP), while artifacts diagnostic of the Early Archaic (10,000-8,000 BP) were recovered from Zone C.[85]

A portion of site 15BE440 was excavated in 1962 as KEN-2 by the University of Nebraska's archeological excavations. That excavation opened an area of approximately 0.05 ha (0.11 acre) in the northeastern corner of what was subsequently identified as Site 15Be440. The Nebraska excavation recovered the remains of a variety of megafauna from the so called "blue clay layer" between 3.8 and 5 m (12.5 and 16.6 ft) below surface, including giant ground sloth, mastodon, bison, musk ox, stag moose, *Odocoileus virginianus* (white tailed deer), and horse.[86]

More recent investigations have included archeological surveys and excavations and limited paleontological testing.[87] Big Bone Lick continues to attract archeological interest for future research, particularly with respect to identifying possible relationships with the Paleoindian culture.[88]

Among noncontributing resources at Big Bone Lick are twenty-four known archeological sites with components ranging in date from the Paleoindian to Historic periods. Twenty-one of these sites are listed as contributing resources of the National Register Big Bone Lick Archeological District (NRIS 00000284, listed August 22, 2002) (15BE001, 15BE018, 15BE265, 15BE266, 15BE267, 15BE268, 15BE269, 15BE270, 15BE271, 15BE272, 15BE273, 15BE440, 15BE442, 15BE444, 15BE445, 15BE447, 15BE448, 15BE449, 15BE450, 15BE451, 15BE452). Three are considered noncontributing resources (15BE441, 15BE443, 15BE446) to that National Register District. These resources are described in detail in the National Register of Historic Places nomination for the Big Bone Lick Archeological District.[89]

It should be noted that until further survey and analysis is conducted, these known archeological resources do not merit nomination for national significance under NHL Criterion 6. NHL nomination documentation may be updated in the future if analysis of excavations demonstrates the integrity and research potential of archeological resources present is found to merit consideration for NHL designation.

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[84] Schultz et al.

[85] Lowthert, *Resource Use and Settlement Patterning Around the Saline Springs and Salt Licks in Big Bone Lick State Park, Boone County, Kentucky.*

[86] Schultz et al.

[87] Jeannine Kreinbrink, *Junior Curator Program in Archaeology Final Report: 2003 Excavations at Site 15Be452, Big Bone Lick State Park, Boone County, Kentucky,* Submitted to Kentucky Department of Parks and Office of State Archaeology, Kentucky Antiquities Permit #01-13 (2004), on file at OSA, Behringer Crawford Museum, and Kentucky Department of Parks; Lowthert, *Resource Use and Settlement Patterning Around the Saline Springs and Salt Licks in Big Bone Lick State Park, Boone County, Kentucky*; Email, John McAndrews to Big Bone Lick State Park with results of water analysis (University of Toronto, 2001), on file at Big Bone Lick State Park; Deidre M. McCartney, Megan A. Finney, and J. Barry Maynard, *Sources of the Salt in the Big Bone Lick Springs, Northern Kentucky*, North-Central Section, 39th Annual Meeting (May 19–20, 2005), Paper No. 24-13, Abstract, (2005); Miller and Duerksen, "Excavation of a Prehistoric Feature," 131-160; Otte*;* Stokes and Lowthert, *Phase I Archaeology Survey;* Storrs et al.; Striker et al, *Big Bone Lick*; Tankersley, "Potential for Early Man;" Tankersley et al., "Clovis and the American Mastodon," 558-567.

[88] Native American time frames from the Paleoindian through Historic periods are also represented at Big Bone Lick. Native Americans visited and lived in the Big Bone Valley from at least 13,000 years ago until the mid-eighteenth century. Further Historic period Native American activity has been documented by a recent discovery of a bison kill site within the park, see Storrs et al.

[89] Striker et al., *Big Bone Lick.*

Type specimens (holotypes) from at least four Pleistocene species recovered from Big Bone Lick are housed at the Academy of Natural Sciences in Philadelphia (now at Drexel University). The University of Nebraska holds the primary collection from 1960s paleontological excavations. Collections from the site are or have been housed at least at: the cabinet of curiosities at the Tower of London; Muséum national d'Histoire naturelle in Paris; Cincinnati Museum Center in Ohio; Behringer Crawford Museum, Covington, Kentucky; Northern Kentucky University, Highland Heights, Kentucky; and Big Bone Lick State Historic Site, Kentucky. These collections continue to influence paleontologists.[90]

The long history of uncontrolled archeological and paleontological excavations conducted between the discovery of the site and the creation of Big Bone Lick State Historic Site makes it difficult to make a definitive statement regarding the integrity of present subsurface deposits. Early expeditions reportedly removed fossil and archeological remains from holes averaging 20 ft (6 m) in diameter and 10 ft (3 m) in depth. Some material was removed in the relatively better documented excavations in the 1960s, but no major investigations have taken place since then. It is the professional opinion of scholars who have worked at the site that significant paleontological deposits remain within the property on large unexamined tracts of land.[91] In addition, excavated paleontological sites may have materials or artifacts which could provide scholars with evidence of historic practices of recreational or scientific fossil exhumation.

Since 1960, the relevant part of the Big Bone Creek Valley has been part of Big Bone Lick State Historic Site. The formation of the park has served to preserve and protect the buried fossil remains. The Park serves both a recreational and educational purpose. Within the proposed NHL boundary, non-contributing buildings and structures include two roofed shelter houses, two children's playgrounds, and four modern buildings. Buildings include the manager's residence, park office and visitor center, and vacant nature center. The fourth building is the Big Bone Methodist Church, listed individually in the National Register of Historic Places (NRIS 88003287, February 6, 1989). The church building sits just south of Route 338 and west of the park entrance. Although listed in the National Register, the building is non-contributing to the National Historic Landmark nomination as its use was not associated with exploration of the valley for Pleistocene fossils.

Today, the Kentucky Department of Parks maintains the park primarily as naturalized prairie, mowed pasture grass, and localized wooded areas, especially along the stream margins. The Gum Branch and Big Bone Creek confluence lies in woods with prairie and mowed fields surrounding it.

Big Bone Lick State Historic Site is listed in the National Register of Historic Places as the Big Bone Lick Archeological District. First listed in 1972, boundary expansion and additional documentation took place in 1997 and 2002.[92] Big Bone Lick State Historic Site was designated as a National Natural Landmark in 2009.[93]

[90] Mayor, 1-31.
[91] Striker et al., *Big Bone Lick*,14.
[92] Striker et al., *Big Bone Lick.*
[93] Jeannine Kreinbrink and John Rockaway, *Big Bone Lick State Historic Site* National Natural Landmark Application (2009), on file with the National Park Service and Kentucky State Parks.

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Previous documentation on file (NPS):

_X_ Previously listed in the National Register (fill in 1 through 6 below)

___ Not previously listed in the National Register (fill in **only** 4, 5, and 6 below)

1. NRIS: 72001585 and 00000284
2. Date of listing: June 13, 1972; additional doc. 1997, 2002
3. Level of significance: National
4. Applicable National Register Criteria: A_X_ B__ C__ D_X_
5. Criteria Considerations (Exceptions): A__ B__ C__ D__ E__ F__ G__
6. Areas of Significance: Science; Social/Humanitarian

__ Previously Determined Eligible for the National Register: Date of determination:
__ Designated a National Historic Landmark: Date of designation:
__ Recorded by Historic American Buildings Survey: HABS No.
__ Recorded by Historic American Engineering Record: HAER No.
__ Recorded by Historic American Landscapes Survey: HALS No.

Location of additional data:

State Historic Preservation Office:

Other State Agency: Kentucky State Parks

Federal Agency: National Park Service, National Natural Landmark (2009)

Local Government: Boone County Public Library

University: University of Nebraska, Lincoln, NE

Other (Specify Repository): Academy of Natural Sciences, Drexel University, Philadelphia, PA**,** Behringer Crawford Museum, Covington, KY

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MAP LOG

Map 1. Location map, showing Regional Natural Areas and Big Bone Lick State Park, Boone County, Kentucky. Source: Fenneman and Johnson, Physiographic Regions (1946); USGS Digital Elevation Model; and USGS Kentucky GAP Analysis Land Cover (2001)

Map 2. USGS topographic map showing proposed National Historic Landmark boundary.

Map 3. Aerial photo showing proposed National Historic Landmark boundary with longitude/latitude coordinates. Aerial photo and coordinates provided by Kentucky State Parks, used with permission.

Map 4. Map of general location of 1960s excavations. Source: National Register (1971)

Map 5. Portions of the Union, Rising Sun, and Verona geological quadrangles showing Big Bone Lick and current spring locations, adapted from Center for Applied Ecology, Northern Kentucky University, 2005.

FIGURE LOG

Figure 1. Historic map with annotation stating: “the large bones are found here” and illustration of an American mastodon molar, likely collected by Croghan in 1766 at Big Bone Lick. Sources: Filson et al., 1784; Collinson, 1768.

Figure 2. Map dating to 1831 of Big Bone Lick, annotated in 1971. Source: Cooper, 1831, reproduced in National Register Nomination, 1971.

Figure 3. Diagrammatic cross section showing main bone-bearing zones below the terraces at University of Nebraska collecting localities KEN-a and KEN-2, Big Bone Lick, Kentucky. Source: Schultz et al., 1967.

The following six figures courtesy of the Academy of Natural Sciences, Drexel University (formerly the American Philosophical Society), used with permission.

Figure 4. *Mammut americanum*, maxilla 13307, Jefferson Collection

Figure 5. *Bootherium bombifrons,* cranium 12994, Jefferson Collection

Figure 6. *Mammut americanum*, humurus 12598, Jefferson Collection

Figure 7. *Mammut americanum*, right mandible 13103, Jefferson Collection

Figure 8. *Mammut americanum,* molar 13134, Jefferson Collection

Figure 9. Cabinet drawer of *Mammut americanum* fossils with Big Bone Lick provenance.

Figure 10. Fossil bones of ice-age mammals collected at Big Bone Lick in 1963 by the University of Nebraska. The bones are curated in the University's paleontological collections. Photographs by Stephen Greb, used with permission, https://www.uky.edu/KGS/education/did-big-bone-lick-ice-age-mammals.php.

Figure 11. Bones from Thomas Jefferson's Big Bone Lick collection at the Academy of Natural Sciences in Philadelphia. Photographs by Stephen Greb, used with permission, https://www.uky.edu/KGS/education/did-big-bone-lick-birthplace.php.

PHOTO LOG

Photos of Big Bone Lick State Historic Site provided by the Park and used with permission. Unless otherwise noted, photos taken June 2022.

Photo 1. View southwest across the valley from the Park entrance driveway.

Photo 2. View southeast across the valley from the Park entrance driveway.

Photo 3. View southwest toward Big Bone Creek (in tree line). Note springs at right of the historical marker.

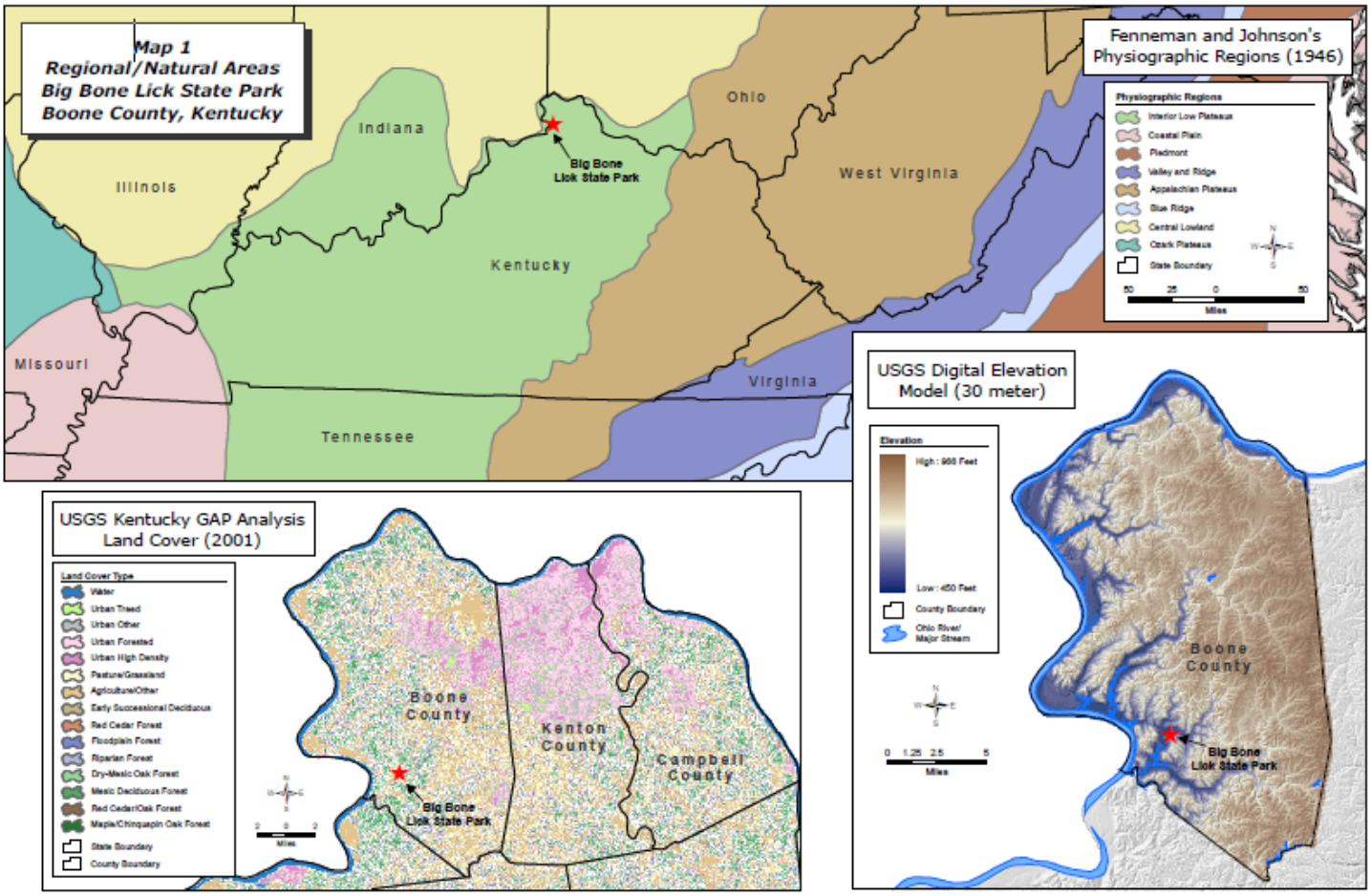
Photo 4. General view of the Big Bone Creek Valley from an upper terrace.

Photo 5. Big Bone Creek in early spring.

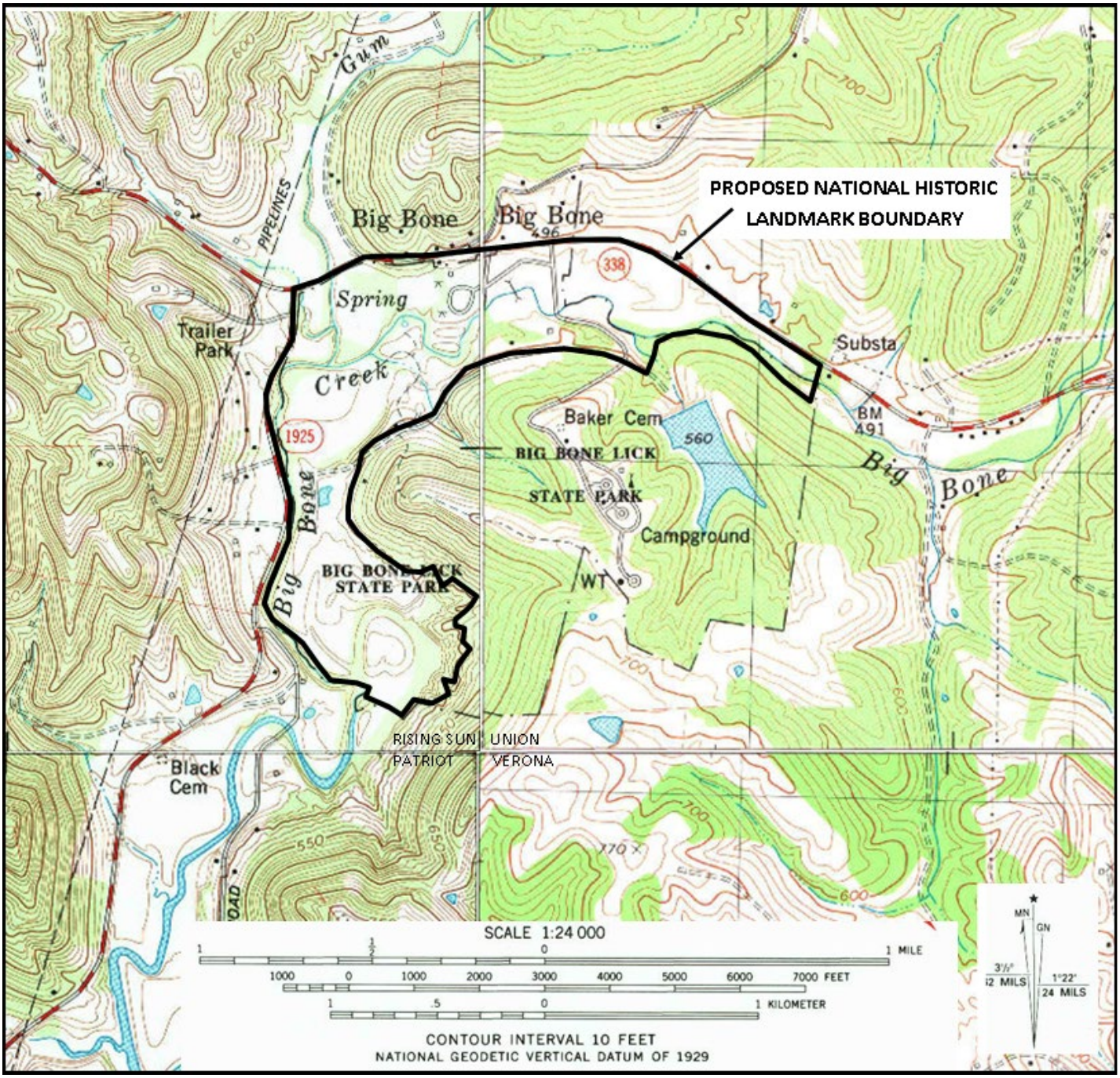
Photo 6. Big Bone Creek in winter.

MAPS

Map 1. Location map, showing Regional Natural Areas and Big Bone Lick State Park, Boone County, Kentucky. Source: Fenneman and Johnson, Physiographic Regions (1946); USGS Digital Elevation Model; and USGS Kentucky GAP Analysis Land Cover (2001)

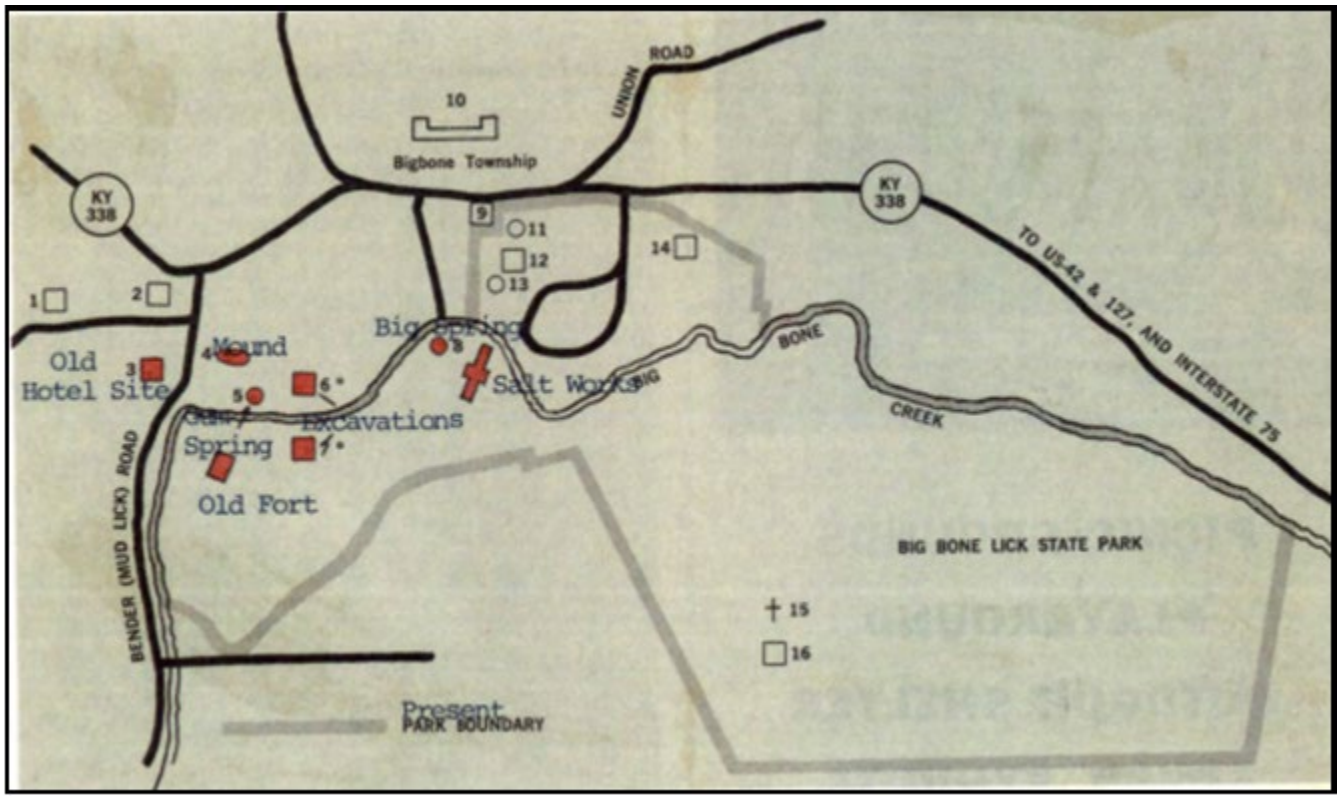


Map 2. USGS topographic map showing proposed National Historic Landmark boundary. Source: USGS 7.5-minute topographic maps: Patriot, Rising Sun, and Verona 1981, and Union 1982.

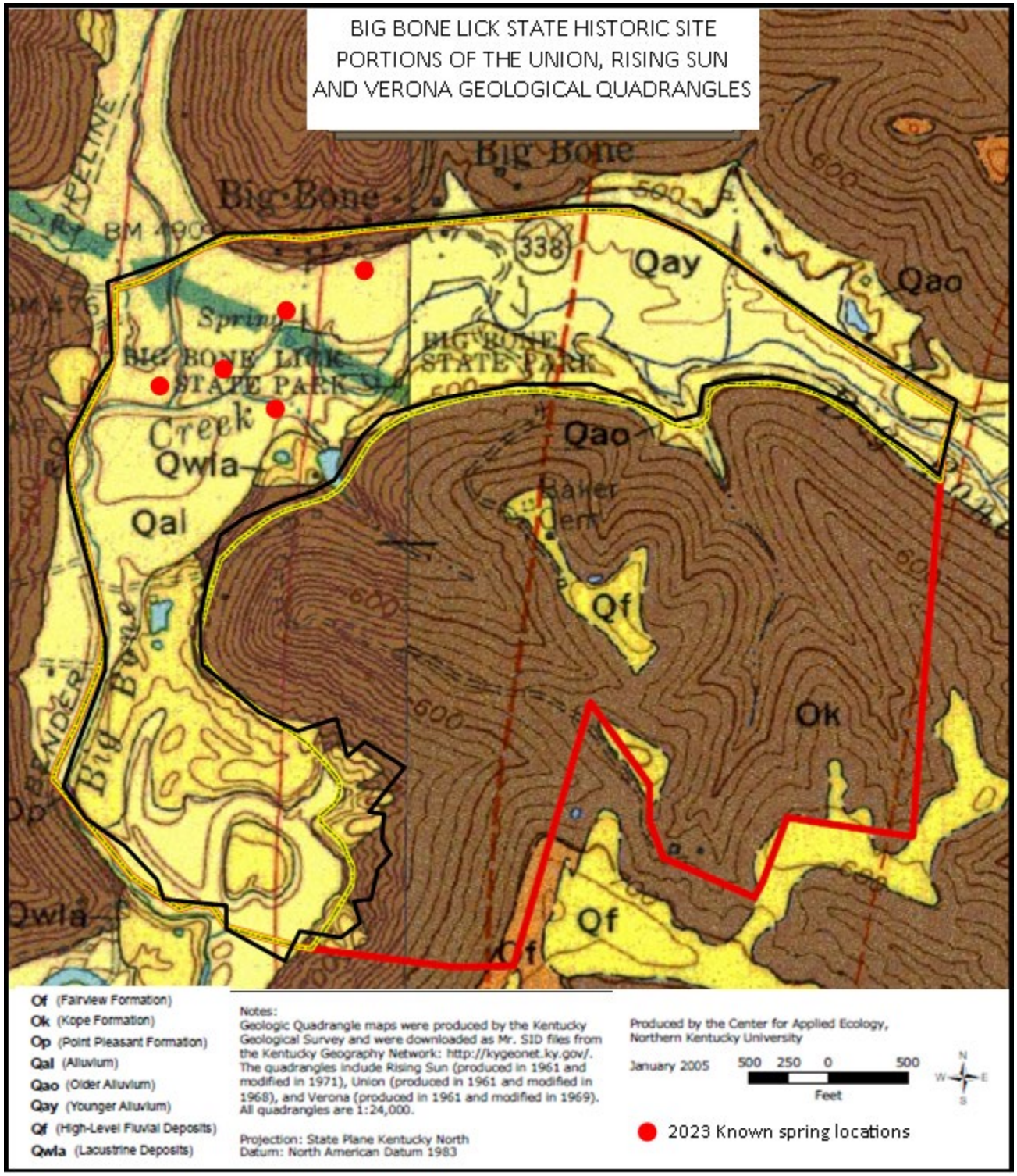


Map 3. Aerial photo showing proposed National Historic Landmark boundary with longitude/latitude coordinates. Aerial photo and coordinates provided by Kentucky State Parks, used with permission.

Map 4. Map of general location of 1960s excavations. Source: National Register (1971).



Map 5. Portions of the Union, Rising Sun, and Verona geological quadrangles showing Big Bone Lick and current spring locations, adapted from Center for Applied Ecology, Northern Kentucky University, 2005.



FIGURES

Figure 1. Historic map with annotation stating: “the large bones are found here” and illustration of an American mastodon molar, likely collected by Croghan in 1766 at Big Bone Lick. Sources: Filson et al., 1784; Collinson, 1768.

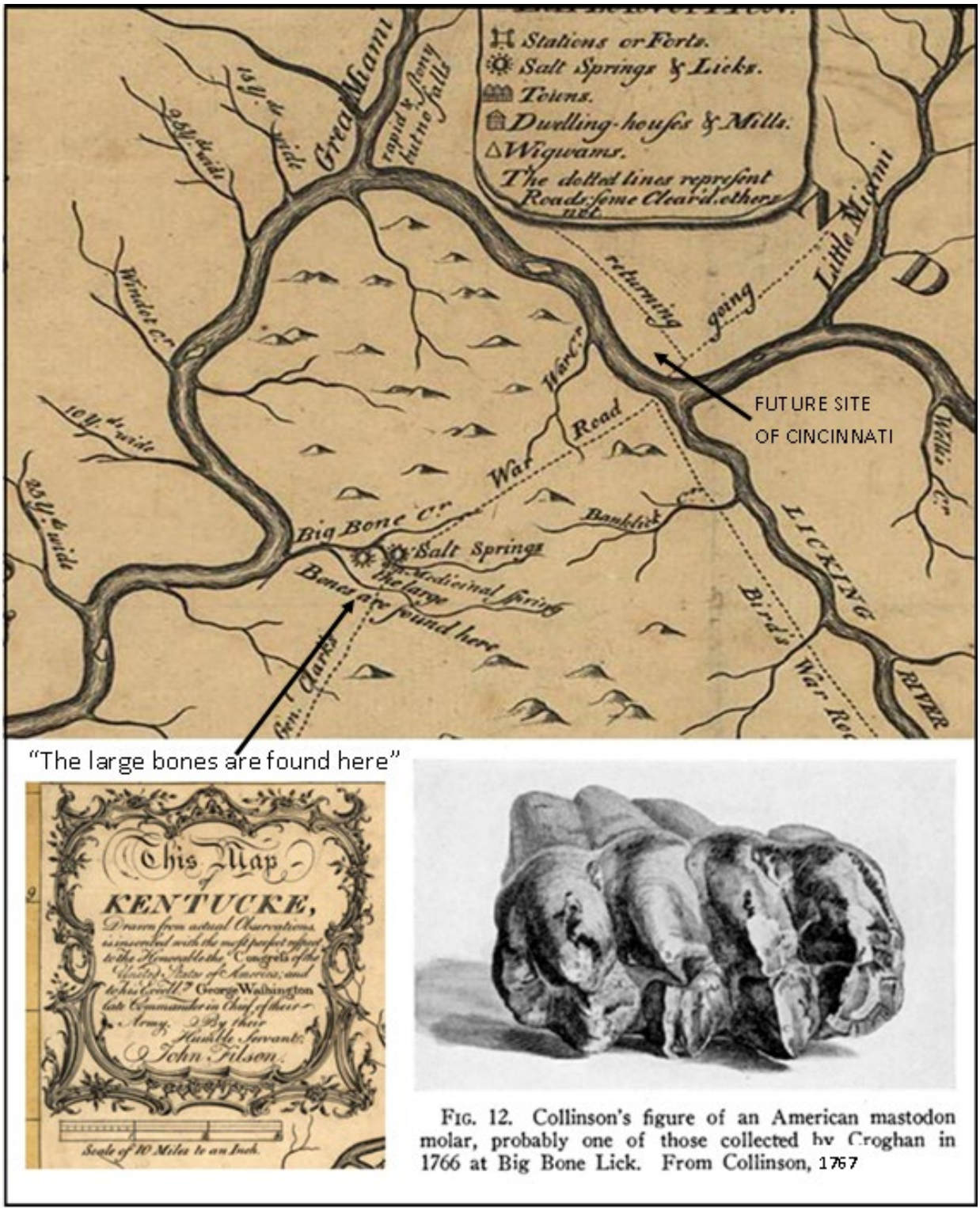
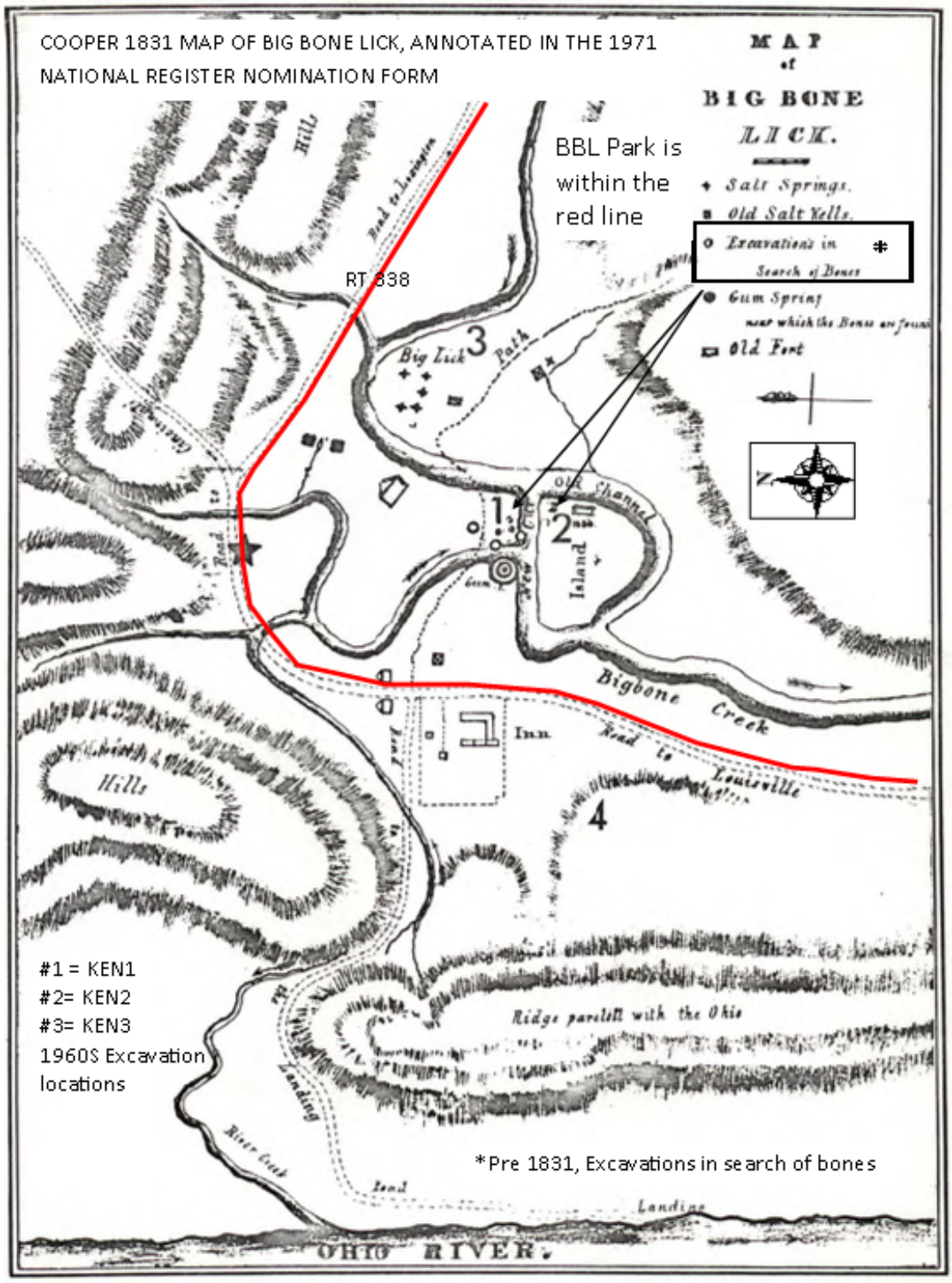


FIG. 12. Collinson's figure of an American mastodon molar, probably one of those collected by Croghan in 1766 at Big Bone Lick. From Collinson, 1767

Figure 2. Map dating to 1831 of Big Bone Lick, annotated in 1971. Source: Cooper, 1831, reproduced in National Register Nomination, 1971.



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 Mastadon Hill is designated by number 4.

Figure 3. Diagrammatic cross section showing main bone-bearing zones below the terraces at University of Nebraska collecting localities KEN-a and KEN-2, Big Bone Lick, Kentucky. Source: Schultz et al., 1967.

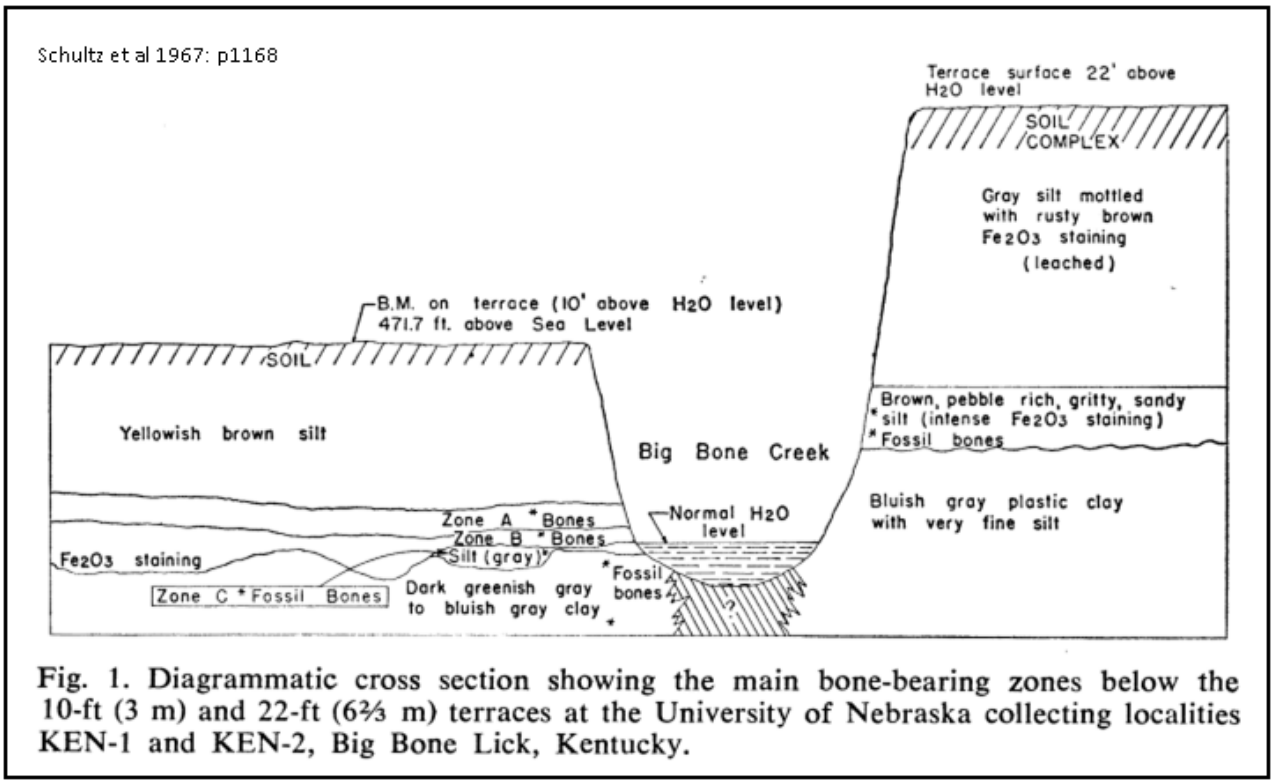


Fig. 1. Diagrammatic cross section showing the main bone-bearing zones below the 10-ft (3 m) and 22-ft (6⅔ m) terraces at the University of Nebraska collecting localities KEN-1 and KEN-2, Big Bone Lick, Kentucky.

The following six figures courtesy of the Academy of Natural Sciences, Drexel University (formerly the American Philosophical Society), used with permission.

Figure 4. *Mammut americanum*, Jefferson Collection, maxilla 13307

Figure 5. *Bootherium bombifrons,* cranium 12994, Jefferson Collection

Figure 6. *Mammut americanum*, humurus 12598, Jefferson Collection

Figure 7. *Mammut americanum*, right mandible 13103, Jefferson Collection

Figure 8. *Mammut americanum,* molar 13134, Jefferson Collection

Figure 9. Cabinet drawer of *Mammut americanum* fossils with Big Bone Lick provenance.

Figure 10. Fossil bones of ice-age mammals collected at Big Bone Lick in 1963 by the University of Nebraska. The bones are curated in the University's paleontological collections. Photographs by Stephen Greb, used with permission, https://www.uky.edu/KGS/education/did-big-bone-lick-ice-age-mammals.php.

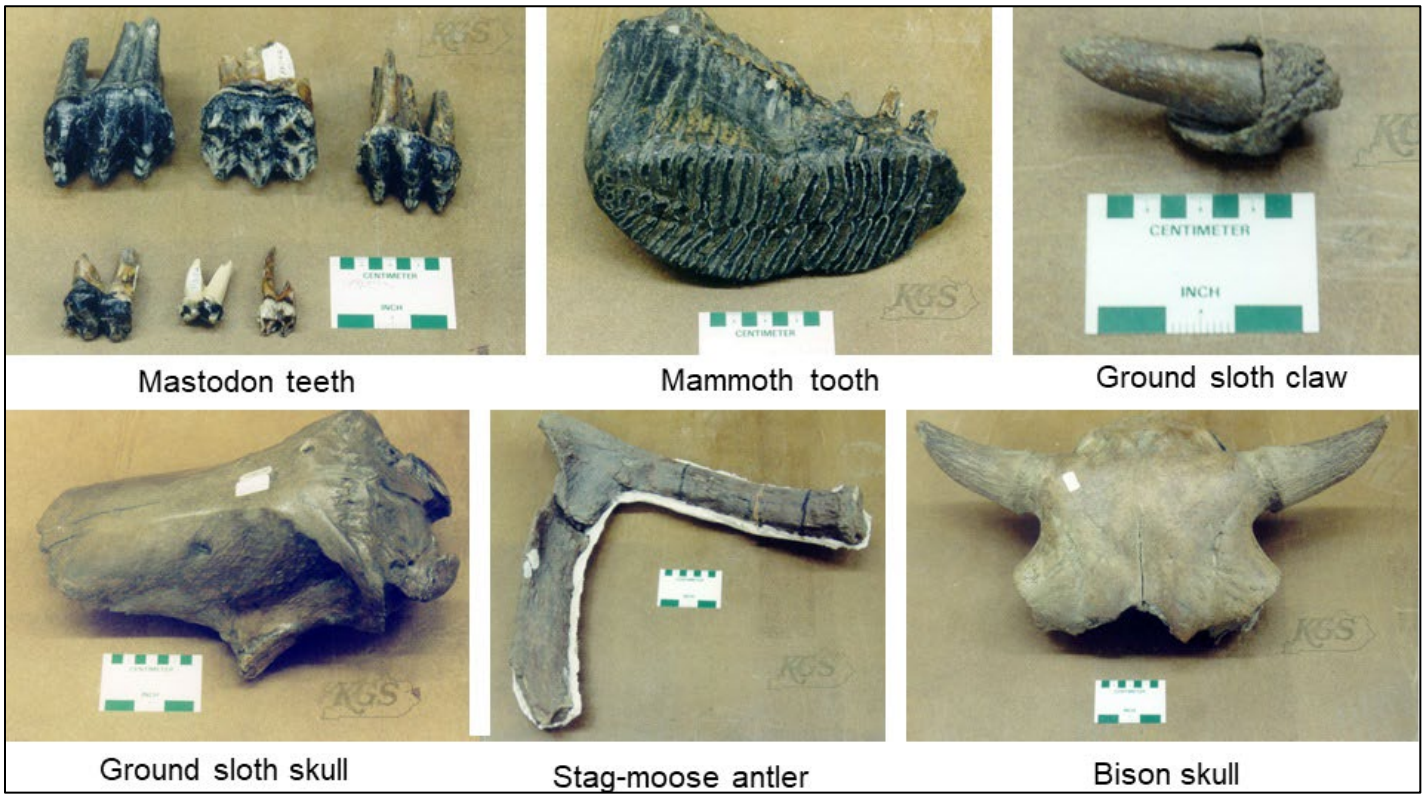
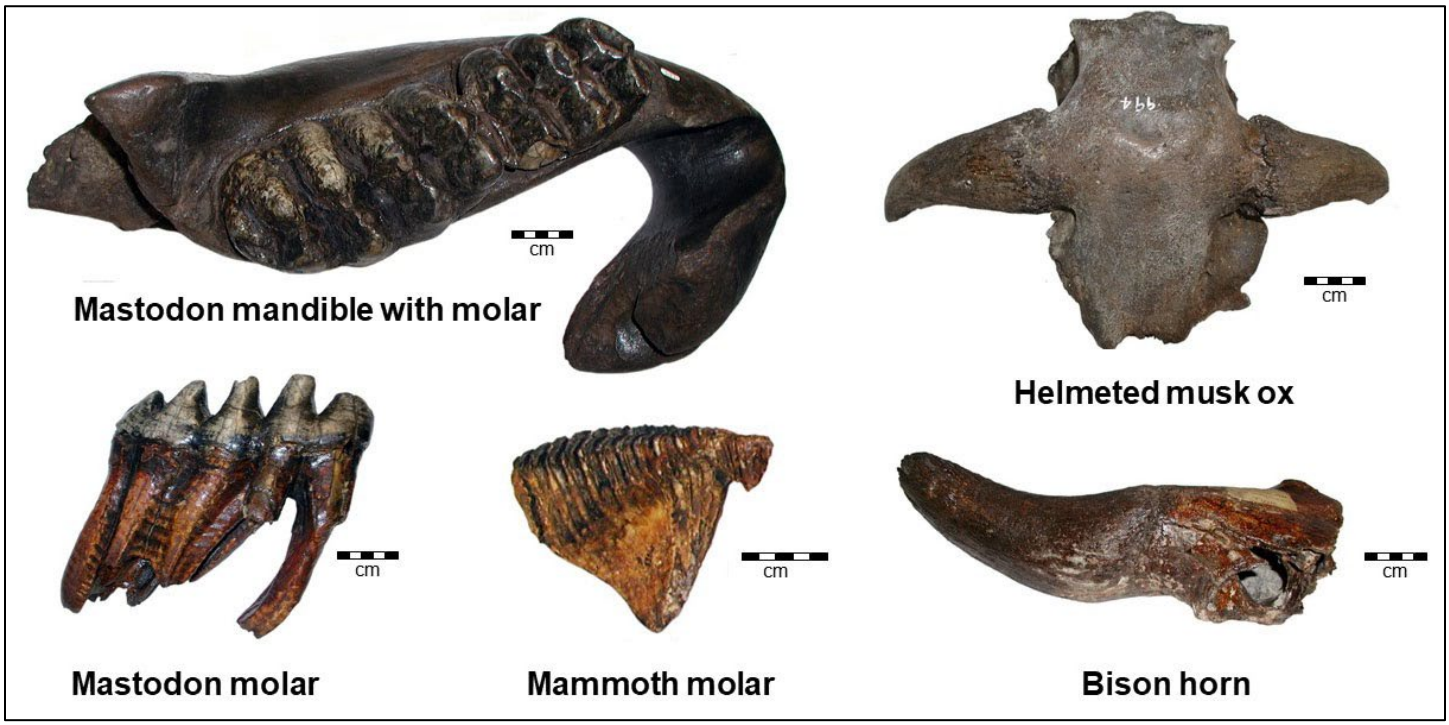


Figure 11. Bones from Thomas Jefferson's Big Bone Lick collection at the Academy of Natural Sciences in Philadelphia. Photographs by Stephen Greb, used with permission, https://www.uky.edu/KGS/education/did-big-bone-lick-birthplace.php.



PHOTOS

Photos of Big Bone Lick State Historic Site provided by the Park and used with permission. Unless otherwise noted, photos taken June 2022.

Photo 1. View southwest across the valley from the Park entrance driveway.

Photo 2. View southeast across the valley from the Park entrance driveway.

Photo 3. View southwest toward Big Bone Creek (in tree line). Note springs at right of the historical marker.

Photo 4. General view of the Big Bone Creek Valley from an upper terrace.

Photo 5. Big Bone Creek in early spring.

Photo 6. Big Bone Creek in winter.