

# THE HISTORICAL TIMES

NEWSLETTER OF THE GRANVILLE, OHIO, HISTORICAL SOCIETY

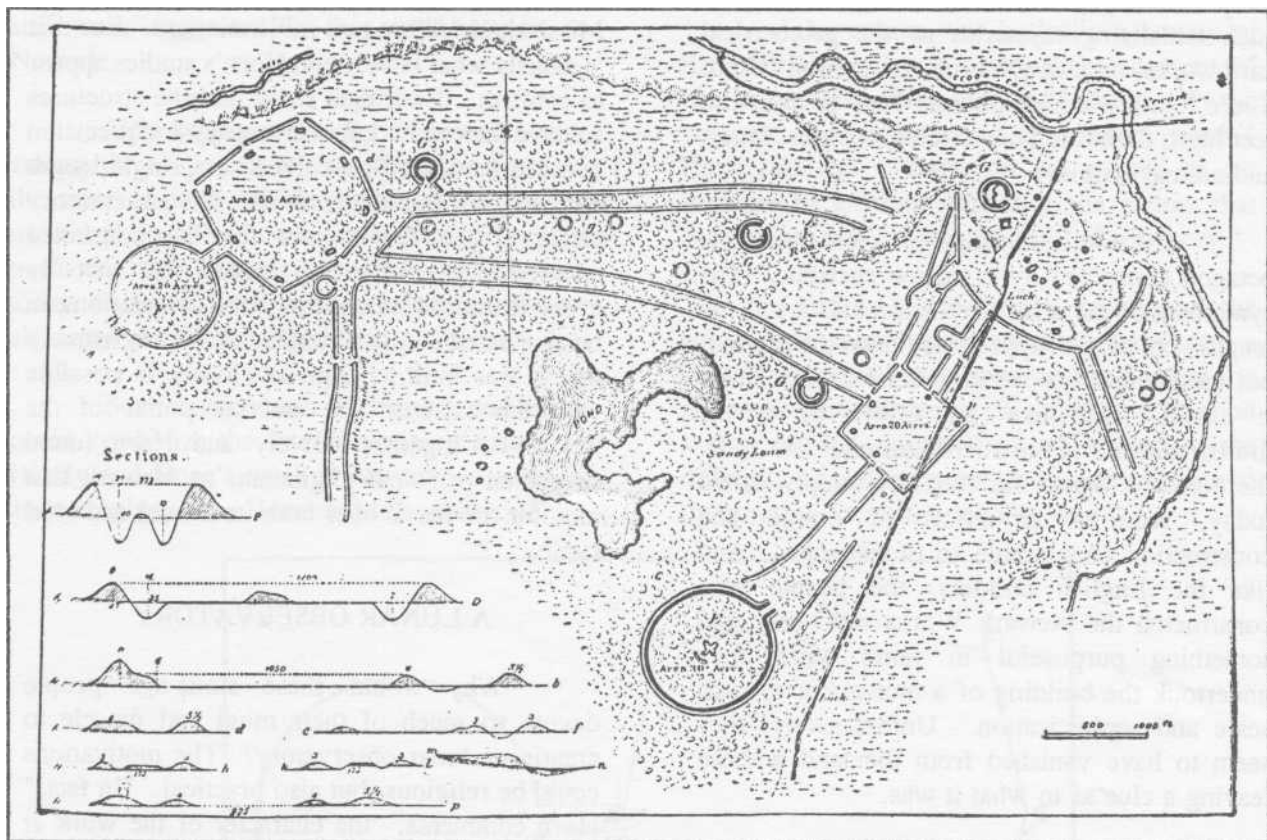
Volume IX Number 2

Spring: 1995

## MOON MAZE

THE NEWARK MOUNDS:

NATIVE AMERICAN EARTHWORKS SCULPT LUNAR ODYSSEY



The Newark Mounds have served as an impetus for the construction of several fascinating theories concerning both their origin and development as well as their purpose. In this essay by two members of the Farlham College Faculty, Professors Robert Horn and Ray Hively, the possibility of interpreting the Newark Mounds as a lunar observatory is discussed in some detail.

The map pictured above is from the 1847 survey indicating how the Newark Mounds appeared to the early settlers coming to Ohio in the first part of the Nineteenth Century. Several sections of the mounds, notably the avenues, have been destroyed over the years. Nonetheless, traces are still visible in contemporary aerial photographs.

# MOON MAZE

## *Native American Earthworks Sculpt Lunar Odyssey*

The Mound Builders persist as one of the great American anthropological puzzles. Just who were these neolithic natives who populated the eastern half of the United States a thousand years before and after Christ? And what of their predilection for fashioning these earthen structures that today dot the landscape from Oklahoma to Pennsylvania by the thousands?

Hobbled by insufficient evidence and confusing myth, researchers have been slow in finding the answers. But the questions grow more demanding when one is confronted with such tantalizing mysteries as the geometrical earthworks outside Newark in central Ohio. There, grassy embankments, four to fourteen feet high, delineate huge circles, squares, lanes, and animal effigies.

The dominant figure is a giant circle and octagon connected by a narrow corridor. The symmetry of the structure--some half a mile in length--can be well appreciated from the ground, but viewed from above its precision astonishes. It could look like an effort of divine draftsmanship. Constructed around 300 A.D. the Newark Works, as they are simply called today, required an effort in design and construction comparable to Stonehenge. And like the English builders, the people who constructed the Newark Works obviously had something purposeful in mind when they undertook the building of a monument of such scale and sophistication. Unfortunately, they seem to have vanished from the land without leaving a clue as to what it was.

### A PIECE OF THE PUZZLE

Now two Earlham professors believe they have found a piece of the puzzle, and if their theories are correct, anthropologists may have to upgrade their estimations of the capabilities of North America's ancient societies.

What Ray Hively and Robert Horn conclude after more than eight years' study is the circle-octagon and associated structures at Newark were--and remain--a lunar observatory: a geometric construct for marking the monthly rise and set points of the moon over its 18.6-year cycle.

Aside from the enormous physical undertaking, creating such an astronomical gauge would require a degree of mathematical and engineering knowledge unsuspected in the "Hopewell culture," an anthropological name attached to these people who flourished in the Mississippi Valley two millennia ago. But that is exactly what Hively and Horn's studies appear to confirm. Their data show that the structures achieve their remarkable symmetry and precision because they were conceived on a single length of measure--the diameter of the observatory circle (1,054 feet). As for the connected octagon, a careful survey reveals that virtually every feature of its geometry and orientation can be accounted for by a simple hypothesis: namely that it was built to align as closely as possible with the extreme rise and set points of the moon. Altogether, Hively and Horn found seventeen principal alignments at Newark that monitor the moon over both its annual and total cycle.

### A LUNAR OBSERVATORY

Why would these stone-age people devote so much of their mind and muscle to creating a lunar observatory? The motivations could be religious, but also practical. "In fact," Horn comments, the character of the work at Newark blurs the simplistic distinctions we are accustomed to make among religion, technology, and science. We find the same kind of condensation of the theoretical and practical in the Pythagorean cult among the Greeks. There science formed a private cult, yet its results had a direct bearing upon the design of instruments for celestial calculation."

The motions of the moon against the "fixed stars," as well as its constantly changing shape, from night to night, first fascinate the observer in their blending of pattern and regularity with constant change. But it is a long step from this fascination to careful record-keeping, and the development of an accurate calendar. Since a main feature of Hopewell is the growing dependence on maize agriculture, an accurate calendar was both a practical necessity and, quite probably, an intellectual delight and source of political power.

THE CONJUNCTION OF HEAVEN  
AND EARTH

Consistent with his colleague's observation about the Pythagoreans, Hively finds still more suggested in the circle-octagon at Newark.

"My own speculation," he says, "is that among the Hopewell we see the expression of the same impulse which generated the rise of natural philosophy in ancient Greece and which motivates the practice of theoretical physics today: the search for correspondences between abstract symmetries and natural phenomena."

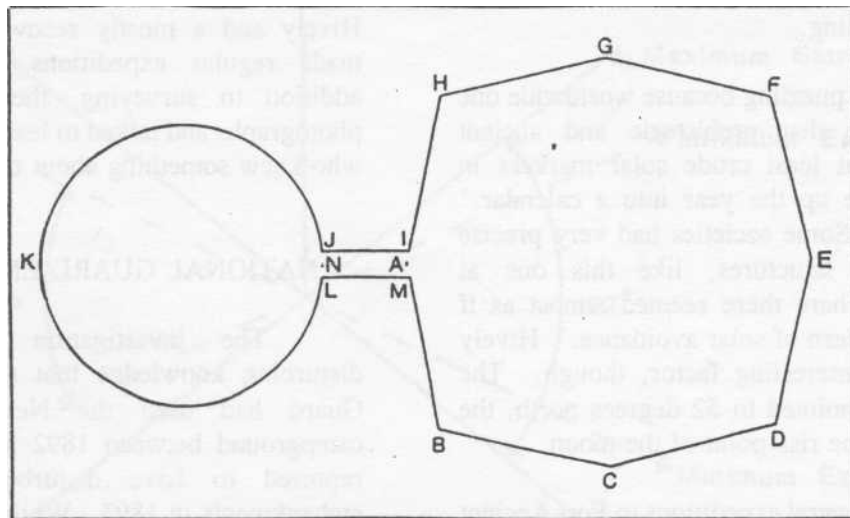
Such conjunction of heaven and earth could symbolize the interdisciplinary nature of Hively and Horn's work at Newark. Hively is an astrophysicist; Horn a philosopher. They

might seem, at first glance, an unlikely combination of researchers, but as it turned out, no other might have worked as well.

The team was formed in early 1975 when Earlham was getting serious about interdisciplinary education. Faculty from different departments were encouraged to find ways of integrating their fields. Several new hybrid courses were created in an effort to give students an understanding of how academic disciplines are shaped by human questions. Among the new curricular offerings was one called *Cosmology: From Stonehenge to the Big Bang*, an intensive two-semester taught by Hively, a relative newcomer to the Physics Department, and Horn, a vintage professor in Philosophy.

"The course was basically a survey of the philosophical and astronomical content of man's understanding of the nature of the universe from prehistoric to modern times," Horn recalled. "Early on we wanted to get students to examine critically the claims that Stonehenge was an astronomical observatory."

"And so," said Hively, picking up the story, "we would take some students and a surveying transit out on some archaeological site and make measurements. We thought it as good a way as any to get them to appreciate the difficulty of making accurate measurements and interpreting them in a reliable way."



A schematic plan of the geometry defined by the midline of the embankments of the Observatory Circle-Octagon combination.

## THE LEBANON EARTHWORKS

Horn suggested a field trip to Fort Ancient, the Hopewell earthworks near Lebanon, Ohio, fifty miles from campus. "We didn't expect to find anything except perhaps some crude solar alignments. And, really, we didn't find even that much that we could depend on," Hively said. However, some measurements on a group of five burial mounds inside Fort Ancient's perimeter embankments surprised them by the sheer symmetry. One angle formed by three of the mounds was just 15 minutes off 90 degrees," Horn remembered. "It got us to thinking whether it was intentional." Intriguing as the symmetry was, there was no way to prove it was deliberate since archaeologists had excavated the mounds long before and no precise record of their restoration could be found.

## A NEW PUZZLE

Nevertheless, it was enough to spur Hively and Horn to investigate further. Their curiosity took them soon to the Hopewell complex at Newark, some fifty miles east of Columbus. Hively reconnoitered the site first with a hand-held compass, then returned with a transit for more precise measurements. Fully expecting to find some approximate line-up with the sun, he found nothing of the kind, and that itself was puzzling.

"It was puzzling because worldwide one finds evidence that prehistoric and ancient societies had at least crude solar markers in order to divide up the year into a calendar," Hively said. "Some societies had very precise and elaborate structures, like this one at Newark. But here there seemed almost as if there was a pattern of solar avoidance." Hively did note one interesting factor, though. The circle-octagon pointed to 52 degrees north, the northern extreme rise point of the moon.

After several expeditions to Fort Ancient and Newark, the research slipped into hiatus for about eighteen months, partly because the

meager findings were giving little encouragement, but mostly because Horn had to drop out, incapacitated with Guillain-Barre Syndrome, a rare chronic inflammation of the spinal cord. The two made dark jokes that Horn had fallen victim to the "Hopewell curse," probably a strain of the same bane that caused their cars to break down nearly every time they drove to one of the mound sites.

## LUNAR SYMMETRY

In the meantime, the thought kept nagging Hively that the Hopewell had missed the sun because they aligned their structure with some other astronomical object, stellar or lunar. The latter was easier to confirm because, unlike the stars, the moon has stayed fairly locked in position with the earth's permutations over the millennia. So from Professor Anthony Aveni at Colgate University, Hively procured a set of computer calculations of the rise and set points of both the sun and moon in centuries past. **From the tables he noticed rough correspondences between the sides of the Newark octagon and key lunar positions around 250 A.D.** Thus it appeared that the structure had been systematically aligned with the moon. "I was amazed," said Hively.

Novel notion though it was, a great deal of exacting surveying was needed to confirm or refute it. So from 1977 and into 1980, Ray Hively and a mostly recovered Robert Horn made regular expeditions to Newark. In addition to surveying, they gathered aerial photographs and talked to leading archaeologists who knew something about the Hopewell.

## NATIONAL GUARD ENCAMPMENT

The investigation turned up the disturbing knowledge that the Ohio National Guard had used the Newark site for a campground between 1892 and 1922 and was reported to have disturbed parts of the embankments in 1893. While the scant records showed that the Guard "restored" the tampered portions before it decamped, Hively and Horn

had urgently to learn if the site had been altered significantly from the original Hopewell scheme.

Fortunately, from an 1888 resurvey of the site, sponsored by the Smithsonian Institution, they found that the Guard's changes had been minor except for the lengthening of one of the octagon's sides thirty feet in order to bring it into apparent symmetry. What the Guard engineers did not know was the Hopewell builders had intended the truncated side in order to catch a particular lunar rise point. For Hively and Horn, the discovery of the "correction" explained one of the missing alignments.

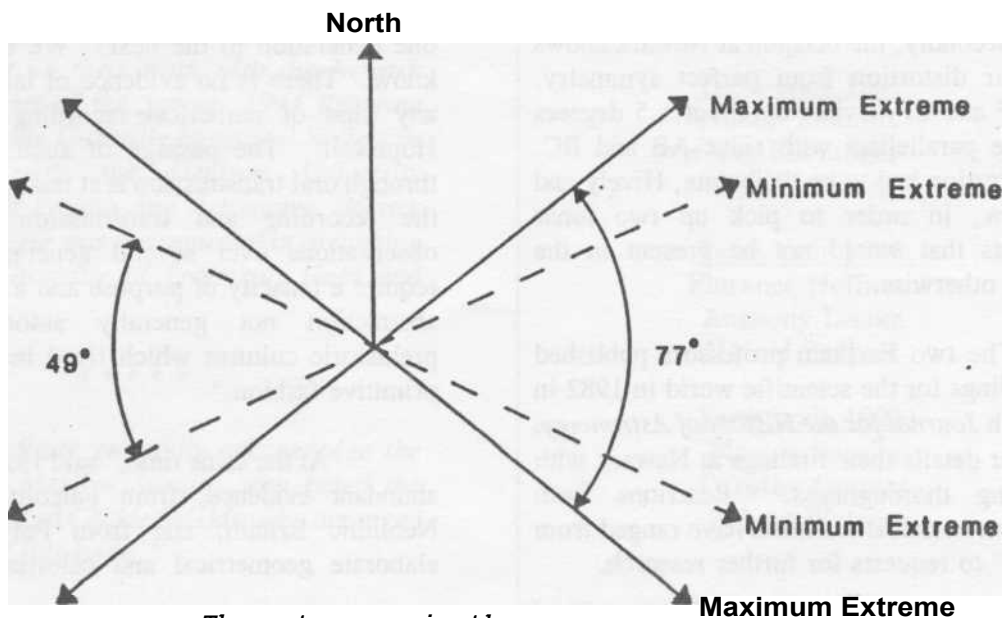
Because the Newark structure was complex and the odds of detecting chance alignments with astronomical phenomena were so great, Hively and Horn considered only those alignments between points for which independent geometric evidence exists to suggest they were consciously associated. For example, they considered sightings along linear embankments of the structure, axes of symmetry, and between other points defined by the geometry of the structure. To assure further fidelity, they rejected all potential alignments which did not have an azimuthal accuracy of better than 1 degree.

## THE EIGHTEEN AND ONE-HALF YEAR CYCLE

Behind all their research is the moon's behavior. During its monthly cycle the moon's rising point oscillates between northern and southern extremes on the horizon. Careful observation of this cycle over many years reveals that these rise points change as well and will show maximum and minimum limits over a period of 18.6 years. Thus, an observer will note altogether eight key lunar points over that period: four rise points representing the maximum and minimum northerly and southerly extremes and the corresponding set points.

Hively and Horn already knew that the major avenue axis of the circle-octagon targeted the moon's northern extreme rise position (in the figure a line connecting points KNAE) within 0.2 degrees. Surveys along the octagon's sides picked up four more key rise points, all within an average accuracy of 0.5 degrees: side AB, maximum south rise; side CB, minimum south set; side EF, maximum north set; side GF, minimum north rise.

Hively and Horn accounted for the remaining three key rise and set points by plotting in measurements from features



*The extreme azimuths of the lunar rise-set points at Newark are shown by the arrows.*

associated with the octagon, principally a small circle nearby and a square and circle further to the south. Although they eventually accumulated nine more lunar targets from the works, the two researchers grew more skeptical of their evidence and began raising the stakes for proof.

"There was always the chance, no matter how many alignments you find, that it's just a series of coincidences," said Hively. Horn remembered the doubt that nibbled at their confidence in their findings. "It seemed that the more convincing the evidence appeared to be, the more we came to suspect our own ingenuity. Were we somehow projecting our own view into the material we had accumulated? It took a long time before the two of us were ready to go beyond saying, 'Well, it's possible,' to state really that the Hopewell intended what was there."

Two additional considerations moved them to that conclusion: First, while it is possible to build equilateral octagons with an infinite variety of shapes and orientations, only one will align as well with lunar or solar extreme rise or set points. A specially written computer program told Hively and Horn that the chances the Hopewell had shaped and oriented their octagon by random to pick up the lunar alignments was about 1 in 20,000.

Secondly, the octagon at Newark shows a peculiar distortion from perfect symmetry. Sides GF and EF deviate by about 1.5 degrees from true parallelism with sides AB and BC. Such distortion had to be deliberate, Hively and Horn saw, in order to pick up two lunar alignments that would not be present in the structure otherwise.

The two Eariham professors published their findings for the scientific world in 1982 in the British *Journal for the History of Astronomy*. The paper details their findings at Newark with painstaking thoroughness. Reactions from archaeoastronomical scientists have ranged from "Bravos!" to requests for further research.

## THE CHILLICOTHE EARTHWORKS

What better evidence could there be than a second Hopewell circle-octagon observatory? Late last year (1983), Hively and Horn completed research on a similar structure called High Bank, near Chillicothe, fifty-five miles south of Newark. Without getting into detail, surveys show that the circle-octagon at High Bank is a Hopewell lunar *and* solar observatory. Hively and Horn's second paper, "Hopewellian Geometry and Astronomy at High Bank," will be published in the *Journal for the History of Astronomy* this summer.

The Hively-Horn discoveries at Newark and High Bank raise some new questions about the Hopewell and their original intentions. Implied in the circle-octagon alignments is a knowledge of the lunar 18.6 year cycle. To be aware that such a cycle exists is, of course, necessary to carefully observe and record it. But there are difficulties with this. For one, moonsets and moonrises are not always easy to observe. Hively estimates it would take a determined observation over at least a century to accurately record the entire cycle.

## A NONLITERATE SOCIETY

"The problem with that is this was a nonliterate society," Hively noted. "How were such observations recorded and passed on from one generation to the next? We simply don't know. There is no evidence of tally marks or any kind of numerical recording among the Hopewell. The passage of such information through oral transmission is at least possible, but the recording and transmission of precise observations over several generations would require a tenacity of purpose and a capacity for abstraction not generally associated with prehistoric cultures which lived in a relatively primitive fashion."

"At the same time," said Horn, "there is abundant evidence, from Paleolithic France, Neolithic Britain, and from Polynesia, that elaborate geometrical and celestial lore have

been 'stored' without the advantage of written language. We have yet to learn precisely how it was done in each case, but there is no doubt that it was done, and in some cases continues to be done."

For reasons archaeologists can only speculate about, the moon was intensely fascinating to the Hopewell, an object of great wonder and importance. Readily useful as a means of developing an accurate calendar, the moon must also have held great mystical value to these people.

In any case, Hively said, "If one stands inside the massive Newark octagon, especially on a moonlit night, one cannot help but be stirred by the stunning expenditure of physical, intellectual, and cultural energy in the construction of that work." It stands, he added, as an example of the kind of greatness which human beings can achieve when committed to ideas with sufficient power to inspire their imagination and courage.

*The Editors of THE HISTORICAL TIMES gratefully acknowledge permission to reprint this article given by Professors Horn and Hively and by the Earlham College Alumni Office. This article originally appeared in The Earlhamite, Volume 105, No. 1, Autumn, 1984, and was written by Richard Holden.*

*Professors Horn and Hively gave a public lecture on their work with the Newark Mounds as part of the Spring, 1994 Program sponsored by the Granville Historical Society in conjunction with the Denison University Department of Physics and Astronomy. Society member Ed Kerle was instrumental in arranging the visit to Granville of Professors Horn and Hively.*

*The editors gratefully acknowledge the assistance of Marilyn Sundin, who typed the original copy, and Cookie Shields, who arranged the format for this issue.*

## **THE HISTORICAL TIMES**

is a quarterly publication included with membership in the Granville Historical Society and is sent to all members.

### **EDITORIAL BOARD**

Maggie Brooks, Florence Hoffman,  
Anthony Lisska

Send questions, comments and suggestions to:

## **THE HISTORICAL TIMES**

P. O. Box 129

## **BOARD OF MANAGEMENT**

### **PRESIDENT:**

Thomas Martin

### **VICE PRESIDENT:**

Dan Campbell

### **SECRETARY:**

Virginia Fletcher

### **TREASURER:**

David Neel

### Term ends 1997:

Kevin Bennett

Kay Koeninger

Gay Weinberg

### Term ends 1996:

Florence Hoffman

Anthony Lisska

Harold Sargent

### Term ends 1995:

Maggie Brooks

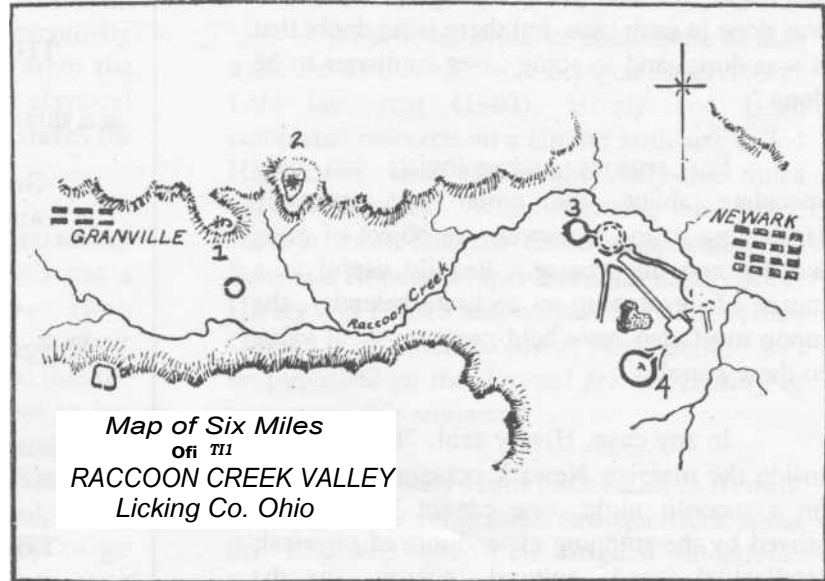
Dorothy Garrett

Robert Watson

## Important mounds in Granville and Newark

1. Alligator Mound
2. Fort Hill, north of the Bryn Du mansion.
3. The Circle-Octagon preserved as the Moundbuilders Golf Course
4. Great Circle Mound

On clear winter days, the Circle-Octagon is visible from the Alligator.



## Granville Explorations

The early settlers in Granville Township found numerous mounds. The Alligator and Fort Hill were discovered when the hill tops were explored. Four other "forts" were identified and dozens of semi-circles, crescents and conical mound dotted the country side. At least four mounds were within the original town plat: on top of Sugar Loaf, Mt. Parnassus, and College Hill, and in front of the Methodist Church near the intersection of Broadway and Main. Southwest of Fort Hill was a stone mound six feet high and eighteen feet wide and a gravel mound. A crescent shaped gravel mound lay further south near the present Newark-Granville Road. Most of the conical mounds contained burials and artifacts. During a period of intense interest in the second half of the nineteenth century most were opened and the contents scattered. The mounds on tillable ground were plowed and re-plowed and have disappeared.

In a paper presented to the one year old Granville Historical Society in the Spring of 1886, Professor E. F. Appy gave a detailed account of the first mound he opened in Granville, Licking County, Ohio on January 4, 1886. It was situated one mile southwest of the Village on a hill top. Conical in shape, it had a diameter of sixty-two feet at the base and was nine feet high. He carefully dug a trench three and a half feet wide, beginning on the north side, to the center of the hill. "Ten feet from the starting point I found the first skeleton; it was in a sitting

posture, facing north, and I think it must have been buried in this position as the bones were in a upright position and the top of the skull uppermost. This skeleton was very much decayed and crumbled to dust as soon as exposed to air."

He uncovered seven other skeletons before he came to an arch of burnt clay four inches thick in the center of the mound which had a hollow sound when stuck. "It was placed over the remains of what I take to be a chief. He was lying on his back with arms extended, head to the west. Around the neck was row of fresh water pearls." Near one hand was a green stone with the profile head of an Indian in feather head dress. Appy was convinced that the mounds had been made by modern Indians, not ancient cultures.

In 1935, Licking County historian Ben Jones wrote of an interview with an elderly citizen who recounted a hoax that he and a friend had worked on Professor Appy. They thought that he was disappointed with his finds and sought to cheer him by engraving an Indian head on a curious stone and placing it in the mound. The hoax worked to the greatest extent. They could not bring themselves to disappoint him and did not tell any one about the deception until after his death.

Two days after finding the carved stone Appy returned to the mound. "I found that some boys had completely demolished it, which spoiled it for further investigation on my part."