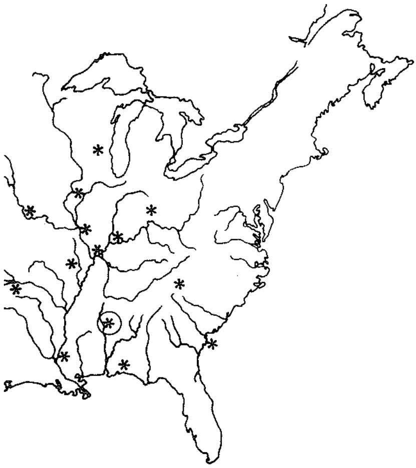


14

Location Theory and Complex Chiefdoms: A Mississippian Example

VINCAS P. STEPONAITIS

The man–land approach has been highly productive especially when dealing with cultural systems of relatively low complexity. I would suggest however that when dealing with systems of greater complexity, man-man relationships take on increasing importance in the determination of the spatial distribution of activity loci and thus of settlements. In emphasizing basically economic man-man relationships, Central Place Theory furnishes a potentially useful analytical model for dealing with these systems [Johnson 1972:769]

Central place principles provide a complete statement of urban location only when urban centers are supported exclusively as market centers by the retail and service functions they provide [Berry 1967:35].

In recent years, archeologists have devoted a great deal of attention to central place theory in the analysis of prehistoric settlement systems. Generally using the formulations of Christaller (1933, 1966), studies have examined the structure of central place hierarchies in the ancient Near East (Johnson 1972, 1975), Roman Britain (Hodder 1972), and prehispanic Mesoamerica (Flannery 1972, Hammond 1974, Marcus 1973, 1976). Such

ISBN 0-12-650640-X

applications have met with varying degrees of success, but overall have shown the utility of the approach, at least in certain situations.

Central place theory consists of a set of related models that were originally developed to explain certain regularities in the sizes and distribution of urban centers. Christaller defined a central place as a locus where centralized goods and services are available to a populace living in a surrounding hinterland, or "complementary region." Christaller's model assumes that central places form a hierarchy in which each lower-order center supplies only a certain subset of the services provided by each higher-order center. Higher-order centers not only supply a wider range of services than lower-order centers, but also have larger complementary regions, each of which encompasses a number of smaller, lower-order regions. It was predicted that under certain conditions, central places would form a regularly spaced, hierarchically nested lattice, with each place centrally located in a complementary region of hexagonal shape. (For a more complete summary, see Berry 1967, Berry and Pred 1961, or Haggett 1965).

It is not difficult to see why archeologists have found Christaller's formulation so attractive. His model is elegant, and it links certain aspects of economic behavior with a type of archeological data that is often easily recoverable—the distribution of sites over the landscape. Yet the model's many attractions should not be allowed to obscure its general limitations. As Berry's quote at the beginning of this chapter indicates, most workers have come to the conclusion that Christaller's model and its various derivative forms are relevant only to the analysis of *market* locations (see also Smith 1974:171).

The purpose of this chapter is to develop a locational model that is applicable to settlement hierarchies in complex prestate societies or complex chiefdoms. Although it has been suggested that Christaller's model, perhaps with minor modifications, can be used in the context of chiefly settlement systems (e.g., Lafferty 1976), I find this view to be questionable. Christaller's central place theory is based on a set of restrictive assumptions which do not hold true in premarket contexts. Since true market economies are absent in complex chiefdoms, these societies are clearly beyond the theory's reach. Thus, a different model is called for, one founded on premises more appropriate to the level of sociopolitical integration being considered.

I will begin by examining the organization of complex chiefdoms and the relations that structure settlement hierarchies within them. Next I will formulate a locational model for chiefly centers, at the same time showing in more detail why Christaller's central place theory is inappropriate. Finally, I will use the model to analyze the spatial distribution of centers in an archeologically known complex chiefdom—the Moundville phase of west-central Alabama.

Complex Chiefdoms: Organization, Tribute, Political Centers

The use of a typological approach in categorizing societies poses the problem of having to define discrete units in what is essentially an evolutionary continuum. The general evolutionary concept of chiefdom, as formulated by Service (1962) and Fried (1967), has been widely used and sometimes misunderstood. Thus, it is necessary to clarify the concept as it is used here. I focus particularly on complex chiefdoms, a category that includes only a subset of the societies traditionally classified under Service's rubric of *chiefdom*.

Chiefdoms are distinguished from politically less complex societies by the fact that they exhibit institutionalized and permanent offices of leadership. These offices are associated with well-defined jurisdictions, and exist independently of the individuals who occupy them at any given time. Each office is endowed with a relatively fixed set of duties and prerogatives, not entirely dependent on the incumbent's degree of competence (Service 1975:72). That is, a chief's mandate to lead derives primarily from the authority vested in the office he holds. This authority is maintained and sanctified by means of a pervasive religious ideology and by conspicuous sumptuary ritual. In politically more developed chiefdoms, sacred authority is supplemented by considerable power of sheer physical coercion, secular punishment, in order to ensure compliance (Sahlins 1958:11, *passim*). Chiefs do not, however, control the institutionalized monopoly of force which has been said to characterize the political apparatus of states. In a society where the ability to use force legitimately is held by various constituent subunits in severalty, the chief does not have exclusive access to force, only the most extensive access (Earle 1973:27).

Individuals who fill chiefly offices are most often recruited, at least in part, with reference to their position in a social hierarchy, wherein differential statuses are ascribed at birth. The ranking of individuals relative to one another is often cognized in terms of genealogical distance to a mythical common ancestor. The closest living descendent of that ancestor is assigned the highest rank, the ranks of other members of society being reckoned in proportion to the proximity of their relationship to this highest-ranking person. The resulting social form has been termed by Kirchhoff (1955) a *conical clan*, and by Firth (1936) a *ramage*.

Chiefdoms are further characterized by what has been termed *redistribution*. In essence, redistribution is based upon an institutionalized relationship of reciprocity between subject and chief (Sahlins 1972:188). The subjects place their surplus goods and labor at the disposal of the chief, and in return, the chief is expected to provide goods and services for the benefit of his subjects. Both Sahlins (1958) and Service (1962, 1975) have argued that redistribution in all chiefdoms exists primarily to coordinate specialized production within a diversified regional economy. More recent work, however, has shown this view to be questionable. Ethnographic evidence suggests that in many chiefdoms, local units of production were self-sufficient in most goods needed for subsistence (Earle 1973, 1977, Finney 1960). Whatever goods were not available locally could be obtained by means of small-scale exchanges organized on the household level (Peebles and Kus 1977). Indeed, it is not very useful to regard redistribution as a unitary phenomenon in all chiefdoms, because its function can vary greatly from one context to another (Earle 1977). Much of this variation is related to differences in the degree of political complexity and centralization in the societies where redistribution is found.

The simplest chiefdoms are characterized by only one level of superordinate political offices. Chiefs who fill these offices are only part-time administrators, and are not exempt from having to engage in the manual labor of subsistence production. Because the chief's household is expected to be self-sufficient, a chief does not live off the surplus food and gifts brought him by his subjects; most of the surplus collected thus gets distributed back to the populace. The flow of material goods between hierarchial levels is balanced, or sometimes even weighted in favor of the commoners. The chief, in living up to his role as a superiorly generous kinsman, is often forced to give away more than he takes in, the difference being made up by his household having to work harder at production.

Complex chiefdoms, on the other hand, have two- or three-tiered political hierarchies. Their social systems exhibit a well-developed class structure, in which nobles are clearly differentiated from commoners. Because most of the nobility are not required to engage in production, the burden of the latter pursuit falls entirely on the commoners. The nobility consume, for their own subsistence and political needs, most of the goods the commoners pass up the hierarchy. Relatively few goods remain available for redistribution to the commoners, so the reciprocal obligation is typically fulfilled in either of two ways: (*a*) by means of secular or religious services that only nobility can perform, or (*b*) by means of presentations that are more symbolic than substantial, such as token redistribution of insignificantly small amounts of food. A semblance of reciprocity between chiefs and commoners is thus maintained, but as Sahlins (1972:140) aptly points out "the cycle has all the reciprocity of the Christmas present the small child gives his father, bought with the money his father had given him." What formally appears to be redistribution in complex chiefdoms is functionally more akin to the collection of tribute than the insitutionalized sharing of surplus (Earle 1973:23, Oliver 1974:1008).

Complex chiefdoms are usually organized according to a principle wherein a higher-ranking chief has control over a number of lower-ranking chiefs, each of whom, in turn, directly controls a certain territorial district or social unit. In such a hierarchical system, political control implies the right to collect tribute, and vice versa. These two processes are inextricably linked, primarily because they are mutually reinforcing. A chief commands the payment of tribute by virtue of his political power. At the same time, however, a large part of the chief's power rests on his ability to maintain continued access to a sufficiently large pool of tribute (Sahlins 1963). A lower-ranking chief collects tribute from his underlings, but in turn he owes tribute to his political superior. The apex of a chiefly political hierarchy is effectively defined by the level at which all upward payments of tribute stop.

What is important for the purposes of this chapter is that different nodes in the political hierarchy are usually associated with spatially discrete (and archeologically recognizable) central settlements. Insofar as administrative control and collection of tribute are the major activities that structure the political hierarchy, these activities may also have some correlates in spatial terms, influencing the locations of central settlements relative to one another and to the populations they serve. Yet before we can build a model to describe these spatial correlates, we must examine how the network of administration and tribute flow is organized vis à vis the political centers in a chiefly system. This question will now be explored with reference to two ethnographically documented complex chiefdoms—the Natchez of the Lower Mississippi Valley, and the Society Islanders of Polynesia.

THE NATCHEZ

The Natchez political hierarchy was composed of two administrative levels. The nation as a whole was governed by a supreme chief called the Great Sun, and also had a supreme war chief called the Tattooed Serpent. Below this upper level, the chiefdom was subdivided into a number of smaller administrative districts, each placed under the immediate control of a lower-ranking chief, with the exception of the district in which the Great Sun and Tattooed Serpent resided, which they themselves administered directly (Swanton 1911, White *et al.* 1971:369, 382).

Some of the earlier accounts mention nine or more of these districts, but after 1716 there seem to have been only six (Swanton 1911:45–48). Information concerning their size is scanty, although one was described as having been more than a square league (9 mi^2) in extent (DuPratz 1774:73). Swanton (1911:43–44) estimates that in 1698 the nation as a whole comprised 3500 souls, but by 1730 had been reduced to some 2100.

Within each district was a single permanent center, referred to by the French somewhat misleadingly as a village. Such a center consisted of a temple and the dwellings of the chiefs and other important personages arranged around a plaza. It was marked by monumental architecture insofar as the temple and/or some of the important dwellings were placed upon pyramidal mounds artificially constructed of earth (Neitzel 1965; Swanton 1911:158, 190–191, 213–214; Thwaites 1900:135). Contrary to what the word "village" implies, these centers did not have nucleated populations. Only the high-ranking officials and perhaps a few others lived here. In 1700, for instance, the Grand Village, political capital of the Natchez, was described as having, in addition to the temple, only nine cabins by one count, and only four by another. Most of the population was widely dispersed over the countryside, living in isolated households or small hamlets situated in the midst of their own agricultural fields (Du-Pratz 1774:33; Swanton 1911:108).

The Natchez had a two-tiered hierarchy of centers, which directly reflected their political structure. At the apex of this hierarchy was the Grand Village, where the Great Sun and the Tattooed Serpent lived. This place served as the administrative and religious center not only of its own district, but also of the nation as a whole. Subordinate to the Grand Village were at least four lower-order centers, each of which directly administered the scattered population living within its district.

Collection of tribute within this system took a number of different forms. At one extreme was sporadic tribute, which stemmed from a chief's right to demand goods or labor from the people under his jurisdiction at any time. It is clear from the accounts that such sporadic demands were not uncommon (e.g., Swanton 1911:110, 135, 166, 221, 217). More regularly scheduled tribute collections also took place, however, the people usually bringing their goods to a place in or near the political center of the district in which they lived. The focus of many of these payments seems to have been the local temple:

> The fathers of families never fail to bring to the temple the first fruits of everything they gather; and they do the same by all the presents that are made to the nation. They expose them at the door of the temple, the keeper of which after having presented them to the spirits carries them to the great chief, who distributes them to whom he pleases [Charlevoix, quoted in Swanton 1911:166].

Most of the goods at the disposal of the chiefs were probably acquired through the agency of large-scale organized feasts (Swanton 1911:109ff). Such feasts were regularly celebrated at least once a month, which to the Natchez meant 13 times a year. Each district held its own feasts separately, although it seems that the harvest feast, which took place annually near the Grand Village, may have involved participation from all the other districts as well. Feasts embodied religious ritual (including some token distribution of food), games, and public dancing, yet their important political function was not overlooked by the early observers. DuPratz remarked:

> The feasts are equally religious and political, religious in that they appear to be instituted to thank the Great Spirit for the benefits he has sent men, political in that the subjects then pay their sovereign the tribute which they owe. . . [quoted in Swanton 1911:110].

Similarly, Penicaut wrote:

> It is ordinarily the great chief who orders the dance feasts . . . in all the villages of his dominion. These feasts are ordinarily undertaken when the great chief has need of some provisions such as flour, beans, and other such things, which they place at the door of his cabin in a heap the last day of the feast. . . . The chiefs of the other villages send him what has been obtained from the dances in their villages [quoted in Swanton 1911:121].

The last passage is of particular interest, for it tells us how the lower-order centers were linked to the capital in the overall flow of tribute. The dominant pattern was apparently this: Individual households would bring their goods to the central settlement of the district in which they resided. There, the goods would be bulked, and the local chief would send a certain fraction of the revenue to the Grand Village, keeping the rest for his own subsistence and political needs. In this way, the Grand Village would receive tribute directly from its own district, but indirectly from the households elsewhere, the goods first being channeled through the lower-order centers.

It is also interesting to note that the flow of administrative information often followed the same channels as the flow of goods, albeit in the opposite direction. Decisions made by the Great Sun were first transmitted to the lower-order centers, from where the local chiefs would be expected to enforce them on the people within their respective districts (McWilliams 1953:88–89, Swanton 1911:100).

THE SOCIETY ISLANDERS

The political structure of the Society Islands at the time of European contact was somewhat more complex than that of the Natchez. The basic political unit was the *fenua,* or "tribe." There were from 17 to 20 of these units on the island of Tahiti alone, a few more or less at any given time owing to the vicissitudes of political consolidation and fragmentation. *Fenua* were quite variable in size. According to Oliver's estimates, their populations on Tahiti ranged from 940 to over 4000 individuals, with a mean of approximately 2080 (Oliver 1974:Table 3).

Each *fenua* was internally composed of smaller administrative districts called *patu,* which were further subdivided into even smaller units called *rahui.* Corresponding to this territorial structure was a three-tiered hierarchy of political offices. The *fenua* as a whole was ruled by a chief. Directly below him were a number of subchiefs, each of whom had jurisdiction over a *patu*. Officials of lowest rank were stewards (*ra'atira*) who each had charge of a *rahui*. Although the larger *fenua* exhibited all three tiers of this hierarchy, the smaller *fenua* tended to have only two (Oliver 1974:969).

Several supratribal alliances existed on the island, each composed of a number of adjacent *fenua* united under the hegemony of a militarily superior chief. This paramount chief could collect some tribute from his weaker allies and expect their support in times of war. Yet to call all of these alliances "princedoms" as some European writers did would be misleading. Some, if not all, of these aggregates were relatively fragile entities in which the paramount chief's centralized political power was never very well consolidated. Moerenhout described these units as:

> invariably divided into [several] major districts each with its own chief, and only temporarily—and at that not absolutely—subordinated to the chief of one of them. Moreover, it appears that each district's own chief had more authority locally than did the chief whose overlordship had been established by conquest. The overall power of the latter was so limited by the jealousy and unity of the former that he was never able to annex their districts to his own domain . . . [quoted in Oliver 1974:991].[1]

Political centers associated with administrative districts at all levels were characterized by the presence of *marae*—structures used in religious ritual. These *marae* were rectangular courtyards, usually paved with stones, and sometimes surrounded by a masonry wall (Oliver 1974:177ff). Within the courtyard were a number of upright stones, and generally a stone platform at one end. *Marae* of many types were built (Emory 1933), but it is quite clear that their size and elaboration were directly tied to the status of the chiefs who used them. Thus, the "tribal" *marae* of a *fenua* chief would be a larger and more complex structure than that of a subchief, which in turn would be more elaborate than that of a steward (Oliver 1974:186, 1010, *passim*). Indeed, such a three-tiered hierarchy of *marae* has been identified archeologically on Mo'orea (Green *et al.* 1967:224–225). Other architecturally distinctive features associated with these centers were chiefly dwellings, assembly houses, and/or assembly platforms, all of which are recognizable archeologically (Green *et al.* 1967:Table 13, Oliver 1974:170ff).

Most of the population on the islands lived in scattered households within several kilometers of the coast. Each household would typically have several buildings constructed for different purposes, and would be set off from other households by a good distance, sometimes hundreds of meters. There was, however, a general tendency for households to form loose spatial clusters of 10 or so (Oliver 1974:44).

[1] Quoted material on this page and on pages 425, 426, and 429 is from Oliver, D. L., *Ancient Tahitian Society*. Honolulu: University Press of Hawaii.

Collections of chiefly tribute were occasioned by various circumstances. Chiefs could, of course, demand goods or labor from their subchiefs and commoners at any time. Large-scale levies would be imposed at the commencement of public works projects, at the arrival of visiting dignitaries, and for the equipping of war parties. More regular contributions from commoners were received as first fruits offerings and at various other ceremonial and ritual occasions (Oliver 1974:1001ff, *passim*).

The tribal (*fenua*) chief always seems to have received tribute from each subtribe (*patu*) as a unit. Sometimes, each subtribe would make separate presentations and on different occasions; other times, all the subtribes would be present and make their contributions jointly (Oliver 1974:1006). A chief could sometimes collect tribute away from his center while traveling, but most of these presentations apparently took place at or near the tribal *marae*, the highest-order chiefly center within the *fenua*.

Collection of tribute at the subtribal level is much more poorly documented, so that the channels through which it generally flowed are difficult to reconstruct with confidence. The only good clue comes from Morrison's description of an offering of first fruits:

> the fruits being ripe the Towha [subchief] . . . informs the Ratirra [steward] . . . that on such a day the offering is to be made and it is proclaimed through the district by a cryer to inform their respective tenants . . . who on the day appointed each gather some of every species and having put them in a basket [also taking a suckling pig, they] repair to the house of their respective Ratirra who then heads his own people and proceeds to the house of the Towha, who with his priest and orator heads the whole and the procession proceeds to the house of the Chief, sometimes four or five hundred in a body, where being arrived [some rituals are performed, after which] the fruits are deposited before the Chief and they retire and return home. When this ceremony is performed to the King [i.e., paramount chief], the Chiefs of the District always head the procession.
>
> This ceremony is then performed by the Ratirras to their respective Towha and afterwards by the Tenants to their Ratirras . . . [quoted in Oliver 1974:262–263].

This passage is noteworthy, because it suggests to us that goods generally moved along regular social channels: commoners to steward to subchief to chief. In spatial terms, this movement would translate as follows: from household to lower-order center to higher-order center, and so on up.

Corvee labor in some instances seems to have been mobilized along the same lines as the flow of goods. In executing corvee projects of a tribal scale, much of the initial work would be allocated and carried out at the subtribal level, the final work being completed at the tribal chiefly center. This process is illustrated in the following passage:

> The *upea ava* or salmon net, is the longest and most important, and is seldom possessed by any but the principal chiefs; it is sometimes four fathoms long, and twelve or more feet deep. One of this kind was made by Hautea, the governor of Huahine, soon after our arrival. . . . As is customary on all occasions of public work, the proprietor of the net required other chiefs to assist in its preparation. Before he began, two large pigs were killed and baked. When taken from the oven, they were cut up, and the governor's messenger sent with a piece to every chief; on delivery the quantity was stated which each was desired to prepare towards the projected net . . . .
>
> The servants of the chief furnished their quantity of netting . . . as other parties brought in their portions, the chief and his men joined them together . . . [Ellis, quoted in Oliver 1974:999–1000].

Similarly, thatch plates for a public building to be put up at the tribal capital were manufactured by each subtrial unit in advance, and pooled at the site of construction:

> The people from different parts are assembling in our neighborhood in order to thatch the big house called Nanu which is built at the public expense. . . . The people of both Huahines are gathered together . . . [and] they have brought their several divisions of thatch . . . [Davis, quoted in Oliver 1974:997].

Whether the netting and the thatch plates that arrived at the tribal capital were sent from the chiefly centers of the subtribal districts is never explicitly stated, but it is extremely likely that they were. Thus, once again the same spatial channels would appear to have been used: Corvee labor destined for a higher-order center often had to be mobilized first at the lower-order centers.

And finally, as in the preceding passage, we find that administrative information was also passed along the same channels, the movement often being in a direction opposite to that of tribute:

> Whenever a measure affecting the whole of the inhabitants was adopted, the king's *ve'a* or messenger was despatched with a bundle of *niaus* or leaflets. On entering a district, he repaired to the habitation of the principal chiefs, and, presenting a cocoanut leaf, delivered the orders of the king. . . . When the chiefs approved of the message, they sent their own messengers to their respective tenants and dependents with a cocoanut leaf for each, and the orders of the king [Ellis, quoted in Oliver 1974:1032].

A Locational Model for Chiefly Centers

Having examined the types of interaction that take place among centers in a chiefly hierarchy, we are now prepared to move to a more general level, and formulate a locational model. First, however, let us examine in more detail why a market-based model like Christaller's is inappropriate for the analysis of chiefly systems as those I have just described. When the characteristics of settlement hierarchies found in market as opposed to chiefly systems are compared, a number of fundamental differences become apparent. These differences do not merely have to do with the types of commodities or services being exchanged. Rather, they are primarily structural, involving the manner in which the centers are articulated with their hinterlands and with each other.

The first of these differences can be seen in how the hinterland served by each central settlement is formed. The hinterland or "complementary region" of a market center arises basically from the statistical outcome of numerous individual decisions. When choosing between market centers which offer equivalent goods, people generally go to the one that is nearest (see Berry 1967:10–23). Thus, the complementary region of a market center consists de facto of the area closer to it than to any other equivalent central place. If a market center were to change its location relative to other centers (all else remaining constant), the size and shape of its complementary region would shift accordingly.

The hinterlands of chiefly centers, on the other hand, are formed de jure as clearly delineated territories. In effect, they are administrative districts, defined in terms of established political boundaries, and often in terms of corporate land-use rights vested in a particular kin group. Such a district owes its existence to social and political factors that are independent of preferential decisions made by commoners. It is imposed from above, as it were, and retains its integrity no matter where within its boundaries the chiefly center is located.

The second difference between market and chiefly systems lies in the nature of the relations among centers of equivalent order. Market centers offering equivalent goods compete with one another for the traffic of the outlying populace. As a result, market centers tend to be evenly spaced over the landscape in a configuration which minimizes their direct competition and maximizes their profits (Berry 1967:86).

The relations among centers in a chiefly system can be quite different. While some degree of competition surely exists among chiefly centers that are independent of each other politically, the amount of competition among centers *within* a single, well-integrated political system should be considerably less pronounced. This lack of competition stems from the fact that the boundaries of internal administrative districts are fixed, de jure, by the social and political parameters of the system as a whole. The size and shape of a center's administrative district remains unaffected by that center's nearness to other politically affiliated centers of equivalent order. Thus, there appears to be no process operating that consistently favors spatial repulsion between such centers, and so it should not be surprising to find a great deal of variance in their relative spacing.

Finally, perhaps the most important difference between market and chiefly systems lies in the configuration of the spatial channels by which rural households are linked to higher-order centers. In a market system, movements between the household and all central places which service it are direct. A consumer travels to a nearby lower-order center for frequently needed goods, and to a higher-order center for less frequently needed goods. In each case, the consumer goes to and from the market directly, and generally by the shortest route (Figure 14.1A).

The links between households and higher-order centers in a chiefly system, on the other hand, are often *not* direct. A household brings its tribute in goods and labor to the lower-order center of the administrative district in which the household is established. From the lower-order centers, a part of this tribute then passes up to the higher-order center. Political messages and administrative information tend to follow the same spatial channels as tribute, but often travel in the opposite direction. In this way, movements between households and higher-order centers are mainly channeled through centers of lower order, intermediate in the political hierarchy. The highest-order center interacts with relatively few households directly: those in its immediate district (as H in Figure 14.1B).

SPATIAL EFFICIENCY IN COMPLEX CHIEFDOMS

Given that a market-based central place theory is inappropriate for analyzing the spatial relationships among centers in a chiefly system, an alternative model is called for. Let us therefore discuss some of the factors

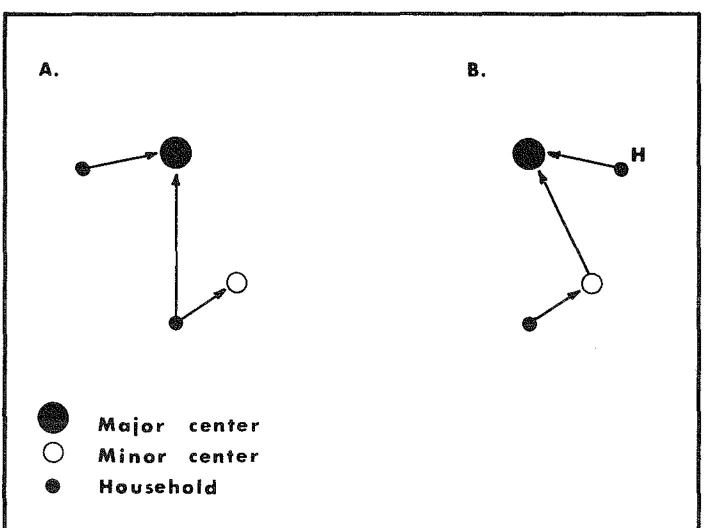


FIGURE 14.1. Linkages between households and centers. A. In a market system. B. In a chiefly system. H Indicates a household in the immediate district of the major center.

likely to serve as constraints on the location of chiefly centers. We can take as a point of departure a statement by Blanton:

> For our purposes here, the most salient characteristics of central institutions are that they require energy to function, and that the transactions take time. Energy is supplied by subsystems of producers, who must work more than would necessary in the absence of such institutions. The fact that there is a finite amount of energy in the environment of any society, and that producers can be pushed or otherwise encouraged to produce only so much surplus means that central institutions always have a maximum size and are always limited to a finite number of transactions per unit time. . . . We might expect, therefore, given time and energy constraints, that in all societies we will find the presence of strategies that minimize both the time and energy costs of central institutions. . . . Although there undoubtedly will be considerable cross-cultural variability in the form of these strategies and the extent to which minimization is actually achieved, there is probably no society in which there is complete disregard for the energy and time costs of these mediating central institutions [1976:251–252].[2]

The central institutions of complex chiefdoms, it will be remembered, were supported by the surplus production and corvee labor of the commoners. Yet Sahlins' (1963, 1972) work has convincingly shown that each producer was willing to expend only a limited amount of effort above the minimum required to fulfill his own and his household's needs.

> In other words, the chiefly toll on the household economy had a moral limit consistent with the kinship configuration of the society. Up to a point, it was a chief's due, but beyond that, highhandedness. The organization set an acceptable proportion between the allocation of labor to the chiefly and domestic sectors [Sahlins 1972:147].

The cost of maintaining the central institutions in complex chiefdoms was quite high. In addition to the nobility, whose numbers could be quite sizable, there were various other nonproducers who derived their support, directly or indirectly, from tribute brought in by the commoners. Among these nonproducers were various religious functionaries and craft specialists subsidized by the chiefs, in addition to a large number of servants, warriors, entertainers, and other "hangers-on," who would gather around the residences of important chiefs and live off their largesse. The entourage of a Tahitian chief, for example, consisted of "many of his friends and their families often amounting to near 100 principals besides their attendants [Banks, quoted in Oliver 1974:971]." Also contributing to the cost of these central institutions was their need to maintain an aura of awesomeness and sanctity, which served to validate the authority vested in them. Monumental architecture, costly sumptuary

[2] This is quoted from Blanton, R., Anthropological Studies of Cities. *Annual Review of Anthropology* **5**.

goods, and elaborate religious ritual were all part and parcel of the chiefly apparatus, the brunt of whose maintainance fell on the commoners. The elaborateness of this sumptuary complex and the size of the chiefly administrative religious superstructure were directly related to the level of political centralization and complexity within the system. As the centralization and complexity increased, so did the cost of maintaining its central institutions.

Returning to the energy constraints I spoke of earlier, it appears that the most complex chiefdoms attained a level of consumption that came quite close to the "moral limit" of household surplus production, and even tended to occasionally surpass it. "The major Polynesian paramounts seemed inclined to 'eat the power of the government too much', as the Tahitians put it, to divert an undue proportion of the general wealth towards the chiefly establishment [Sahlins 1963:297–298]." If a chief continued to make unacceptable demands on the goods and labor of his subjects for too long, the usual response was rebellion, the offending chief being deposed by another who was more moderate in his exactions (ibid.). The fact that such rebellions occurred (or at least were said to occur) means the chiefly apparatus was well aware that its access to tribute was limited, and that it had to be concerned with staying within certain bounds. Thus, as Sahlins (1968:93) notes, "The Hawaiian paramounts worried about [the people most subject to tribute] and devised all manner of means to relieve the pressure on them."

One way to relieve this pressure without curtailing the size of the chiefly establishment would be to make more efficient use of the effort which the people were legitimately willing to put to chiefly ends. Speaking in general terms, this "public" effort consisted of two major components: (a) effort invested in surplus production and corvee labor, and (b) effort invested in movement of people and goods (such as tribute) to and from the chiefly centers. The chiefs could maximize the former, without increasing the burden on the commoners, only by minimizing the latter. One of the most effective and obvious ways to minimize the latter might have been to locate chiefly centers efficiently over the landscape.

In order to see how such spatial efficiency is optimally achieved, we can construct an idealized model based on the parameters already discussed. Consider a chiefly system consisting of five administrative districts each of which has a political center (Figure 14.2). The administrative hierarchy is of two levels, with one major center, or capital, and four politically subordinate minor centers. Each center collects tribute from the settlements in its own district. In addition, the capital collects tribute from each of the minor centers.

Let us assume that the "cost" or effort involved in moving over a certain distance is proportional to the distance squared.[3] Let us also

[3] The "cost" we are concerned with here is not simply measurable in terms of energy

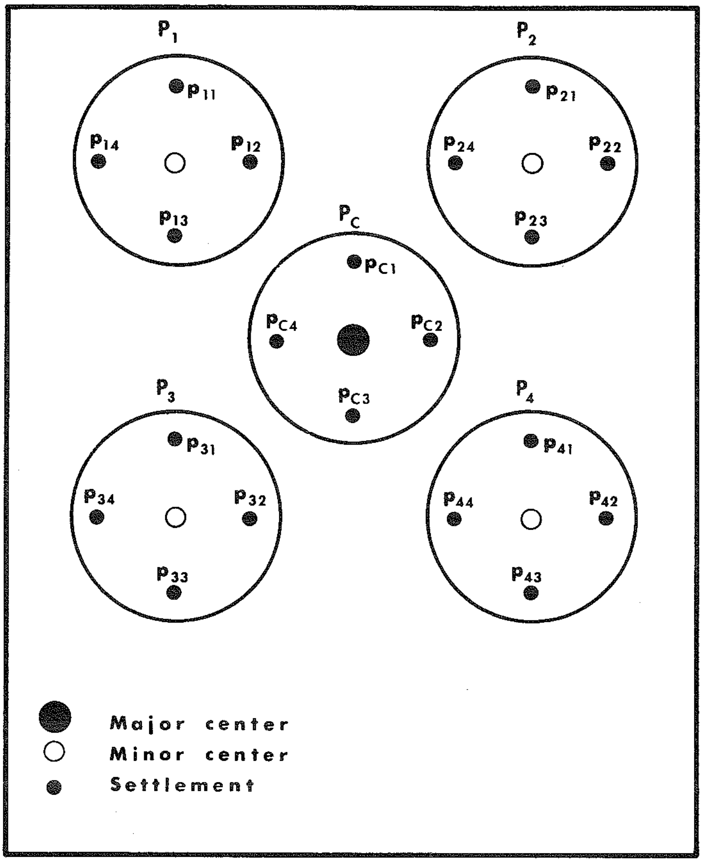


FIGURE 14.2. An idealized chiefly system consisting of five administrative districts. The populations of individual settlements (p_{ij}) and of districts (p_i) are noted symbolically.

assume that the demand for goods and services placed by a district center on a particular settlement is proportional to the settlement's population; similarly, that the demands the capital places on a minor center are proportional to the population of the district which the minor center controls. We can then express the aggregate yearly effort invested in movement between the settlements in a single district and their center as:

$$m_i = \sum_{j=1}^{J} tp_{ij}d_{ij}^2, \tag{1}$$

expenditure (which would be directly proportional to distance), but rather involves people's perception of how much effort and trouble a trip of given length involves. Empirical studies have shown that the frequency of travel (or other kinds of interaction) between two points often diminishes in proportion to a value very close to the distance squared (Haggett 1965:35–37), suggesting that the latter measure may well approximate the variable we are interested in. Using distance squared has the added advantage of having a mathematically simple solution for finding the point at which "cost" is minimized.

where m_i is proportional to the aggregate yearly effort expended in intradistrict movement, that is, in movement between the political center of the ith district and the settlements tributary to it, t is proportional to the average yearly amount of tribute, in goods and labor per capita, that is channeled into (or through) the minor centers, p_{ij} is the population of the jth settlement in the ith district, and d_{ij} is the distance from the jth settlement in the ith district to that district's political center.

Similarly, the yearly cost of movement between the minor center of the ith district and the capital is expressed as follows:

$$m_i' = T_iP_iD_i^2, \qquad (2)$$

where m_i' is proportional to the aggregate yearly effort expended in interdistrict movement, that is, in movement between the minor center of the ith district and the capital, T_i is proportional to the average yearly amount of tribute, in goods and labor per capita, sent to the capital from the minor center of the ith district, P_i is the population of the ith district, and D_i is the distance between the minor center of the ith district and the capital.

The symbols t and T_i represent measures of how much tribute flow takes place at the intra- and interdistrict levels, respectively, and thus are related to the degree of political centralization at each level. Each value increases as the intensity of interaction at that level increases, that is, as there are more man-trips per person per year. In addition, these values are related to the amount of goods (tribute) flowing at each level, measured in terms of bulk. As the flow of goods increases, so do these values, because the more goods are being carried, the greater is the effort to move a certain distance. In most cases, t is greater than T_i, because all tribute destined for the capital must first pass through the minor center.

Movements to and from minor centers thus involve costs on two levels: (*a*) costs deriving from interaction with settlements within their districts (m_i), and (*b*) costs deriving from interaction with the capital (m_i'). A measure of the total costs of movement to and from the minor center of the ith district (M_i) can be expressed as follows:

$$M_i = m_i + m_i', \qquad (3)$$

$$M_i = \sum_{j=1}^{J} tp_{ij}d_{ij}^2 + T_iP_iD_i^2. \qquad (4)$$

The ideal location for a minor center is the place where M_i is minimized. If there were no interdistrict tribute flow ($T_i = 0$ and $m_i' = 0$, as is the case in simple chiefdoms), then M_i equals m_i. Under these conditions, M_i is minimized when the minor center is geographically centered with respect to the population in its own district (Figure 14.3). This ideal location is the district's *demographic center of gravity* (henceforth referred to as DCG; for a procedure to calculate the DCG see the Appendix).

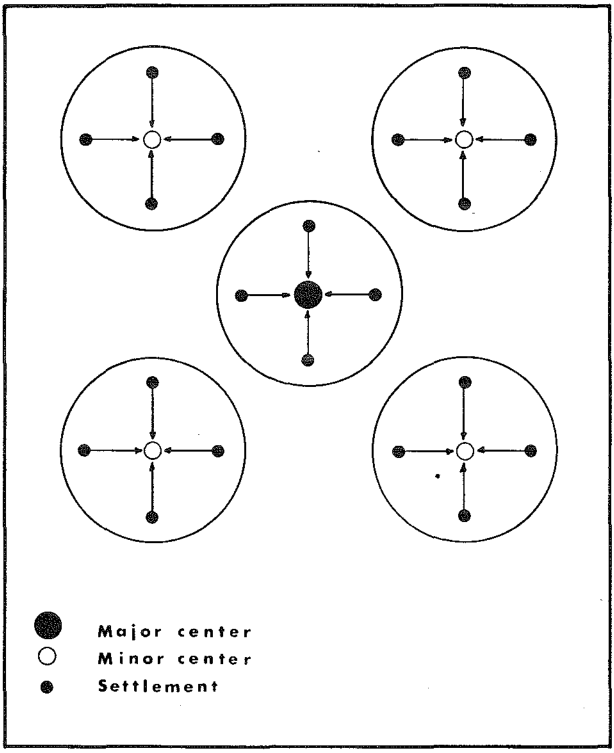


FIGURE 14.3. The ideal locations of centers with no tribute flowing from minor centers to the capital (i.e., $T_i = 0$). Each center is located at the demographic center of gravity (DCG) of its administrative district. Arrows indicate the flow of tribute.

If, however, the lower-order center pays tribute to the higher-order center ($T_i > 0$ and $m_i' > 0$, as in complex chiefdoms), then the ideal location of a minor center is no longer at the DCG, but is closer to the capital (Figure 14.4). The greater the degree of political centralization, the greater is the ratio of T_i to t, and the farther is the optimal location deflected away from the DCG and toward the capital. (A procedure to calculate this ideal location is given in the Appendix.)

The implications of the latter finding are quite interesting, because they are contrary to what one would expect in a market situation. As we have seen, the optimal location for a chiefly center is often *not* at the geographical center of the population within its district, whereas a market (if it is to minimize movement costs) is always ideally located at the geographical center of its complementary region. Moreover, our model predicts that lower-order chiefly centers would tend to cluster *toward* their capital. This is in opposition to the empirically observed tendency in market systems, where lower-order central places are prone to be dis-

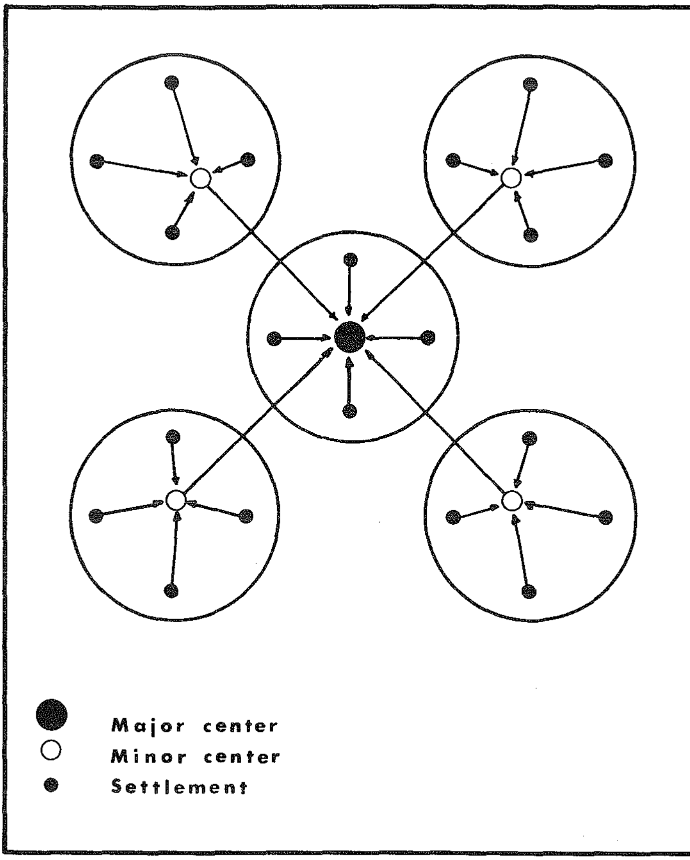


FIGURE 14.4. The ideal location of centers with tribute flowing from the minor centers to the capital (i.e., $T_i > 0$). Note that each minor center is not at the DCG of its district, but rather is closer to the capital. Arrows indicate the flow of tribute.

persed *away* from higher-order central places because of the latter's competitive advantage in attracting customers (Hodder 1972:897–900; Brush 1953).

The next aspect of the model to be considered is the optimal location of the chiefly capital. As in Eq. (1), we can express the yearly cost of intradistrict movement to and from the capital (m_c) as:

$$m_c = \sum_{j=1}^{J} t p_{cj} \, d_{cj}^2, \tag{5}$$

where p_{cj} is the population of the jth settlement in the capital's immediate district, and d_{cj} is the distance between the capital and the jth settlement in the capital's immediate district. Since the capital collects tribute from all the minor centers as well, the interdistrict component of the movement costs can be written, following Eq. (2), as:

$$m_c' = \sum_{i=1}^{I} T_i P_i D_i^2. \tag{6}$$

Combining Eqs. (5) and (6), we get the expressions for the total yearly cost of movements to and from the capital (M_c), analogous to Eqs. (3) and (4):

$$M_c = m_c + m_c', \tag{7}$$

$$M_c = \sum_{j=1}^{J} t p_{cj} d_{cj}^2 + \sum_{i=1}^{I} T_i P_i D_i^2. \tag{8}$$

The capital is ideally located at the place where M_c is minimized. If it were to optimize with respect to the first term (m_c) only, the capital would locate at the DCG of its district. If, on the other hand, it were to optimize with respect to the second term (m_c') only, the capital would be situated at the *center of gravity of the minor centers* (CGMC), each being weighted according to $T_i P_i$. (A procedure to calculate CGMC is presented in the Appendix.) In fact, the capital would be expected to optimize with respect to both m_c and m_c' at the same time, its ideal location being somewhere between the DCG and CGMC, a spatial comprise between the two.

This is not to say, however, that the two terms are of equal importance. When a high degree of political centralization exists, the ideal location of the capital is primarily determined by the positions of the lower-order centers, rather than by the distribution of local settlements within its own district. If the value of T_i is not small relative to t, m_c' will generally be large in comparison with m_c. This is true because $\overline{D}_i$ is likely to be very much greater than $\overline{d}_{cj}$, and $\overline{P}_i$ very much greater than $\overline{p}_{cj}$ (D_i being the mean value of D_i, $\overline{d}_{cj}$ the mean value of d_{cj}, etc.). The resulting implication is that in order to keep movement costs from becoming excessive, the location of the capital must always be near the CGMC.

In an empirical situation, finding the optimal location for the capital requires, among other things, complete data on the distribution of population, and a knowledge of where the boundaries between the administrative districts lie. However, such complete data are almost never available to the archeologist. This problem can to some extent be circumvented by using the CGMC as an approximation of the ideal locus, for as we have just shown, in theory these two points should always be relatively close to each other. If we can assume that the tribute flow from each of the minor centers is the same (i.e., the value of $T_i P_i$ is the same for all i), then calculating the CGMC is a considerably more practical undertaking, especially in an archeological context, because it requires only that we know the spatial distribution of the minor centers (see Appendix). Since such centers tend to be archeologically conspicuous sites, complete recovery of their locations within a region is often not difficult to accomplish.

Using the CGMC as an approximation, we can empirically determine the degree to which a capital's observed location approaches its theoretical ideal. Assuming that the annual tribute flow from each of the minor centers is the same, we can use an index of spatial efficiency (E) expressed as follows:

$$E = \frac{\sum_{i=1}^{I} R_i^2}{\sum_{i=1}^{I} D_i^2} \tag{9}$$

where R_i is the distance from the CGMC to the minor center in the ith district, and D_i is the distance from the capital to the minor center in the ith district. Because by definition $\sum R_i^2$ is less than or equal to $\sum D_i^2$, this index equals 1.0 when the capital is ideally located, and becomes smaller as the distance between the observed and ideal location increases (see Massam 1972:6).

In constructing this model, we have dealt with finding the ideal location of a minor center and that of the capital as two separate problems. In fact, the two problems are closely related, because the optimal location of a minor center depends upon the location of the capital, and vice versa. Although it should be possible to build a model that takes both aspects into account simultaneously, I do not feel it would substantially change the nature of the predictions. The approach adopted here is heuristically sound, and has the advantage of being much less complicated mathematically.

Briefly summarizing this section, we have examined a number of factors which are likely to influence to location of political centers in a complex chiefly society. The following general conclusions have emerged, based on the model just developed:

1. Chiefly centers within a stable, politically unified system engage in little competition among themselves, and there is no direct process which consistently favors mutual repulsion between adjacent centers. Hence, we should not necessarily expect to find regular spacing among centers within such systems.
2. In order to minimize movement costs, lower-order centers would tend to cluster toward the higher-order center (or capital). The ideal location for a subordinate center is therefore not in the geographical center of the population within its own district, but rather is closer to the superordinate capital to which it pays tribute.
3. Where political centralization at the capital is strong and incoming tribute flows are high, the optimal location of the capital is principally determined with respect to the lower-order centers within its political control. The degree to which the actual location of the

capital approximates the ideal can be measured by means of an index of spatial efficiency (E).

The Model Applied: The Moundville Phase

Having derived a model for the location of chiefly centers, we can now apply it to a body of empirical data. Before we proceed, however, it is important to make clear what this application should accomplish. The model is based on a set of ideal assumptions which may not hold perfectly true in any real situation. An empirically observed pattern can be expected to be more or less like the one predicted by the model only to the extent that other factors, which the model does not take into account, do not intervene. The model is primarily useful in helping us ask meaningful questions of our data, and in allowing us to generate hypotheses which can be tested by other means (Hodder 1972, Johnson 1972:769, 1975:291).

It is in this light that we now examine the settlement data from the Moundville phase of west-central Alabama. This phase, thought to date approximately between A.D. 1200 and 1500, was a variant of the Mississippian culture found in many parts of the southeastern United States in late prehistoric times. On the basis of an extensive burial analysis and various other lines of evidence, Peebles (1971, 1974, Chapter 13 of this volume) has argued that the Moundville phase represents the archeological manifestation of what we have defined as a complex chiefdom.

The sites we are specifically concerned with are found along the Black Warrior River between the fall line at Tuscaloosa and the confluence with the Tombigbee River near Demopolis (see Figure 14.5; Peebles Chapter 13 of this volume, Nielsen *et al.* 1973). On formal grounds, these sites can be classified into three categories; major center, minor center, and residential site. The first category has only one example, the site of Moundville itself. This major center is by far the largest site in the valley, and is one of the largest in the southeast as a whole. It contains at least 20 mounds, and covers over 120 ha. Sites of the second category are considerably more modest in size, each exhibiting only a single mound, with or without evidence of an immediately adjoining village. There are ten such minor centers in the Black Warrior River Valley. The third category consist of all settlements which are not associated with mounds. The six largest of these residential sites range in size from .4 to 2.6 ha (Peebles, Chapter 13 of this volume). These larger settlements probably do not, however, represent the entire picture. There is evidence to indicate that some part of the population may have lived in dispersed farmsteads (cf. the sites referred to as "camps" in Nielsen *et al.* 1973). Exactly what proportion of the people may have lived in these small settlements is not known. Residential sites,

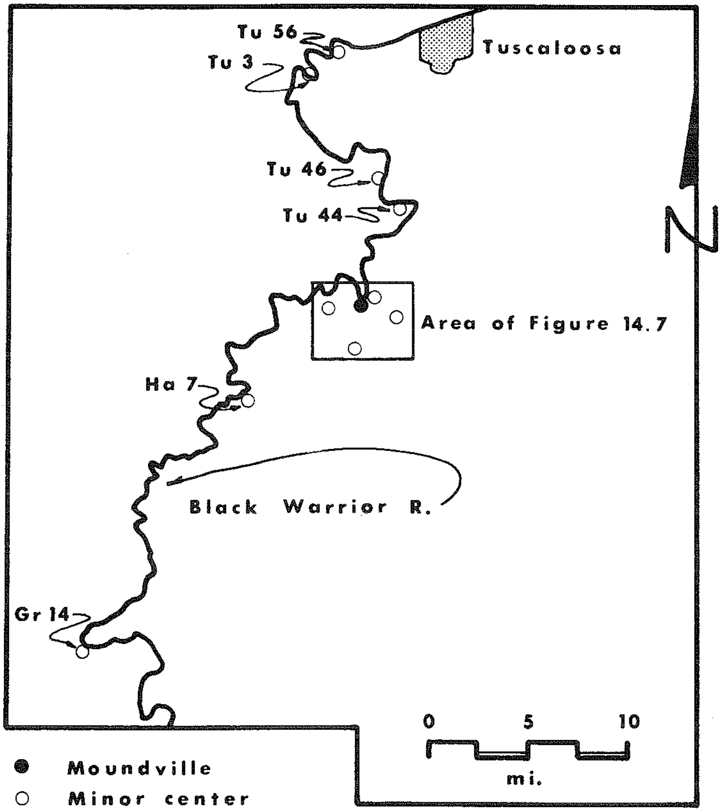


FIGURE 14.5. *Moundville phase centers in the Black Warrior River Valley.*

especially the smaller ones, are relatively inconspicuous and difficult to locate archeologically. Hence, it is probable that only a small fraction of those present in the valley have been recorded.

The Black Warrior settlement system was thus characterized by a clearly defined two-level hierarchy of centers. The fact that only one major center existed and that all the minor centers were of equivalent size (that is, they each had only one mound) strongly suggests that the valley was politically unified, with the administrative capital being Moundville. Indeed, Moundville's function as the highest-order center has been documented on grounds other than its relative size. Burial analyses have suggested that while persons of elite status were associated with both Moundville and the lower-order centers, individuals of the highest rank were interred only at Moundville (Peebles 1971).

Having established the background of the chiefly settlement system being considered, let us now examine the degree to which these data conform to the model's expectations.

LACK OF REGULAR SPACING

The straight line and river distances between adjacent Moundville phase centers are presented in Table 14.1. If spatial competition of the kind found in market systems were present, we would expect to find a high degree of regularity in the spacing of these centers relative to one another. Among the Moundville phase centers, such regularity is clearly not seen. Distances between centers along a straight line range from .8 to 22.3 km. While the mean distance is 6.3 km, the standard deviation of these measurements is 5.5 km, almost as large as the mean. Using river kilometers as a measure of distance produces similar results, with a mean spacing of 14.6 km and a standard deviation of 13 km. Although this irregularity in spacing could admittedly be caused by many different factors, it is quite consistent with the chiefly model, which postulates that

TABLE 14.1
Distances between Adjoining Centers

Adjoining centers	Straight-line distance in miles (km)	Distance along river in miles (km)[a]
Tu-56–Tu-3	1.7(2.7)	3.1(5.0)
Tu-3–Tu-46	6.2(9.8)	14.1(22.7)
Tu-46–Tu-44	1.9(3.1)	2.9(4.7)
Tu-44–Tu-50	5.2(8.4)	7.8(12.6)
Tu-50–Ha-1	1.6+(2.6)	—
Moundville–Tu-50	.5(.8)[b]	.5(.8)
Ha-1–Moundville	1.6(2.6)[b]	—
Ha-1–Ha-9	2.9(4.7)	—
Ha-9–Moundville	2.1(3.4)[b]	—
Moundville–Ha-14	1.7(2.7)[b]	3.9(6.3)[c]
Ha-14–Ha-9	2.5(4.0)	—
Ha-7–Ha-9	6.5(10.5)	—
Ha-14–Ha-7	6.7(10.8)	14.8(23.8)
Ha-7–Gr-14	13.9(22.4)	26.1(42.0)
	μ = 3.93(6.32)	μ = 9.15(14.73)
	σ = 3.42(5.50)	σ = 8.09(13.02)

[a] All river distances are measured along the present channel from the point where the river comes closest to the site.

[b] Distances to Moundville are measured with respect to the nearest of the mounds surrounding its plaza.

[c] Ha-14 is presently located on an oxbow lake which might possibly have been part of the active river channel when the site was occupied, although Nielsen *et al.* (1973:90) think this possibility is unlikely.

there is no direct process necessarily favoring mutual repulsion between centers.

SPATIAL EFFICIENCY: MOUNDVILLE

The degree of political centralization in the Black Warrior system appears to have been quite high. The capital, Moundville, was extremely large in comparison to each of the minor centers. Moundville had a total of 20 mounds, and each of the minor centers had only one. Indeed, the tribute in goods and labor needed to support a capital the size of Moundville must have been substantial. In addition, some of this tribute would have had to have been transported over long distances. The Black Warrior system was over 117 river kilometers (51.5 air kilometers) in extent, with the most distant minor center, Gr-14, being 72 river kilometers from Moundville. Such a system was extensive by prestate standards, approximating the size of some of the "supratribal" alliances on Tahiti (see Oliver 1974:Figure 23–1). Under such circumstances, the pressure to achieve an optimal state of spatial efficiency would probably have been great.

In order to measure the degree to which Moundville's location approximates the theoretical optimum, we can use the index of spatial efficiency (E) presented in Eq. (9). Measuring straight line distances, we find that Moundville's spatial efficiency with respect to the minor centers is very high, E taking a value of .94. The practical significance of this result can be highlighted by comparing it to values of E calculated for each of the other site locations (Figure 14.6). Nine of the 10 other centers have lower spatial efficiencies than Moundville; one site, Ha-14, does have a higher spatial efficiency (.98), but the increment by which it exceeds Moundville's value is rather small.

Straight line distances can in this case serve only as a first approximation, however. Given the heterogeneous, nonisotropic landscape in the area being dealt with, the effort expended in movement per unit distance cannot be expected to be the same between all pairs of sites. It seems reasonable to assume, for example, that for any given distance movement by river entails a different amount of effort than movement by land. Although there is no way of assessing the relative difference in precise quantitative terms, we can to some extent control for the difference by calculating our index of spatial efficiency with regard to the two modes of movement separately. To this end, the minor centers can be divided into two groups: those that were probably connected to Moundville mainly by river, and those that were probably linked with Moundville by land. The former group is composed of Gr-14, Ha-7, Tu-44, Tu-46, Tu-3, Tu-56; the latter group of Tu-50, Ha-1, Ha-9, and Ha-14. The distances between

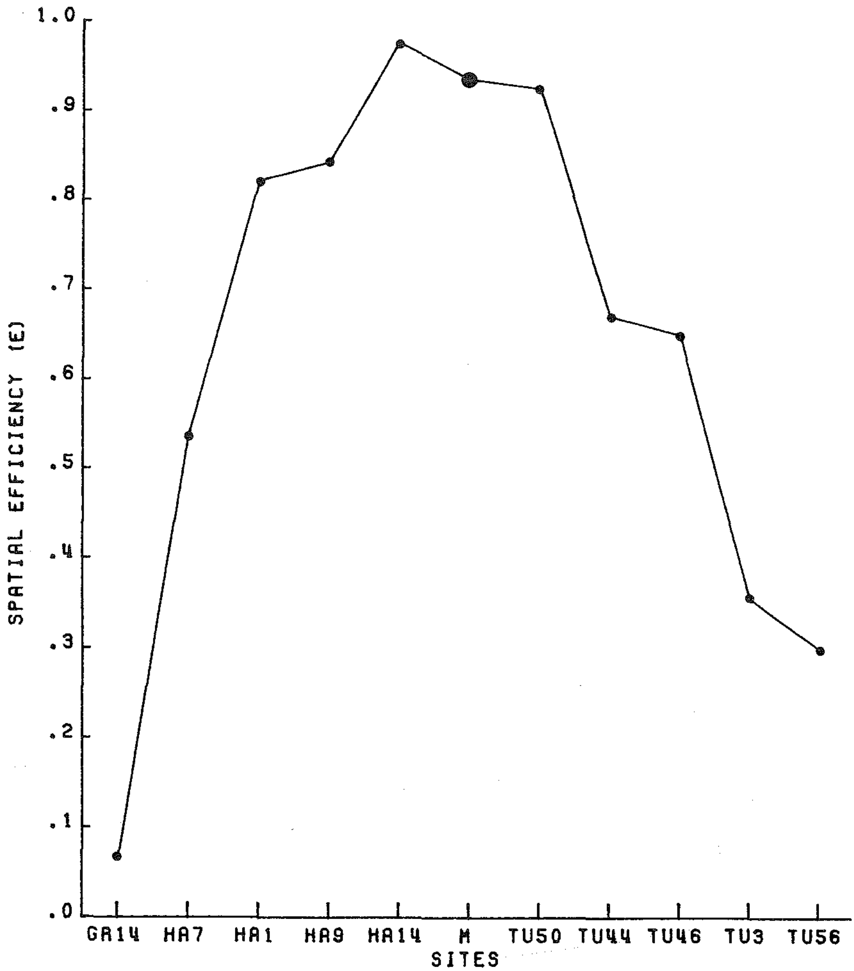


FIGURE 14.6. The Spatial Efficiency (E) of the locations of Moundville phase chiefly centers, calculated using straight line distances. Note that the Moundville site has a very high spatial efficiency of .94, higher than that of all other sites except one (Ha-14).

Moundville and sites in the former group are best expressed in river kilometers, whereas the distances between Moundville and sites in the latter group are best measured in land kilometers.

With respect to the river sites (Table 14.2), Moundville's location has an extremely high spatial efficiency of .996. In relation to the four land-connected centers (Figure 14.7), a similarly high value of .89 is obtained. As can be clearly seen in Figure 14.8, Moundville's location generates the highest value of *E* within each group. We thus find that Moundville's location closely approximates the ideal predicted by our model, suggest-

TABLE 14.2
River Distances from Moundville to Selected Minor Centers

Site	Direction from Moundville	Distance along river in miles (km)
Gr-14	South	44.8(72.1)
Ha-7	South	18.7(30.1)
Tu-3	North	25.3(40.7)
Tu-44	North	8.3(13.4)
Tu-46	North	11.2(18.0)
Tu-56	North	28.4(45.7)

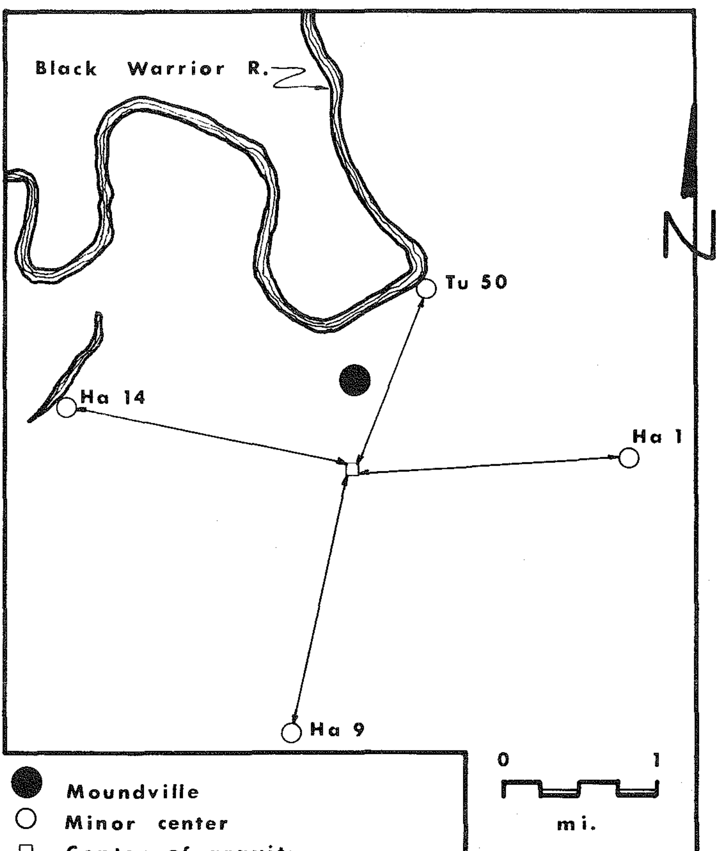


FIGURE 14.7. Moundville and its four nearest neighbors. The square denotes the center of gravity of the four minor centers in this group.

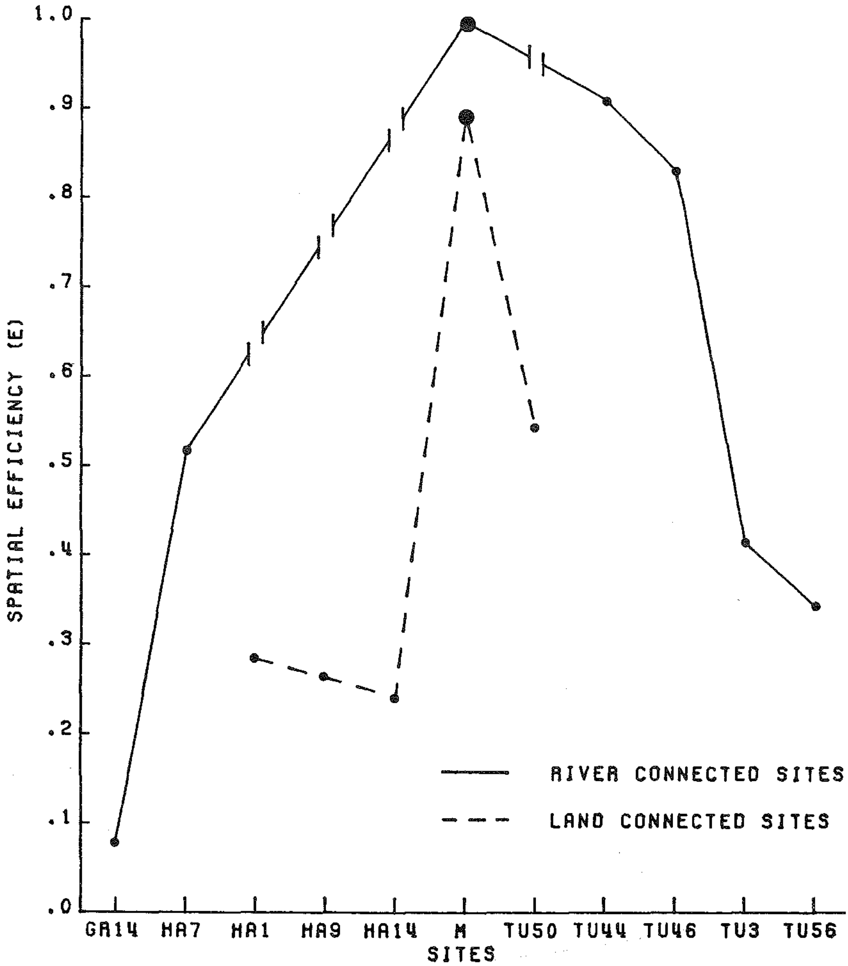


FIGURE 14.8. *The spatial efficiency (E) of the locations of Moundville phase chiefly centers, calculated separately for river and land connected sites. Note that Moundville has the highest spatial efficiency within each group.*

ing that minimization of movement costs between Moundville and the minor centers was an important factor influencing the spatial configuration of the Black Warrior system.

SPATIAL EFFICIENCY: THE MINOR CENTERS

In order to measure precisely the degree to which the locations of minor centers conform to the predicted ideal, we would require complete information on the boundaries of administrative districts, and on the distribution of population within them. Because data of this sort are not available in the case at hand, the model must be assessed with regard to its more general prediction that minor centers would have a tendency to cluster toward the capital. Such clustering does seem to have taken place in the Black Warrior system. Of the 10 minor centers, four have Moundville as a nearest neighbor (Table 14.3). This cluster, consisting of Ha 1, Ha 9, Ha 14, and Tu 50, can easily be seen in Figure 14.5. The mean distance between Moundville and each of the four surrounding centers is 2.4 km, whereas the mean nearest-neighbor distance for centers not in this cluster is 6.6 km.

It does not appear likely that the proximity of these four centers to Moundville can be explained with reference to the distribution of good agricultural soils within the valley. Based on data provided by Peebles (Table 13.6), an index of the mean agricultural productivity per acre was calculated for the lands within a 1-km (.6 mile) walk of each minor center (Table 14.4). The results are presented graphically in Figure 14.9. The average mean productivity per acre for sites within the cluster is 25.3 units, whereas that for the outlying sites is 33.8 units. The centers clustered around Moundville were generally located near poorer agricultural soils than the centers found elsewhere. Thus, our evidence is consistent with the notion that sociopolitical factors related to the minimization of movement were influencing the spatial distribution of the minor centers.

Departure from the Model: Flow of Tribute in Relation to Distance from Moundville

In initially formulating the model, it was assumed that the amount of tribute per capita being transported to the major center from each of the

TABLE 14.3
Nearest Neighbor Distance in Miles (Kilometers)

Site	Nearest neighbor	Straight-line distance in miles (km)
Gr-14	Ha-7	13.9(22.4)
Ha-1	Moundville	1.6(2.6)[a]
Ha-7	Ha-9	6.5(10.5)
Ha-9	Moundville	2.1(3.4)[a]
Ha-14	Moundville	1.7(2.7)[a]
Tu-3	Tu-56	1.7(2.7)[a]
Tu-44	Tu-46	1.9(3.1)
Tu-46	Tu-44	1.9(3.1)
Tu-50	Moundville	.5(.8)[a]
Tu-56	Tu-3	1.7(2.7)
Moundville	Tu-50	.5(.8)[a]

[a] Distances to Moundville are measured with respect to the nearest of the mounds surrounding its plaza.

TABLE 14.4
Catchment Productivity[a]

Site	Acres (ha) of arable land in Catchment (1 km walk)	Index of catchment productivity	Average productivity per acre
Tu-3	84(34)	3,535	42.1
Tu-44	303(123)	10,950	36.1
Tu-46	490(198)	13,240	27.0
Tu-56	380(154)	15,120	39.8
Ha-7	559(226)	19,458	34.8
Gr-14	328(133)	7,597.5	23.2
			μ = 33.8
Ha-1	723(293)	10,708	14.8
Ha-9	723(293)	11,913	16.5
Ha-14	541(219)	17,980	33.2
Tu-50	428(173)	15,640	36.5
			μ = 25.3

[a] Based on data presented by Peebles (Chapter 13).

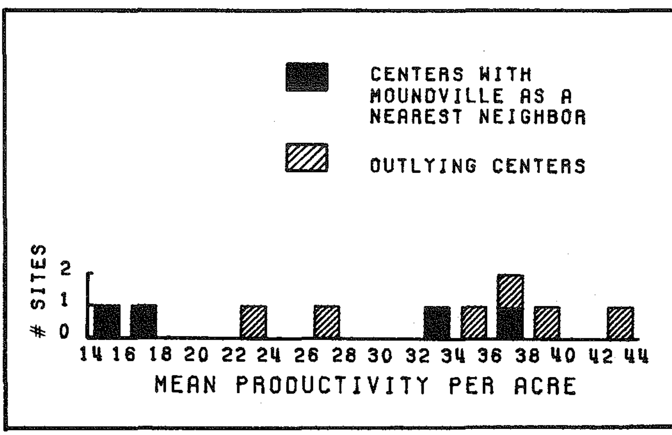


FIGURE 14.9. Histograms of minor centers showing mean productivity per acre of arable land within a 1-km walk of each site (the catchments of adjacent sites do not overlap). The four centers with Moundville as a nearest neighbor (dark squares) average 25.3 units per acre, whereas the outlying centers (hatched squares) average 33.8 units per acre. [Based on Table 14.4.].

minor centers was the same, in other words, that T_iP_i was constant for all i. There is reason to believe, however, that in some complex chiefdoms the per capita levy of tribute (T_i) might not be uniformly distributed among the various districts. For instance, Sahlins (1968:93) has pointed out that in Hawaii, "people near the paramount chief's court were most subject to its predation." Indeed, it would be logical to expect that in a large chiefdom, such would be the case. We have assumed that the cost of transport increases as do (*a*) the amount of goods being moved, and (*b*) the square of the distance. Remember also that the chiefs had to be concerned with staying within the "moral limit" of what effort the people were willing to expend on the nobility's behalf, otherwise being faced with the possibility of being deposed from office. Under such conditions, it is likely that the largest amounts of tribute would be demanded from the subordinate centers within a certain limited distance, beyond which transport costs (and the costs of enforcing compliance) would become too burdensome.

It is therefore possible that the minor centers closest to Moundville were supplying a greater amount of tribute per capita than those farther away. If we tentatively assume (for the sake of argument) that the population in each of the districts was approximately the same, this proposition can perhaps be tested archeologically in the following manner: The more surplus goods and corvee labor a minor center was forced to allocate to the purposes of the capital, the less would have been available for expenditure locally. Minor centers sending a disproportionately large share of tribute to Moundville would probably have had a severely curtailed ability to engage in mound construction. Thus, if the proposition were true, one would expect that the minor centers closest to Moundville would also have the smallest mounds.

Table 14.5 presents the available data on the sizes of the mounds at the minor centers. An index of the volume of earth used to build each mound

TABLE 14.5
Sizes of Mounds at Minor Centers[a]

Site	Date described	Basal length (L) in feet (m)	Basal width (W) in feet (m)	Height (H) in feet (m)	Index of size ($L \times W \times H$)
Gr-14	1905[b]	195(59.4)	150(45.7)	9.7(3.0)	283,725(8,144)
	1973[c]	159(48.5)	118(36.0)	9(2.7)	168,858(4,714)
Ha-1	1933[d]	70(21.3)	70(21.3)	8(2.4)	39,200(1,089)
Ha-7	1905[b]	129(39.3)	115(35.1)	13.5(4.1)	200,272(5,656)
Ha-9	1933[d]	20(6.1)	20(6.1)	6(1.8)	2,400(67)
Ha-14	1933[d]	78(23.8)	78(23.8)	5(1.5)	30,420(850)
Tu-44	1933[d]	98(29.9)	59(18.0)	4(1.2)	23,128(646)[f]
Tu-46	1933[d]	133(40.5)	100(30.5)	7(2.1)	93,100(2,594)
Tu-50	1933[d]	35(10.7)	35(10.7)	14.3(4.4)[e]	17,558(504)
Tu-56	1933[d]	190(58)	45(13.7)	11.5(3.5)[e]	98,325(2,781)

[a] Measurements are not available for the mound at Tu-3.
[b] Moore (1905:127).
[c] Nielsen *et al.* (1973:34).
[d] Site survey files, Mound State Monument, Moundville, Alabama.
[e] Where several different measurements of height were recorded, the mean is used.
[f] Field notes indicate this mound had probably been "flattened down for stock" in recent times.

is computed by multiplying its basal dimensions by its total height. Since these mounds were originally pyramidal rather than rectangular, and have undergone a considerable amount of erosion since the time they were being used, the index does not represent an exact measure of volume, but rather a figure that is proportional to the volume by some more or less constant factor. Thus, the index should accurately reflect the sizes of the mounds relative to one another.

Figure 14.10 shows the value of the index for each minor center arranged in order of increasing distance from Moundville. Clearly, the five

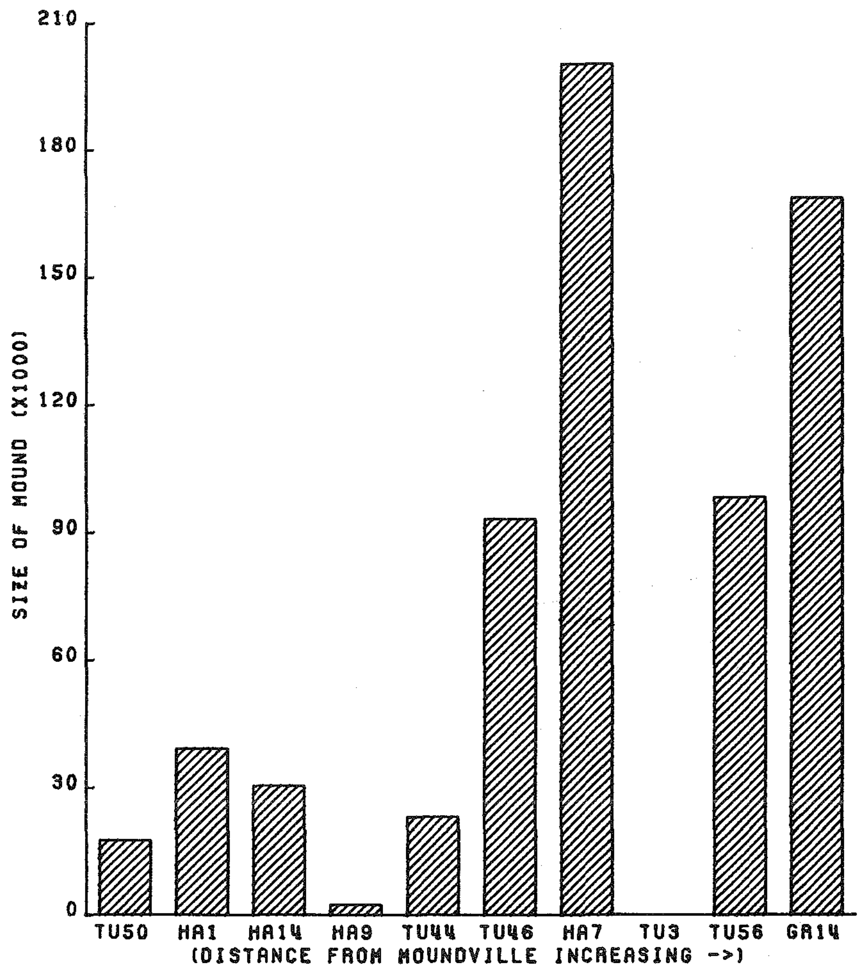


FIGURE 14.10. The relative sizes of the mounds at minor centers. Note that the sites nearest to Moundville (on the left side of the histogram) all have mounds that are comparatively small. [Based on Table 14.5.]

sites closest to Moundville have mounds significantly smaller than the sites farther away. This difference in size does not appear to have been dictated by differences in the natural productivity of the soils on which these sites were located. Figure 14.11 clearly indicates that mound size is not correlated either with the total productivity or with the mean productivity per acre of the land within a 1-km walk of the site. It thus appears possible that a major variable dictating mound size is the site's distance from Moundville, a result consistent with our tentative hypothesis that Moundville exacted the largest tribute from the minor centers closest at hand. Based on the range within which the smaller mounds occur, it appears that 14.5 river kilometers may have been the approximate distance beyond which continual large-scale movement of tribute was made impractical by the high costs of transport and/or enforcement. The observed differences in mound size may, of course, have been due to other factors such as differences in the size of locally available labor pools and/or different temporal spans of occupation. These questions, however, will only be

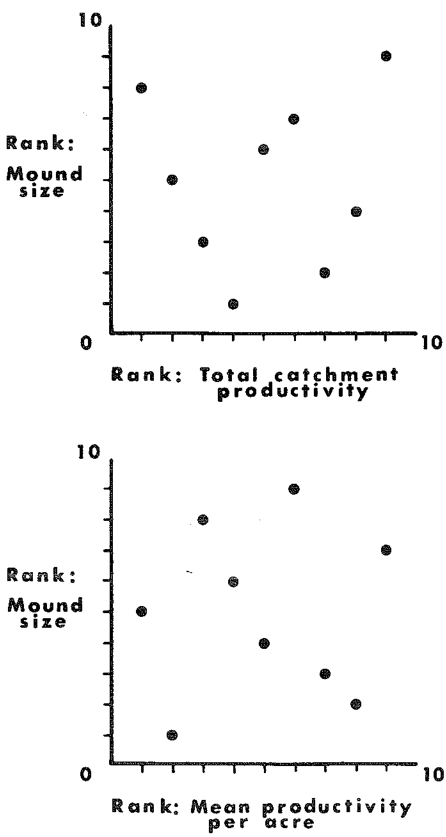


FIGURE 14.11. Scatter plots showing no rank correlation between mound size and (top) total productivity of 1-km Catchment; (bottom) mean productivity per acre of arable land in a 1-km catchment. Only the nine minor centers for which mound size is known are included. [Based on Table 14.5.]

resolved when further excavation at the minor centers and additional survey in the valley are undertaken.

Summary

In the preceding pages, I have discussed some of the sociopolitical relations in complex chiefdoms that link territorial units together, and the effects that these relations might have on the spacing and distribution of chiefly centers. A model expressing these relations was formalized, and was applied to settlement data from the Moundville phase of the Black Warrior River Valley. In a number of respects, the data were found to be consistent with the expectations generated by the model. It now remains for me to mention briefly some of the limitations of the model, probably already apparent to the reader, and certain possibilities it might present for future research.

Perhaps the greatest shortcoming of this model is that it does not take sufficiently many factors into account to be justifiably labeled "predictive." It considers the ideal location of centers only with regard to a fairly restricted set of sociopolitical variables, that is, the flow of tribute and administrative information. It takes no account of various other factors, which, in many cases, may also have a significant influence on the location of chiefly centers. For example, one such factor might be intensive warfare, which could cause the major center to be located as far as possible from the enemy frontier. Another might be interpolity alliance, which might influence the capital to be located where its direct access to major political centers elsewhere would be maximized. A third possibly relevant factor is "locational inertia," which refers to the fact that in some cases a political center, once firmly established, might tend to remain where it is even if changing circumstances render its location less than optimal.

Clearly, much more work needs to be done before the variables influencing chiefly settlement location are adequately understood. The utility of the model presented here lies in the fact that it provides us with a way to measure spatial efficiency objectively vis-à-vis a clearly defined and important set of internal political processes. To the extent that any empirical case deviates from this theoretical optimum, it is hoped that the investigator will be led to examine other variables and formulate better models which might help account for the observed divergence.

Appendix

To find the demographic center of gravity of the *i*th administrative district, begin by imposing a two dimensional grid over the distribution of sites. Any units of measurement can be used for this grid, even purely arbitrary ones. The coordinates of the DCG can then be calculated as follows:

$$x_i' = \frac{\sum_{j=1}^{J} x_{ij} p_{ij}}{\sum_{j=1}^{J} p_{ij}}, \tag{10}$$

$$y_i' = \frac{\sum_{j=1}^{J} y_{ij} p_{ij}}{\sum_{j=1}^{J} p_{ij}}, \tag{11}$$

where x_i', y_i' are the coordinates of the DCG in the ith district, x_{ij}, y_{ij} are the coordinates of the jth settlement in the ith district, and p_{ij} is the population of the jth settlement in the ith district.

In the preceding computations, the actual administrative center should not be counted as one of the J settlements. For a more extended discussion and a simple example of how these formulas are applied, see Massam (1972:5 or 1975:24ff).

Using the same two-dimensional grid, the coordinates of the ideal location for a minor center that pays tribute to a higher-order center can be calculated as follows:

$$x_i'' = \frac{t \sum_{j=1}^{J} x_{ij} p_{ij} + T_i x_c P_i}{t \sum_{j=1}^{J} p_{ij} + T_i P_i}, \tag{12}$$

$$y_i'' = \frac{t \sum_{j=1}^{J} y_{ij} p_{ij} + T_i y_c P_i}{t \sum_{j=1}^{J} p_{ij} + T_i P_i}, \tag{13}$$

where t is a constant proportional to the per capita rate of tribute flow from settlements to minor center (see page 432), T_i is proportional to the per capita rate of tribute flow from a minor center of the ith district to the capital (see page 432), x_i'', y_i'' are the coordinates of the ideal location for the minor center of the ith district, P_i is the total population of the ith district, and x_c, y_c are the coordinates of the capital or higher-order center. As in Eqs. (10) and (11), the actual minor center should not be included as one of the J settlements when computing x_i'' and y_i''.

To find the center of gravity of the minor centers (CGMC), a two-dimensional grid must once again be used (any units of measurement will suffice). The coordinates of the CGMC are computed as follows:

$$X' = \frac{\sum_{i=1}^{I} T_i\, x_i\, P_i}{\sum_{i=1}^{I} T_i P_i}, \tag{14}$$

$$Y' = \frac{\sum_{i=1}^{I} T_i\, y_i\, P_i}{\sum_{i=1}^{I} T_i P_i}, \tag{15}$$

where X', Y' are the coordinates of the CGMC, and x_i, y_i are the coordinates of the minor center in the ith district. Assuming, as we do in this chapter, that $T_i P_i$ is the same for all i, Eqs. (14) and (15) become equivalent to

$$X' = \frac{\sum_{i=1}^{I} x_i}{I}, \tag{16}$$

$$Y' = \frac{\sum_{i=1}^{I} y_i}{I}, \tag{17}$$

where I is the total number of subordinate minor centers. The coordinates of the capital and the population of its district should be excluded when calculating Eqs. (14)–(17).

Acknowledgments

I wish to thank the following individuals who critically read earlier drafts of this paper and provided many useful suggestions: John Alden, J.P. Brain, I.W. Brown, L. Cameron, W. Cowan, R.I. Ford, K.L. Hutterer, K.W. Kintigh, W. Macdonald, J. Marcus, D.F. Morse, J. Parsons, C.S. Peebles, B. Smith, W.R. Tobler, and H.T. Wright. Responsibility for the final product, or course, rests entirely with me. Thanks also go to W. Macdonald for preparing most of the illustrations, and to L. Cameron for typing the various drafts.

References

Berry, Brian J.L.
1967 *Geography of market centers and retail distribution.* Englewood Cliffs, New Jersey: Prentice-Hall.

Berry, Brian J.L., and A. Pred
1961 Central place studies: A bibliography of theory and applications. *Regional Science Research Institute, Bibliographic Series,* **I**.

Blanton, Richard
1976 Anthropological Studies of Cities. *Annual Review of Anthropology* **5**.

Brush, John E.
1953 The hierarchy of central places in southwestern Wisconsin. *Geographical Review* **43**:380–402.

Christaller, W.
1933 *Die Zentralen Orte in Süddeutschland.* Jena.
1966 *Central places in southern Germany.* C.W. Baskin, Translator. Englewood Cliffs, N.J.: Prentice-Hall.

DuPratz, M. LePage
1774 *The history of Louisiana.* (Reprinted 1972, Claitor's Publishing Division, Baton Rouge, La.)

Earle, Timothy K.
1973 Control hierarchies in the traditional irrigation economy of Halelea District of Kauai, Hawaii. Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.
1977 A reappraisal of redistribution: Complex Hawaiian chiefdoms. In *Exchange Systems in Prehistory,* edited by T.K. Earle and J.E. Ericson. New York: Academic Press. Pp. 213–227.

Emory, K.
1933 Stone remains in the Society Islands. *Bernice P. Bishop Museum Bulletin,* No. **116.** Honolulu.

Finney, B.
1966 Resource distribution and social structure in Tahiti. *Ethnology* **5**:80–86.

Firth, Raymond
1936 *We, the Tikopia.* London: Allen and Unwin.

Flannery, Kent V.
1972 The cultural evolution of civilizations. *Annual Review of Ecology and Systematics* **3**:399–426.

Fried, Morton H.
1967 *The evolution of political society.* New York: Random House.

Green, Roger C., Kaye Green, R.A. Rappaport, Ann Rappaport, and Janet M. Davidson
1967 Archaeology on the Island of Mo'orea, French Polynesia. *Anthropological Papers of the American Museum of Natural History* **51,** Part 2.

Haggett, Peter
1965 *Locational analysis in human geography.* London: Edward Arnold

Hammond, Norman
1974 The distribution of Late Classic Maya major ceremonial centers in the central area. In *Mesoamerican archaeology: New approaches*, edited by N. Hammond. London: Duckworth.

Hodder, I.R.
1972 Locational models and the study of Romano-British settlement. In *Models in archaeology*, edited by D. Clarke. London: Methuen. Pp. 887–910.

Johnson, Gregory
1972 A test of the utility of central place theory in archaeology. In *Man, Settlement, and Urbanism,* edited by P. Ucko, R. Tringham, and G. Dimbley. London: Duckworth. Pp. 769–786.
1975 Locational analysis and the investigation of Uruk local exchange systems. In *Ancient civilization and trade,* edited by J. Sabloff and C.C. Lamberg–Karlovsky. Albuquerque: University of New Mexico Press. Pp. 285–339.

Kirchhoff, Paul
1955 The principles of clanship in human society. *Davidson Anthropological Journal* **1**:1–10.

Lafferty, Robert H.
1976 Kincaid and other Mississippian sites: A central place perspective. Paper read at the 41st annual meeting of the Society of American Archaeology, St. Louis.

Marcus, Joyce
1973 Territorial organization of the Lowland Classic Maya. *Science* **180**:911–916.
1976 *Emblem and state in the Classic Maya Lowlands: An epigraphic approach to territorial organization.* Washington D.C.: Dumbarton Oaks.

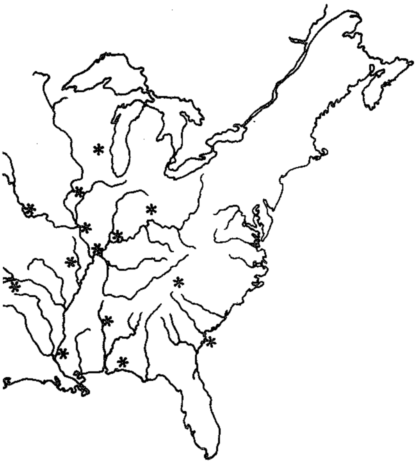
Massam, Bryan H.
1972 The spatial structure of administrative systems. *Commission on College Geography Resource Paper* No. 12.
1975 *Location and space in social administration.* New York: Wiley.

McWilliams, Richard Gaillard
1953 *Fleur de Lys and Calumet: Being the Penicaut narrative of French adventure in Louisiana.* Baton Rouge: Louisiana State University Press.

Moore, Clarence B.
1905 Certain aboriginal remains of the Black Warrior River. *Journal of the Academy of Natural Sciences of Philadelphia,* **13.**

Neitzel, Robert S.
1965 Archaeology of the Fatherland site: The Grand Village of the Natchez. *Anthropological Papers of the American Museum of Natural History* **51,** Part 1.
Nielsen, Jerry, John W. O'Hear, and Charles W. Moorehead
1973 An archaeological survey of Hale and Greene Counties, Alabama. Final Report to the Alabama Historical Commission for Contract AHC 52472. University of Alabama: University Museums.
Oliver, Douglas L.
1974 *Ancient Tahitian Society.* Honolulu: University Press of Hawaii.
Peebles, Christopher S.
1971 Moundville and surrounding sites: Some structural considerations of mortuary practices II. *Memoirs of the Society for American Archaeology* **25**:68–91.
1974 Moundville: The organization of a prehistoric community and culture. Ph.D. dissertation, Department of Anthropology, University of California, Santa Barbara.
Peebles, Christopher S., and Susan Kus
1977 Some archaeological correlates of ranked societies. *American Antiquity* **42**:421–448.
Sahlins, Marshall D.
1958 *Social Stratification in Polynesia.* Seattle: University of Washington Press.
1963 Poor man, rich man, big man, chief: Political types in Melanesia and Polynesia. *Comparative Studies in Society and History* **5**:285–303.
1968 *Tribesmen.* Englewood Cliffs, New Jersey: Prentice-Hall.
1972 *Stone age economics.* Chicago: Aldine.
Service, Elman R.
1962 *Primitive social organization.* New York: Random House.
1975 *Origins of the State and civilization.* New York: W.W. Norton.
Smith, Carol A.
1974 Economics of marketing systems: Models from economic geography. *Annual Review of Anthropology* **3**:167–202.
Swanton, John R.
1911 Indian tribes of the lower Mississippi Valley and adjacent coast of the Gulf of Mexico. *Bureau of American Ethnology Bulletin* **43**.
Thwaites, Reuben Gold
1900 *The Jesuit relations and allied documents,* Vol. 68.
White, Douglas, R., George P. Murdock, and Richard Scaglion
1971 Natchez class and rank reconsidered. *Ethnology* **10**:369–388.

[Note: Errors that appeared in the published versions of Eqs. (12), (14), and (15) on page 450 have been corrected here.]



Mississippian Settlement Patterns

Edited by
BRUCE D. SMITH
Department of Anthropology
National Museum of Natural History
Smithsonian Institution
Washington, D. C.

With a Foreword by
JAMES B. GRIFFIN

ACADEMIC PRESS
New York San Francisco London
A Subsidiary of Harcourt Brace Jovanovich, Publishers