

The Whelpley Collection of Indian Artifacts

at the
St. Louis Museum of Science
& Natural History



Transactions of the Academy of Science of St. Louis
Volume 32 Number 1

The
**Whelpley Collection
of Indian Artifacts**

Leonard W. Blake and

James G. Houser

MISSOURI BOTANICAL

JUL 18 1988

GARDEN LIBRARY

Transaction of the Academy of Science of St. Louis

Volume 32 Number 1

FEBRUARY 1978

Dr. Henry M. Whelpley

Dr. Henry Milton Whelpley was one of those extraordinary individuals whose accomplishments and interests seemed too numerous to fit into the span of one life. He was at once a teacher of medicine on the faculty of two colleges, a college dean, an editor, a collector, lecturer and nationally known authority on the American Indian.

Dr. Whelpley was born in Battle Creek, Michigan, on May 24, 1861. His father, who joined the Union Army during the Civil War, moved the family to Cobden, Illinois, shortly after the war ended. It was there that young Henry first became interested in Indian artifacts. Undoubtedly, he was encouraged by his father who was also a collector. Later the family returned to Michigan where Henry Whelpley finished high school. He attended the St. Louis College of Pharmacy, graduating in 1883 at the age of 22. Whelpley was a bright student, winning the alumni medal for the best scholastic record in his graduating class. For the first two months following his graduation, he managed the company pharmacy at Mine LaMotte, Madison County, Missouri. He returned to St. Louis in 1884 to become the associate editor of the *St. Louis Druggist*. In 1890 he graduated from Missouri Medical College, and two years later he completed his work at the St. Louis Postgraduate School of Medicine. In June of 1892 he married Laura Eugenia Spannagel.

Whether lecturing on Indian lore to a group of Rotarians or teaching physiology to college students, Henry M. Whelpley was first and foremost a teacher. His ability to communicate with others was evident to the board of directors of his high school who provided young Henry with a year's tuition for teaching a class in algebra that could not be accommodated in the regular curriculum. At the St. Louis College of Pharmacy, Whelpley was Dean and professor of pharmacognosy, materia medica, and physiology. He was also secretary of the faculty, professor of physiology and histology and Director of the Biological Laboratory of the Missouri Medical College.

In addition to his teaching duties, Dr. Whelpley served a term as President of the American Pharmaceutical Association and was treasurer of that group from 1908 to 1921. He was President of the American Conference of Pharmaceutical Faculties from 1905-1906 and was Secretary of the Missouri Pharmaceutical Association for 30 years. He was also instrumental in organizing professional groups such as the National Association of Boards of Pharmacy.

This is only a partial list of his activities; yet for all his endeavors, Henry Whelpley found time to laboriously put together one of the largest and finest collections of Indian artifacts in the Midwest. Many he collected himself in the fields near his Illinois home, while others he obtained by purchase or trade with collectors and



dealers across the country. The list of fellow collectors with whom he communicated was nearly as thick as a small town telephone directory. But Henry Whelpley was more than just a collector; he was also a scholar who, without formal training in archaeology, was nonetheless greatly respected by both amateur and professional archaeologists. He wrote many articles for professional as well as non-professional journals. He was President of the Anthropological Society of St. Louis and chairman of the committee on archaeology of the Missouri Historical Society. He was Vice-President of the St. Louis Society of the American Institute of Archaeology. He was a member of the National Research Council State Archaeological Survey Committee, the Missouri Archaeological Survey and the Academy of Science of St. Louis.

When Dr. Whelpley died in June of 1926, the collection that he had compiled over nearly 60 years went to his wife, Laura. A newspaper article that appeared in the *Globe Democrat* two months after his death described the collection as numbering 50,000 artifacts and worth \$250,000 dollars. The article added that the figure 50,000 was a guess, since the collection had never been inventoried. When it was finally catalogued nearly 40 years later, the total came to fewer than 17,000 artifacts. While somewhat diminished from original estimates, it was nonetheless an impressive collection by any reckoning.

During the time that Mrs. Whelpley owned the collection, she occasionally gave individual pieces to close friends and relatives, so that today portions of the collection are still held in private hands. In 1943 Laura Whelpley gave the collection remaining in her care to the Academy of Science of St. Louis. Selected artifacts from the collection were displayed for a time at the Academy of Science Museum on Lindell, while the bulk of the material remained stored in a motley assortment of old spool drawers, cartons, crates and other temporary containers. In 1959 when the Museum moved to Oak Knoll Park in Clayton, all the collections (including Dr. Whelpley's) were transferred to the new facilities. Shortly after the move, cataloguing the Whelpley collection began in earnest. The job required a year and a half and the volunteer services of two dedicated and knowledgeable men, Leonard Blake and Harold Mohrman. For the first time the scope of this collection was revealed. Most of the material was collected in Missouri and Illinois with lesser but substantial numbers of artifacts having been found in the surrounding states of Kentucky, Ohio, Oklahoma, Tennessee and Arkansas. Dr. Whelpley was a discriminating collector, and many of the pieces are unique and among the finest examples of prehistoric Indian craftsmanship. The weakness of the collection is one that is typical of older collections - detailed information with each piece is either lacking or sketchy. Approximately 80 per cent of the artifacts have written upon them the county and state where found, but little else. Ten to 15 per cent have no data at all and, perhaps,

5 per cent have the name of the farm or some other specific information in addition to the county and state noted on the specimen.

The following is a completed inventory of the Museum's archaeological collections by category. The figures include

some material donated by persons other than Laura Whelpley.

Pottery-614

Ceremonial objects-143

Pipes-83

Small pottery (figurines, fragments, etc.)-280

Atlatl weights and other polished stone-466

Plummets-457

Discoidals-187

Ornaments-444

Notched hoes-379

Lanceolate points-465

Unnotched hoes-1110

All other categories of points-6216

Grooved axes-1120

Drills-712

Hand tools-1395

Miscellaneous artifacts and artifacts of doubtful authenticity-1000

Celts-811

The question might properly be asked: why does a museum need a collection of this size? There are, of course, many reasons. The Whelpley collection, as well as other collections owned by the Museum, form a large and varied source of material for not only the Museum's permanent exhibits, but also for the temporary and traveling exhibits. The education department at this Museum draws constantly on the Whelpley collection for material for their suitcase exhibits (small exhibits delivered on request to schools throughout the metropolitan area) and for demonstrations to school groups visiting the museum. The Exhibits Exodus program, panel exhibits and modular exhibits that are set up in bank lobbies, theatres, schools, libraries and other public places also use specimens from the collection. And collections serve purposes other than public exhibit. They are a store house of source material for scholars, educators, students and amateur collectors. Over the last 15 years the Whelpley collection has been used at least once by every major university within a radius of 150 miles of St. Louis. Finally, there is the obligation to preserve these articles of the past for generations of the future. Of all public and private institutions, museums are best suited to do this.

Figure 1.

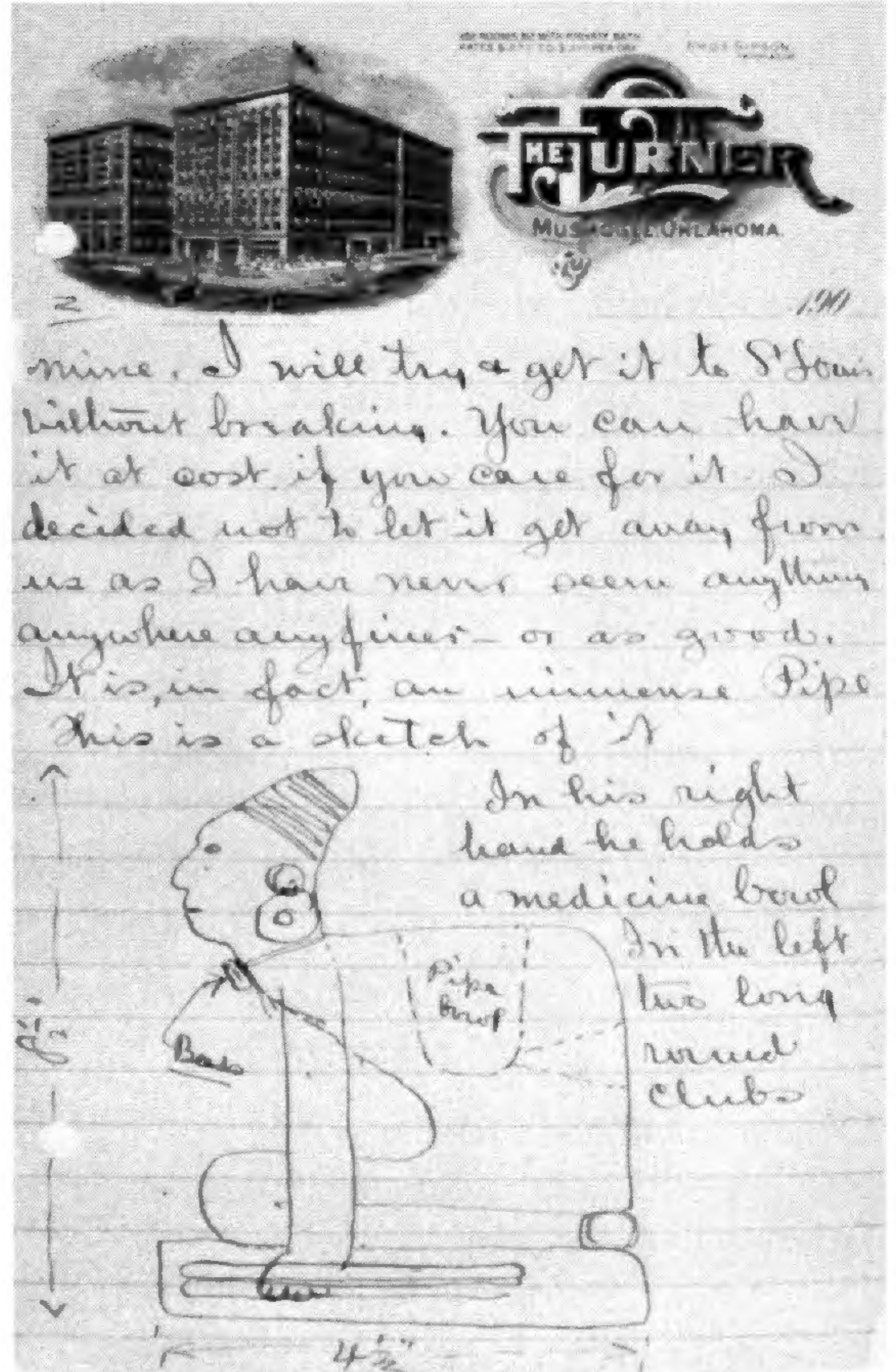
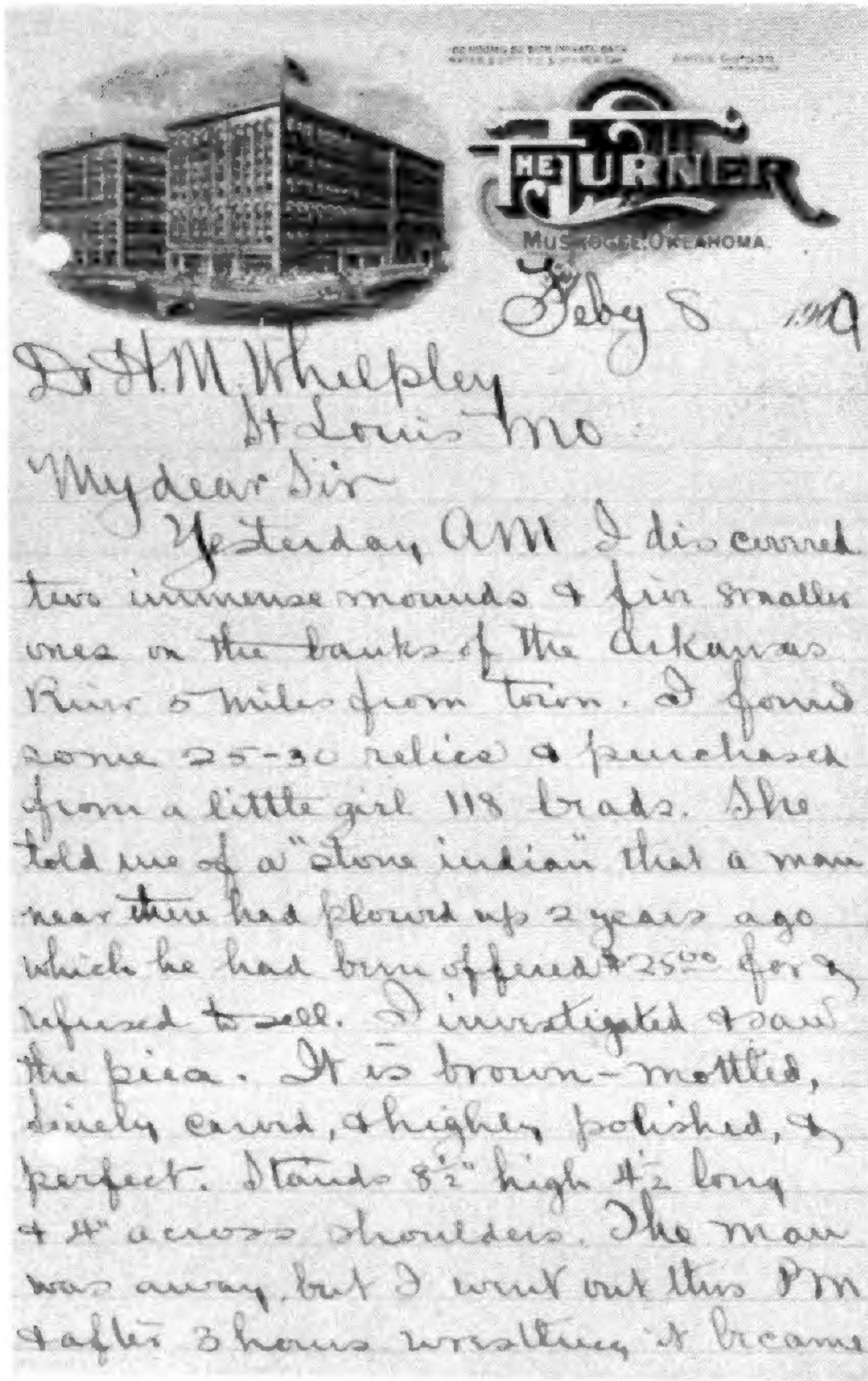
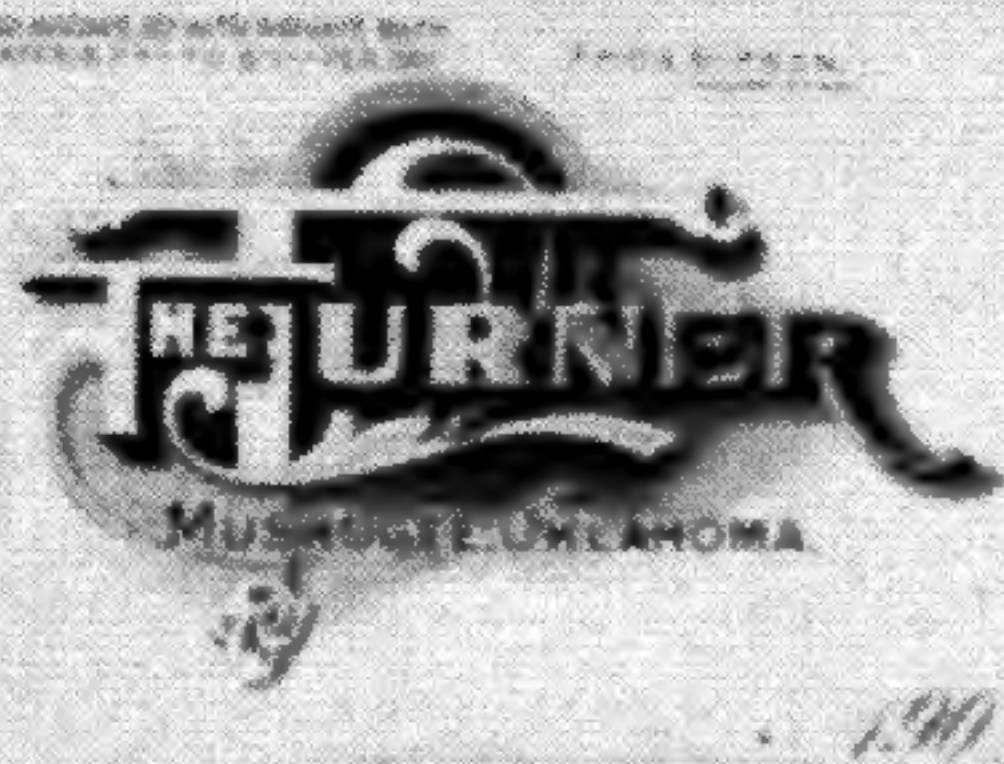
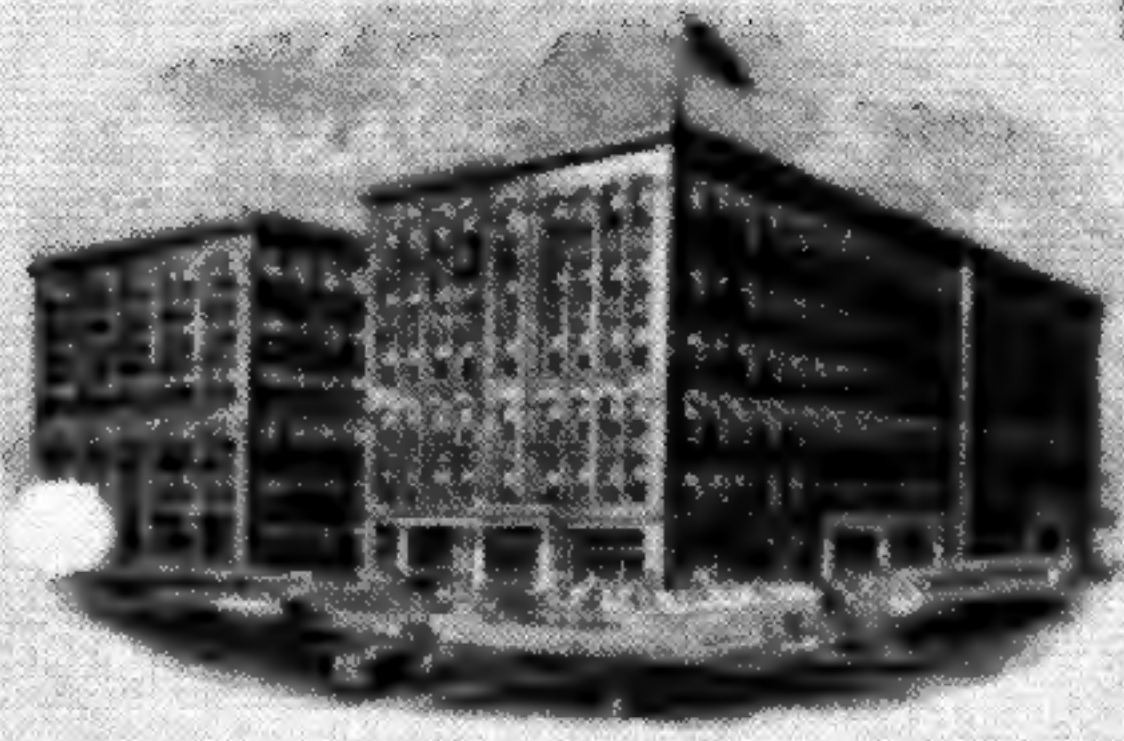


Photo copy of letter of February 8, 1900 of F.S. Brochett to Dr. Whelpley



1911

3—

There is all kinds of fine
pipes &c here also arrows
I commissioned the boys
& girls to hunt for me
& we may get something
else good this summer.

I shall be here for several
days — let me know what
you think of it.

Yours truly

S. J. Brockett



Plate 1.

Plate 1.

This large, stone pipe represents a player of a game still played in historic times throughout the Southeast called *chunkey*, which has been spelled a number of different ways. Swanton, 1946 (Bureau of American Ethnology, Bulletin 137, p.682) has a good description of the game. "There are evidently several different varieties (of the game of chunkey), but all made use of a smooth stone roller and two long, slender poles, often supplied with short crosspieces midway of their length. While there were usually only two active participants, numbers of onlookers wagered quantities of property on the outcome. The essence of the game was to start the roller along a smooth piece of ground with which every town was supplied, after which the two players threw their poles after it with the idea of hitting the stone, coming as near it as possible when the stone came to rest, or preventing the opponent's stick from accomplishing either of these results." In the West a similar game was played with a small hoop instead of a smooth stone roller. Rollers like those used in the game historically have been found throughout the South and Middle West. Some, which date as early as A.D. 900-1000 were found in Mound 72 at Cahokia. They are usually associated with the Mississippian culture. Disc-shaped, smooth stone rollers are usually called *discoïdals* in archaeological reports.

It will be remembered that Mr. F.S. Brochett in his letter of February 8, 1900 to Dr. Whelpley described the pipe figure as holding a "medicine bowl" in his right hand and "two long round clubs" in his left. Mr. Brochett was obviously not well informed. The right hand holds a discoïdal, the left two poles, as described by Swanton.

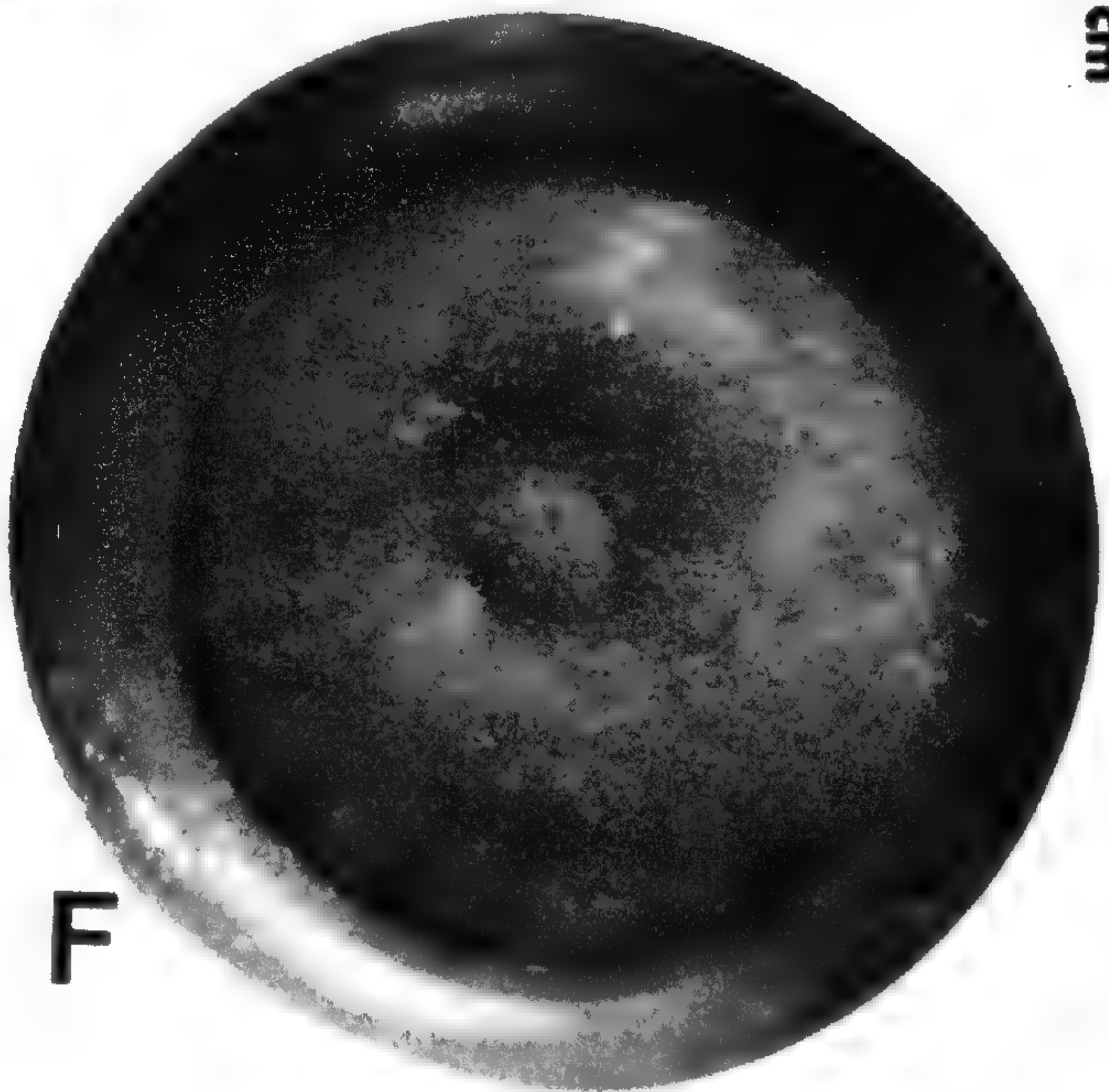
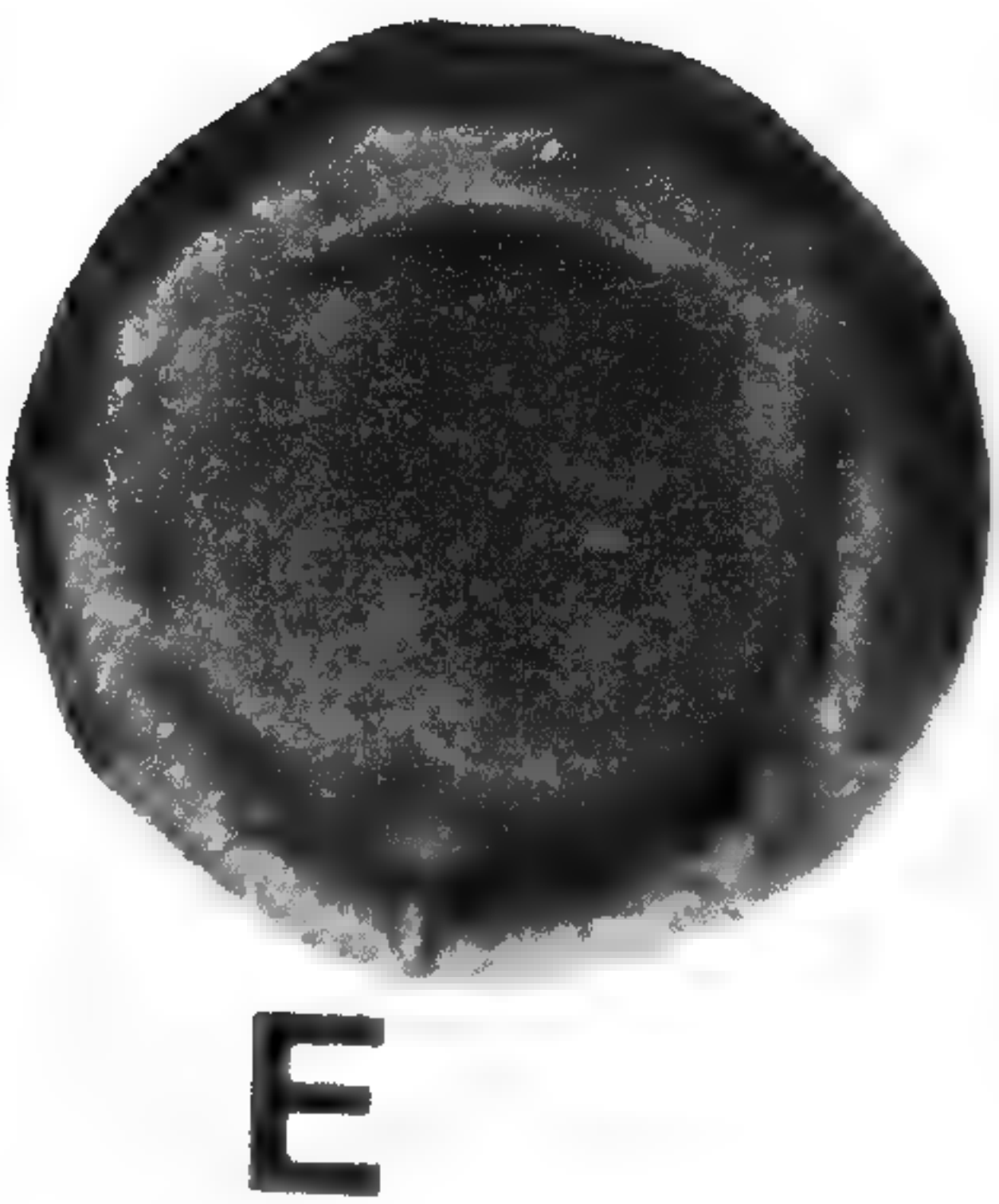
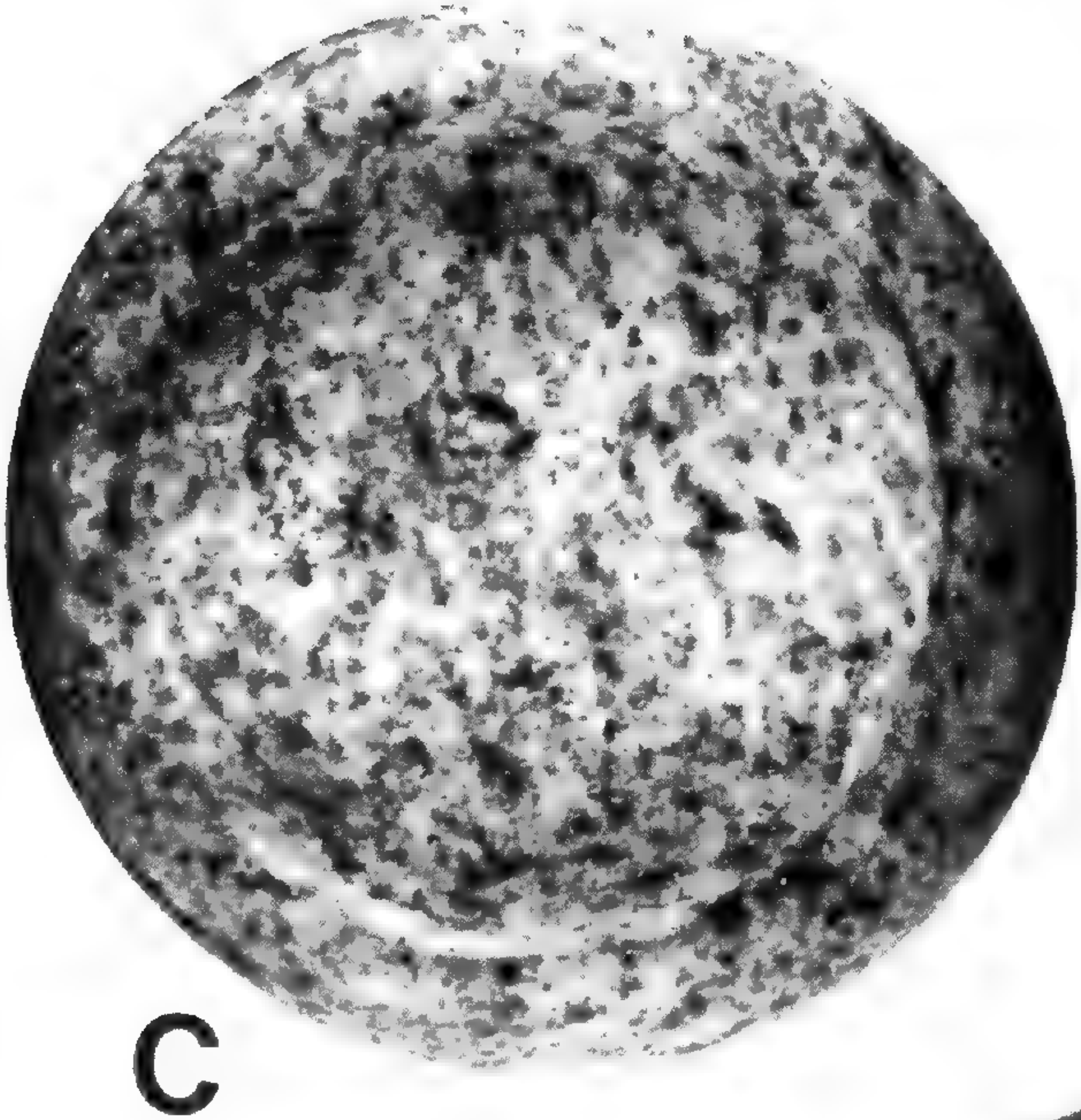
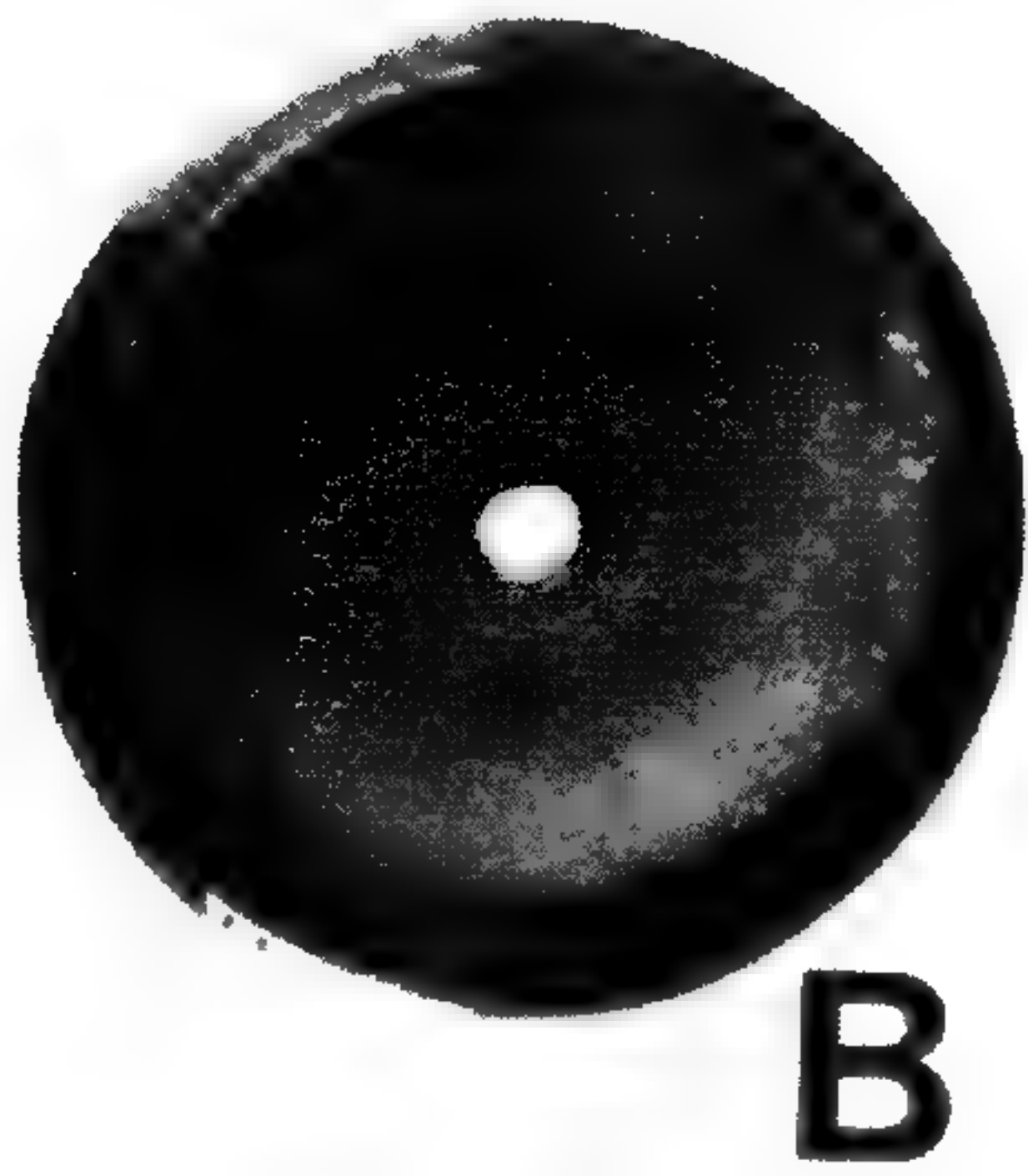
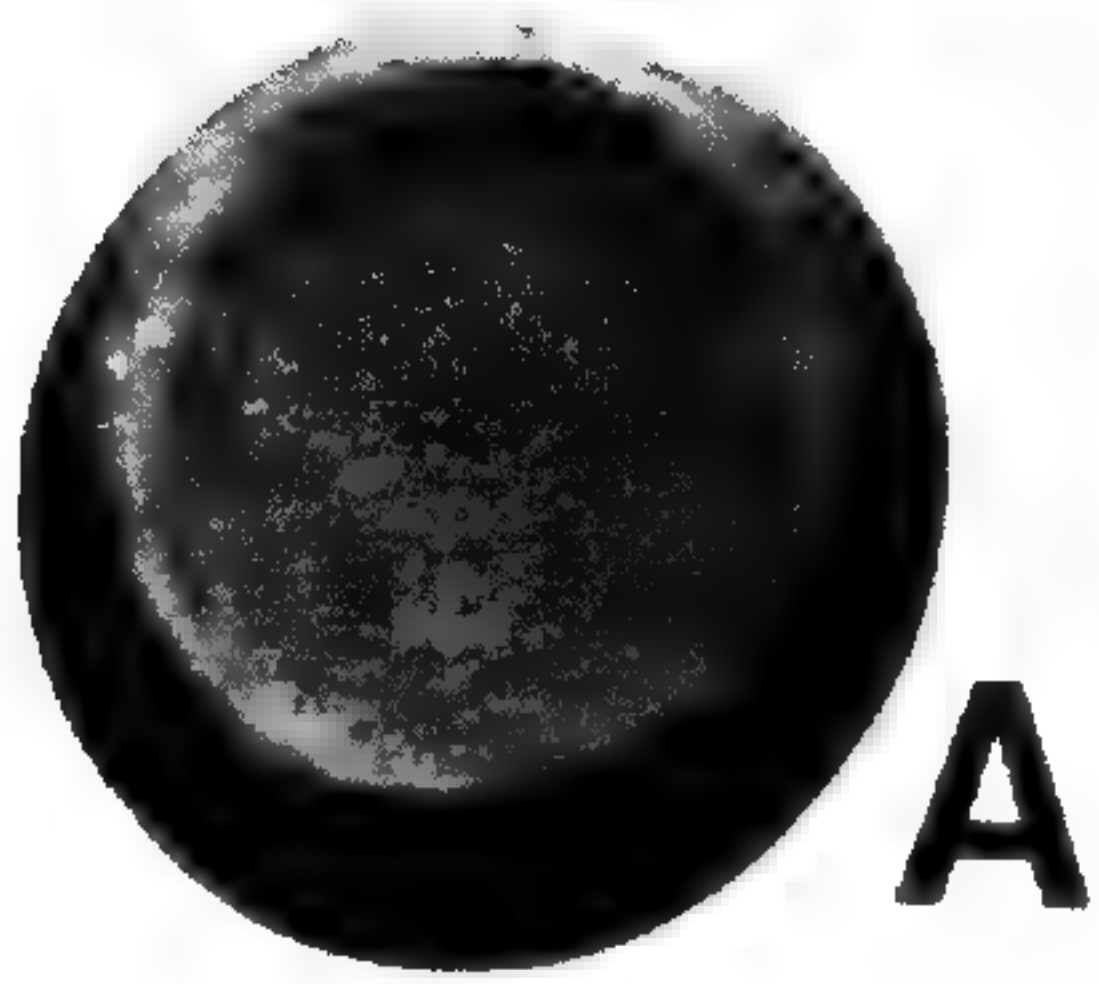


Plate 2.

This shows a sampling of some of the discoidals in the Welpley collection.

Plate 2.

- A. Catalog No. 14X78, from Mountain Glen, Union Co., Ill.
- B. Catalog No. 14X46, provenience is unknown.
- C. Catalog No. 14X1, from McLean Co., Ill. in 1861.
- D. Catalog No. 14X24, provenience is unknown.
- E. Catalog No. 14X29, from New Madrid Co., Mo.
- F. Catalog No. 14X36, from Clay Co., Ill. in 1860.



Plate 3.



Plate 4.



Plate 5.



Plate 6.

Plates 3-6.

There are four head vases (effigies of human heads) in the Whelpley collection. Two views of two of each of these are shown in Plates 3-6 (Plate 3 and 4, Catalog No. 8X57, Plate 5 and 6, Catalog No. 8X63). Both are from Mississippi County, Arkansas. Lawrence Mills, who examined the Museum's specimens when preparing an essay on "Mississippian Head Vases of Arkansas and Missouri" for the *Missouri Archaeologist* (1968, Vol. 30), made the following comments on this type of vessel: "The purpose of the head vase is still unknown. There seems little question that they are of a funerary nature, but no contents of vases have been preserved to indicate what, if anything was stored in them. The majority are poorly documented and were probably surface finds or were uncovered by pot hunters."

There is one documented find of a head vase with a burial (No. 10A) at the Campbell site in Pemiscott County in the Missouri bootheel (Chapman and Anderson, 1955, p.62). The time period is estimated at approximately A.D. 1540-1650 (p. 105).

Mills goes on to say that, "It would seem likely that the heads represented one concept of portraiture with distinct individualism being represented by facial painting and tattooing, rather than the position and proportions of the facial features." He points out that nearly all the known vessels of the type in the Museum's collection come from a limited area in northeastern Arkansas and southeastern Missouri near the Mississippi. The Museum's specimens are all from Mississippi County in northeastern Arkansas. Head vessels are rare. Mills reported that he was able to locate and describe only 63 of all types. Previously a total of only 59 had been reported.



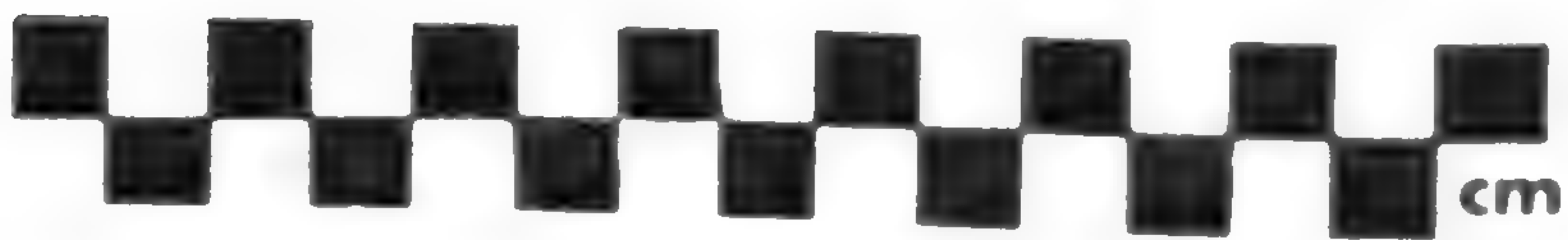
Plate 7.

On the bottom of this effigy vessel of a mother nursing a child (Catalog No. 8X65) is the following notation in Dr. Whelpley's handwriting:

"Found in a small mound in 1876, East St. Louis, Illinois, St. Clair Co., Francis Simonin farm, now 7600 State St."

The vessel was apparently made to hold liquids or small objects. There is a hole approximately one inch (2.5 cm.) in diameter in the back of the head as in other examples of this class of pottery vessels, commonly called *hooded water bottles*. Archaeological investigations have shown that this type of vessel was made by prehistoric Indians, probably some time in the period of about A.D. 1000-1400. The material culture of the people who made such vessels has been called *Middle Mississippi* by archaeologists. Regional variations of *Mississippi* were widespread throughout much of the Mississippi Valley. Some of these lasted into historic times and included several different tribal groups.

We have been told that this is the only known vessel of this type made by prehistoric Indians in the Midwest which depicts a mother nursing a child.



Plates 8 and 9.

Hooded water bottles such as these (Plate 8, Catalog No. 8X319, provenience unknown; Plate 9, Catalog No. 8X73, Mississippi Co., Mo.) depicting elderly, humpbacked women, have been found most frequently as burial offerings in the region near the junction of the Ohio and Mississippi Rivers. Archaeological investigations indicate that they were made by Indians of the Middle Mississippi culture some time after A.D. 1000. It may be suggested that such vessels represent deities, legendary figures or even female humpbacks with whom the potters were acquainted. However, since none of the makers survived to reveal their meaning, such explanations are only conjecture. Their true significance remains unknown.



Plate 9.

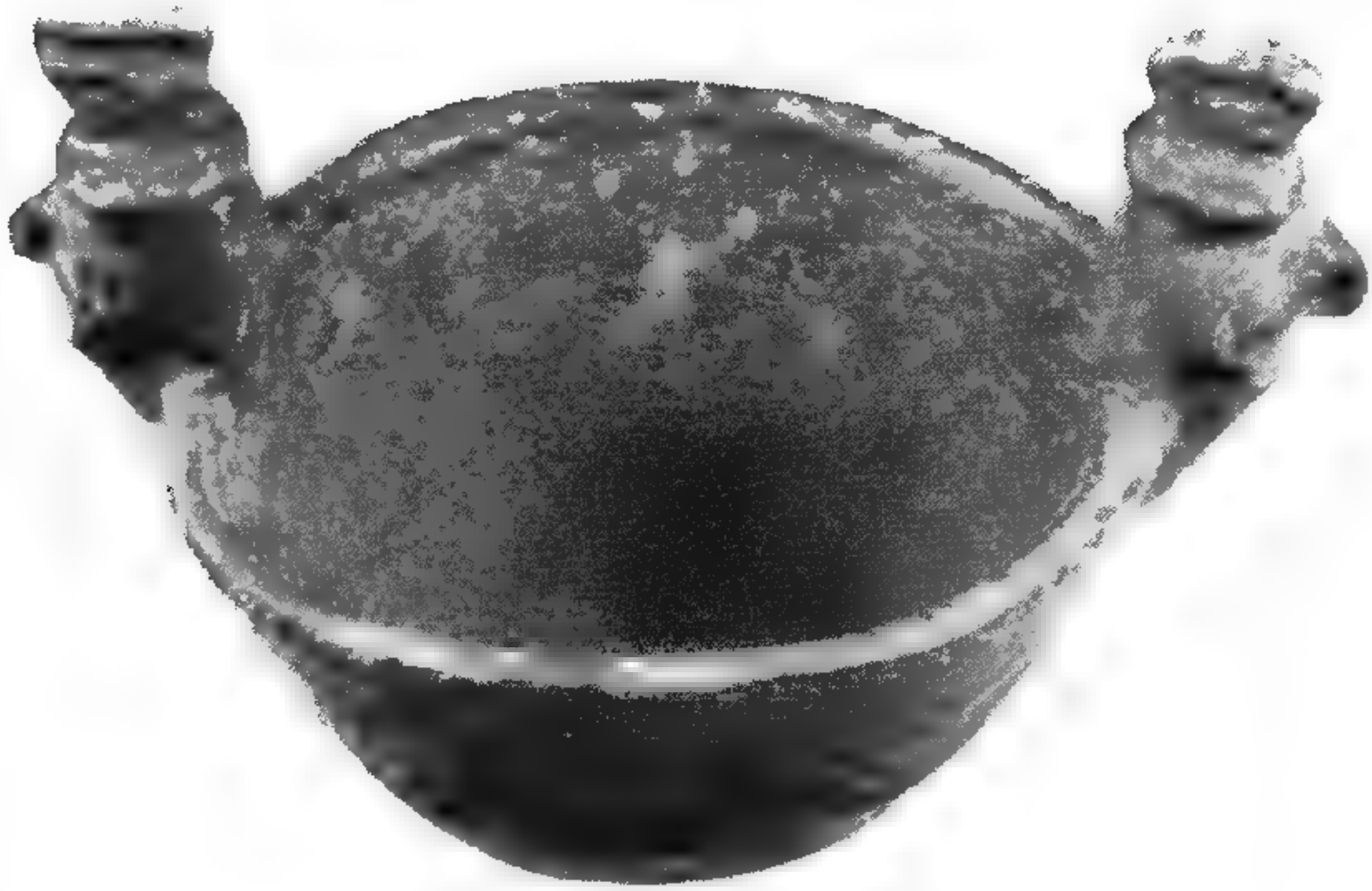


Plate 10.



Plate 11.

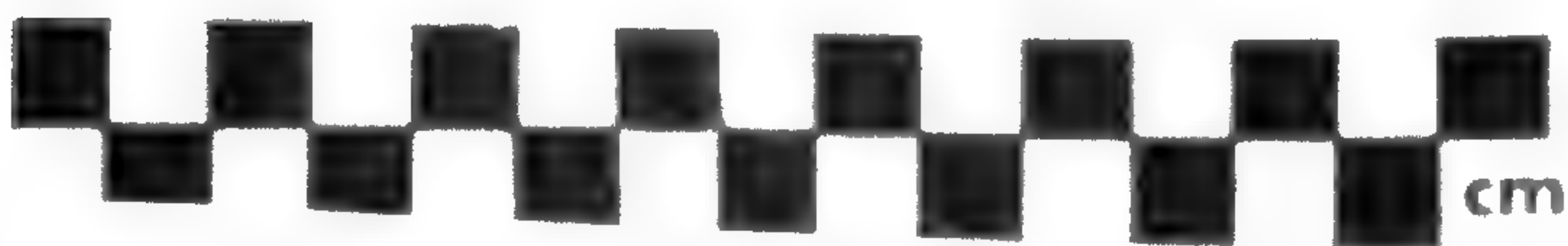


Plate 12.

Plates 10, 11, 12.

Plates 10 and 11 are views of a bowl with two outward facing human heads (Catalog No. 8X43). The vessel has red slip or paint in the interior. The heads show painting in a band across the nose, around the mouth and around the forehead. The throat, body and arms are indicated by red paint, and the figures give the impression that they are swimming. On the outside of the vessel is a notation that it came from Lawrence County, Arkansas.

Plate 12 (Catalog No. 8X58) is an effigy bowl representing a person lying on his back. It is vaguely reminiscent of the *chacmool* figures in Mexico.

This vessel also bears a red slip or paint on both the inside and outside. Note that there are five fingers and a thumb on each hand on the sides of the bowl. A notation on the side indicates that the vessel came from Mississippi County, Arkansas.

Both of these vessels were made by Indians of the Middle Mississippi culture.



Plate 13.

Plate 13.

A letter regarding this pot (Catalog No. 8X273) dated March 24, 1971, from Dr. Charles C. DiPeso, Director of the Amerind Foundation, Inc. and a leading authority on the Casas Grandes settlement in Chihuahua, Mexico, reads in part as follows: "The definition of brown and black and the obvious vitrification of the black as reflected in the photograph, suggests that this is a very rare hooded effigy of Huerigos Polychrome. Most of these forms appear in Ramos Polychrome Standard Variant, and one would have to almost examine the object firsthand to determine the difference . . . produced in the Casas Grandes Valley sometime between A.D. 1050 and 1340."

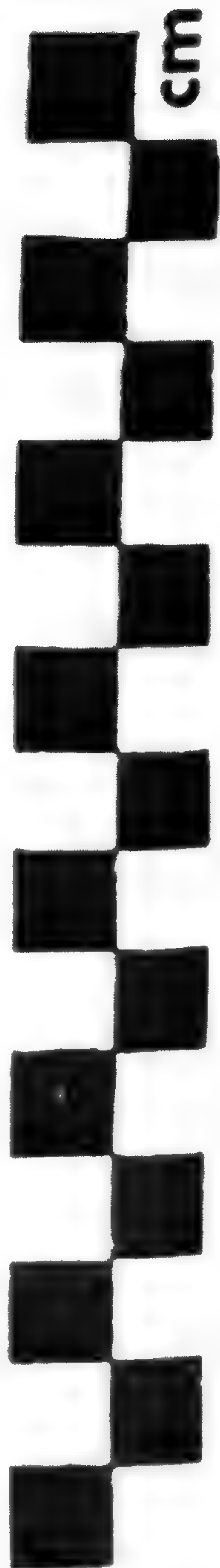
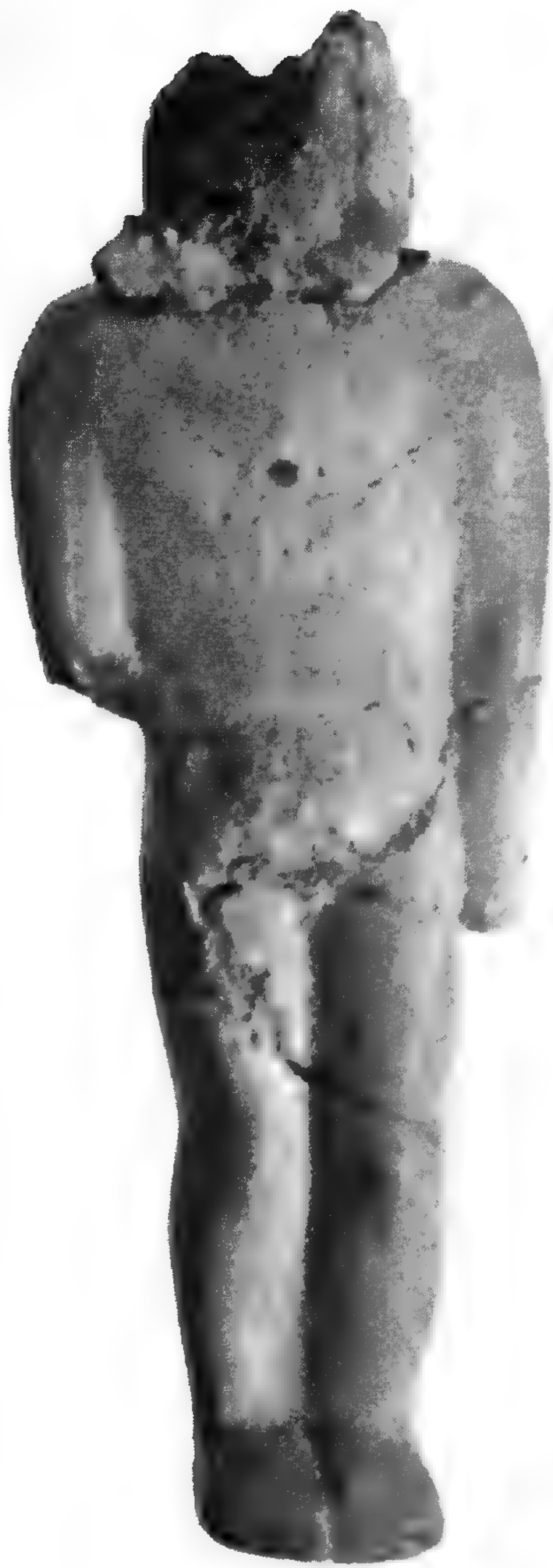


Plate 14.

In the spring of 1895, John Francis Snyder, a medical doctor, reported his excavations of mounds in Brown County, Illinois, in a periodical called *The Archaeologist*. Dr. Snyder's article has been reprinted by the Illinois Historical Society in *John Francis Snyder, Selected Writings*, edited by Clyde C. Walton, 1962. In a large mound on the land of a farmer named Paul Baehr, on the Illinois River floodplain, he reported finding a little "headless image" and at another time a second "terra cotta image." Both of these figurines were illustrated by life-sized line drawings in his publication.

Most of Dr. Snyder's collection from the Baehr farm was eventually acquired by the American Museum of Natural History in New York. The whereabouts of the figurines was unrecorded until 1967. In that year when Ms. Nancy Engel, an authority on prehistoric North American figurines, was in St. Louis sketching figurines in the hands of museums and collectors, she recognized these two in the Whelpley collection as the long-lost Snyder figurines from the Baehr Mounds.

The headless male figure on the left (Catalog No. 9X183) was found on a mica plate with flint chips and bone-perforated, pulley type ear spools near a skull in the big Baehr Mound. The figure on the right (Catalog No. 9X285) was found wrapped in a woven bag of vegetable fiber with a copper celt and a very small, four-lobed pottery vessel with a tall neck in the same mound (Griffin et al, 1970; p. 82).

Both figurines were made by Indians who lived in the Midwest between about 200 B.C. and A.D. 300; their culture has been called *Hopewell* in archaeological publications. Tribal affiliations and language or languages are unknown, as the culture did not survive into historic times.

Photographs of the two Snyder figurines were used by Dr. James B. Griffin and Richard E. Flanders in a monograph dedicated to the late Dr. Paul F. Titterington, titled: "The Burial Complexes of the Knight and Norton Mounds in Illinois and Michigan," 1970.

Dr. Titterington, like Dr. Whelpley, was an active member of the Academy of Science of St. Louis for many years and a lifelong student of midwestern archaeology.



Plate 16.



Plate 17.

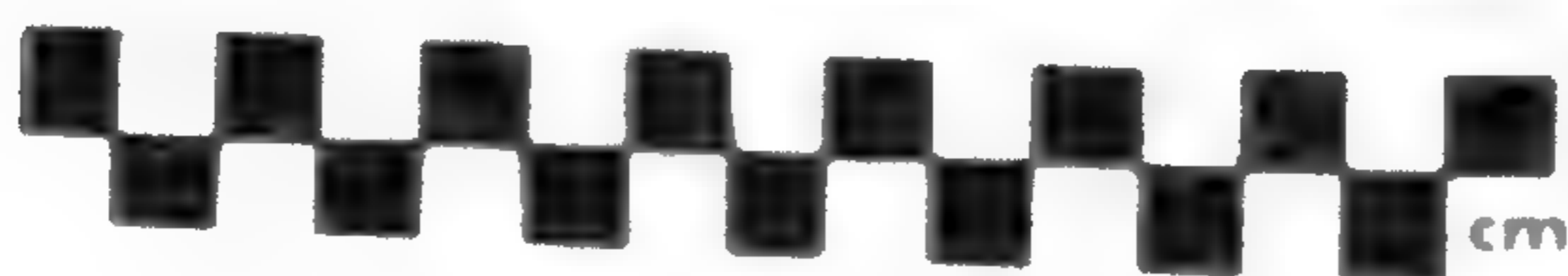


Plate 15.

Plate 15, 16, and 17.

Plate 15 (Catalog No. 8X69) is a realistic, but oversized frog effigy vessel nearly a foot long. Barely showing in the photograph are two holes on both the front and rear of the opening on the back, presumably for suspension. This seems to indicate that the vessel had a utilitarian function, and was not solely for mortuary use. The pot is well smoothed and fired, the work of an expert, as well as artistic potter. Notation on the base indicates that it was discovered in Mississippi County, Arkansas.

Plate 16 (Catalog No. 8X47) is a stylized effigy of a dog. This type of vessel has been called both an *open mouthed water bottle*, and a *narrow-neck olla*. The dog is less realistic than the pottery *Colima* dogs of Mexico. The Mexican dog representations sometimes have an opening in the end of a straight tail, instead of on the top of the back as in this vessel. There is no information on where this well made vessel was found, but it is similar to others from near the Mississippi River in the Missouri, Kentucky, Tennessee, and Arkansas area.

Plate 17 (Catalog No. 8X59) is an animal effigy in the form of a hooded water bottle. The animal resembles a raccoon. The modeling is less sure than that of the other two vessels. A notation on the back indicates that it was found in Fulton County, Kentucky in 1880.

All three of these vessels were made by Mississippian Indians, probably sometime in the period of about A.D. 1300-1600.

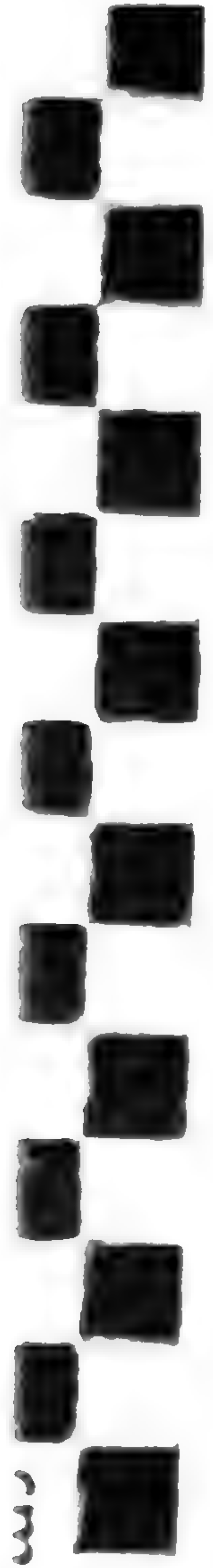


Plate 18.

This compound vessel consists of a wide-mouthed water bottle resting on a jar with strap handles (Catalog No. 8X45). It is from Fulton County, Kentucky, which is in extreme southwestern Kentucky across the Mississippi River from New Madrid, Missouri.

James B. Griffin, noted authority on Indian pottery in the eastern United States, calls vessels such as this *Vertical Compound Vessels*. We can do no better than to quote some of his comments. "There are numerous variations, including jar on jar, bottle on jar, bottle on bowl, etc. This treatment is, of course, rather widespread, and is found in eastern United States in Hopewell times" (that is, about A.D. 1), "but reaches a peak in the Mississippi cultures, and particularly in southeast Missouri and the Survey area. It is also found in the *Caddo* area" (parts of western Arkansas and surrounding area) "but not as commonly as in the St. Francis, Memphis and southeast Missouri." He also notes that "Vertical compound forms are found in the Southwest and particularly in the Casas Grandes area of Chihuahua." (Phillips, Ford and Griffin, 1951, p. 170, Figure 104, k-o, t).

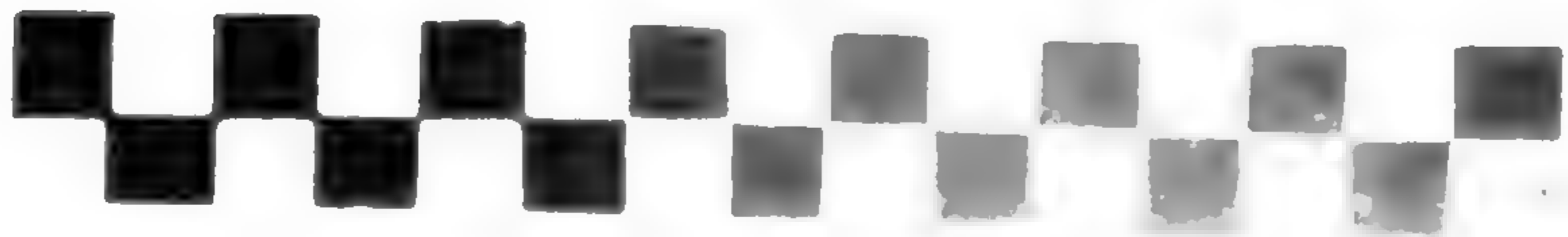


Plate 19.

There is no direct information on the place from which this beautifully decorated vessel (Catalog No. 8X50) came. James B. Griffin has called vessels with decorations such as those on this pot, *Rhodes Incised*. “Whorls and festoons cover the body and occasionally the rim. This design, as observed on whole pots, characteristically spirals from a nuclear swastika or triskele repeated four times on the vessel.” (Phillips, Ford and Griffin, 1951, p. 127, and Figure 98). He notes that this decoration occurs on globular jars, some of which have a short straight collar, as does this one, which he says is a common feature on such jars found with burials. He further notes that this kind of decoration is found on vessels from late prehistoric Mississippian sites along the Mississippi River floodplain principally in the area of Memphis, but also extending down to about the mouth of the Arkansas River. Comparable types are not found to the north or east. Relationships appear to be rather with certain types of the *Caddo* area to the west and possibly to certain others in southern Louisiana.



Plate 20.



Plate 21.

Plate 20, 21.

This illustrates two chipped flint objects (Catalog No. 20X2 and 20X7, provenience unknown) which have been variously called maces or batons. Their exact purpose is not known. As far as can be learned, there is no record of their use in historic times. The depiction of elaborately garbed, dancing figures holding such objects, embossed on copper or engraved on shell, indicates that their use was probably ceremonial or religious rather than practical. (See Figure 2 below).

In excavations in 1971 by the University of Missouri - Columbia at the large, fortified Lilbourn site near New Madrid, Missouri, a chipped flint object similar to the one on the right of Plate 20 was found on the chest of a burial of a mature adult male. (See Plate 21).

According to Waring and Holder (*American Anthropologist*, 1945, New Series, 47:1, 11) batons, or representations of them have been found at Etowah Mounds in Georgia, Moundville in Alabama, Spiro Mound in northeastern Oklahoma, near New Madrid, Missouri, and in Louisiana and Illinois. An example of a wooden baton of similar form was found preserved in the muck at Key Marco in Florida by Frank Cushing in the late 1890's.

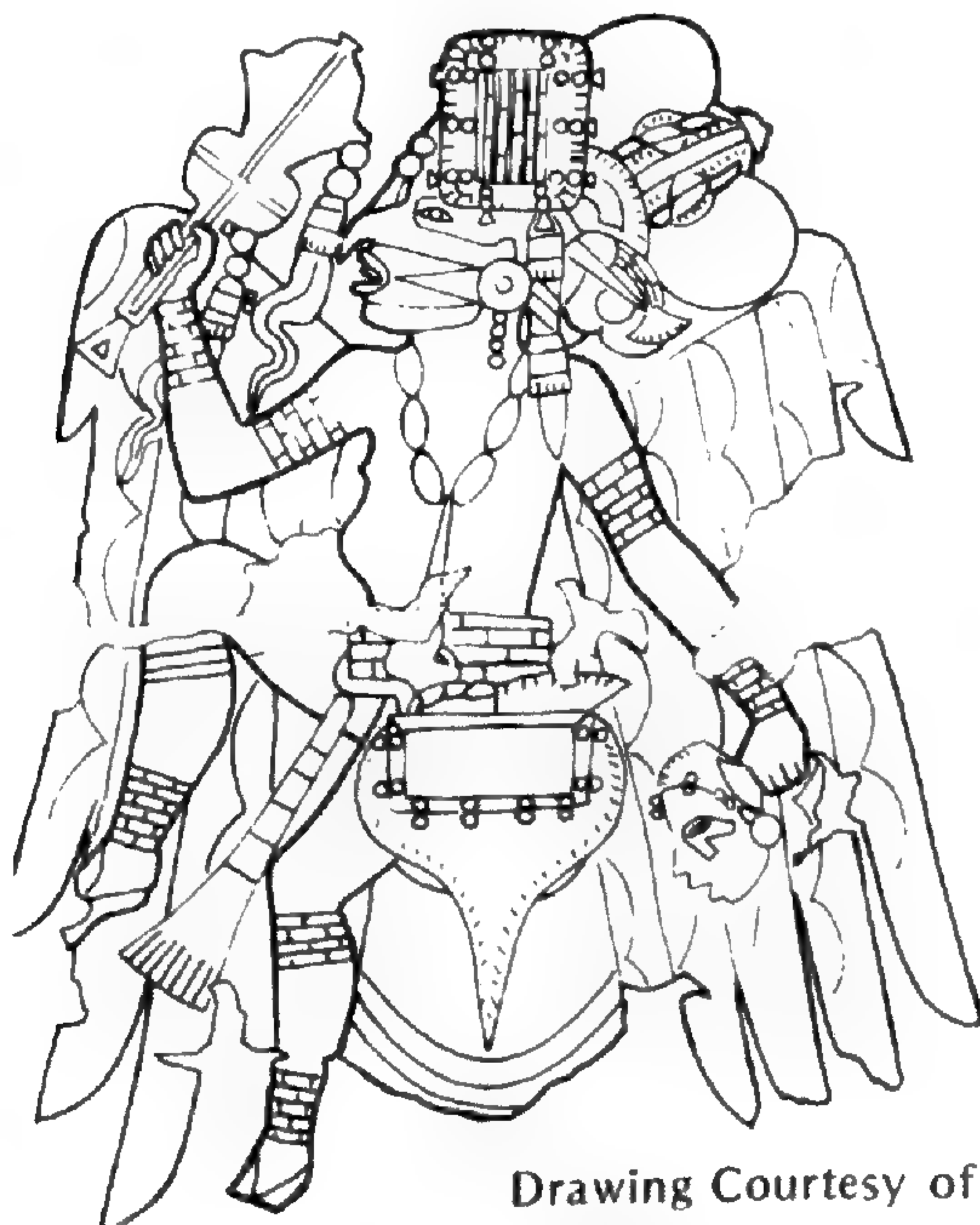


Figure 2.

Drawing Courtesy of Mrs. Eleanor Chapman

cm.



Plates 22, 23.

Four pieces of engraved shell are shown on these two plates. Each has two perforations near the edge and probably was suspended on a cord and worn as an ornament around the throat. Burials have been found with engraved shell ornaments in this position. An example is the one presently exhibited in the Indian Hall of the St. Louis Museum of Science and Natural History. Such ornaments are called *gorgets* because they were worn near the throat. The word *gorge* means *the throat*, according to Webster's 20th Century Dictionary. All shown in this plate were made by Indians of the Mississippi culture in southeastern United States.

Plate 22 A.

Plate 22A (Catalog No. 21X66) This gorget is from Gallatin County, Illinois, which is in the southeastern part of that state at the junction of the Ohio and Wabash Rivers. Shell gorgets similar to this one are illustrated in Holmes, 1883, Plates LXXI and LXXII and in Kneberg, 1959, Figures 34 - 38, all from eastern Tennessee. Kneberg (pp. 5, 39) states that such gorgets have been found on sites of the Dallas culture, a variety of Mississippi culture, and she estimates that they date between A.D. 1350 and 1500.

The design on this gorget and on others like it represent a running or dancing figure with a long nose. The representations are so stylized that they appear to us to be caricatures, though perhaps they were not to the people who made them. Representations of a long nosed figure in a variety of forms and materials have been found over a wide area from northern Florida to eastern Texas and as far north as southern Minnesota. These are believed to represent a mythical character or diety which has been called *Long Nosed God* in a number of archaeological publications. A small copper mask of a face with a long nose was found in the Big Mound in St. Louis. Big Mound was destroyed in 1869. An interesting account of this is given in Williams and Goggin, 1956.

Plate 22 B.

Plate 22 B (Catalog No. 21X65) Information is not available on where this gorget was found. Kneberg (1959, p. 15) calls the engraved design the *Scalloped Triskele Design* and says that it is widely distributed, occurring in central as well as eastern Tennessee. As with the gorget shown in Plate 22 A, it has been found with burials of the Dallas culture and is estimated to date between A.D. 1350 and 1500. Kneberg deduces that the design motif may be a female symbol. Gorgets with this design have never been found with male burials, only with those of women or children.

One writer has suggested that scalloped discs such as this may represent sun symbols. This is speculation, although the Indians in the southeastern United States, when first discovered by Europeans, revered the sun and might have been called sun worshipers with some justification.

Similar gorgets are illustrated in Holmes, 1883, Plate LVI; in Griffin, 1952, Figure 109G; and Kneberg, 1959, Figures 25 - 33.

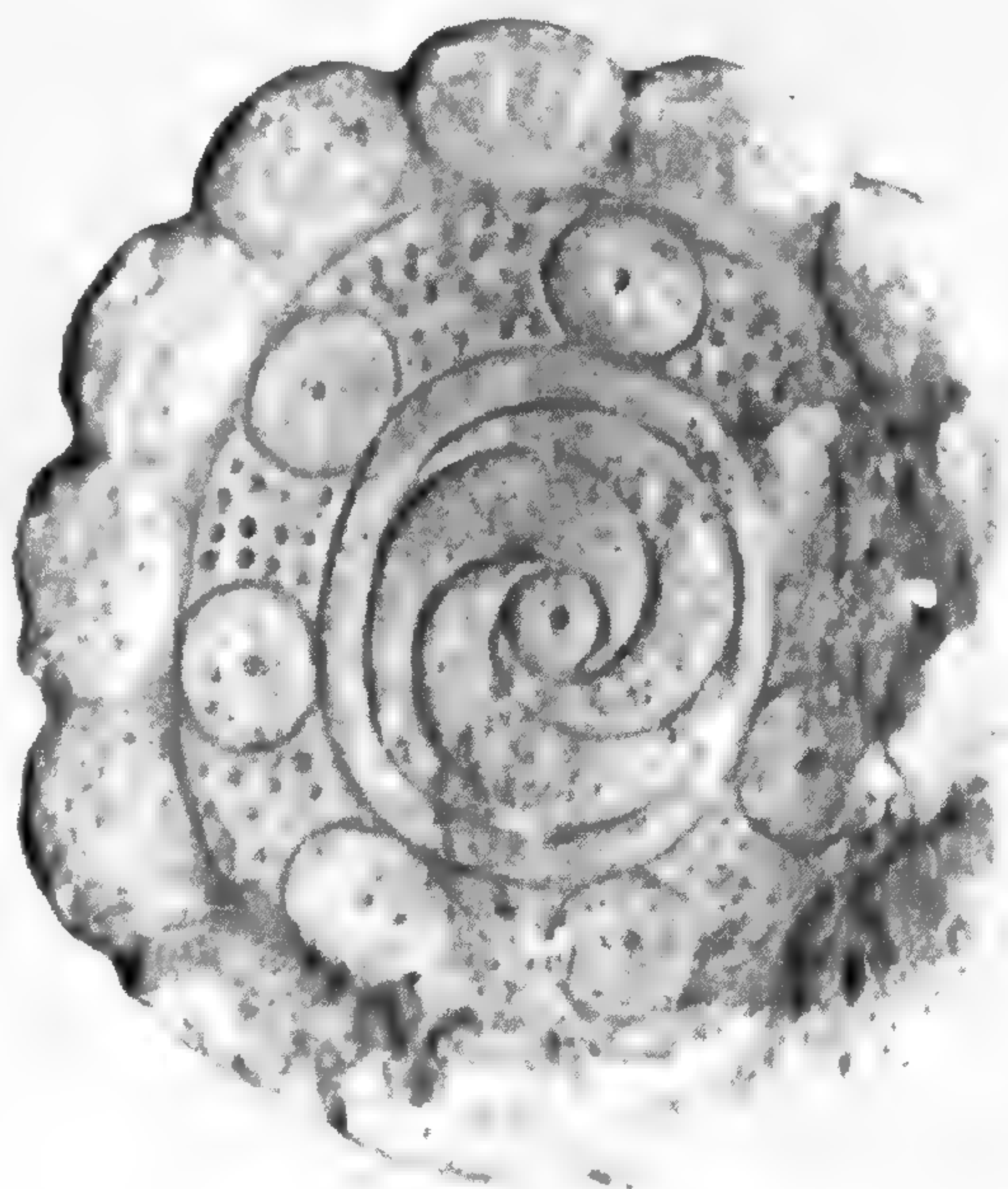
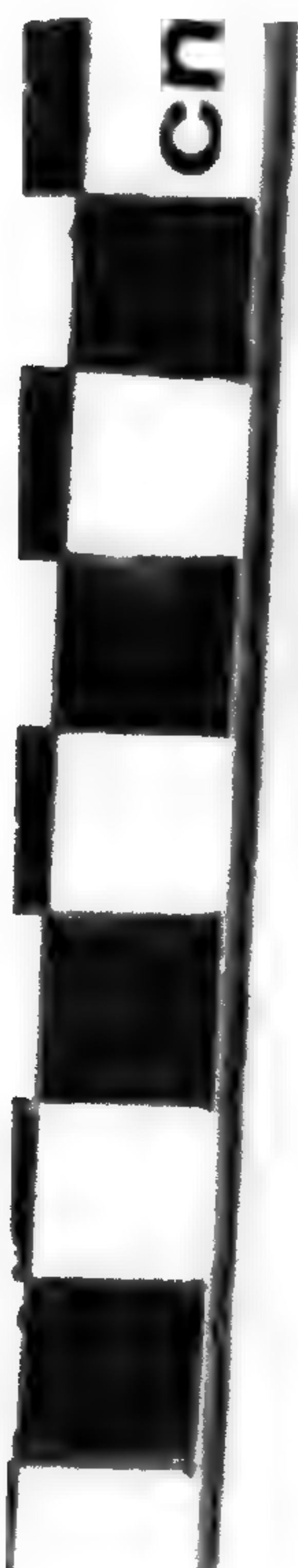


Plate 23 A.

Plate 23 A (Catalog No. 21X399) This badly weathered shell gorget bears the notation "Mound, W. Va." The design has been called a rattlesnake design by Holmes and Kneberg because on others in better condition than this one, a conventionalized rattlesnake may be discerned. A gorget with a rattlesnake design was found with a burial which also contained iron trade items in North Carolina (Thomas, 1893, pp. 336 - 338) and hence such gorgets probably are late. Kneberg estimates they date from A.D. 1450 to 1750. Illustrations of gorgets of this type may be seen in Holmes, 1883, plate LVIII; Griffin, 1952, Figure 109G and Kneberg, 1959, Figures 39 - 50.



Plate 23 B.

Plate 23 B (Catalog No. 21X400) Information is not available on where this gorget was found. Designs similar to the looped strands which appear on this engraved gorget are shown with representations of woodpeckers in Holmes, 1883, Plates LVIII and LVIX. The elements in these illustrations cross alternately instead of in pairs, as on this gorget.





Plate 24.



Plate 25.

Plates 24 and 25.

Plate 24 is a photograph of a large marine conch shell (*Busycon perversum*). The inside of the shell has been cut away by the Indians to make a container for liquids (Catalog No. 20X101, provenience unknown). Plate 25 illustrates a representation of a conch shell in pottery from Fulton County, Kentucky (Catalog No. 8X31) possibly made by Indians who had seen one, but lacked the real thing. Conch shell containers were often traded far inland and are sometimes found buried with the dead. It is known from a number of descriptions of the customs of the southeastern Indians by early explorers and traders that such containers were used for drinking the *black drink*, which is described below (Williams, 1930, p. 49).

The Black Drink

This drink was prepared by making an infusion of the parched leaves of a species of holly (*Ilex vomitoria*) called by the Indians *cassina* in some places, *yaupon* in others. This holly shrub is found from Florida to Texas and north to southeastern Virginia and northern Arkansas (Fernald, 1950, p. 981). The drink was used by historic Indians in the Southeast for ceremonial purification. Among the Creek Indians the liquid was drunk before councils in order, as they believed, to invigorate mind and body and prepare for thought and debate. It was also used at the annual *green corn* dance of thanksgiving. A strong infusion of the drink has purgative, vomative and diuretic effects. Investigation has shown that the plant contains caffeine and that a beverage made from the leaves provides the stimulating qualities of tea and coffee (Hodge, Part 1, 1912, p. 150).

A drink made from the leaves of a species of holly (*Ilex paraguensis*) is still drunk today in parts of South America instead of tea or coffee. It is called Paraguay tea or *Maté*, and it may be purchased at some specialty and health food stores in the United States.

An illustration of Indians in Florida taking the black drink is shown below, (Figure 3). It was copied from a painting by the French artist LeMoyne, who was an eyewitness to this custom about A.D. 1565. The original painting has been lost (Lorant, 1946, p. 93).

Figure 3.





Plate 26.

Dr. Whelpley was so pleased with finding this large flaked implement (Catalog No. 11X10-542), and who could blame him, that he had a life-sized photograph made and printed with the following caption above the illustration:

**A PRE-COLUMBIAN INDIAN FLINT IMPLEMENT
FOUND IN UNION COUNTY, ILLINOIS, JULY, 1899
BY DR. H.M. WHELPLEY, ST. LOUIS, MO.**

Underneath appeared the following:

“Material, flint; color, fawn, with reddish-brown spots and stripes; length, 20 inches; width, 3-3/4 inches; thickness at center, 1 inch; weight, 43 avoirdupois ounces. This large pre-Columbian piece of Indian flint work must be seen to be fully appreciated. It gracefully tapers in all directions from the center to the thin cutting edge. The rich, natural fawn color is artistically sprinkled with light specks and various reddish-brown spots and stripes. This gives the implement a beautiful appearance, unequalled by any other large piece of flint that I have ever seen. In this respect, one side is slightly more convex than the other, and the edge has a graceful curve which suggests the type of so-called twisted arrows and spears. The piece shows no evidence of having been worn by use. The thick (3/16 inch) portion of the edge, for about 1-3/4 inches near one end, is a peculiarity noticed in other large flint pieces.”



Plates 27 and 28.

Plate 27 illustrates two very large and beautifully flaked knives of obsidian, a glass-like rock of volcanic origin. The one to the left (Catalog No. 11X10-534) is 29-5/8 inches (75.2 cm.) long and the wider one on the right (Catalog No. 11X10-531) is 29-1/4 inches (71.8 cm.) long. Both bear the notation "Salmon River, Siskiyou County, California."

W. H. Holmes (1919, p. 214) said, "Among the most remarkable chipped implements in America, and in the world for that matter, are the obsidian blades of California, the largest of which are upward of 30 inches in length and at the same time are of remarkable symmetry and beauty of finish." *The Handbook of American Indians North of Mexico* (Hodge, 1912, Part 2, p. 102) also comments on the large obsidian blades from the Pacific states. By their account they have largely been obtained from living tribes and were made more for ceremonial than for practical use. They cite published accounts by anthropologists of their use in ceremonies in which they figured primarily as objects of wealth.

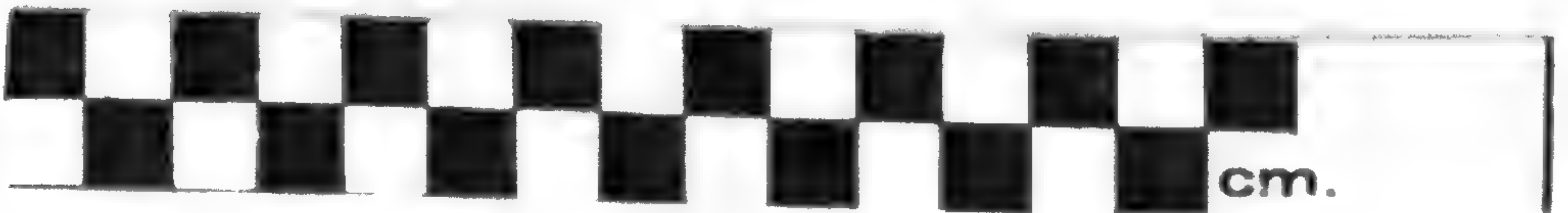


Plate 28 (Catalog No. 11X10-261) illustrates a smaller blade chipped from a curved flake of obsidian. There is no information on the source of this item. Material shown in both plates is black obsidian, but those shown in Plate 27 are shiny and that in Plate 28 is of a different, duller or more weathered variety.

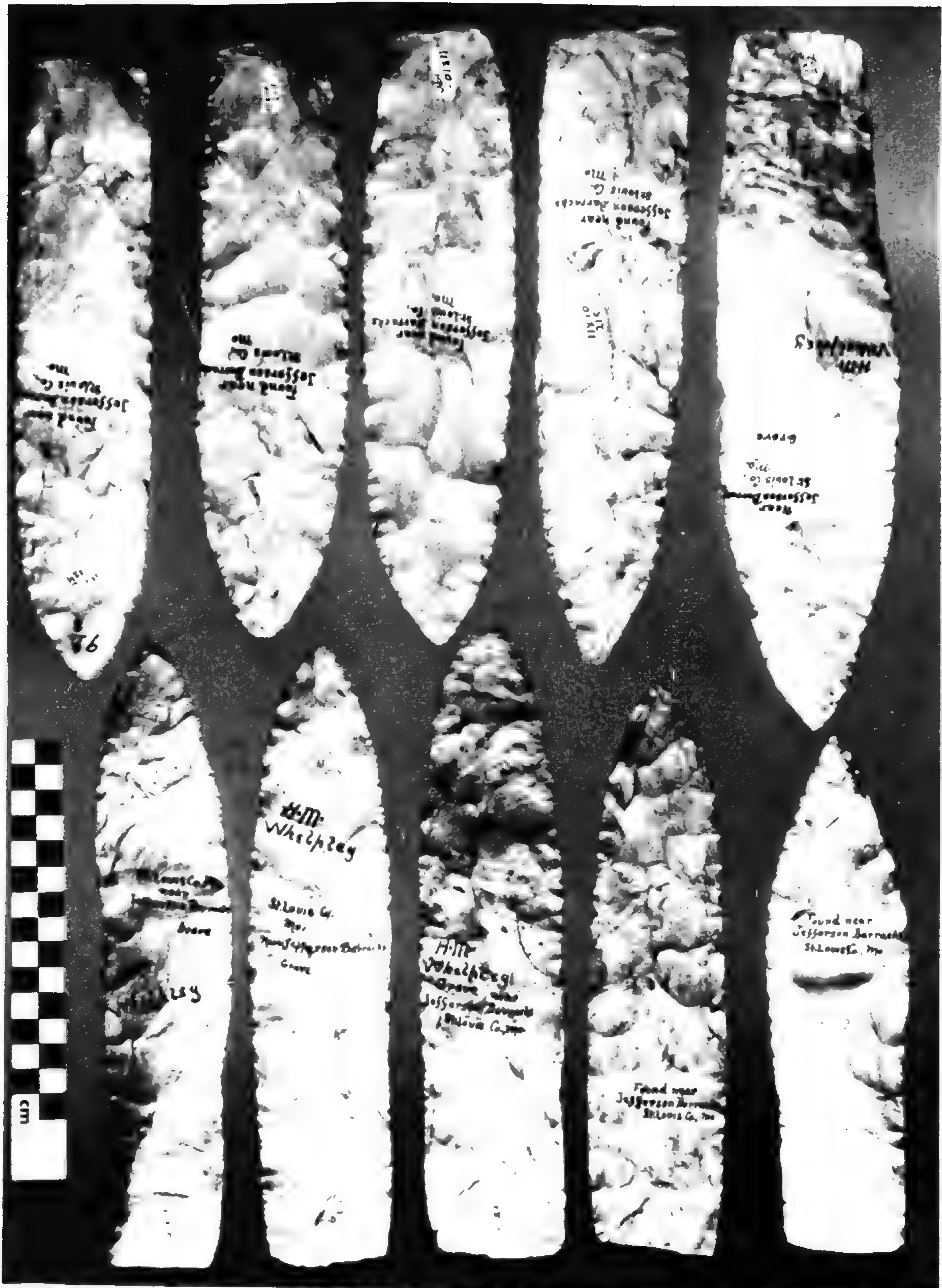


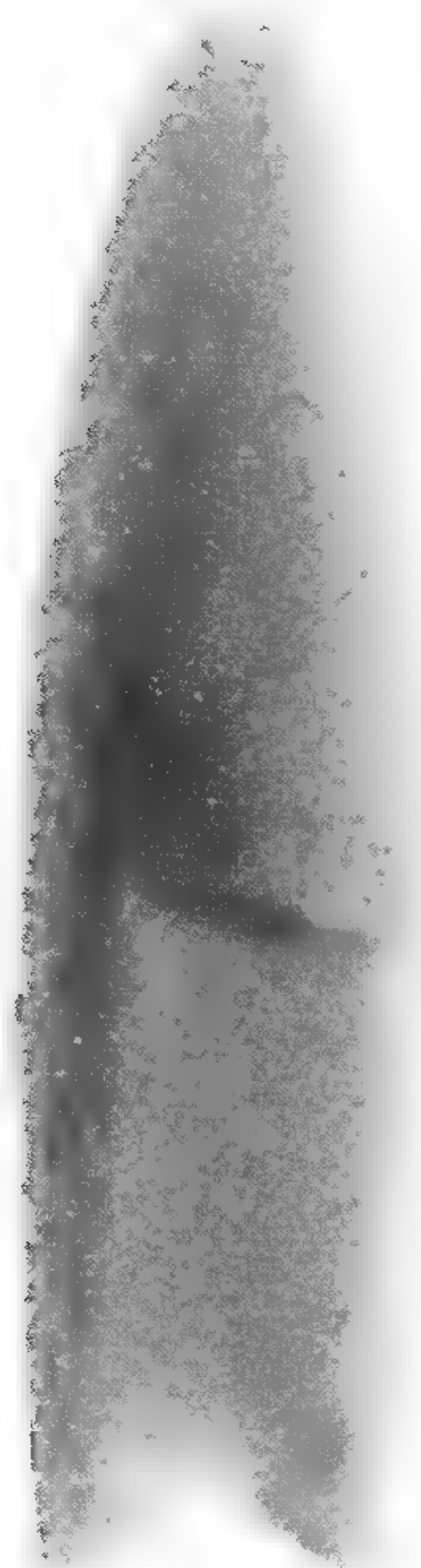
Plate 29.

Each of the ten large blades in this plate bears a notation in Dr. Whelpley's hand that they were found near Jefferson Barracks in St. Louis County, Missouri. One has the word "grave" written on it. It is possible that some or all of these came from one or more graves, for there are good records elsewhere in the St. Louis area of this type of blade being found as part of grave offerings. Since no notes about them could be found among Dr. Whelpley's effects, it is probable that no one will ever know just where, with what else and under what circumstances they were found.

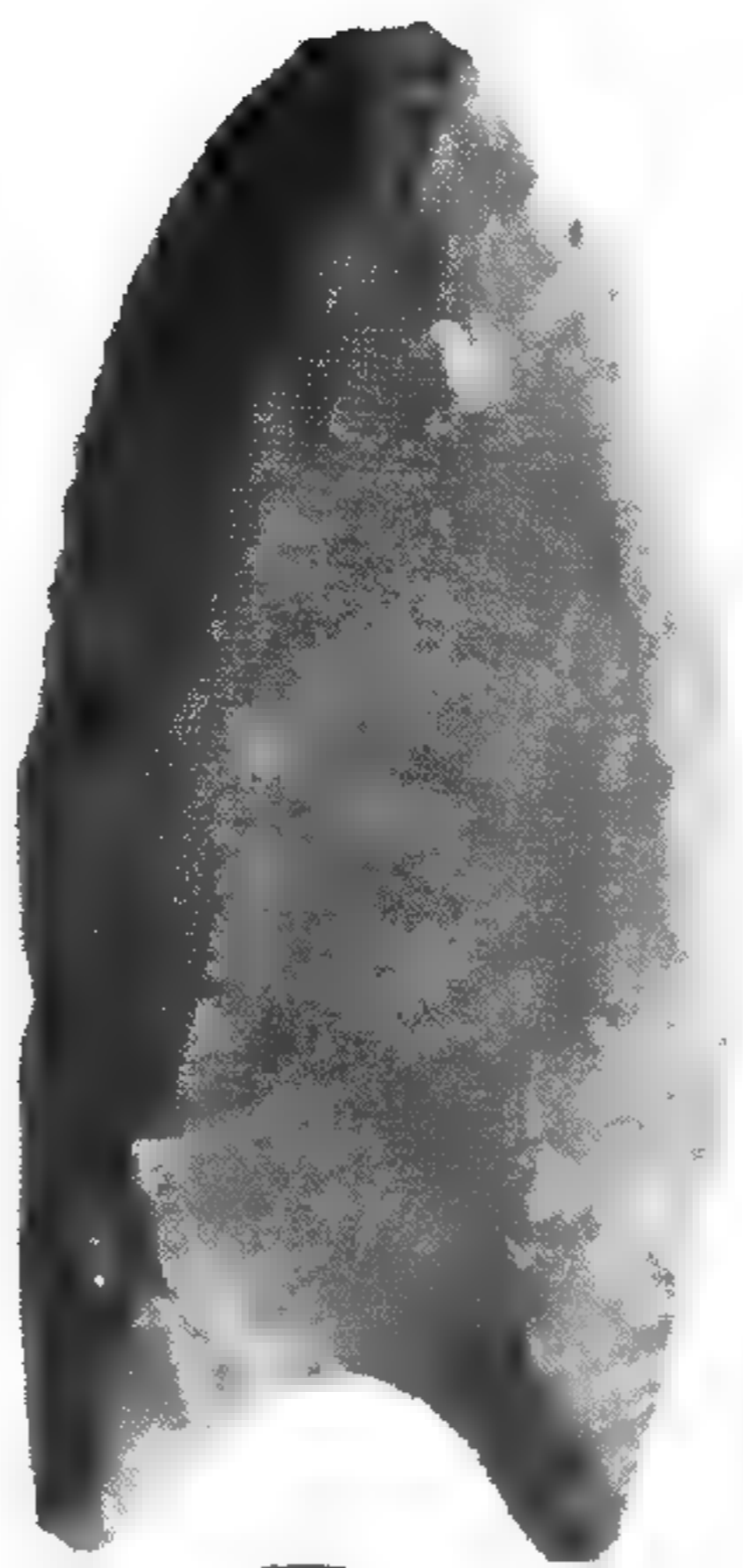
Dr. Carl H. Chapman in his *The Archaeology of Missouri, I* (1975, pp. 251-252) illustrates and describes this type of blade under the name of *Red Ochre Lanceolate*. The name is derived from sites of a Late Archaic culture called *Red Ochre* from a custom of sprinkling red ochre on burials. It is estimated to date about 3000-1000 B.C.

One of the best descriptions of artifacts of this culture is by the late Dr. Paul F. Titterington, a medical doctor and a member of the Academy of Science of St. Louis, who was an authority on the archaeology of the Greater St. Louis area. His article "Some Non-Pottery Sites in the St. Louis Area" in the *Journal of the Illinois State Archaeological Society*, (1950) led to the use of the term *Titterington focus* in archaeological literature for the variety of Red Ochre culture, which he described.

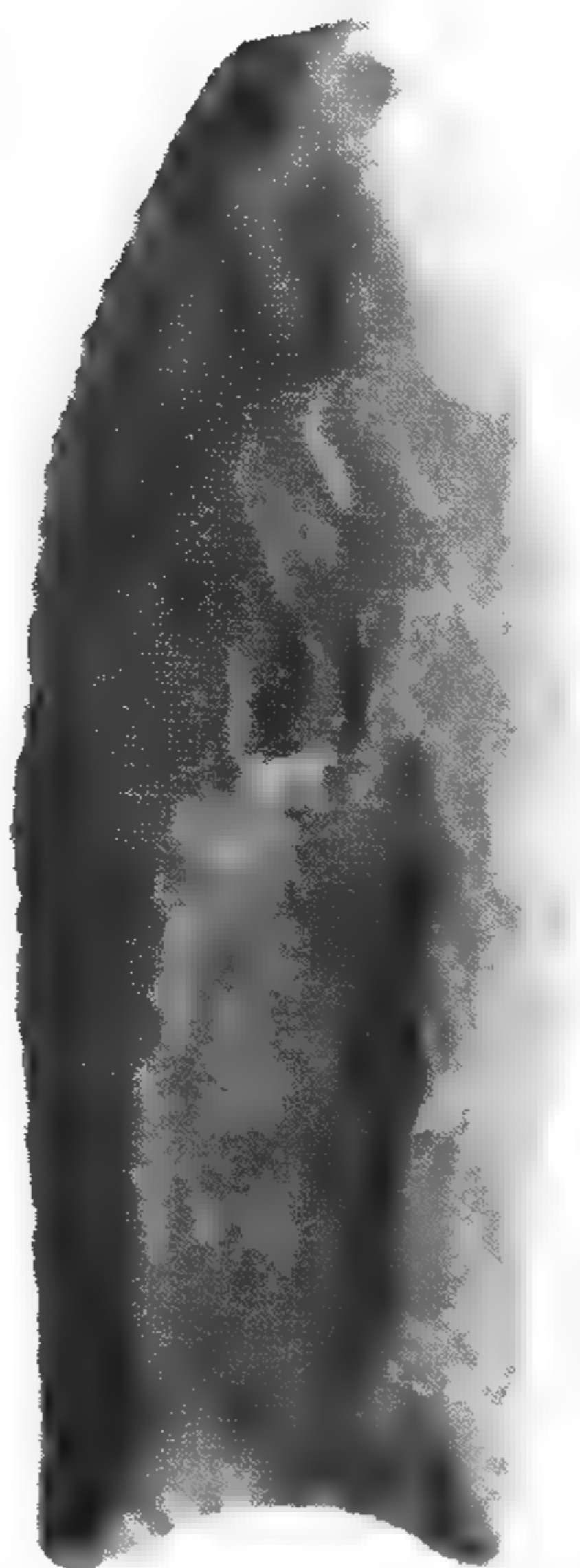
Chapman says that the *Red Ochre Lanceolate* occurs in the Northeast Prairie region of Missouri and Illinois. Gregory Perino in his *Guide to American Indian Projectile Points*, 1968, describes the same type under the name of *Wadlow Point*. He indicates that it is usually found in caches along the Missouri and Mississippi Rivers and the lower part of their tributaries from St. Louis to approximately Jefferson City to the west and Quincy and Peoria in Illinois to the north, usually on blufftop sites. Some of the blades are said to show use as knives, but some appear to have served as blanks or *preforms* for the making of a notched form called *Etley*, which is here shown in Plate 32C.



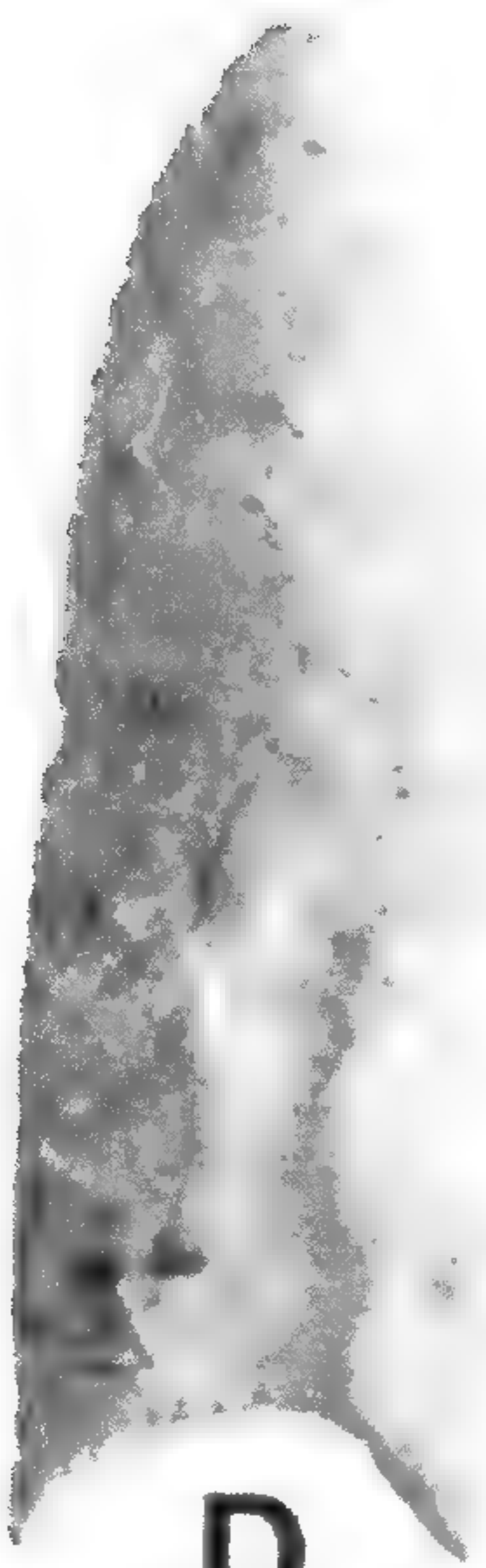
A



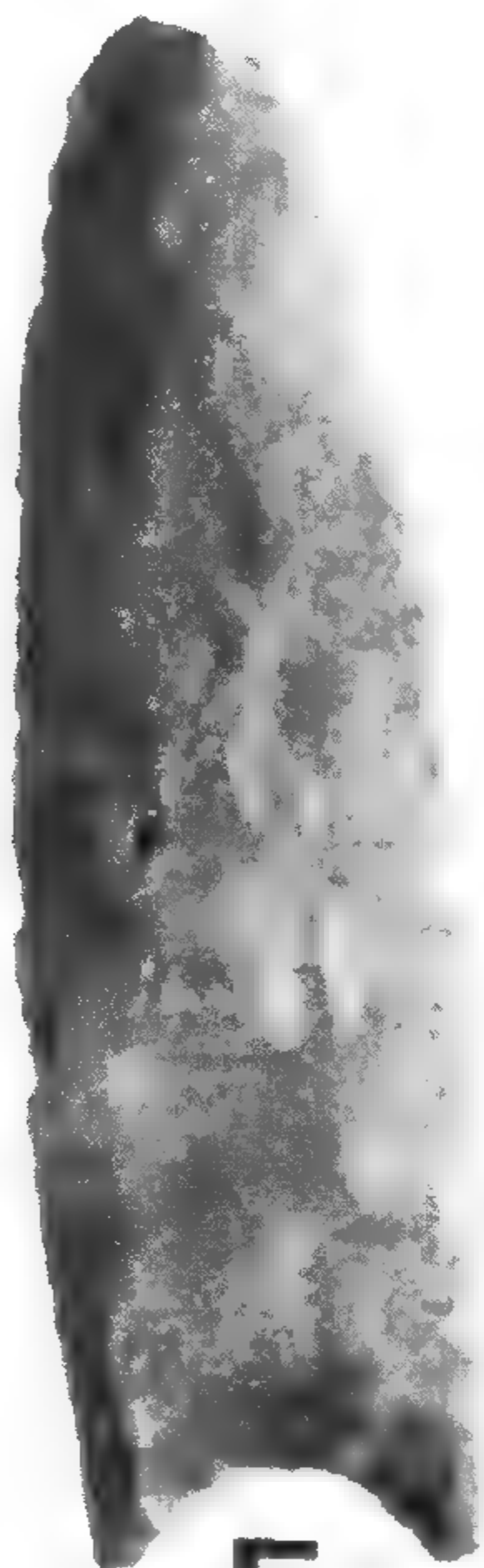
B



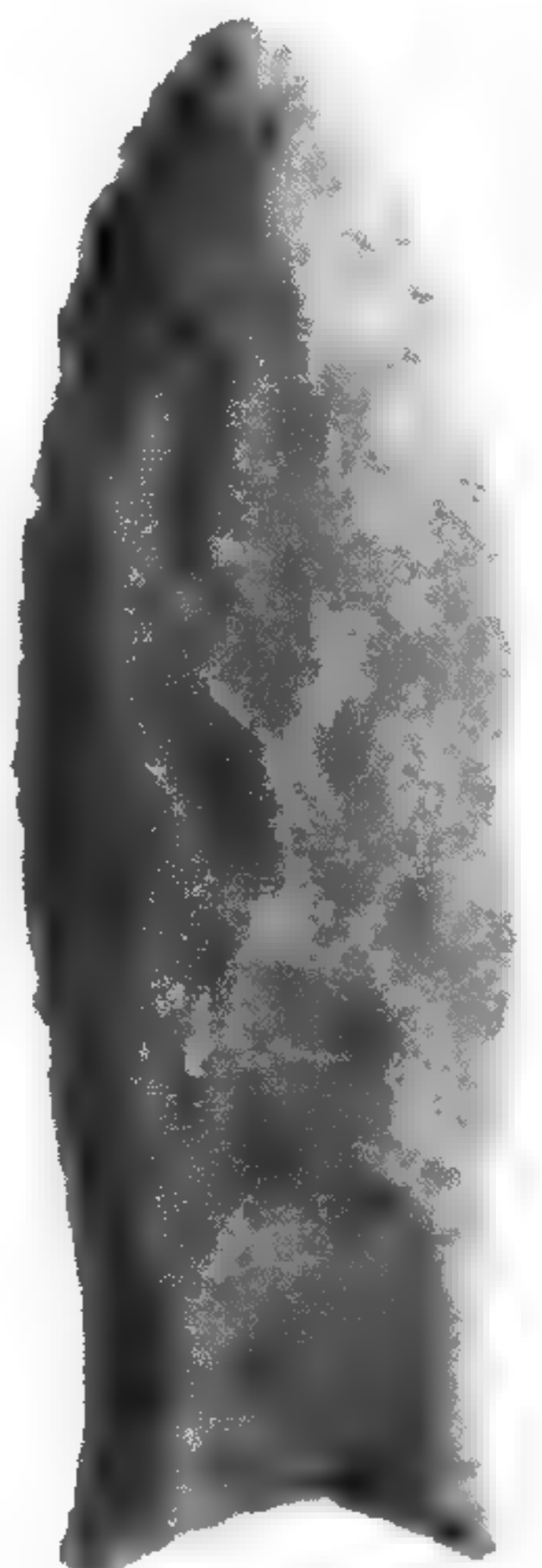
C



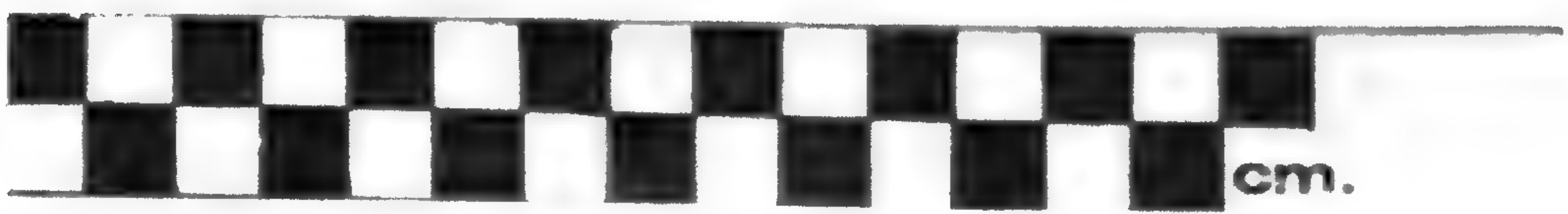
D



E



F



cm.

Plate 30.

This plate illustrates a fluted form of a flaked projectile point called *Clovis* or *Clovis Fluted*. It has widespread ancient distribution in the United States. It derives its name from the town of Clovis, New Mexico, near which such points were found in association with the bones of extinct animals in 1932. The second part of the name is from the characteristic flute. Chapman in his *Archaeology of Missouri, I* has a good description of the flutes: "Flutes are most commonly produced by the removal of multiple flakes and usually extend one-fourth to one-half the length from the base toward the tip. One side generally has a longer flute than the other, and sometimes fluting is on one side only. In some instances single flakes are removed to produce flutes." *He further points out that the bases are concave, and that the bases and lower parts of the sides are usually smoothed by grinding.

This type of point has been found closely associated with the bones of mammoths and extinct forms of bison only on the western plains and in the Southwest. Clovis points are found throughout the East but, so far, not in association with mammoth, mastodon or bison. The third item in the second row with recurved sides represents one of several variations of Clovis points sometimes found in eastern United States.

Radiocarbon dates associated with these points usually cluster around 9500-9000 B.C., but the only dated finds from Missouri are more recent, 8580-8250 B.C. These are from Rogers Shelter in southwestern Missouri on a southern tributary of the Lake of the Ozarks.

CATALOG NUMBERS AND LOCATIONS

- | | |
|---------------------------------|--------------------------------|
| A. 11X1-186 from Union Co., IL. | D. 11X1-179 from Osage MO |
| B. 11X1-184 from Phelps Co., MO | E. 11X1-273 from IA |
| C. 11X1-176 from Union Co., IL | F. 11X1-185 from Union Co., IL |

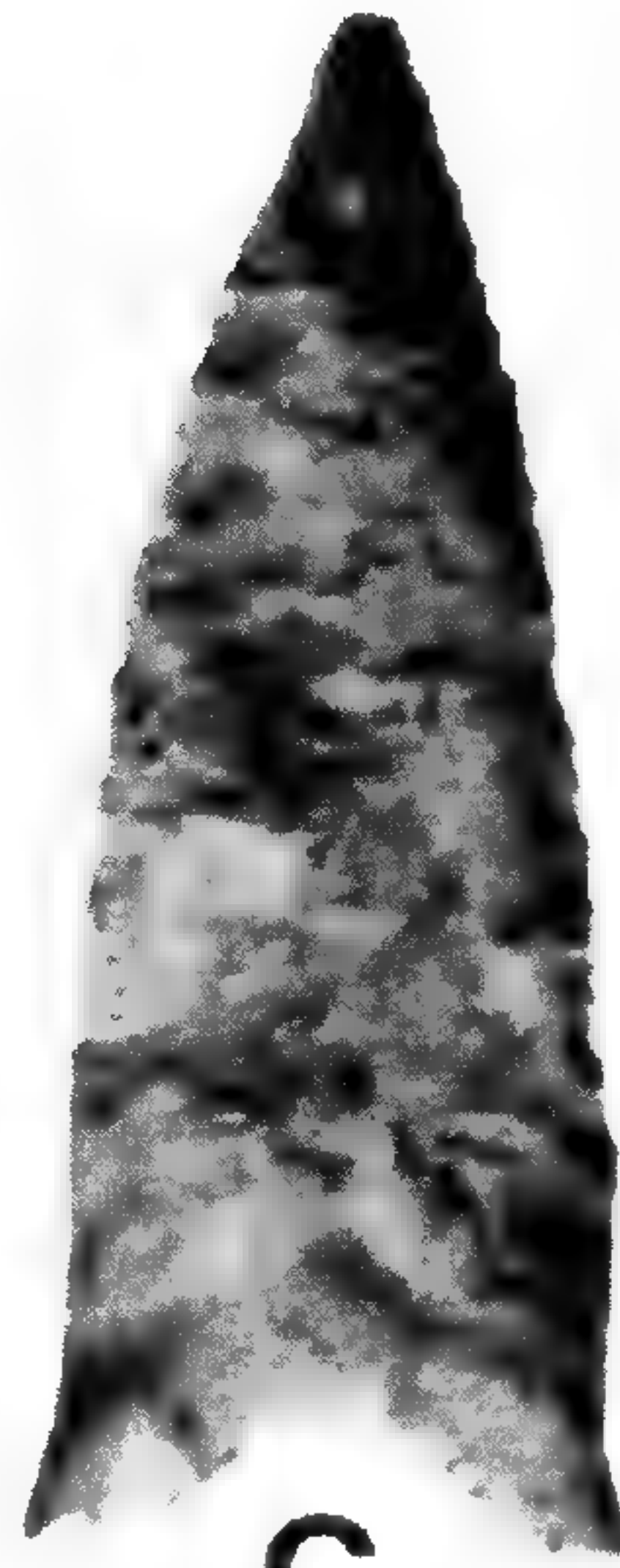
*Reprinted from "The Archaeology of Missouri, I" by Carl H. Chapman by permission of the author and the University of Missouri Press. Copyright 1975 by the Curators of the University of Missouri.



A



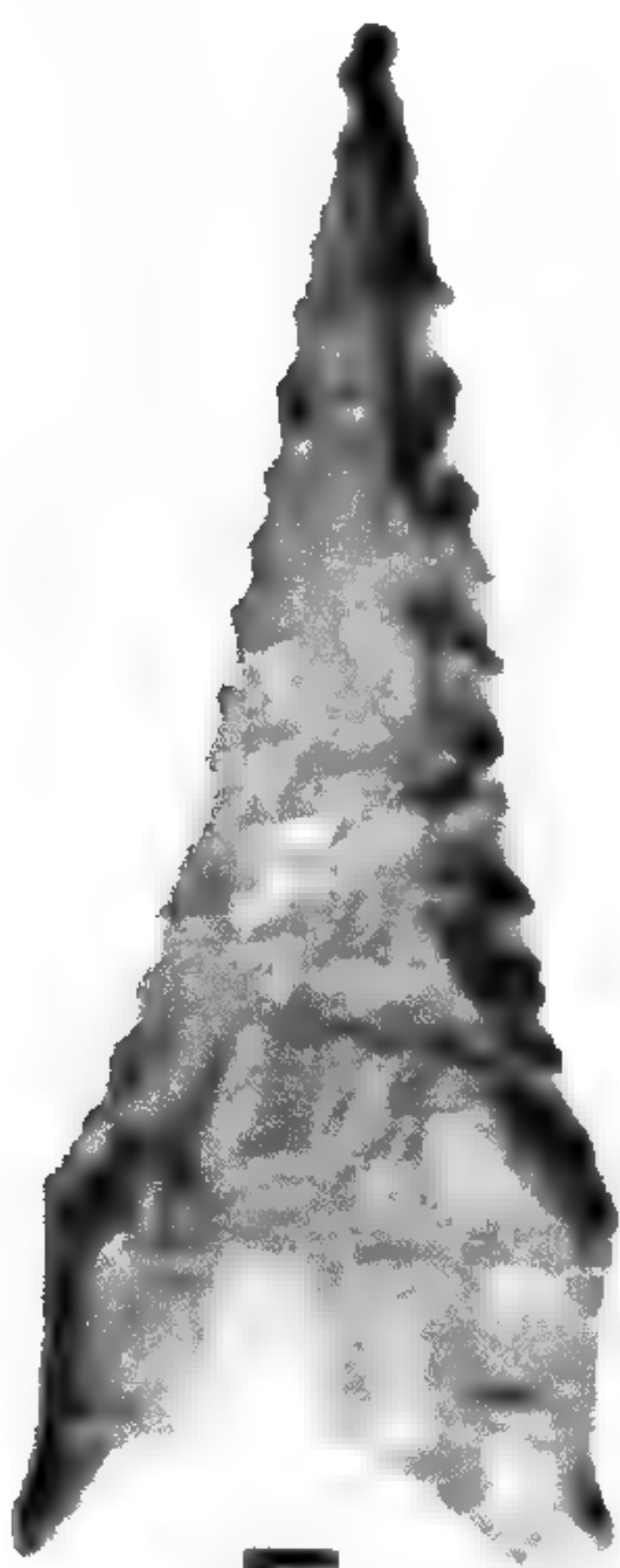
B



C



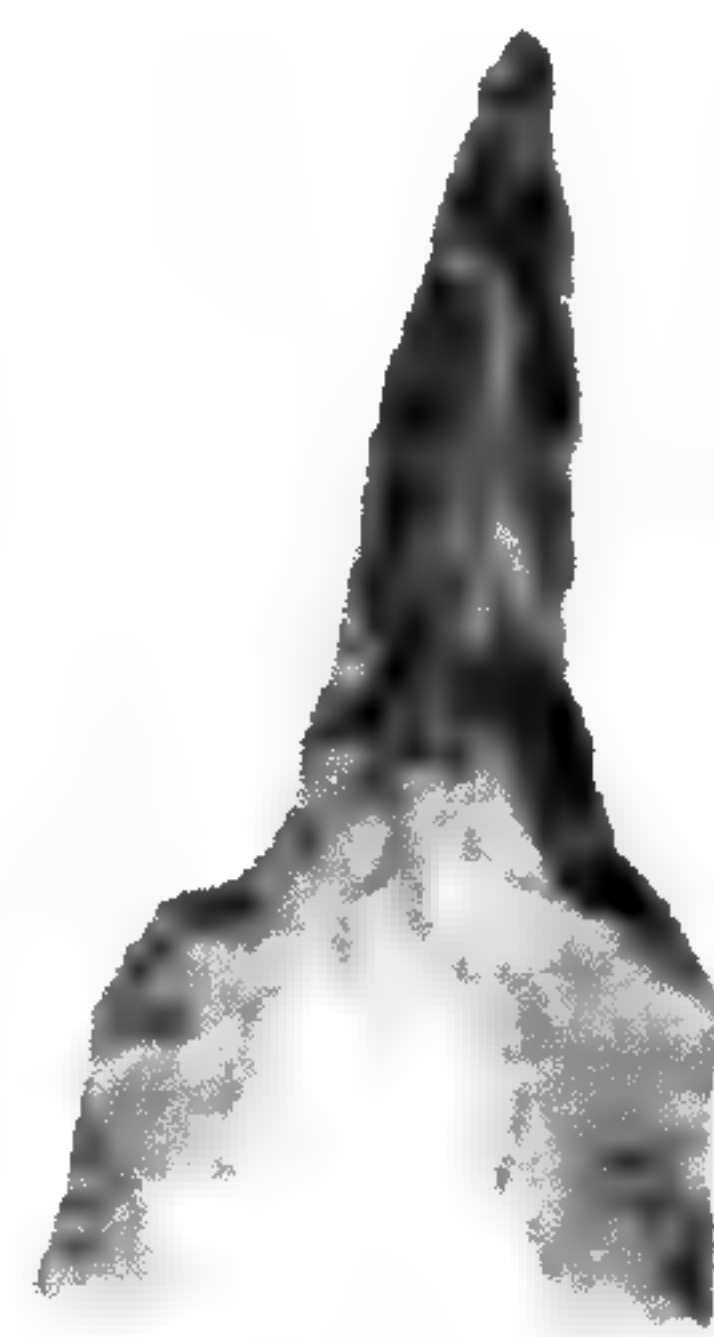
D



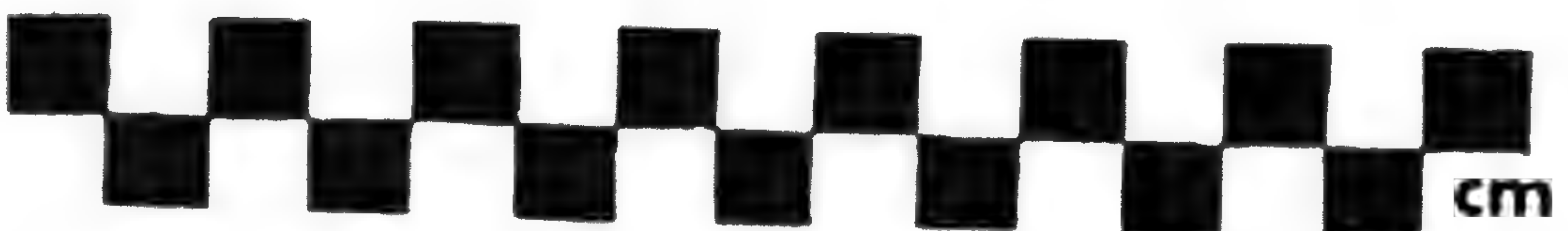
E



F



G



cm

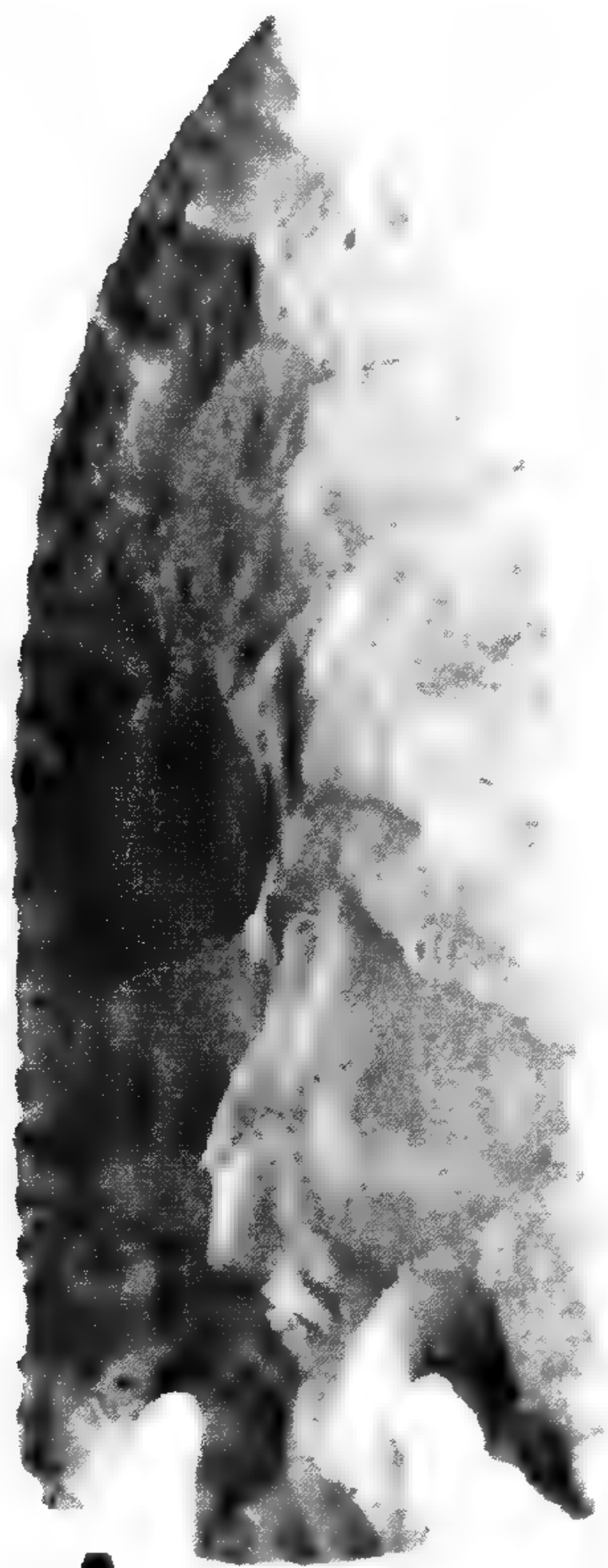
Plate 31.

- A. No. 11X1-430 from Crawford Co., MO
- B. No. 11X1-212 from Union Co., IL
- C. No. 11X1-192 from Union Co., IL
- D. No. 11X1-253 from Union Co., IL
- E. No. 11X1-39 from Union Co., IL
- F. No. 11X1-342 from Union Co., IL
- G. No. 11X1-343 from Union Co., IL

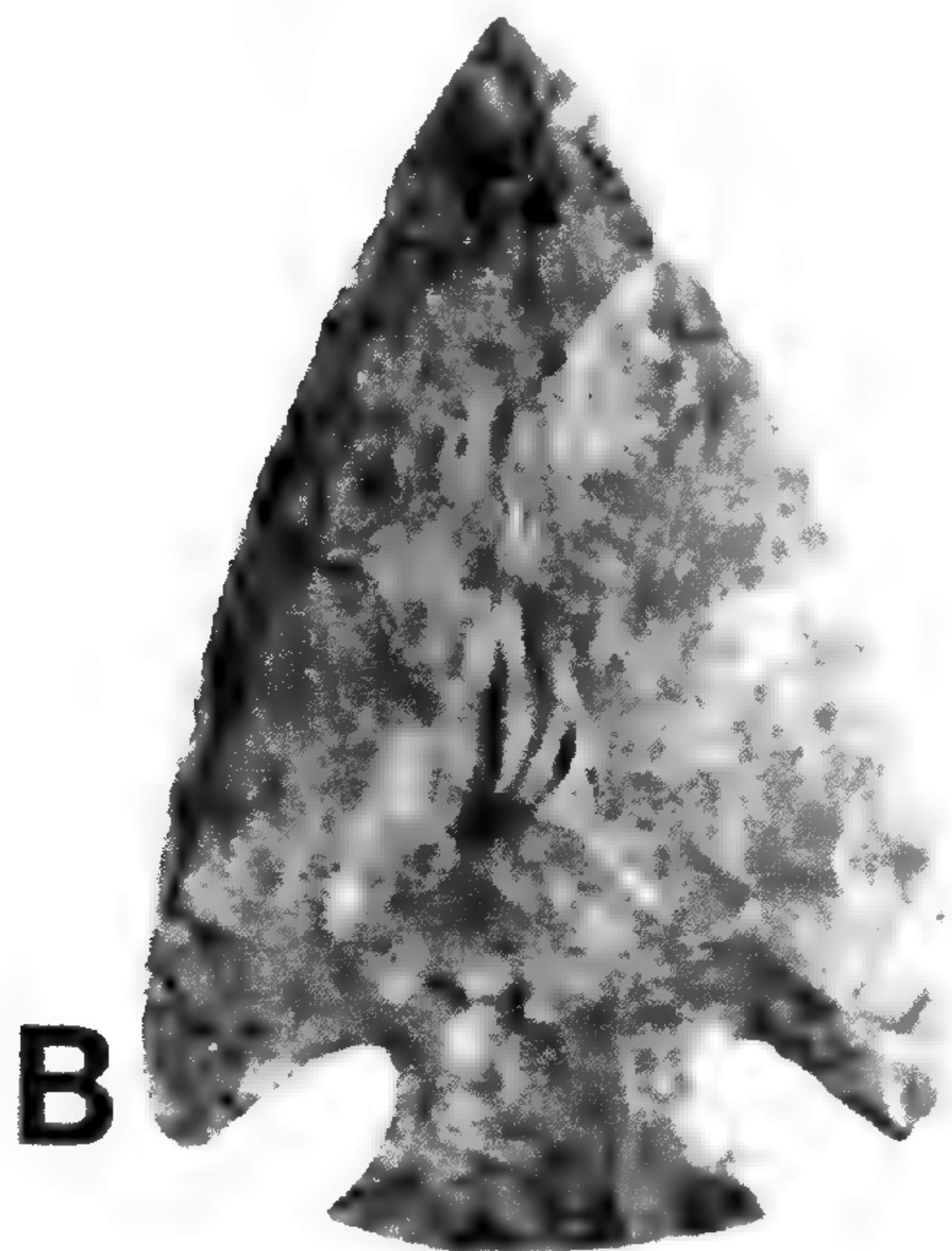
This plate illustrates a form of a chipped implement which appears to have been used interchangeably as a dart point or as a knife. It has been called *Dalton* or *Dalton Point* after the late Judge S. P. Dalton, former Chief Justice of the Missouri Supreme Court, who discovered and described the type site near Jefferson City, Missouri. It is sometimes called *Dalton Serrated*, because of the serrations on the blade edges of many specimens. Plate 31E illustrates a typical example. Blades were resharpened by a beveling technique, which modern experiments have shown to be the best way to get maximum use. With the point up, the bevel usually slopes to the right, although there are occasional exceptions. Plate 31A is an example of such an exception. All of the points illustrated in the top row of Plate 31, that is, A, B, C and D have been sharpened very little. The three illustrated in the bottom row (E, F, and G) have been sharpened so often that they can now serve best as drills or reamers.

Dalton Points are most numerous in the central part of the Mississippi Valley. Similar forms bearing different names such as *Meserve*, *Greenbrier* and *Hardaway* are found to the west, south and east.

Chapman (1975, p. 245) points out that Dalton Serrated has been found *in situ* in the earliest levels of Graham Cave, Arnold Research Cave and Rogers Shelter in Missouri. Radiocarbon dates range from about 8500 to 6000 B.C., but use of this form may have persisted to as recent as 5000 B.C. in some places. Daltons appear to represent a transition from the lanceolate, Clovis and Folsom points of the early Paleo-Indian hunters to the notched and stemmed forms of the later Archaic hunters and gatherers.



A



B



C



D

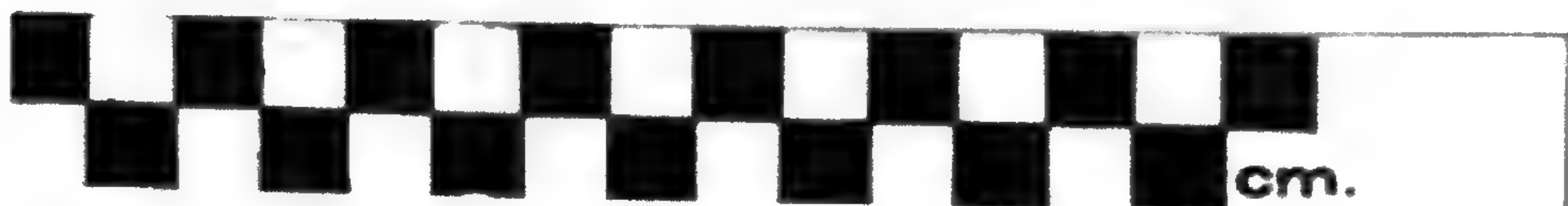


Plate 32.

A. Catalog No. 11X9-78, provenience unknown

This type of chipped implement has been described by Chapman (1975, *Archaeology of Missouri, I*) under the name of *Smith Basal Notched*. He states that it is found throughout Missouri and also occurs in Arkansas, Oklahoma and Texas. Estimated dates are 5000-1000 B.C. and it is primarily a cutting tool of the Late Archaic period. The name comes from the Smith site in Delaware County, Oklahoma, the type site.

B. Catalog No. 11X9-197, Osage Co., Missouri

This type of point has been called *Snyder's Corner-Notched* by Anta Montet-White (1968, *Anthropological Papers, Museum of Anthropology, University of Michigan No. 35*). The name is from the type site in Calhoun County, Illinois. This form of point is usually associated with the Middle Woodland culture called Hopewell which flourished for several centuries before and after the beginning of the Christian era. A similar point is said to have been made in the late Archaic period. The Snyder's point has been found over much of the central Midwest, north into southwestern Michigan and south into Oklahoma.

C. Catalog No. 11X4-334 St. Marys, Ste. Genevieve Co., Missouri

This is an unusually large example of a type of chipped point which is common in the St. Louis area. Chapman (1975) describes it under the name of *Etley Stemmed*. Bell (1960) calls it the *Etley Point* and others simply *Etley*. The name is from the type site in Jersey County, Illinois, near Pere Marquette State Park. It was first described by the late Dr. Paul F. Titterington (1950) as were the large blades shown in Plate 29, which are believed to have sometimes been the blanks for the manufacture of Etley Stemmed. This form of point is associated with Late Archaic of approximately 2000-500 B.C., according to Bell (1960) and is found in the Northwest Prairie and Northeast Prairie region of Missouri which extends into Illinois, according to Chapman (1975).

D. Catalog No. 11X2-821, provenience unknown

This large and beautiful implement is an example of *Graham Cave Notched*, as described by Chapman (1975, 248-249), although it is longer and wider than most. Many points of this type have incurvate blades as a result of resharpening, but this one shows no signs of reworking. Geographical distribution, according to Chapman (1975), takes in the equivalent of south, southwestern, south central and the eastern half of Missouri and adjoining areas in Illinois. Evidence from the Graham Cave site and other early midwestern sites indicates that such points are representative of the Early Archaic period and they are estimated to date about 8000-5000 B.C.

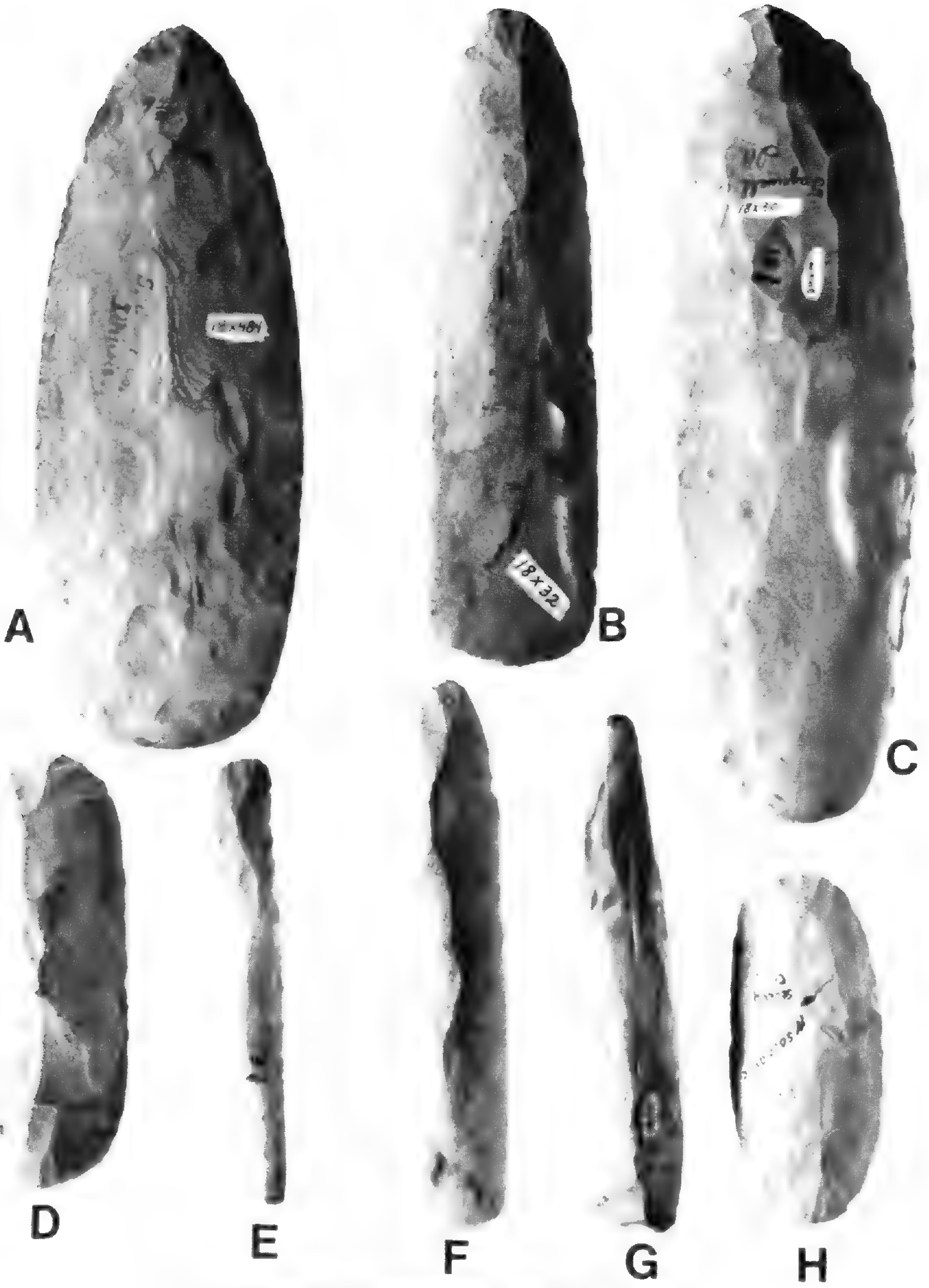


Plate 33.

This plate illustrates some of the woodworking stone tools used by the Indians who lived in the Mississippi Valley. All but the two pieces at each end of the bottom row are types used by Indians during the period A.D. 1000 to historic times. The other two were made by earlier people. Although objects of wood seldom survive in the humid climate of eastern United States, it is known from occasional finds and from the accounts of the earliest explorers that wood was worked extensively and well.

In 1895 an excavator for the Smithsonian Institution uncovered artistic wooden objects which included masks of deer and wolf, which had been preserved by being buried in the swamp muck of Key Marco Island on the west coast of Florida. These were recently exhibited in a showing of Indian art at the Nelson Gallery of Art in Kansas City (Coe, *Sacred Circles*, 1977, p. 63).

The Gentleman of Elvas, a participant in the DeSoto expedition in A.D. 1539-1542, mentions several times in his narrative things made of wood. When the expedition first landed in Florida he speaks of houses "built of timber" and "a temple, on the top of which perched a wooden fowl with gilded eyes" (Bourne, 1904, p. 23). Many of the towns were fortified with wooden palisades. Here is his description of one of these: "The place was enclosed, and near by ran a small stream. The fence which was like that seen afterwards to other towns, was of large timbers sunk deep and firmly into the earth, having many long poles the size of the arm, placed crosswise to nearly the height of a lance, with embrasures and coated with mud inside and out, having loop-holes for archery." He also describes dugout canoes which were a part of the daily life of the Indians which the Spaniards encountered along the Mississippi. Some of these were quite large, capable of holding sixty to seventy persons (p. 196).

Garsilaso, another chronicler of the expedition, describes canoes which held seventy-five or eighty. This is probably an exaggeration, but he does state that they were made from one piece of wood (Varner & Varner, 1951).

A. Catalog No. 18X
484 from St. Clair
Co., IL

B. Catalog No. 18X
32, provenience is
unknown.

C. Catalog No. 18X
30 from Tazewell
Co., IL

D. Catalog No. 18X
19 from Union
Co., IL

E. Catalog No. 18X
129 from Union
Co., IL

F. Catalog No. 18X
64 from Mont-
gomery Co., MO

G. Catalog No. 18X
11 from Pike Co.,
IL

H. Catalog No. 18X
24 from St.
Clair Co., IL

Plates 34, 35, 36.

These three plates illustrate digging tools used by Indians of the Mississippi culture. Those in Plate 34 are often called *notched hoes* in archaeological literature and the larger, unnotched forms shown in 35 and 36, *spades*. There is no question that both were sometimes used for digging in soil in which grass or corn (maize), which is also a grass, had grown. This is because of the gloss which those intensively used often exhibit, but there is some question whether the longer ones were hafted like a spade or like a hoe.

Several years ago it was discovered that the shine or gloss, which can best be seen on the bit end of the right hand object in Plate 35, is a build-up on the tools of opaline inclusions in grasses which remain in the soil after the grasses decay. Those that are interested in the technical, physical and chemical processes involved will find explanations in John Wittoft's "Glazed Polish on Flint Tools" in *American Antiquity*, Volume 32, No. 3, pp. 383-388, 1967.

One may sometimes find the same glaze on smaller flint tools that were used before agriculture for digging roots of edible wild plants in prairie soil. It is more commonly found on digging tools used by Mississippian Indians after A.D. 900 when the cultivation of corn was extensive.

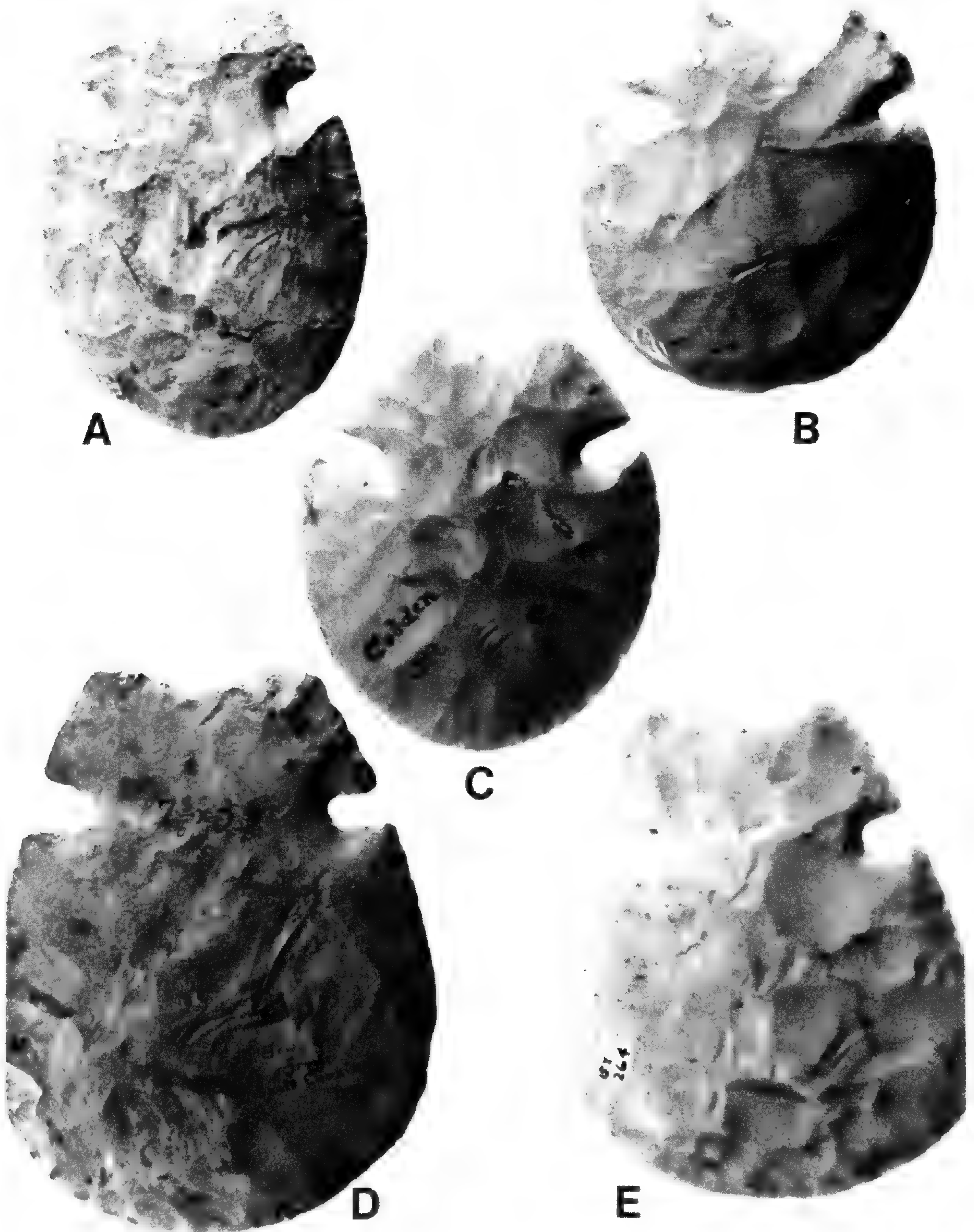
All hoes were not of stone, although they have survived best. Hoes of more perishable materials such as wood, shell or bone have been subject to decay. Swanton (*B.A.E. Bulletin* 132 p. 129) documents the use of wooden hoes among the Caddo in what is now the eastern part of Texas. Well worn hoes of shells of river mollusks, perforated for attachment, have been found in excavations and also hoes made of elk and deer shoulder bones. The agricultural Indians on the upper Missouri River used hoes made of bison shoulder bones, historically and prehistorically.

The question arises, why did the Mississippi Indians make large hoes like these, when the earlier Indians were content with smaller ones? The earlier Indians were capable of making quite large tools. One reason may lie in the way they made their corn fields. Good information on this has been uncovered in recent years. Dr. Melvin L. Fowler, now of the University of Wisconsin at Milwaukee, made aerial photographs of the Lunsford-Pulcher site near Dupou, Illinois, across the Mississippi from south St. Louis. In the photographs striations were noted, which were interpreted as ridged

Plate 34.

- A. 15X22 from St. Clair Co., IL
- B. 15X361 provenience is unknown

- C. 15X268 from Cobden, Union Co., IL
- D. 15X362 from St. Charles Co., MO
- E. 15X264 provenience is unknown



A

B

C

D

E

W. M. Adams
to
Dr. J. F. Snyder
1883.

H. M. Whelpley
2.7.11.

Perry Co.
Missouri.

St. Clair
Co. Ill.
Dr. J. F. Snyder
H. M. Whelpley
JH Col
2.27.11.

16x21

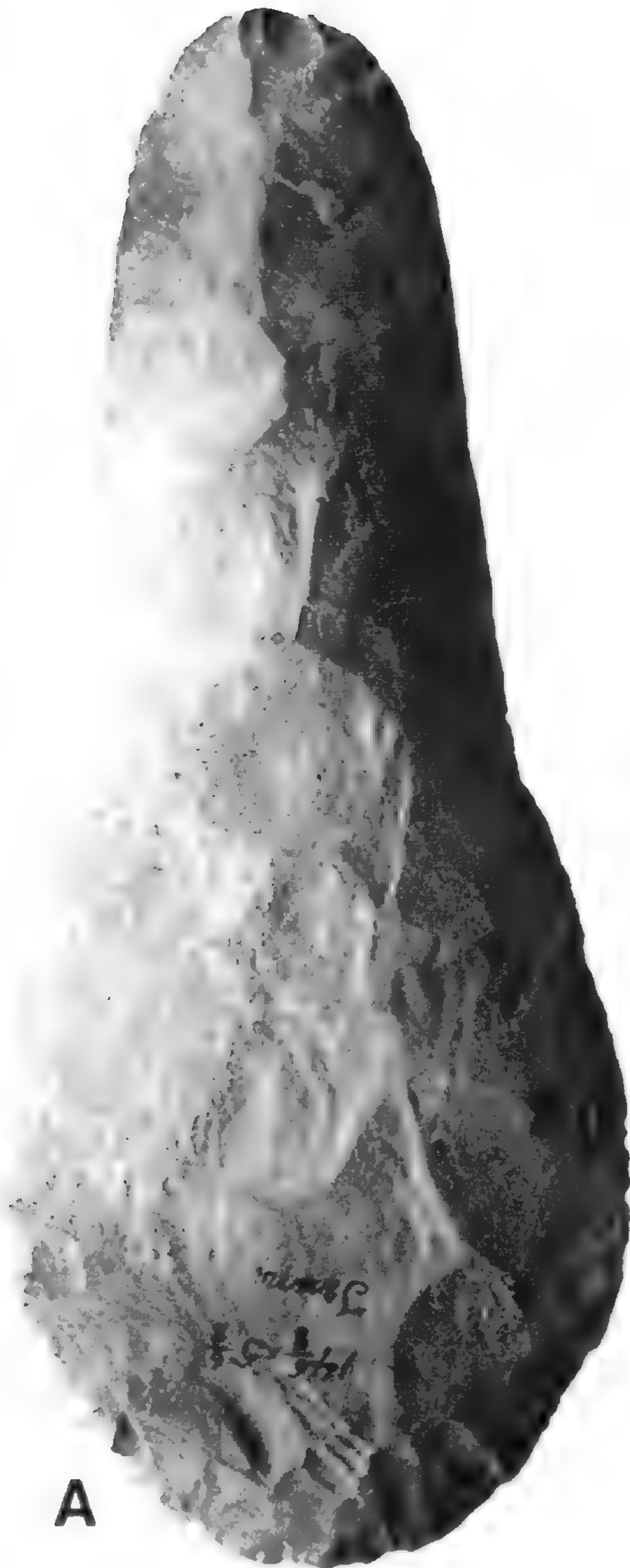


fields. Aerial photographs were also taken of a Mississippi site being excavated along the Kaskaskia River, east of St. Louis. Here also similar striations showed up in the photographs, but here it was possible to excavate and learn positively what caused the curious regular streaks in the photographs. Fowler's interpretation appears to be vindicated. Excavations showed that there were "definite rows of dark soil about 80 cm. to 1 m. in width and spaced at intervals of about 2.5 to 3.0 m." Furthermore, these and other excavations indicated that there was a very light (almost white) subsoil. It appears that the garden beds were formed by piling up the top soil into rows. This exposed the light subsoil, and it is for this reason the ridges were still apparent in the aerial photographs (Fowler, *American Antiquity* 34:4, 371). The furrows of modern plowing are not this widely spaced. It appears probable that large hoes would be very helpful in piling up such ridges.

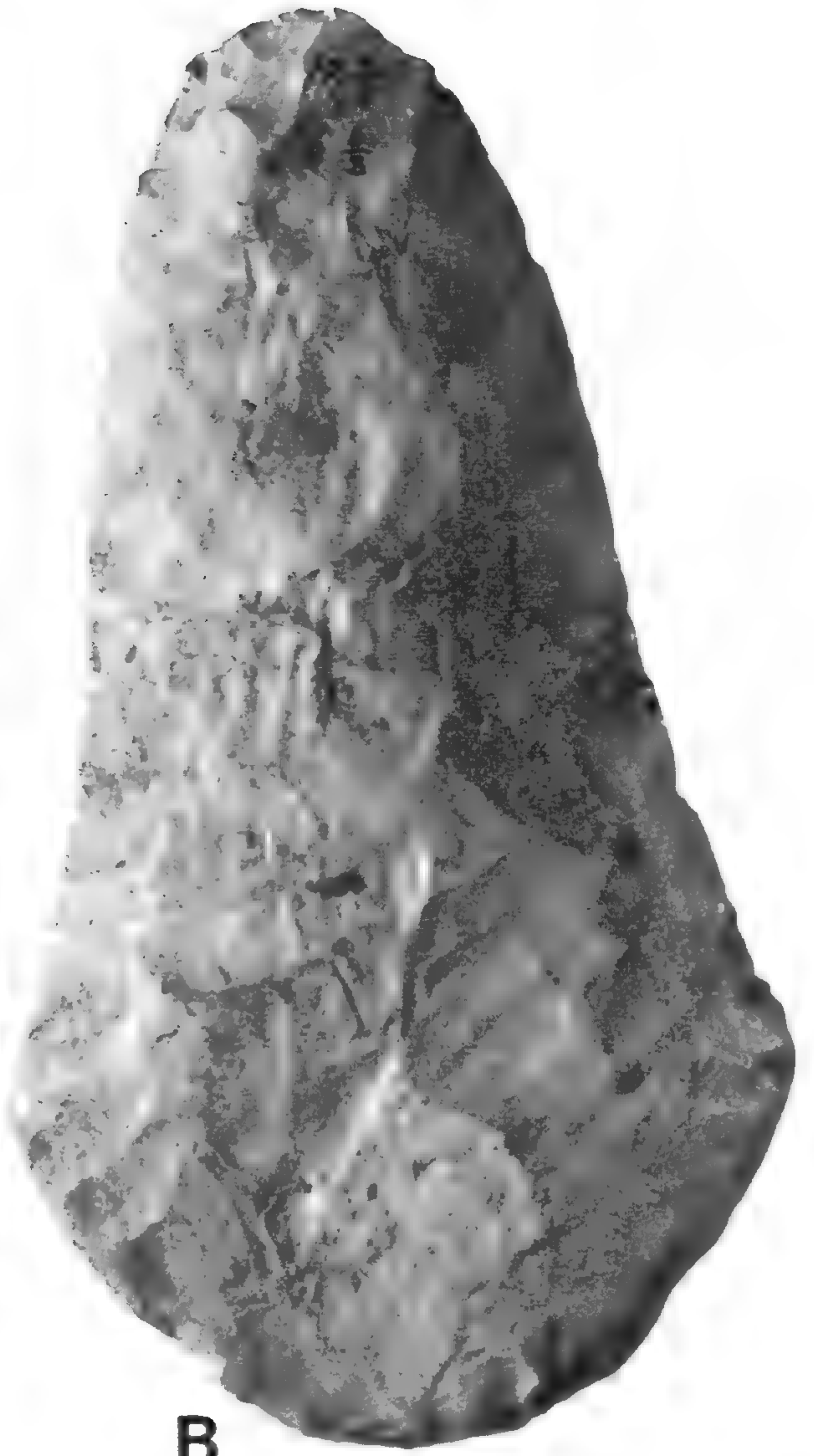
Another possible use for the large, unnotched "spades" or hoes could have been in house construction. Houses of most Mississippi Indians were made by placing poles which formed the sides into a narrow trench and then backfilling, instead of making individual holes for each post. The implements shown in Plates 35 and 36 appear to be ideal for this purpose. Dr. Warren Wittry, who conducted extensive highway salvage excavations near the great Cahokia Mound in 1960 and 1961, said that when "spades" were found in that operation they were often in the wall trench of a house (personal communication).

"Spades" of all of the shapes shown in Plates 35 and 36 have been found in the St. Louis area, though the shape of those in Plate 35 appear to be more prevalent. The flare-bitted forms in Plate 36 are the more popular style as one gets farther south near the mouth of the Ohio River.

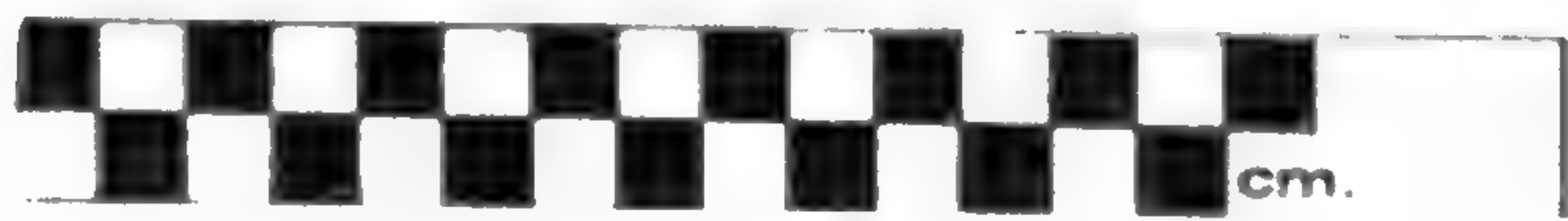
It will be noted that the "spade" on the left hand side of Plate 35 once belonged to William McAdams, a newspaper publisher of Alton, Illinois, who had an active interest in the archaeology of the area. He was also well known as a public spirited citizen, and the scenic McAdams highway along the Mississippi from Alton to Grafton has been named for him. The object then passed into the hands of John Francis Snyder, the man who excavated the figurines shown in Plate 14. Incidentally, Snyder was born in a farm house on the Lunsford-Pulcher site, mentioned above. The object on the right hand side of the plate also once belonged to him.



A



B



cm.

Plate 36.

A. No. 16X689 from
Clinton Co., IL

B. No. 16X664 from
a mound in Hum-
phrey Co., TN

Acknowledgements

Permission to quote from various publications by the following individuals and institutions is gratefully acknowledged:

Dr. James B. Griffin and Peabody Museum at Harvard University for quotation from Peabody Museum Papers, Vol. 25, 1951, *Archaeological Survey in the Lower Mississippi Alluvial Valley, 1941-47* and to Dr. Stephen Williams for expediting this approval.

Dr. Carl H. Chapman and the University of Missouri Press for quotation from his *The Archaeology of Missouri, I*.

Dr. Lawrence Mills for quotation from his article on Head Vases in Vol. 30 of *The Missouri Archaeologist*.

Dr. Charles C. DiPeso for quotation from a personal letter.

Thanks are due to Mrs. Eleanor Chapman for permission to reproduce her drawing of the dancing figure on a copper plate from Etowah Mounds and to David R. Evans for photograph of the burial with a mace at the Lilbourn site in New Madrid County, Missouri.

Thanks are also due to Jan Godfrey, Claudia Mink, Karen Corley and Lynn Kratzer of the Museum's staff for editorial assistance, to Karen Corley for layout work and Lynn Kratzer and Karen Zimmerman for typing.

Bibliography

Bell, Robert E.

- 1960 "Guide to the Identification of Certain American Indian Projectile Points," *Special Bulletin No. 2, Oklahoma Anthropological Society*, Oklahoma City.

Bourne, Edward Gaylord, Editor

- 1904 Narratives of the Career of Hernando De Soto, Buckingham Smith Translation, A.S. Barnes & Co., New York, Vol. 1.

Chapman, Carl H.

- 1975 *The Archaeology of Missouri, I*, University of Missouri Press, Columbia, Mo.

Coe, Ralph T.

- 1977 *Sacred Circles, Two Thousand Years of North American Indian Art*, Catalog of Exhibit at Nelson Gallery of Art, Kansas City, Mo.

Fernald, Merritt Lyndon,

- 1950 *Gray's Manual of Botany*, Rewritten and expanded by Fernald, Eighth Edition, American Book Co., New York.

Fowler, Melvin L.

- 1969 "Middle Mississippian agricultural Fields," *American Antiquity*, Vol. 34, No. 4, pp. 365-375, Salt Lake City.

Chapman, Carl H. and Leo O. Anderson

- 1955 "The Campbell Site, A Late Mississippian Town Site and Cemetery in Southeast Missouri," *The Missouri Archaeologist*, Vol. 17, Nos. 2 and 3.

Griffin, James B., Editor

- 1952 *Archaeology of Eastern United States*, University of Chicago Press.

Griffin, James B., Richard E. Flanders & Paul F. Titterington

- 1970 "The Burial Complexes of the Knight and Norton Mounds in Illinois and Michigan," *Memoirs of the Museum of Anthropology, University of Michigan*, No. 2, Ann Arbor.

Hodge, Frederick Webb, Editor

- 1912 "Handbook of American Indians North of Mexico", *Smithsonian Institution, Bureau of American Ethnology*, Bulletin 30, Part 1 Fourth Impression, Part 2 Second Impression, Washington.

Holmes, W. H.

- 1883 "Art in Shell of the Ancient Americans", *2nd Annual Report of the Bureau of American Ethnology, 1880-1881*, Washington.

Holmes, W. H.

- 1919 Handbook of Aboriginal American Antiquities, Part 1, *Bureau of American Ethnology*, Bulletin 60, Washington.

Kneberg, Madeline

- 1959 Engraved Shell Gorgets and their Associations, *Tennessee Archaeologist*, Vol. XV, No. 1, pp. 1-39.

Lorant, Stefan, Editor and Annotator

- 1946 *The New World*, Duell, Sloan & Pearce, Inc., N.Y.

Mills, Lawrence

- 1968 "Mississippian Head Vases of Arkansas and Missouri," *The Missouri Archaeologist*, Vol. 30. pp.1-83.

Montet-White, Anta

- 1968 "The Lithic Industries of the Illinois Valley In the Early and Middle Woodland Period," *Anthropological Papers, Museum of Anthropology, University of Michigan*, No. 35, Ann Arbor.

Perino, Gregory

- 1968 "Guide to the Identification of certain American Indian Projectile Points," *Special Bulletin No. 3, Oklahoma Anthropological Society*, Oklahoma City.

Phillips, Phillip, James A. Ford and James B. Griffin

- 1951 Archaeological Survey in the Lower Mississippi Alluvial Valley, 1940-1947, *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard College*, Vol. XXV, Cambridge, Mass. Page 170 and Fig. 104, k-o,t.

Swanton, John

- 1942 "Source Material on the History and Ethnology of the Caddo Indians," *Bureau of American Ethnology Bulletin* 132, Washington.

Swanton, John R.

- 1946 "The Indians of the Southeastern United States," *Smithsonian Institution, Bureau of American Ethnology, Bulletin* 137, United States Government Printing Washington.

Thomas, Cyrus

- 1893 Report on the Mound Explorations of the Bureau of Ethnology, *12th Annual Report, Bureau of American Ethnology*, Washington.

Titterington, Paul F.

- 1950 "Some Non-pottery Sites in the St. Louis Area" *Illinois Archaeological Society, N.S.*, Vol. 1, No. 1, pp. 19-30.

Varner, John and Jeannette Varner, Translators

- 1951 *The Florida of the Inca* by Garcilaso de la Vega, University of Texas Press, Austin.

Walton, Clyde C. Editor

- 1962 *John Francis Snyder, Selected Writings*, Illinois Historical Society, Springfield.

Waring, A.J., Jr. and Preston Holder

- 1945 "A Prehistoric Ceremonial Complex in the Southeastern United States," *American Anthropologist*, Vol. 47, No. 1, pp. 1-34. Menasha, Wisconsin.

Williams, Samuel Cole

- 1930 *Adair's History of the American Indians*, National Society of Colonial Dames of America, in Tennessee, Promontory Press, N.Y.

Williams, Stephen and John M. Goggin

- 1956 "The Long Nosed God Mask in Eastern United States," *The Missouri Archaeologist*, Vol. 18, No. 3, Columbia.

Wittoft, John

- 1967 "Glazed Polish of Flint Tools," *American Antiquity*, Vol. 32, No. 3, pp. 383-388.