# SALT AS AN ECOLOGICAL FACTOR IN THE PREHISTORY OF THE SOUTHEASTERN UNITED STATES

by

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This thesis assesses the importance of salt in the subsistence patterns of each of the major cultural traditions of Southeastern prehistory. Historical references and archeological and ethnographic data were used to reconstruct the methods and material culture involved in salt extraction. The distribution of salt sources is plotted.

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# PREFACE

In November of 1967, during a brief visit to Avery Island, Louisiana, one of the more famous salt domes of the Gulf coast, I was impressed both with this topographic form and with the possibility that salt could have been a well-known resource to the aboriginal peoples of America. Later, my interest was renewed by references to the existence of a Mississippian vessel form, "salt pan pottery," which is supposedly associated with the evaporation of saline water to obtain salt. In further reading, I encountered a great deal of very scattered information which I felt could be assembled to give at least a partial picture of aboriginal salt utilization in the southeastern United States.

## ILLUSTRATIONS AND TABLES

# CHAPTER I

# INTRODUCTION

## The Importance of Salt to Human Subsistence and Culture

Fundamentally every culture must provide patterns of behavior which function to enable the people possessing them to survive and reproduce. The concepts of cultural ecology include the role that culture plays in the adaptation of human groups to their environments. Three aspects of man's relationship to environment are involved: first the relationship of the human community to the inorganic environment; second to the plants and animals upon which it depends; and third the interrelationship between human communities. All these factors interact to form a total web of life which supports a human group.

Archeologists have increasingly paid attention to the interaction of prehistoric cultures with their environments. The ecological setting, especially the resources available for subsistence, can usually be reconstructed by the archeologist.

The importance of salt as a resource of environment has generally been neglected by anthropologists and archeologists (Gilmore 1955:1015). Salt is involved in all three aspects of man's relationship to his environment.

First, salt is a product of the inorganic environment and technological methods for its extraction have to be devised. Second, the need for salt, as will be shown, is related to the percentage of animal and plant foods in the diet. Third, the physiological necessity for salt created by a primarily vegetarian diet made salt an item which was traded out of regions in which it was found, thus stimulating the formation of links between human communities.

In all parts of the world, man's quest for salt extends beyond recorded history. Throughout recorded history, a great deal of effort has been expended in its procurement (Kaufmann 1960:4). This interest is no accident, as sodium chloride is essential in the nutrition and physiological processes of all animals (Dauphinee 1960:382). Consciously or unconsciously, all humans must ingest, on a more or less continual basis, a certain amount of sodium chloride in order to live.

Of the basic necessities of life, salt is unique because of the relatively limited number of areas from which it may be obtained. Compared to other resources of environment, salt comes from few places. Gilmore (1955:1014) emphasizes that the need for salt, coupled with its limited distribution, plays a very important role in preventing the isolation of otherwise economically self-sufficient local groups. Salt has been universally the most handled item of trade. As evidenced by numerous accounts from the early contact period, the southeastern United States was no exception (Driver 1961:237).

Locations of ancient civilizations are correlated with the occurence of salt. Available salt was an important factor in the rise of civilizations in the Nile, Tigris-Euphrates, and Yellow River Valleys. In the New World, the same was true in the Valley of Mexico and Peru. Control of the sources of salt by rulers of rising civilizations enabled them to exert powerful economic and social influence (Bloch 1963).

In North America, although not an area of major civilizations, salt resources were important to prehistoric peoples. In the Eastern Woodlands, salt was especially important to Mississippian groups, whose diets were vegetarian to a greater extent than had been the case with earlier cultural traditions (Caldwell 1950:ix). Black (1967:580), in discussing the ecology of the Middle Mississippian Angel Site in the Ohio River Valley, observes that the availability of mineral salt was a contributing factor to population increase and cultural advancement.

## Sources of Information and Delineation of Area Under Discussion

This thesis will combine information from archeology, geology, ethnography, history, and human physiology to obtain a picture of salt utilization by the aboriginal occupants of the southeastern United States.

Mapping the locations of salt sources provides some idea of the direction it may have moved in its redistributions. The major salt-bearing strata, which are the ultimate sources of inland salt, have their genesis far in the geologic past.

It is likely that the major areas of salt availability remained essentially the same from the time of the first human occupation of the East. This assumption is given strength by the association of extinct animals with inland salt sources.

The literature of geology is helpful, especially early economic surveys of mineral resources of the states involved. In reconstructing the utilization of environment, judgment must be exercised as to whether a resource was available to cultures with a more limited technology than our own. Many of the salt-bearing strata lie thousands of feet under the ground and are known only from drilling records.

Historical accounts and archeological data suggest that salt sources very close to the ground surface, especially salt springs, were the only ones readily accessible to prehistoric groups. Colonial and pioneer accounts are useful because the first European settlers, in moving into a region, immediately took over the salt-producing areas of the Indians, using identical procedures of procurement, but substituting iron pots for pottery (Clark 1938; Lippincott 1912). Early accounts sometime mention which Indian groups were involved in making salt.

In addition to plotting the location of sources, this thesis will outline the processes and items of material culture involved in salt extraction. Information on this aspect can be obtained from ethnographic description and from the limited amount of archeological work that has been done on salt spring sites. A striking fact about salt technology is

that it is basically the same throughout the world (Forbes 1954:257; Bloch 1954:92-93). Perhaps something about the nature of the raw material and the ultimate responses of the human brain to the properties involved (Harrison 1954:75), combined with the necessity of obtaining salt, has led to the invention of virtually identical procedures. Hopefully this paper will contribute to the understanding of the evolution of the processes of utilizing environment and of the material correlates of such utilization.

The area of this study will include the southeastern United States, plus some additional area to the north and west. Some of the area north of the Ohio River and west of the Mississippi will be included. The boundaries of the area to the east and south are set by the Atlantic and Gulf coasts. To the north the limits of recorded salt utilization occur just north of the Ohio Valley. This boundary was influenced by dietary and climatic factors which will be explained in more detail. By far the more arbitrary boundary is the western one. The present states of Louisiana and Arkansas have been included because this region has an abundance of salt which was redistributed overland to the east and along the Mississippi Valley.

The states and portions of states covered are:

1) Alabama
2) southern Arkansas
3) Georgia
4) southern Illinois
5) southern Indiana
6) Kentucky
7) Louisiana
8) Mississippi
9) eastern Missouri

10) North Carolina
11) southern Ohio
12) South Carolina
13) Tennessee
14) Virginia
15) West Virginia

# CHAPTER II

## THE PHYSIOLOGICAL BASIS

### The Functions of Sodium Chloride in the Body and the Effects of Salt Depletion

Sodium chloride is the major inorganic constituent of the body.

The amount of sodium chloride in an individual organism is in relative proportion to body size. Among the vertebrates, the proportion of salt to body weight remains remarkably constant, a reflection of the common origin of vertebrates from marine-environment ancestors (Dauphinee 1960:389).

Salt does not remain in the body as the compound sodium chloride, but is ionized into sodium ($Na^+$) and chloride ($Cl^-$) ions. By far the most common and easily obtainable source for these ions is ingested mineral salt.

NaCl is important in regulation of the pressure of the body's liquids and in the general maintenance of a suitable environment for the body tissues. As an abundant substance in the extracellular fluids, constituting over half of the inorganic salt present in the blood plasma, dissolved NaCl is the source of practically all electrolytic osmotic pressure exerted by these fluids and is therefore intimately concerned with control of the volume of interstitial fluids and of the water content of tissue cells. It is involved

in the maintenance of the volume and pressure of circulating blood and with other activities having to do with the regulation of the total amount and distribution of body water (Dauphinee 1960:391).

The concentration of salt in the bodily fluids is maintained in normal persons by the activities of the kidneys, within remarkably narrow limits. If the salt concentration of the body fluids falls, especially in the blood, the body compensates by reducing the excretion of salt in the urine. However this excretion can not be reduced to zero and if more salt is not ingested, the body then attempts to adjust by accelerating its secretion of water to maintain the blood's salt concentration at the vital level (Bloch 1963:89).

Other functions are concerned with the regulation of acid-base balance and hydrogen ion concentration of the body fluids. Sodium and chloride ions are associated, in a vaguely understood way, with the various vital processes involved with the maintenance of the correct relative concentration of sodium, potassium, calcium, magnesium, and other ions of extreme importance to normal physiological activity (Dauphinee 1960:391).

Clinical studies of the effects of salt depletion show that anyone who is deprived of salt can be a very sick person. The symptoms are:

1) Loss of Weight. The facial and other features lose their fulness.

2) General lassitude and tiredness accompanied by evidence of

muscular weakness.

3) Loss of appetite. Food loses its flavor and nausea is common.

4) The body suffers from fluid depletion because the excretion of fluids is increased to keep the salt level of the blood constant. However thirst is absent and fluids which are taken are vomited immediately.

5) Painful and severe muscle spasms. These are especially painful when the abdominal muscles are involved.

If the symptoms are allowed to persist, the victim may eventually go into "heat shock," which resembles other situations such as severe bleeding, when a reduction of the body fluids is involved. Heat shock is characterized by weakness, nausea, restlessness, increasing pulse rate and falling blood pressure. If fully developed the patient becomes very weak, his skin cold and clammy, and his complexion takes on an ashen color. A description of actual death from salt depletion is unknown, as no experiment has been carried that far under controlled conditions (Dauphinee 1960:422).

The chroniclers of the De Soto expedition were the first to report about lack of salt in some areas of the Southeast. Their accounts are also interesting for the vivid descriptions given of the suffering which they attributed to lack of salt. Drawn to the region by the hopes of finding gold and other riches, their wishes soon turned to more mundane minerals:

> There was such want of meat and salt that oftentimes, in many places, a sick man had nothing for his nourishment, and was wasted away to bone, of some ail that might have found a remedy; and would die of pure debility, saying; Now,

if I had but a slice of meat, or only a few lumps of salt, I should not thus die (Elvas in Lewis 1907:167-168).

Garcilaso de la Vega (Varner and Varner translation 1951:421-422) gives a vivid description of the death of some of the expedition members who supposedly died from lack of salt. As his tale is second-hand, it probably should be taken with a grain of salt. The Spanish were living by plundering the country-side as they moved along, meaning that their diets consisted mostly of corn. Vegetable diet and salt depletion from sweating, combined with the harsh conditions of a continuous march through a strange environment, could have weakened them to the point of making them susceptible to other diseases:

> You must know that when our Spaniards left the vast province of Coza and entered that of Tascaluza, they possessed no salt, and when they had traveled some days without it, their suffering was such that it became an absolute necessity. Some of those whose constitutions must have demanded salt more than others died a most unusual death for lack of it. They were seized with a very slow fever, on the third or fourth day of which there was no one who at fifty feet could endure the stench of their bodies, it being more offensive than that of the carcasses of dogs or cats. Thus they perished without remedy, for they were ignorant as to what their malady might be or what could be done for them since they had neither physicians nor medicines. And it was believed that they could not have benefited from such had they possessed them because from the moment they felt the first fever, their bodies were already in a state of decomposition. Indeed, from the chest down, their bellies and intestines were as green as grass.
>
> In this manner they commenced to die, to the great horror and consternation of their companions, many of whom out of fear now began to employ a remedy which the natives concocted to succour themselves in this same necessity. First they would burn a certain herb of which they knew, and from its ashes make a lye that served as a sauce in which to moisten what they ate. With this concoction they saved themselves from rotting to death as the Spaniards were doing.
>
> More than sixty Spaniards died in this manner during the time they lacked salt, which was almost a year.

The Spaniards were considerably relieved when they finally arrived in areas which they called "salt provinces." The locations of these areas will be discussed in further detail in Chapter IV.

## Diet and the Need for Salt

About one hundred years ago, Bunge (Dastre 1901:563) suggested that the craving for salt may be related to the subsistence base of a people. He argued that people such as the Eskimo, who lived primarily on animal products, had little desire for salt. People in settled agricultural communities, who lived mainly on grains and vegetables, had a great craving and physiological necessity for salt. He presented, to support his point, a cross-cultural survey of the use of salt by groups with different subsistence bases. His hypothesis of a correlation between salt use and vegetarian diet has stood up to the present day (Dauphinee 1960:412). The amount of salt needed by each human group would depend on the relative proportion of animal to vegetable food in the diet.

Analyses of animal and vegetable foods have shown that the former contain much more sodium chloride than do the latter. As a rule, the sodium content of seeds and fruits of plants such as the cereals, legumes, and nuts is very low. Corn at best has only 2 milligrams / 100 grams; beans 1 milligram / 100 grams; and nuts 3 milligrams / 100 grams. On the other hand, beef contains 70 milligrams / 100 grams; turkey 65 milligrams / 100 grams; and fish 50-60 milligrams / 100 grams (Dauphinee 1960:402-405).

Estimates vary as to how much sodium chloride humans must consume to maintain health. Dauphinee (1960:415) estimates that the normal daily intake of salt required for adult individuals living in a temperate climate is about six grams, if the diet is primarily a vegetarian one. Bloch (1963:89) estimates that a need of 2 to 5 grams daily exists in parts of the world where meat is scarce and the diet is primarily vegetable. A much lower estimate of 0.7 ± 0.2 grams daily is arrived at by Keslin (1964:11), who summarized the information from a number of clinical studies of sodium-restricted diets. The sodium-restricted diets consisted primarily of rice, fruit, and sugar.

Using Dauphinee's estimated daily requirement of six grams, even meat-eating people would probably require supplementary salt, as their intake of meat would have to be very high to gain the needed salt. For a vegetarian, obtaining this amount of salt totally from diet would require the consumption of impossible quantities of food. Even using Keslin's low estimate of 0.7 ± 0.2 grams daily, a vegetarian would have to eat 154 pounds of corn, beans, and squash (these three plants have approximately the same sodium content) to obtain this much salt. The same requirement could be filled by the consumption of 1.5 pounds of raw meat. Keslin feels that 2-4 pounds of meat a day for people living on animal foods would not be an unreasonable amount to consume.

The need for salt is also influenced by climate. In warmer regions, salt may be very rapidly lost through sweat-

ing. While salt passing through the kidneys may be filtered out and stored if the blood's salt level is low, the body has very little control over salt content of sweat. The loss of salt through sweating can be very high under hot, humid conditions. Some investigators have recorded losses by sweating as high as five liters of liquid containing more than twenty-five grams of salt in individuals exercising vigouously in a hot humid atmosphere for just three hours. Dauphinee (1960:407) states that as much as ten to fifteen liters of sweat containing fifteen to thirty grams of salt may be lost by workmen in an eight-hour day. The amount of salt loss and sweating is usually reduced in individuals acclimatized to an area (Dauphinee 1960:416).

In North America a survey by Hunter (1940) revealed very little use of salt among people of the eastern Woodlands, north of the Delawares. Hunter (1940:18) attributes this phenomenon to a diet which included a good balance between vegetable and animal foods. A map constructed by Driver (1961:73) shows the limit of recorded salt use by ethnographic cultures occurring just north of the Ohio Valley. He attributes the position of the boundary both to diet and to cooler climate.

Gilmore (1955:1014) suggests that the "custom" of using salt is primarily culturally acquired, although he notes the resistance of most peoples who use it to doing without it or accepting a substitute. The amount of salt used can be varied according to cultural preference and availability. The present-day population of the United States consumes salt far beyond

minimum needs. Among some American Indian groups, the Cherokee for example, salt seems to have acquired greater importance and wider use after European contact, suggesting a greater consumption conditioned by acculturation (Hunter 1940:48). The human tongue contains special taste buds for the salty flavor, which Dauphinee (1960:399) suggests is an adaptive characteristic which makes the flavor pleasant to most humans and guarantees that it will be sought in sufficient amounts. In summary, it might be said that the craving for salt depends both on cultural conditioning and physiological need.

Diet and Salt Needs in Southeastern Prehistory

The proportion of animal food to vegetable food is difficult to determine for prehistoric groups. Such information could be obtained only from detailed analyses of material from individual sites. Quantitative information about the proportions of types of foods for each cultural tradition is as yet lacking in Southeastern prehistory. The total picture of these proportions is distorted by the fact that plant material is much less likely to be preserved than is the bone and shell that are indicative of the fauna used by a people. However, enough is known about the general shift over time in subsistence to attempt to obtain at least a general picture of how important deliberate procurement of salt would have been, given the major types of dietary patterns thought to be involved in Southeastern prehistory.

In the earliest cultural tradition, that of Big-Game Hunter (Willey 1966:37), very little is known about the diet,

except that the hunting of large game animals was important. Although it is unlikely that diet consisted totally of animal food, the meat of large game animals was probably of great importance. The conscious seeking of salt and devising methods of procuring it were probably unnecessary.

However, in another respect, the presence of salt licks and inland salt sources was likely to have been of extreme importance to the subsistence of these early hunters. Salt licks attract animals from miles around. These areas would have been natural hunting and ambush spots. Just as is the case with man, sodium chloride is necessary for animals according to the type of food on which they depend. Carnivores secure sufficient salt from consumption of flesh and blood (Bell 1960:454-458). The Herbivors, such as buffalo and deer, need supplements and are attracted to areas where salt can be obtained (Dauphinee 1960:397).

In the eastern United States, the attraction of animals to surface salt sources is often evidenced by a remarkable concentration of animal bone of both modern and extinct forms.

The Big Bone Lick in Boone County, Kentucky, is a notable example, which obtained its name for obvious reasons:

> Not only do we find the bones of animals which occupied the country when the whites first came to it--the buffalo, the elk, the deer, etc.--but also deeper in the mire or in portions that indicates greater antiquity, great quantities of bones of fossil mastodon, the musk ox, an extinct long-legged buffalo, the caribou or American reindeer and various other creatures . . . (Super 1904:252)

For the same state, Filson, (1784:32) comments on the

licks and the impressive attraction they held for game:

> The Noblick, and many other, do not produce water but consist of clay mixed with salt particles. To these the cattle repair and reduce high hills rather to valleys than plains. The amazing herds of Buffalo which resort thither by their size and number, fill the traveller with amazement and terror, especially when he beholds the prodigious roads they have made from all quarters, as if leading to some populous city; the vast space of land around the springs desolated as if by ravaging enemy. . . .

Around salt springs in Jackson County, Ohio, Stout (1932:11) notes the abundant presence of the remains of mastodon, mammoth, and elephant, as well as modern bison, elk, deer, and bear. Bownocker (1906:9) reports that on the well-beaten path converging on these same springs, the last buffalo in Ohio were spotted in 1802. Faunal remains are abundant on Avery Island, Louisiana, a salt dome with surface springs (Arata 1964:69). The clustering of animal bones around the salt springs of Jefferson County, Missouri, has also been noted (Adams 1949).

The clustering of animals around these saline springs could also have exerted an effect on the distribution of the human population dependent on them. The sources of salt were probably known from the first human occupation of the Southeast and were an intimate part of the ecology from the earliest times. Later, as they acquired importance as sources for deliberate production of salt, there was no need to "rediscover" them, as knowledge and utilization of the areas for hunting purposes had been continuous.

Clark (1938:42) notes that the pioneer roads of the early settlers of Kentucky were to a great degree influenced

by the well-defined trails connecting salt sources and that these were beaten down by "salt-hungry" animals. Assuming the sources of salt remained the same for thousands of years, these trails could have existed at least that long and could have been put to use by the earliest human inhabitants. By historic contact times, the major trails were greatly influenced by animal trails leading to salt sources (Myer 1928).

With climatic change and the extinction of large game came a gradual shift to greater reliance on plant foods and smaller animals, leading to the development of the Archaic tradition. In some cases, for example the shellfish users of the Tennessee River Valley, animal foods may have remained a fair proportion of the diet. Greater efficiency in the use of forest products and the means of obtaining them were developed during this period (Caldwell 1950:vii). It is difficult to make any inferences regarding how important the direct procurement of salt may have been to Archaic peoples. Gagliano (1964:64) notes the high frequency of use of exotic stone in the Archaic artifacts of Avery Island. He suggests that salt could have been traded in return for imperishable items of stone. He also suggests that salt could have become an important item of trade by Poverty Point times.

The Woodland tradition is marked by the rise of Adena and Hopewell, the first distinctive and fairly complex cultures of the area (Willey 1966:267). Some evidence exists that Hopewellian peoples cultivated maize and some other plants, but it is still a matter of debate as to how important they

were to total subsistence. Caldwell (1950:vii) feels that dependence on hunting and gathering patterns was still most important. In the salt springs in Missouri investigated by Keslin (1964:74), a Woodland component underlay a Mississippian one. The same was true for a salt springs site in Alabama. Whether or not the Woodland occupants of these sites were making salt is open to question. It does not seem improbable that they could have been boiling the saline water to obtain crystalline salt, but definite evidence is lacking.

The Mississippian tradition is distinguished by major changes in the subsistence pattern, occasioned by the introduction of new food crops, especially corn, from Mesoamerica. The density of living refuse and larger public works indicate a stable population of much greater size than was possible earlier. In all likelihood, the diet was based more on these cultivated vegetable foods, with meat becoming a supplement. With the increase in human population, it is unlikely that the animal population also increased. Intensive agriculture combined with a de-emphasis on hunting, could have led to a much smaller per capita consumption of animal products (Keslin 1964:13). From the establishment of the Mississippian subsistence pattern to well after the European contact period, there is much evidence that salt was a needed and sought-after mineral. Additional salt had become a physiological necessity and the cultural means of procuring it had been devised.

## CHAPTER III

## THE GEOLOGY OF SALT DEPOSITS

Salt occurs naturally either in solution or dry forms. Landes (1960:29) classifies its occurrences in this manner:

| | |
|---|---|
| I. Salt in solution | II. Dry deposits |
| (a) ocean water | (a) playa salts |
| (b) lake water | (b) bedded salts |
| (c) ground water | (c) flowage salts |

Playas and saline lakes, as geomorphic features, are correlated with special conditions surrounding restricted bodies of water in arid and semi-arid climates.

In the eastern United States, inland surface salt sources are ultimately supplied by extensive underground salt deposits. As an extremely soluble mineral, salt does not occur in surface outcrops in the humid Southeast. The salt is normally brought to the surface in the form of brines where the strata of salt-bearing rock have become disturbed, usually be faulting. The brine may be from the solution of bedded salt strata by ground water or from the mixture of ground water with connate water.

Salt-bearing strata were formed at various times in the past, when extensive shallow inland seas covered portions of the eastern United States. When these seas became restricted from the main oceans and the climate was more arid than the present, conditions were favorable to the extensive de-

position of sodium chloride and other salts (Landes 1960:57). The salt may have been deposited in crystalline form, or it may have been trapped in the interstices of other clastic sediments such as sandstone and shale. Trapped supersaline brines are known as connate water.

In the eastern United States there are two areas underlain by extensive salt deposits. The Eastern Salt Basin or Salina Basin underlies Michigan, Ontario, Ohio, Pennsylvania, and New York. The bedded salt of the states of Kentucky, Tennessee, West Virginia, and Virginia are thought to be related to those of the Michigan Basin and may represent the fluctuating margins of the larger basin or several smaller regional depositions. The salt of the Eastern Basin is primarily Silurian and Devonian in age. The second major area is the Gulf of Mexico Salt Basin, Jurassic in age, with its northern rim beneath the Gulf Coastal Plain of Alabama, Mississippi, Louisiana, Arkansas, and Texas. The Basin extends south to the Isthumus of Tehuantepec and the Yucatan peninsula and includes the deposits important to Mesoamerican civilizations. Salt domes, believed to be created by the flowage of bedded salt under pressure, are distinctive of the Gulf Basin (Landes 1960:41).

The area of concern in this study will include the southern margins of the Eastern Salt Basin and the northeastern areas of the Gulf of Mexico Salt Basin. In addition, salt occurs locally in a few places where it does not seem to be related to these larger structures.

All areas along the sea coasts are potential regions for making salt. However, the concentration of salt in sea water is very low compared to that of some of the inland springs. Sea water would have yielded the least amount of salt for the effort spent.

# CHAPTER IV

# LOCATIONS OF SALT SOURCES

## Introduction

The general areas of occurrence having been outlined in Chapter III, the following pages will be devoted to a more detailed description of locations using information obtained from geology reports and historic accounts. A discussion of the archeological remains around these areas is reserved for Chapter VIII.

## Alabama

Drilling for petroleum has revealed that salt-bearing strata of the Gulf Salt Basin extend into Cleburne, Greene, Jefferson, Lawrence, Marion, and Perry Counties in western Alabama. However, surface springs occur only in Choctow, Clarke, and Washington Counties, where the salt strata have been disturbed by the Hatchetigbee anticline, which, in turn, is crossed by the Jackson fault. The salt springs surface along the plane of the fault (Barkesdale 1929:8). Two springs in Clarke County, ten miles south of the town of Jackson, show evidence of having been used extensively by Mississippian and Woodland groups.

The Spanish complained that there was no salt in the provinces of Coza and Tascaluza (Garcilasco de la Vega, Varner

and Varner translation 1951:421-422). These provinces would have been located in central and northern Alabama. Swanton (1946:303), in surveying sources of salt along the Gulf Coast between Florida and the Mississippi River, finds only one aboriginally known source other than the sea. This was the salt springs of Clarke County, Alabama.

## Arkansas

South central Arkansas lies within the northern boundaries of the Gulf Salt Basin. Drilling in the Smackover oil field of Bradley, Calhoun, Union, and Ouachita Counties reveals an anticlinal structure resting unconformably on a salt series, probably indicative of a salt dome (Spooner 1932:603). These deposits supplied the salt provinces reported in the De Soto narratives.

After a long time in traveling through Georgia, Alabama and Mississippi without any salt, in 1541 the De Soto expedition finally arrived in the province of Pacha, placed by Swanton (1946:300) somewhere north of Helena, Arkansas. Here the Spaniards obtained some information as to the possibility of getting salt:

> Seeing the great necessity for salt that his people were experiencing for they were dying for lack of it, the Adelanto made thorough inquiries of the curacas of their Indians in that province of Cahpaha in order to learn where he could get some. In the course of this questioning, he found eight Indians in the hands of the Spaniards, who had been captured when they entered that pueblo, and were not native of it, but strangers and merchants who had traveled many provinces with their goods, and among other things they were accustomed to bring salt to sell. Being brought before the governor they told him that in some mountains forty leagues away there was a great deal of very good salt, and to the repeated

> question they asked them they replied that there was also metal which they asked for (Garcilaso, Varner and Varner translation 1951:450).

De Soto dispatched two Spaniards to go along with the merchants to check the story out. They returned in eleven days "with six loads of rock salt crystals, not made artificially but found in this state" (Swanton 1947:300). The source of this salt is problematical. It may have come from the salt springs of southern Arkansas, where the Caddo and Tunica were active in boiling salt from springs and trading it to other groups along the Mississippi (Swanton 1928: 690). The specific mention of rock salt is also of interest. Rock salt is usually massive, coarsely granular, and compact in appearance while salt obtained from evaporation of a liquid consists of tiny, single crystals (Ramsdell 1960:16). It is possible that the Spanish may have been able to tell the difference between the two forms. Swanton (1939:252) suggests that an old salt mine is located near Bald Knob, Arkansas. Another area where rock salt closely approaches the surface is in the region of salt domes along the Gulf coast. De Soto's men may well have obtained salt that was being traded up the Mississippi.

De Soto and his men followed the Arkansas River until they arrived near the site of the present day city of Little Rock. After plundering Coligua, the Indian town there, they turned to the southwest and marched until they reached Culpista, where there were salt springs. Swanton (1946:54) believes that these springs were near the present day town of

Benton, in Saline County, Arkansas. They continued in the southwesterly direction until they came to the River of Cayas, which was probably the present-day Ouachita River. Here they came to another "Province of Salt" and they observed the Indians making and trading it to other regions. Swanton (1946: 54) identifies this region with Salt Creek, a stream flowing into the Ouachita River near its bend above Arkadelphia.

## Georgia

Inland Georgia seems to have included one of the largest expanses of territory in the Southeast which had no salt (Lang 1957; Lefond 1969:102).

A survey of the mineral springs of Georgia (McCallie 1908:228) revealed only one spring with sodium chloride as the predominant dissolved solid. The spring was known to the Cherokees as a "deer lick" and was located near Lithia Springs Station, Douglas County.

## Illinois

Salt-bearing strata related to the Illinois Basin (Lang 1955:map) occur in Bond, Gallatin, Jackson, Madison, Marion, Randolph, and St. Clair Counties. Early settlers had salt works in all these counties (Lamar 1938:222-224; Lippincott 1919:1042).

The Illinois springs most important to the Indians appear to have been those along the Saline River in Gallatin County. In historic times an important Shawnee town was situated nearby, for the purpose of trade (Myer 1928:807). Black

(1967:581) feels that Gallatin County supplied the occupants of the Angel Site with their salt.

## Indiana

Harris (1960:337) mentions that saline springs occur in eleven counties but does not give the source of the information. Lefond (1969:102) lists Indiana as one of the eastern states which lacks salt deposits.

## Kentucky

The region encompassed by the present state of Kentucky contained salt springs and licks by the hundreds, surpassing even Louisiana in the number of sources. Although the brines are considered extremely weak (Lefond 1969:102), the white settlers still found the area particularly attractive both for making salt and for hunting (Clark 1938:42). Salt springs occur in Allen, Barren, Bath, Boone, Bourbon, Bullitt, Carter, Clark, Clay, Henry, Jackson, Jefferson, Knox, Letcher, Lewis, Mason, Nelson, Nicholas, Owen, Perry, Pike, Pulaski, Wayne, Webster, and Whitley Counties.

Some of the more prominent licks and springs which were definitely in aboriginal use were Big Bone Lick of Boone County; Upper and Lower Blue Licks of Nicholas County; Drennon's Lick, northern Henry County; and Mann Lick and Bullitt Lick at the mouth of the Salt River near the Jefferson and Bullitt County line (McFarlan 1943:429). Salt making was engaged in at a spring in Clay County near Manchester and a band of Shawnee were located at the spring near Winchester

in Clark County (Myer 1928:872).

## Louisiana

The salt reserves of Louisiana occur in two areas of the state: the salt springs of the north and the salt domes along the coast (Spooner 1929:269). Salt domes are great plugs of salt believed to be the result of flowage of bedded salt under pressure. When they reach the surface along the Gulf Coast, they create anticlinal sturctures averaging one hundred and fifty feet in height and one to four miles in diameter. Their height is often emphasized by the fact that many of the domes rise from sea level marshes and therefore appear as "islands." Besides their distinctive topographic manifestations, their presence may be indicated by saline prairies or salt licks at their centers, lakes without surface outlets, and mineralized springs (Thornbury 1958:212). Domes which are capped with massive anhydrite, gypsum, limestone, or dolomite are known only from drilling and have no surface salt springs. In north central Louisiana, salt springs occur along the east bank of the Red River. These salt-producing areas are supplied by interior salt domes associated with the east flank of the Sabine uplift. Salt domes further inland tend to have circular basins at their centers, which are enclosed by one or more rings of hills. The topography around Bistineau, King's, Price's, and Drake's salt works leads to the conclusion that these areas are inland salt domes (Spooner 1929:269).

The earliest accounts of the salines of northern

Louisiana come from the De Soto expedition. After coming south from the salt provinces of Arkansas, they again passed through a salt province which they recorded as the Province of Chaguate. About a month later they moved north to yet another salt province. Swanton (1946:57) identifies the former province (Chaguate) as being in the vicinity of Drake's salt works and the latter in the vicinity of Lake Bistineau. About 140 years later, the French found the Caddo, Tunica, Koroa, and Washita Indians of northern Louisiana busily engaged in boiling down salt and carrying it in trade to the tribes of the Mississippi, especially the Quapaw and the Taensa (Swanton 1929:301).

Moving from north to south along the Red River Valley, a brief account of the most important salines will be given. Veatch, a geologist who in 1902 surveyed the salines of both northern and southern Louisiana, made careful note of whether aboriginal use was made of the area, often devoting considerable description to the artifacts he observed. Some of his comments will be discussed in further detail under archeological information.

Bistineau Saline, near Lake Bistineau in south Webster Parish, was the northernmost of the important early salines. The area directly surrounding the colonial salt works was called Potter's Pond, due to the great accumulation of pottery on the surface (Veatch 1902:83; Swanton 1946:57).

In the southeastern corner of Bienville Parish, Bayou Castor Saline occurs near the present town of Saline. Veatch

(1902:83) notes that the amount of pottery around the area is much less than at other springs, which he attributes to the relative weakness of the brine. He suggests that the area was used more for hunting than salt making.

Spooner (1929:270) reports salt springs at Grand Bayou in Red River Parish but does not describe any aboriginal use of them.

A saline of major importance occurs at Saline Bayou on the line between Winn and Natchitoches Parishes. This saline, believed to be the one encountered by De Soto's party, was referred to by its later users as "Drake's Salt Works." The earliest reference made by the French to the trading of salt in this region is made by de Bienville in his journal on March 22, 1700:

> Four and a half leagues to the west from the Tensas we found some Ouachitas, with several pirogues loaded with salt (Quoted by Veatch 1902:53).

On March 29, 1700, after leaving the village of the Ouachitas and crossing the Red River to the village of the Natichitoches, de Bienville reported meeting "six Natchitoches who were going to the Coroas to sell salt" (Veatch 1902:53).

In 1758, Du Pratz (1763:149) also described this region:

> On the north side of the Riviere Rouge or Riviere des Natchitoches and pretty near the Natchitoches there is, as is said, a spring of water very salt, running only four leagues. This spring, as it comes out of the earth, forms a little river, which during the heats, leaves some salt on the banks.

A little later, Daniel Coxe reports a location on the River Natchitock, a hundred miles from the mouth, where the Indians made salt for themselves and for trade with neighbor-

ing nations (Veatch 1902:52).

Veatch gives a detailed description of pottery at Drake's Salt Works, which will be discussed at greater length.

Six miles north of Drake's Salt Works lies the area called Price's Salt Works. Veatch (1902:65) found no accumulation of pottery like that at Drake's, which he attributes to the saline being less conveniently located in relation to the river.

Spooner (1929:270) mentions salt springs at Brown Saline in southeastern Winn Parish but does not comment about aboriginal use.

The next area of major importance was Lake Catahoula in La Salle Parish. Du Pratz (1763:153) describes the area:

> When one has ascended Black River for about 30 leagues, he finds on the left a stream of saline water which comes from the west. Ascending this stream about two leagues, he comes upon a lake of salt, which is perhaps two leagues long by one wide. One league higher toward the north he comes upon another lake of salt water almost as long as the first and as wide. This water passes without doubt through some salt mines. It has salt taste without having the bitterness of sea water. The natives come to this place from considerable distances, to hunt during the winter and to make salt. Before the French sold them kettles they made earthern pots for this operation on the spot. When they have enough of a load, they return into their own country loaded with salt and dry meat.

West of the Red River, Phalen (1919:101) mentions salt springs occurring in the valley of the Sabine River in Sabine Parish near the present town of Negreet. They also occur near the town of Many in the same parish. No reference could be found to their pre-contact use.

In southern Louisiana, salt domes supply surface

springs and possibly may have furnished rock salt. Of the Five Islands of Iberia and St. Mary Parishes, salt lies within sixteen feet of the ground surface at Avery Island. Jefferson and Weeks Islands come next, with the salt there beginning at about one hundred feet below the surface (Landes 1960: 83).

Salt springs are found both at Belle Island and Avery Island, but only at Avery Island is there any evidence indicating aboriginal use of the salt (Gagliano 1964:62).

## Mississippi

Although the southern part of Mississippi lies well within the boundaries of the Gulf Salt Basin and is underlain by a number of structures which appear to be salt domes (Landes 1960), no references to surface salt sources were encountered. The Gulf Coast east of the Mississippi River, as already mentioned, has only one known surface salt source.

## Missouri

An area of salt springs occurs about forty miles to the south of St. Louis, near Ste. Genevieve, in Ste. Genevieve County. Now unused, they were of considerable importance to the early white settlers (Lippincott 1912:1037). The Indian use of the area was first investigated by Bushnell (1914) and much later and more thoroughly by Keslin (1964).

Bushnell (1907; 1908) also investigated some salt springs in Jefferson County, Missouri, near the small town of Kimmswick.

A salt spring site is reported from southern St. Louis County, on the east side of the Meramac River about one mile north of Fenton (Diesing 1955:5).

North Carolina

Brackish water, from faulted sediments of the Wilmington anticline, comes to the surface along Salt Marsh Creek, in Bladen County, North Carolina. At the point where the salt content of the water is strongest LeGrande reports (1955: 2021):

> An ancient salt pit marks the locality, where brackish water seeps from surficial sands into a small stream. From the salt pit the natives evaporated the brackish water to get salt during the early days. . . .

The "natives" were probably white settlers. An analysis of water from the spring revealed a sodium chloride content less than that of sea water. With the seacoast nearby, it is unlikely that the spring was very important.

In 1663, William Hinton, who was exploring the coast of the Carolinas, reported for the Cape Fear region:

> Some of the Indians brought very good salt aboard us, and made signs, pointing to both sides of the river's mouth, that there was great store thereabouts (Lawson 1714:73).

In 1650, some English explorers were told that there were "great heapes of Salt" at the mouth of the Roanoke River (Alvord 1912:127).

The source of the salt mentioned by these references is problematical. The possibility exists that it was being extracted from sea water.

Lawson (1714:83) also speaks of inland licks in North

Carolina, whose mineral content he analyzed as being saltpeter (potassium nitrate, sodium nitrate) rather than sodium chloride:

> Hot Baths we have an account of from the Indians that frequent the Hill Country, where a great likelihood appears of making Saltpeter, because the Earth in many places, is strong mixed with a nitrous salt which is much coveted by Beasts, who come at some seasons in great Droves and Herds, and by their much licking of this earth, make great Holes in those Banks. . . .

Sodium is most abundant and easily obtained as sodium chloride. However the sodium ion may occur in other compounds (sodium bicarbonate, lactate, phosphate, proteinate, etc.) and still be used by an animal organism (Hawk, Oser, and Summerson 1954:1083). Whether this sodium was extracted from the soil of these licks and used for human consumption was something I could not determine.

## Southern Ohio

In eastern and southern Ohio, the Salina and a dozen or so other formations ranging from Ordovician to Pennsylvanian in age are known to be brine-bearing (Landes 1960:75).

One of the most-used and largest of the salt springs of prehistoric Ohio is located in the present Jackson County, on Salt Creek. The use of this spring by the Indians was reported in many early accounts. In size and attraction for game, the Scioto Saline, as it later came to be called, can be ranked with that of the Big Bone and Blue Licks in Kentucky (Hildreth 1945:4).

Mary Ingles, a white woman who was captured from an isolated Virginia settlement in 1755 by a band of Shawnee,

was twice set to work boiling salt with the other women captives in the course of her travels along the Ohio Valley, while her Indian captors hunted at the springs. Eventually Mrs. Ingles was taken to the important town of Shawnee, located at the mouth of the Scioto, and probably built in response to the important salt sources to the north along the river (Hale 1886:3).

A company of white salt makers settled at the Scioto springs in 1795. For about twenty years, until 1815, the Indians continued to come for salt, making the area an important one for contact between the two groups (Bownocker 1906: 9).

A lick along Leading Creek in Meigs County appears to have been of importance mainly for game it attracted. In Athens County, springs and licks are found along the Hockhocking River. Salt springs are also found in Morgan County, along the Muskingum River (Hildreth 1945:8-10). I found no information concerning their aboriginal use.

## South Carolina

The area included in South Carolina has no inland sources of salt (Lefond 1969:102). Nevertheless, some very early references are found to its presence.

The Spanish found "an abundance of very good salt" at Cofitacheque, a town thought to be located on the Savannah River. The Indians near the headwaters of the Santee were reported to have descended to the coast periodically to obtain salt in trade (Swanton 1946:268).

The Sara Indians are mentioned as being connected with the Santee in trade. In 1670, when John Lederer visited some of the inland Siouan tribes, he observed salt among the Sara, who were located somewhere on the South Carolina piedmont:

> I did likewise to my no small admiration, find hard cakes of white salt amongst them; but whether they were made of sea water, or taken out of pits, I know not; but am apt to believe the latter, because the sea is so remote from them (Lederer in Alvord 1912:158).

Swanton (1946:268) ventures the opinion that the salt observed among them by Lederer could have been obtained through trade. This reference suggests that the salt may have been formed into cakes for trade, a practice known from many other parts of the world (Forbes 1954:257).

## Tennessee

The sources of salt in Tennessee are geologically related to those farther north in Virginia and Kentucky (Landes 1960:94).

Spanish chroniclers reported four or five springs in Chisca country from which salt was being extracted. This territory is placed in southeastern Tennessee by Swanton (1946: 802). Saline springs which may correspond to this reference are found at Winter's Gap in Anderson County (Killebrew 1869: 271).

Other areas in eastern Tennessee which were definitely aboriginally known include Morgan Springs in Rhea County, Flynn Lick in Jackson County, and Red Boiling Springs in Macon County. These springs and licks were all connected to each other and the mountain area to the east by an intricate system of trails

(Myer 1928:834).

White County is mentioned as an important area for the production of salt during pioneer times and was probably known in aboriginal times (Safford 1869:501).

In Davidson County in central Tennessee, the Nashville area contained major salt springs, later to be called the French Lick (Myer 1928:851). Robertson (1878:276-278) reports the abundant presence of large, shallow, shell tempered basins which he associates with the Indian manufacture of salt.

Salt licks are found in western Tennessee near Memphis in Shelby County and near Paris in Henry County (Swanton 1946: 802).

Safford (1869:501) reports surface salt sources in Overton and Van Buren Counties but there is no information concerning their aboriginal use.

## Virginia

Virginia's one major source of inland salt was located near Saltville, Smyth County, in the southwestern part of the state. Along the valley of the north fork of the Holston River, salt springs come to the surface at the plane of a thrust fault, in which rock of Cambrian age has over-ridden the Mississippian MacCrady formations (Stose 1911:225). From the earliest contact times, these springs were reported to be in use by the Indians (Stose 1911:242).

## West Virginia

The strong brines from springs on the northeastern

side of the Kanawha River, five miles above the town of Charleston in Kanawha County, seem to have been very important as a supplier to the Ohio Valley. Geologist Price (1937: 6) notes the abundance of pottery around the springs.

In 1666 a party from Virginia under Captain Henry Batte set out west across the mountains with some Indian guides. After reaching a certain point in their travels west, their guides refused to go any farther, saying that there dwelt nearby a tribe of Indians who made salt and sold it to other tribes. The tribe was reported to be numerous and powerful and to cause much trouble to anyone who trespassed onto their territory. The region may have been the Kanawha Valley (Hale 1886:23).

Mrs. Ingles, the captured white woman whose story is mentioned in connection with Ohio, was forced to make salt for the Indians here during her captivity (Hale 1886:3).

The springs at Kanawha were known in pioneer times as "Big Buffalo Lick" because of the herds that used them (Hale Ibid:62).

At springs in Braxton County the manufacture of salt by the Indians was also reported. Licks are reported in Sumners County, on Lick Creek, one-half mile from its junction with the New River. There are saline seeps in Greenbrier County (Price 1937:2732).

Map 1 shows the location of the salt sources discussed. The key to Map 1 summarizes the locations in terms of modern towns and political boundaries.

Key for Map 1

* reference to use by Indians for salt-making

Alabama

1 Choctaw Co.
2 Jackson, Clarke Co.*
3 Washington Co.

Arkansas

4 Salt Creek, Clark Co.*
5 Benton, Saline Co.*

Georgia

6 Lithia Springs Station, Douglas Co.

Illinois

7 Saline River, Gallatin Co.*

Indiana

no exact locations for salt springs

Kentucky

8 Allen Co.
9 Barren Co.
10 Bath Co.
11 Big Bone Lick, Boone Co.*
12 Bourbon Co.
13 Mann Lick and Bullitt Lick, Bullitt Co.
14 Carter Co.
15 Winchester, Clark Co.*
16 Manchester, Clay Co.*
17 Drennon's Lick, Henry Co.
18 Jackson Co.
19 Jefferson Co.
20 Knox Co.
21 Letcher Co.
22 Lewis Co.
23 Mason Co.
24 Nelson Co.
25 Upper and Lower Blue Licks, Nicholas Co.
26 Owen Co.
27 Perry Co.

28 Pike Co.
29 Pulaski Co.
30 Wayne Co.
31 Webster Co.
32 Whitley Co.

Lousiana

33 Bayou Castor Saline, Bienville Parish
34 Avery Island, Iberia Parish*
35 Lake Catahoula, LaSalle Parish*
36 Drake's Salt Works, Natchitoches and Winn Parish*
37 Grand Bayou, Red River Parish
38 Negreet and Many, Sabine Parish
39 Belle Island, St. Mary Parish
40 Lake Bistineau, Webster Parish*
41 Price's Salt Work, Winn Parish

Mississippi

none

Missouri

42 Ste. Genevieve, Ste. Genevieve Co.*
43 Kimmswick, Jefferson Co.*
44 Fenton, St. Louis Co.*

North Carolina

45 Salt Marsh Creek, Bladen Co.

Ohio

46 along the course of the Hockhocking River, Athens Co.
47 Scioto Saline, Jackson Co.*
48 Leading Creek, Meigs Co.
49 Muskingum River, Morgan Co.

South Carolina

none

Tennessee

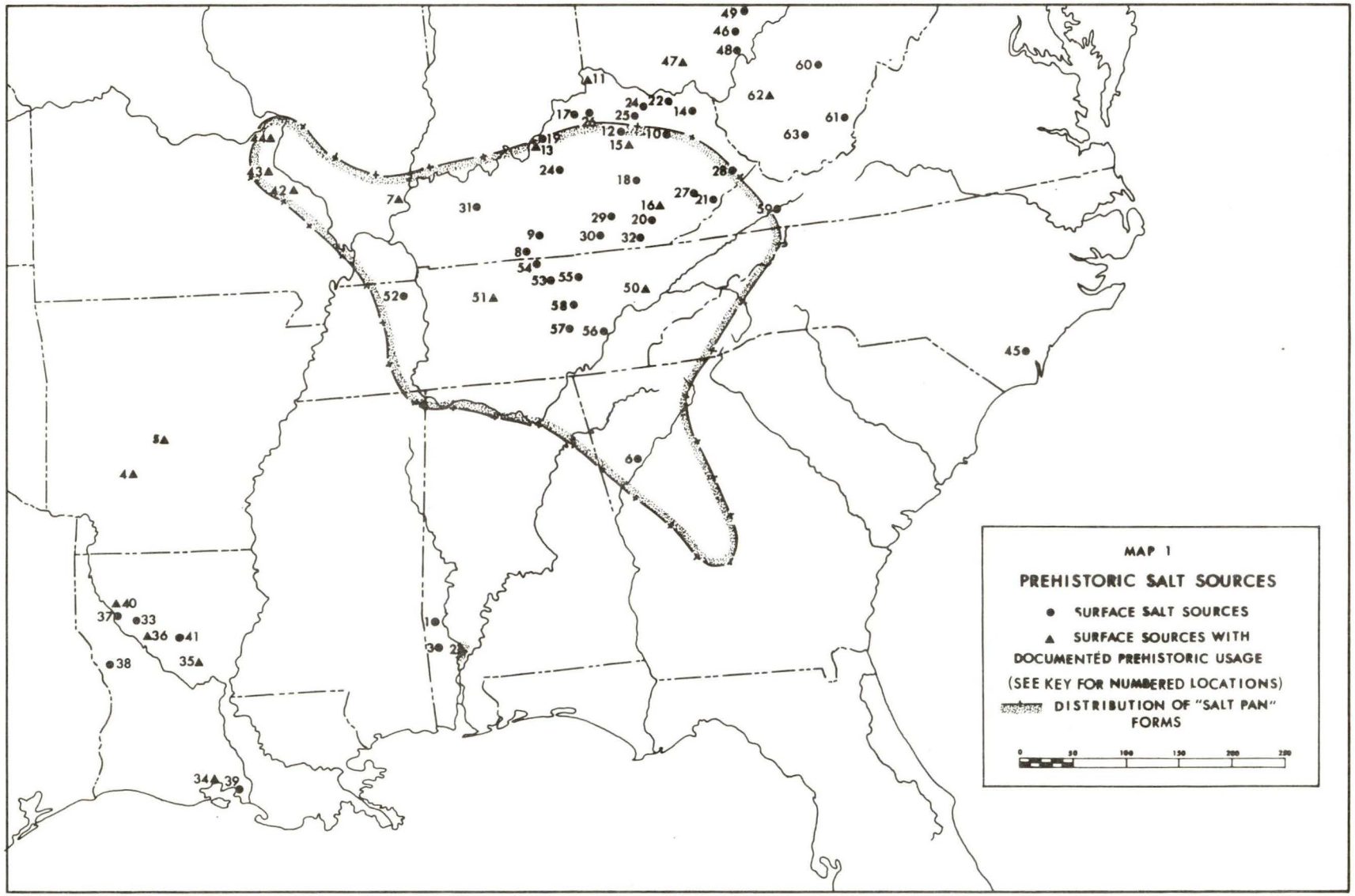
50 Winter's Gap, Anderson Co.*
51 French Lick, Davidson Co.*
52 Paris, Henry Co.
53 Flynn Lick, Jackson Co.
54 Red Boiling Springs, Macon Co.
55 Overton
56 Morgan Springs, Rhea Co.
57 VanBuren Co.
58 White Co.

Virginia

59 Saltville, Smyth Co.

West Virginia

60 Braxton Co.
61 Greenbrier Co.
62 Charleston, Kanawha Co.*
63 Lick Creek, Sumners Co.


MAP 1
PREHISTORIC SALT SOURCES
SURFACE SALT SOURCES
SURFACE SOURCES WITH DOCUMENTED PREHISTORIC USAGE
(SEE KEY FOR NUMBERED LOCATIONS)
DISTRIBUTION OF "SALT PAN" FORMS
0
50
100
150
200
250

## CHAPTER V

## TRAILS, TRADE AND SALT

The need of the human body for salt has made it one of the few trade items which could be classified as a necessity rather than a luxury. From the standpoint of human ecology, establishment of patterns of interchange of resources between groups exploiting different environmental situations has allowed the use of materials from a much broader radius than the immediate environment of the local group. The comparatively limited occurrences of salt have, in most parts of the world, made it an important item of exchange. In many places, cakes of salt acted as a medium of exchange somewhat resembling money in function. In the eastern United States, salt formed into cakes was found among the Sara and Mohetan (Hunter 1940:5).

Driver (1961:237) feels that salt, shaped into cakes weighing two or three pounds apiece, was the most important single item of trade in the prehistoric Southeast. He is of the opinion that the persons involved in the production and trading of salt were specialists. Historical references indicate that certain groups in areas which contained salt sources were producers and traders for the surrounding regions. The Caddo, Tunica, Koroa, and Washita have already been mentioned

as traders along the Mississippi Valley. In the Ohio Valley, the Shawnee are often mentioned in connection with production and trade of salt (Hale 1886:3; Myer 1928:872).

Finding salt in archeological context does not seem likely, given its solubility and the humid climate of the eastern United States. The routes that it followed can only be surmised indirectly. Myer (1928), in plotting the Indian trails of the Southeast, found that many of them converged on the larger licks and springs which were natural avenues kept open by countless animals. Salt sources seem to have exerted an important influence on the courses of trails. A review of Myer's maps reveals that every single major area of importance for salt production had at least one major trail leading to it. The intricate interconnections of trails meant that every area of the Southeast ultimately had access to a salt source.

In northern Kentucky, a trail connected Big Bone Lick with Blue Lick and Drennon's Lick. A trail followed the Licking River of Kentucky, which had many salt springs along its course. This route connected the courses of the Great and Little Miami Rivers to central Kentucky and east Tennessee. A major trail ran south from the salt springs of Gallatin County, Illinois. The territory surrounding the Angel Site was also connected by an old trace to the Gallatin County salines (Black 1967:581). From the salt springs around the present-day city of Nashville, Tennessee, two major trails ran to the south and one to the north. The Black Fox Trail

began at the Cherokee settlements along the Hiwassee River in eastern Tennessee, crossed the Tennessee River, and led to the ancient salt springs at Morgan Springs in Rhea County, Tennessee. The Scioto Trail connected the Scioto River salt sources to central Kentucky, east Tennessee and certain sections of Georgia and the Carolinas. A trail later known as the Great Indian Warpath connected Creek country in Alabama and Georgia to eastern Tennessee Cherokee settlements and ultimately ran to the salt sources of the Holston River and on north to the salt districts of the Kanawha River. The trail named Camino Real by the Spanish, ran through the southern portions of the present Gulf States and passed through the Red River Valley and Natchitoches, Louisiana, region. The salt area of southern Alabama was a focal point for several major east-west trails.

# CHAPTER VI

## THE USES OF SALT IN SOUTHEASTERN CULTURES

Within the scope of this thesis, it is not possible to discuss in specific detail all the cultural usages surrounding salt among the groups of the Southeast. For the most part, salt seems to have been used as a condiment on food.

The use of salt as a preservative for meat and fish has wide distribution over the world, but seems to have been unknown or at least unobserved in native North America. No mention is found of the use of salt in the preparation of skins and hides (Hunter 1940:37).

The importance of salt as a commodity which was relatively difficult to obtain and therefore valued is reflected in the customs surrounding its use (See Table 1). Before important events it seems either to have been tabooed or ritually consumed. Some groups of North America used salt in healing while others excluded it from all therapeutic procedures. Salt is used as a clan totem among some groups.

The use of ash as a substitute for mineral salt is known from many areas of the world (Forbes 1954:258). This practice is recorded for the Southeast as well. The Spanish described this custom and even resorted to it themselves.

Speaking of the Virginia Indians, Hariot (1588:23)

said:

> There is an hearbe which in Dutch is called Melden. Some of those that I describe it unto, take it to be a kind of Orage . . . of the stalke by burning into ashes they make a kind of salt earth, wherewithall many use sometimes to season their brothes; other salte they knowe not.

This practice commonly occurs in salt-lacking areas of the world, which would seem to indicate that it is of some value. When plant materials are analyzed in the laboratory, sodium and chloride are almost universally found in the ash. Plants vary greatly in the amount of sodium and chloride which they retain in their tissues (Wadleigh and Sherman 1960:470). For each locality, the most retentive plants were probably discovered and utilized. Burning plants reduces them to from one to three percent of their original bulk and would have the effect of concentrating the sodium and chloride. I found no actual chemical and nutritional studies of the value of this practice, but it is likely that the amount of salt obtained from it was quite small.

Table 1 summarizes the information available for those groups in the area covered by this survey. The source of salt, whether traded or locally obtained, is recorded when known. The table reveals that groups in areas where salt would have been relatively scarce used substitutes, while those in areas of greater abundance have no record of the use of such substitutes. Some groups such as the Cherokee and Creeks seem to have used both salt and a salt substitute. In some cases the use of salt can be inferred from negative evidence, i.e., the presence of a taboo against its use at certain times.

Table 1

Ethnographic Information on Salt Usage in the Southeast and Adjacent Areas

| Cultural Group | Location | How obtained | Some Cultural Usages | Reference |
|---|---|---|---|---|
| Caddo | Southern Arkansas, and the Red River Valley of central Louisiana | Boiling brine from salt springs | Salt traders, condiment | Swanton 1928:690 |
| Tunica | Mississippi Valley of northern Louisiana | Boiling brine from salt springs | Salt traders, condiment | Swanton 1928:690 |
| Chitimacha | Coastal Louisiana | Boiling sea water | | Swanton 1928:690 |
| Natchez | Mississippi Valley of central Louisiana | Obtained in trade | | Swanton 1928:690 |
| Quapaw | Mississippi Valley of central Arkansas | Obtained in trade | | Swanton 1946:301 |
| Koroa | Mississippi Valley of northern Louisiana | Boiling brine from salt springs | Salt traders | Swanton 1946:301 |
| Washita | Northeastern Louisiana | Boiling brine from springs | Salt traders | Swanton 1946:301 |

Table 1 (continued)

| Cultural Group | Location | How obtained | Some Cultural Usages | Reference |
|---|---|---|---|---|
| Taensa | Mississippi Valley of northcentral Louisiana | Obtained in trade | | Swanton 1946:301 |
| Choctaw | Southern Mississippi and Alabama | | Ash substitute, taboo against salt during ceremonies | Swanton 1928:690 |
| Chickasaw | Northern Mississippi | | Ash substitute | Swanton 1928:690 |
| Creek | Alabama and Georgia | | Ash substitute, taboo against use during the first four days of the Green Corn Dance, taboo against use in certain illnesses, salt clan, condiment | Swanton 1928:713 |
| Cherokee | Mountains of North Carolina, Georgia and Tennessee | | Ash substitute, condiment, taboo during ceremonies, taboo before ball games, taboo from therapeutic substances, use in mortuary customs | Hunter 1940:41 |

Table 1 (continued)

| Cultural Group | Location | How obtained | Some Cultural Usages | Reference |
|---|---|---|---|---|
| Yuchi | Eastern Tennessee | | Condiment, taboo during ceremonies, excluded from therapeutic substances | Hunter 1940:41 |
| Algonkians of North Carolina and Virginia | Tidewater North Carolina and Virginia | | Ash substitute | Hariot 1588:22 |
| Sara | Piedmont South Carolina | Obtained in trade | Condiment, shaped into cakes | Lederer in Alvord 1912:158 |
| Monhetan | West Virginia | Inland springs | Condiment, shaped into cakes | Hunter 1940:25 |
| Shawnee | Ohio Valley | Boiling brine from springs | Salt traders | Hunter 1940:25 |
| Cascassias | Mississippi Valley of central Missouri | Boiling from springs | | Pénicaut narrative, McWilliams edition 1953:39 |

# CHAPTER VII

## SALT MANUFACTURING TECHNOLOGY IN SOUTHEASTERN PREHISTORY

Six basic processes have been devised by primitive peoples of the world for obtaining salt (Kaufmann 1960:4):

1) Solar evaportaion of brines from varied sources
2) Quarrying and mining of solid salt
3) Burning of salt-containing plants; using the ashes as a substitute
4) Evaporation of brines by pouring directly on burning wood and afterwards grinding the ashes for use on food
5) Evaporation of brine in vessels by application of heat obtained from burning fuels (Open-pan evaporation)
6) Leeching of salt-impregnated mud, peat, or peat ashes, followed by evaporation of the brine

From this list, methods three, five and six are either archeologically or historically documented in the Southeast. Method two, quarrying and mining, may also have been employed. Method one, solar evaporation, may also have been used in combination with boiling.

The burning of salt-containing plants by many Southeastern groups has already been discussed.

Solar evaporation methods require a steady supply of brine, dry climatic conditions, and very large shallow pools. Several attempts by early European settlers at using the solar method along the coast of the eastern United States resulted in failure due to the moist climate (Harris 1960:633). The settlers soon resorted to boiling salt at inland springs.

Although all natural brines have some associated impurities, sea water always has a fairly consistent percentage of impurities, called bitterns, which, if not removed, give the salt a bitter taste. The chemical composition of sea water is about 65 percent NaCl, 28 percent hydrated magnesium salt, and 4 percent gypsum, plus small amounts of other compounds (Moriarty 1965:67). Table 2 presents data on some of the sources which would have been available to prehistoric groups. Sea water is shown to be the least desirable in terms of yield, while brines from the inland springs which have been analyzed are shown to be stronger. No evidence exists for the practice of solar evaporation of sea water by prehistoric groups in the Southeast. The Chitimacha (Swanton 1928:690) are reported to have boiled sea water, and some other groups may have done the same.

From all indications, the aboriginal Americans practiced the open-pan evaporation method. The method has been known since the beginning of recorded history in other parts of the world (Riehm 1961).

The open-pan method, as described for other parts of the world will aid in forming an ethnographic analogy as to how the process was handled in eastern North America. Two thousand years ago in the British Isles, salt was obtained by evaporating brine in large, shallow iron pans open to the air and heated below by coal-fired furnaces. As evaporation proceeded, small salt crystals formed on the surface. After they had become too large and heavy to be supported by surface

Table 2

Analyses of brines (Veatch 1902:94)

From Sources Available in Prehistory

| Localities | % of NaCl per unit weight of liquid | Total % of dissolved solids per unit weight of liquid |
|---|---|---|
| Saltville, Smyth Co., Va. | 25.975* | 26.4 |
| Bistineau Works, La. | 8.45 | 8.930 |
| Pomeroy, Ohio | 7.5531 | 9.528 |
| Charleston, West Virginia | 7.3094 | 9.200 |
| King's Salt Works, La. | 6.940 | 7.450 |
| Drake's Salt Works, La. | 5.580 | 6.160 |
| Rayburn's Salt Works, La. | 4.60 | 5.064 |
| Price's Salt Works, La. | 3.14 | 3.437 |
| Sea Water (Average) | 2.70 | 3.53 |

*A saturated solution of NaCl contains 26.4 percent of solid matter

tension, they sank to the bottom of the pan. The salt, as it formed, was raked out with perforated shovels and stacked to drain or dried in molds (Chambers Encyclopedia 1967: Vol. XII, 70). In some areas of Europe, molds of unfired clay were used to dry the salt further and shape it into uniform cakes. The molds with salt in them were placed near the fire and the moisture was drawn out through the absorbant clay walls. Many sites of prehistoric European salt production are indicated by the large number of molds which had been smashed to remove the cake of salt (Riehm 1961:181-191).

Among salt makers using iron kettles, non-salt precipitates allowed to build up on the bottom of the pan would cause uneven heat expansion, eventually splitting the iron kettle if not removed. These deposits could be removed by scraping and running fresh water over them (Lonn 1933:50). Whether clay vessels would react in the same manner is uncertain, but doubtless the precipitates were a problem to Indian salt makers, who may have scraped or rinsed them out.

The grain size of the salt obtained depended on how rapidly the brine was boiled. If the boiling was rapid, the salt formed was likely to be fine-grained whereas very slow heating produced a coaser crystal. During evaporation the pans were kept continuously filled with brine and were only emptied when it was necessary to remove the deposits formed on the bottom of the pan by impurities (Lonn 1933:50).

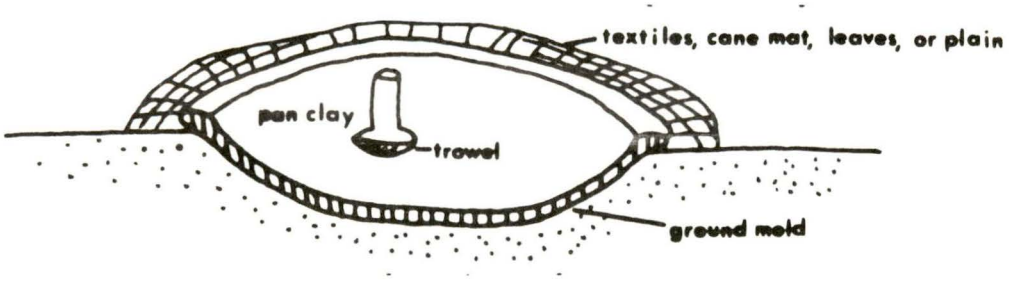
The aboriginal salt makers of the Southeast, from all indications, followed somewhat similar methods, using

large, shallow-form pottery vessels and wood fires. Brine was probably added to the pans as evaporation took place to avoid having to reheat the pans, which would have had the effect of saving both time and fuel. The salt was probably scooped from the pans as it precipitated, possibly with perforated shell dippers, which allowed some of the brine from the salt to drain back into the pan as it was lifted. Scrapers may have been used to clear unwanted precipitates from the bottom of the pans. The salt was allowed to drain and dry and then may have been stored in pottery containers, bags, baskets or even somehow shaped into cakes.

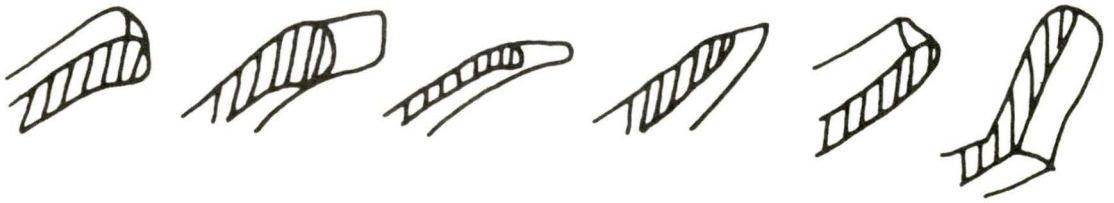
A particular form of ceramic vessel of the Mississippian tradition (See Figure 1 for examples from the Kincaid Site), which occurs adjacent to many salt springs, is for that reason designated "salt pan" pottery. This form is thought to be closely associated with salt evaporation. The regional variants of the form have a general distribution (See Map 1) in the central United States, occurring particularly in southern Illinois and Indiana, western Tennessee and Kentucky and east-central Missouri (Keslin 1964:5).

The large size of the pans would have made them difficult to transport to the salt springs. At least one reference from Louisiana indicates that the pottery vessels may have been made right at the springs. Du Pratz (1763: 307) reported, "Before the French sold them kettles they made earthern pots for this operation on the spot."

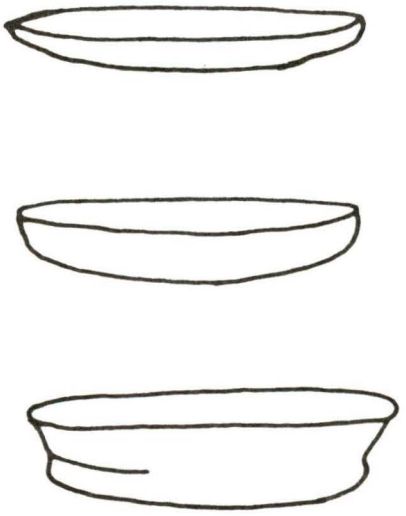
The outer surfaces of these pans are either smooth




HYPOTHESIZED METHOD OF MANUFACTURE, CROSS-SECTION



TYPICAL RIMS



TYPICAL PAN FORM

FIGURE 1 (after Orr 1951:317)

or impressed. Due to their shape and large size, the impressed pans are thought to have been manufactured in molds (See Figure 1). The concave disk forms of the vessels and their large diameters would have been difficult for wet clay to hold. A basin of the appropriate shape was dug in the ground and was coated with clay or else the soil packed hard. Over this mold a covering of textiles, mats, or leaves was placed. This was, in turn, spread with a clay and shell mixture to the desired thickness, the inside surface was smoothed with a pottery trowel, and the rim was finished by smoothing off the excess clay. After the clay had dried, the pan was removed with the help of the mold liner, and the pan was fired. No direct evidence is available for this widely accepted explanation of how the pans were manufactured (Orr 1951:316).

The finished pans had a broad surface and a shallow depth, perfect for effecting evaporation. They were probably placed directly over fires, as the number of hearths and amount of ash encountered in excavations around salt springs would suggest. The method of supporting the pans over the hearths is not known; but it may have involved the employment of a support made out of slabs of stone. Bushnell (1914:648) feels that stone boiling may have been employed, in place of direct positioning over the fires.

In some cases a combination of processes may have been involved in obtaining salt. Sandstone basins were used to collect brine in one instance and may have been areas where the brine could concentrate by solar evaporation before being

boiled.

The Gentleman of Elvas (Lewis 1907:217) explicitly describes the leaching of salt-impregnated sand followed by evaporation:

> Till they had reached that spot the Christians had wanted salt; they now made a quantity and took it with them. The Indians carry it into other parts, to exchange for skins and shawls.
>
> They gather it along the river, which leaves it on top of the sand when the water falls and since they can not gather it without more sand being mixed in it they put it into certain baskets which they have for this purpose, wide at the top and narrow at the bottom. They hang the baskets to a pole in the air and put water in them, and they place a basin underneath into which water falls. After being strained and set on the fire to boil, as the water becomes less, salt is left on the bottom.

This method may have been widely practiced where salt springs were unavailable but earth with salt content could be obtained.

The preceding pages have reconstructed from historical and ethnographic descriptions the possible procedures for extracting salt. Chapter VIII discusses the remains of cultural activity found around salt springs, as reported by archeologists and other observers.

# CHAPTER VIII

# THE ARCHEOLOGICAL EVIDENCE

## Missouri

### Ste. Genevieve County

The salt springs most thoroughly archeologically investigated are located in Ste. Genevieve County, Missouri, sixty-five miles south of St. Louis. These springs were investigated first by Bushnell (1914) and later by Keslin (1964). Most of the discussion will focus on Keslin's work, except where otherwise stated.

Four of the sites are very near or at salt springs, located along the course of the Saline River near where it flows into the Mississippi. These are the Kreilich Site (STG 5), the Cole Site (STG 7), the Cornucopia Site (STG 112), and the Fortnight Site (STG 113). In addition, Keslin studied two nearby burial areas, the Bluff Site (STG 300) and the Copperhead Site (STG 75).

Keslin's work was primarily concerned with placing the sites in the archeological context of the rest of the locality and with defining the temporal sequence of sites and materials. The Mississippian tradition is amply represented in the locality by village, burial, and mound sites. Woodland sites are present. Surface collections yielded characteris-

tically Archaic projectile points.

The four sites adjacent to the salt springs have similar cultural assemblages. All of the sites show an abundance of pottery and a paucity of non-ceramic cultural materials. Salt pans of one type or the other are abundantly represented. Projectile points are rare and are found on the surface or within the first few levels. Other artifacts of chipped stone are almost non-existent. Bone and antler artifacts are few, and bone refuse is at a minimum.

At the Kreilich Site (STG 5), the area immediately adjacent to the spring is barren of all vegetation due to the saturation of the soil with saline water. The French settlers from Kaskaskia used the springs from 1715 to 1735 and left historic material and vast quantities of wood ashes and charcoal on some portions of the site.

An eight-foot-high knoll just south of the springs was chosen as the excavation area. Four-inch levels were used to excavate five five-foot square excavation units. The first two or three levels (eight to twelve inches) in these units consisted of brown loam and alluvium which had accumulated since the site was occupied and which contained very little cultural material. The quantity of cultural material increased markedly with the depth of the units. The cultural material extended to at least a depth of six feet below the surface. None of the units was dug down to sterile subsoil, because the water table was encountered five feet below the surface; tests with a steel rod indicated that the cultural

detritus extended to at least a depth of nine feet below the surface. Pottery and ash formed the bulk of the occupational layer.

Three types of features were encountered: hearths, firepits, and cache pits. The hearths were indicated by areas of ash flecked with charcoal surrounded by circles of reddish burned earth. The hearths appear to have been built directly on the surface of the ground. They were usually round or oval in outline and not more than fourteen inches in diameter. Keslin feels that the hearths were used only for a short period of time, as the burned soil beneath them rarely extended more than an inch or two in depth. Hearths of this kind were exceedingly numerous throughout all excavation units and levels. The hearths were interpreted as those over which the vessels of brine were placed to boil. Bushnell (1914:64), who had earlier investigated the same site, reported a number of pieces of sandstone, all fire-reddened, ranging from one inch to a foot in diameter, which had been carried from a source several miles away. He feels that they had been heated in hearths and then placed in the pans full of brine, the evaporation being effected by stone boiling.

Two large, prepared fire pits were also excavated. The top of one of them was found sixteen inches below the surface. At twenty inches, the pit appeared oval in outline, measuring four feet along one axis and three feet along the other. The sides were almost vertical, and the pits averaged three feet in depth. The centers of the pits were filled

with white ash, while a fired red earth defined their outer margins in contrast to the surrounding black soil. Burned earth at the base of the pit was six inches thick at the center and therefore indicated hot, intense fires. Keslin interprets these pits as being used to fire salt pans, which he feels were being made directly at the site.

The cache pit, the second major type of feature, was not recognizable from any differences in soil color or texture. The only clue as to the outline of the pit was the circular outline formed by a number of broken salt pan sherds and mussel shells vertically placed in the soil. Feature one, which was representative of this type of pit, was oval in shape (three feet two inches by two feet seven inches) and extended to a depth of thirty inches. The function of the pits, other than as areas for disposal of broken pottery and unused shell, is unknown.

The ceramic analysis for the site was based on 14,668 recovered sherds, of which 10,340 were clay-tempered and 4,328 were shell-tempered. The analysis indicates that the site was being used long before Mississippian times. The Mississippian occupation lasted long enough to allow several shifts in popularity between the fabric-marked and smooth-surfaced pans. Shell-tempered pottery was subdivided into three types: St. Marys Plain, Saline Plain, and Saline Fabric Marked.

The clay-tempered sherds are Kornado Cord Marked and Korando Plain, types which had already been established for very similar pottery at sites in Jackson County, Illinois.

The surface finish is either smooth or covered with impressions of a cord-wrapped paddle. Some of the sherds are from vessels in the form of bowls and jars with rounded bases. Most of the sherds come from basin-shaped vessels which resemble the Saline Plain salt pans in general outline. The chronological position of Kornado ware is thought to be post-Hopewellian and pre-Mississippian. At the Kreilich site, Korando types appear exclusively in the lower levels and continue to be found throughout all levels. Only in the top levels do the shell-tempered types begin to form a majority of the pottery. Keslin's interpretation is that the Korando pottery continued to be made after Mississippian influences arrived in the area, but by Late Middle Mississippian times its manufacture had been discontinued. Seventeen rim sherds, which closely resemble Korando contain a mixture of clay and shell tempering.

Of the 4,328 sherds of shell-tempered wares, the 3,414 salt pan sherds constitute the largest category. Of these, 2,601 were of the smooth-surfaced Saline Plain type, and the other 813 are Saline Fabric Impressed. Saline Fabric Impressed is thought to have been constructed in molds.

The non-salt pan, shell-tempered sherds or household wares are mostly of the St. Marys Plain type. The prevalent vessel forms are jars, bowls, and plates which are coil-constructed. Other household wares appear to be exotic in provenience and bear closest affinity to the ceramic complex at Cahokia.

The sequence at the site was reconstructed on the basis of ceramics in the following manner. A Woodland culture was present at approximately A.D. 500 to A.D. 600 and was followed very closely by early Mississippian groups who manufactured Saline Plain salt pans. Korando pottery continued to be made. At a later time, probably about A.D. 1000, influence and trade from the Cahokia region arrived simultaneously with the beginnings of the Saline Fabric Impressed pottery style. For a short while, the fabric impressed pans were popular but in time they were entirely replaced again by the smooth-surfaced salt pans which had been made continuously. The use of the site may have continued uninterrupted up to the time of European contact. In early historic contact times, the spring was used by both the French and the Illinois (Pénicaut Narrative, McWilliams 1953:39).

In contrast to the abundant quantities of pottery fragments, artifacts of stone were represented by five projectile points and a crudely manufactured blade. An awl was the only artifact of bone encountered in excavation. Three shell beads also were found.

The Cole Site (STG 7) is located near two saline springs which are now dry most of the time. A total of ten test pits, two and one-half feet square, were excavated in arbitrary four-inch levels to the depth of thirty-six inches.

The assemblage of cultural material closely resembled that of the Kreilich Site. The stratigraphic distribution of clay- and shell-tempered ceramics was similar. Sixty-one

percent of all pottery on the site was assigned to the Korando types. Six sherds of a basically Korando clay-tempered type were impressed with a twined fabric rather than being cord marked. At this site, Saline Fabric Marked formed 69.4 percent of all shell-tempered pottery, while it had formed only 19.2 percent at the Kreilich site. It seems likely that the site was most in use during the period of time when the fabric-impressed pan was most popular.

The only feature encountered was of particular interest because its function was interpreted as being a mold for the manufacture of the pans. Approximately three feet below the surface, an area of compacted earth was encountered. Excavation revealed an almost perfectly round (north-south diameter thirty-four and three-fourths inches, east-west diameter thirty-five and one-half inches, and depth seven and one-half inches) basin-shaped depression. The gently sloping sides and bottom were packed to a very hard consistency. No fire had been built in this depression. The only item found within it was one large fabric-impressed sherd with the fabric-impressed side against the basin wall.

Keslin found three shell scrapers with sharpened edges opposite the hinges. He suggests that their use was for digging cache pits and small postholes. Another possibility is that they may have been used for dipping crystallized salt from the brine or scraping it from the bottom of the pans.

As at the Kreilich Site, artifacts other than pottery were rare.

The Fortnight Site (STG 113) occupies the edge of a flat plateau sixty feet above the level of the Saline River. The site is convenient to both saline and fresh water springs. Excavation did not take place immediately around the springs. A trench fifty feet long and five feet wide was staked out on the area of the plateau which from surface collecting seemed to be most promising. Six-inch vertical levels were used. Most of the cultural material was found in level one and the top three inches of level two. Sterile sand was encountered at fourteen to eighteen inches.

Although no traces of permanent structures were located, the cultural assemblage seems to indicate a small Mississippian village.

In the sample of 3,507 sherds, 0.5 percent are Korando wares, 7.7 percent St. Marys Plain, 8.5 percent Saline Fabric Impressed, and 82.3 percent Saline Plain. Trade pottery was not abundant at the site, but the limited amount found is indicative of contact with the Cahokia area.

Also encountered were shell scrapers and a broken projectile point. A child was found buried without associated artifacts under a limestone slab. Fired fragments of daub were abundant in most areas of the site.

The site probably represents the habitation area for the people involved in salt-making activities. It suggests that the salt-makers were camping or even living permanently at the nearest spot suitable for convenient use of the springs.

The Cornucopia Site (STG 112) was washing out of the

bank of Saline Creek and was only briefly surface collected. A profile was cleared on the eroding bank, which showed a band of fire-reddened earth two and one-half feet thick, full of ash and charcoal. This band was twelve feet below the surface. Keslin feels that this site was important primarily for the manufacture and firing of pottery because of a suitable type of clay which occurs just below the beach.

Of the pottery collected, 88.8 percent was Saline Plain. This site is about 500 feet from the Fortnight Site. Similarity in pottery type and percentages suggest that the site may have been used by the same people who occupied the Fortnight Site.

In addition to the four sites discussed, two cemeteries (STG 75 and STG 100) in close proximity to the salt springs were investigated. At STG 75, the burials were placed in stone boxes six feet by one and one-half feet in dimension, made of stone slabs set in the ground. Mortuary offerings consisted of vessels with a St. Marys Plain paste, a fact that connected these graves to the salt making people. At STG 300, digging was done by amateurs, who reported finding graves lined with large sherds of Saline Fabric Impressed ware as well as some stone-lined graves.

On the basis of the stratigraphic sequences and materials from all the sites, Keslin (1964:143) constructed the following horizons for the Missouri salt springs:

> I (ca. A.D. 500 - A.D. 800) A period when only clay-tempered ceramics are being produced and is represented by the lowest levels at the Kreilich and Cole Sites.
> II (ca. A.D. 800 - A.D. 1000) This period covers the

time span from the introduction of Saline Plain to that of Saline Fabric Impressed. St. Marys Plain is also present and Korando ceramics continue. This period should equate with the developmental phase at Cahokia which culminates in the full-blown Old Village Focus by A.D. 1000.

III (ca. A.D. 1000 - A.D. 1200) Saline Fabric Impressed marks the beginning of this period, and its absence the culmination. Saline Plain and St. Marys Plain continued as does Korando, except that the latter probably terminates prior to the close of the period. Old Village trade pottery is most abundant at this time and at Cahokia itself, modifications are taking place in the direction of the Trappist Focus.

IV (ca. A.D. 1200 - A.D. 1700) In this period St. Marys Plain continues to be made as does Saline Plain. St. Clair Plain is represented in small quantities as trade items and is copied by local potters. Saline Fabric Impressed is no longer made in this locality, nor is Korando Cord Marked. There is no assurance that sites were occupied during the final phases of the period.

V (A.D. 1700+) The final temporal horizon refers to the historic period, which in this locality would begin about A.D. 1700. Not all sites were occupied at this time, but there is little doubt that the Kreilich site was utilized both by Europeans and Indians. However, it was the western margin of this site where historic materials were found. Whether the Saline Plain pottery found here represents its continued manufacture into historic times, or occupation of this area during period IV, is not known.

This sequence is quoted at length because the limited amount of data from other springs seem to suggest a generalized sequence from Woodland to Mississippian to historic occupation which is very similar.

The sites of the Saline Locality present similarities to a series of Middle Mississippian sites along the Mississippi, Ohio, Tennessee, and Cumberland River drainages.

A few comments about the term "salt pan" might be in order at this point. Regional and temporal variants of "salt pans" occur under a plethora of names at a number of Mississippian sites, most of which are not located at salt springs. In many cases the pan form may represent a considerable per-

centage of the pottery. For example pans account for 31.8 percent of the Late Period Pottery at Kincaid (Orr 1951:316) and 50 percent at the Tolu Site (Webb and Funkhouser 1931: 375). Textile-marked pans are found at sites in northern Alabama along the Tennessee River (Griffin 1939:150-151) and on the Macon Plateau (Jennings and Fairbanks 1940:5-6), areas where no salt sources are reported. Bennett (1941:165) observes that the mere fact that salt springs show large quantities of the form is no positive argument for the function being universal. A wide, shallow pay might have had a considerable variety of other functions of which evaporating salt could have been but only one. The labeling of the form as "salt pan" wherever it occurs is unfortunate because this was probably the function in only a small percentage of the cases.

On the basis of the excavation of the four Missouri sites surrounding salt springs, the following tentative conclusions are offered:

1) Salt was used in the Central Mississippi Valley for a fairly long temporal span. Certainly it was used by peoples of the Mississippian cultural tradition and probably earlier by Woodland peoples.

2) The process used for salt making was boiling. The concentration of hearths, fire-pits and the high frequency of extremely functional pans all seem to support this conclusion.

3) The items of material culture--the pans, the shell scrapers, etc.--were part of general Mississippian assemblage of material

culture which had been adapted to the more specialized purpose of salt boiling.

4) The immediate areas around the springs were specialized for salt manufacture. During both the Woodland and Mississippian occupations, ceramics are abundantly represented; but stone, bone, and antler tools are absent and primary chert flakes and bone refuse are limited.

Jefferson County, Missouri

A salt spring similar to those in Ste. Genevieve County was investigated by Bushnell (1907; 1908) about the turn of the century. The spring is located thirty miles below the mouth of the Missouri and about one and a half miles west of the Mississippi River, near the small village of Kimmswick in Jefferson County, Missouri.

The site covered about a two-acre area on a terrace twenty feet above Rock Creek. A small salt spring arose from the base of the terrace only a few inches above the level of the creek. The area excavated by Bushnell was located on the terrace about 500 feet away from the springs. He also dug a trench into the bank about 100 feet away from the spring.

An 8,000 square-foot area on the terrace was dug to undisturbed yellow clay, which occurred at a depth of thirty inches below the ground surface. The clay surface was interpreted by Bushnell to be the original ground surface at the time that the site was occupied. The stratum above the clay was formed of ashes; charcoal; vast quantities of broken pans; and bones of deer, elk, birds, and fish. Two marine shells

from the Gulf of Mexico were found on the site.

Resting on the clay were found four large, unbroken pans, fragments of four similar pans, and twenty-eight fire beds.

The four unbroken pans were roughly aligned from northwest to southeast and were spaced approximately eighteen feet from each other. Pan I was thirty-one inches in diameter and twelve inches deep; Pan II twenty-five and one-half inches in diameter and nine inches deep; Pan III twenty-one inches in diameter and seven and one-half inches deep; and Pan IV twenty-four inches in diameter by nine inches deep. All were shell-tempered and had smooth surfaces.

Pans II, III, and IV were set in depressions in the clay surface with about two inches of the rim extending above the clay. They appeared to have been stabilized in the depressions by having broken sherds and blue clay from the creek bed packed around them. Pan I was not set in the yellow clay but rested instead on a mass of ashes and earth above the clay surface. Bushnell felt that this pan had never been used. However an alternate interpretation might be that it was sitting on the bed of ashes of a fire which had been built under it. No mention is made of the clay underneath it having been fired.

In Pan II a piece of fire-reddened stone about eight inches in diameter was found; similar stones were discovered either near or resting upon different fire beds. Bushnell postulated stone boiling as the method for evaporating the

brine. The pans placed in the ground were in readiness to receive the stones. An alternate explanation for the stones is that they served to support the vessels above the fires.

The twenty-eight fire hearths averaged more than two feet in diameter. The clay beneath was hardened and reddened from six to nine inches in depth.

Local fresh-water shells, some of which were perforated, with sharpened edges, were found in the bottoms of some of the pans. Bushnell thought that these were attached to handles and used as dippers.

The north end of the twenty-five-foot trench dug near the spring extended into the slope of the terrace. Undisturbed clay was encountered at a depth of four and one-half feet on the north and three and one-half feet at the south end. Resting on the clay was a stratum of about eighteen inches in thickness, composed of large fragments of pans, some fresh water shells, animal bone, wood ash and charred wood. Above the stratum were earth and sand attributed to alluvial deposition by the creek. The sherds from the trench are all fabric-impressed, in contrast to the smooth vessels of the upper portion of the site on the terrace. Bushnell interpreted the evidence as indicating that the site was occupied at different times. Twenty-two box graves were located near the spring. Ten of these were lined with smooth surfaced sherds from pans rather than stone slabs.

Bushnell's excavation techniques and record keeping were not modern, which makes interpretation of exact rela-

tionships difficult. More information about the in situ pans might aid us in interpreting why they were placed this way. If they were set into pits as Bushnell thought, building a fire under them would have been impossible. Their good preservation also makes it seem unlikely that they represented unfired pots still in molds. Their placement in this position for purposes of stone boiling as Bushnell suggests remains a possibility. No historic references to stone boiling exist nor is this method a general practice around the world. It would seem that stone boiling would be less efficient in terms of the amount of fuel than putting the pan directly over the fire would be.

St. Louis County, Missouri

A large salt spring site, resembling closely the two already described, is located on the east side of the Meramac River about one mile north of Fenton. A stone box cemetery and village site are also reported nearby. There seems to be little doubt from the description that this site was being used by Mississippian peoples and was possibly an important supplier for Cahokia:

> A large pre-historic salt factory had been located at this place. Fragments of huge bowls or basins of clay tempered with mussel shell littered a field of some eight or ten acres. The lips of the rim sherds were either flat or rounded. The potsherds were fairly uniform in thickness (about three-fourths of an inch). On the outside of the pottery fragment were impressions of woven material. . . . A few had a crystalline deposit on what had been the bottom of a bowl (Deising 1955:5).

## Illinois

Gallatin County

In Gallatin County, Illinois, salt springs are located three miles southeast of Equality on the Saline River. An area of about thirty acres surrounding these springs is littered with broken shell-tempered salt pan ware.

The report by Peithman (1953) of his excavations constitutes the best description of the site but is of limited value archeologically, except possibly for the descriptions of the features.

Three test pits five feet square were dug in a cultivated field about 100 yards to the east of the springs. Test pits one and two were within five feet of one another. Test three was fifty feet to the southeast of the other two. All were excavated in six-inch levels.

The test revealed a midden deposition consisting of ash, potsherds, shell, and some bone.

A total of nine fire basins were encountered. The description of feature two is typical of these basins (1953: 69):

> It showed evidence of very heavy firing, the clay having been burned to almost brick hardness. This fire basin was egg-shaped and very well constructed. It contained wood ash, charcoal, and a large sherd of utility pottery (burned) and three irregularly shaped stones that also show evidence of fire. There were finger marks on the inside, indicating that wet clay had been used in its construction. This fire basin measures 12 inches by 18 inches and was 15 inches deep.

In tests one and three, the sixteen postholes encountered thirty-six inches below the surface were interpreted as part of a structure; but no idea was gained as to dimensions or kind of structure. In test two, which was dug down

to clay subsoil, the shell-tempered sherds diminished greatly in number at the thirty-six to forty-two inch level and were replaced by numerous smooth, gray and buff, clay-grit tempered sherds identified as Yankeetown, a late Woodland type. At the forty-two to forty-eight inch level, the Yankeetown type continued and about five cord-marked, grit-tempered sherds were found. At forty-eight to fifty-two inches there was no evidence of human occupation.

Thick, textile-impressed, shell-tempered fragments of pans were found by the hundreds. Peithman's (1953:72) analysis of ceramics is restricted to the following comment:

> The potsherds found were in stratigraphic levels from top down as follows: Middle Mississippi, Yankeetown, Lewis or Raymond, in association with Jackson ware.

The ceramics from the Gallatin springs are somewhat different from those in the Missouri area but the general sequence from Woodland to Mississippian is quite similar and indicates parallel development (Keslin 1964:161).

Peithman feels the bulk of the salt was obtained by solar evaporation. He explains (1953) the hearths:

> There may be a connection here in regard to fire basins being used to expedite salt making or drying salt by means of fire.

However Peithman's own evidence concerning the fire basins and amount of ash appears more supportive of salt boiling operations.

## Ohio

No archeological investigation has been done at the Scioto Saline in Jackson County, Ohio, but some descriptions

of the physical remains and activities are informative about the procedures followed there and the sexual division of labor:

> . . . The Indian women, upon whom all the servile employments fell, collected the salt water by cutting holes in the soft sandstone, in the bed of the creek in the summer and autumn when the stream was low. These were generally not more than a foot or two deep and the same in width. Into these rude cavities the salt water slowly collected, and was dipped out with a large shell into their kettles, and boiled down into salt (Hildreth 1945: 4).

Stout (1932:11), who was probably summarizing earlier observations, notes that the brine was concentrated by the sun before being boiled to the saturation point. If this were so, it could mean that combining solar evaporation with boiling was a common technique. Bownocker (1906:9), probably referring to the basins carved into the sandstone reports that "their old salt pans were blasted out in 1899."

The mention of the use of the shell dipper may be one explanation for the function of the shells with thinned edges reported from Missouri (Keslin 1964:87; Bushnell 1907: 20).

## West Virginia

No information is available about the material around the springs along the Kanawha River in West Virginia, other than that pottery is abundant and is imputed to be connected with salt manufacture (Price 1937:6).

## Tennessee

At the French Lick salt springs along the Cumberland

River near Nashville, Tennessee, Robertson (1878:276-278) observed:

> . . . Fragments of pottery abound, some of the common sort, and others very thick, about one half to three fourths inch composed of grayish clay with large fragments of shell. The vessels of which they were part must have been very large. Traditionally they are believed to have been used for evaporating salt from the spring. A brief search resulted in finding numerous specimens on the surface and protruding from the sides of the ridges near the surface.

## Louisiana

### Avery Island

At the coastal salt dome of Avery Island the possibility exists that rock salt may have been quarried at very early times. However, the most abundant evidence for later aboriginal occupation is found around the surface salt springs of the Island.

An archeological survey of Avery Island has been conducted by Gagliano (1964), with the primary objective being a determination of the extent and sequence of occupation and not the investigation of a prehistoric salt industry.

Excavations on the Island were carried on most extensively where salt springs were located. Salt Mine Valley is a solution depression through which much of the drainage of the Island is channeled and slowed, resulting in rapid deposition. In recent times, the area has also been used for the disposal of brine from mining operations. Surface collections on a spoil bank composed of fill from the Valley floor produced a great deal of pottery of the Plaquemine Period.

A combination of augered holes, continuous cores,

and pits revealed artifacts at several levels in the complex depositional sequence overlying the rock salt.

Two test pits, IV and V, were excavated with machinery in an undisturbed area of the lake floor. Scoops of material were kept separate; and an elevation reading, using Mean Low Gulf Level as a datum, was taken after each (1964:18).

Directly above the rock salt was a layer of coarse sand and gravel which formed the bottom levels (twenty and twenty-one) of Pit V. Overlying this (from levels nineteen to twelve) was a sequence of interbedded silty clays, sands, and gravels, which extended from approximately Mean Low Gulf Level to eight and one-half feet below datum. Levels twelve through fourteen in this sequence yielded a distinctive assemblage of pitted pebbles, bladelets, and burin-like tools, manufactured by bipolar chipping techniques. Smaller quantities of these artifacts were found in levels eighteen and nineteen. On the basis of a projected rate of deposition, the bipolar industry appears to be a minimum of 6000 years old (1964:24). Levels eleven through seven, extending from MLG to six feet above MLG, were composed of a rich organic sequence. A rich accumulation of Plaquemine pottery was found in level seven, which is about six feet below the present surface. A radiocarbon sample from this level yielded a date of A.D. 1512$\pm$ 105 (1964:19). The upper levels (one to six) consisted of finely laminated silts and clay with abundant evidence of historic mining operation in the top foot.

In Pit IV, Plaquemine pottery was also found at a

depth of seven to eight feet below the surface in similar black organic clay.

Three ten-foot square pits (Pits I, II, and III) were dug on the midden located on the Pleistocene deposits outside of the actual lake bed itself. The shallow midden of a few inches to two feet in depth, contained thousands of potsherds, virtually all of which belonged to the Plaquemine Period. No features were reported (1964:24).

Artifacts from all over the island, radiocarbon dates, and geological evidence indicate that occupation had taken place during the Lithic and Archaic Stages; and during the Poverty Point, Coles Creek, and Plaquemine Periods of the Formative Stage.

Lithic and Early Archaic peoples were more likely attracted to the island by the abundance of animals around the salt and the gravel available for making tools. A high frequency of exotic stone from which Avery Island projectile points and tools were fashioned, may indicate trade for Archaic times. Raw materials suggest contact with peoples in Texas, Arkansas, Missouri, north and central Louisiana, and possibly even Ohio (1964:64).

In the 1860's, during pit mining operations, a fragment of basketry was found in Salt Mine Valley on the surface of the rock salt along with remains of extinct animals. This fragment was immediately taken to be proof for the concomitance of man and extinct animals. When this theory had been discounted for lack of evidence, the basketry was attributed to

the much later pottery-making groups, who were postulated to have been digging pits to obtain the salt. Gagliano (1964: 66) feels that the occurrence of the bipolar industry, at a stratigraphic level which may be early enough to have been contemporary with extinct fauna, again opens the question of the antiquity of the basket. At this earlier time, the salt would have been much nearer the surface. By Plaquemine times the rock salt was not readily apparent and was covered with a thick mantle of marshy deposits. Rock salt was not discovered on the island by white settlers until 1863, although salt springs had been known there since 1791 (1964:6). Indications are that Plaquemine peoples were boiling brine, a time-consuming and laborious process which would seem unnecessary if rock salt was readily available. Gagliano concludes (1964: 66), "it now seems highly probable that this material was truly in association with fossil bones." If the basket's position on the surface of the salt is taken to be evidence that rock salt was being gathered, this could well be the earliest evidence for the use of salt.

Evidence for a salt-boiling industry consists entirely of the abundance of pottery, particularly that of the Plaquemine period, around the area of the island where surface brines were available. Plaquemine Brushed, the commonest type, is clay-tempered and has a distinctive brushed surface. The commonest vessel forms were shallow bowls, with flat circular or square bottoms, and large pots and cauldrons. In the cultural sequence of southern Louisiana, the Plaquemine Period

(A.D. 1350 to A.D. 1700) is part of the Formative Stage, during which agriculture became the basis of the economy and earth mounds and ceremonial centers were being constructed in the alluvial valleys of the Mississippi and Red River to the north. About the affiliations of the people involved Gagliano (1964:63) concludes:

> It can be inferred from the quantities of Plaquemine pottery in the valley that the salt trade was brisk during that period. The similarity between types of pottery from Salt Mine Valley and the Medora Site in West Baton Rouge Parish was noted in the previous section. This pottery assemblage, typified by the Medora material, is found at innumerable village and mound sites in the lower Mississippi alluvial valley and the upper portions of the deltaic plain. However, coastal shell middens of approximately the same vintage usually display a different assemblage of types. The late prehistoric coastal traditions in Louisiana shows strong affiliations with the Mississippi Sound-Mobile Bay area to the East. A high percentage of this coastal pottery is shell-tempered, and decoration motifs are distinctive and indicate that Plaquemine period salt production and trade at Avery Island was carried on by agricultural peoples from the Mississippi Valley and deltaic plain, and not by nearby coastal peoples.

The data also suggest the ecological correlation for salt use already discussed. The people living on seafood would be less dependent on obtaining mineral salt than the agricultural inland dwellers.

Plaquemine pottery types differ markedly from the "salt pans" of the Ohio and Central Mississippi Valleys. Here again, prehistoric peoples of southern Louisiana had taken the most suitable form from their assemblage of material culture and adapted them to the specialized task at hand.

Northern Louisiana

Numerous historical references attest to the importance

of the salt springs of northern Louisiana to the Indians of the contact period. Descriptions of cultural material are entirely limited to accounts of early travelers and geologists who surveyed the springs.

Around Drake's Salt Works, often mentioned in historical accounts, Du Pratz (1763:118) described the production of the pottery by the Natchitoches: "The women of the nation go and gather these shells and make a powder of them which they mix with earth of which they make their pottery or earthern ware."

Du Pratz goes on to say that these fossil shells were preferred by the Indian women and had to be carried to the site from several miles away.

In 1902, Veatch (1902:53) confirmed this observation in his examination of the pottery at Drake's Salt Works:

> . . . The pottery seems to have been made on the spot for scattered through the piles of broken pots are specimens of Ostera falciformes, a fossil oyster which does not occur in situ at this place but is found in great abundance on the hills three or four miles to the west, and examination of the fragments show that these shells were ground or partly pulverized and mixed with clay in making the pottery.

Neither observer makes any comment about the vessel form.

At the portion of Lake Bistineau Salt Works called Potter's Pond, little information is available other than the pottery found there lacks the shell-tempering found at Drake's (Veatch 1902:83).

At the Catahoula springs in Louisiana, Du Pratz also reported that the Indians came to make salt and produced pot-

tery for the operation right at the springs. It is assumed that this salt area would also contain evidence of aboriginal use, but no modern observations are available.

## Alabama

### Clarke County

In Clarke County, salt springs surface where the Jackson fault has disturbed the strata of the Hatchetigbee Anticline. Two sites which seem to have been related to salt making are known and undoubtedly future exploration would reveal more sites, as salt springs are reported along this section of the Tombigbee River (Lonn 1933:129).

Beckum Village ($Ck^V$ 24) is in sec. 33, T. 6 N., R. 2 E., Clarke County. The site is located one half mile from the east bank of the Tombigbee River, on a natural levee. Salt springs in the swamp below the area were assumed by the excavator (Wimberly 1960:30) to be responsible for the occupation of the site.

Extensive Civil War salt works as well as plowing had destroyed some of the site. Erosion on the levee crest had reduced the midden to 0.1 to 0.3 feet in thickness. Excavation procedures were not explicitly stated, but an accompanying photograph shows a large area staked out in what appears to be ten foot squares. Arbitrary six-inch levels were used.

Descriptions of finds on the site were brief in the extreme. Features included twelve circular pits, two to three feet in diameter and from one to two and one-half feet deep. They contained nothing significantly different from the midden

on the site which was composed of potsherds, bone and other debris. The flexed burial of a child also was found.

If the features were not particularly supportive evidence for the presence of a salt industry, the percentage of the "salt pan" vessel forms at the site appeared to be. Of the 38.60 percent of shell-tempered pottery at the site, 29.45 percent of it was either Langston Fabric Marked or Beckum Plain. At the four other sites of the eighteen in Wimberly's survey, at which Langston Fabric Marked was found, it formed only a very small percentage of the total pottery ($Ck^V$ 5, .017 percent; $Ck^V$ 26, 1.14 percent; $Mb^O$ 3, .21 percent; and $Mb^O$ 7, .1 percent). Langston Fabric Marked Ware (1960: 86) is tempered with coarsely crushed shell, is a large, shallow pan in form, and has no coil fractures. The surface may be either fabric-marked or cane-impressed. Beckum Plain ware is similar to the above but has a plain surface and has only a moderate lip thickening. Both types are placed in the Mississippian period of Alabama. Weeden Island types formed a small percentage (2.25) of the rest of the pottery, and sand-tempered Woodland types formed the remaining 59.11 percent.

Table 3 presents the percentage by level of occurrence of the two "salt pan" types at the site. As at the sites investigated by Keslin in Missouri, a plain and fabric-impressed type were manufactured and seem to show varying degrees of popularity through time.

The Salt Springs Sanctuary site is located in Clarke County about thirteen miles south of Beckum village. It is

Table 3

Pan Forms from $Ck^V$ 24 (Wimberly 1964:Table 13)

| Depth | Langston Fabric Marked | % of total from level | Beckum Plain | % of total from level |
|---|---|---|---|---|
| 0.0-0.5' | 274 | 15.48 | 80 | 4.52 |
| 0.5-1.0' | 560 | 23.48 | 271 | 11.36 |
| 1.0-1.5' | 429 | 31.96 | 32 | 2.38 |
| 1.5-2.0' | 27 | 20.6 | 4 | 3.0 |
| 2.0-2.5' | 39 | 20.2 | - | - |
| 2.5-3.0' | 7 | 36.8 | - | - |
| 3.0-3.5' | 1 | 7.1 | - | - |

located on the edge of the flood plain of the Tombigbee River in the NW ¼ of sec. 28, T. 5 N., R. 2 E., Choctaw Bluff Quadrangle. The salt springs surface along the Jackson Fault, at the bottom of a steep hillside which marks the edge of the flood plain. The discharge of several springs contributes to a small, shallow brackish stream which flows across a flat marshy area at the foot of the bluff. This marsh supports no vegetation in the most saturated portion, and a typical salt water weed grows at its margins (Barkesdale 1929:7). Vegetation was primarily water oak festooned with Spanish moss, which gave way in the marshy areas to coarse grasses, sedges, rushes, and palmetto.

The extensive Civil War salt works located here (Lonn 1933:129-136) are recognized by large pits for collecting brine, wooden pipes set into the ground from which brine still flows, wooden troughs for channeling brine, pieces of cast iron kettles and a great many bricks from furnaces scattered about.

Most of the pottery was washing out from the slopes of the several spring branches which indented the hillside. Small terraces in the slopes above the springs appear to have formed the working areas. No pottery was found in the marshy flat.

The most apparent surface material, besides the Civil War debris, was shell-tempered pottery, most of which appeared to be large pans. Trowel scraping along a small surface of the eroding bank revealed a layer of dark loam at least eighteen inches deep, starting at the surface and composed of char-

coal, pottery, shell, and some bone. This layer rested on a dark gray clay which appeared to contain no cultural material. The bottom part of the loam layer contained mostly sand-tempered, cord-marked Woodland sherds, while in the upper portion and the surface, shell-tempered pottery was predominant. Fresh-water shell was abundant throughout the layer. Some bone was present. No stone artifacts or chips were encountered anywhere on the site. Controlled excavation would probably yield a sequence of occupation from Woodland to Mississippian.

A total of 445 sherds were collected, mostly from the surface, although some come from the trowel scraping in the side of the bank. The fact that the sample came primarily from the surface probably skews it heavily in favor of the shell-tempered pottery.

This writer cannot begin to deal with the complexity of the Woodland types. They formed 45.16 percent (201) of the sherds collected and most were sand-tempered, cord-marked, and appeared to be from shallow bowls. Shell-tempered pans with a variety of surface impressions, including coarse fabric, cane matting, loose net, and grass and twigs, are typed by Wimberly (1960:186) as Langston Fabric Impressed at Beckum Village. This type, mostly cane matting impressed, formed 28.08 percent (125) of the pottery collected. Another 11.01 percent (49) was Beckum Plain, a heavy shell-tempered ware of circular basin form. The other 15.73 percent (70) of the sherds were shell-tempered types which were thinner, had a

better surface finish and appeared to come from a variety of vessel forms.

The fact that large pan forms composed 39.09 percent of the total surface-collected sample and 71.3 percent of the total shell-tempered wares, plus the proximity to the salt springs, strongly suggests to this writer that the area was specialized for salt manufacture.

# CHAPTER IX

## SUMMARY AND CONCLUSIONS

Salt, whether obtained from the immediate environment or through trade, has been shown to be an important ecological factor to intensive farmers all over the world. In the past, when transportation was more difficult, salt was often a scarce and precious comodity, especially for inland peoples.

In the preceding pages I have attempted to outline the need, the distribution, and the technological availability of salt to the major cultural traditions in Southeastern United States prehistory.

The plotting of the distribution of natural salt deposits and a discussion of the forms in which salt occurs show the environmental possibilities. Undoubtedly many more specific locations were known to prehistoric peoples but have failed to be recorded. However, a general idea of directions in which the salt may have moved can be gained. Major portions of the Southeast, including the area of the present states of North and South Carolina, Georgia, Alabama, and Mississippi, appear to have very limited, if any, saline resources. The Lower Ohio and the Central Mississippi Valleys, Kentucky, Tennessee, northern and southern Louisiana, and a small area in southwestern Alabama were regions of notable

salt producing activities.

A great deal of the impression of the importance of salt to the earliest cultural traditions is based on analogy with the recorded use of salt by living cultures. To the early Big-Game Hunters, whose diet is assumed to have contained a major portion of animal flesh, the physiological need was provided for by the ordinary diet. For Archaic tradition peoples, this was probably also the case. The possibility that rock salt may have been quarried at these very early times rests on one fragment of basketry of uncertain provenience from Avery Island. For the intensive agriculturalists of the Mississippian tradition, predictably salt would have been more important. Both historical and archeological evidence focuses on people with this pattern of adaptation.

At salt springs in Ste. Genevieve County, Missouri, and at Beckum Village ($Ck^V$ 24) in Alabama, Woodland pottery types formed a greater percentage of the total sherds. At the Missouri sites, the common occurrence of shallow bowl forms among the Woodland pottery types and lack of camp-site debris led Keslin to conclude that the springs were already being used as specialized areas for salt manufacture by Woodland peoples. Certainly the transition from Woodland to Mississippian usage of the springs seems to be gradual and overlapping.

By Mississippian times, the saline springs were receiving much attention. Groups in the central Mississippi and Ohio valleys, Kentucky, Tennessee and Alabama, were using pottery vessels, primarily of a flat, shallow pan form, to

free dissolved salt from the brine. In southern and northern Louisiana brine was also boiled in large pottery vessels. Sea water may also have been boiled, but the archeological evidence for this practice would be dispersed. The De Soto narratives make one reference which sounds as though rock salt was being obtained, but the source of it is uncertain. Cakes of salt are mentioned as having been used in trade.

Some social correlates of salt making are also suggested by early accounts. The sex of the salt makers, when mentioned, is female (Du Pratz 1763:118; Hale 1886:3; Hildreth 1945:4). The references imply that both sexes went to the springs, and the men hunted while the women made salt.

Salt making might have been a seasonal activity for some groups. At the Scioto springs in Ohio, the optimum time for salt making appears to have been summer and autumn (Hildreth 1945:4). In northern Louisiana, Du Pratz (1763:307) mentions that Indians came from considerable distance in the winter to make salt and to hunt. The pottery at Avery Island suggests that Mississippian peoples from areas to the north may have come there on salt-making expeditions (Gagliano 1964:63).

Immediate local populations in areas where salt springs were available were probably manufacturing salt both for local consumption and for trade purposes. The area surrounding the salt springs of Missouri had a dense Mississippian population. Village and burial sites are near to the springs and suggest that working at the salt springs was practiced by the members of the local population, probably by the women, rather

than by specialists. Keslin (1964:4), on the basis of his excavations, concluded that permanent residence was not maintained in the immediate vicinity. Certainly the marshy areas around these springs, most of which were practically at water level in relationship to nearby streams, would have made poor places to live. About 1000 feet away from Keslin's main excavation at the Kreilich Site, Bushnell (1914:645) reported a Mississippian village with a small mound. Keslin's own excavations at the Fortnight site seem to suggest a small village or camp area on the plateau just above a salt spring. However the material from the immediate vicinity around the springs, as Keslin noted, does suggest that activities there were specialized for salt making.

The local groups may have controlled the resources or allowed access to neighboring groups which lacked such resources. The reports of some early explorers from Virginia (Hale 1886:23) concerning a powerful tribe which made salt and sold it to other tribes and who jealously guarded their territory, may indicate that control of salt resources existed in some areas.

Driver (1961:237) suggests that persons involved in salt making and trading were specialists. As discussed above, some of the historical documentation seems to indicate that salt making was the responsibility of women as part of the seasonal round of activities, although populations near to springs likely engaged in making more than was locally needed. However the traders themselves may well have been more special-

ized, with salt as only one of a whole complex of traded items, such as skins, copper, stone, and marine shell. The account of the white woman captured by the band of Shawnee suggests that, in later times at least, expeditions may have combined raiding with salt making and trading.

Salt's solubility and the fact that it was consumed at its destination makes the possibility of finding it in archeological context slim. Therefore analysis of samples to trace them to their sources, as can be done with other items of trade, is impossible.

Some suppositions can be made about the areas that the major springs supplied. The springs south of St. Louis, Missouri, probably supplied Cahokia, and the presence of trade ware from Cahokia supports this connection. The Gallatin county, Illinois, area appears to have been an important supplier of that region and may have supplied the Angel site. The southern Alabama springs may have supplied the Moundville area (some Moundville Incised Pottery was found at $Ck^{V}$ 24). Numerous smaller springs, away from the major water and over land routes, probably supplied local populations.

In the extensive area of the Southeast which lacked local sources, some of the salt may have been obtained from long distances by trade routes; but the reported use of salt substitutes in these areas attests to the fact that other steps had to be taken as well. The effectiveness of these customs in replacing mineral salt is unknown. Keslin (1964: 17) claims that in the salt-lacking areas of the Southeast,

the use of salt was virtually unknown before contact and that diet supplied salt in sufficient quantities to eliminate the necessity of obtaining it in the free state. The discovery of sites which appear to be related to salt making in Alabama, part of the area to which Keslin attributed no salt usage, would cast doubt on this generalization. Also this conclusion seems inconsistent with the importance he attributes to salt as an element of diffusion, for if salt were used only in the areas where it was immediately obtainable, it would hardly constitute an important stimulus for cultural diffusion. The ethnographic references to salt clans and the use of salt in ceremonies by tribal groups of this area, suggest that salt was used when obtainable and was treated as a sacred and scarce material.

It is suggested that in future archeological investigations possible sources of salt could be added to the list of important factors to be considered in the ecology of an area.

BIBLIOGRAPHY

ADAMS, ROBERT M.
1949 Archeological Investigations in Jefferson County, Missouri. The Missouri Archeologist 2(3-4):1-72.

ALVORD, CLARENCE W. and LEE BIDGOOD, eds.
1912 The First Exploration of the Trans-Allegheny Region by the Virginians, 1650-1674. Cleveland, Arthur H. Clark Company.

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
1926 The Geology of Salt Dome Deposits.

ARATA, ANDREW A.
1964 Fossil Vertebrates from Avery Island. In An Archeological Survey of Avery Island, by Sherwood M. Gagliano, Baton Rouge, Coastal Studies Institute Louisiana State University.

BARKSDALE, JELKS
1929 Possible Salt Deposits in the Vicinity of the Jackson Fault, Alabama. Alabama Geological Survey Circular 10.

BELL, DONALD T.
1960 Sodium Chloride in Animal Nutrition. In Sodium Chloride, Dale Kaufmann, ed.

BENNETT, JOHN
1941 "Salt Pans" at the Kincaid Site. American Antiquity 7:165.

BLACK, GLENN A.
1967 Angel Site, An Archeological, Historical, Ethnological Study. Indianapolis, Indiana Historical Society.

BLOCH, M. R.
1963 The Social Influence of Salt. Scientific American 209(1):88.

BOWNOCKER, J. A.
1906 Salt Deposits and the Salt Industry in Ohio. Ohio Geological Survey, 4th Series, Bulletin 8.

BUSHNELL, DAVID I.

1907 Primitive Salt Making in the Mississippi Valley. Man, No. 13.
1908 Primitive Salt Making in the Mississippi Valley, II. Man, No. 35.
1914 Archeological Investigations in Ste. Genevieve County, Missouri. Proceedings of the United States National Museum 46:641-668.

CALDWELL, J.R.
1950 Trend and Tradition in the Prehistory of the Eastern United States. Memoir 88, American Anthropological Association.

CHAMBERS ENCYCLOPEDIA
1968 London, Pergamon Press

CLARK, T.D.
1938 Salt as a Factor in the Settlement of Kentucky. Filson Club Historical Quarterly 12(1).

COLE, FAY-COOPER, ed.
1951 Kincaid. Chicago, University of Chicago Press.

DASTRE, M. A.
1901 Salt and Its physiological Uses. Smithsonian Institution Annual Report for 1901, Separate No. 1351.

DAUPHINEE, JAMES A.
1960 Sodium Chloride in Physiology, Nutrition, and Medicine. In Sodium Chloride, Dale Kaufmann, ed.

DIESING, EUGENE H.
1955 Archeological Features in and Around Washington and Jefferson Counties, Missouri. The Missouri Archeologist 17(1).

DRIVER, HAROLD E.
1961 Indians of North America. Chicago.

DU PRATZ, M. LE PAGE
1763 The History of Louisiana or of the Western Part of Virginia and Carolina. London.

FILSON, JOHN
1784 Filson's Kentucke. Filson Club Publications, No. 35.

FORBES, R. J.
1954 Chemical, Culinary, and Cosmetic Arts. In A History of Technology, Singer, Holmjard, Hall, and Williams, eds.

GAGLIANO, SHERWOOD M.

1964 An Archeological Survey of Avery Island. Baton Rouge, Coastal Studies Institute, Louisiana State University.

GILMORE, HARLAN
1955 The Role of Salt as an Element of Cultural Diffusion. American Anthropologist 57(5):1011-1015.

GRIFFIN, JAMES B.
1939 Report on Ceramics of Wheeler Basin. In An Archeological Survey of Wheeler Basin on the Tennessee River in Northern Alabama, by William Webb, Bureau of American Ethnology Bulletin 122.

HALE, J. P.
1931 Trans-Allegheny Pioneers. Charleston, W. Va.

HARIOT, THOMAS
1588 Narrative of the First English Plantation of Virginia. London, Bernard Quaritch.

HARRIS, FLORENCE
1960 Economics of the Salt Industry. In Sodium Chloride, Dale Kaufmann, ed.

HARRISON, H. S.
1954 Discovery, Invention, and Diffusion. In A History of Technology, Singer, Holmjard, Hall, and Williams, eds.

HAWK, PHILLIP B., BERNARD L. OSER, and WILLIAM H. SUMMERSON
1954 Practical Physiological Chemistry. McGraw Hill Books, Inc.

HILDRETH, S. P.
1945 Ohio's Mineral Resources, Part 3, Salt; Part 1, Salt Springs, Early History of the Salt Manufacture in Ohio. Ohio State University Studies, Engineering Experimental Station Circular 47.

HUNTER, HELEN VIRGINIA
1940 The Ethnography of Salt in Aboriginal North America. M.A. Thesis, University of Pennsylvania.

JENNINGS, JESSE D. and CHARLES H. FAIRBANKS
1940 Pottery Type Descriptions. Newsletter, Southeastern Archeological Conference, 2(2).

KAUFMANN, DALE W., ed.
1960 Sodium Chloride. American Chemical Society Monography Series.

KESLIN, RICHARD O.
1964 Archeological Implication on the Role of Salt as

an Element of Cultural Diffusion. The Missouri Archeologist 26.

KILLEBREW, J. B.
1874 Introduction to the Resources of Tennessee. Nashville, Eastman and Howell, Inc.

LAMAR, J. E.
1938 "Brines" in Unexploited or Little-known Industrial Minerals of Illinois. Illinois State Geological Survey Circular 23, 5th Annual Mineral Industries Conference.

LANDES, KENNETH K.
1960 The Geology of Salt Deposits. In Sodium Chloride, Dale Kaufmann, ed.

LANG, WALTER B.
1957 Annotated Bibliography and Index of Salt Deposits in the United States. United States Geological Survey Bulletin 1019-J.

LAWSON, JOHN
1714 History of Carolina Containing Exact Description and Natural History of That Country. Richmond, 1937 edition.

LEFOND, STANLEY J.
1969 Handbook of World Salt Resources. New York, Plenum Press.

LEGRAND, H. E.
1955 Brackish Water In Great Carolina Ridge. American Association of Petroleum Geologists Bulletin 39: 2020-2037.

LEWIS, THEODORE H.
1907 The Narrative of the Expedition of Hernando De Soto by the Gentleman of Elvas. In Original Narratives of Early American History, Franklin J. Jameson, ed.

LIPPINCOTT, ISAAC
1912 Early Salt Trade of the Ohio Valley. Journal of Political Economy 20:1029.

LONN, ELLA
1933 Salt as a Factor in the Confederacy. New York, Walter Neale.

MCCALLIE, S. W.
1908 A Preliminary Report on Underground Waters of Georgia. Geological Survey of Georgia Bulletin 15.

MCFARLAN, A. C.
1943 Geology of Kentucky. University of Kentucky.

MCWILLIAMS, RICHEBOURG G.
1953 Fleur de Lys and Calumet; Being the Pénicaut Narrative of French Adventure in Louisiana. Baton Rouge.

MORIARTY, JAMES R.
1965 The Influence of Strand Plain Morphology on the Development of Primitive Industries along the Costa de Nayarit, Mexico (2nd part). American Indigena 25(1).

MYER, WILLIAM E.
1928 Indican Trails of the Southeast. Forty-second Annual Report of the Bureau of American Ethnology.

ORR, KENNETH G.
1951 Change at Kincaid: A Study of Cultural Dynamics. In Kincaid, Fay-Cooper Cole, ed.

PEITHMANN, IRVIN
1953 A Preliminary Report on Salt Making and Pottery Manufacture at a Prehistoric Site in Gallatin County, Illinois. Journal of the Illinois Archeological Society 3(3).

PRICE, P. H.
1937 Salt Brines of West Virginia. West Virginia Geological Survey 8:203.

RAMSDELL, LEWIS S.
1960 Mineralogy of Salt. In Sodium Chloride, Dale Kaufmann, ed.

RIEHM, KARL
1961 Prehistoric Salt Boiling. Antiquity 35(139):181-191.

ROBERTSON, R. S.
1878 Antiquities of Nashville, Tennessee. Smithsonian Report for 1877.

SAFFORD, JAMES M.
1869 Geology of Tennessee. Nashville.

SINGER,C.; E. J. HOLMJARD; A. R. HALL; and T. I. WILLIAMS
1956 A History of Technology. New York, Oxford University Press.

SPOONER, W. C.
1929 Interior Salt Domes of Louisiana. In The Geology of Salt Dome Deposits, American Association of

Petroleum Geologists.
1932 Salt in Smackover Field, Union County, Arkansas. American Association of Petroleum Geologists Bulletin 16.

STOSE, G. W.
1911 Geology of the Salt and Gypsum Deposits of Southwestern Virginia. United States Geological Survey Bulletin 530.

STOUT, WILBER, et. al.
1932 Brines of Ohio. Ohio Geological Survey, 4th Series, Bulletin 37.

SUPER, S. W.
1904 Salt. Popular Science Monthly 65:252.

SWANTON, JOHN R.
1928 Social Organization and Social Usages of the Indians of the Creek Confederacy. Forty-second Annual Report of the Bureau of American Ethnology.
1939 Final Report of the United States De Soto Expedition Commission. 76th Congress, 1st Session, House Document No. 71.
1947 The Indians of the Southeastern United States. Bureau of American Ethnology Bulletin 137.

THORNBURY, WILLIAM D.
1958 Principles of Geomorphology. New York, Willey and Sons.

VARNER, JOHN G. and JEANETTE J. VARNER
1951 The Florida of the Inca. Austin.

VEATCH, A. C.
1902 The Salines of North Louisiana. Geological Survey of Louisiana, Report of 1902, Special Paper No. 2.

WADLEIGH, CECIL H. and MILDRED S. SHERMAN
1960 Sodium Chloride in Plant Nutrition. In Sodium Chloride, Dale Kaufmann, ed.

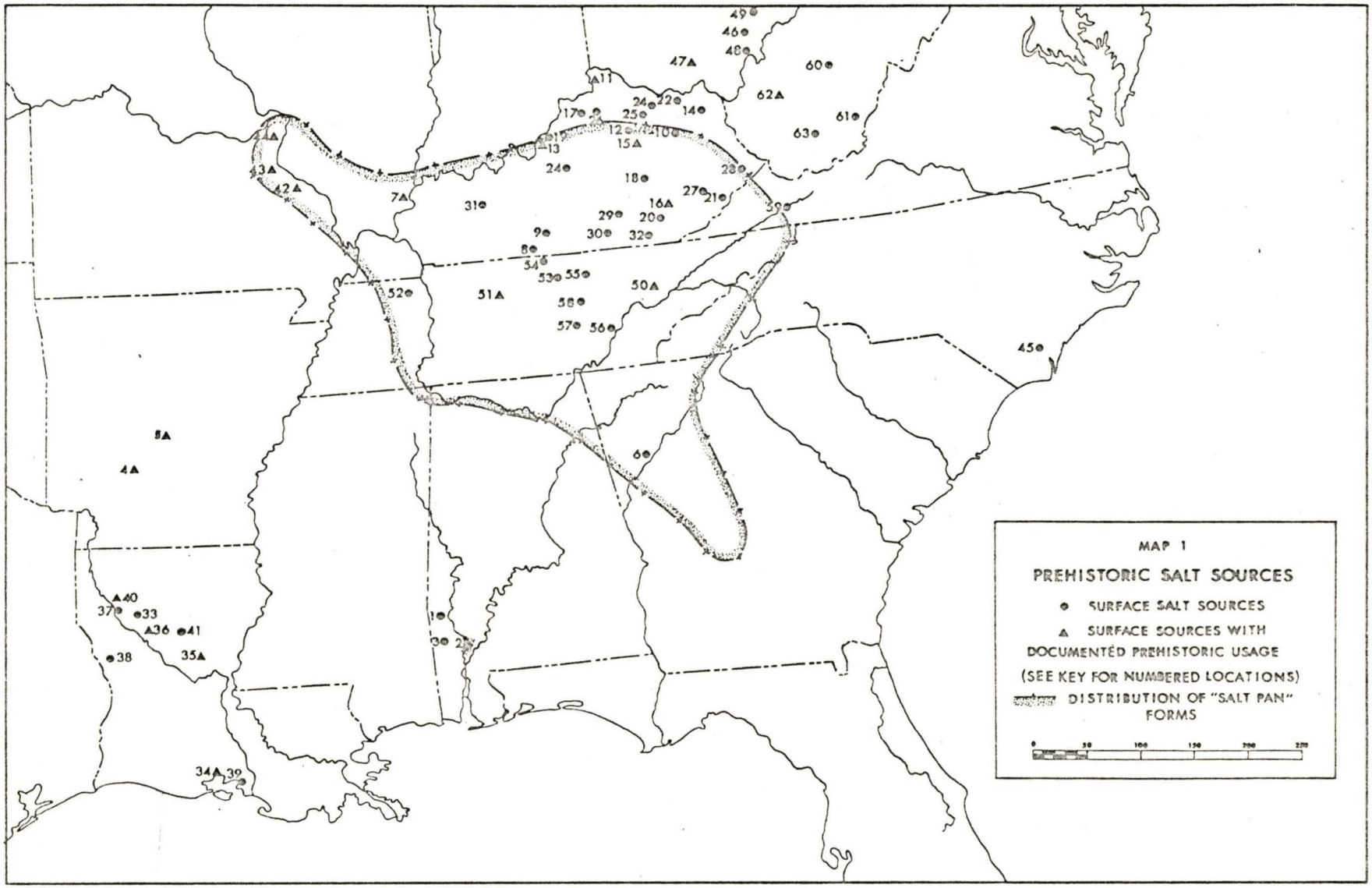
WEBB, WILLIAM S.
1939 An Archeological Survey of Wheeler Basin on the Tennessee River in Northern Alabama. Bureau of American Ethnology Bulletin 122.

WEBB, W. S. and W. D. FUNKHOUSER
1931 The Tolu Site. Reports in Archeology and Anthropology, University of Kentucky, 5:314-410.

WILLEY, GORDON R.
1966 An Introduction to American Archeology. New

Jersey, Prentice-Hall, Inc.

WIMBERLY, STEVE B.
1960 Indian Pottery from Clarke County and Mobile County, Southern Alabama. Alabama Museum of Natural History Paper No. 36.


MAP 1
PREHISTORIC SALT SOURCES
SURFACE SALT SOURCES
SURFACE SOURCES WITH DOCUMENTED PREHISTORIC USAGE
(SEE KEY FOR NUMBERED LOCATIONS)
DISTRIBUTION OF "SALT PAN" FORMS