PLANT FOOD PRODUCTION AND THE EMERGENCE OF THE MOUNDVILLE CHIEFDOM

C. Margaret Scarry
Tallahassee, Florida
April, 1988

Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix, Arizona

The emergence of the Mississippian polities was marked by new social relations and new economic strategies. Indeed, the apparently concurrent development of hierarchical organization and field agriculture has led many researchers to suggest that there is a causal link between the two. Several frequently cited models propose that the risk of crop failure was a selective factor in the development of the Mississippian chiefdoms (Brown 1974; Chmurny 1973; Ford 1974). The basic arguments of these risk models are: 1) maize production was increased because locally high population densities made foraging/gardening strategies too expensive to maintain; 2) field cropping of maize produced higher yields, but was vulnerable to failure due to adverse climatic conditions; 3) high population densities meant that, when crops failed, reliance on wild resources and tribal networks for sharing resources were inadequate mechanisms for coping with food shortages; and 4) these factors selected for the establishment of the chiefly office, whose occupant served as a buffer against food shortages by collecting provisions as tribute in times of plenty and redistributing foodstuffs when crops failed.

We assign maize agriculture a prominent role in our models of the development of Mississippian societies. But until recently we lacked the detailed data necessary for evaluating the propositions used to construct these models. In this paper, I describe changes in plant procurement and production that occurred during the emergence of the Moundville chiefdom, and I discuss the reliability of maize production within the boundaries of the polity. I argue that crop production was intensified in the period immediately preceding the establishment of the Moundville polity, but that agricultural risk cannot be invoked as the causal link between the new social formation and the new economic strategy[1].

The Moundville polity was located in the Black Warrior Valley of Alabama (Figure 1). At its height, about AD 1400, the Moundville chiefdom included a paramount center, at least six subsidiary centers, and numerous farmsteads and hamlets (Figure 2; Bozeman 1982; Peebles 1982; Steponaitis 1983; Welch 1987). Here, however, I'm concerned with earlier and less spectacular stages of Moundville's development. I focus on the West Jefferson and Moundville I phases, which span the transition from egalitarian to ranked communities in the valley.

During the West Jefferson phase, AD 900 to 1050, the valley's population was distributed in small villages (Figure 2). These appear to have been egalitarian, tribal communities. There were no mounds and we have no other evidence of ranking.

By the beginning of the Moundville I phase, AD 1050, mounds had been built at 4 sites and the population had dispersed to farmsteads and hamlets (Figure 2). These changes, along with other evidence, indicate the emergence of hierarchical social and political relations. The communities in the valley were apparently organized into several simple chiefdoms, with each mound center serving as the ritual and political focus for populations scattered in nearby hamlets. By the end of the Moundville I phase, AD 1250, further social and political changes had

---

[1] Detailed discussions of the analyses summarized here and the data on which they are based can be found in Scarry 1986.

occurred. The communities in the valley had been integrated into a single, complex chiefdom controlled from a paramount center at Moundville.

I used plant remains recovered by flotation to examine the procurement and production of plant foods during the West Jefferson and Moundville I phases. The West Jefferson plant assemblage includes remains from 17 refuse pits from 7 sites (Figure 3). Based on associated ceramics I divided the plant samples into groups representing early and late West Jefferson contexts. The Moundville I plant assemblage includes remains from 32 refuse pits from Moundville (Figure 4). A few Moundville I samples were recovered from an area on the northwest edge of the site (Figure 4, Area SCB). Most Moundville I samples, however, were recovered north of Mound R (Figure 4, Area NR), from a deeply stratified, elite residential deposit that I excavated (Figure 5). The Moundville I samples were assigned temporal positions using ceramic and stratigraphic criteria.

Throughout the West Jefferson and Moundville I phases the same plant resources were exploited. Hickory nuts, acorns, and maize were the dominant resources. Their remains occur in virtually every sample from both phases. The native starchy seed cultigens (chenopod, maygrass, and little barley) and wild fruits (persimmon, blackberry, blueberry, and elderberry) also were used. Their remains, however, are neither as abundant nor as ubiquitous as nut and maize remains.

While the resources exploited remained the same, there were significant differences over time in the proportionate utilization of some resources. The intensity of nut procurement and maize production changed dramatically. In contrast, fruit procurement and starchy seed production varied little over time.

To illustrate the changes in the use of the dominant resources, I use boxplots (Figure 6). Boxplots are a graphic technique developed for Exploratory Data Analysis (Tukey 1977; Velleman and Hoaglin 1981). A boxplot is a visual summary of a sample's distribution around the median. The variable's minimum and maximum values determine the scale of the diagram. The median is marked by a "+". The box defines the midspread around the median: half of the values lie within the box. The "whiskers" extend to the farthest values that are not an outliers. Outliers are marked by "*"'s, and extreme outliers are marked by "O"'s. When boxplots are compared, parentheses around the medians define a simultaneous confidence interval. If the parentheses do not overlap, there is a 95% probability that the sample medians are different.

I constructed boxplots comparing the abundance of hickory, acorn, and maize remains in pits from different chronological contexts. The values plotted are standardized counts reexpressed as natural logs. Early and late West Jefferson samples are plotted separately because detailed analyses indicated that there were significant changes in resource use within the phase. In contrast, Moundville I samples are plotted together because analyses indicated an extremely stable pattern of resource use within the phase. I do not have time to discuss the intricacies of my analyses. I want to emphasize, however, that I have considered and rejected the possibility that site formation processes, depositional contexts or other such variables are responsible for the observed differences in resource abundance.

The boxplots (Figure 7) comparing the distribution of nut remains, indicate a significant decrease in nut procurement through time. The plots for nutshells as a group (top) suggest that within the West Jefferson phase, nut use was stable. Between late West Jefferson and Moundville I, however, there was a dramatic decline in nut use. The individual plots for hickory (middle) and acorn (bottom) show similar patterns, though the decrease in hickory is more extreme than that of acorn.

The boxplots (Figure 8) comparing the distributions of maize cupules (top) and kernels (bottom) indicate that maize production increased through time. There is a significant increase in the abundance of maize from early to late West Jefferson. In contrast, quantities of maize remains are not significantly different between late West Jefferson and Moundville I contexts.

My analyses suggest that the shift toward an economic strategy based on field production of maize began in the West Jefferson phase and was complete by early in the Moundville I phase. Entire communities or larger social units do not decide from one season to the next to become farmers rather than forager/gardeners. Economic changes of this sort are the composite effect of decisions about how to allocate labor made by individual households. The increase in maize production within the West Jefferson phase and the decrease in nut procurement between the West Jefferson and Moundville I phases suggest a subsistence economy in transition. In contrast, though I don't have time to demonstrate it, the Moundville I assemblage displays little internal variability. It appears that a new balance of procurement and production strategies was achieved early in Moundville I. By the time we have evidence for hierarchical social and political organization, an agriculturally based economy seems to have been in place.

The argument that agricultural risk was a selective factor in the emergence of Mississippian chiefdoms assumes that field production of maize preceded the development of ranking and that wide-spread crop failure was a recurrent threat. I have presented evidence that maize production was indeed intensified prior to the emergence of the Moundville chiefdom. The next step in assessing whether agricultural risk played a role in the development of the Moundville polity is to estimate the frequency with which major crop losses occurred. I investigated the risk of severe production shortages by comparing the varying requirements of maize crops as they mature to the specific environmental conditions found in the Black Warrior Valley (Figure 9). My ecological data are drawn from detailed temperature, rainfall, flood, and soil records that span the past 100 years (Edwards et al. 1939; Johnson 19981; Long 1951; Peirce 1962; Rowe et al. 1912; Winston et al. 1914).

In the early stages of development, maize is vulnerable to late frosts, severe droughts, and floods[2]. For the Black Warrior Valley, the risk of major crop losses due to late frosts is extremely low. Saturated soils and the threat of floods delay planting until mid-April. By the time the seedlings emerge from the soil, the threat of frost is long past. Spring drought is likewise not a problem. Even in the driest years on record there was sufficient soil moisture to support germination and seedling growth.

---

[2] The information on the effects of climate and soil conditions on maize production is derived largely from Shaw (1977, 1983).

In contrast, late floods are a common problem for some areas of the bottomlands. The Black Warrior floods regularly, often more than once in a single year. Most floods occur before the end of March, but floods occur after mid-April about once in four years. Such late floods can destroy or seriously injure crops already in the ground.

While late floods are a problem, the threat of floods at or after planting is not equal for all bottomland soils. Most late floods are small and affect only land below the two-year recurrence interval (some but by no means all of the area shown as bottomland in Figure 9). For low-lying, poorly drained fields, late floods and saturated soils would be a problem every other year. For fields at elevations between the two-year and ten-year recurrence interval (again soils within the area shown as bottomland) late floods might delay planting, but in only 1 year out of 33 would crops planted in mid-April be jeopardized. For fields located above the ten-year recurrence interval (some bottomland, the terrace soils and the uplands), only 1 year in 66 would floods be a risk after mid-April.

Spring floods posed problems in the early part of the growing season. The risk of severe crop losses due to floods, however, could be largely eliminated by sensible cropping strategies. By delaying planting until mid-April, planting fields at several different elevations, and starting planting in the highest fields severe crop losses due to late floods could be virtually eliminated for areas lying above the two-year recurrence zone.

When maize reaches the later stages of development the greatest threats to yields are early fall frosts and drought. If maize is planted in April or May in the Black Warrior Valley, fall frosts are not a risk. Fall temperatures below 32° F never occur before mid-October. Even if maize was planted at the end of May the crop would have had at least 140 frost-free days in which to mature.

Prolonged droughts are rare in the Black Warrior Valley. In the last 130 years, there have been only three years in which both preseason rainfall and growing season rainfall were 50% below the mean for the area. In other words, severe droughts occur once every 40 to 50 years.

The drought of 1986 was one of the worst on record. It provides a fortuitous opportunity to assess the effect of extreme drought on maize yields in the Black Warrior Valley. My information about crop yields is informal, but nevertheless telling. Despite the drought, the "bottomland" soils produced "record" maize yields (W. Foster USDA Agricultural Service Center, Tuscaloosa, personal communication 1986; K. McCray USDA Soil Service Field Office, Tuscaloosa, personal communication 1986). It appears that the water-table is sufficiently high in the bottomlands that the maize crop is not dependent solely on rainfall for its moisture supply. In contrast to the bottomlands, severe crop losses (described as 50% below normal or a total loss) occurred in maize fields planted at higher elevations. Prehistoric farmers in the Black Warrior Valley might not have had "record" yields under drought conditions, but severe crop losses to drought were not a problem for the bottomlands.

My investigation of maize requirements and climatic conditions indicates that in the Black Warrior Valley floods and droughts posed the greatest threats to crop production. The risk of major crop losses due to either excessive or inadequate moisture, however, varies for the available agricultural soils. The best agricultural soils are rarely flooded after planting would have commenced and have adequate moisture reserves to produce crops under severe drought conditions. Major crop losses on a valley-wide scale would have been extremely rare events in the Black Warrior Valley.

My evidence about Mississippian crop production strategies is circumstantial. Nevertheless, I would argue that the people had at their disposal the elements for a cropping strategy in which differential yields could be buffered at the kin group rather than the polity level.

Dependence on crops to meet subsistence needs always involves some risk. Plants in individual fields may be destroyed by hail, insects, deer, or other localized hazards. Threats to food supplies from such events can be reduced by planting fields spaced at some distance from one another and by staggering planting so that not all crops are vulnerable at once. Moreover, such misfortunes can be compensated at the level of the household or production unit. The effected individuals can forage for alternative resources, or draw on kinship and other social obligations to see them through the hard times.

Our concern here is not with such individual losses. Rather, for agricultural risk to have played a role in the emergence of the Moundville chiefdom, crop failures that created food shortages for sizeable portions of the population would have to have been a recurrent threat. This does not appear to have been the case.

Of course, maize production posed some problems. Clearly, planting dates would have had to be adjusted to accommodate the frequent spring floods. Additionally, too great a dependence on the produce from fields at higher elevations would lead to occasional shortages due to droughts. The risk of significant crop losses could largely be eliminated, however, by cropping strategies practiced at the level of the production unit (i.e., household or extended kin group). At virtually any point in the bottomlands a 1 km radius agricultural catchment encompasses areas of soil with different drainage rates and flood frequencies. The risk of crop losses could be mitigated by planting fields on more than one soil, staggering planting, and planting more than one cultivar. In other words, risk could be compensated by practicing a divided risk strategy at the level of the production unit rather than the polity. Under such a strategy, disasters large enough to require valley-wide solutions would occur at most once or twice a century. While not denying that agricultural risk may have played a role in the development of some Mississippian chiefdoms, I would argue that it is unlikely that the risk of crop failure was a selective pressure in the emergence of the Moundville polity.

If agricultural risk was not the link between intensified crop production and the emergence of ranking, then what was the connection? This may be a "chicken or egg" question, or one for which there is no single, simple answer. Nevertheless, I want to offer some speculations on the subject. Before doing so, however, I want to emphasize that my suggestions are intended to be thought provoking. I make no claim that I have solved the puzzle that has intrigued so many of us who are interested in Mississippian societies.

Throughout the Southeast, the period from AD 800 to 1200 seems to have been a period of changing social relations. It is possible that intersocietal competition or hostility compelled communities to restrict the territories in which they hunted, foraged, and gardened. In such circumstances, local population/resource imbalances could produce subsistence stress, and lead to changes in procurement and production strategies. Uneasy intersocietal relations may have placed a premium on strategies that could extract more food per unit of land (i.e., crop production). Implementation of new production strategies may in turn have provided the basis for further changes in intra- or intersocietal relations.

Recently, Steponaitis (1986) proposed that the adoption of maize agriculture provided opportunities for amassing food surpluses that could be manipulated for social and political purposes. He noted that it is difficult to generate surpluses of wild resources and suggested that reliance on foraging/gardening may have placed a limit on the use of competitive feasting, gift giving, and so on for political purposes. Economies based on crop production may have permitted social deployment of food on a grander scale than was previously possible.

Steponaitis's proposition is based on a scheme in which subsistence stress serves as a catalyst. Stress selected for the adoption of agriculture which in turn created new opportunities for disbursing foods to manipulate personal or community obligations.

The use of subsistence stress as a catalyst is in line with much current thought. It seems unlikely, however, that the population reached critical mass, causing subsistence stress and a shift to field agriculture throughout the Southeast. I suggest that at least in some areas escalating demands for foodstuffs may have led to increased crop production in the absence of subsistence stress.

It is possible that changing social relations in and of themselves increased demands for provisions. Communities, or perhaps households of powerful individuals, may have intensified crop production to generate surpluses that could be deployed for their self-aggrandizement.

These ideas are clearly speculative, and finding ways to evaluate such propositions will be difficult. Nevertheless, I think they offer some exciting possibilities for further research and provide an alternative to our recent preoccupation with the search for a functional link between increased crop production and the emergence of chiefdoms in the Southeast.

REFERENCES CITED

Bozeman, Tandy K.
1982 Moundville Phase Communities in the Black Warrior River Valley, Alabama. Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara.

Brown, James A.
1974 Regionalism, Inter-regional Exchange, and Centrality in Mississippian Systems. Paper presented at an Advanced Seminar on Mississippian Development, School of American Research, Santa Fe.

Chmurny, William W.
1973 The Ecology of the Middle Mississippian Occupation of the American Bottom. Ph.D. dissertation, University of Illinois. University Microfilms, Ann Arbor.

Edwards, M. J., B. H. Williams, A. L. Gray, C. H. Wonser, M. E. Stephens, and M. E. Swann
1939 Soil Survey of Hale County, Alabama. United States Department of Agriculture Bureau of Chemistry and Soils, Washington.

Ford, Richard I.
1974 Northeastern Archeology: Past and Future Directions. Annual Review of Anthropology 3:385-413.

Johnson, Kenneth W.
1981 Soil Survey of Tuscaloosa County, Alabama. United States Department of Agriculture Soil Conservation Service, Washington.

Long, Arthur R.
1951 Tuscaloosa, Alabama Climatological Summary. United States Department of Commerce Weather Bureau, Washington.

Peebles, Christopher S.
1982 Research at Moundville, Alabama: The European Connection. Paper presented at the 47th Annual Meeting of the Society for American Archaeology, Minneapolis.

Peirce, L. B.
1962 Surface Water in Tuscaloosa County, Alabama. County Report 9. Geological Survey of Alabama, Tuscaloosa.

Rowe, R. W., W. G. Smith, and C. S. Waldrop
1912 Soil Survey of Hale County, Alabama. In Field Operations of the Bureau of Soils, 1909, pp. 677-703. United States Department of Agriculture Eleventh Report. United States Department of Agriculture, Washington.

Scarry, C. Margaret
1986 *Change in Plant Procurement and Production During the Emergence of the Moundville Chiefdom*. Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Shaw, Robert H.
1977 Climatic Requirement. In *Corn and Corn Improvement*, edited by G. F. Sprague, pp. 591-623. Academic Press, New York.

1983 Estimates of Yield Reduction in Corn Caused by Water and Temperature Stress. In *Crop Reactions to Water and Temperature Stresses in Humid, Temperate Climates*, edited by C. D. Raper, Jr., and P. J. Kramer, pp. 49-65. Westview Press, Boulder.

Steponaitis, Vincas P.
1983 *Ceramics, Chronology, and Community Patterns: An Archaeological Study at Moundville*. Academic Press, New York.

1986 Prehistoric Archaeology in the Southeastern United States, 1970-1985. *Annual Review of Anthropology* 15:363-404.

Tukey, John, W.
1977 *Exploratory Data Analysis*. Addison-Wesley Publishing, Reading, Massachusetts.

Velleman, Paul F. and David C. Hoaglin
1981 *Applications, Basics, and Computing of Exploratory Data Analysis*. Duxbury Press, Boston.

Welch, Paul D.
1987 Mississippian Emergence in West Central Alabama. In *Mississippian Emergence: The Evolution of Agricultural Chiefdoms in the Southeastern United States*, edited by B. D. Smith. Smithsonian Institution, Washington. (In Press)

Winston, R. A., W. J. Latimer, L. Cantrell, W. E. Wilkinson, and A. C. McGehee
1914 Soil Survey of Tuscaloosa County, Alabama. In *Field Operations of the Bureau of Soils, 1911*, pp. 5-74. United States Department of Agriculture Thirteenth Report. United States Department of Agriculture, Washington.

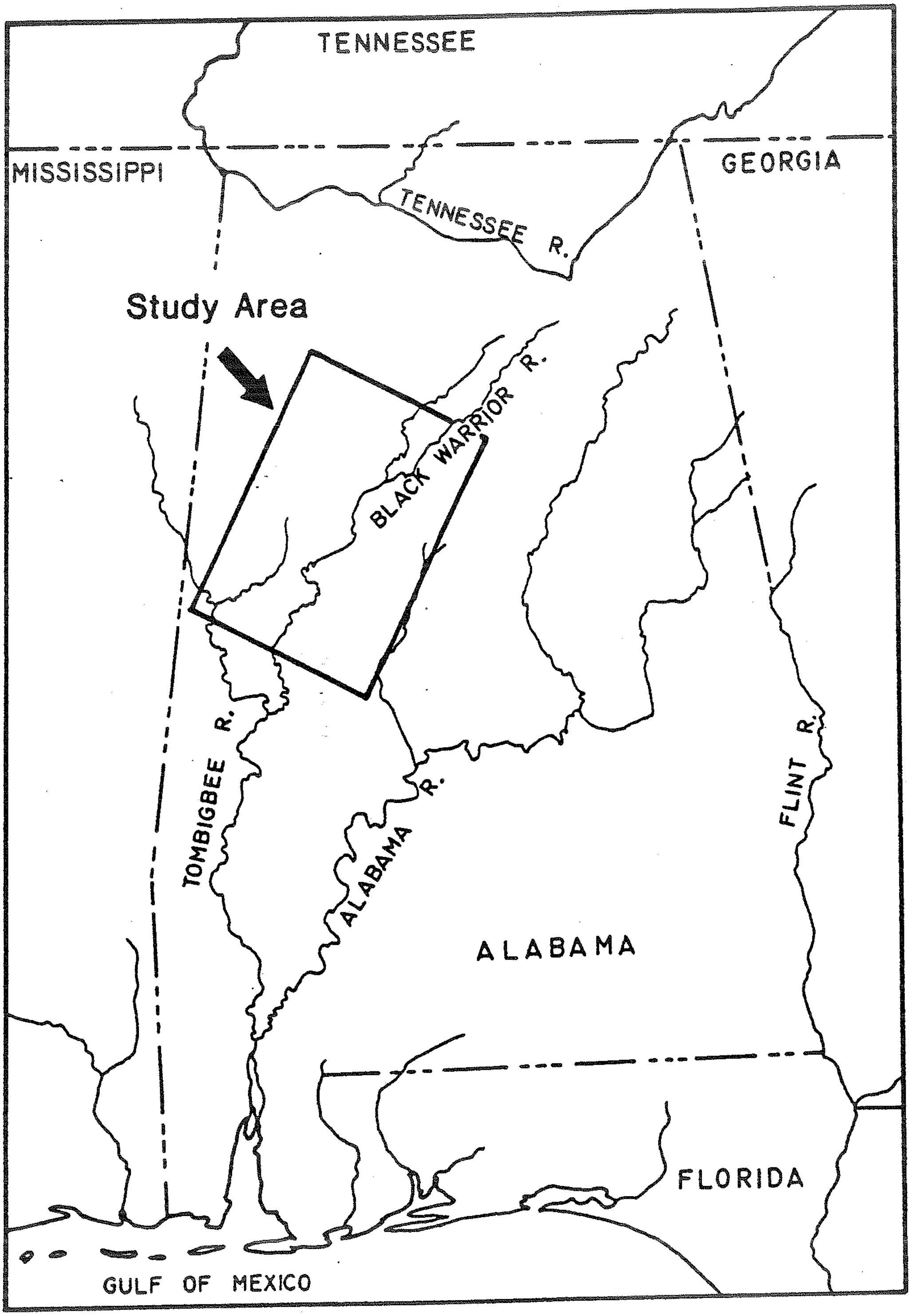


FIGURE 1. Location of the study area.

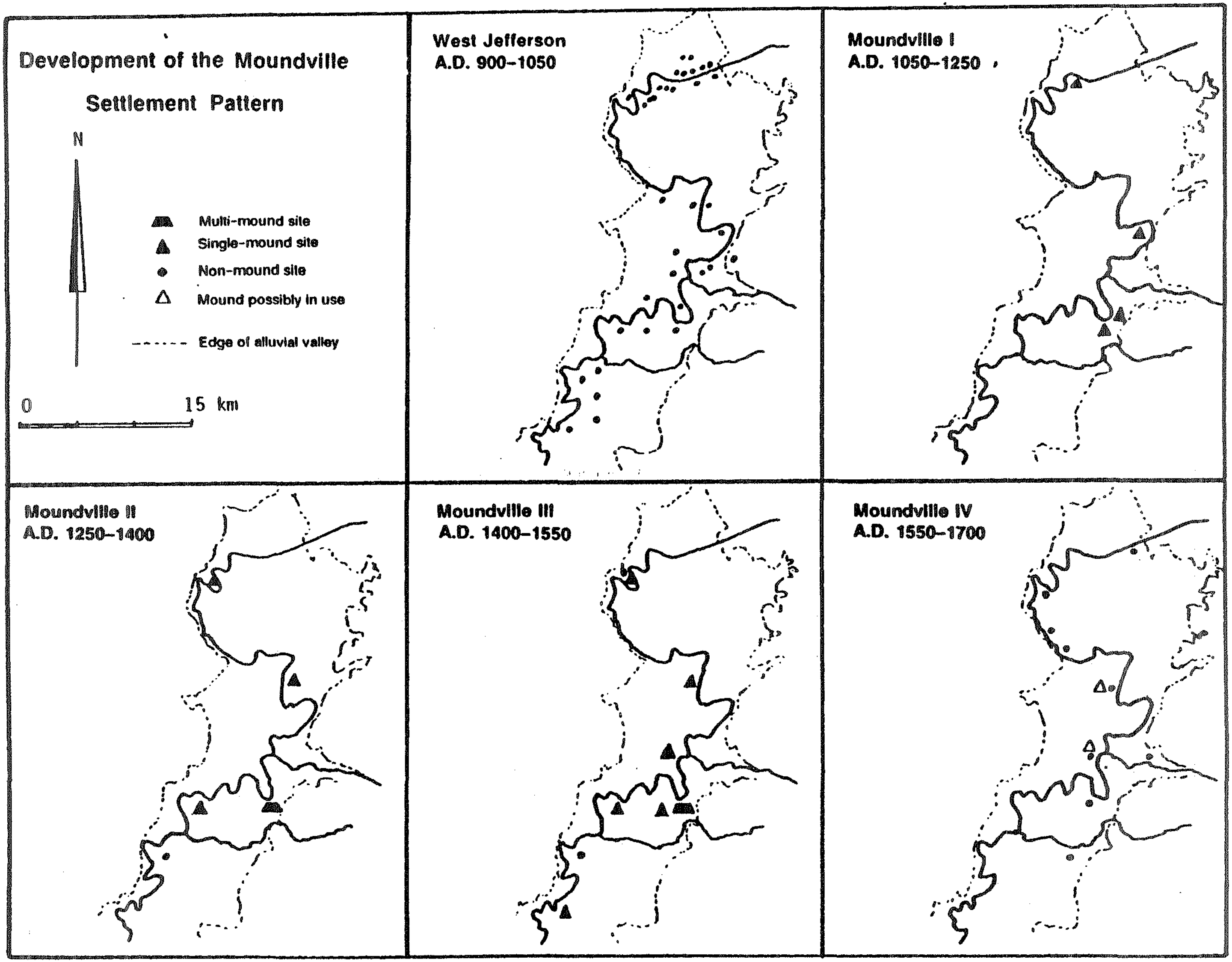


FIGURE 2. Development of the Moundville Settlement Pattern

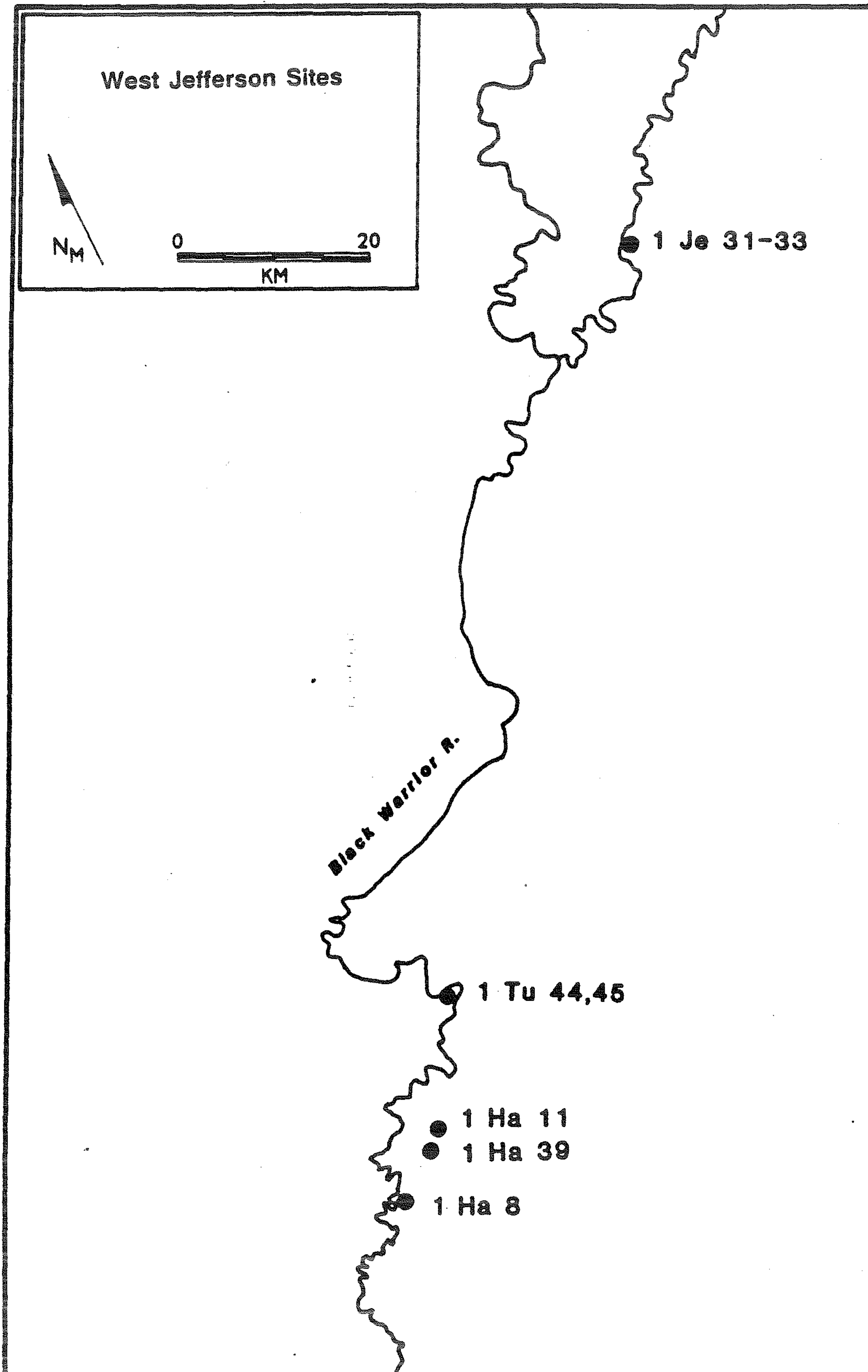


Figure 3. West Jefferson Phase sites included in the study.

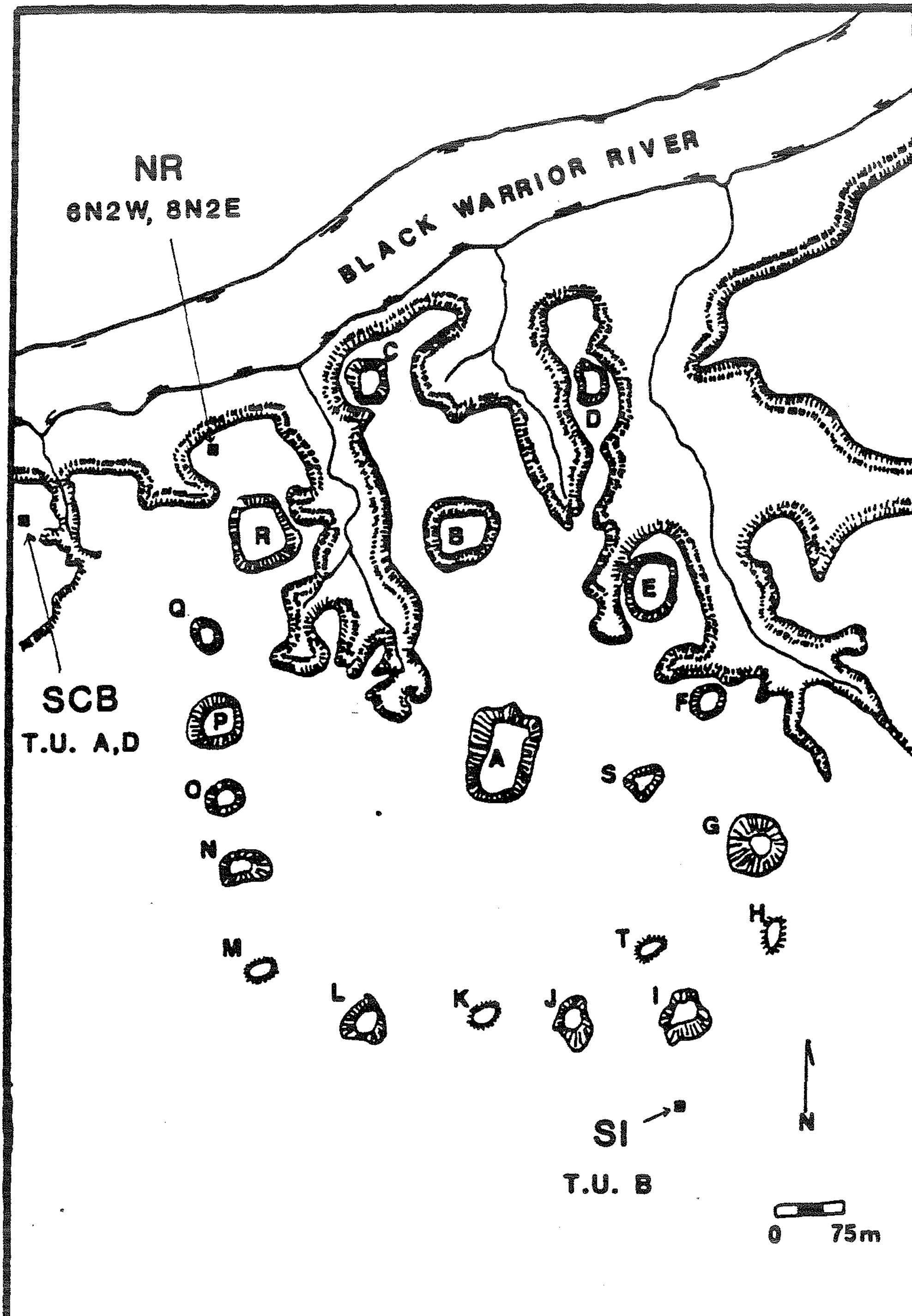


FIGURE 4. Location of excavations at Moundville.

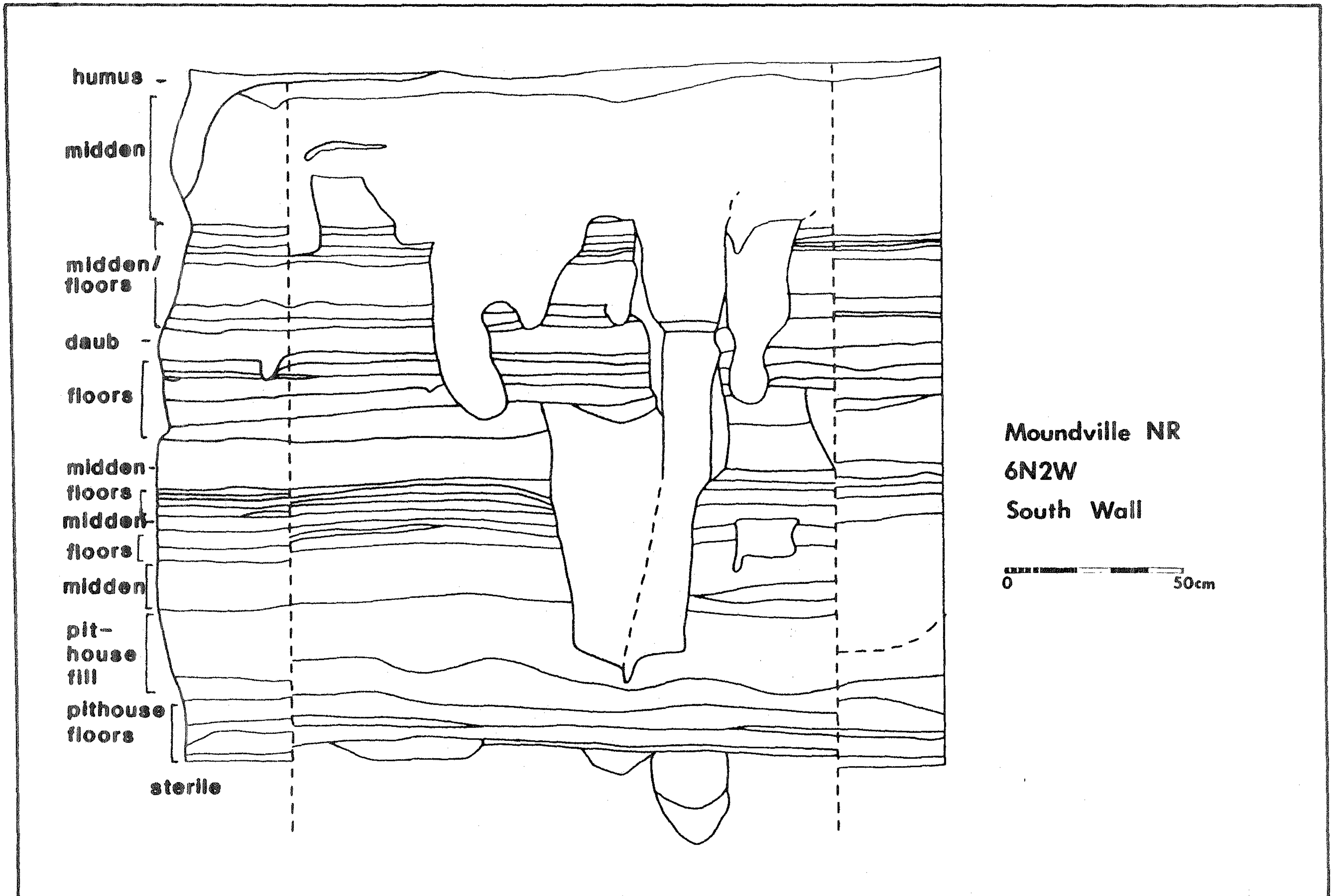
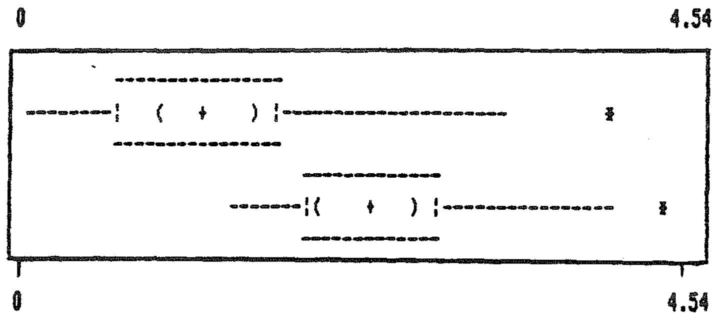


FIGURE 5. Stratigraphic profile of elite, residential deposit north of Mound R.

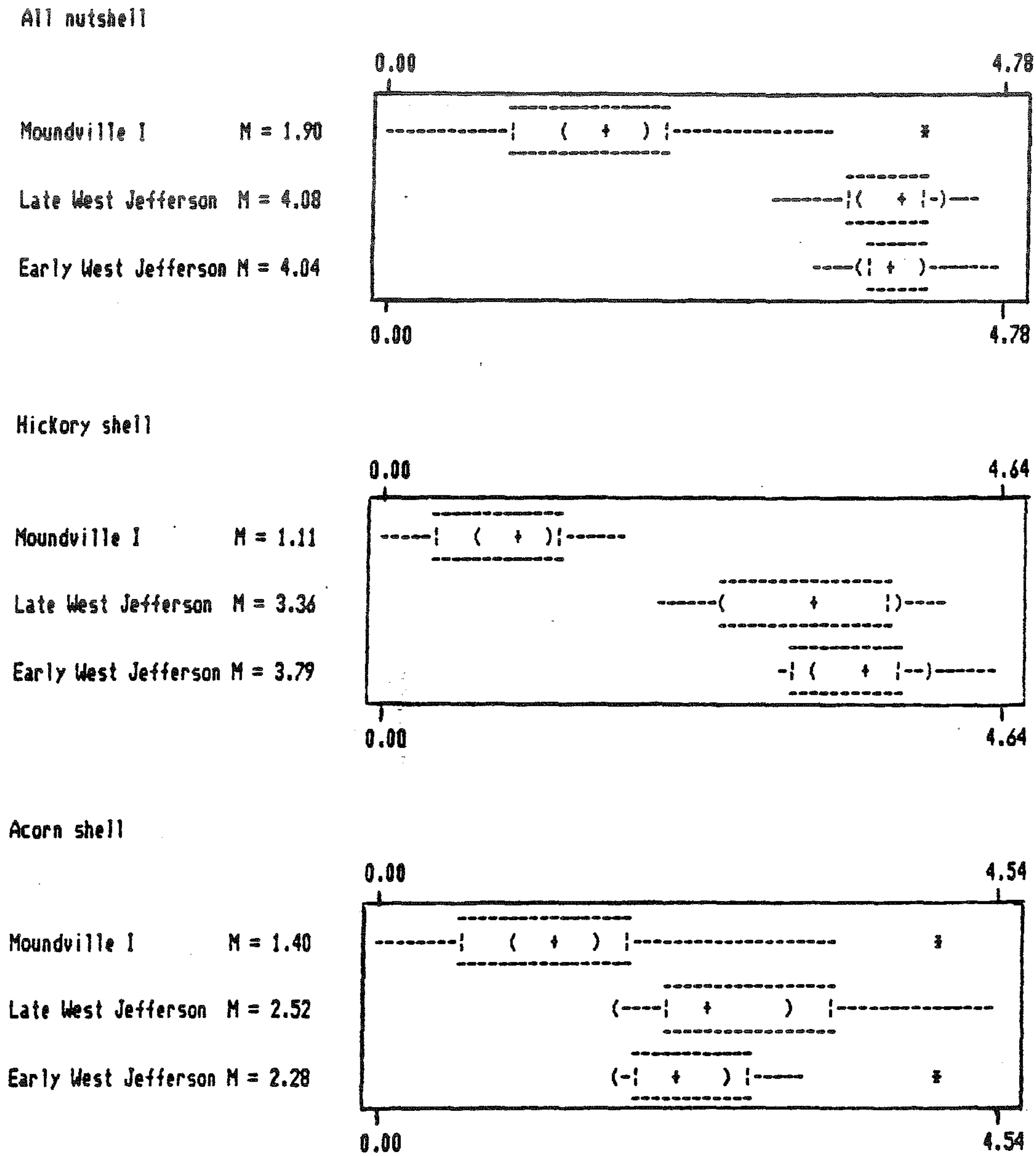


Key:

- `+` median (M)
- `¦` hinges
- `--` whisker (values < 1.5*H-spread beyond hinges)
- `*` outliers (values > 1.5*H-spread beyond hinges)
- `0` extreme outliers (values > 3*H-spread beyond hinges)
- `()` 95% confidence interval about the median

Example of a boxplot.

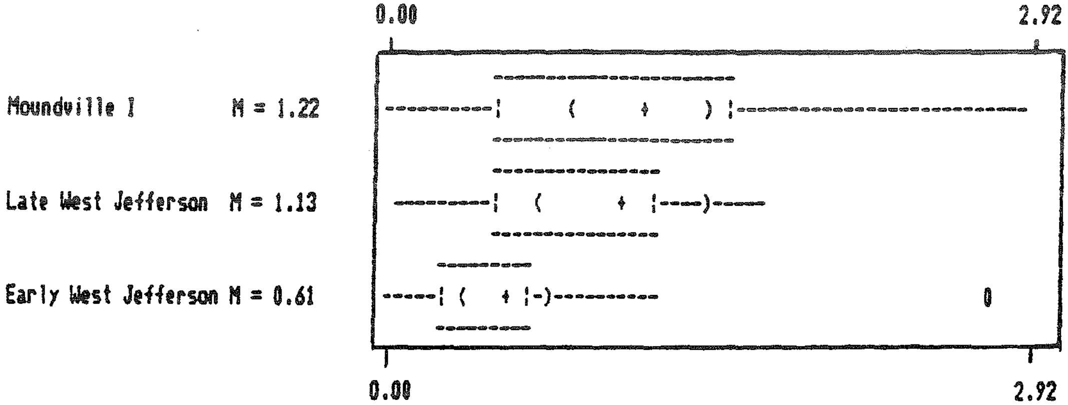
FIGURE 6.



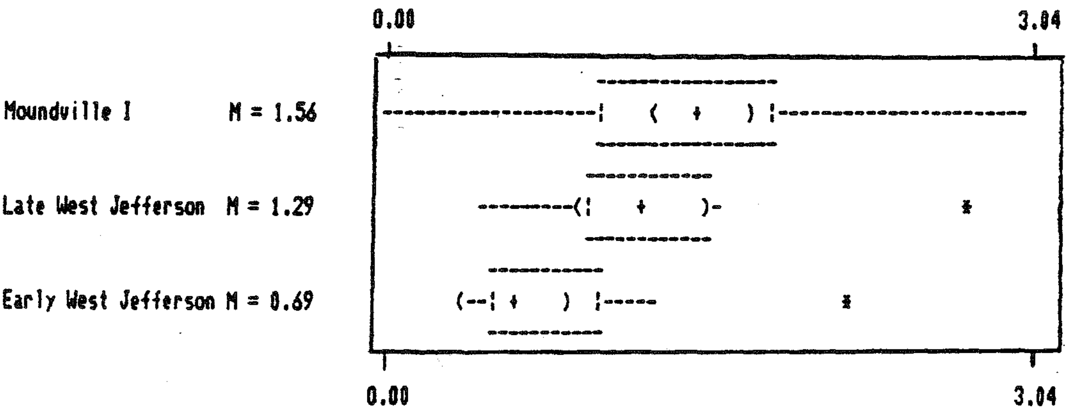
Distribution of nutshell, hickory shell, and acorn shell by chronological position, West Jefferson and Moundville I batches.

FIGURE 7.

Maize cupule



Maize Kernel



Distribution of maize cupules and kernels by chronological position, West Jefferson and Moundville I batches.

FIGURE 8.

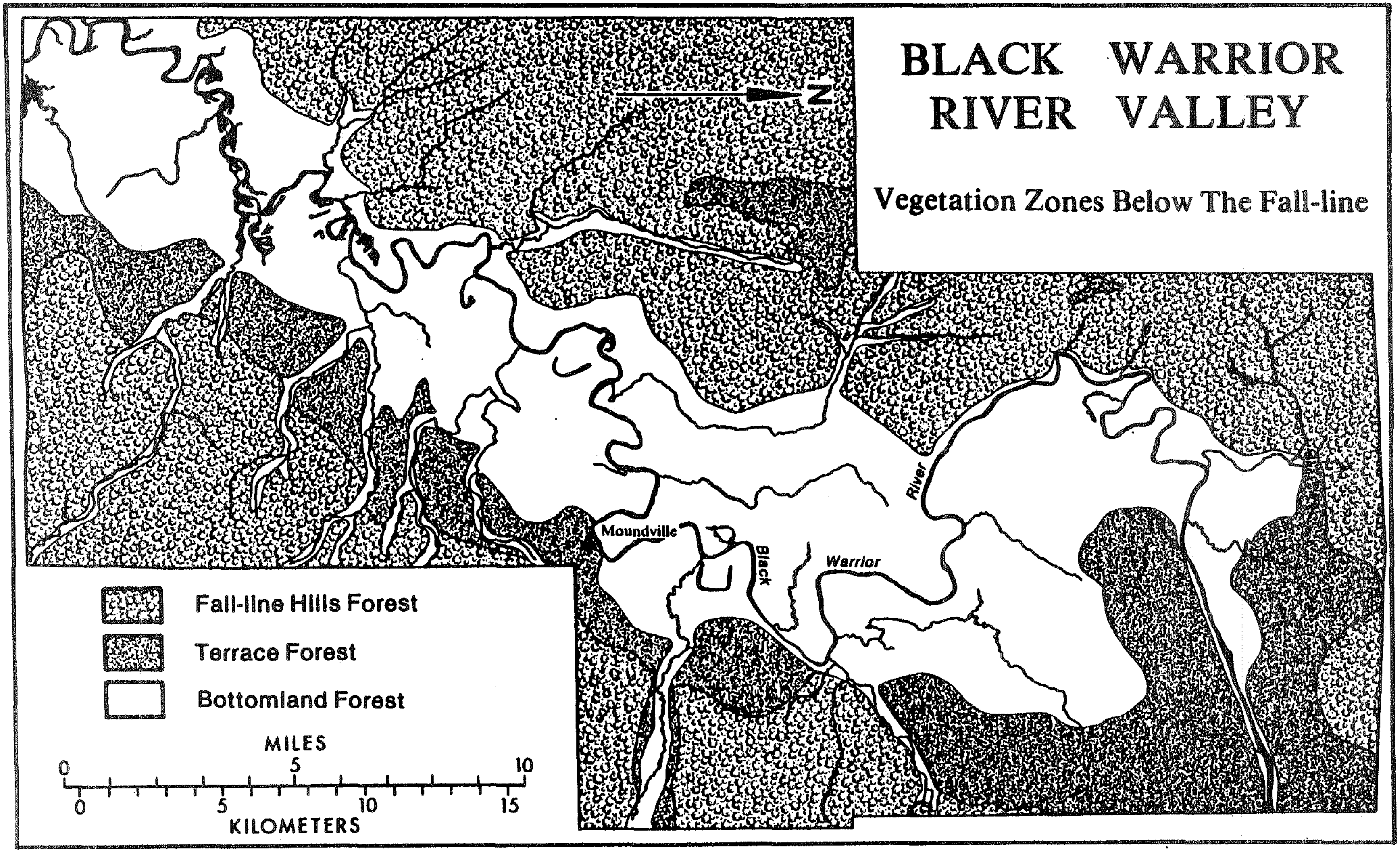

BLACK WARRIOR
RIVER VALLEY
Vegetation Zones Below The Fall-line
N
Moundville
Black
Warrior
River
Fall-line Hills Forest
Terrace Forest
Bottomland Forest
MILES
0
5
10
0
5
10
15
KILOMETERS

FIGURE 9.