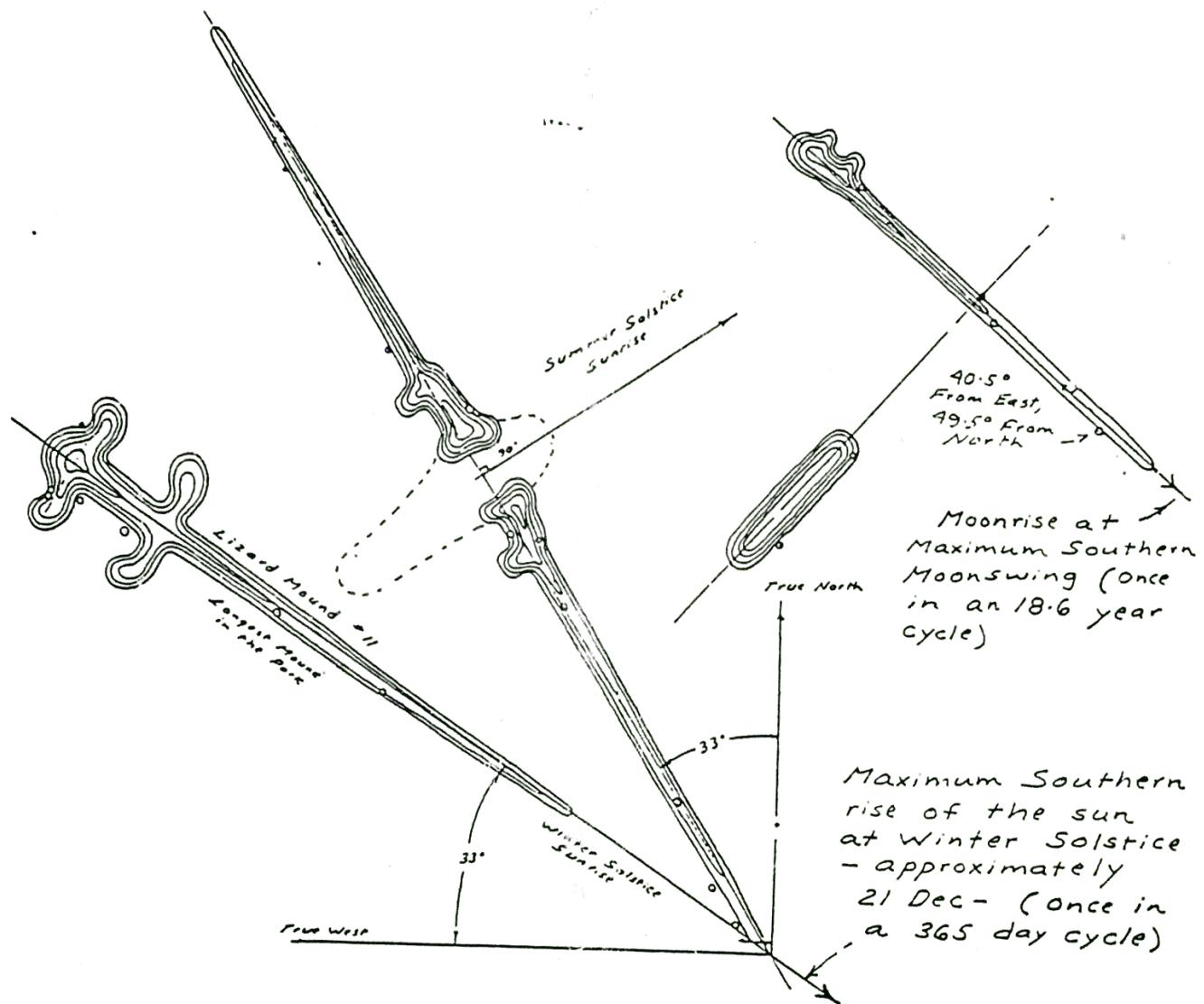


THE JOURNAL OF THE ANCIENT EARTHWORKS SOCIETY



The Ancient Earthworks Society, Inc.
p.o. box 1125
Madison, Wisc, 53701

AES is devoted to the mapping, study, and preservation of Indian Mounds and related landscape features. Most members live in the Madison area, but we work throughout Wisconsin and the upper Midwest.

Our most fundamental work concerns the precise surveying and mapping of mounds and other features. Our members have discovered some mounds; many others have been called to our attention by the public. We do much archival research of the records of early surveyors and explorers, we study the anthropological literature, and we listen closely when instructed by native teachers. We collect and catalog site reports. We help register mounds with the State Historical Society. We assist in the struggle to preserve mounds from destruction. We have developed methods to recover the outlines of apparently obliterated mounds. We help inform and educate the public.

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**JOURNAL
of
THE ANCIENT EARTHWORKS SOCIETY
Madison, Wisconsin**

**VOLUME III
AUTUMN, 1990**

(2nd Edition, Spring 1991)

**LIZARD MOUND PARK
Washington County, Wisconsin**

Based on the Survey by
William F. Wenzel

(President, Sauk Prairie Area Historical Society)
and

Patricia A. Arntsen
Larry A. Johns

(under the direction of Professor James P. Scherz,
Department of Civil and Environmental Engineering
University of Wisconsin/Madison)

All Text and Figures by J.P. Scherz (JPS)
unless otherwise noted.

Published by The Ancient Earthworks Society, Inc.

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Research Director: James P. Scherz

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ACKNOWLEDGEMENTS

We wish to acknowledge the volunteer assistance of other individuals who helped map and sketch the mounds described in this report. These include: Holly A. Higgins, Carol and Ray Knapp, Karine and Patricia Muschinske, Parisha H. Pakroo, Novak Sekulovich, Jeffrey W. Sommers, and Cynthia L. Sontvedt. In addition we wish to thank John Boatman, American Indian Studies, University of Wisconsin-Milwaukee, and his friend Jan A. Borgenhagen for their assistance with conceptualizing some of the traditional American Indian significance of the mounds. We are also indebted to other unnamed park visitors who, when we needed someone to hold a rod for a few minutes, volunteered their time during their stroll through this enchanted park.

We acknowledge the support and help of Buck Trawicky, especially during map compilation, proofing, and checking the results.

Reference Material

Copies of the larger scale final maps produced in this project are available at the University of Wisconsin Air Photo and Map Library, Science Hall, Madison. The original survey notes and compilation maps are on file with the Survey Division, Department of Civil and Environmental Engineering, University of Wisconsin, Madison.

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AES Publications

On Obtaining AES Publications, copies of this Journal, and large maps

PREFACE

A Guide for the Reader

Buck Trawicky

The intent of this year's Journal is to provide a thorough Survey and Site Report of the Lizard Mound Group (including detailed maps, with angles and distances, and a collection of relevant archival and anecdotal material, especially some Native material), and to use this as the occasion to explain at some length a number of other topics which this survey report illustrates. You are holding a trove of delightful information: read every word, or you'll miss many surprises.

The Lizard Mound Group is located (p.3) about 20 miles north of Milwaukee, Wisconsin at Lizard Mound County Park. This is near the shore of Lake Michigan, northeast of West Bend, in Washington County.

This is a very significant site, and we are quite lucky that it is a protected county park; many equally important sites have passed into the paws of real estate developers, or within the purview of road surveyors, and have been bulldozed out of existence. However, even this site has not been completely preserved: there were once more mounds to the west of the park (p.25, Fig. 6); these are now invisible above the surface, though it is barely possible that their outlines may be retrievable by soil sampling (pp.40-42).

The Lizard Mound Site is named after one of its most prominent mounds (#11), a lizard mound over 250 feet long. Another mound (#16) is a panther with a protuberance in the tail, originally containing a burial. When this was still a state park, the park authorities exposed this portion of the mound and enclosed the bones of a burial in a glass viewport, and labeled them those of an "Indian Princess." (It is unclear whether these bones originally came from a burial elsewhere.)

At the time of our survey, and while precious lore was being transmitted by an Indian teacher (p.16, fig. 4d), the party discovered that the burial had been desecrated and the bones stolen.

We chose the Lizard Mound Site as the topic for this Journal because so much that we already know comes together here. We have surveyed many other sites, but few others reveal themselves so clearly while shedding so much light on other mound groups. (See Annexes D-I.)

However, this site is not merely a universal template; there are very special features here. There is the duality of landforms, mirrored in the mound groupings. (Fig.10ff, pp.34ff.) And there is a mysterious angle of 47.5 deg., which has been found elsewhere but which occurs here as well, prompting us to conclude that it is meaningful. We do not know what it indicates, but it must be significant. (Annex K.)

The Lizard Mound Group displays strong orientations towards the winter solstice sunrise, summer solstice sunrise, and maximum moonswing (Figs 4c-d, pp. 14-16). There appears to be an alignment with the maximum southerly swing of Saturn (Annex H-26).

Regarding angles and dimensions, the Lizard Mound group displays many significant angles. 1) The major construction angles are there (30, 45, 60, and 90 degrees). 2) True North (to great accuracy) is the prime angle. 3) The angles of the sun's rise and set at the solstices and equinoxes are there. 4) So is the maximum moonswing. (The furthest north and south points of the moon's rise and set: a period of approximately 18.6 years.) 5) The angle of the Earth's axial tilt (ca. 23.5 degrees), which is the sun's maximum declination, is present. So is the maximum declination of the moon. 6) The latitude and co-latitude (90deg. minus the latitude) are present. 7) Phi angles (divine proportion angles) are present. 8) It is possible that planetary angles are present (Annex H). 9) The site is laid out on a 200-foot baseline. For summaries and keys to all these angles, see the overall Index Maps (Fig.3, p.5; Fig.4, p.12; Fig.5, p.19). Also see Annexes D, E, F, H, and M. For a discussion of possible standard distances, see Annex G.

We realize that this material is likely to be fascinating yet dauntingly mathematical. Therefore, we are including several annexes intended to introduce the reader to the topics of time, celestial motion, angles, and geometry. We include a simple introduction to basic trigonometry in Annex S. And since Phi (the Greek letter, pronounced to rhyme with "fry"; also known as the Divine Proportion, or the "mean and extreme ratios", etc.) is so important and pervasive in mound layout and in temple geometry worldwide, we give it a great deal of demonstration. Moreover, our units of measure, as used by surveyors and navigators, are of great antiquity and subtlety; these too are discussed, as is the significance of latitudes of various sacred sites of the northern hemisphere. The study of mounds, and of Phi, has enabled us to discover solutions of two ancient geometrical conundra, "squaring the circle" and "trisecting any angle." These solutions are demonstrated. Finally, the geometry of circles, and of spirals, appears to be important in the geometry of some sites, most obviously at Aztalan. And once one's awareness of spirals is awakened, the evidence for cultural influences from India and elsewhere becomes very compelling. For all this material, see Annexes M, P, Q, R and S. Annex M also has a short annotated bibliography of books related to sacred geometry and metrology certain to expand your mind.

For those to whom the topic of effigy mounds is quite new, we include a simple introductory essay on the subject. (Annex L.)

And for those interested in the political process of preserving the mounds, we include Annex J, on progress to date. This annex also includes a very old sketch map of central Madison, showing a huge number of mounds, all now gone.

For those interested in the details of surveying, and of our surveys and maps in particular, read Annex N. This annex also includes information on elephant mounds.

And for the surveyor's perspective on mounds, read Annex O.

For information on The Ancient Earthworks Society, see the inside front cover, the title page, and the publications list at the rear.

While surveying the Lizard Mound group, we were given some valuable information by an Indian teacher. We were taught that in times past the two panther mounds (#9-10) were the site of a sunrise ceremony. The people would form the outline of a bird's body, with the two panthers forming the wings, and they would direct their prayer towards the rising sun. Our surveys indicate that this would have occurred at the summer solstice sunrise.

This immediately strengthens three hypotheses: 1) Implicit angles (angles offset by 90 deg.) are indeed significant, and are not just random artifacts. 2) The mounds were (and perhaps still are) used as active sites, with the geometry vitally important for their focus. 3) The understanding of what these sites mean is still retained in living memory. Much knowledge has been preserved. (And very little has been revealed to us: we Euro-Americans are having to decipher a living language. I wish I were a Winnebago, educated by the Lodge and the Jesuits, and mapping with my transit. Utter heaven.)

Several other important topics are discussed in this Journal.

Soil sampling is a potentially invaluable technique. Mounds were not built with the equivalent of a backhoe and a bulldozer. According to our interpretation, a mound was built by first laying out its outline, then excavating this to a depth of about 18 inches, and then filling in this shape with deliberately-chosen soil up to the desired height. Sometimes the mound was layered with different materials. All this has been described in previous AES Newsletter and Journal articles. The current (brief) statement of the technique, as it applies to Lizard Mound State Park, and to other sites (especially some close to Madison, trashed by real estate developers) is outlined in Annexes B,C.

Another topic is the revised estimate of trustworthiness of the old surveyors. (Annexes A-C). Only T.H. Lewis's surveys are really trustworthy. Brown, Canfield, and Lapham (among others) produced quite misleading maps. Their maps have been used for mound analysis, yet they are fatally flawed. Lewis' survey notes, on the other hand, are enviably accurate. They are a precious resource. They can be used to rediscover the outlines of mounds whose surfaces are now obliterated.

If Lewis is trustworthy, then his surveying records are irreplaceable. Even if an entire mound group has been plowed flat, it is not truly lost. In some cases we can establish through soil sampling that there were indeed mounds where he said they were. And his maps can then be tied into the State grid, and precisely located. In other cases, where the ground is too disturbed to soil sample (houses, roads, etc), we can nevertheless be pretty accurate in locating and orienting his maps. In all cases this data can then be entered into our data base, and included in the Grand Autocad Map.

This effort has several important benefits. One is the vast increase in data we'll get for overall interpretation, and for discovering large-scale and long-range patterns.

Another is a sharp revision upward of the estimate of the number of mounds here originally. It may be that the estimate of mounds in Madison, for instance, is off by a large number. It may be that there were other centers of concentration which have been overlooked. And it may be that there are unspoiled mounds out in the bushes which have been lost to us but which can now be found, using Lewis' survey notes. And it could be that there were almost no single mounds: all were in groups. We think of isolated mounds because only single examples survive at many sites.

If Lewis is so valuable, why has his work not been used? The answer will be very interesting to students of the pathology of science. His field notes, covering about 20 years of surveying between 10,000-30,000 mounds, are all squirreled away in Minnesota, and there has been barely any access to them. This is almost illegal. The Winnebago Nation stands ready to microfilm these notes if the Minnesota Historical Society does not. Thereafter, they can then be transcribed and digitized.

It is unfortunate that archaeologists tend not to learn astronomy, or be comfortable with mathematics. And if they are not comfortable with complicated math, it is hard for them to believe that the Old Indians were. Yet this is quite incorrect. So they need their minds expanded. If this happened, then it would be obvious to them why it is vital to preserve mounds unspoiled, including all associated rocks and pits, and the skyline perspectives. (We're saving for the next generation of archaeologists the additional fact that virgin mounds are vital for the fertility of Wisconsin and the sanity of its inhabitants. One thing at a time.)

In sum, the old inhabitants of Wisconsin, the forerunners of the Winnebagos, built very beautiful, powerful and accurate structures of complex mathematical subtlety. These mounds continue to teach the respectful student new insights. They are extremely precious.

**SURVEY REPORT
LIZARD MOUND PARK
WASHINGTON CO., WISCONSIN**

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James P. Scherz
21 August, 1990
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Survey By

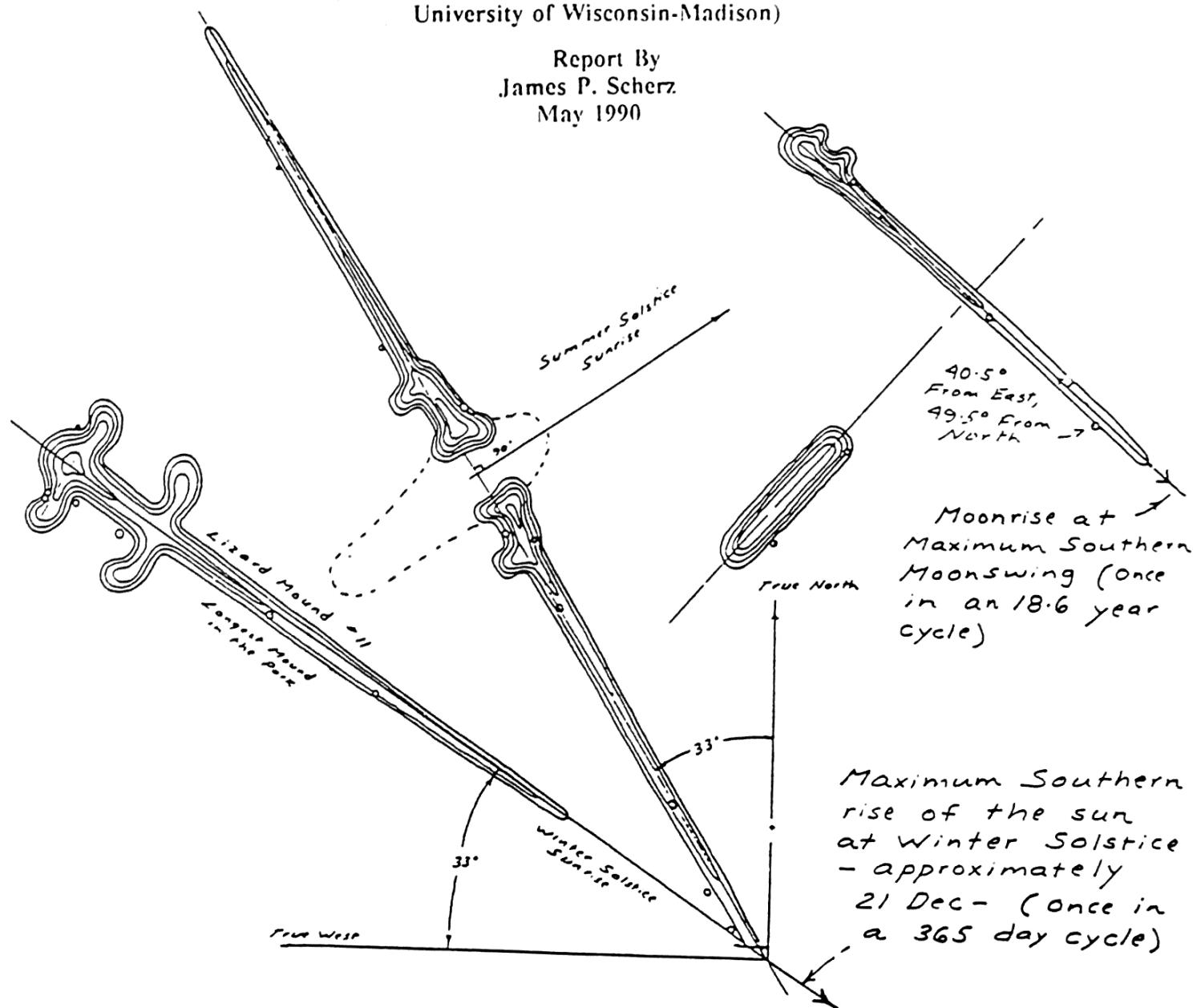
**William F. Wenzel
(President of Sauk Prairie Area Historical Society)**

and

**Patricia A. Arntsen
Larry A. Johns**

**(Under Direction of Professor James P. Scherz,
Department of Civil and Environmental Engineering
University of Wisconsin-Madison)**

**Report By
James P. Scherz
May 1990**



Mounds at Lizard Mound Park
Washington Co. Wisc

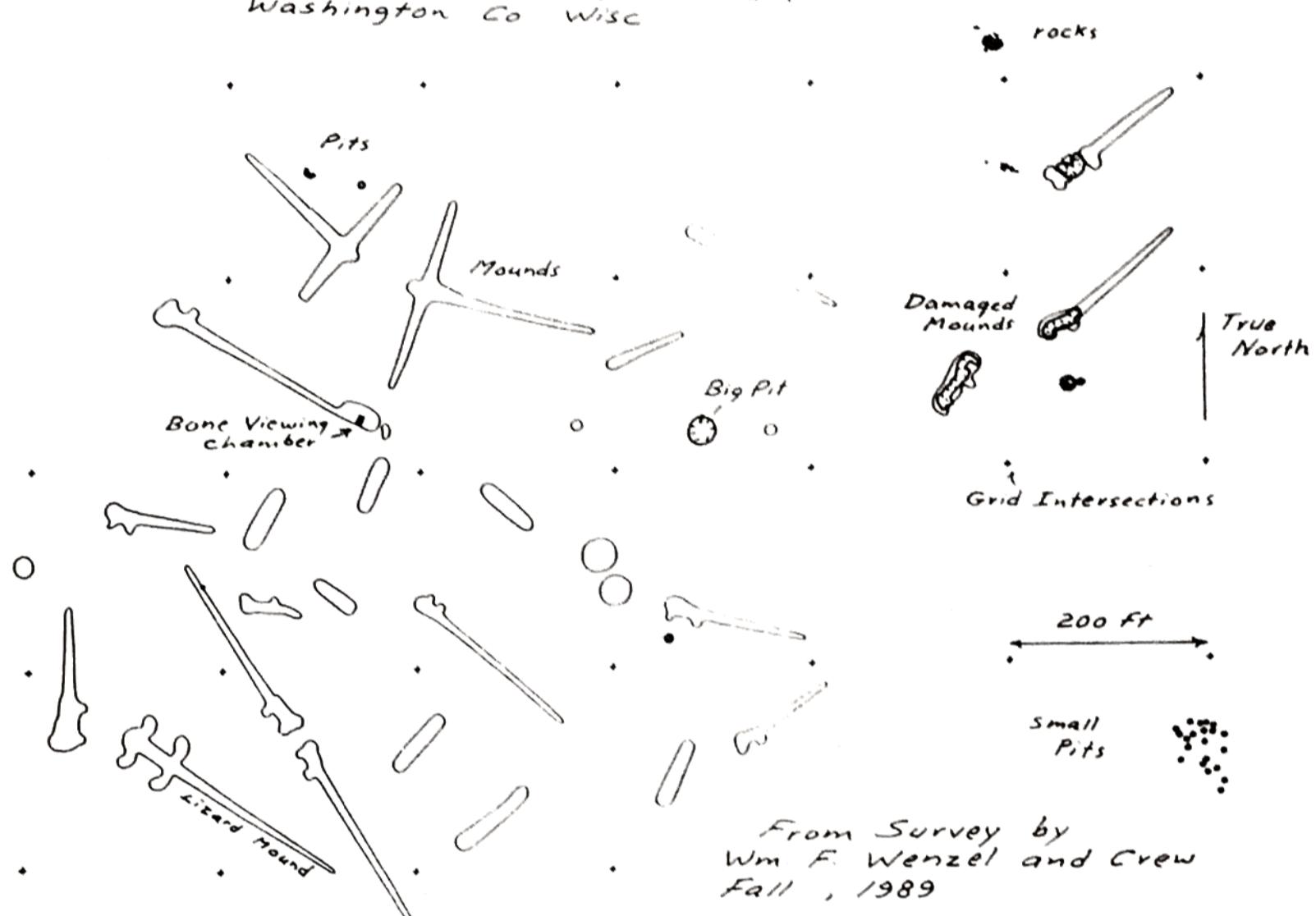
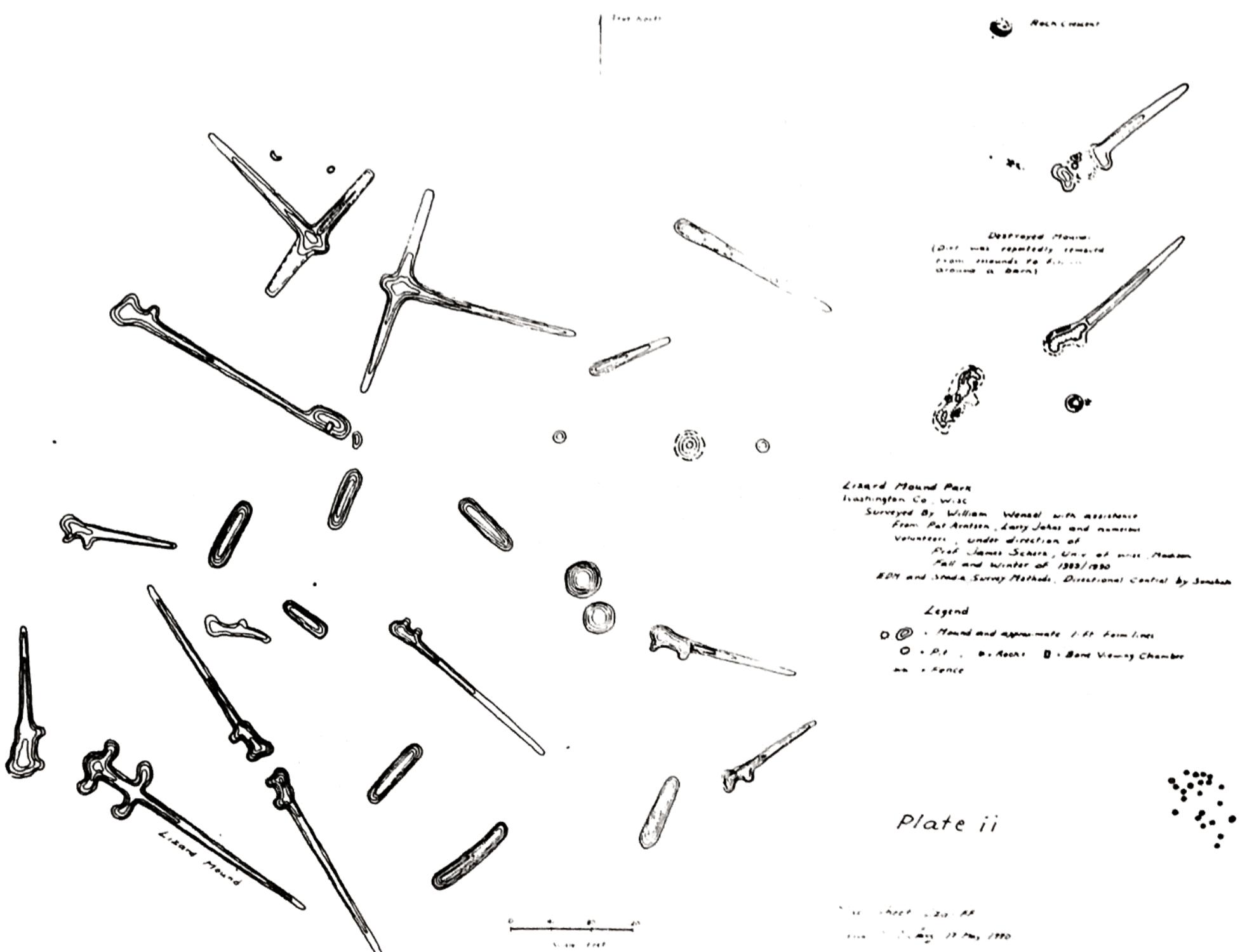


plate i



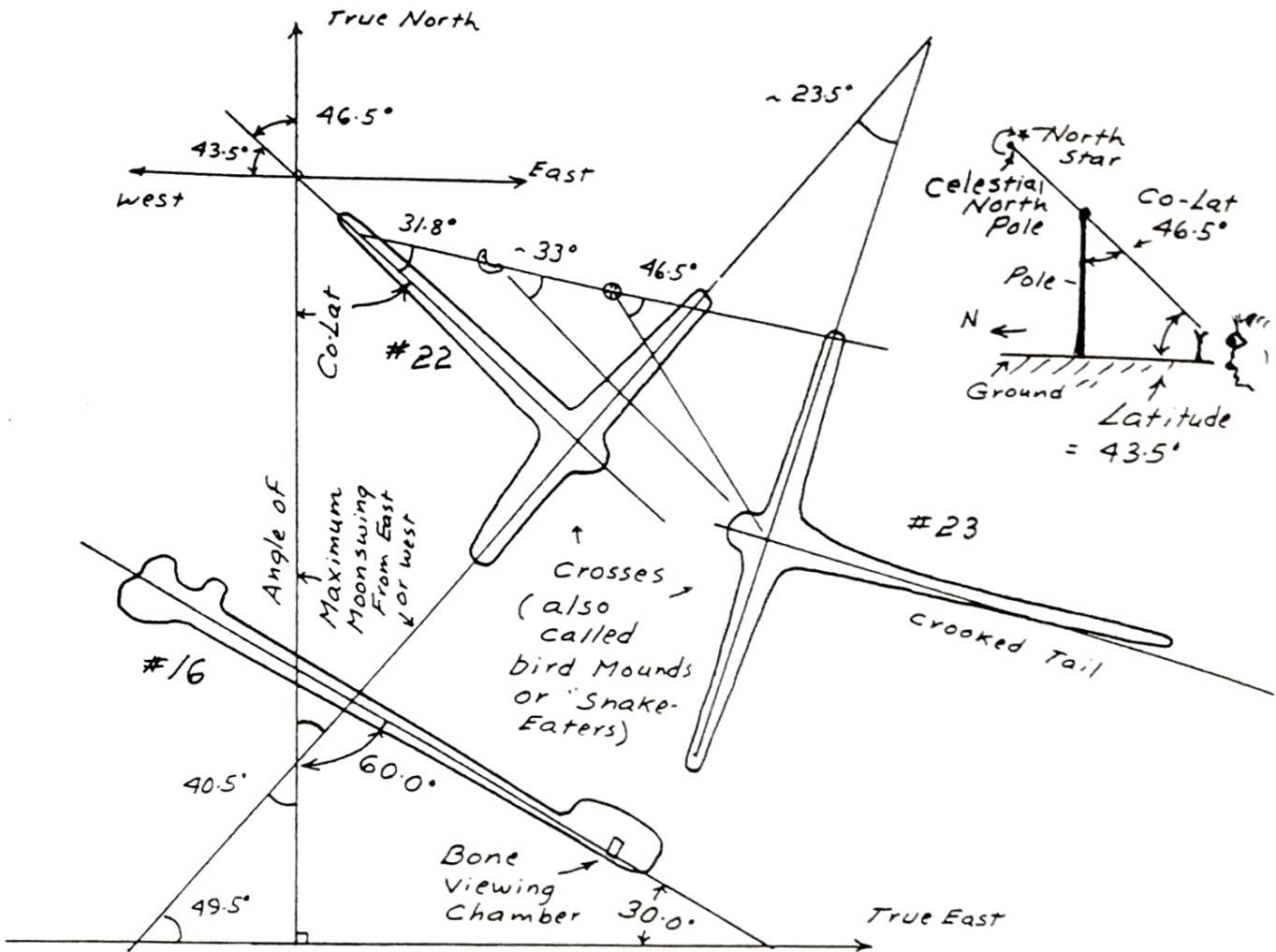
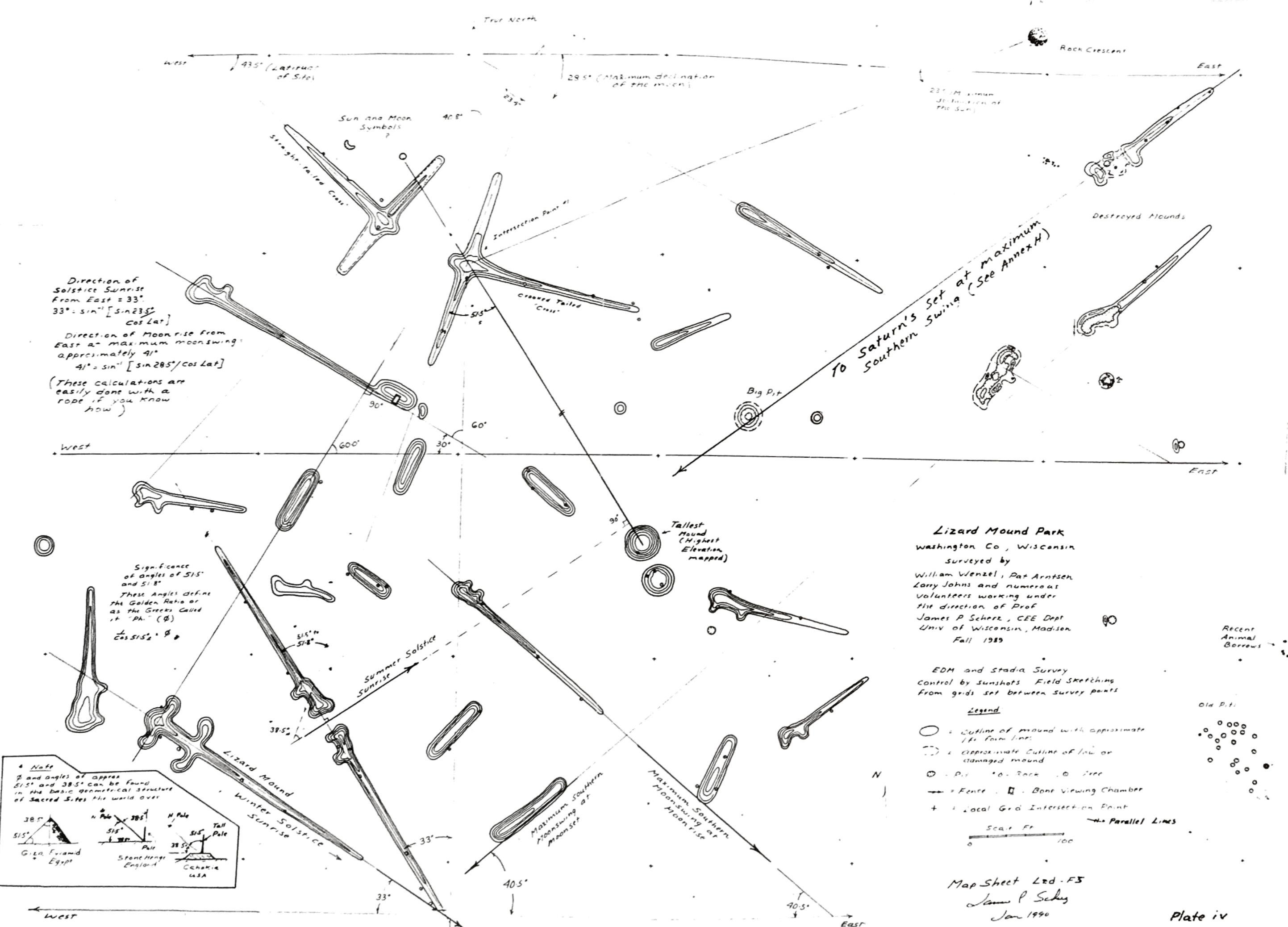


Plate iii

Some interesting geometry in the Northwestern part of the Lizard Mound Group. Such geometry primarily relates to the true cardinal directions defined by projecting the celestial north pole to ground level. Mound #16 makes a $30^\circ - 60^\circ - 90^\circ$ triangle with the cardinal directions. This is a basic construction triangle (still used by draftsmen). Angles of 60° and 30° are first steps in dividing a circle into smaller workable units. The tail of Mound #22 creates angles of 46.5° and 43.5° with the cardinal directions. These correspond to the latitude and co-latitude of the site (latitude is shown on all modern maps). This latitude corresponds to the position of the site between the equator and the north pole of the earth. Angles of 23.5° , 31.8° , 33° , 40.5° and 49.5° relate to the migration of the sun and moon across the celestial equator and to universal principles of sacred geometry.



INTRODUCTION

This report describes stadia and EDM surveys made of the mounds at Lizard Mound Park during the fall and winter of 1989/90 and preliminary analysis of this data.* The park is located in Washington Co., north of West Bend, Wisconsin. See Figures 1 and 2.

The survey work herein described was accomplished in the fall and winter of 1989-1990 by the volunteer survey work of William F. Wenzel, and assistants Pat Arntsen and Larry Johns, working under the direction of Professor James P. Scherz of the Department of Civil and Environmental Engineering, University of Wisconsin-Madison. In addition to these trained mappers, numerous other volunteers also donated their time to hold rods and sketch the mounds.

An EDM traverse was run through the area of the mounds. Directional control was with sun and star shots (accuracy $\pm .02$ degrees). The position of the EDM traverse stations are considered to be accurate to ± 0.2 ft. From these EDM traverse stations, stadia surveys were used to locate stations on the mounds themselves. Between these stadia stations a cloth tape was stretched, and extended level rods were used to measure the position of the edge of the mound right and left of this tape centerline. This field data was transferred to a field sketch grid sheet. The scale of these field sketches was 1 inch = 20 ft. The position of approximate 1 ft. form lines (height of the mounds at different positions) was also noted on the field sketch by the person doing the sketching.

The locations of all the EDM stations and stadia stations were plotted onto a compilation map using an arbitrary local grid system oriented to true north. (The scale of the compilation map was 1 inch = 20 ft.). The individual field sketches were traced onto this compilation sheet and the complete map was compiled. The accuracy of stadia stations are considered to be ± 1 or 2 ft. The ability to precisely locate the edge of a mound by

(Continued on page 4)

* Stadia is an ancient method of measuring distances. It is rapid but its accuracy is limited by about 1 to 2 feet per shot. EDM stands for Electronic Distance Measurement. It uses the time delay in a laser light to measure distance. It is very accurate but the equipment is expensive and often not readily available.

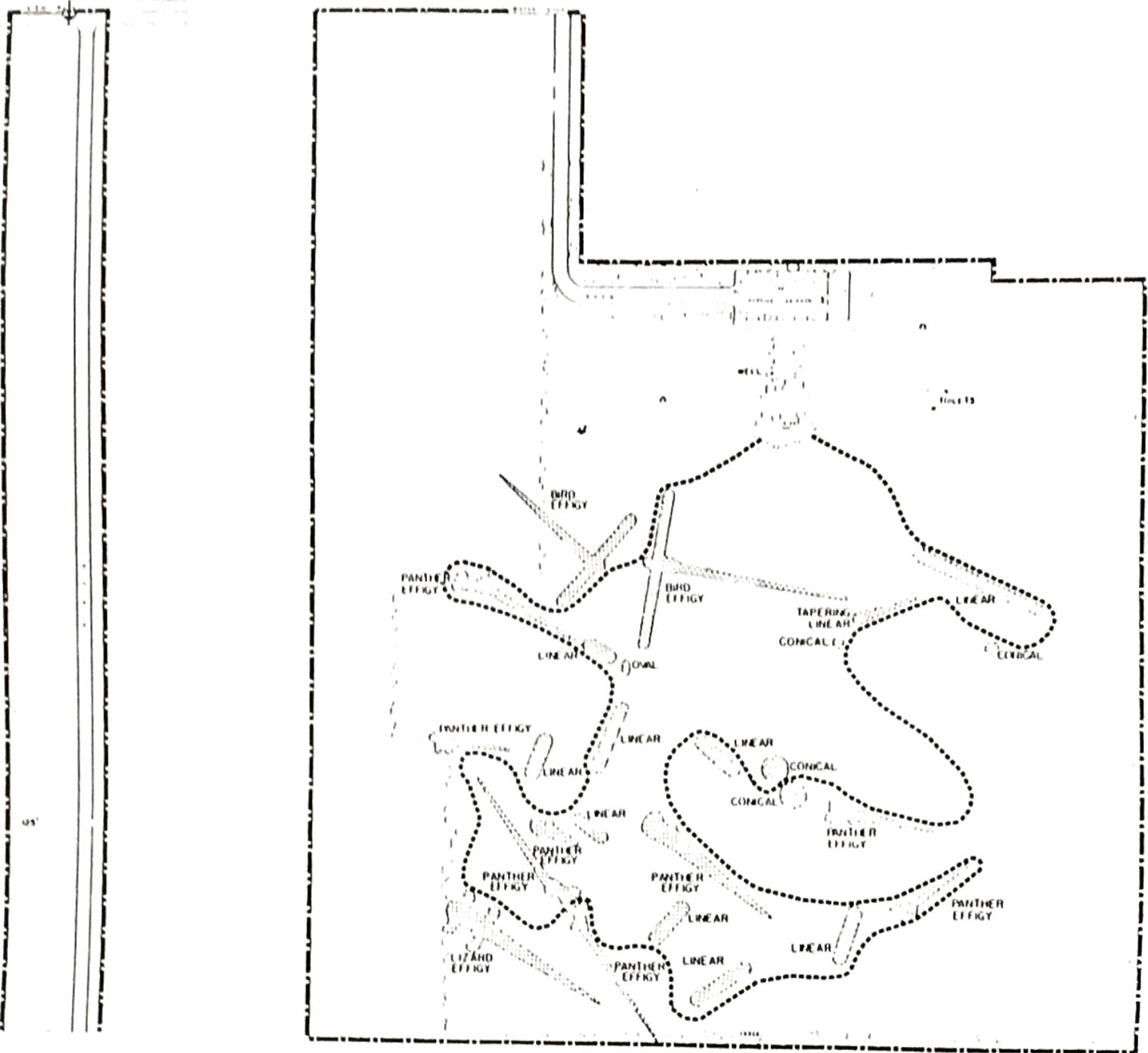
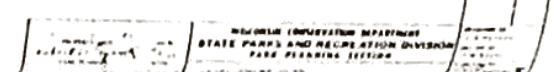


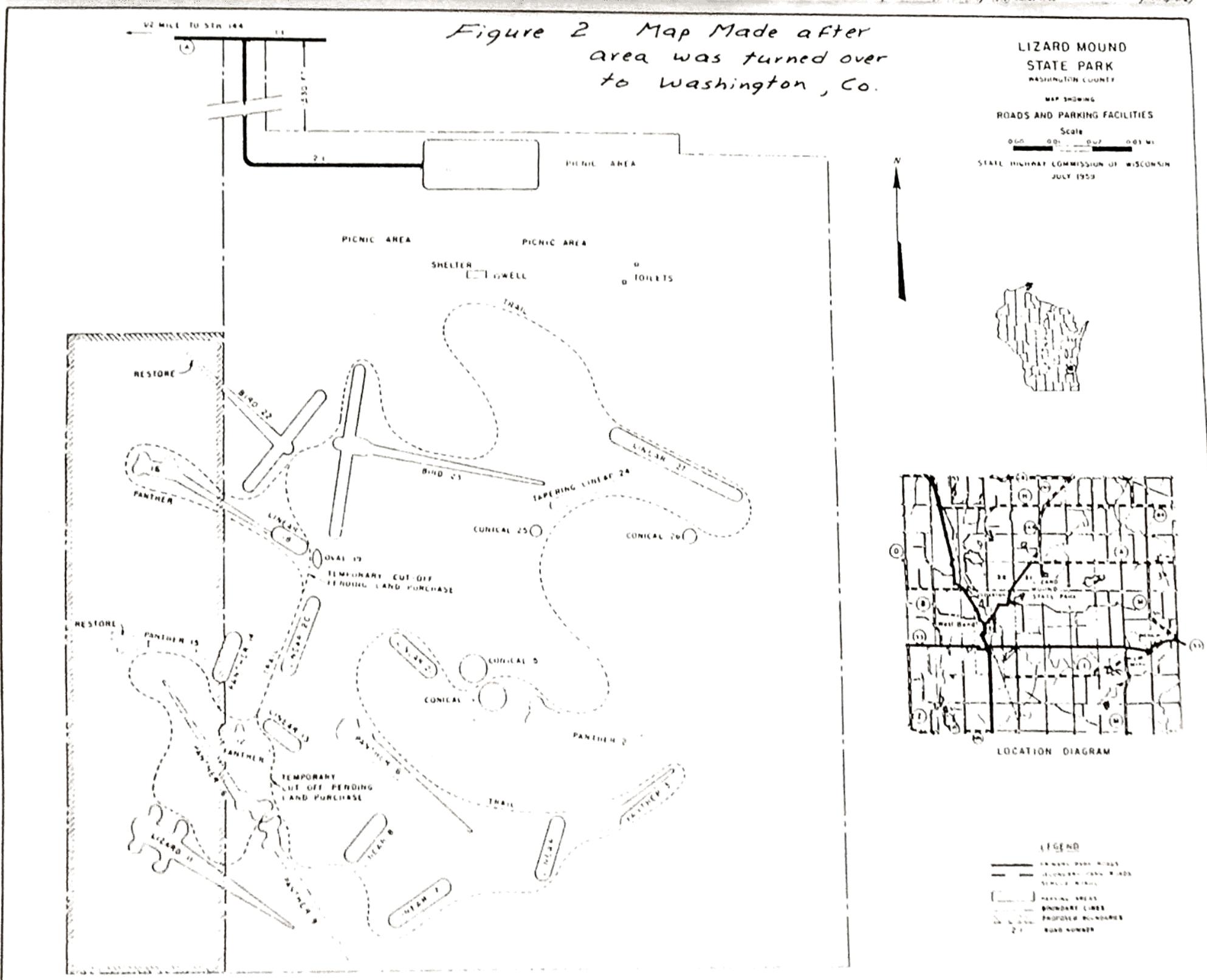
Figure 1

Map when Park



LEGEND
BUILDINGS
ROADS
TRAILS
PARK BOUNDARY
PROPOSED BOUNDARY

Figure 2 Map Made after area was turned over to Washington, Co.



our technique is also about \pm 1 to 2 ft. Therefore, the locations of all the features on the final composite map are considered accurate to about \pm 2 ft. The area mapped was about 1000 ft. x 800 ft. in size.

The Maps

Figure 3 shows a reduced map of the north part of the mound group. The original scale of this map was 1 inch=20 ft. The map in Figure 3 has been reduced in size about 3 times. Notations on the logic used to begin the survey, similarity of symbols present at this site compared to other sites, and obvious significant angles are also shown on Figure 3. Because of the extreme reduction in scale in the map in Figure 3, less reduced portions of the map are shown in Figure 3b to 3f so that the writings can be more easily seen. The index for Figures 3b to 3f is shown in Figure 3a.

Figure 4 is a map of the southern part of the mound group. Figures 4a to 4f show details of this map.

Figure 5 is a map of the western end of the mound group. The geometrical patterns of the two northern "cross mounds", the panther mound with the bone-viewing chamber, and the Lizard mound can be seen in this sheet.¹ Figures 5a to 5f show details on Figure 5.

Figure 6 is an attempt to show the geometry of all the mounds that remain in this group on one sheet.

The full-sized map used to produce Figure 3 is entitled Lzd-F1A; for Figure 4 the map is Lzd-F2A, and for Figures 5 and 6, Lzd-F3 and Lzd-F4. Larger scale versions of
(Continued on page 26)

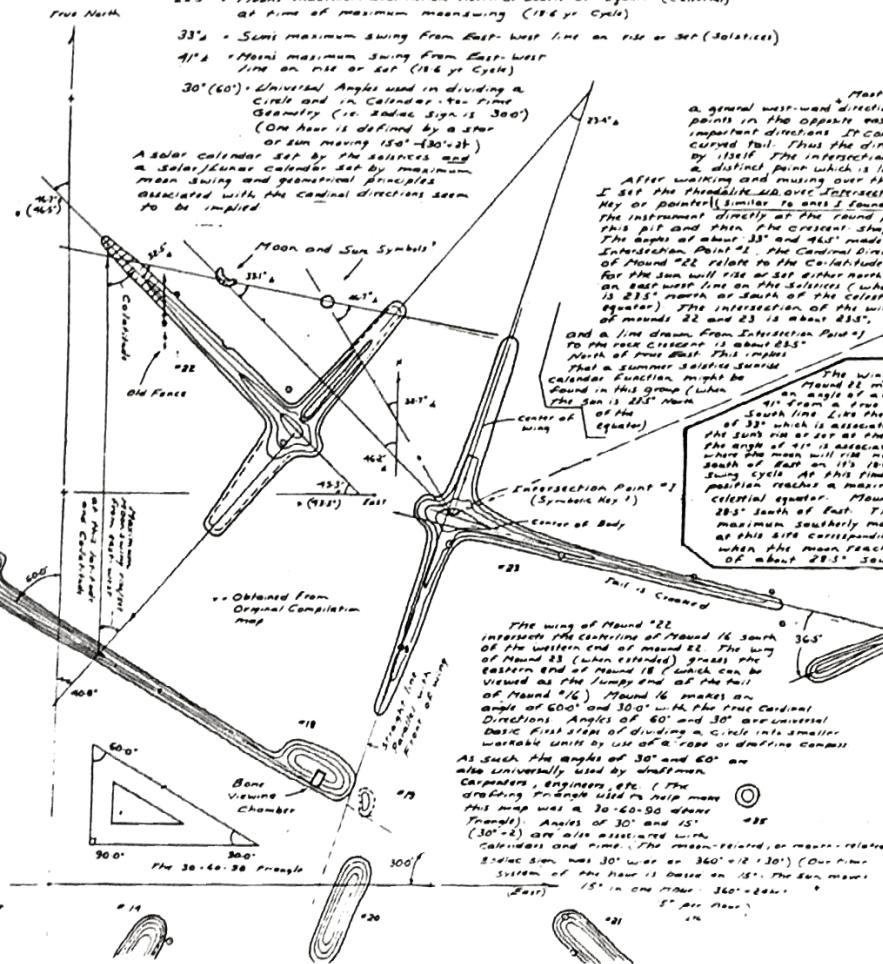
¹The bone viewing chamber was removed in the spring of 1990. This in part resulted from the indignation felt by persons with native American heritage who worked on this survey about prevailing attitude towards Indian graves, the fact that vandals broke into the chamber one night and removed the bones there on display during the period when this survey was being done, and because Pat Arntsen, a survey crew member, clearly expressed her indignation to a number of state newspapers, and because appropriate officials responded.

Northern Part
of
Group

Lizard Mound Park, Washington Co., Wisc.
Strata and EDM Survey by William Wendell, Art
Astrand, Larry John, James Schora and numerous volunteers
Fall and winter of 1989. Directional Control by Sunsite
Angles read from 1' x 20' maps with a large protractor.
Probable errors from survey and protractor readings for aver-
age lines = $\pm 0.1^{\circ}$ to $\pm 0.2^{\circ}$.

Significant Angles

- 46°S • Co-Latitude of Site, 43°S • Latitude of Site
 23°S • Sun's maximum declination north or south of Equator on the Solstices
 28°S • Moon's maximum declination north or south of Equator (Culmina)
 at time of maximum moonswing (186 yr Cycle)
 33°S • Semi-maximum swing from East-West line on rise or set (Solstices)
 49°S • Moon's maximum swing from East-West
 line on rise or set (186 yr Cycle)



Map of Northern Part of Group

Searching for possible symbolic messages. As a general rule the northeastern portion of an ancient geometrically- or astronomically- based ceremonial site often seems important. This is probably associated with the sunrise in that direction on the longest day of the year, when nature's growth and man's activities reach their highest. This principle can be seen in the Mound Group itself, and mound in the Mounds Eastern Mount Group, from which the geometry seems to radiate (See Survey Report for this group, 1981). The principle can be seen with the important Heelstone at the Staircase (located to the North-east of the site), it can even be seen in the ceremonies of the Masonic Lodge where the youngest apprentice member takes a seat in the north-eastern part of the group. Following this principle, a search was made in this north-eastern part of the Lizard Mound Group for something special or a place to begin. Organized stones were found unique to this part of the group. The rocks seem to be arranged in a mosaic depicting a crescent moon. A similar crescent was located in the Baskerville Park Mound Group in Middleton, Wis., when it was surveyed in 1981 by four local and state officials, allowed this fine mound group to be surveyed. ROCK CREEK

officials allowed the use of gunpowder to be sacrificed for hunting, for the safety of our tracks. The south line of the Middle Missouri Park is created by a small rock south of the Crescent and the western-most rock is created from another group of rocks south of the crescent. This would imply the ability to establish true north-south lines by observing the rotation of the North Star about the celestial pole (The Latitude and Co-latitude of the site is a by-product of such an all-night exercise which must be done when the skies are clear). One might be troubled by the fact that a few old briars are also found amongst the rocks. This can be easily dismissed as an argument that such sites were still being used by Indians in historical times, as they may still be used today. A small piece of modern survey ribbon can be found marking an east-west base line at a site near Sack City, Wyo.

Most of the off-ray records at Lizard Head Park point in a general westward direction. The western crabs or birds record #22, however, points in the opposite eastward direction. Its tail and wings are straight and simple important directions. It contrasts Hound #23 which has a straight wings but a curved tail. Thus the direction of the rear cannot be an accurate pointer by itself. At the intersection of the body and wing of record #23 comes a distinct point which is a good pointer. Part II.

After walking and musing over this side for hours one clear, sunny day I set the theodolite up over Intersection Point #1. Following my key or pointer (similar to ones I found at several other sites) I pointed the instrument directly at the round peak north of Mount 22, then the point of intersection of the sun's path around the celestial equator. The angle of about 33° and 46° was given by the sextant. The angle between Intersection Point #1, the Cardinal Directions, and the Crest of Mount 22, relate to the Colatitude of the site and how far the sun will rise or set either north or south of the celestial equator. The intersection of the wings of mounds 22 and 23 is about 235° , and a line drawn from Intersection Point #1 to the ring cairn is about 235° . The angle of 235° is the angle of precession. This angle of 235° is what summer solstice sunrise under Function might be in this group (when the sun is 235° North of the celestial equator).

The wing of Mount 22, the angle of 235° is the angle of declination of the sun's rim at the time the sun's angle of 33° is associated with the cardinal directions. The angle of 235° will be associated with the sun's position when the sun reaches its maximum declination of 23° South. At this time the moon's position reaches a maximum of 103° from the celestial equator. Mount 22 points to direction 285° which is East. The angle of 285° is the angle of maximum southerly mean rise. South might be found at this site corresponding to the 186 year cycle when the moon reaches a maximum declination of about 23° South.

The wing of Mound "2c" intersects the centerline of Mound 16 south of the western end of Mound 22. The wing of Mound 23 (when extended) grazes the eastern end of Mound 18 (which can be viewed as the "tail" of the "wing" of Mound 16). Mound 16 makes an angle of 60° and 30° with the true cardinal directions. Angles of 60° and 30° are universal units. First step of dividing a circle into smaller workable units by use of a tape or drafting compass. As shown, the angles of 30° and 60° are universally used in drafting. Carpenters, engineers, etc., the drafting engineer used a protractor. This map was a 30-60-90 degree triangle. Angles of 30° and 15° (30°/2) are also associated with calendar and time. The moon-related, or month-related degree sign was 30° over an $360^{\circ}/12 = 30^{\circ}$. Our time system of the hour is based on 360°. The sun moves 15° in one hour. $360^{\circ} = 24$ hours + (part) 15° per hour.

The symbols
dots, and geometrical
indicators point to the following
in my opinion. Cardinal Directions
established by observing rotation of
north star about the celestial pole.

ESTABLISHED BY
NORTH STAR ABOLITION
SOCIETY OF NEW YORK
TUESDAY NOVEMBER 6th 1838
UNIVERSAL PRINCIPLES OF
CALENDAR POSITION BY
THE RISING AND SETTING SUN
AT MORN, MIDDAY AND
OF SUNSET FROM THE EQUINOX
(83°45' FOR THE SUN, ABOUT 68°30'
FOR THE MOON). THE SUN'S ECLIPSE
WOULD BE 365 DAYS, THE MOON

Footnote
Contrary to the general claim made by most archeologists, anthropologists, and educators in our schools that there is no tie between the mound builders and historical Indians, very histories relating to the mounds are still very much alive among Indians in certain tribes. On this site, when we arrived to begin our full survey effort on Sat., 14 Oct., 1935, John Bear, man and son George, sons of parents

Footnote

a Contrary to the general claim of anthropologists, anthropologists, and educated in our schools that there is no life between the historical and historical Indians, the historic Indians were very much alive and very much interest among special people in certain tribes. On this site we arrived to begin our survey late at night, 1935. John Bowman and Jim Oldman, two of the most prominent leaders in the Indian ancestry, who were remembered stories told by Samson, now deceased Mesememee chief, told us that the drums had started (which they had started) of where the drums were played when people were held to assist the rising sun; how the mounds were pointers to resuscitate lights in the sky (which, according to John Bowman, the deceased elders, helped him, gave him a real education). We were told that the drums were played in the morning, which terminated when people were buried in the mounds etc. Our verbal education was terminated when we reached Mendota and found we have chamber there (where a group of Indians gathered on a grassy hillside, including Bowman and Copenhagen around and about, and the Europeans became angry at the ignorance, insensitivity and arrogance of the comprising white culture. They began their task of completing the survey with great motivation.

b Subnote The display case had been broken into and the books removed as well as the Indian artifacts. However, a number of the Indians, who were present, shot at the intruders, killing many of them, who people became dead. A

Legend

- ① • Mound with upper Left Form Lines
- ② • Pit, '22 + Mound Area
- + Tree, + a Rock
- + Local Grid
Intersection Point
(The local grid
was oriented to
True North by
use of Sunsheds)
- II = Robotic Mound

Scale, ft.

0 10 20 30 40 50

Map Sheet: 220-F1 A
P. Scrm 19 Jan 1942

Figure 3
North Part of Mound Group

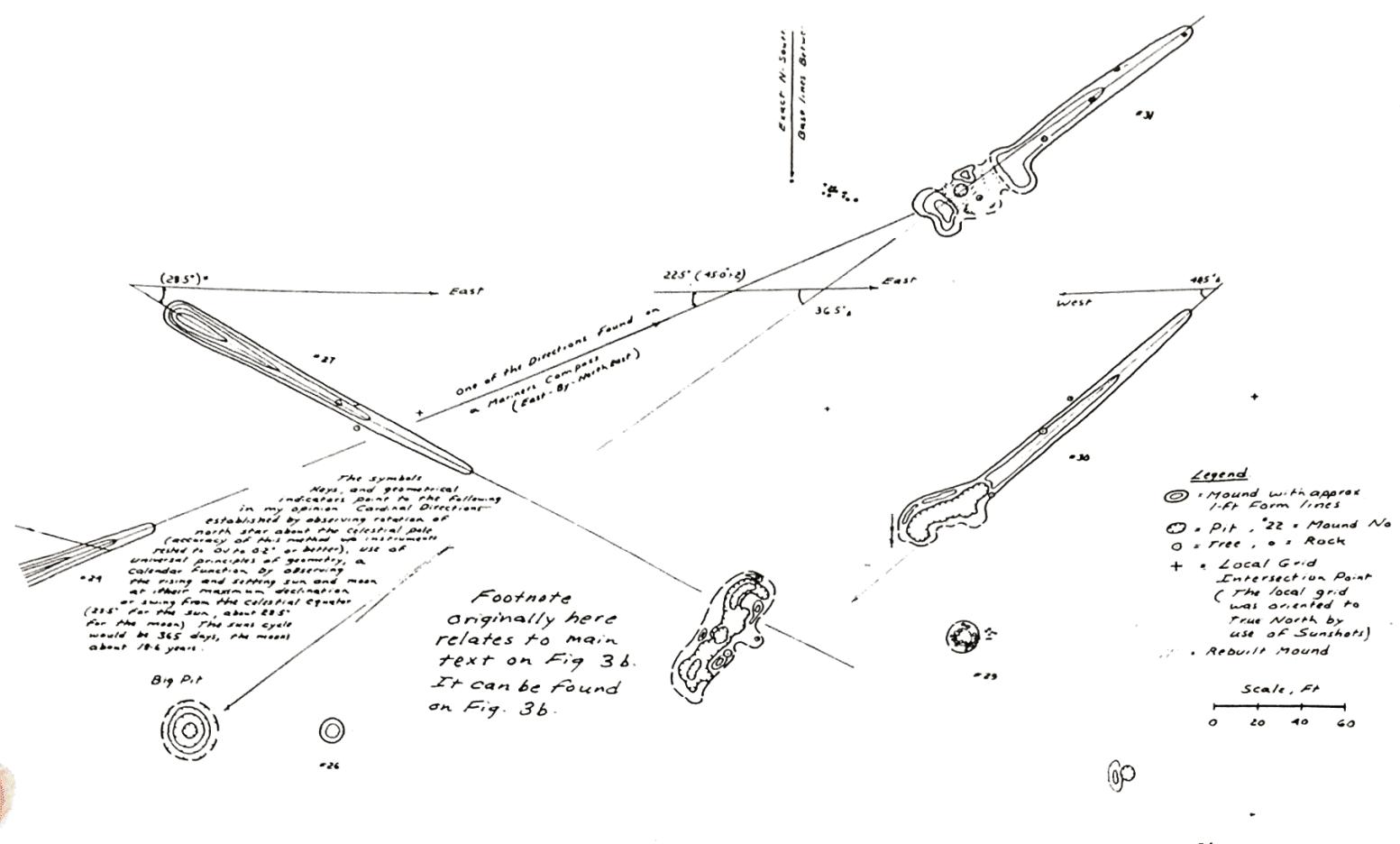


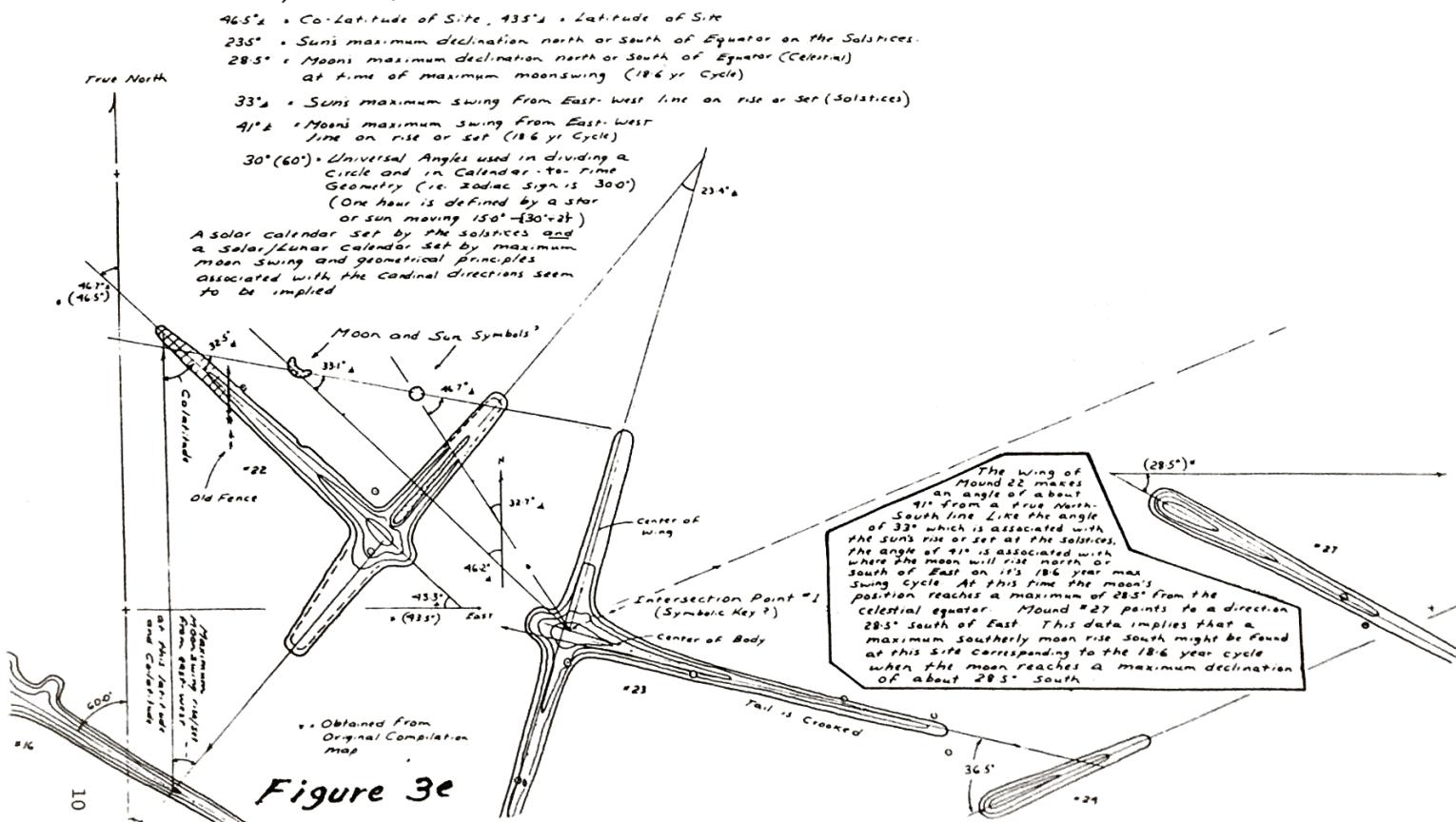
Figure 3d

Northern Part
of
Group
Map 1 of 2 sheets

Lizard Mound Park, Washington Co. Wisc.
Stadia and EDM Survey by William Wenzel, Pat
Arntzen, Larry Johns, James Scherer and numerous volunteers in
Fall and Winter of 1989. Directional Control by Sunshots
Angles read from 1° to 20ft maps with a large protractor
Probable errors from survey and protractor readings for average
long. lines ± 0.1 or 0.2°

Map Sheet 222-51A

Analyses by James Strong 28 Jan 1990
Update 9 April 1990



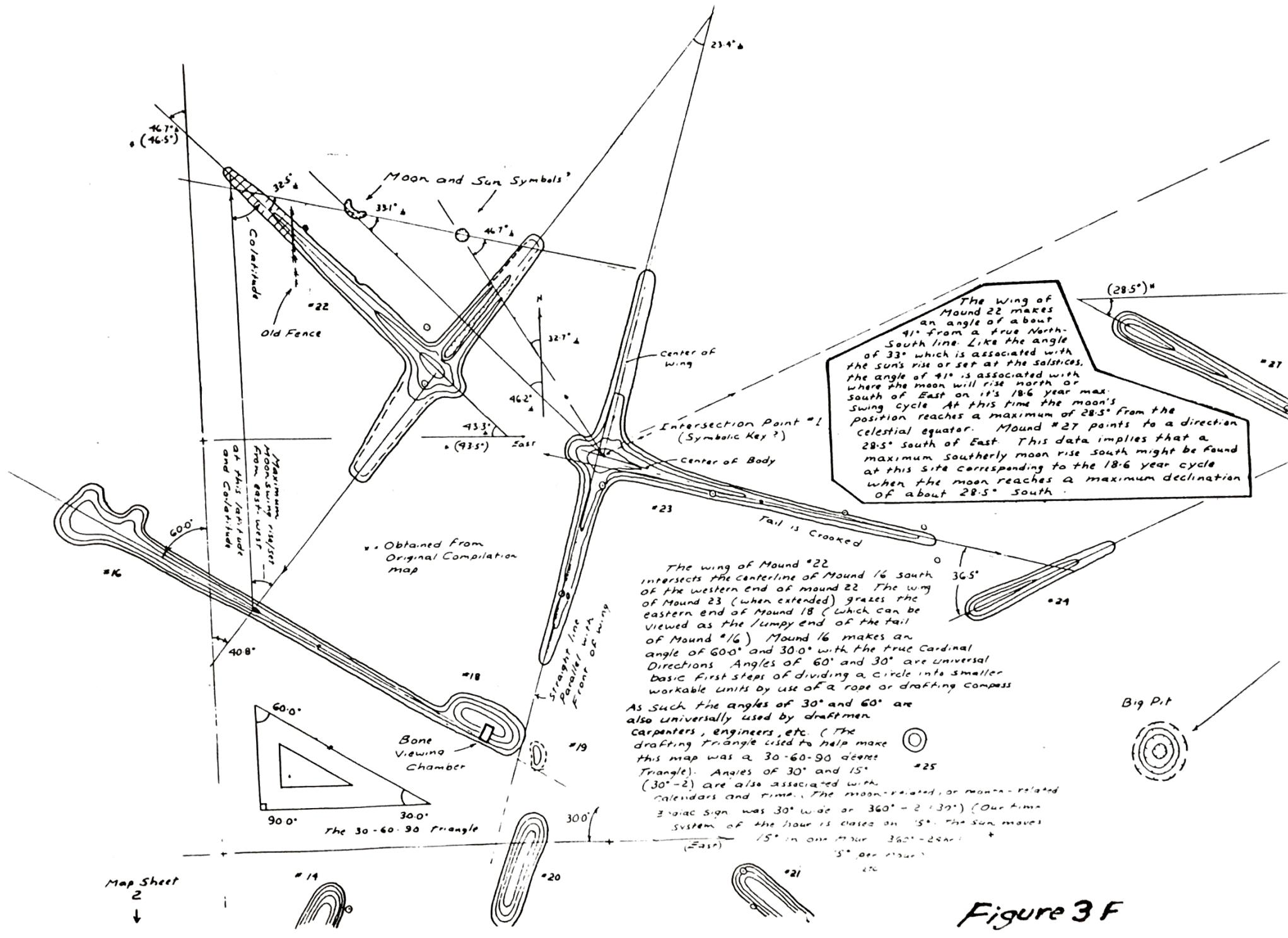


Figure 3 F

As such the angles of 30° and 60° are also universally used by carpenters, engineers, etc. (The drafting triangle used by the author has a 30-60-90 degree triangle. Angles of 30° and 15° (30°-2) are also associated with carpenters and masons; the minimum angle, or mason's square, is 90°. The 30-60-90 triangle is based on 360° = 2⁵ (One half of 360° = 180° = 2⁴. The Sun moves 3° per day, 360°/120 days = 3° per day).

Big Pit

Lizard Mound Park
Washington Co., Wisc.
Modern Survey
Fall 1989

Southern Part of Group
Map 2 of 2 sheets

• Mound and approximate
the form lines

○ Pit, H. Rock

• Tree

• Rock

Scale FT

0 20 40 60

View of Spring
Sun in March

Line to where the
last green of the sun
will occur (near end of line)
and where the sun
will have moved. Line 1

Last Green of Spring

Sun to Spring equinox occurred
during the last before sunset
(27 degrees opened
and last green would be
even further ahead)

Door Display
Chamber

Big Pit

Line 2

Line 3

Line 4

Line 5

Line 6

Triangle

Areas of 30° and 15°

are also associated with

carpenters and masons; the minimum angle, or mason's square,

(30°-2) is 90°.

Scale 1:2000

System of date hours is based on

360° = 2⁵ (One half of

360° = 180° = 2⁴

3° per day)

Figure 3E

Map Sheet 1

Map Sheet 2

Map Sheet 3

Map Sheet 4

Map Sheet 5

Map Sheet 6

Map Sheet 7

Map Sheet 8

Map Sheet 9

Map Sheet 10

Map Sheet 11

Map Sheet 12

Map Sheet 13

Map Sheet 14

Map Sheet 15

Map Sheet 16

Map Sheet 17

Map Sheet 18

Map Sheet 19

Map Sheet 20

Map Sheet 21

Map Sheet 22

Map Sheet 23

Map Sheet 24

Map Sheet 25

Map Sheet 26

Map Sheet 27

Map Sheet 28

Map Sheet 29

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Map Sheet 31

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Map Sheet 166

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Map Sheet 190

Map Sheet 191

Map Sheet 192

Map Sheet 193

Map Sheet 194

Map Sheet 195

Map Sheet 196

Map Sheet 197

Map Sheet 198

Map Sheet 199

Map Sheet 200

Map Sheet 201

Map Sheet 202

Map Sheet 203

Map Sheet 204

Map Sheet 205

Map Sheet 206

Map Sheet 207

Map Sheet 208

Map Sheet 209

Map Sheet 210

Map Sheet 211

Map Sheet 212

Map Sheet 213

Lizard Mound Park
Washington Co., Wisc.
Modern Survey
April 1933

◦ Found and captured
 the down bird
 ◦ Found
 ◦ Found
 ◦ Found
 ◦ Found

• 100

See Figure 4e

See Figure 4b

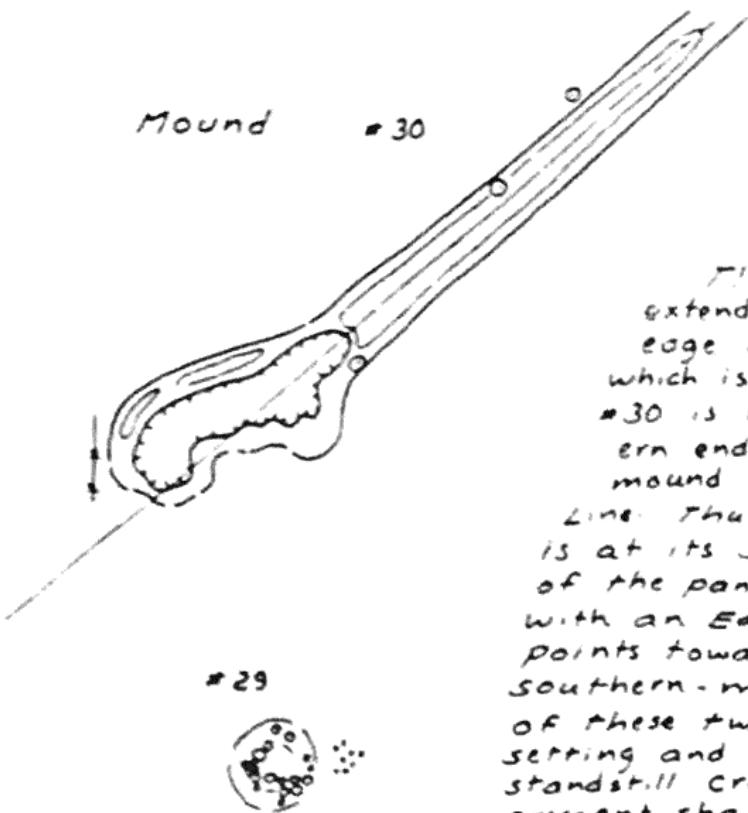
See 4c

See 45

See Figure 4d

Figure 4a Index Indicating
which Figures Better
show Writing Details

Figure 4a
Southern Part of Mound Group



Moon Swings

The axis of the panther mound #30, when extended southwestward, intersects the eastern edge of Mound #7 which is the only large mound which is slightly crooked or crescent-shaped. (Mound #30 is the second northern-most mound at the eastern end of the Lizard Mound Group). The axis of this mound makes an angle of 40.5° with an East-West Line. Thus it points towards the setting moon when it is at its southern-most moon-swing. The center-line of the panther mound #6 also makes an angle of 40.5° with an East-West line. Thus the tail of Mound #6 points towards the rising moon when it is at its southern-most standstill. The lines through the axes of these two panther mounds which point towards the setting and rising moon when it is at its southern-most standstill cross just a bit north and east of the slightly crescent shaped Mound #7.

Also the head of the panther mound #6 points to the northern-most moon set and the tail of the panther mound #30 points to the northern-most moon rise (an 18.6 year cycle). All of these maximum moon rise and set directions can be used to set the 18.6 year Solar-Lunar Calendar which can be used to predict maximum tides and eclipse cycles. That historical

Indians did have some easy way of predicting eclipses is indicated in the writings of Wm Cogswell (my Part-Indian ancestor). While traveling through the former Indian area which is now Cleveland, Ohio in the early 1800's he described a gallows where a woman, whom Europeans called an Indian witch had been hung. She had successfully predicted an eclipse. Reportedly the hanging was instigated by Christian missionaries who, since they could not predict eclipses, concluded that the woman was in league with the devil who had shown her how to predict eclipses. (The laws of the U.S. government that forbid the killing of witches, though required in the Bible, did not yet apply to the Indian Territories where the missionaries were working. There are other reports of witch hangings in the Indian territories up through the mid-1800's.)

In summary the geometry of the mounds at Lizard Mound Park can be used to set the 18.6-year Solar-Lunar Calendar which in other cultures has been used to keep track of maximum tides and eclipses. This can be done at the time of maximum moon swing either north or south by using either the rising or setting moon. All such possibilities are found in the geometry of this mound group.

*Footnote: The concept of the devil and female witches in league with the devil, so prevalent in European history is an invention of the white man and not the Indian. The Christian witch-hunts sometimes directed by the Church Office of "The Holy Inquisition" (which killed many thousands of "witches" and members of secret lodge societies such as the "Templars") continued into the 1800's. These efforts can be related to attempts to stamp out remnants of Pre-Christian religions including ancient knowledge relating to astronomy and geometry (which were a part of these old religions). Attitudes began to change when teachings of men like Galileo, Copernicus, and Newton became accepted and the so-called "Scientific Age" dawned. Prof. Galileo was imprisoned for life (but not executed) because his teachings were contrary to the general beliefs of the religious leaders of the day.

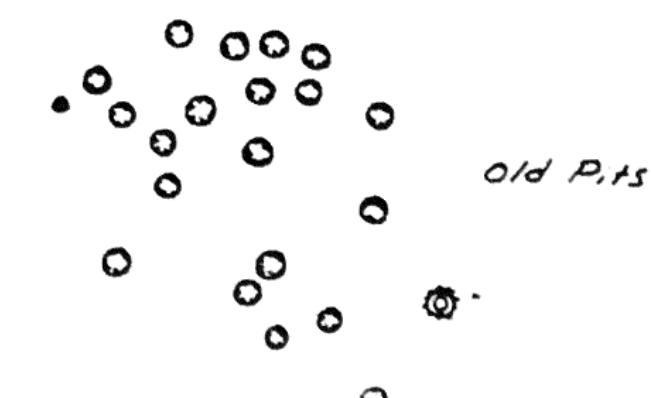
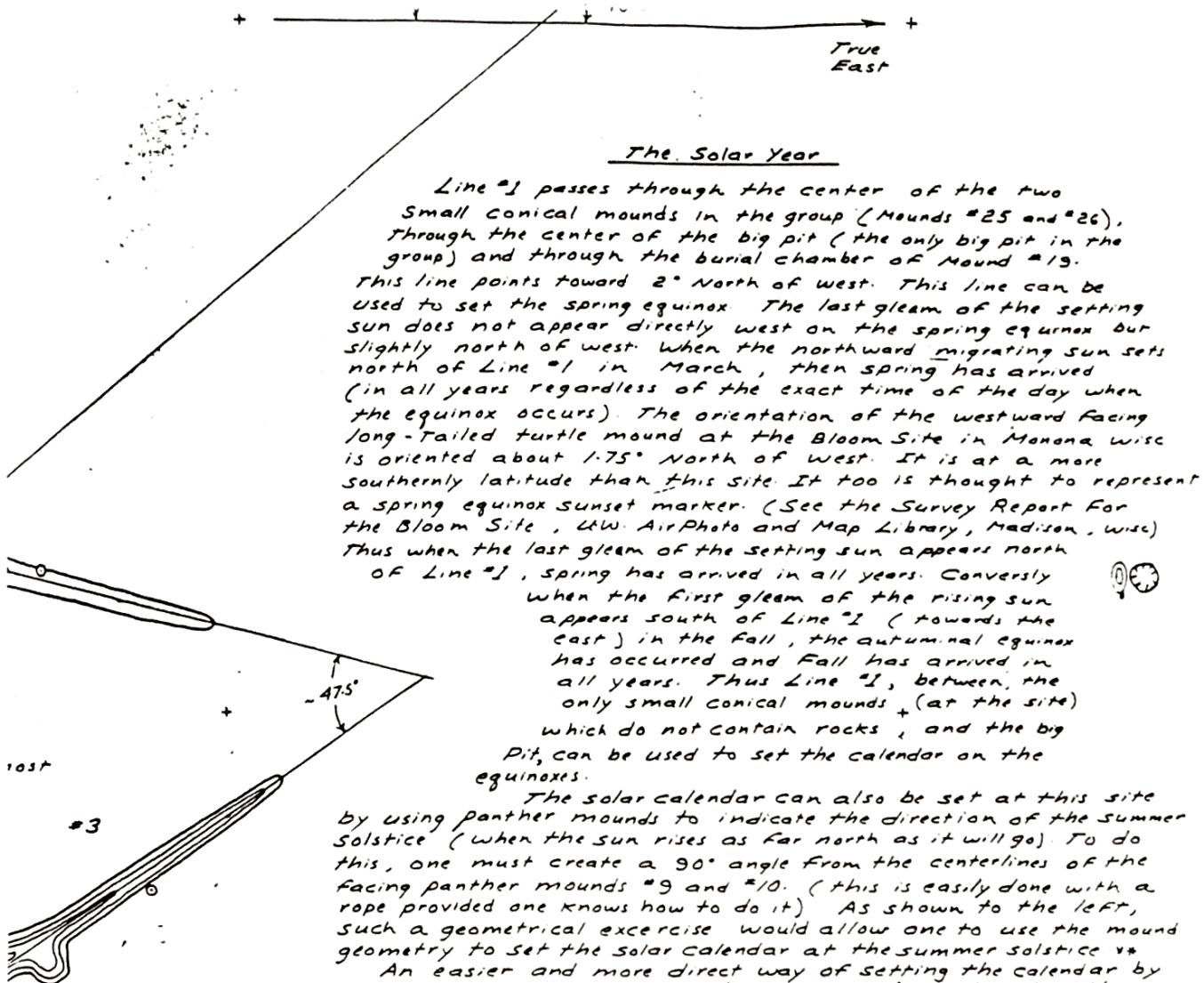


Figure
4b



The solar calendar can also be set at this site by using panther mounds to indicate the direction of the summer solstice (when the sun rises as far north as it will go). To do this, one must create a 90° angle from the centerlines of the facing panther mounds #9 and #10. (this is easily done with a rope provided one knows how to do it). As shown to the left, such a geometrical exercise would allow one to use the mound geometry to set the solar calendar at the summer solstice **

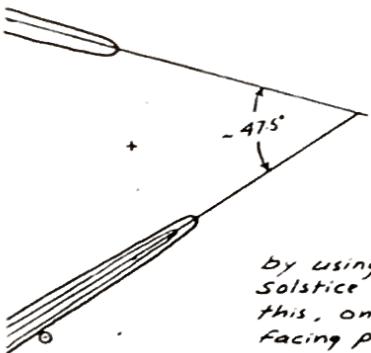
An easier and more direct way of setting the calendar by the solstices is to use the longest mound at the site's, the Lizard Mound #11. The tail of the Lizard Mound points directly at the rising sun on the winter solstice! This was witnessed in December of 1989 by Ray-Knapp and James Scherz. Photos were also taken on this day. Conversely the Lizard Mound #11 also points toward the position where the sun would set on the summer solstice.

In summary, the geometry of the mounds at Lizard Mound Park can be used to set the solar calendar at the equinoxes or solstices, either at sunrise or sunset.

** Footnote:

See Figure 4d for this Footnote.

Figure 4c



The solar calendar can also be set at this site by using panther mounds to indicate the direction of the summer Solstice (when the sun rises as far north as it will go). To do this, one must create a 90° angle from the centerlines of the Facing panther mounds #9 and #10. (this is easily done with a rope provided one knows how to do it) As shown to the left, such a geometrical exercise would allow one to use the mound geometry to set the solar calendar at the summer solstice **

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In summary, the geometry of the mounds at Lizard Mound Park can be used to set the solar calendar at the equinoxes or solstices, either at sunrise or sunset.

** Footnote: The possibility that this postulated practice was actually carried out is strengthened by the verbal accounts, from the Elders, which were related to us by Boatman and Borgenhagen that two groups of Indian people stood in a tight group between the heads of the two facing panther mounds. This tight-packed group created a body for a bird mound with its tail extending south-west nearly to the Lizard Mound. This living body activated the site and the people converted the two panther mounds or "Minor Thunders" (Earth Symbols) into a Thunderbird or "Major Thunderer" (A Sky Symbol) as the attention of all persons was directed towards the rising sun.

The possible useful function of the mounds to set both the Solar Calendar (365 days) and the Lunar-Solar Calendar (18.6 yrs) is consistent with the symbolic keys noted on Map Sheet 1 of 2 (or Map Sheet Lza-F1) and the angles in the geometry of the mounds indicated on that map sheet which correspond to the declination of the sun and the moon at the times when they migrate to their maximum degree from the equator (when the solar calendar can be set at the maximum sun swing at the solstices and the moon-solar calendar can be set by the rise or set of the moon at its maximum moonswing)

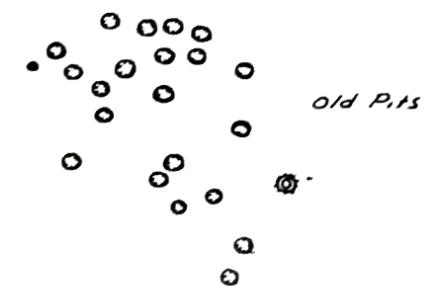


Figure 4d

Lizard Mound Park
Washington Co, Wisc
Modern Surveys
Fall 1989

Southern Part of Group
Map 2 of 2 sheets

- (@) = Mound and approximate 1ft Farm Lines
- (W) = Pit, 1/4 + Rebuilt Mound
- (•) = Tree
- (*) = Rock

Scale, Ft
0 20 40 60

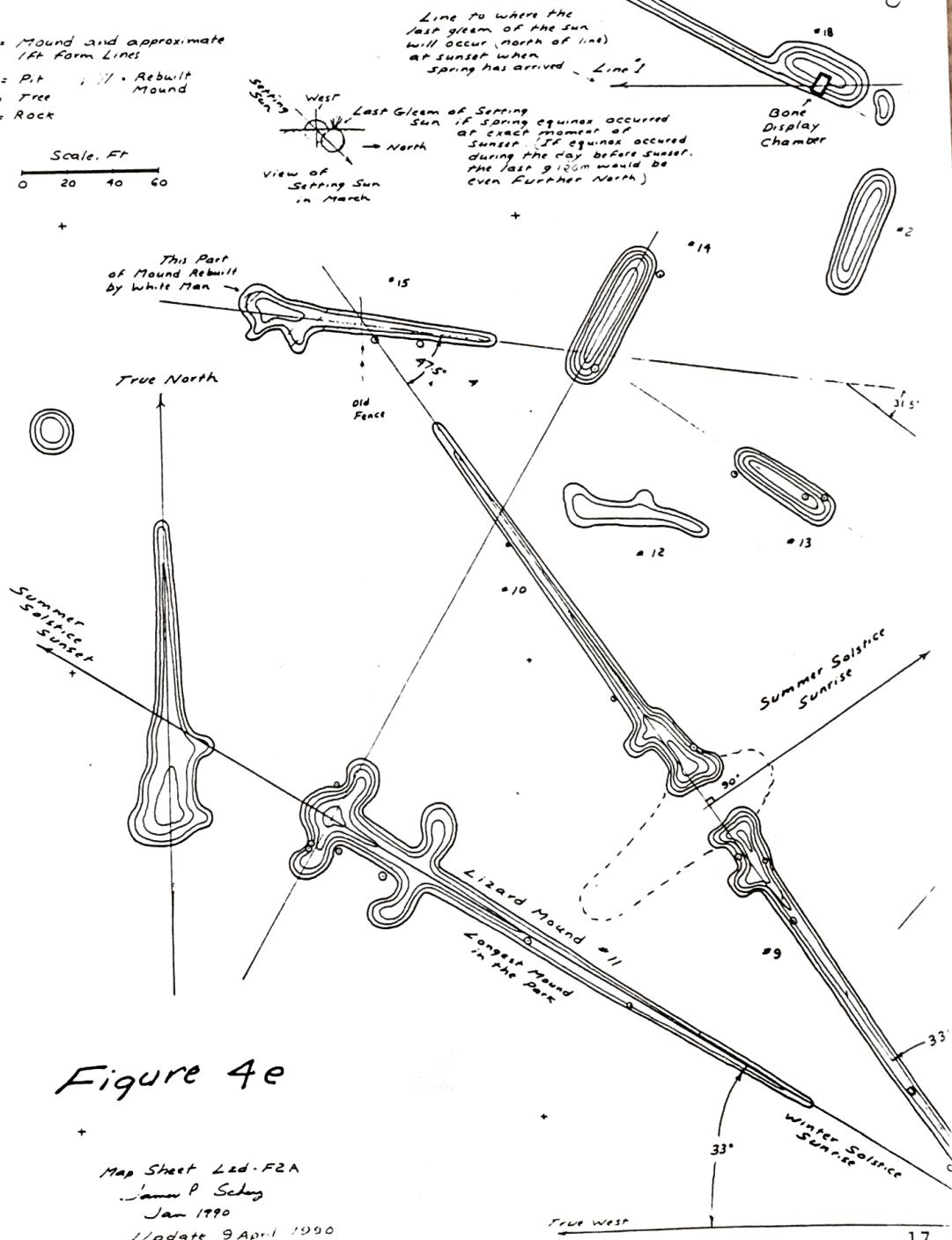


Figure 4d

Map Sheet Lsd-F2A
James P. Schrey
Jan 1990
Update 9 April 1990

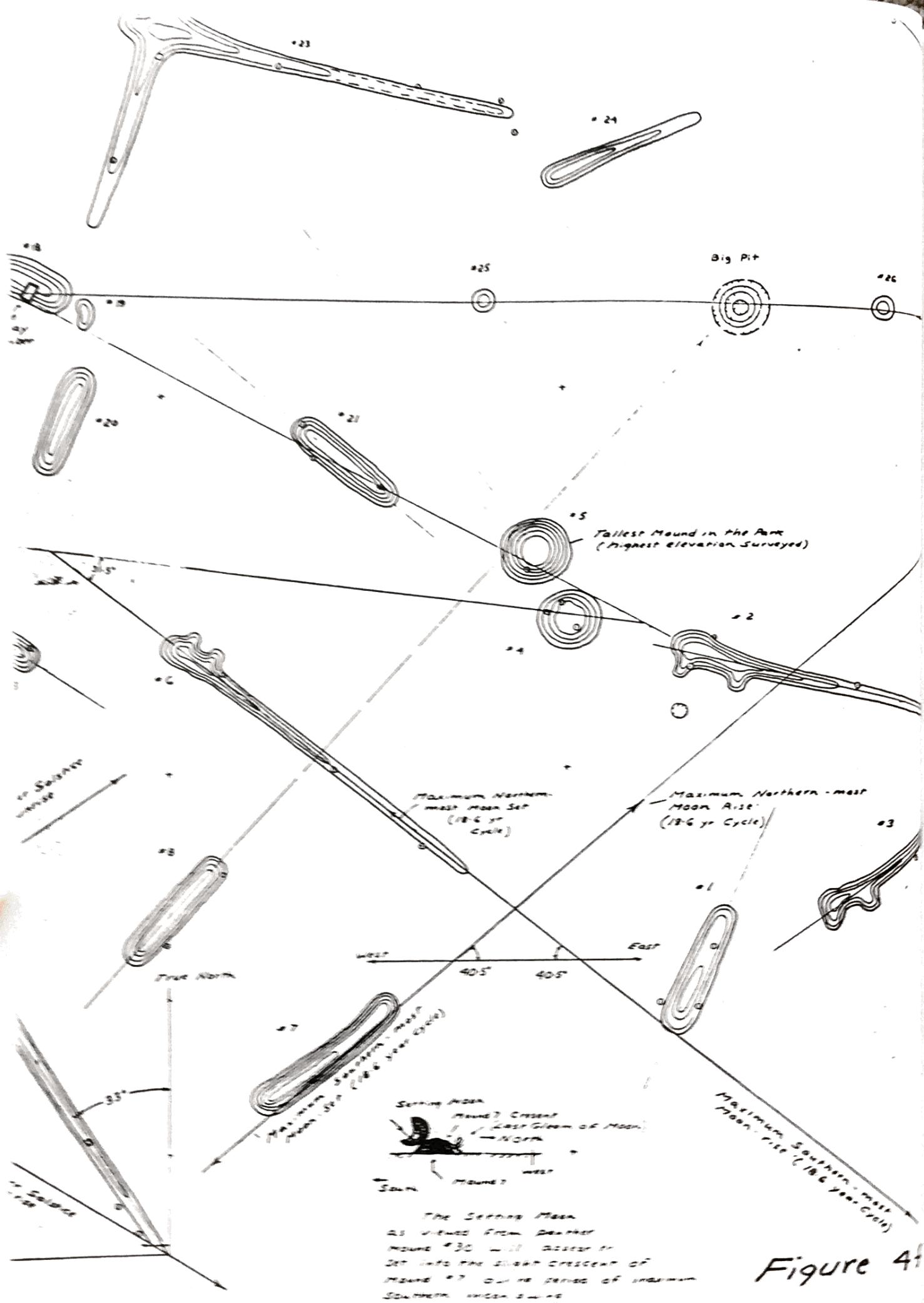


Figure 4f

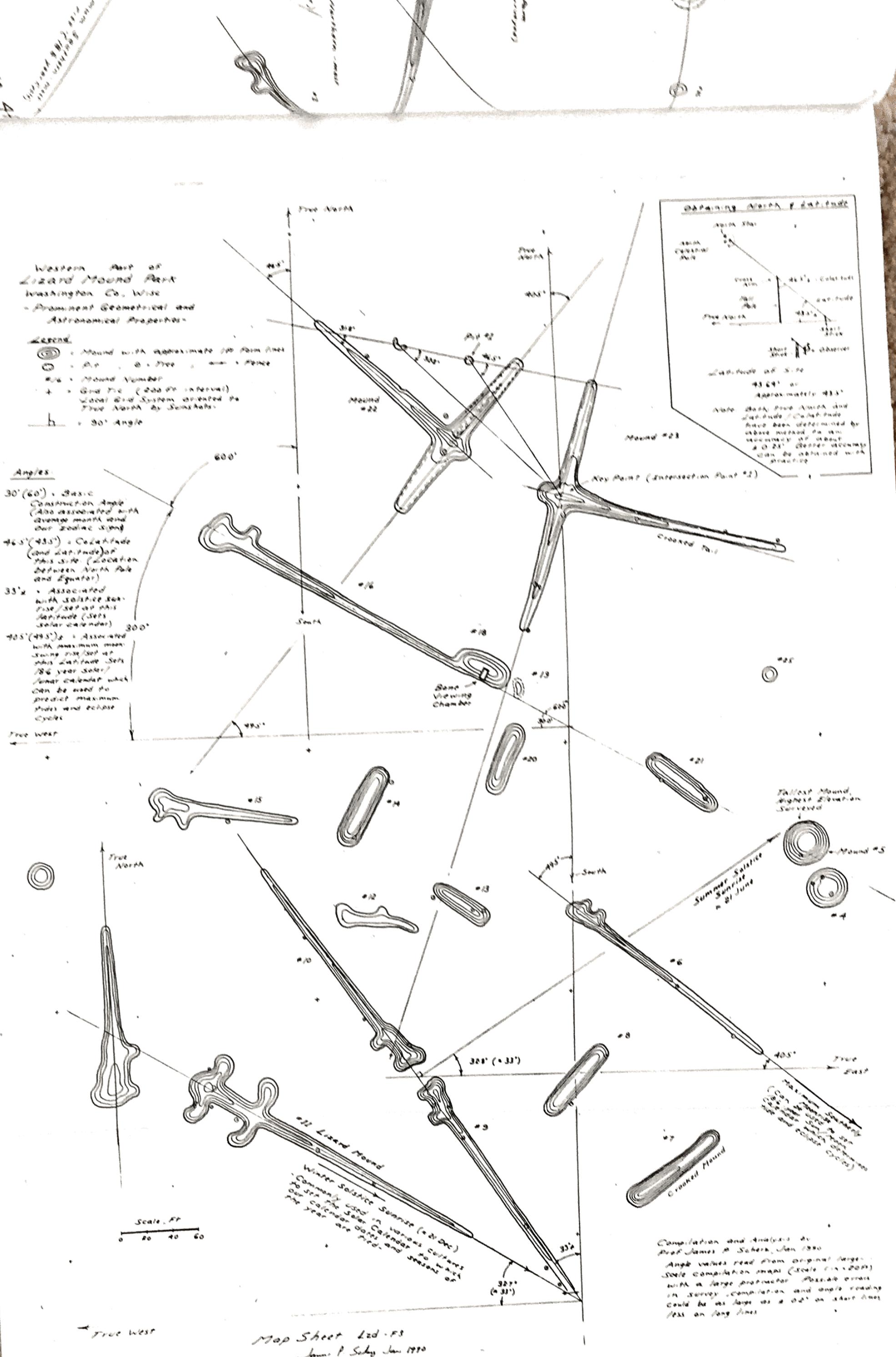


Figure 5 Western End of Mound Group

Figure 5a Index Indicating Which Figures Better Show Writing Details

See Figure 5b

Western Part of Lizard Mound Park Washington Co. Wisc
- Prominent Geometrical and Astronomical Properties -

Legend

- (○) = Mound with approximate 100' form lines
- (○) = P.M. = O = Tree
- - - = Fence
- * = Mound Number
- + = Grid Tie (200 ft. interval)
- Local Grid System oriented to True North by Sundials.
- = 30° Angle

Angles

30° (60°) = 13.13° c
(Also associated with average month and our zodiac signs)
46.2° (93°) = Celestial
(and Earth) Axis of this site (Location between North Pole and Equator)
33° d = Associated with winter solstice (December 21st) and summer solstice (June 21st)
40.5° (49.5°) = Associated with maximum moon during first/last of each lunation (Sets 18.6 year apart). Lunation calendar which can be used to predict maximum moon and eclipse cycles

30° (60°) = 13.13° c

(Also associated with average month and our zodiac signs)

46.2° (93°) = Celestial

(and Earth) Axis of this site (Location between North Pole and Equator)

33° d = Associated

with winter solstice (December 21st)

and summer solstice (June 21st)

Lunation calendar which

can be used to

predict maximum

moon and eclipse

cycles

18.6 year

13.13° c

13.13

Western Part of
Lizard Mound Park
Washington Co., Wisc.

- Prominent Geometrical and
Astronomical Properties -

Legend:

- () = Mound with approximate 1 ft form lines
- () = Pit , O = Tree , — = Fence
- #/16 = Mound Number
- + = Grid Tie (200 ft interval)
- Local Grid System oriented to
True North by Sunshots -
- b = 90° Angle

Angles:

- 30° (60°) : Basic Construction Angle (Also associated with average month and our zodiac signs)
- 46.5° (43.5°) : Colatitude (and Latitude) of this site. (Location between North Pole and Equator)
- 33° : Associated with solstice sunrise/set at this latitude (Sets solar calendar)
- 90.5° (49.5°) : Associated with maximum moonswing rise/set at this Latitude Sets 18.6 year solar/lunar calendar which can be used to predict maximum tides and eclipse cycles

True West



True North

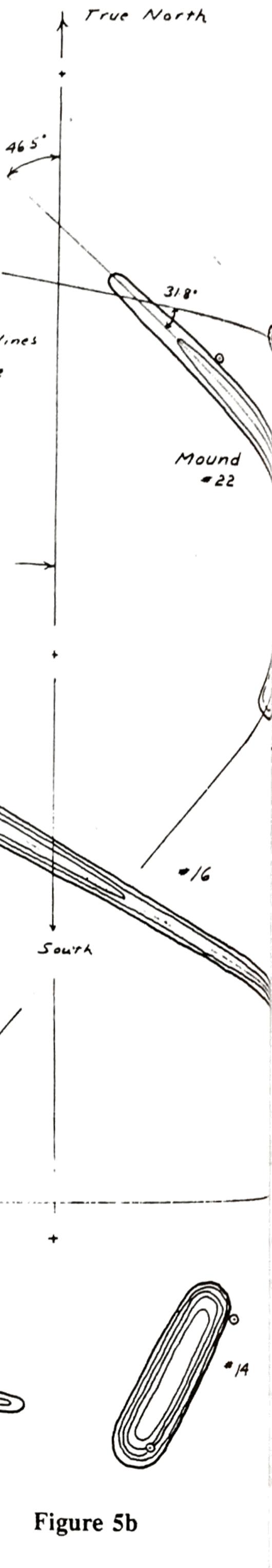
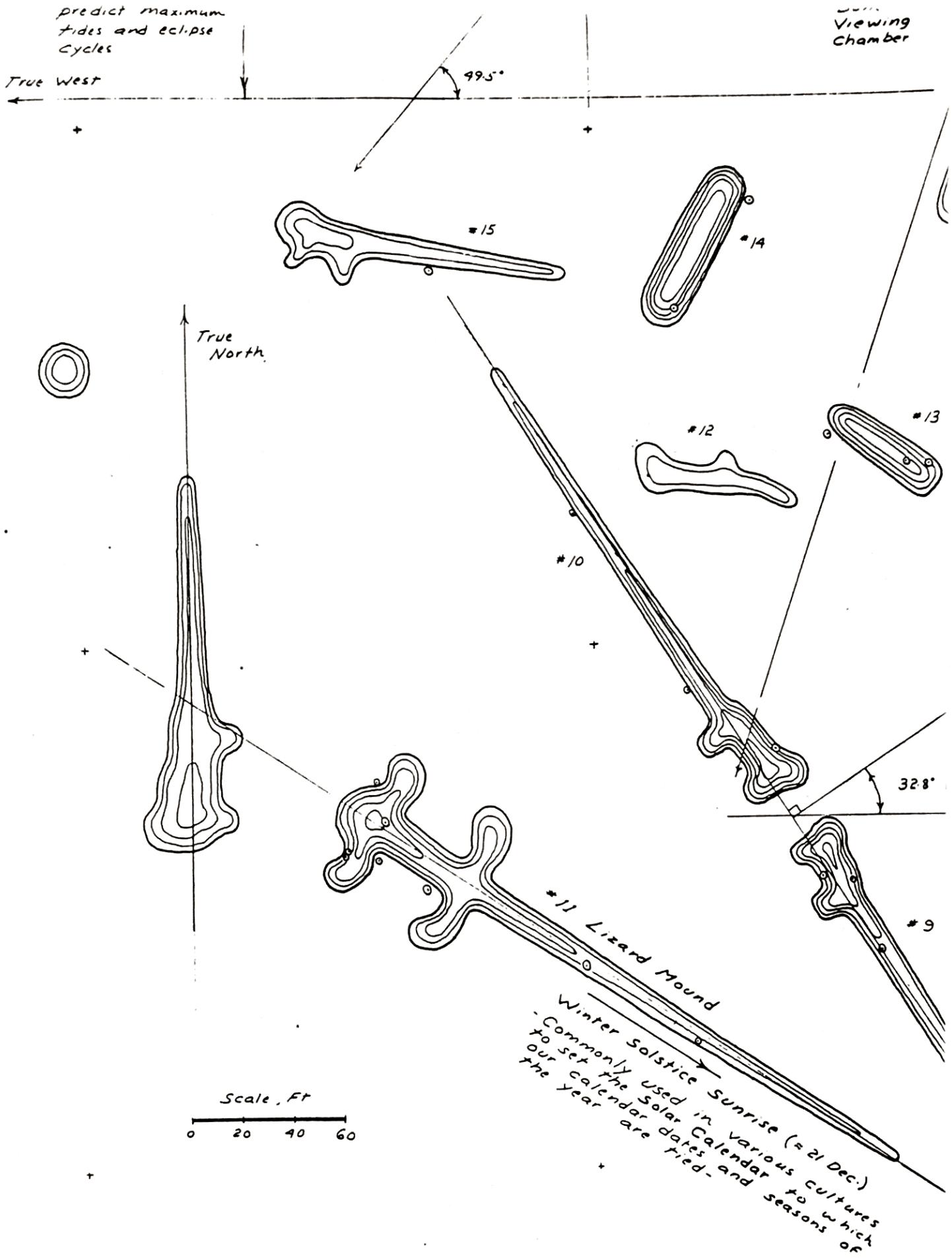
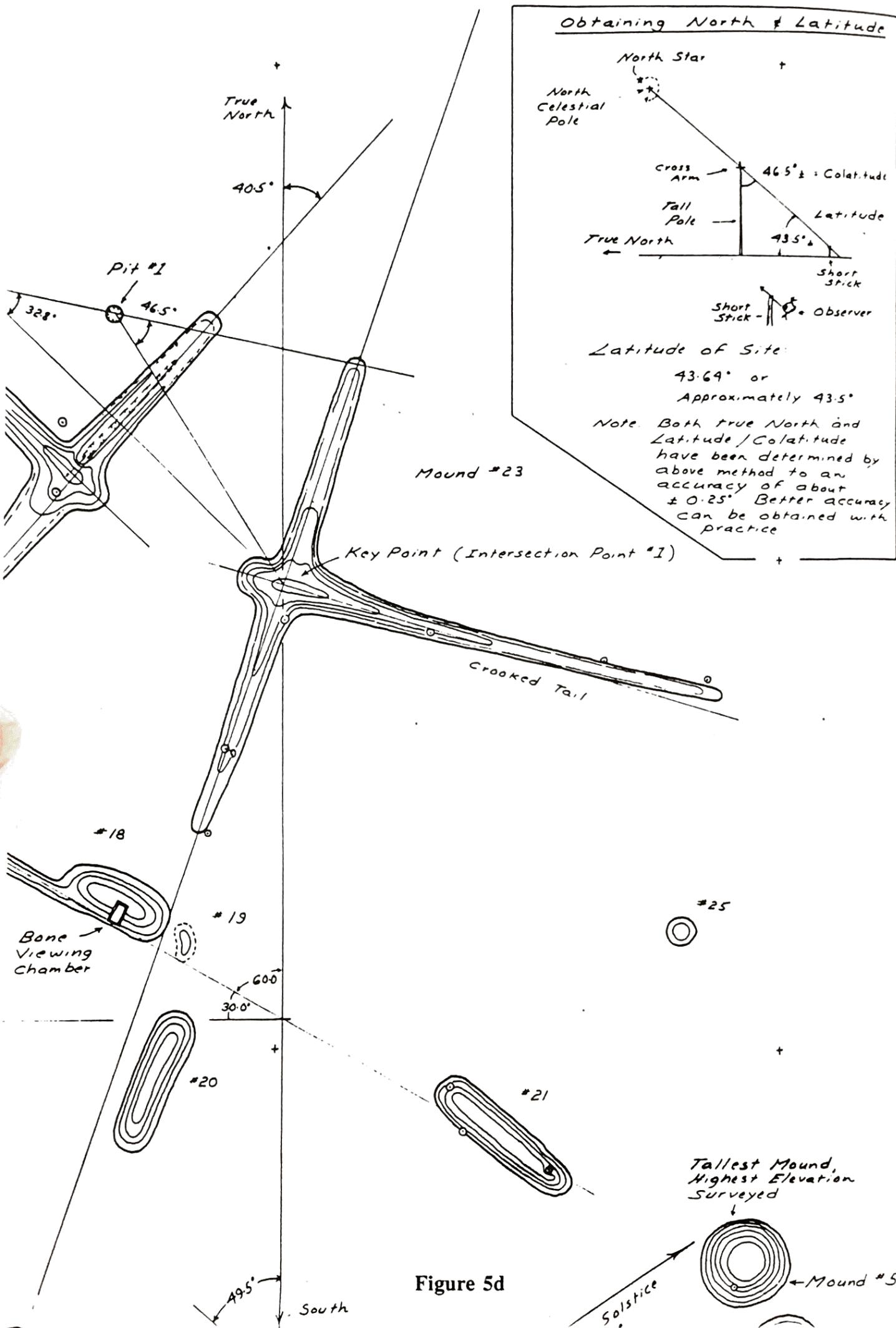


Figure 5b



True West
 Figure 5c

Map Sheet L2d - F3
 Jan. P. Schuy Jan 1990



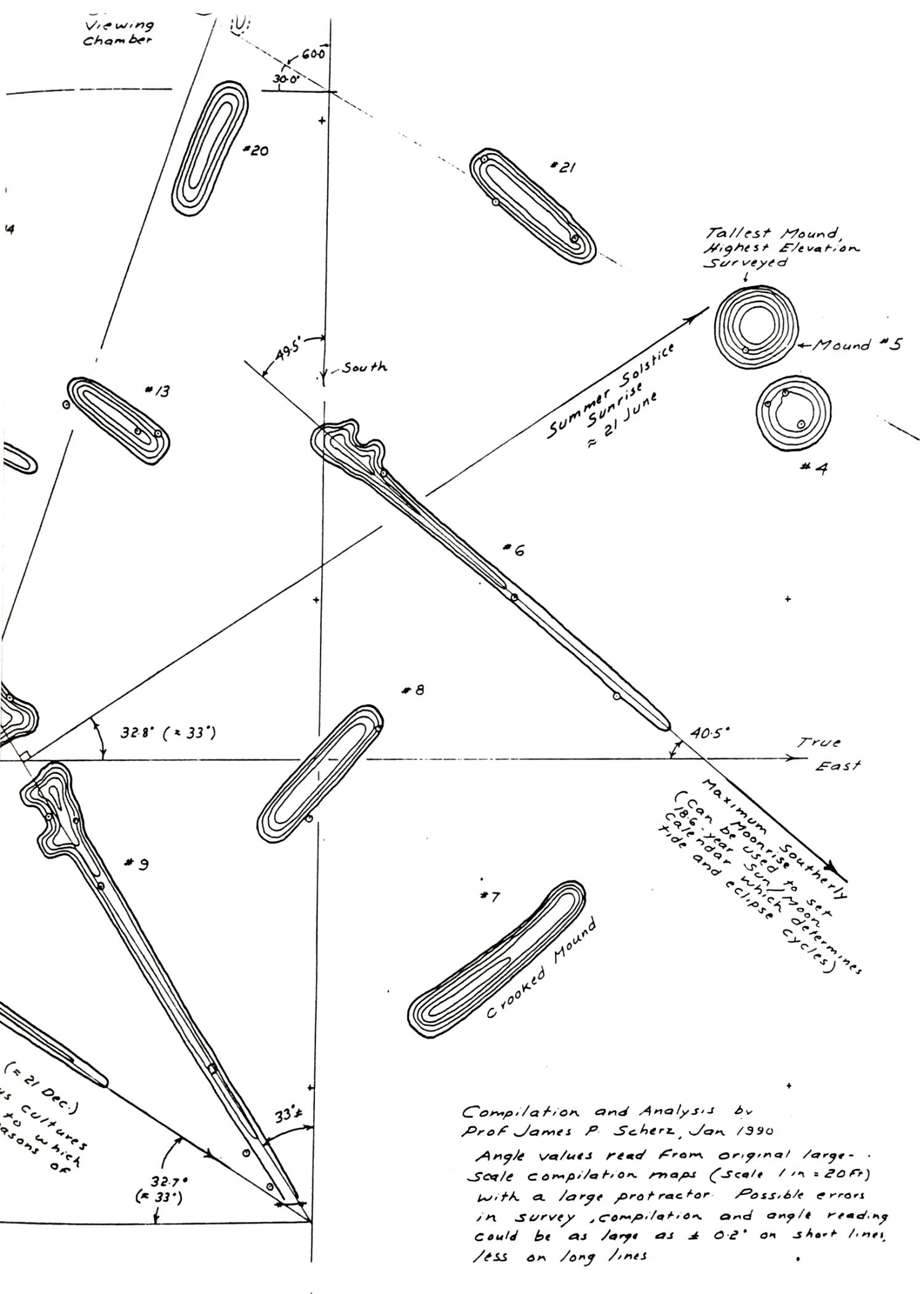


Figure 5e

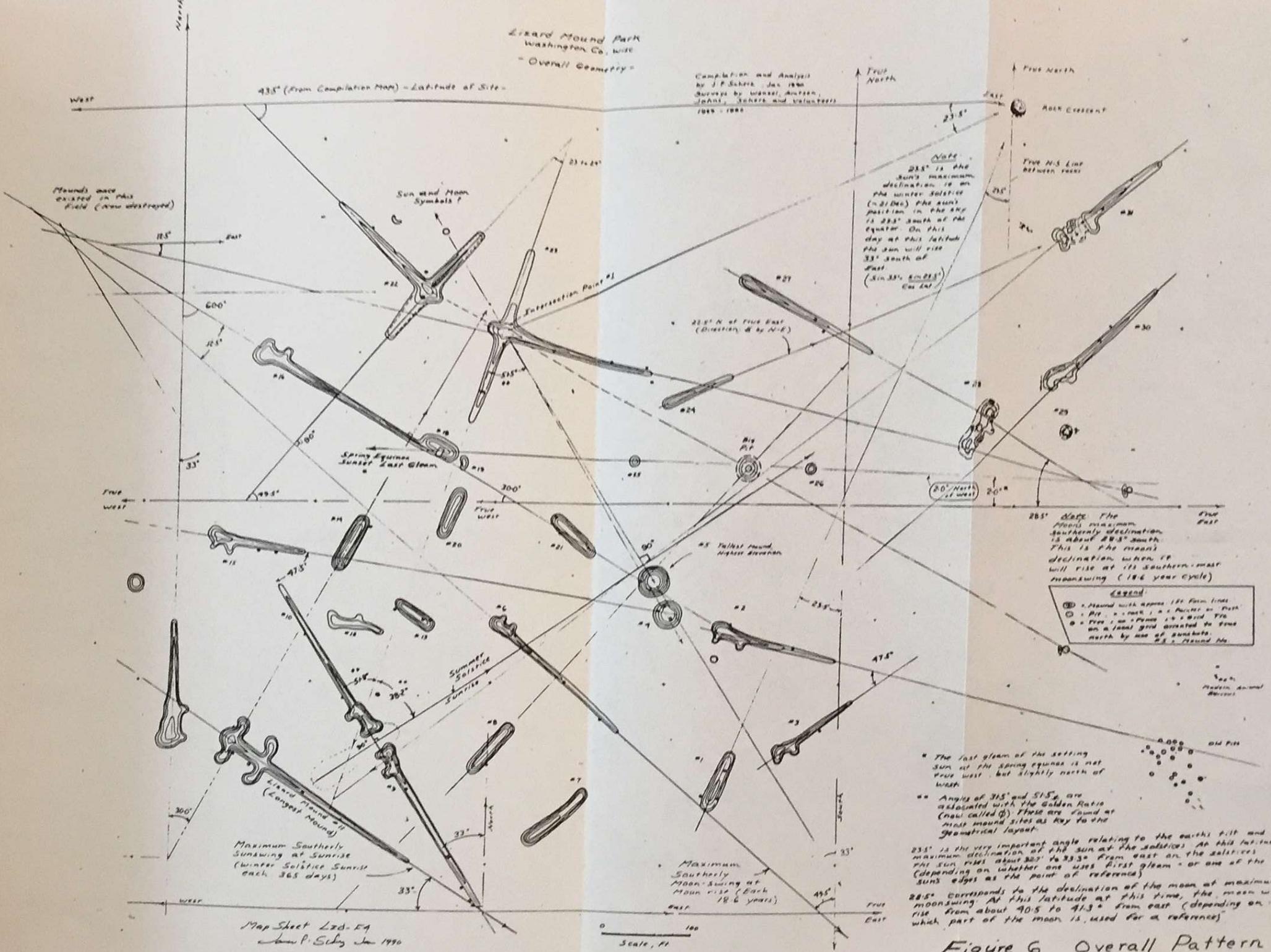


Figure 6 Overall Pattern 25

these maps can be found in the map and photo library, Science Hall, UW-Madison.

Significant Geometrical Properties

The latitude of the site (in this case 43.5°), the angle of 23.5° (or the maximum declination of the sun), $30^\circ - 60^\circ - 90^\circ$ (construction angles) and angles that relate to the sunrise at the solstices (in this case $33^\circ = \sin^{-1} [\sin 23.5^\circ / \cos \text{lat}]$) can be found at this site as they can at most sites. These angles are laid off from the true cardinal directions (which can be determined from observing the rotation of a northern star about the celestial pole).

The tail of the lizard mound itself points 33° south of east. Thus it points precisely at the rising sun at the winter solstice (an event that can be readily witnessed). The angle of 51.5° (or its compliment 38.5°) is also found here as at most sites. This angle is related to the magical ratio known as the golden section, the divine proportion, etc., which the Greeks called Phi or ϕ . The ratio is found in the joints of your finger, in the cycles of Venus compared to the sun, in the 3x5 or 5x8 library card, etc. Phi and angles that make Phi can be found in structures made by many ancient people. (The Giza Pyramid of Egypt has sides that are about 51.5° from the horizon. The latitude of Stonehenge is about 51.5° ; the latitude of Cahokia is about 38.5° , etc.)

This site also has two subtle symbols that are in the shape of a crescent moon (the rock mosaic to the northeast, and the crescent-shaped pit to the northwest). Also the maximum declination of the moon (28.5°) at its maximum moonswing (once each 18.6 years) is incorporated in the mounds. (This 28.5° for the moon is similar to the angle of 23.5° for the sun). Also as the lizard mound points to the rising sun at its maximum southern swing on 21 December (a 365 period), so also some of the mounds point towards the rising and setting moon at its southern swing on an 18.6 year cycle.

Therefore the mounds could be used to set both the solar calendars (365 days) and the longer 18.6 year lunar cycle. This later cycle is still used by surveyors who must determine mean sea level (the cycle can be used to set the maximum tides). It also sets the eclipse cycles.

In Ohio in the 1800's, there is evidence that an Indian woman could predict eclipses.² She was reportedly hung as a witch at the instigation of Christian missionaries who could not make such a prediction. Although any such knowledge was therefore obviously forced underground, its possibility among the Native Americans can be seen in these mounds.

The Winter Solstice Sunrise

Figure 7a through 7d show photos of the rising sun over the tail of the lizard mound at the winter solstice, 1989. The sunrise was photographed by James Scherz and witnessed by Ray Knapp.

Comparison of This Survey with Previous Surveys of This Mound Group

To obtain the accuracy needed to predict solstice sunrises, etc., modern surveyors must determine true directions to better than 0.25° (it would appear that Indian surveyors achieved such accuracy). We have done tests with only pointed sticks as instruments and defined our latitude and true north to this accuracy. The only presently used survey method that will give accurate enough directional control to check mound alignments to within 0.25° is by the use of celestial observations (star shots or sun shots). Previous to our work essentially all surveying of Indian mounds was done with a compass which, except in the hands of extremely skilled surveyors, has errors of about $\pm 2^{\circ}$.³

²Writings of my part-Indian ancestor, Edward Cogswell.

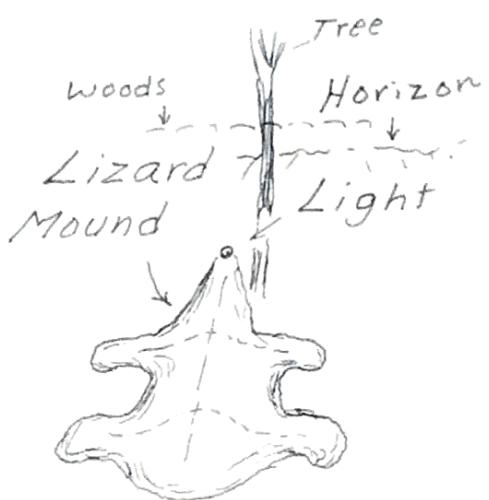
³T.H. Lewis, a former army surveyor, mapped thousands of mounds in the late 1800s. His notes and field methods are examples of an extremely competent, careful and skilled surveyor. Although he used a compass, he recorded his angles to the nearest 1/4 degree (0.25°). Checking of his work indicates that we can rely on his angles to be accurate to

(Text of footnote continued on page 30.)



Figure 7A.

Looking down tail of Lizard Mound two minutes before sunrise. Note lantern on centerline of tail of mound.



First Gleam of
Rising Sun over
Centerline of
Mound 7D

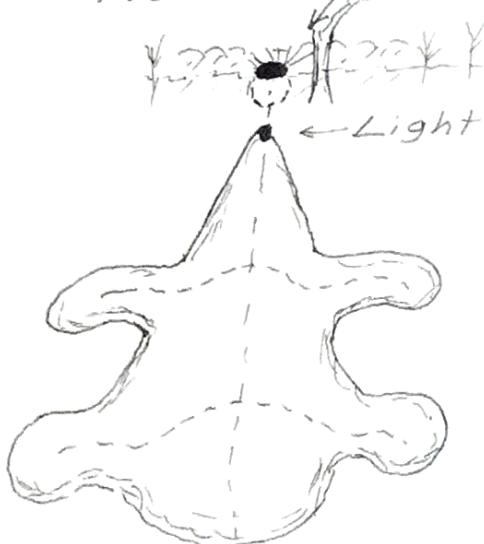


Figure 7B.



Winter Solstice
Sunrise over Lizard
Mound, December 1989.

First Gleam
of sun

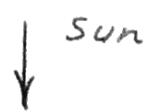
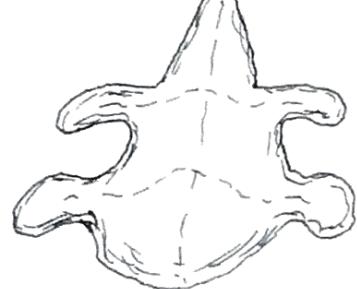
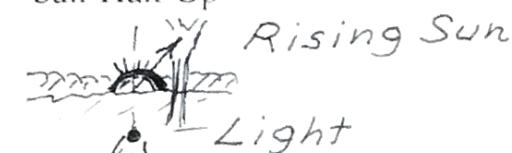


Figure 7c



Sun Half-Up



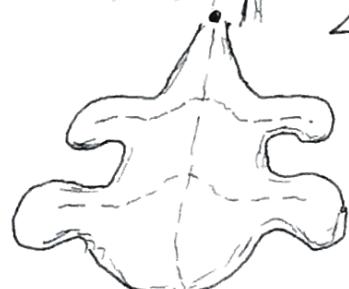
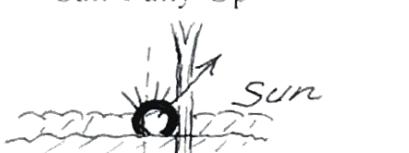
← Lizard Mound →



Figure 7d



Sun Fully Up



Winter Solstice Sunrise Over Lizard Mound.

Previous surveys by amateurs using compasses were adequate to locate general position of mounds for park planning, etc., but one cannot expect to obtain reliable geometrical nor astronomical data from them. Many published maps of Indian mounds were not even properly surveyed. They were only sketched. However, compass surveys and sketches are indeed valuable for showing general location of mounds which are now flattened.

Historical Surveys

The Wisconsin Archeologist, Vol. 23, No. 1, carries an article entitled, "The Hagner Indian Mounds" by Kermit Freckmann in which the author describes a survey in 1941 of a group of mounds in W 1/2, SE 1/4, NW 1/4 Sect 20, Town 12 North, Range 20 East, Farmington Township, Washington Co., Wisconsin. The mounds were located on the farm of Ernst Hagner, thus the name of the mound group. It is presently the site of Lizard Mound Park.

The author mentions that prior to 1941 no accurate map had been made of this group, but that a rough sketch had been made in 1883 by Professor Julius L. Torney of Milwaukee. This sketch, like many sketch maps by people like Rev. Peet, Charles Brown, etc., was probably made by pacing and direction approximations.⁴ "Although numerous

0.25^{*} provided we know the precise magnetic declination at the site he was surveying. We have found no other surveyor whose work we can trust in this fashion. His fragile and crumbling notes are on file at the Minnesota State Archives where they can be studied. They have not yet been microfilmed and are thus not readily available to the average researcher. When asked why his notes had not been protected by microfilming, employees of the Minnesota Historical Society said it was a conscious policy not to microfilm his notes due to influence by local archaeologists who were concerned that if they were microfilmed the general public would have access to the data and might destroy the mounds. Thus at the date of this report, the notes of T.H. Lewis' accurate surveys are not available to the researcher in microfilm format, nor are they presently allowed to be xeroxed.

⁴However, it appears that they didn't document their method nor the resulting accuracy.

errors were evident in this sketch map, it must be considered that, under the circumstances, a fair record was produced showing the approximate position of each mound relative to the others". According to Freckmann, Torney's map of 1883 was a great help in guiding him to the remaining mounds and in finding partially destroyed or almost entirely destroyed earthworks. He further states that the only previous data on this group of earthworks was the sketch map made by Prof. Julius L. Torney in 1883.

Prof. Torney's Sketch Map

According to Freckmann, Prof. Torney illustrated a total of 47 mounds on a site labeled the Hagner & Meyer mound group. The mounds on the Meyer property were already disturbed by cultivation in 1941. Those in the Hagner woods were still preserved. Figure 8 shows Freckmann's map of 1941 showing both the intact mounds in the Meyer woods and locations of other flattened mounds on neighboring property.

Freckmann's Survey

Freckmann began his survey on June 24, 1941. Seven days were required to finish the work. He states that he borrowed the necessary survey equipment from Dr. Ira Edwards, Director of the Milwaukee Public Museum. He does not mention the type of equipment used, but one may assume a transit with a compass needle for directional control, as that was the survey method most commonly used for such work in 1941. From the descriptions of the length of the mounds, often to the nearest 0.1 ft., we conclude that he probably used a tape for distance.

Figure 8 is a map produced by Freckmann showing both the mounds he surveyed in 1941 and the ones that Torney sketched in 1883 but which got flattened. Figure 9 is a comparison of our 1989 survey results with Freckmann's map. The overlay was made by use of the AutoCad computer mapping program. In addition to the 2° directional error one

(Continued on page 34.)

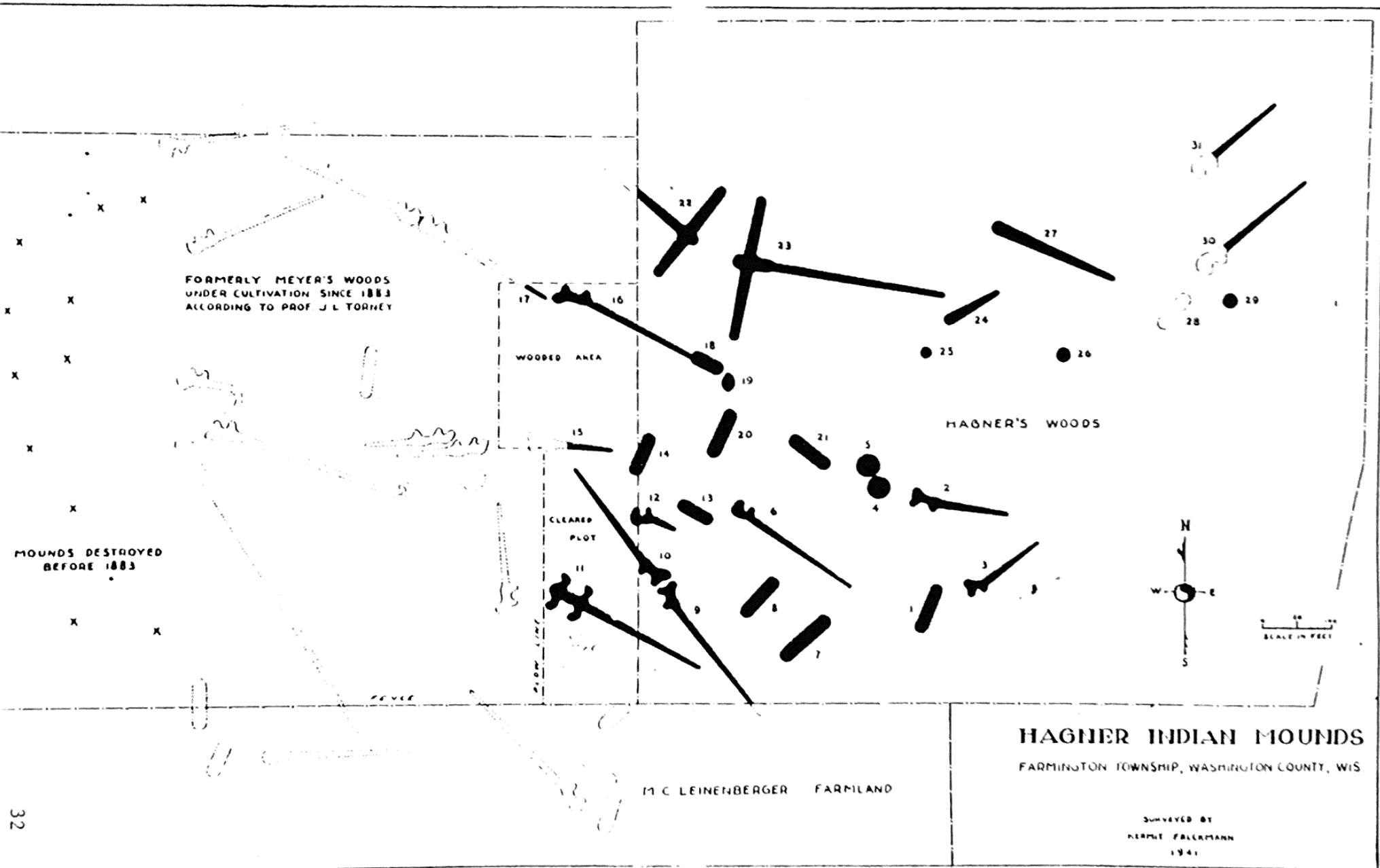


Figure 8 Survey Data From 1941 and 1883

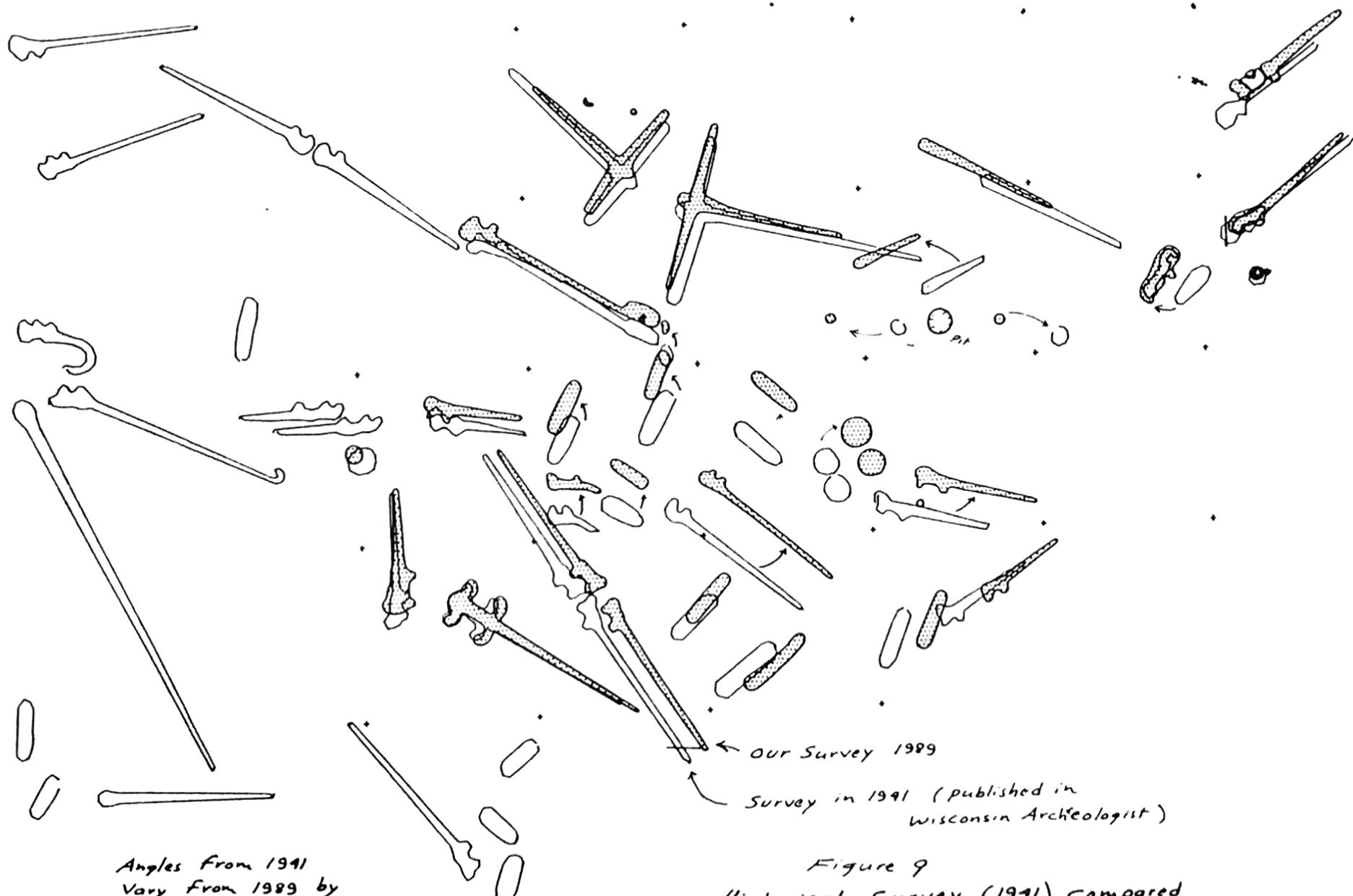


Figure 9
Historical Survey (1941) Compared
to Modern Survey (1989)

JPS 20F-8 80

would expect with Freckmann's compass (on his transit) there is at least one obvious blunder or mistake somewhere of about 100 ft. But as Freckmann said in 1941 of Prof. Torney's sketches from 1883, we can also say of Freckmann's work, "Although numerous errors were evident...it must be considered that, under the circumstances, a fair record was produced showing the approximate position of each mound relative to others."

A statistical detailed comparison of Freckmann's work in 1941 to the work in 1989 is given in Annex A. One conclusion is that on the average, the directions of the mounds given by Freckmann differ from what was determined by precise surveys controlled by sun shots by about 2.0 to 2.8°.

What this means is that one cannot use Freckmann's work for geometrical nor astronomical analysis where accuracies of $\pm 0.2^\circ$ or better are needed. Annex A also compares the conventional verbal description of the mounds used by Freckmann and many other archaeologists to our method of simply portraying the sum of the data graphically on an accurate map. For symbolic, geometrical and astronomical purposes we prefer the graphical representation.

Location and Landforms

When visiting the elaborate mounds at the park, one is apt to ask: "Why would the Indians have located this important mound group where they did?" Today one sees no large body of water or rivers which are normally associated with important mound groups. In an attempt to better understand the landform of the area, aerial photos were acquired and a topographic map with 5 ft. contour lines (form lines) was compiled. This is shown in Figure 10. From this map one is impressed with the springs that can be found on different sides of the area. They drain in different directions. The mounds are located on two irregular high spots on a dividing area between watersheds of different tributaries of

the northern branch of the Milwaukee River (note the concept of duality). The irregular shapes of these high spots are also noteworthy. They have a general shape of men or birds, one going northwest, one headed southeast. Since the area near Plymouth, Wisconsin was known to the Indians as the "Hand" because the general shape of the landform resembles a hand, one should not assume that the Indians overlooked the dual landforms at Lizard Mound Park, which resemble men.⁵ See Figure 11.

Figure 12 is a map showing the general drainage pattern: no contour lines are shown. Figure 13 is a smaller scale map which shows how the Lizard Mound group fits into the prehistoric and historic water route patterns of the region.

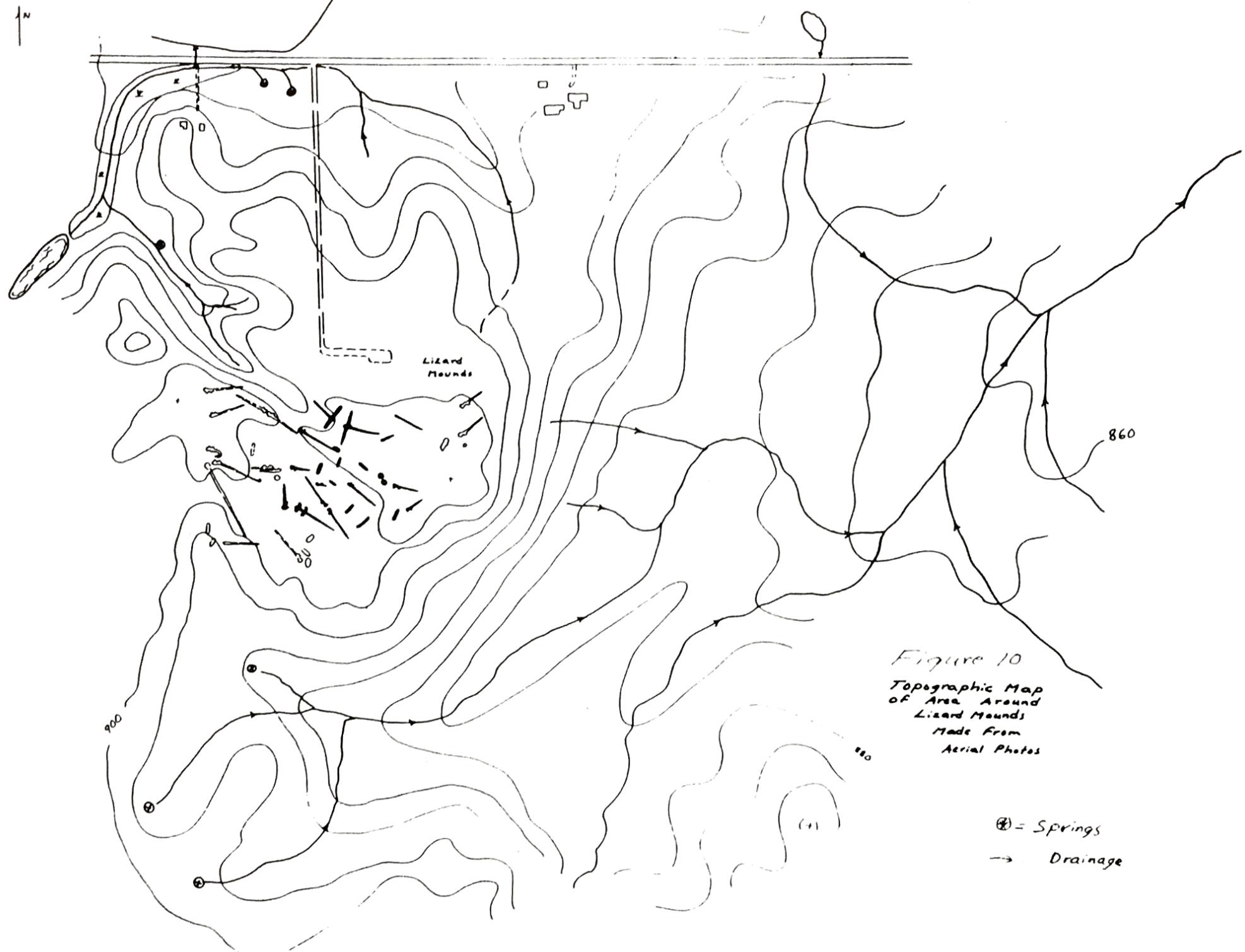
Here too, the concept of duality can be seen. As the area (where the mounds are built) drains into two tributaries of the northern branch of the Milwaukee River, so also within a few miles of the site, to the west, there is a drainage divide between the northern and western branch of the Milwaukee River (two branches of the Milwaukee River). Ten miles west of Lizard Mound Park one could see rain falling that would drain into the Mississippi River and into the Gulf of Mexico (whereas the Milwaukee River flows into Lake Michigan and into the Atlantic). Thus, Lizard Mound Park is within sight of the drainage divide between two major river systems that drain to oceans in the east and south.

Summary and Conclusions

The geometry of the site is sophisticated, but fully in line with principles found at other mound groups further west. Construction angles (such as 30° and 60°) are found as are angles corresponding to the latitude of the site. Angles of 23.5° and 51.5° are found as well as pointers to the solstice sunrise. Also angles corresponding to the declination of the moon at its maximum southern moon swing are found, as well as pointers to the rising and

(Continued on page 40.)

⁵Personal conversation with Jan Borgenhagen and John Boatman, October, 1989.



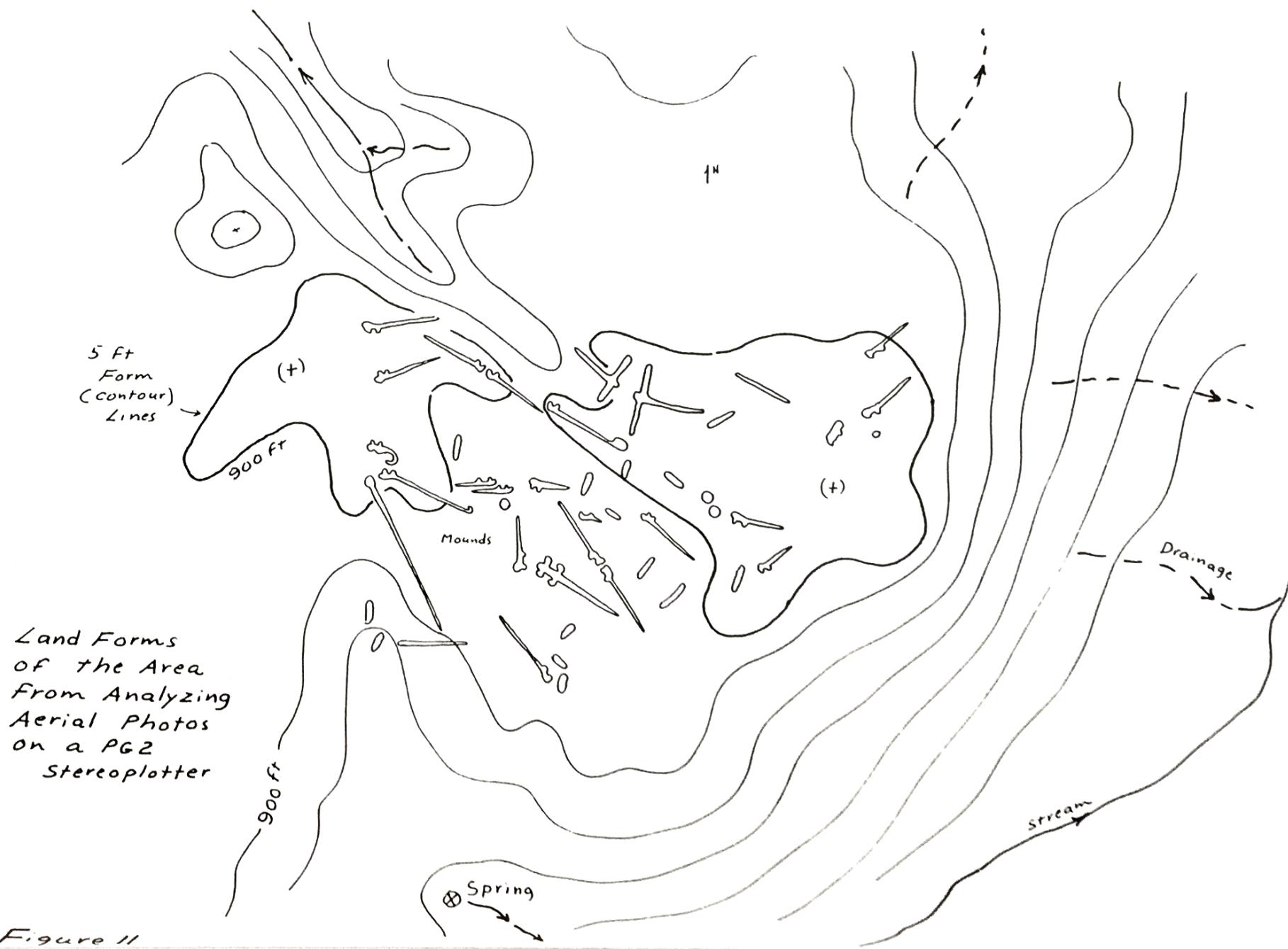


Figure 11

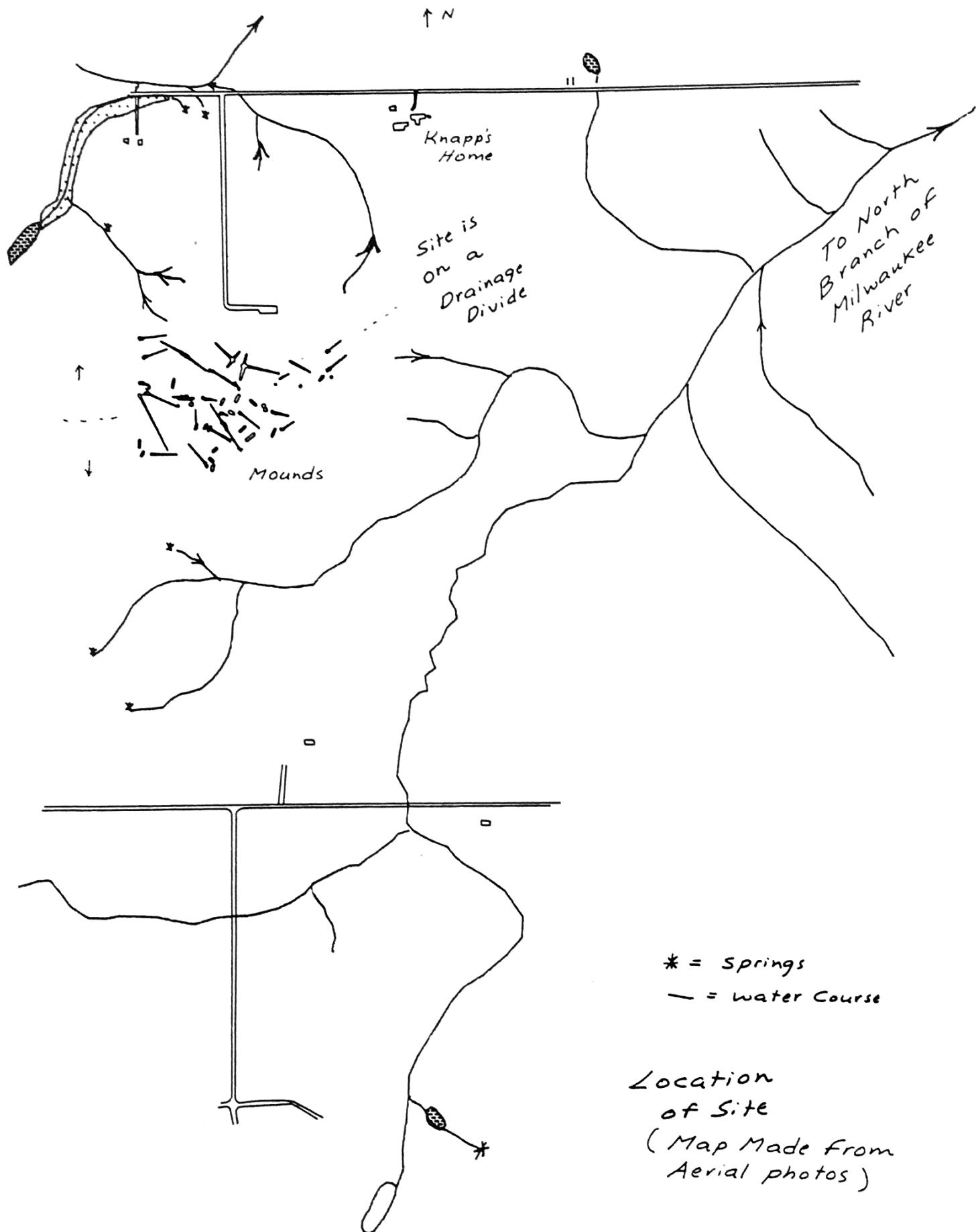


Figure 12

Location of the Lizard Mound Park
on the prehistoric water routes.
(also on the routes used during
the historical fur trade)

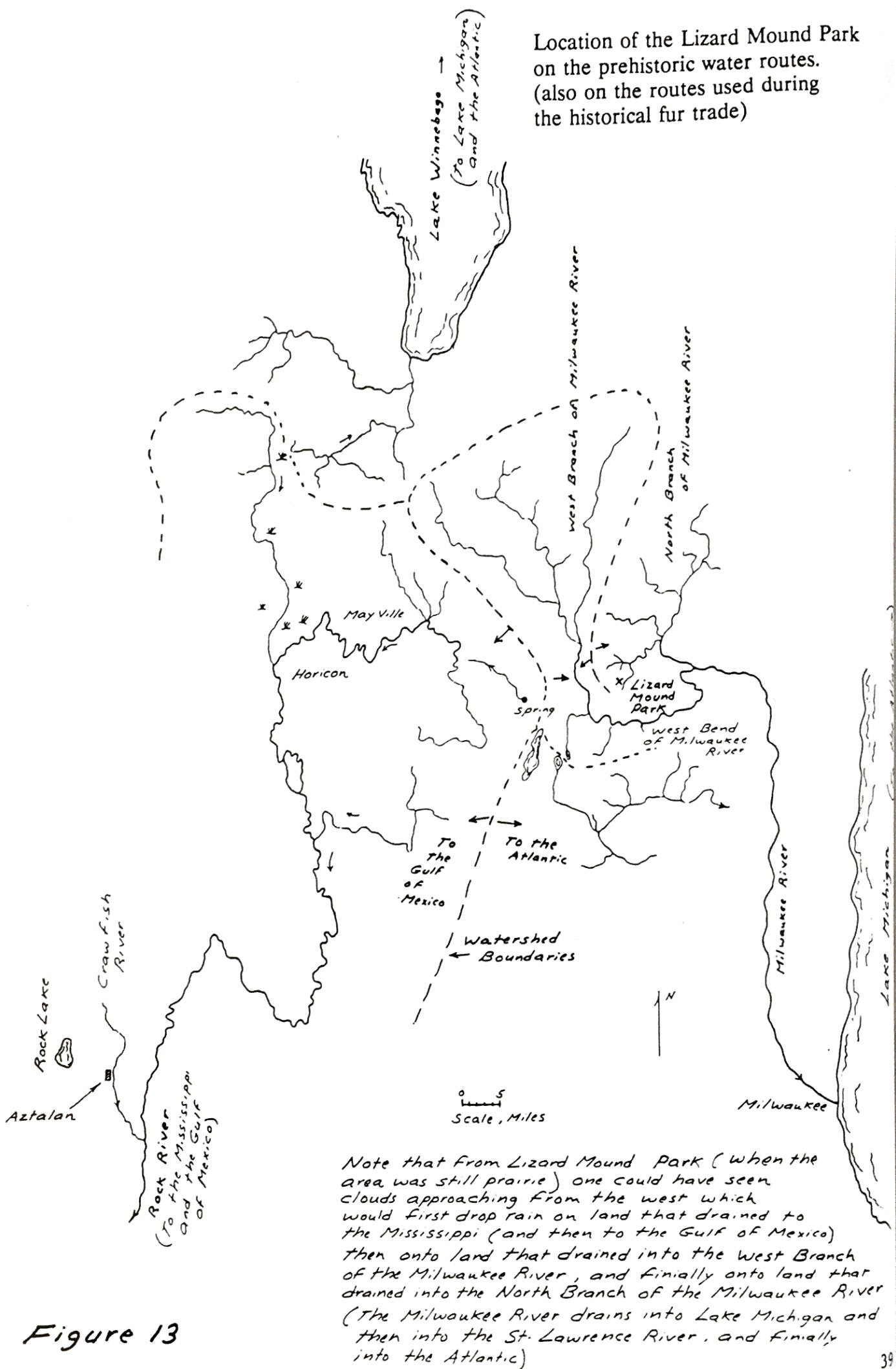


Figure 13

setting moon at this time. All geometry is related to the true cardinal directions. A rock mosaic symbol corresponding to the shape of the new moon is also found, similar in shape and size to one found in Madison. I sense a strong theme of duality throughout the site. The verbal histories that remain with the Indians speak of duality and two groups of people, etc. There are two crosses, two round mounds, and two mirroring panther mounds. The geometry and astronomy relate to the two equal sized (as we see them) heavenly bodies, the sun and the moon. The mounds are on two somewhat similar shaped landforms pointing in opposite directions from which water will drain to two tributaries of the northern branch of the Milwaukee River. The area is within a few miles of the drainage basin of the western branch of the Milwaukee River and within 10 miles (one could see such falling rain) of where water will drain to the south to the Gulf of Mexico. The duality of drainage basins is expanded from small to large: from two tributaries, to two branches, to two river systems. The concept is inspiring and educational today to anyone who can stand atop the lizard mound and visualize the pattern.

Statistical analysis of the maps made by Freckmann in 1941 show that they are not accurate enough for geometrical nor astronomical analysis. However, they do show mounds which are now flattened.

Some reconnaissance soil probing was done south of the fence in the area where Freckmann indicated the tail of mound 9 once extended. Rather drastic soil erosion in this area has washed away about 1 to 2 feet of topsoil, consequently destroying any visible root of the tail of mound 9 in this field. Similar soil probing was tried where Freckmann indicates mound 17 once extended northwestward. Charcoal and some strange blue glass-like slag were found at a depth of about 14 inches where mound 17 should have been located. But no sharp soil anomaly could be clearly seen between where the mound

supposedly was and the background soil.

At other sites such as the large bird mound at the Mendota Site in Madison and the feet of the Man Mound at Baraboo, Wisconsin, soil probing in places where portions of the mounds were flattened in historical times revealed that the shape of the mound was apparently first excavated to a depth of about 15 inches and then the area was filled in and the mound constructed with black topsoil. Consequently soil probing in several such areas clearly indicates the root of the flattened mound by the depth of black soil (15 inches where the mound once was and about 6 inches for background soil).

In other sites where subsoil and not black soil was used for fill, the process is less discernable but often still works where the mixed subsoil of the mound root is visibly different from the background soil profile. See Annexes B and C.⁶ From observing eroded mounds and spoils from animals borrowing into the mounds at Lizard Mound Park, we can conclude that subsoil seems to have been largely used for construction of the mounds. Consequently there is very little visual difference between the soil in the mound root and in the background area. We occasionally did find charcoal where mound #17 was supposed to be. However unlike many other sites we could not readily tell from a single soil sample whether it apparently was an old mound root or not.

The background soil was also complicated. There were numerous naturally occurring small packets of clay, washed sand, and silt. As of this date we have made no other attempts to precisely locate the boundaries of other flattened mounds by soil sampling.

Annexes B and C show data at several other sites where anomalous soil profiles clearly correspond to where known mounds were flattened. As shown in these Annexes

⁶If you have the abbreviated version of this report, Annexes B and C are not included. They are in the non-abbreviated versions.

the correlation worked in the majority of the sites tested, but not in all cases, especially in heavily worked and deeply plowed agricultural fields. Based on the data in these annexes, it is felt that one should not give up on the possibility of locating the flattened mounds at the Lizard Mound Park area without more concerted effort. On the other hand, the system may prove not to work at this location due to erosion, deep plowing, and a very complicated natural soil profile including many pockets of varying silt and clay.

Many large trees are growing on the mounds at Lizard Mound Park. It is strongly recommended that all such trees be cut down before they are uprooted by winds, destroying large portions of the mounds.

Annexes

There are three versions of this report: (1) an abbreviated version which has only Annex A, (2) a second version which also has supplemental annexes B through L, and (3) a full version which has all of the supplemental annexes B through Q. The supplemental annexes document how soil probing might possibly work for locating some of the now flattened mounds in the area and how the geometrical patterns, symbolism, and possible astronomical and calendar functions that can be observed at Lizard Mound Park relate to other sites. As the supplemental annexes make the report very long, the non-abbreviated versions are normally only provided to especially interested persons. A list of all annexes follow.

- Annex A Comparison of 1941 Survey and 1989 Survey (only annex provided with abbreviated version of report)
- Annex B Modern Survey and Soil Probe Data Compared to Survey by Canfield in 1859.
- Annex C Modern Survey and Soil Probe Data Compared to Survey Notes of T.H. Lewis.

- Annex D** Similar Geometry at Other Sites.
- Annex E** Solstice Alignments at Other Sites.
- Annex F** Equinox Sunset Possibility at Lizard Mound Park Compared to Other Sites.
- Annex G** Possible Standard Distances at Lizard Mound Park Compared to Other Sites.
- Annex H** Grooved-Wing Mounds at Lizard Mound Park and Madison, Wisconsin.
- Annex I** The Stone Crescent at Lizard Mound Park Compared to Ones at Madison.
- Annex J** Political Progress Towards Preserving Wisconsin's Indian Mounds.
- Annex K** The Mysterious Angle of 42.5° at Lizard Mound Park Compared to Similar Angles at Other Sites.
- Annex L** The Effigy mounds Region.
- Annex M** Pertinent Aspects of Geometry, Astronomy and Time.
- Annex N** Surveying Overview and Guidelines.
- Annex O** A Surveyor's Perspective.
- Annex P** Squaring the Circle and Trisecting an Angle --with compass and straight edge
- Annex Q** Pi, Phi, and The 1/4 Series Function-- and an introductory look at spirals

ANNEX A

Comparison of 1941 Survey and 1989 Survey

A statistical comparison was made of the work done in 1941 by Freckmann with the work done in 1989 by William F. Wenzel and crew. The directional control in 1941 is assumed to have been by compass (poor accuracy) and the distance measurement by taping (potentially accurate to about ± 0.2 ft.). In the 1989 survey, the directional control was by sun shots (accurate to about $\pm .02''$) and the distance measurement was by stadia (accuracy limited to about 1-2 ft. for a normal shot). Freckmann apparently measured the height of the mounds by transit and level rods; field sketchers in 1989 estimated the heights. Freckmann taped the width of the mounds. In 1989 the widths were sketched in on a grid sheet. Table I compares the length, width, height and alignment of 31 numbered mounds (surveyed in 1941 and 1989). The mound numbers are the same as those shown in the maps.

The values for the 1941 survey were taken from published data. The values for the 1989 survey were taken from the compilation maps (scale 1" = 20 ft.)

TABLE I
Data on the mounds from 1989 and (1941) surveys and comparison of directions.

Mound No.	Length, ft	Width, ft	Height, ft	Direction, Degrees	Difference in Direction
1	71 (73.3)	18 (20)	3+ (3.3)	N 25.0 E (N 23.0 E)	-2.0
2	148 (145)	26 (28.3)	3+ (3.8)	S 76.4 E (S 80 E)	+3.6
3	111 (120)	-	3+ (3.1)	N 55.7 E (N 54 E)	-1.7
4	32 ft dia (35)	-	3+ (5, damaged)	-	-
5	36 ft dia (36)	-	5+ (6)	-	-
6	195 (211)	-	3+ (3.3)	S 49.5 E (S 55 E)	+5.5
7	90 (92.4)	-	4+ (3.8)	- Crooked - (N 49 E)	-
8	71 (74)	-	3+ (3.7)	N 42.1 E (N 43 E)	+0.9
9	205 (174.5)	-	4+ (3.6)	N 33 W (N 36 W)	+9.0
10	200 (214.5)	-	4+ (4.2)	N 33.5 W (N 35 W)	+1.5
11	258 (258.5)	-	4+ (4.3)	S 57.5 E (S 60 E)	+2.5
12	~65 (67.5)	-	1+ (2.5)	- Curved - (S 62 E)	-
13	51 (56.5)	-	3+ (3.5)	N 54 W (N 55 W)	+1.0
14	68 (66)	-	4+ (3.8)	N 30.0 E (N 23 E)	-7.0
15	115 (115)	-	-	N 81 W (N 83 W)	+2.0
16	215 (215.5)	-	2+ (3.2)	N 60.0 W (N 60 W)	0
17	- Not Found in 1989 -				-
18	45 (47)	- Too Short to Give direction in 1989 - (N 65 W)			
19	16x7 (26x15)	-	1+ (1.3)	-	-
20	58 (78)	-	3+ (3.8)	- Curved - (N 24 E)	-
21	67 (71)	-	3+ (~4)	N 47.5 E (N 52 E)	+9.5
22	Tail 140 (rebuilt)	-	3 (3)	N 96.5 W (N 99 W)	+2.5
	L. Wing	-	-	N 91.5 E (N 91 E)	-0.5
	Rt. Wing	-	-	N 38.5 E (N 39 E)	+0.5
	Body	-	3+ (3.8)		
23	Mistake?				-
	Body 199 (308)	-	-	- Crooked - (N 80.0 W)	-
	Rt. Wing 96 (98)		1-2 ft (1.5)	N 16.2 E (N 12 E)	-4.2
	L. Wing 108 (114)	-	3+ (~4)	N 18 E (N 12 E)	-6.0
24	85 (88)		2+ (2.5)	N 67.2 E (N 62 E)	-5.2
25	12 ft dia (14 ft dia)		1+ (1.5)	-	-
26	12 ft dia (20 ft dia)		1+ (2+)	-	-
27	174 (190)		3+ (3.5)	N 61.5 W (N 64 W)	+2.5
28	71? (60)	- Mostly Destroyed -			
29	25 ft dia (21 ft dia)		1+ (2)	{ Stones on the Mound }	
30	174 (150 - body destroyed)		1+ (2)	N 49.5 E (N 52 E)	+2.5
31	157 (114 ft of tail) { 114 ft of tail }			N 53.5 E (N 51 E)	-2.5
			{ Damaged }		

On Heights, a
designation of 3+
means more than 3 ft and less than 4

Statistical Analysis →

± 2.8

Conclusions on Comparison

Heights of Mounds and how they are portrayed:

If we take Freckmann's heights of the mounds as correct and the field sketchers estimated height from the field sketches in 1989 as approximations, then the data shows that the maximum heights of the mounds as indicated by the mound sketch methods of 1989 are, in general, accurate to the nearest foot. Some of the differences could be in erosion between 1941 and 1989. A few of the mounds with large pits in them had also been reconstructed which could have accounted for differences in height as well as length. Thus we can conclude that our field sketches can (by their streamlined method) estimate the height of mounds to the nearest foot.

The reason for using the field sketch is to create a visual representation of the mound and obtain heights everywhere, not just at the highest point. The assumption is that an accurate picture is worth a thousand words. Figure A-1 shows a picture of mound #2 along with the form lines which indicate its form and height. Figure A-2 is a verbal description of the same mound.

Lengths of Mounds

Because there would have been erosional problems and mound reconstruction between 1941 and 1989, one cannot expect precise correlation in lengths of mounds between the two surveys.

On mound #23, however, Freckmann described the mound as 308 ft. long. Wenzel measured it to be 199 ft. long. This is a difference of 109 ft. One expects a common mistake or blunder of miscounting 100 ft. tape lengths. A final field check in spring 1990 confirmed Wenzel's length.

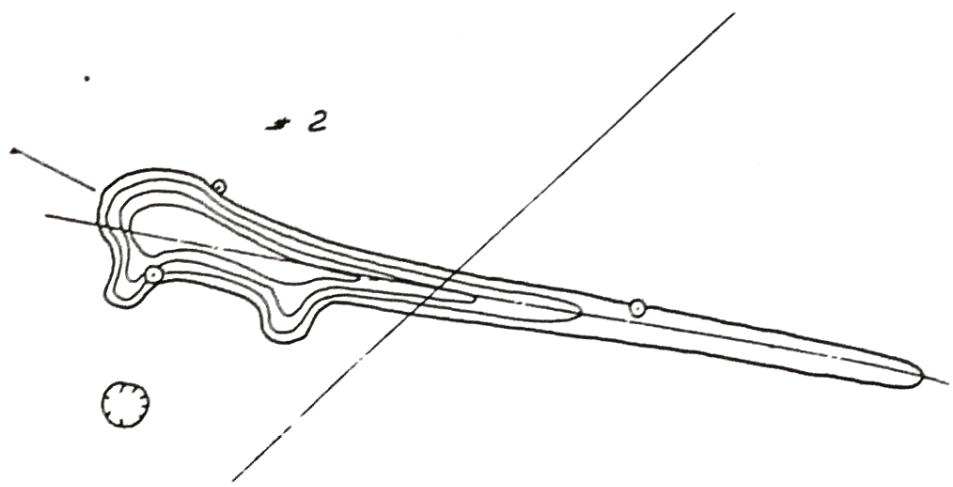


Figure A1 Graphical
Representation of Mound No. 2
(From 1989 Data)

INDIVIDUAL MOUND RECORDING

PANTHER EFFIGY MOUND NO. 2.

This panther earthwork has a body extending S. 72° E. whereas its tapering tail extends S. 80° E. The overall length, from the head to the tip of the tail, is 145 feet. The length of the body is 41 feet. The width of the fore part of this mound as measured from the extreme edge of the head to the outer edge of the foreleg is 28.3 feet. The width across the rear portion of the mound as measured from the hip to the edge of the rear leg is 23 feet. The fore leg is 13 feet wide, the rear leg 12 feet wide, and the body 18 feet wide at a point equidistant between the legs. The long tapering tail is 13 feet wide at a point 5 feet from the body and tapers to a width of about 2 feet near the tip. The entire length of the tail is 104 feet. The head of this effigy is nothing more than just a widening of the body and is much less prominent than are the two legs. This mound is 3.8 feet high at the shoulder and 3.1 feet high at the hip. The tail is 1.8 feet high near the body and diminishes to approximately a few inches in height at the other extremity. This mound is in a good state of preservation and has numerous maple trees growing on it.

The tails of all the effigy mounds in this group range from 1 to 1.5 feet in height at a point equidistant between the body and the tip of the tail. It may be noted here that all of the effigy mounds of this group possess straight tapering tails and are, wherever definable, well rounded at their extreme tips instead of being pointed as Professor Torney's sketch map shows, he also represents this mound as possessing a curved tail, whereas a straight one is evident.

Figure A2 Verbal Description of
Mound No. 2 (From Freckmann's
Survey of 1941)

Directions

If we assume that our directions of mounds are correct, then Freckmann's directions, on the average, deviate by $\pm 2.8^\circ$. If we assume that Freckmann's bearings are magnetic and not true bearings and if we further assume a magnetic deviation for this area as $2^\circ E$ in 1941, then the statistics are as follows:

In the NE and SW quadrants, add 2° to Freckmann's bearings.

In the SE and NW quadrants, subtract 2° .

See Table II.



TABLE II

Comparisons of Directions
with Declination Corrections
Applied to the 1941 data

$$\begin{array}{r} -2 \\ +2 \end{array}$$

Corrections

Mound	1989 Brg	Original 1941 Brg	Corr to true	Corrected 1941 Brg	Origin- al Diff	New Diff
1	N 25.0E	N 23.0E	+ 2	N 25.0E	- 2	0
2	S 76.4E	S 80E	- 2	S 78E	+ 3.6	+ 1.6
3	N 55.7E	N 59E	+ 2	N 56E	- 1.7	+ 0.3
6	S 19.5E	S 55E	- 2	S 53E	+ 5.5	+ 3.5
8	N 92.1E	N 93E	+ 2	N 95E	+ 0.9	+ 2.9
9	N 33W	N 36W	- 2	N 34W	+ 4.0	+ 1.0
10	N 33.5W	N 35W	- 2	N 33W	+ 1.5	- 0.5
11	S 57.5E	S 60E	- 2	S 58E	+ 2.5	+ 0.5
13	N 59W	N 55W	- 2	N 53W	+ 1	- 1.0
14	N 30.0E	N 23E	+ 2	N 25E	- 7	- 5.0
15	N 81W	N 83W	- 2	N 81W	+ 2	0
16	N 60W	N 60W	- 2	N 58W	0	- 2.0
21	N 97.5E	N 52E	+ 2	N 59E	+ 4.5	6.5
22						
R	N 46.5W	N 49W	- 2	N 47W	+ 2.5	+ 0.5
L	N 41.5E	N 41E	+ 2	N 43E	- 0.5	+ 1.5
R	N 38.5E	N 39E	+ 2	N 41E	+ 0.5	+ 2.5
23						
R	N 16.2E	N 2E	+ 2	N 19E	- 9.2	- 2.2
L	N 18E	N 12E	+ 2	N 19E	- 6	- 4.0
24	N 67.2E	N 62E	+ 2	N 69E	- 5.2	+ 3.2
27	N 61.5W	N 69W	+ 2	N 68E	+ 2.5	+ 0.5
30	N 49.5W	N 52W	- 2	N 50W	+ 2.5	+ 0.5
31	N 53.5E	N 51E	+ 2	N 53E	- 2.5	- 0.5

A.M.S

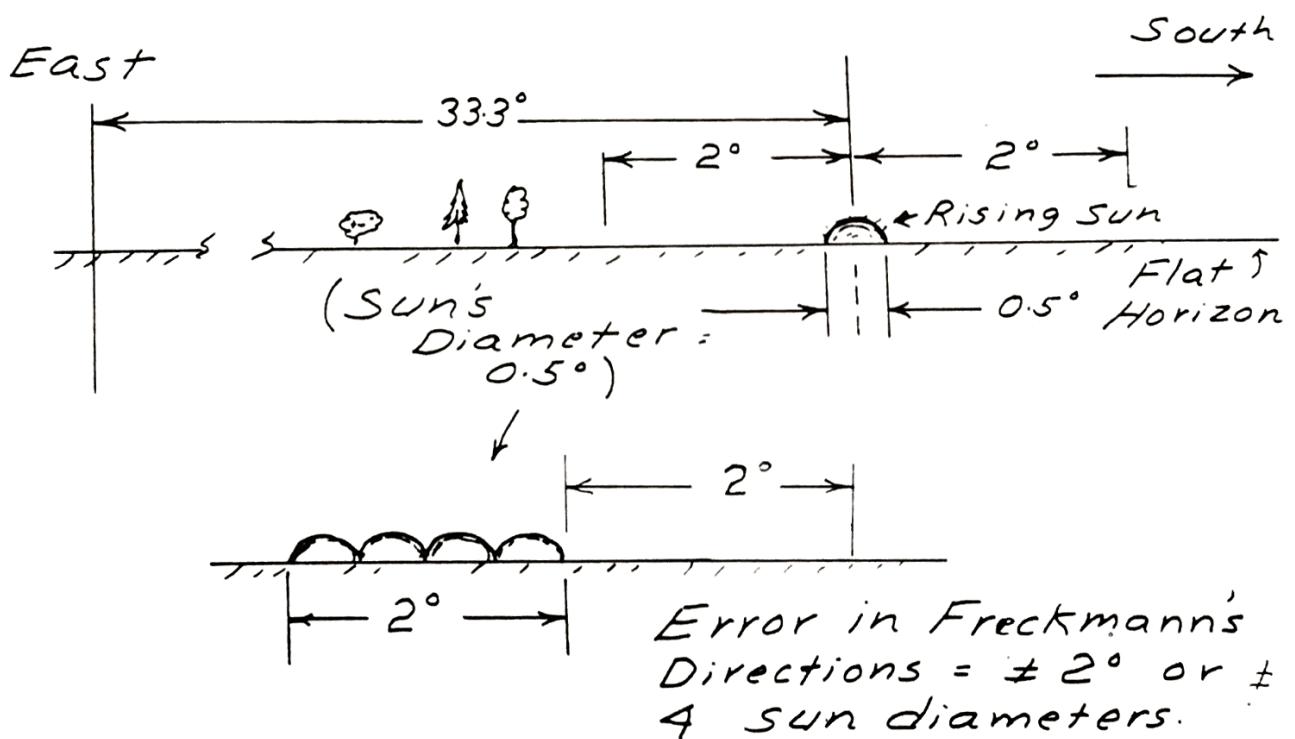
2.8° 2.0°

Thus from Table II, even with the correction for magnetic declination applied to Freckmann's directions, they vary from the directions obtained by sunshots by an average of about 2° . This is about what one would expect for a compass-controlled survey commonly made about 1941 by non-professional surveyors, particularly working with borrowed equipment. Although a skilled surveyor of mounds (T.H. Lewis) could obtain reliable directional accuracy to about $0.25''$ (he recorded his bearings to the nearest quarter degree), most surveyors of Indian mounds never approached such accuracy. Neither did Freckmann; in those days most people did not suspect that precise directions nor alignments were important. Furthermore, the surveying equipment and calculating procedures needed to adequately check for precise alignments were not generally available before about 1970. To reduce a series of sunshots by use of logarithms is a long and tedious process. The availability of computers and accurate digital watches changed all this after 1970.

Freckmann's work was done to draw attention to the mounds at the site and to inspire local citizens to take action to preserve them. To this purpose his laudable work was obviously successful. However, for purposes of trying to detect possible meaningful geometry and astronomical alignments, such as pointers to the rising solstice sun, the techniques used in his 7-day survey of the site in 1941 lacked the necessary accuracy by a factor of 10 (see Figure A-3).

Figure A3. Sketch showing
a 2° Error on Sunrise
Alignment

Accuracy needed to determine sunrise pointing = 0.2° ; accuracy of obtaining true north by use of a pole and sticks (methods that could have been used by Indians, and proven by Johns and Scherz) = 0.2° ; accuracy of Freckmann's survey: $\pm 2^\circ = (10 \times 0.2^\circ)$.*



* Although a 2° directional error using magnetic compass is well within the accuracy that one would expect by the average person using such techniques, very skilled and experienced surveyors using good quality equipment have achieved better accuracy. It appears that the surveys of T.H. Lewis were accurate to $\pm 0.25^\circ$ or better as Annex C will show. No other surveyor's notes have been found which can be relied on to this accuracy.