ARCHEOLOGICAL INVESTIGATIONS ALONG ARMAND BAYOU HARRIS COUNTY, TEXAS

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TECHNICAL REPORT NUMBER TWO
Department of Anthropology · Rice University
Houston, Texas

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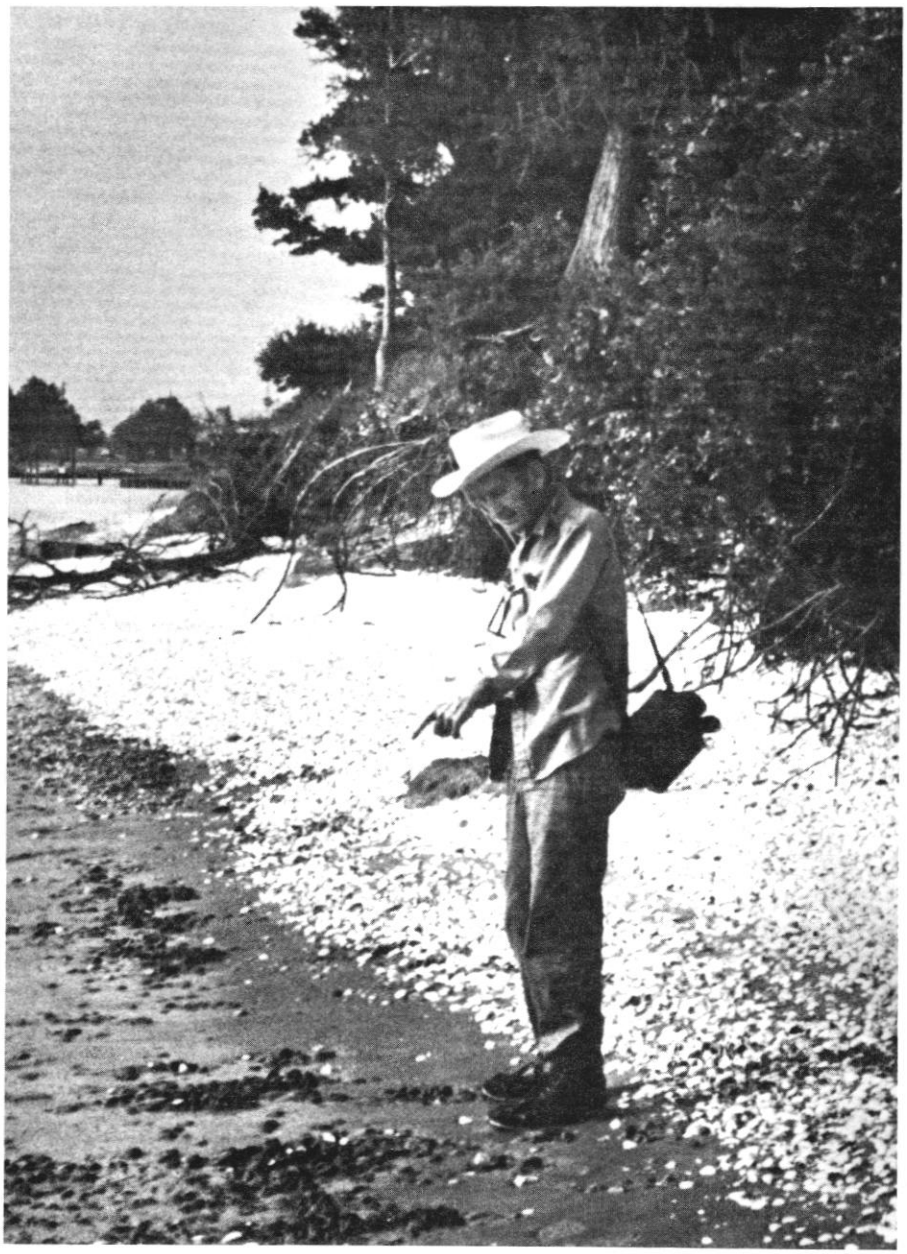

Wayne Neyland pointing out Indian pottery
during survey of Clear Lake in 1970

These reports are dedicated to the memory of Wayne B. Neyland whose enthusiastic participation in the archeology of the Houston area as a member of the Texas Archeological Society and founder and past President of the Houston Archeological Society, is gratefully remembered. In his last project, Wayne served as Director of the Armand Bayou survey, at a time when his health was rapidly failing. Much of the success of this project, which is reported here, is due to Wayne's tireless efforts and example of enthusiastic dedication.

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Preface

The field research reported in this volume was carried out in 1970 and 1971 and the analysis of material was completed in the next two years. The projects were carried out under the supervision of Frank Hole although much of the fieldwork and all of the analysis of the sites and their contents was directed by Michael J. O'Brien. Bonnie Laird Hole participated in the excavation and conducted the studies of molluscan remains. Responsibility for writing the reports thus rested upon three persons whose contributions are listed as separate sections of this volume. In spite of this formal division of labor, the reports all represent the collective ideas of the three authors during the years we were together at Rice University. Responsibility for compiling the reports and editing them for publication was assumed by Frank Hole whose personal remarks about this project follow.

My own participation in the work described here came about when I agreed to serve as archeological advisor to the Houston Archeological Society's survey of Armand and other bayous which run through property belonging to Friendswood Development Corporation, a subsidiary of Humble Oil Company. Following the survey in 1970, during which we found a number of small sites, members of the Society asked whether we might undertake the excavation of one of the sites. This I agreed to do, both because of my own growing interest in the local archeology and because such an excavation could serve to train members of the Society in archeological techniques. Although a number of sites were available to

dig, I decided that the Fullen site would serve our needs best. It was relatively easy to get to and previous work there had raised some problems that needed to be resolved.

My inexperience in Gulf Coast archeology is apparent in retrospect. I had never dug in gumbo before and I was not prepared for the problems it would present during the very wet and very dry spells we experienced. The dig took much longer than I had expected. In retrospect I would have planned the work differently. Nevertheless, the excavation served as a useful introduction for me to field work in this area, it was good experience for the volunteers who worked at the site, and it has resulted in a significant contribution to local archeology.

Following the excavation we found ourselves with masses of data, a problem compounded by the fact that we had assiduously collected each flake, shell, bone and sherd so that we might carry out quantitative studies. All of this material had to be washed, labeled, sorted and analyzed, a task which is both tedious and time-consuming. To facilitate this processing I employed students at Rice University who could come into my lab at odd hours. Thus we kept the project moving at a slow but steady pace. When this was done, Michael O'Brien and Bonnie Hole took charge of separate portions of the data and carried out the analyses which comprise their separate reports.

Acknowledgments

We should like to express our gratitude to Friendswood Development Corporation, and especially to Mr. George Merriwether, who allowed us access to their property and encouraged us to carry out these investigations prior to the start of construction.

The extent to which this has been a team project will be apparent in the following lists. Members of the Houston Archeological Society and students at Rice University who participated in the survey and/or digging include: the late Wayne B. Neyland, Director of the Survey; Larry and Rhonda Chrisco, Frank Brezik, Chuck Stedman, Dick Gregg, Lou and Margie Fullen, Tom Cobb, Tom Medlin, Bill Ainsley, Don and Evelyn Lewis, Bill Moore, Nancy Jircik, Marsha and Linda Zehl, Janet Collins, Kay Evans, Marie Bishop, and Liz Tagge. Bruce Byland, Ed Koehler, Ted McDonald and Eddie Schorr aided in the washing of artifacts and shell.

A special note of thanks is owing to Bill O'Brien. Although his name does not appear otherwise on these reports, he aided in survey, excavation and analysis, and directed the excavation in the absence of his brother. He also made collections of local fauna for comparative purposes and lent a welcome air of congeniality to the project.

Aid in preparing the manuscripts was provided by Susie Bielstein, Sue Woodson and Mary Margaret Williamson. Melissa Crowfoot, Mary Margaret Williamson and Steven Hole drafted the maps and figures. Ron Wilson aided in analysis of artifacts, and A. P. Collins drew the sherd profiles.

Finally, the completed manuscripts were set up for typing and publication by C. K. Chandler and Jack Klatt.

Mrs. J. R. Glaspy typed all of the manuscripts and assisted in proofreading the entire report. Her able assistance is gratefully acknowledged.

I. ARCHEOLOGY OF THE UPPER GALVESTON BAY REGION

by Frank Hole

Archeological Problems

For many years the presence of Indian artifacts in shell middens along the bayous in and around Houston has attracted the attention of collectors, amateur archeologists, and an occasional professional archeologist. However, attention tended to be focused on a relatively few localities, and the gathering of information about Indian sites was haphazard. The problem worsened with each passing year because of industrial development which obliterated sites and with the subsidence of shorelines where many of the sites were located. In consequence, today there are very few known sites remaining in the immediate vicinity of Houston which have not been disturbed by severe erosion or by the potholes of weekend collectors.

The magnitude of the problem became apparent only when serious systematic work was initiated a decade or so ago. At about the same time, in response to the interest of many enthusiastic amateurs, the Houston Archeological Society was born, dedicated to furthering knowledge about local Indian sites and the preservation of these resources. It was shortly after this that I was asked to become involved in advising the Society on archeological projects. Eventually, through the enthusiasm of the members, I was personally drawn into the work, although my own research had been primarily centered in Southwest Asia, a vastly different kind of archeology from that which we find on the Gulf Coast.

Because of my inexperience in local archeology, I was able to bring a somewhat different perspective to bear on the local problems. One of the first things that seemed to be needed was

an assessment of what was known. It was only after an initial attempt to draw together these data that the haphazard and unsystematic coverage became apparent. With that situation in mind, however, it seemed essential to try to develop a planned approach which would help us to understand the history of Indian use of this area.

Fortunately for this scheme, the Houston Archeological Society was offered the opportunity of conducting studies of a large block of land which had not been developed extensively. This land, centering on what is now called Armand Bayou, was owned by Friendswood Development Corporation which planned to develop it for residential use. Officials of the Corporation allowed us access to the land and encouraged research on the entire 30,000 acres of what had once comprised a large ranch. It seemed to be an ideal place to initiate an intensive survey and some excavation. Two purposes would be served: to involve members of the local Society in an important project, and to begin to develop an understanding of the ways Indians had used the land.

Before we embarked on the project, however, it was necessary to formulate some questions which would guide our work and help us to design productive research problems. Such a list was prepared and discussed at meetings of the Houston Archeological Society. There were five general types of problems that we thought needed work: 1) a study of the modern and prehistoric environment with relation to the location and use of Indian sites, 2) the relation between historically-known Indians and the remains found in sites, 3) a reconstruction of prehistoric

ways of life, 4) methods of dating sites, and 5) methods of conducting surveys, digging sites, and analyzing artifacts. The last two problems are technical in nature but they needed to be solved if we were to be able to interpret Indian remains with any accuracy. Thus we set for ourselves rather broad and long-range goals.

It is the interpretation of Indian remains themselves, however, that remains the central goal of archeology and interests most professionals and amateurs alike. Problems relating to this concern fall into three major categories: 1) "Time-space systematics" - determining when and where each recognizable kind of artifact occurs. This provides a basic chronological outline of Indian history from the point of view of changes in artifacts. 2) Reconstructing prehistoric ways of life. What were the Indians doing? How did they live? Were there changes in their ways of life? 3) Tracing of historically-known Indians. Can we identify Karankawa or Capoque or Hans? Can we tell the differences between Karankawa and Atakapan peoples? Can we find sites where Indians are known to have been in contact with specific early travelers like Cabeza de Vaca?

To answer each of these kinds of questions requires somewhat different kinds of evidence and, of course, no single site is likely to provide more than a few clues about any one of them. Moreover, the problems require that we adopt a broad regional view of local archeology and a systematic compiling of information from many sites. The questions concerning how the Indians adapted to the area require that we learn about the land as it was before the modern era - the natural environment, its changes,

and its effects upon man.

Although we can specify the general things that we might wish to learn about prehistoric Indians, it is clear that we cannot hope to learn everything in a short time. Instead, we must select certain things that are important as beginning points in a long-range series of investigations. In short, we must design research projects which are specifically directed toward solving some important problems. If we are successful in these, we can build upon them and in this way gradually develop an accurate understanding of Indian history.

In any scientific work it is important first to determine what we know. In passing I have mentioned historical records and briefly referred to previous archeology. When we began this project there were 564 archeological sites recorded in the seven-county region that includes Houston. Most of these sites were simply listed as being present. There was little, if any, information on their size, their contents or their ages. Many of the sites no longer exist because of erosion, subsidence of the land, or industrial development. Furthermore, much of the information in the files is inaccurate, either as to the precise location of the sites, or as to their physical features. In short, the information is generally of poor quality and it reflects the unsystematic nature of collecting and reporting. In spite of these limitations, however, an examination of the maps which plot these sites, leads one to the conclusion that Indians preferred certain locations rather than others. Thus, we can predict with some accuracy where sites should be found, even if they have not already been

reported.

Aside from the listing of sites, there have also been programs of excavation and survey carried out in a few areas by both professionals and amateurs. The most notable of these are in the Livingston, San Jacinto, Addicks and Wallisville reservoirs. Other smaller-scale surveys and excavations have been carried out on Clear Creek, Chocolate Bayou, Lake Jackson, Galveston Island and Bolivor peninsula. To this list we can now add the work on Armand Bayou, formerly called Mud Lake.

Much of this work has been reported in journals, newsletters of amateur archeological societies, and reports of State agencies concerned with protecting or salvaging archeological remains before their destruction by major construction projects such as the development of reservoirs. The common theme which runs through all these reports is the development of "time-space systematics." There has been little serious effort to consider the ways of life of the Indians whose sites have been excavated.

In the last few years, however, this situation has been changing rapidly. Both professional archeologists and amateurs, often under the guidance of professionals, have begun to carry out much more systematic inquiries which incorporate ideas about patterns of settlement, seasonal rounds of activities, studies of changing landforms and resources, and relations among geographically separate Indian groups as evidenced by trade or exchange of pottery, flints and the like. We are finally beginning, as a result, to bring some life to the stones and bones of prehistory.

Strategies of Research

When we began this project we had a number of specific things we wished to find out and these determined the methods we used in survey, excavation and analysis of the data we recovered.

The excavation was to serve several purposes: 1) to help us understand the nature of shell middens, 2) to help us in defining changes in artifacts through time more accurately, 3) to provide us with information that would aid in interpreting the environment, and 4) to try new methods of digging middens.

Shell middens are heaps of clam and oyster shells in which there are tools, utensils of pottery and remains of fish or mammalian bones. They are trash heaps. The problems that we wished to understand were of the following kinds: 1) How did middens accumulate? Did people throw baskets full of trash in heaps as we would in a garbage dump? Did people live on the middens, or were their camps nearby? Were there long periods during which sites were not occupied? Did the same people always come back to the same sites?

These kinds of questions could only be answered through careful digging which would separate separate events - dumpings of shell, camping on the surface of the midden, abandonment of the site, and so on. Traditionally middens had been dug in a series of arbitrary levels of say 3" or 6" because it is very difficult to see layers in the heaps of shell. But, if a midden had accumulated as a series of separate heaps of shell which were placed alongside rather than on top of one another, digging in arbitrary horizontal units would miss this fact.

In order to solve this problem we experimented with a different digging technique. We attempted to let the artifacts tell us where the levels, which denoted separate events in the accumulation of the site, were. Our procedure was to dig down with screwdrivers or trowels very slowly and carefully across a small area. We tried to peel off only very thin layers across a horizontal surface. If large fragments of bones and pottery were found, they were left in place until the entire square had been uncovered at that level.

We did this because we assumed that people living on the site would have scattered their debris across the available surface. Later, if the people came back, they would scatter another layer of debris on top of the previous one. By peeling off each layer we hoped to be able to isolate artifacts from each major occupation of the site.

The method of digging has proved useful in European caves where layers as thin as one centimeter are often separated. It was much more difficult at Armand Bayou, however. There were two problems; the fact that shells are hard to dig around, and that untrained excavators find it hard to translate the idea of digging by layers of artifacts to the practice of doing so. People have a tendency to dig too deep or to worry endlessly about each crumb of earth. The pace and quality of work were thus somewhat uneven.

Aside from the layers of artifacts, we thought that we might learn equally as much from a study of the layers of shells. We hoped to gain environmental information and clues that would tell

us whether the site had been used continuously or whether there were long periods without occupation. These requirements necessitated keeping all of the bits and fragments of shell. We wanted to know what species were present, how old and large they were, and what their condition was: Were they whole, highly fragmented or eroded?

Collecting whole shells is relatively easy but it proved to be very tedious to pick out fragments from the earth being screened. This was especially true when the dirt was hard. Since saving shells was also a departure from customary work and since the value of doing so remained to be proven, my insistence upon picking them out of the screen was met with some resistance. As Bonnie Hole's report shows, we could have dispensed with some of this.

The separation of shells and artifacts by thin layers was absolutely crucial, however, if we wished to distinguish minute changes which would enable us to subdivide the chronology and obtain information on changes in local environmental conditions. As both O'Brien's and Bonnie Hole's reports show, our tedious efforts did pay off in these regards.

One final aspect of the excavation must be mentioned. Historic records left us in some doubt as to where the Indians actually lived. The crucial question was, did they live on top of the shell heaps or did they live nearby? In my view it would have been unpleasant to live on top of the shells, but archeologists have usually assumed that the Indians did just that. There are two arguments in favor of this idea. First, the arti-

facts are found in the middens as if the people had used them there. Second, especially in wet weather, shells provide some drainage and might be better to live on than a wet clayey field.

There were no direct lines of evidence to suggest that Indians did not live on the sites, but the fact remains that systematic study of the area surrounding middens has not been made. To test the possibility that temporary shelters had been erected off the midden we obtained a tractor-drawn scraper and had the surface soil removed from two long strips away from the site. What we hoped was to find scatters of artifacts, postholes and fireplaces; or nothing at all. We wanted conclusive evidence.

Unfortunately for these plans, we had an extremely dry spring so that the soil became near rock hard. When the surface was scraped, the underlying clay itself became hard immediately, making it almost impossible to clean it for purposes of observing any postholes or other features. At that time we did not have the means to spray the surface except in small patches. Nevertheless, the scraper did turn up concentrations of pottery and a trace of what might have been part of a shelter. The data, however, are ambiguous and we still cannot state with certainty where the Indians lived. It is relevant to note, however, that excavations at burned rock middens in central Texas, which are analogous to the shell middens, do have occupation areas away from the piles of stones.

The difficulties that we encountered at the Fullen site were overcome in subsequent work that we have done. The most important innovation to arise from this experience is the use of a pump to

draw water out of the bayous so that all of the dirt may be washed through the screens and so that large areas may be sprayed. Both the speed of screening and the amount of material recovered increase dramatically with the use of water.

The Survey

Our primary intent in doing the survey was to document each site as thoroughly as possible. We needed information on its location with respect to topography, drainage and vegetation. We also wanted to know its size, whether it was composed of clam or oyster shells, or if it was on a sandy knoll. Finally, we wanted a collection of artifacts which would help us assess its age and cultural affiliation.

With these data we felt that we would be able to reconstruct an outline of the pattern of settlement at different periods. We thought that we might be able to identify sites of different kinds: campsites, workshop sites, transitory camp and the like. Finally, we wished to investigate the distribution of sites with respect to the regions that may have been used by single groups of Indians. Did each group habitually travel along one bayou, did it use the territory encompassed by several bayous? Did it live part of the year on the coast and part of the year inland at places like Addicks reservoir?

Clearly answers to these kinds of questions require more than the survey of just one small bayou but they require the kind of data enumerated above. Our survey was designed to be a small step toward understanding how the Indians used this particular region.

Analysis of Artifacts and Shells

In order to answer our questions we needed to make very detailed studies of both the artifacts and shells. In our opinion, suitable methods for doing these had not been devised. Accordingly we designed a form which listed attributes or characteristics of sherds. We hoped in this way to be able to recognize subtle changes in the ways pots were made which would help us to subdivide our chronology more accurately. This meant that each sherd had to be studied separately and have its attributes recorded. Finally, when this was finished, we could look at the forms to see which attributes were important in distinguishing changes in time. These attributes then, could be used in future studies to make comparisons among sites and to chart differences and similarities in the ceramic histories of separate regions. We had hoped to do this as well with other kinds of artifacts but they were not numerous enough to be of great value. The most significant other artifacts were, of course, projectile points which are always found and always reported on at other sites. Nevertheless, by charting changes in the points against the layers in the site we were able to clarify the chronological distribution of some of the types of points.

With these goals in mind, Michael O'Brien and Bonnie Hole carried out their studies independently. We had hoped that the analysis of shells would serve as an independent check on the layering of the site as it appeared from studies of the artifacts. In many instances they did but in others we found changes in shells which did not relate directly to changes in artifacts.

This is what we should expect from independent lines of evidence. Nevertheless, in combination, the two kinds of analysis shed more light on the nature of the site - the way it had accumulated - than either would have by itself. Thus, our approach to the study proved worthwhile. What it did not do was clear up all the possible sources of ambiguity. This in itself is a challenge. A successful project raises new questions and demands new approaches and techniques. The important thing is that we have a solid foundation upon which to build in future work.

The Historical and Archeological Background

It is a fundamental rule of thumb in archeology that you should begin with what you know and build from there. Although the details are exasperatingly skimpy, the things we know best about the local Indians come from ethno-historical records. These are stories told by travelers and settlers, and information compiled by historians about the Indians before they were exterminated or absorbed by growing numbers of Anglo settlers. By the mid 1800's there were no active Indian cultures in this part of the Gulf Coast. Counting the first recorded sightings of Indians we have about 300 years of very sketchy and incomplete records. But these records serve to give us descriptions of how the Indians lived which are far superior to what we could obtain solely from the known archeological record. And they serve as a point of departure for our archeological investigations.

Anthropologists have consistently noted one thing about peoples who lived along the Texas Gulf Coast: they never developed a complex way of life. They had no agriculture, they had no

elaborate religion, and they did not even have permanent villages with houses. Nor did they have strong chiefs, advanced technology or writing. In short, they were among the simplest cultures in all of North America. However, one should not sell them short. The Gulf Coast is not an easy place to live, and to succeed here for several thousands of years the Indians had to develop an ingenious way of life. Our problem is to determine how they did it; perhaps in the answer to that question we shall see some reasons why they did not develop into higher cultures.

The first records of Texas Indians come from a remarkable book, Cabeza de Vaca's Adventures in the Unknown Interior of America, (Covey 1961). In this book Cabeza tells how he, along with seven companions reached Galveston Island by raft in 1532 after the ships of his expedition to Florida had sunk. The seven survivors struggled ashore to be met by bands of Indians called the Capoques and Hans who fed them and gave them shelter.

A resume of this encounter is given by Newcomb in the Indians of Texas.

> "The Capoques and Hans, with whom Cabeza de Vaca was so familiar, camped on the off-shore islands, catching fish in cane weirs and eating the root of an underwater plant in the fall. By midwinter these plants had begun to grow, making the root useless as food, and the bands were forced to move. They subsisted until spring exclusively upon oysters, which were found along the shore of the mainland; then for a month they ate blackberries. The summer months appear to have again been spent in the lagoons and islands of the coast... The bars and islands were cold and wet during the winter months, while the mainland shore was warmer and more attractive." p.66

Newcomb continues with a description of the Karankawa,

the large group of Indian bands who lived on the Texas coast between the Rio Grande and Galveston. Some of this is based upon Cabeza de Vaca and some on later travelers' records.

> "The Karankawa's nomadic mode of life restricted their housing and household gear to the portable. Their hut... for example, was made of a dozen or so slender willow poles, approximately eighteen feet long and pointed at one or both ends. The sharpened ends were forced into the ground in a circle, the upper ends interlaced and tied with thongs to form an oval framework over which skins and woven mats were thrown. Often only the windward side was covered, so it could as well be called a windbreak as a hut...The size of the huts varied, but normally they were some 10-12' in diameter and accommodated 7 or 8 people. Fires for cooking and for heat were built in the center of these huts, the smoke easily finding its way out. Skins were used to sit on and to wrap up in when sleeping. These huts could be rapidly dismantled by the women, who had a special knack for twisting the willow poles together to stow them in dugouts." p.68

From descriptions like these we can gain some useful information which will help us archeologically, both in looking for sites and in interpreting them after we find them.

A few of the historic records are quite specific about the identities of Indians living at certain sites and historians have been able to give us a sketchy picture of some of the separate tribes. For example, a group called the Akokisa (Orcoquisac) inhabited the area from the Neches to halfway between the Trinity and Brazos rivers (Bolton 1915:334). Bolton infers that the location of four of their camps is along Spring Creek which flows east into the San Jacinto river. He also mentions the Attakapa, linguistically related to the Akokisa, who extended eastward into western Louisiana. With this kind of information archeologists can attempt to find the sites mentioned and begin

to study the different customs of the various Indian groups.

Nevertheless, such historic information pertains to only a very short span of time, as compared with the long Indian occupation of the region. History has also told us of the frequent shifting of Indian groups from one territory to another. Thus, we cannot be sure that the Akokisa, for example, who were known to live along Spring Creek in the 1700's, also lived there in 1500, let alone 1000 A.D. For most of prehistory we must be content to deal with remains left by people whose names we can never know.

More useful for our general purposes of understanding how Indians lived in this area are the descriptions of Indian life. For example, we know that Indians moved from place to place during the year in order to make use of different food resources. We know that they used plants, fish, oysters and deer. Strangely, we find no mention in Cabeza de Vaca of their hunting deer, although later peoples did mention it. We know that they lived in small groups, dwelling in only the most rudimentary of shelters, and had little or no clothing. The people traveled by canoes into which all their gear could be stowed. Cabeza de Vaca did some trading for the Indians, carrying bits of asphalt, shells and oil from the coast to tribes further inland who gave in return things like flint for arrow heads. He also tells us that Indians sometimes gathered in large camps during seasons of plentiful food. Thus, the people were not totally isolated, although each band had its own traditional territory.

The style of life which has been described for the local

Indians would be difficult to interpret solely from archeological remains, especially when sites have been discovered accidentally and when excavations have been sporadic and widely separated from one another. The style of life does suggest, however, that one should try to do careful, systematic work in one particular region, attempting to find examples of the range of sites occupied by a band of Indians during their seasonal round of activities.

But there is another, more serious problem. Since the Indians had so little in the way of equipment and they did not live in permanent houses, there are likely to be relatively few remains at any one site. In fact, to judge from the historic records, it would probably be nearly impossible to identify some of the places that people used. For example, people camping near a berry patch in warm weather might leave few traces that could be found today after some hundreds of years. Thus, we cannot hope to recover anything like all the remains left by Indians nor can we hope to learn everything about them that we would like. Before we turn specifically to an investigation of the local Indians, however, it is useful to put them into somewhat broader cultural and geographic contexts.

Anthropologists have determined that the Indians of this area belong to a much larger group which shares a language called Coahuiltecan. There are two main groups within this language area: the Coahuiltecan proper, who lived in northeast Mexico from the Panuco river to Brownsville, and the Karankawan, who are found chiefly between Corpus Christi and the Trinity rivers.

Within these two major groups were the local bands comprised of people who camped together and who shared dialects of the Coahuiltecan language. In their basic orientation toward substance, all of these peoples were similar to a much larger group we call the Desert Culture: people who were adapted to arid lands and the extensive use of plants for food. It is strange to realize that the Indians who lived along the coast were oriented more toward inland foods than they were to the sea; they were not seafarers.

Farther to the north and east, beyond the Trinity river, were Atakapan peoples who practiced agriculture and were related to the large, powerful tribes of the lower Mississippi valley. That such peoples did not penetrate into the Houston area has something to do with its peculiar geography.

The coastal plain in the vicinity of Houston and Galveston is flat and covered with heavy gumbo soils. When Indians first came here, however, the shore line was probably farther out into the Gulf and the landscape looked much different. The gumbo clays that we now see were deposited in the last 10,000 years as the Gulf rose following the end of the last great Ice Age. As its level rose, the rivers that flowed into it also rose and deposited their loads of silt into their own valleys. Estuaries and lagoons also began to fill up, a process which is continuing even today. Gradually the lowlying marshy areas along the coast are becoming filled in. Sites of Indians who lived here before this filling-in are probably buried under the gumbo clays and under the waters of the Gulf. Our history of the region thus begins, not with the earliest of the Indians but with those

whose remains were protected from burial. For the most part we have nothing accessible in this immediate vicinity older than 4000 years.

The archeological history of Texas is conventionally divided into four periods: 1) Oldest are the Paleo-Indian or Big Game Hunters, whose spear points are found over much of the United States east of the Rockies in association with extinct bison, elephants, and other large mammals. Aside from an occasional point found on the surface, we have no archeological records of such people in the Houston area. Since this period ends around 5000 B.C., it is likely that any local remains are to be found deeply buried. 2) The next period, the Archaic, is well-known and includes most of the sites in the entire State of Texas. In this region Archaic peoples hunted with darts - a kind of spear - and often camped along streams where they left piles of oyster and clam shells. These sites, which are called middens, are found along every major river or bayou. 3) The third archeological sub-division is called "Neo-American" and lasted at the earliest from A.D. 100 up to 1850 when the last Indian cultures were destroyed. These people are recognized by the fact that they use arrow points and they have pottery. Again, their sites are usually heaps of shell. 4) A final period can be recognized in some places. The Proto-historic period begins after the early 1500's when Indians came into contact with Spaniards, Frenchmen and, later, Anglo travelers or settlers. In sites of this period we find non-Indian artifacts.

Most of the local archeology pertains to the Neo-American period after pottery was in use. Locally we can distinguish two broad geographic divisions, the Rockport between the Nueces and the Brazos rivers, and the Galveston Bay area. In the former, the pottery was crudely painted with asphalt and, in the latter, there is little, if any, such decoration. Instead the Galveston Bay people preferred to scratch linear designs on their pottery. Archeologists think that pottery was introduced into the area from the lower Mississippi valley, gradually spreading southward. Thus, pottery appears later in the south. At the earliest, in the Galveston Bay region we have pottery going back to A.D. 100. Around A.D. 700 the first incising and painting begins. Thus, we have some rather crude ways of subdividing any archeological remains that we might find. These ways are based on changes in time: Paleo-Indian spear points, dart points, and, later, arrow heads of different styles; we also have changes in pottery, including incised designs and paint, which allow us to distinguish periods and areas. Such divisions are crude, at best, and they specifically tell us about the ages of sites, rather than about how the people lived or whether there were any major changes in adaptation throughout the history of this region.

Review of Local Archeology

Although this publication deals with one small area within the greater Houston-Galveston region, it is worth reviewing quickly some of the other work that has been completed. All of it bears on the interpretations we make of the Armand Bayou sites. However, the reports of greatest interest are those in

which skeletons have been found, for these alone allow us to make inferences about the people themselves - what they looked like, how they differed from comtemporary Indians in other regions, what physical problems they may have had, and the rigors of living in this region.

Two biological populations have been reported. One consists of a group of more than 40 skeletons at the Caplen site on Bolivar Peninsula, and a single skeleton from Jamaica Beach on Galveston Island. These Indians were relatively short, and had short, wide skulls. They are almost certainly to be identified with the Atakapan horticulturalists.

A second biological population is found in sites between Houston and Corpus Christi. All of these are of people who are tall (5'9" to about 6'), very robust and with long, narrow skulls. The females are considerably smaller than the males but they, too, have long, narrow skulls. These people are the Karankawa.

Interestingly, there are several burials at the Kobs and Doering sites in the Addicks reservoir where there is a mixture of these types. The people are short, but they have long, narrow skulls. These sites are situated at the environmental border between the coastal hunters and gatherers and the horticulturalists. Possibly these populations intermarried to produce a distinctive hybrid group.

It is also noteworthy that the "Atakapan" skeleton at Jamaica Beach was found in a burial ground, which included about 20 other individuals. The others were all of "Karankawan" type. We can refer to our historic records for a possible explanation.

Indians are reported to have sometimes taken wives, either by force or by agreement, from other bands. We may see in this burial group then, something which is rarely found archeologically - evidence of marriage practices. If this had become customary among the Indians on Galveston Island, perhaps they would have come to resemble the Indians in the Addicks reservoir, a mixture of the two distinct types.

Other burial grounds are no less interesting, but for different reasons. At both the Shell Point site on Chocolate Bayou and at the Boy's School site on Armand Bayou, evidence of pathology which affected the Indians has been found. At both sites adults showed bone diseases of uncertain cause but which must have been painfully disabling. The evidence comes from extensive swelling of the tibia - the larger lower leg bone. As the individual grew older, the bone swelled more and more and it became very porous where it should have been hard and smooth. The best guess is that the bone was affected by an infection somewhere in the body which lodged in the bone tissue. Diseases like tonsilitis and syphilis have been suggested as possible causes.

It is interesting to look at the teeth, too. Very few of the Coastal Indians (the Karankawa population) had cavities, whereas the agriculturalists of east Texas had considerably more. This situation is found repeatedly in archeological sites. People who live on wild foods very seldom have dental problems, whereas those who live by agriculture have many. In places where agriculture provides the bulk of the food, cavities may

plague most of the people.

The Shell Point site is also interesting in that it has a simultaneous burial of five persons. They consisted of three adult males, one female and one child of 5-6 years. These people were apparently buried all at the same time as a group. Shell Point seems to have been a fishing camp used by people whose main camp ground was up the bayou about two miles. We do not know for certain what caused their death, but it seems likely that it was a sudden catastrophe. When we look at weather records we find that extreme northers may hit the area with savage ferocity, bringing freezing rain, snow and high winds. It may be that these people were caught in such a storm and buried later by survivors of the group who had stayed behind in their sheltered camp site. That this is not solely a wild guess is suggested by the tales told about settlers in the region who have experienced death while on their boats or in their fishing camps during severe northers. And we must remember that the Indians did not wear clothing, nor did they have power boats.

A final item of interest also comes from this burial group. The food that the people ate was so coarse and gritty that their teeth wore down to an amazing degree. Adults had worn their teeth through the enamel and were forced to chew on the dentine inside. Old individuals had very little of their teeth left. Even younger persons show advanced wear of teeth which had been in place only a few years. It is remarkable, therefore, to find that the child showed none of this wear. It is clearly implied that his diet was different. Again we can turn to historic

records. They tell us that Indian children were nursed until they were 6-7 years old.

One final point may be made about the Indians as we see them in burial grounds. At the Boys School site, and at Shell Point, some skeletons had "jewelry" and other special artifacts. These were made of bone and shell, not in themselves valuable materials. What makes them interesting is that they were fashioned into objects which nearly always turn up only with burials: beads, bone whistles, dice, pendants, and so on. Clearly these were objects of personal use and adornment which were buried with the dead. That not all persons had them suggests that some people were special. What we do not know is whether these people could be considered leaders, medicine men, or what. Unfortunately, the historic records do not help us in this regard; they only make passing reference to the fact that some Indians practiced medicine. On the other hand, observers of the Indians were quite positive that there is no "chief" or exalted leader among these people, a fact which we would expect in comparison with peoples around the world who live the simple life of hunters and gatherers.

Although burials can tell us a great deal about the people who lived in our region, there are many things which they cannot tell. For one thing, the burials have not been dated with very great accuracy, although most are presumed to be of Neo-American age - that is, within the last 5-700 years. Nor can the burials tell us how big any single group was or what the people did in their seasonal rounds. For answers to these questions we must turn to an analysis of the sites themselves. This we do in the following section.

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II. THE ARMAND BAYOU SURVEY AND EXCAVATIONS

by Michael J. O'Brien

The Environment

Geology

Lakeford (1971) defined the region inland from the Gulf of Mexico as a nearly featureless coastal plain, which slopes gently toward the Gulf with an average dip of about 1.2 feet per mile. In the study area (Fig. 1), the coastal plain is formed by the surface of the Beaumont Formation, the youngest of the sedimentary subdivisions of the Pleistocene recognized in the upper Texas coast (Bernard and LeBlanc 1965). Unconformably overlying the Beaumont Formation is a topsoil composed of poorly consolidated sediments - gravel, sand, silt and clay, which are riverine and marine in origin. In the A zone (modern soil zone), the pedalfic soil being formed today in the humid climatic environment contains iron manganese nodules. These nodules contrast with the caliche ($Ca\ Co_3$) nodules found in the B zone, which show that pedocal soil was formed in a more arid environment.

Drainage

Wheat (1953) gives a good review of the drainage pattern of the region as a whole. The pattern of runoff in the Clear Lake area is largely determined by three streams: two large bayous, Taylor and Armand, provide southward drainage; and Clear Creek provides eastward drainage. Armand Bayou, formerly called Middle Bayou, heads eighteen miles to the north and follows a meandering course south, where it is met by Willow Springs Bayou, Spring Gully and Big Island Slough. It continues due south to its juncture with Horsepen Bayou, where it widens considerably, forming Mud Lake (or Forest Lake) (Fig. 2). Mud Lake empties directly

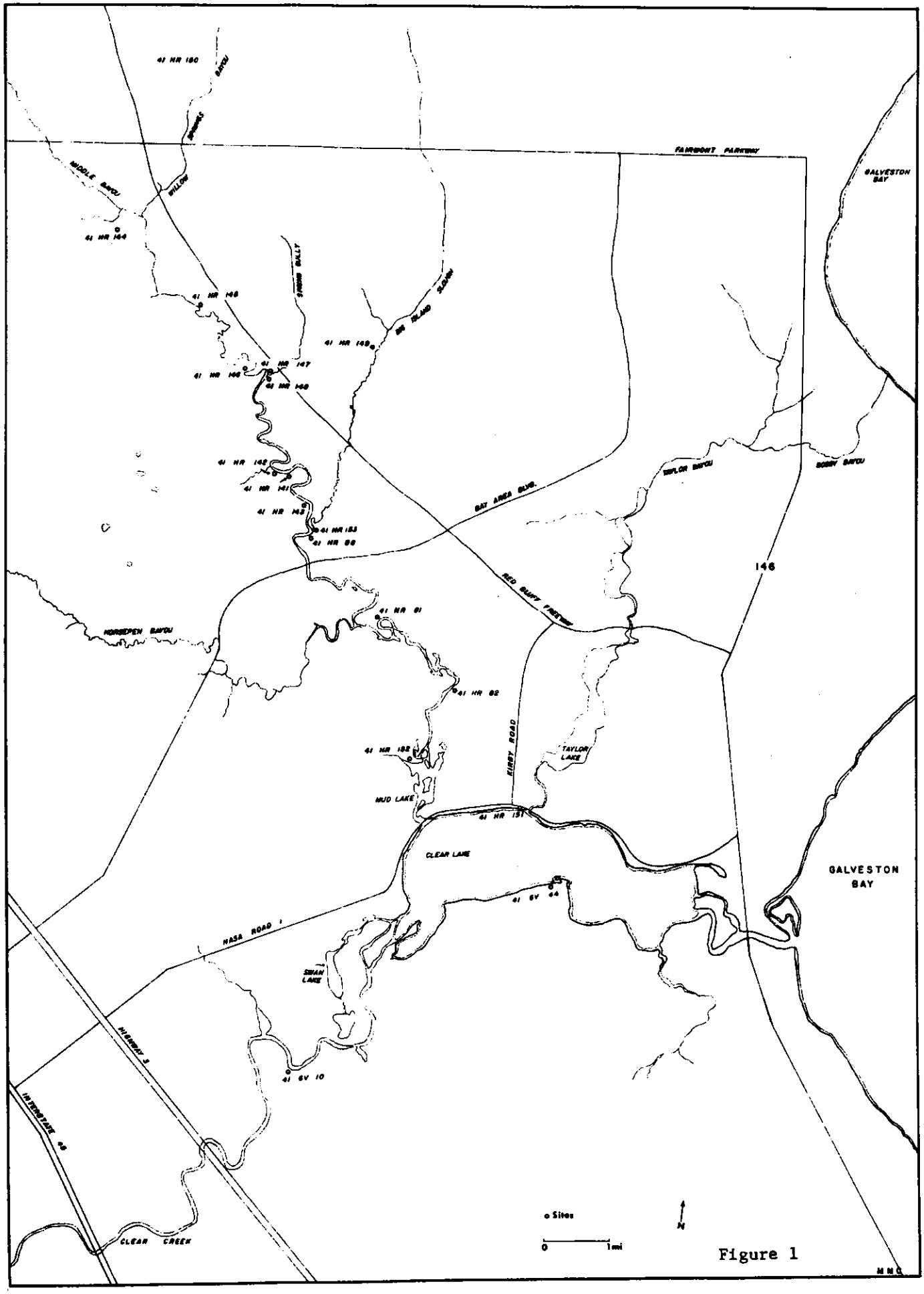
41 HR 150
SPRINGS BAYOU
FAIRMONT PARKWAY
GALVESTON BAY
MIDDLE BAYOU
WILLOW
41 HR 144
41 HR 145
SPRING BALLY
BIG ISLAND SLOUGH
41 HR 149
41 HR 147
41 HR 146
41 HR 142
41 HR 141
41 HR 143
41 HR 153
41 HR 88
BAY AREA BLVD.
TAYLOR BAYOU
BOBBY BAYOU
146
RED BLUFF FREEWAY
HORSEPEN BAYOU
41 HR 91
41 HR 92
41 HR 152
KIRBY ROAD
TAYLOR LAKE
MUD LAKE
41 HR 151
CLEAR LAKE
GALVESTON BAY
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Figure 1

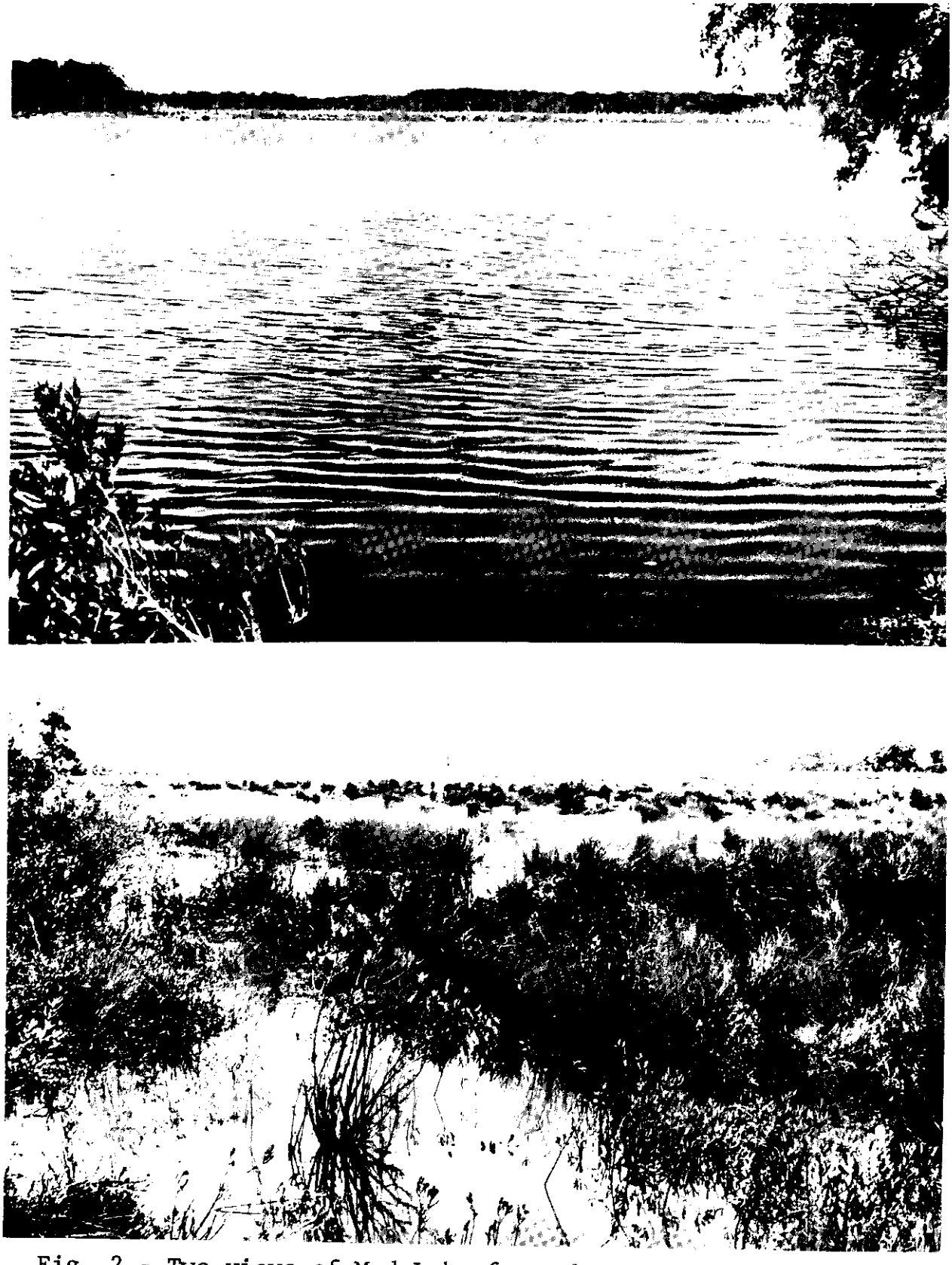


Fig. 2 - Two views of Mud Lake from the Fullen site (41 HR 82).

into Clear Lake at State Highway 6.

To the east of Middle Bayou and Mud Lake are Taylor Bayou and Taylor Lake. Taylor Bayou starts well north of Clear Lake and runs almost due south. It widens to form Taylor Lake and then runs under Highway 6 into Clear Lake.

Clear Creek begins far to the west of Clear Lake and meanders slowly eastward, picking up water from smaller feeder channels such as Cow Bayou, before emptying into Clear Lake.

Waters in Mud, Taylor and Clear Lakes are strongly affected by wind and tides, since Clear Lake empties directly into Galveston Bay near the towns of Kemah and Seabrook.

Topography

The principal topographic features of the area include a deeply incised terrain to the north and a shallower, broader dissected area to the south. As one moves up Armand Bayou, he notices that the surrounding plain consists of a fine gray sand overlying a basal clay. The entire plain slopes gently eastward toward Armand Bayou, at which point the land breaks suddenly down to the water.

At first glance, the occurrence of sand appears to be a result of flooding by the bayou, but the topography of the area almost precludes this possibility. The down-cutting by the bayou has produced steep banks along this particular stretch, and, if the sand is the result of fluvial deposition, a high wall of water moving along the bayou would have been necessary. The same may be the result of fluvial deposition which might have occurred when the bayou was at a higher elevation, or it may be due to

aeolian transportation. Old one-foot contour maps of the Deepwater, Genoa, Seabrook and Laporte quadrangles show many depressions off to the west of Middle Bayou. Today these holes are surrounded by clean white sand and after a rain they fill with water. It is possible that as the wind blew this sand eastward, it was trapped in the forest along the bayou and settled out. This hypothesis of aeolian transport is supported by the fact that there are no depressions on the east bank of the bayou. The small piles of sand near the bayou would have provided well-drained camp sites. One such small hummock, 41 HR 146, is discussed later in this report.

Flora and Fauna

All three streams and their tributaries are lined with dense vegetation. The most abundant tree in the area is the water oak, followed by the willow oak, ash, elm, loblolly pine, hackberry and youpon. Other common vegetation includes Spanish moss, Virginia creeper, blackberry, coral berry, senna bean and palmetto, and various types of water and marsh grass.

A varied fauna still inhabits the area, although it has been greatly reduced by man. White-tailed deer and bobcats can still be seen, and there have been reports of wolves in the immediate area. Raccoons, gray squirrels, possums and cottontail rabbits are still abundant. Of the poisonous varieties of snakes, the water moccasin is by far the most prevalent. Various fish, such as the gar and mullet, are present along with many species of turtles. The streams are home and nesting ground for thousands of fowl, including the snowy egret. At one time the water pro-

vided a habitat for shellfish, but due to changes in the environment, especially pollution, it is doubtful that beds of molluscs still exist in these waters (Lankford 1971).

Survey and Testing of Sites

Introduction

Due to rapid development of the land surrounding Clear Lake in southern Harris County, the Houston Archeological Society, in April of 1970, began an intensive archeological investigation of 30,000 acres belonging to Friendswood Development Corporation. This land extends from Red Bluff Road on the east, to the NASA Manned Spacecraft Center on the west, and approximately from Fairmont Parkway on the north to NASA Road 1 on the south (Fig. 1).

The land is part of the former Jim West ranch-estate which Humble Oil Company bought and began developing in 1960. For years the property had been leased for oil rights and numerous shell roads have been cut through the land. In addition, Kirby Drive and Bay Area Boulevard have provided modern thoroughfares in the area.

Although most of our work involved surveying Friendswood land, a few sites which lie to the north and south of this area are included in the survey reports. Fourteen sites were found during reconnaissance. These, along with four others which had been previously noted, brought the total to eighteen sites. In view of the fact that the survey was carried out in the months of April through July, during which time the area was a virtual tropical rain forest, some small sites may have been so obscured by vegetation that they were overlooked.

Of the sites which we found, one small shell midden (41 HR 153), a sand midden (41 HR 146) and an historic house site (41 HR 88) were tested.

Each site examined held answers to our questions concerning the archeology of the area. We knew that numerous shell middens occur along the coast, and that large sand middens exist inland; at some point we expected to find a change from shell to sand middens. We also knew that lithic and ceramic materials from the two types of sites are very similar, if not identical in appearance. By examining a large shell midden near Clear Lake (41 HR 82), a smaller shell midden farther up Armand Bayou (41 HR 153), and finally a sand midden even farther up the bayou (41 HR 146), we had hoped to compare three kinds of sites. The historic site, 41 HR 88, was utilized as an aid in teaching volunteers how to excavate.

The sites surveyed

41 HR 150. This small site was located in the College Park subdivision of Deer Park. It consisted of 60 cm. of sandy loam overlying a clay knoll. Before the site was destroyed, one large dart point (Fig. 19a) and 11 flint flakes were picked up.

41 HR 144. On the evidence of a large point and a biface (Figs. 19e & 20i), a site was assumed to be somewhere in the immediate vicinity of a small ditch which empties into Armand Bayou from the west, just north of the Genoa-Red Bluff Road. Dredging of the ditch may have displaced the site and spoil from the ditch probably covers most of the remains. No shells were observed.

41 HR 145. This site was a small sand knoll on the east bank of

Armand Bayou about one-half mile north of Spring Gully. It was leveled during construction of the fifth tee box on the Baywood Country Club golf course. During several visits to the site, Alan Duke of Pasadena collected three large stemmed points and a few sherds. Nothing else is known about the site.

41 HR 146: The Gillespie Site. Named for an oilfield foreman who aided us during our work, the Gillespie Site is located on the west bank of Armand Bayou, approximately one mile south of the Genoa-Red Bluff Road. The site is a small, low sand knoll (without shellfish remains) about 15 cm. in height and 10 m. wide. Occupational debris is concentrated in a five meter square area (Fig. 3).

We knew from the outset of our test excavation that there would not be a lot of material present because the sherds were extremely friable and difficult to extract from the ground. It seemed likely that the circumstances which had softened the pottery also might have destroyed any bone in the site.

We dug in 5 cm. levels and put all sand through a $\frac{1}{4}$ in. screen. No square was dug deeper than 20 cm. 104 sherds were recovered, 74 from the 5-15 cm. level and the remainder from the initial test pits. Every piece is extremely friable. No significant reconstruction could be done although all the pieces appear to have come from one vessel. One contracting stem dart point of petrified wood was found in the 5-10 cm. level (Fig. 19i). Three pieces of red ochre were recovered from the 10-15 cm. level. Throughout the strata, there were fine particles of charcoal, but we could not determine whether they had come from an Indian fire

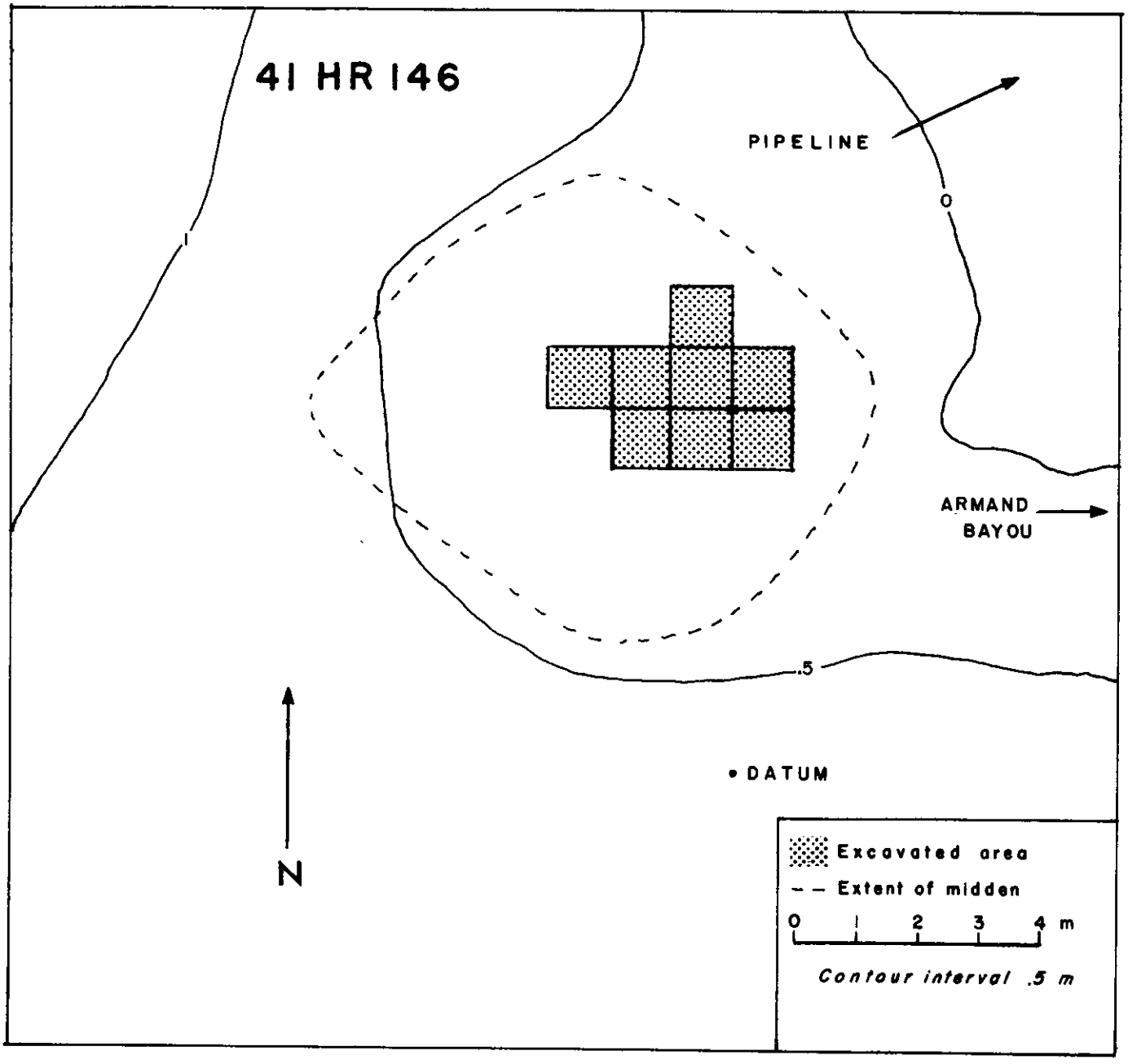


Fig. 3 - Approximate area of the Gillespie site (41 HR 146).

or whether they came from a charred root of a tree burned in historic times.

In the 5-10 cm. level, there were 8 unretouched chert flakes.

The lack of shell is curious since the site is fairly close to sites 141, 142, and 143, which all contain shell. This lack may be due to the fact that the site is situated just north of the limits of shellfish distribution.

The Gillespie Site was so small that it could not have been a base camp; rather it may have been a transitory campsite. Alternatively, it may have been used for an activity or ceremony that took place away from the main residence of the group. The paucity of artifacts suggests that the site was not used for very long or by very many people. One person or one family camping for a night could have left the remains we found: a dart point, 8 flint chips and a broken pot.

41 HR 147. This site was situated at the northeast junction of Spring Gully and Armand Bayou but after its discovery it was destroyed by dredging. One arrow point, a scraper (Fig. 20j) and a few sandy paste sherds, along with some Rangia shells were picked up.

41 HR 148. Located across Spring Gully from site 147, this site has also been destroyed. All that we could find were a few sandy paste sherds and some Rangia shells.

41 HR 142. This very small, eroding Rangia midden is just north of site 141. Twenty-two flint flakes and a piece of bone were recovered.

41 HR 141. Located on the west bank of Armand Bayou just above

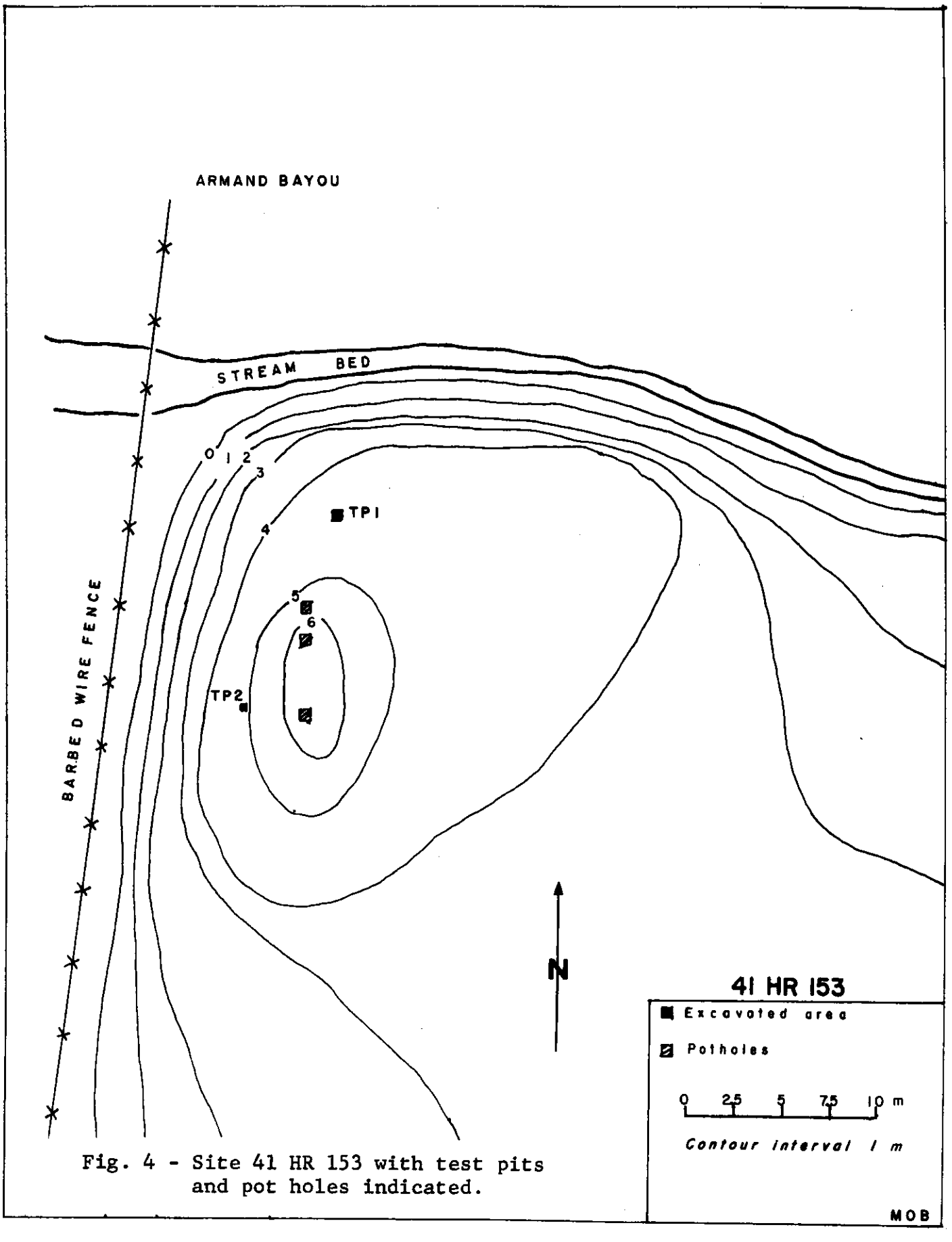


Fig. 4 - Site 41 HR 153 with test pits and pot holes indicated.

Bay Area Boulevard, this small Rangia midden is presently being eroded by the water. One point (Fig. 18b) was the only cultural material recovered.

41 HR 143. A small Rangia midden just south of site 141, consisting of a very thin layer of shell about 8 cm. below the surface. No cultural material was found.

41 HR 153. This site, just north of 41 HR 88 on the east side of Armand Bayou, is approximately 20 m. by 15 m. in size (Fig. 4). The excavation comprised two test pits, one 50 cm. by 50 cm. and the other 25 cm. by 25 cm. The soil matrix is very compact black gumbo with some sand present in the upper 10 cm. Test pit 2 was taken down 60 cm. and still contained shell at that depth. Pottery occurred down to 20 cm. in both pits but no sherds were found below this depth.

Several levels of both test pits contained large chunks of calcium carbonate, or caliche. One possible use of these stones by the Indians is discussed in the analysis of 41 HR 82.

Table 1 gives the percentages of bone, Rangia, and Crassostrea by level in the test pits. Although the pits were small, these data do serve to indicate the amount of variability which one might expect to find in a shell midden.

The site is interesting for several reasons. It has both a pottery and a non-pottery horizon, and it appears to have some degree of horizontal variability. The site is also interesting because a long preceramic period may be present. Finally, since the site is the northernmost shell midden on Armand Bayou, it would be interesting to compare faunal remains from it with those

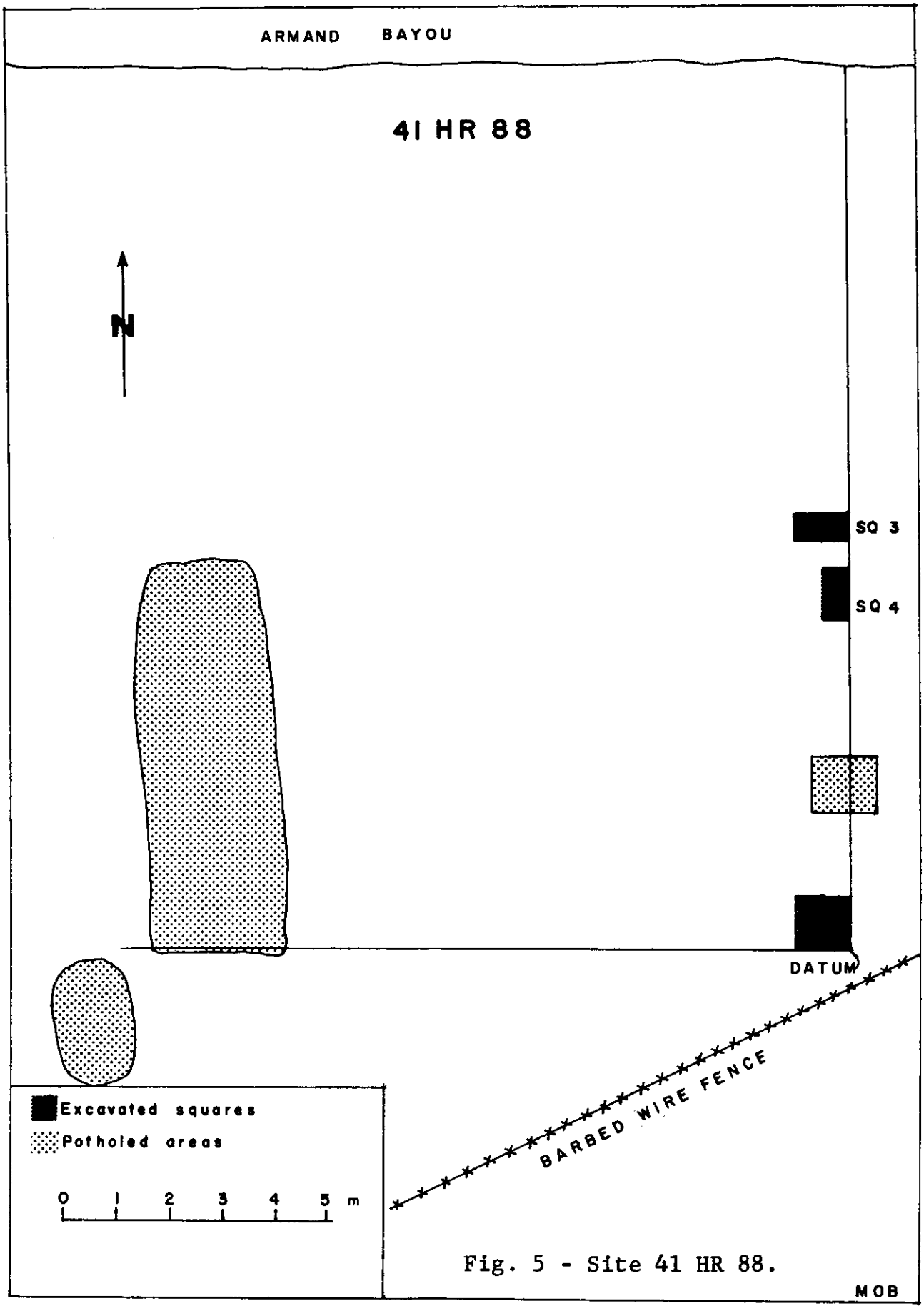


Fig. 5 - Site 41 HR 88.

from 41 HR 82 to the south. The site warrants future study.

41 HR 88. This is the ruins of a 19th century house belonging to a family named Henry, whose graves are on the property. The site also contains Indian artifacts and shells. In a story in the Houston Chronicle, the site was originally incorrectly reported as the probable location of a French settlement.

The site was tested both to teach excavation techniques to people who had never excavated an archeological site before, and to find out whether the house had been built on an Indian midden. Although prehistoric sherds had been picked up during survey, it was unclear whether these sherds were from a primary deposit. If not, we reasoned that the shell and sherds had been scooped out from a midden in the area and placed there as a house foundation.

The site was riddled with large potholes made by bottle hunters who reportedly unearthed many perfect specimens. The eastern part of the site appeared least disturbed, so a grid system was established in this sector along a north-south base line (Fig. 5). Five squares were partially excavated: squares 35 and 21 were taken down to 15 cm., squares 15 and 3 were excavated to 10 cm. and square 4 to 5 cm.

The only feature found in the excavated area was the base of a brick wall in squares 3 and 4 (Fig. 6). Whether it was part of an exterior brick walk or an interior wall of the house was not immediately evident. Oyster shells and .22 caliber cartridge casings were found directly on top of the bricks along with bits of glass. Pottery and flint chips of Indian origin found alongside the Anglo material indicated that mixing had occurred.

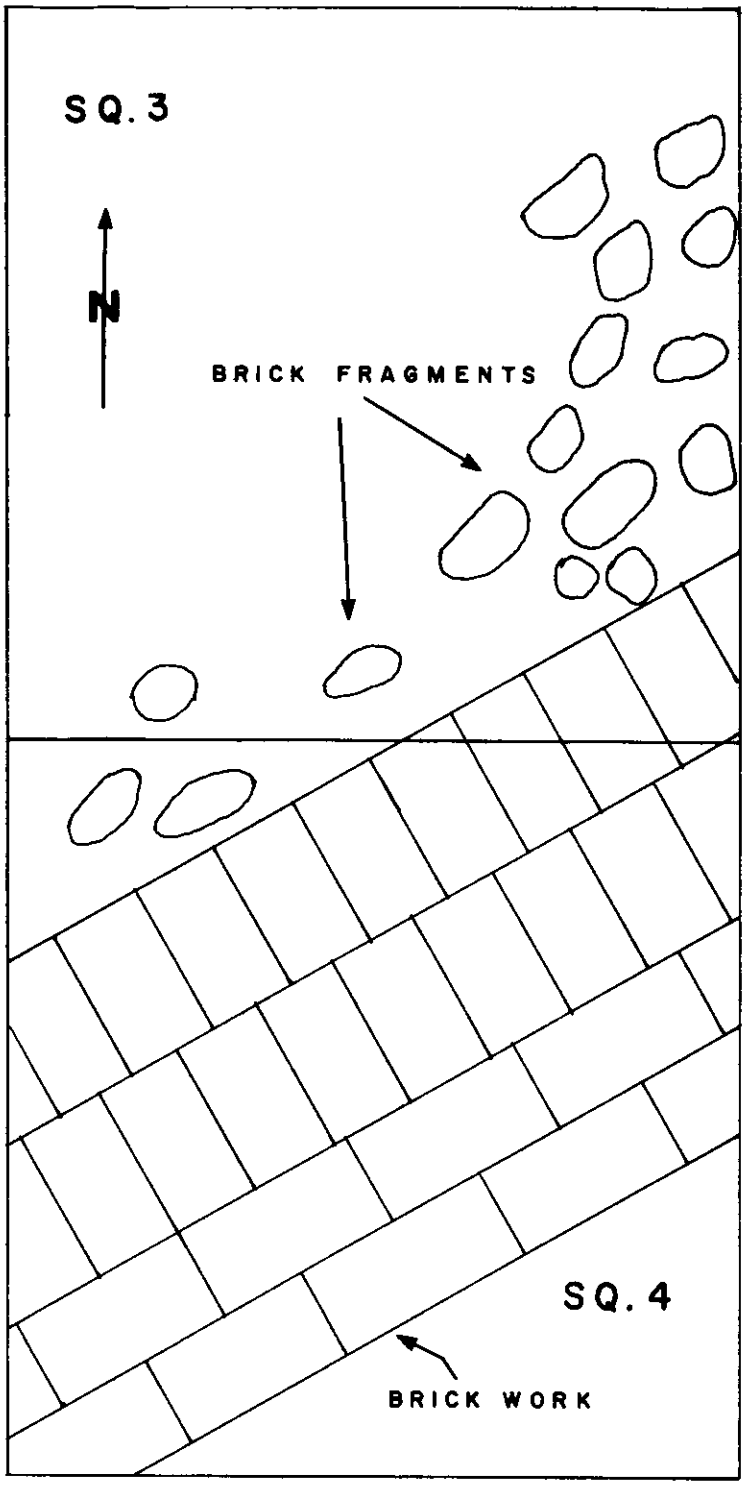


Fig. 6 - Brickwork at site 41 HR 88.

Artifacts recovered include 53 sandy paste body sherds, 1 dart point and 1 biface (Fig. 19-1 & 20g). Historic artifacts include the nickelplated cartridge casings, china fragments, glass bottle necks, jar bases dated to the first decade of this century, many red brick fragments and 5 brick fragments with blue-green glaze. Since many pieces of pottery and the dart point were highly eroded, the hypothesis of secondary deposition of the Indian material on the Anglo site is supported. We found no Indian material except in association with historic artifacts.

When it became apparent that we were dealing with a redeposited midden, work was stopped. However, archeologists interested in historic periods might find additional work rewarding.

41 HR 81. Although this site had been previously reported, it was reinvestigated during survey and was found to contain human skeletal material. The site is a Rangia midden on the eastern shore of Mud Lake, just south of Bay Area Boulevard. Artifacts recovered from the initial testing of the site were reported by O'Brien (1970).

41 HR 149. The remains of this site were found on a spoil bank on the east bank of Big Island Slough. No artifacts were recovered, although there were a few Rangia shells and some mammal bones.

41 HR 151. This site is an extremely large Rangia midden on the north side of Clear Lake, just east of Lakeshore Drive. Part of the site has been destroyed by an apartment house complex, but the part that is left extends along the shore for some 150 to 200 m. The site is being eroded, and part of it has been graded, but the

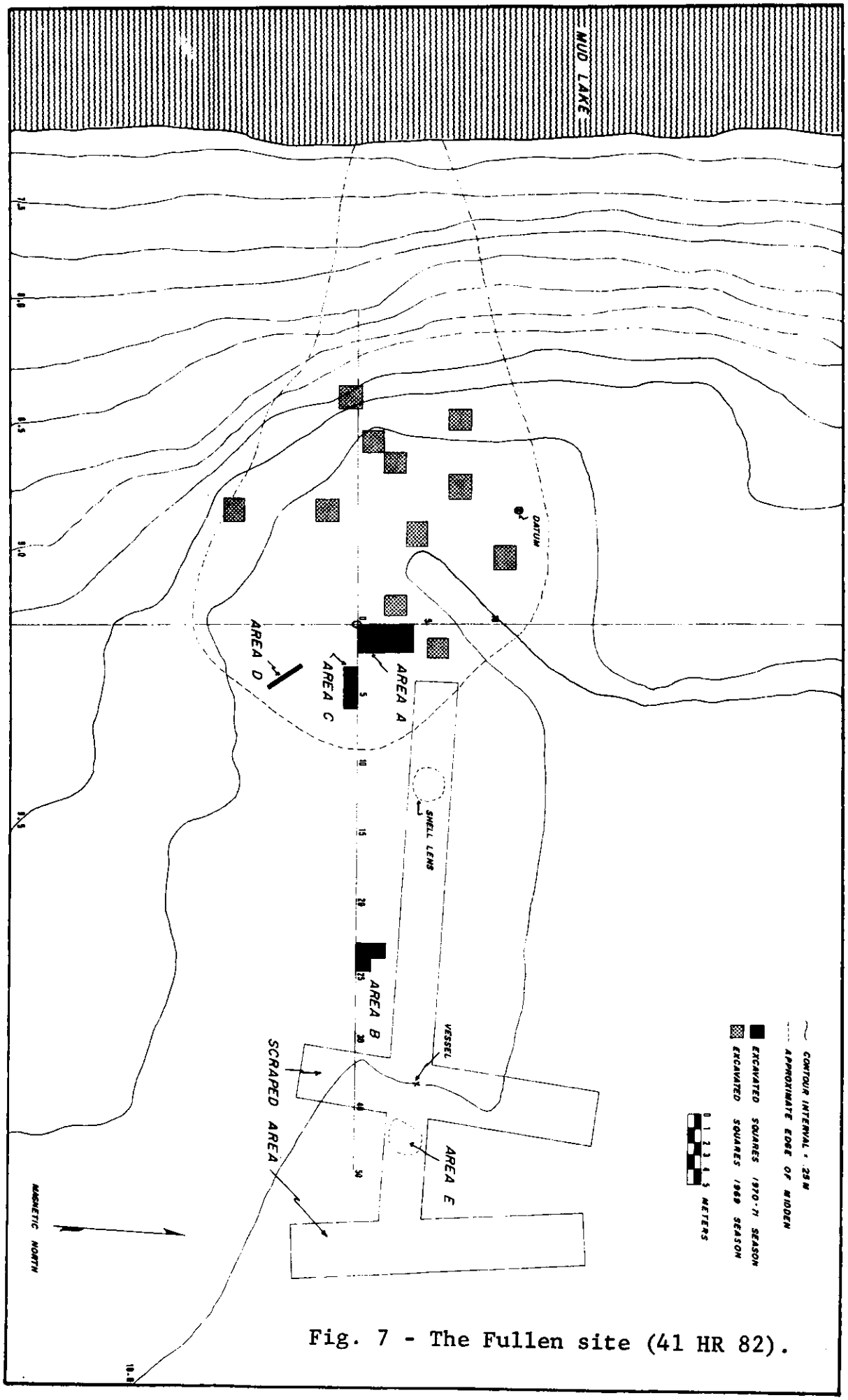


Fig. 7 - The Fullen site (41 HR 82).

part back away from the water is intact. The depth of the deposit could not be determined accurately, but an eroded edge suggests that the site is as much as 50 cm. thick.

41 GV 44. This large Rangia midden had been known for some time, but it had never been formally reported. The site is on the south shore of Clear Lake, just west of Rost Point (41 GV 16). The length of the site is greater than 150 m., and the depth is at least 45 cm. The site sits on a high bluff where it is exposed to wind and wave erosion. Although very little is left of the site, a few sandy paste sherds were collected.

Excavation of the Fullen Site (41 HR 82).

The second season of work at the Fullen Site began in September of 1970 as a final step in the Armand Bayou project. A detailed report on the physical description of the site and of the first season's work has already been published (O'Brien 1971). The site is a shell midden, approximately 38 m. by 22 m. in size (Fig. 7). It gradually pinches out as it extends downhill toward the lake, where small amounts of cultural debris can be seen in the bank during periods of extremely low tide. The extent of cultural material is not limited to the shell deposit itself. Through trenching and bulldozing, detailed later in the report, material well off the main part of the midden was discovered. This new information forced us to consider ways to further investigate the land surrounding the midden proper.

Eastward from the site, the land is slightly higher. All the land surrounding the site is black gumbo (Lake Charles clay) which is of the same consistency as the dirt of the shell midden

itself.

Goals of the Excavation

The initial excavation at 41 HR 82, by a group of Rice University students (O'Brien 1971) was carried out with considerably less control than the present study. In consequence, the quantitative findings of this first effort are not very reliable. This fact became clear when some of the back dirt from the previous excavation was screened. This back dirt was a rich source of both small artifacts and bones. However, irrespective of the quality of the previous work at 41 HR 82, several problems were raised for future investigation. These are discussed below.

How to Dig Middens.

Except in rare cases where middens along the Texas Gulf Coast have obvious layering, the usual procedure has been to dig them by a system of arbitrary levels. Although this method allows one to see broad trends of change, each stratum may represent an actual time period of more than half a century. It seemed desirable to learn to dig middens by natural units that more closely followed the actual episodes of occupation of the midden.

The previous work at the site had exposed a series of isolated squares in an attempt to sample various portions of the site and to enable each team of diggers to work relatively unimpeded. This kind of sampling is often used on Gulf Coast shell middens, but it invariably leads to confusion because the isolated pits cannot be related directly to one another. For this reason, we elected to excavate 8 contiguous one-meter squares in a 4 by 2 meter rectangle. This afforded a chance of correlating strata

from one square to the next.

The Nature of Shell Middens

There have been few serious attempts along the Gulf Coast to investigate the nature of the range of sites that are called "shell middens". They have been considered to be house sites, short-term camp sites, garbage dumps, cemeteries, etc. At the Fullen site we hoped to obtain a good picture of one part of a midden by excavating 8 square meters and thus to be able to interpret its depositional history and use. The kinds of things we thought that we might find were the remains of the butchering of a single animal, the dumping of a single load of shells, or the discarding of a single pot. In short, we were looking for remains that could be specifically related to one event.

We were also concerned with the frequency of use of the site; were there long hiatuses between occupations, or was there seasonal or year-round occupation? Today there is a layer of black gumbo 5 cm. thick over the first true shell layer in the site. This bespeaks the passage of a considerable but unknown duration of time. One might expect to find similar layers within the midden if the site went unused for an extended period of time during which flooding built up the site. Thus, in digging the site we maintained not only an interest in the deposition of artifacts in the midden, but also a concern for the structure of natural features on the site.

Historic records of the Indians in this area are not very informative about dwellings. Indians pass through the pages of history as hunters and gatherers, afoot or in canoes but never in

houses. We must therefore turn to archeology for this information. There are several possibilities for the location of prehistoric dwellings: perhaps Indians lived on the middens, off the middens, or never stayed long enough at any site to erect a camp with durable facilities. If Indians lived on the midden, we would expect to find fireplaces, perhaps postholes, and a non-random distribution of artifacts which could be attributed to activity areas. If they lived off the midden, we would expect to find these traces somewhere away from the midden. In order to investigate this possibility, we investigated the area surrounding the midden proper.

It has been noted in historic records that the Indians of this area were not food producers. The lack of artifacts associated with food production (milling stones, etc.) substantiates these records. Consequently, one would expect to find Indians hunting, fishing and collecting in the area of the Fullen site in prehistoric times. Was the site a hunting camp, and, if so, at what times of the year was it used? Over how broad an area did the Indians range from the site? Did the Indians at the site carry on a full range of hunting and gathering, or was this a specialized camp where only a few species were harvested? The answers to these questions must come from the faunal remains in the site. There are few edible plants in the area and, of these, none need special processing, so one would not expect to find much artifactual evidence for the practice of plant collecting. Thus we relied heavily on bones and shells to infer subsistence patterns.

The first season of work seemed to show a high proportion of oysters in the lower levels and their replacement by Rangia clams. We wondered whether this observation could be substantiated by a better controlled excavation. If it were true, could these data be correlated with other indicators of environment to give a more detailed description of the changes in environment in the site area during prehistoric times?

Data from Gulf Coast shell middens are often presented in a summary form that gives no clues about the amount of variability within the middens. Before one can make inferences about what he finds in one area of one site, he must have some idea of how likely things in other areas of the site are to be similar to the things he has already found. In other words, the archeologist must have some concept of how much variability he might expect to find in a shell midden. If one square has no potsherds in it, should we infer that the site is pre-pottery in age? If two squares have no clams in them, is it fair to say that clams were not gathered at the site? If three squares have no burials in them, is it wise to assume that there are no graves on the site? How much of a shell midden does an archeologist have to dig before he has reached the point of diminishing returns? These questions - and, in fact, virtually every interesting question in prehistoric archeology - require archeologists to understand the variability in archeological sites. Thus, we were interested not only in reporting what was found, but also in discovering the distribution and variability of the things that were found in the shell midden.

Excavation Technique

The digging technique was based on the assumption that middens accumulate from separate cultural episodes and that the material remains of these activities can be studied by analyzing the layers of the midden. The idea was to expose the entire area simultaneously layer by layer, by following strata of bone, artifact and shell. The depth of each level of the excavation was determined by the natural distribution of remains in the soil.

From the beginning, it was assumed that nothing except dirt should be left in the field. Since many significant remains are small, all dirt was passed through a $\frac{1}{4}$ in. screen.

One difficulty in using these procedures was that the workers did not have a "feel" for what was required. This was especially apparent in the difficulties they had in following layers of artifacts rather than some predetermined arbitrary level. Another problem was that digging conditions varied greatly from week to week. One day the ground would be soggy and the next, brick hard. Because of this, the rate of digging varied considerably and the screening of dirt was often very tedious. Finally, on many weekends there were only two or three persons digging. For these reasons we were seldom able to expose any single layer over the entire extent of our trench all at the same time. This made it hard to correlate some of the layers between squares, although this problem could usually be resolved through subsequent analysis.

Area A

The core of our work was the excavation of eight contiguous squares (Fig. 7). We call this Area A to distinguish it from

other parts of the site which we also tested. The eight squares were located toward the eastern edge of the site which we thought we might find the longest sequence of occupation. The first season of work had shown that the shell was deeper here than elsewhere on the site - about 40 cm.

Since it proved to be impossible to open all squares to the same level simultaneously, our procedure was to expose each layer of artifacts in each square, plot the material, remove it, and then to continue to the next layer independently of the progress in adjacent squares. Because of differences in digging, some squares thus have more units of excavation than others. We corrected these inconsistencies in the analysis. In the subsequent discussion, level (e.g. level C 6) refers to the actual level of the excavation in the field, whereas, zone (e.g. Zone III) denotes a group of excavated levels which have been lumped to reflect our interpretation of the natural stratification of the midden.

During excavation, we designated the level from the surface to the top of the shell as Zone I (Fig. 8). This level (A) was characterized by loose, sandy gumbo with no shell and a few sherds. It was fairly flat over the eight squares and approximately 5 cm. in depth.

Zone II began at the surface of the shell layer and extended down to a hard-packed shell layer which was discernible in all eight layers. Figure 8 shows the actual excavated layers which were grouped into Zone II. The shell in Zone II was compact, sherds were numerous, and the deposit was undisturbed.

Below Zone II lay a sterile layer of dirt averaging 2 cm. in

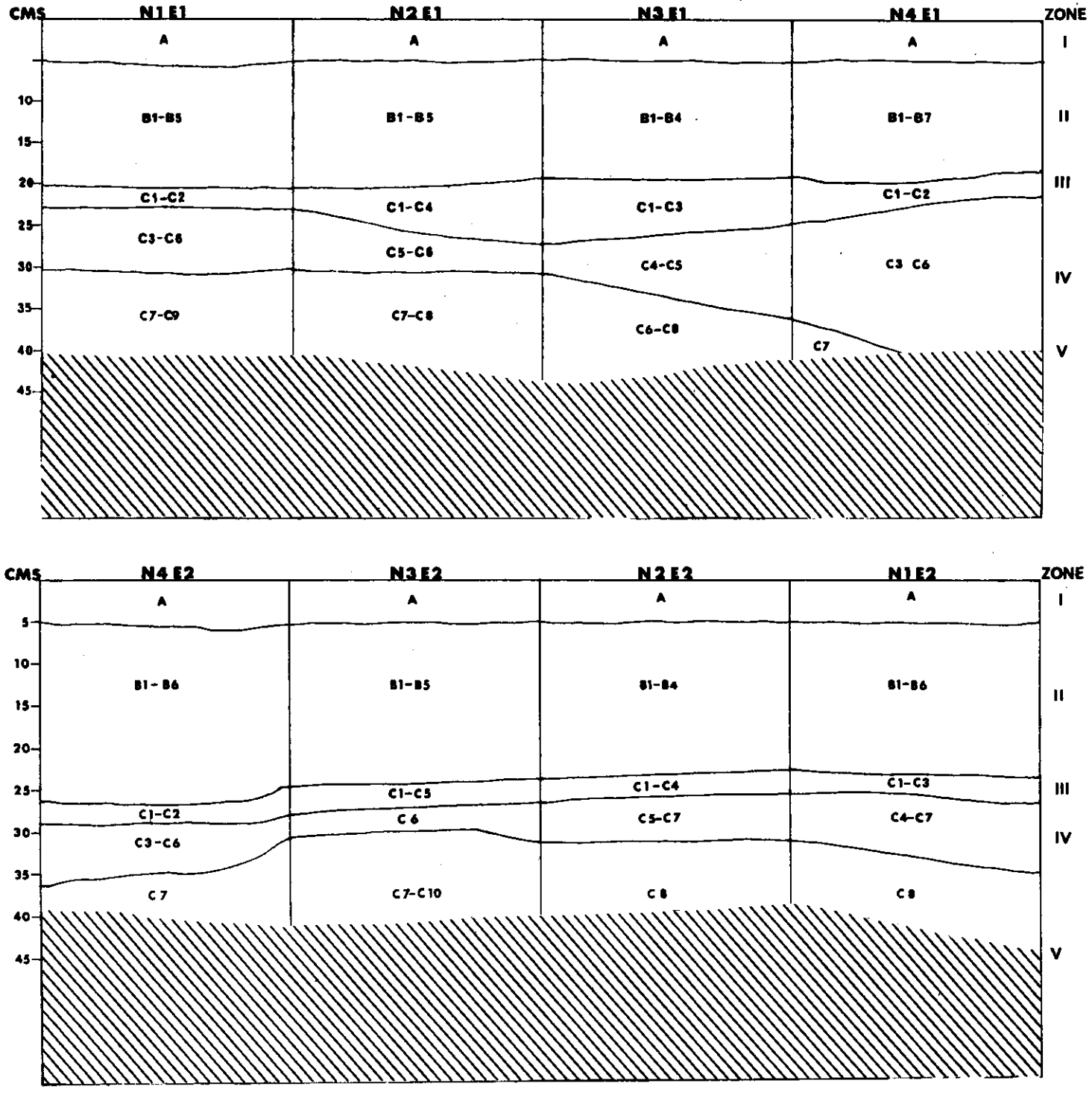


Fig. 8 - Profiles of squares in Area A at the Fullen site showing Zones and levels assigned to each zone in each square.

thickness. A hard-packed layer of shells below this sterile zone marked the beginning of Zone III. This hiatus in deposition gave us an opportunity to begin excavation again on a new surface which extended over the entire test pit area. For this reason, the excavated levels below this surface were labeled C1, C2, etc.

On the basis of pronounced differences in sherd counts, sherd matches and visual correlations, the division between Zones III and IV was placed between levels C2-C3 in N1E1, C4-C5 in N2E1, C3-C4 in N3E1, C4-C5 in N2E2, and C5-C6 in N3E2 (Fig. 8).

Shell in Level IV was compact but not nearly so dense as in the first 5 cm. of Level III.

Zone V contained Feature 1 (Fig. 9), a cluster of caliche along with a scatter of deer bones, mostly jaws and teeth. This feature was located in level C7-C8 of square N2E1. Accompanying bones were found in C8 of N1E1 and N2E2 and C6 of N3E1.

Level 5 is called preceramic because it contained virtually no pottery. In thickness it varied from 12 cm. in N1E1 to nothing in N4E1. The uppermost portions of the preceramic levels (C7 in N1E1, N2E1, and N4E2) contained a few sherds, but most notable is the large amount of flint refuse in the level, a good deal of which is petrified wood.

Once the preceramic material was stripped away, the original surface of clay was exposed and a small depression was found in squares N2E2 and N3E2. This depression contained a few shells and bones and 5 pieces of chert. This was overlain by a thin layer of sterile dirt sealing it off from the level above. This depression was called level D1 of the preceramic level.

Fig. 9a - Feature 1 in square N2E1, Zone V.

Fig. 9b - Feature removed showing depression in sterile soil.

Area B

Area B consisted of three contiguous one-meter squares -- N1E24, N1E25 and N2E24 (Fig. 7). This area was opened in the hope of finding some occupational debris which might indicate houses or shelters. A thin scattering of Indian artifacts, along with pieces of modern crockery and glass, were found in all three squares, indicating that a good bit of mixing had occurred. The deposit was very shallow and work was terminated after three squares had been dug.

Area C

After someone had dug a pothole into the site near our excavation, we noticed that the shell layer was much deeper there than in Area A. When we cleaned out the hole we noticed that all the pottery occurred above the shell layer. We wondered then if this part of the midden had been deposited before the material in Area A or if it were all preceramic. For these reasons we opened three contiguous squares which we denoted Area C. As it turned out, the shell layer in this area did contain a small amount of pottery, but the excavation of these squares revealed some interesting information on the deposition of the site.

The soil zone above the shell layer contained an abundance of sherds, due, perhaps, to plowing. However, since the sherds from one vessel were lying horizontally adjacent to one another, and no shell, broken or otherwise, was found in the zone, it looks as if the deposit represents only the discarding of a pot.

Figure 10 shows a cross section from the datum point at the SW corner of Area A to the NE corner of Area C. Although the

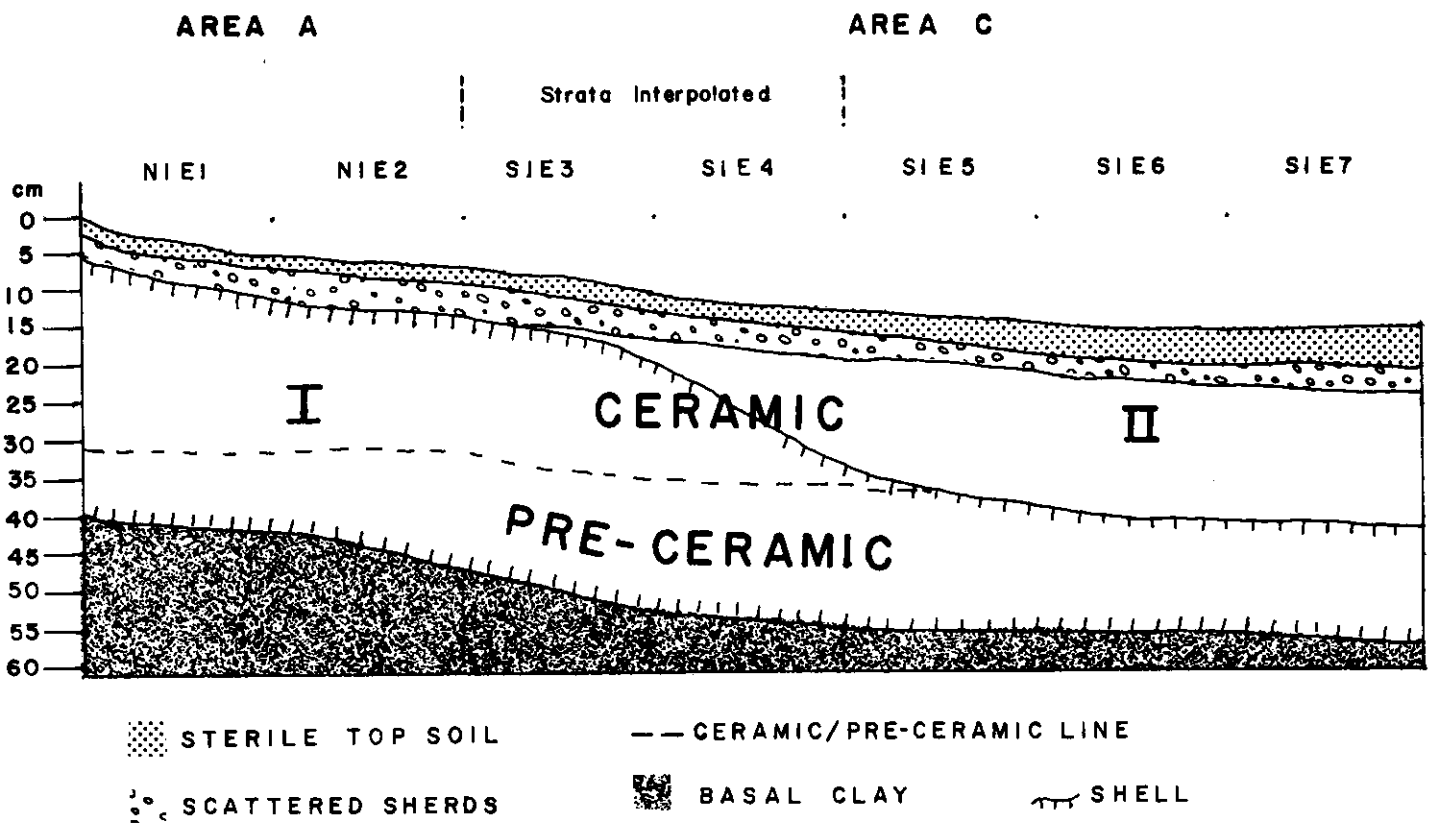


Fig. 10 - Cross section from datum through short axis of Area A and long axis of Area C showing simple zonation.

drawn section crosses 5 designated squares, we had to interpolate the strata in squares S1E3 and S1E4 because they were not excavated. In Area A a shell layer lies directly under the topsoil and above a layer of yellowish clay. In Area C the shell layer lies some 15 cm. below the topsoil and is amost entirely confined to the preceramic level. Figure 10 shows our extrapolation across the unexcavated squares, but it is presently impossible to tell whether either the preceramic or the ceramic zones in the two areas are strictly contemporary.

Area D

As part of our reconnaissance of the area surrounding the midden, we tried a proton magnetometer survey. Although we were unable to make the instrument work correctly because of a malfunction in its circuitry, we did detect some analogies that suggested interesting subsurface features. Upon investigation of one of these through probing with a steel rod, we discovered an apparent absence of shell, although there was a distinct depression in the basal clays.

The depression was investigated following the scraping of an area 30m long and 3m wide between the midden and the depression. Excavation, which was carried out in 10cm levels, revealed a hole 15cm in diameter. This hole appeared to extend from the present land surface down into the basal clay. It had cut through the shell layer and our probe had gone directly down its center. The hole was filled with black gumbo. Since it cut through the shell and contained no Indian artifacts, it is apparently a modern feature.

Scraped Area

This area includes the remainder of the ground scraped by a tractor-drawn back blade. The area was scraped to see if we could find any house remains such as postholes, hearths, or charred wood. The method of excavation was to break the sod with a plow attachment, to remove the dirt with a back blade, and then to scrape down again with the back blade to bring out any features in the soil.

A localized shell lens was found to the east of the midden proper (see Fig. 7), but it was not excavated. Between this small accumulation and Area E, the blade just crossed the top of a small pile of sherds. Analysis indicated that three distinct vessels were represented there. The rim sherds include one straight and pointed rimmed vessel, one outflaring and pointed rimmed vessel, and the third outflaring with a rolled lip. Three round base sherds and seventy-five body sherds, all Goose Creek Plain, comprise the entire sherd collection from the area. One small point (Fig. 18a) a small chert core and an antler flaker (Fig. 23b) were the only other artifacts recovered.

Area E

This small area was located in the scraped area approximately 4 meters east of the accumulation of sherds marked "vessel" on Fig. 7. After the tractor had scraped off the area, we could see a faint semi-circular sandy discoloration in the clay-gumbo, 10 cm. wide, with inside diameter of about 120 cm. (Fig. 11). We designated it Feature 2. The area was troweled and scraped, after wet-

ting with a hand sprayer, in an attempt to bring out the details of the feature. The discolored soil was lighter in color and softer in texture than the surrounding clay-gumbo. The open part of the semicircle faced south. One incised rim sherd and 6 plain body sherds were found along the outside perimeter of the ring along with three chert flakes and a small point. Nothing was found inside the ring.

The evidence suggests that this ring of clay may have been the foundation of a low wall facing the north wind. Perhaps branches were stuck into this wall to serve as a windbreak and shelter. The fact that all the artifacts were found on the outside of this ring lends credibility to this theory. Unfortunately, very dry weather conditions forced us to abandon our exploration of this rea.

Another part of the same area revealed what may have been a line of post holes, (Fig. 11). The traces here were very faint and the holes were only 2-7 cm. deep. Not enough of this possible structure remained to make an accurate determination of what it was.

Analysis of Artifacts

Ceramics

Methods of Analysis. The analysis was carried out in considerably more detail than after the first season of work. In order to ensure consistency, all of the analysis was done by O'Brien according to a list of attributes which was developed beforehand. The form on which the data were recorded is Fig. 12. Definitions of attributes or methods of analysis which are not self-explanatory

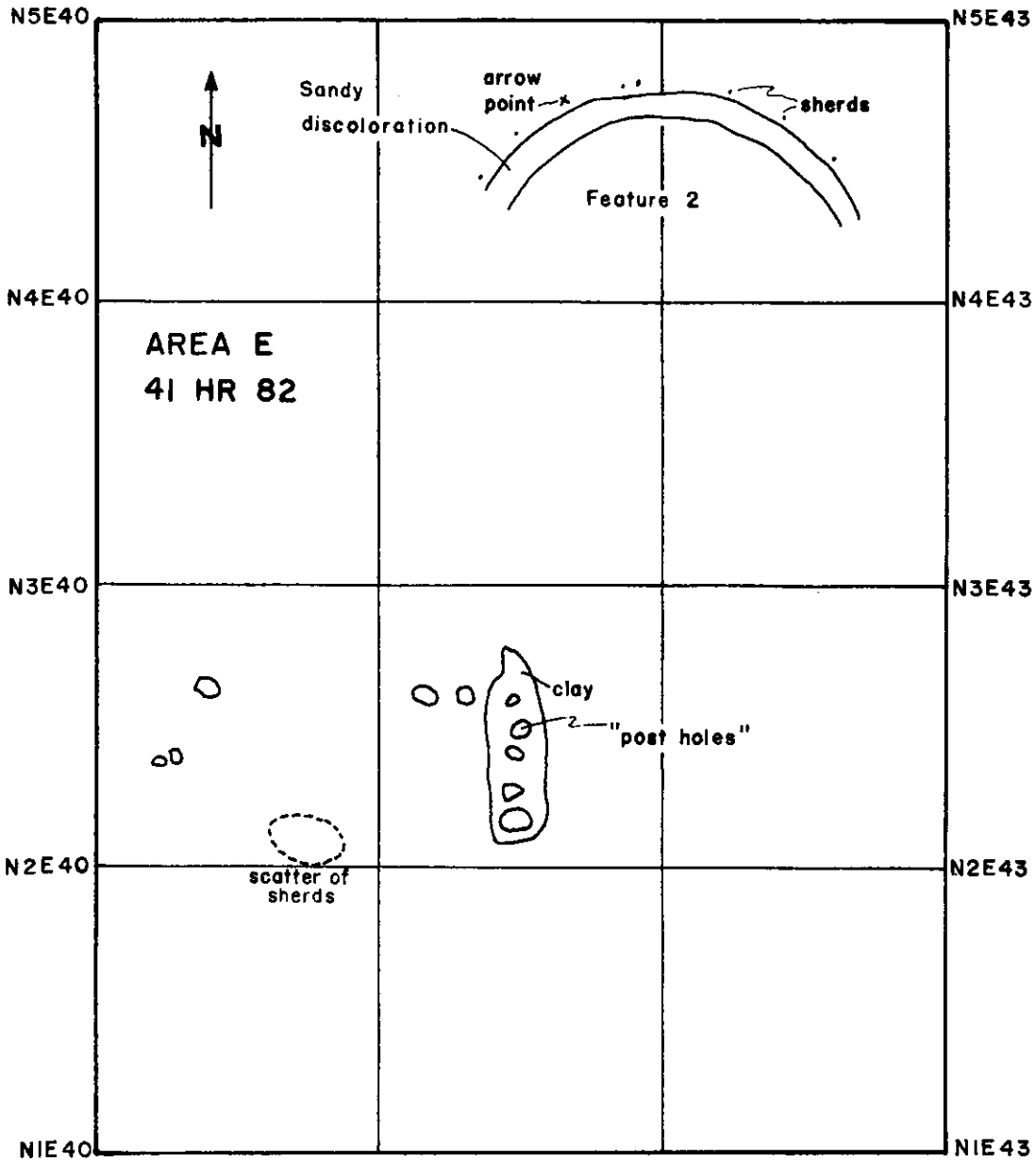


Fig. 11 - Feature 2 in Area E at the Fullen site.

SHERD ATTRIBUTE LIST

Work Sheet

					Sherd #		
					Rim	Type of Sherd	
					Body		
					Rounded Base		
					Flat Base		
					Concave Base		
					Noded Base		
					Sand	Temper & Paste	
					Grog		
					Vegetable		
					Contorted		
					None		
					Smooth in	Surface Treatment	
					Smooth out		
					Sandy in		
					Sandy out		
					Burnished in		
					Burnished out		
					Black in	Surface Color	
					Black out		
					Lighter grey/brown in		
					Lighter grey/brown out		
					Orange in		
					Orange out		
					Mottled dark & light in		
					Mottled dark & light out		
					Uniform	Core Color	
					Dark inside		
					3 lines	Incised Decoration	
					3 lines		
					Wavy lines		
					Ladders		
					Trinagles & Pendants		
					Punctations	Other Decoration	
					Cord Marked		
					Asphalt		
					Red Film		
					Trace of Notching	Rim Decoration	
					Deep Notches		
					Pie Crust		
					Straight	Rim Form	
					Flaring		
					Rim thickness 1 cm down	Thickness (in mm)	
					Sherd Thickness minimum		
					Sherd Thickness maximum		

Fig. 12 - Form used in analysis of pottery.

are given below:

Temper and Paste. In principle one can distinguish whether the clay has non-plastic inclusions added to it to help control shrinkage, modify its plasticity, etc. In practice it is often hard to tell whether such inclusions are deliberate or whether they occurred naturally in the source of clay. In our view there is no way to tell whether the sand grains found in all of the local pottery were put there intentionally. Since they are also present in all local sources of clay, it would hardly seem necessary to add them deliberately, thus the paste is sandy. Other kinds of temper are made of vegetable fibers, ground up pieces of fired pottery, and occasionally caliche. When such inclusions are found, only rarely they can be assumed to be accidental.

Surface treatment. We included this category because we thought it might be useful in discerning changes in the site. We felt each sherd on the inside and the outside and judged it to be either sandy, smooth, or burnished. No burnished sherds were found. In fact, we have concluded that surface treatment is not a very useful attribute since the same vessel has both smooth and sandy sherds.

Surface color. Each sherd was examined inside and outside for surface color, which was recorded as black, grey/brown, orange. As with surface treatment, it was found that the same vessel might contain pieces of very different colors ranging from dark black to bright orange. Thus, this attribute was also of no use in making comparisons between squares and levels.

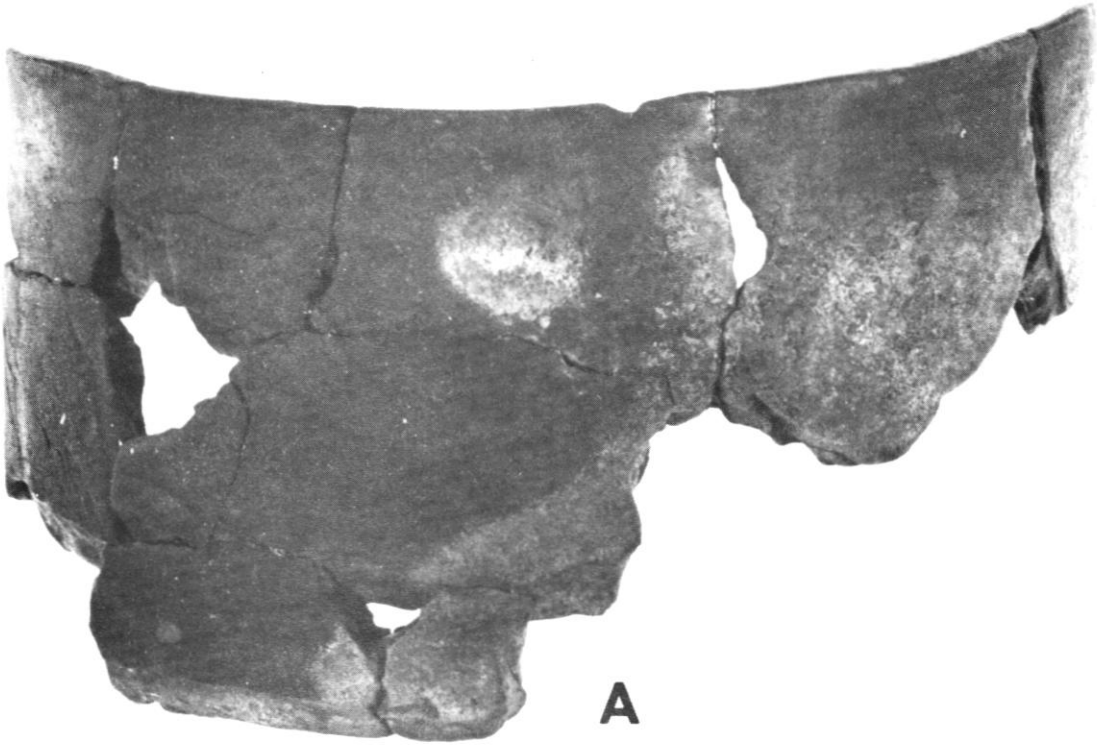
Core color. By making a small break on each sherd and examining the core, we hoped to gain some insight into firing techniques. As originally set up, the attribute contained only two alternatives -- uniform or homogenous color throughout and, dark inside or a sherd which changes from light on the outside to dark on the inside. Unfortunately, a category for dark on the exterior was not established. Nor was one for sandwich cores, that is, those which contain dark cores with light exteriors In both the inside and outside of the vessel. These categories were added later. The fact that we found several core types on the same vessel may be evidence for imprecision in firing, but it was no help in analysis of the site.

Thickness. We measured the minimum and maximum thickness of each body sherd, and the thickness 1 cm. below the rim of rimsherds, hoping to find differences through time.

Although the system of analyzing pottery by attributes contained flaws and involved procedures which proved useless, the importance of finding attributes which change through time must be emphasized. If we are to develop a detailed ceramic chronology for the area, elements which reveal changes through time must be found. At the present, tempering (non-tempered sandy wares vs. tempered wares), base and rim forms, the appearance of decoration, and changes in design elements are the most useful attributes for chronological purposes.

Techniques of pottery manufacture. Throughout the entire sequence all Gulf Coast ceramics have sandy paste. Toward the end of the sequence pieces of fire clay, probably from crushed sherds, were added to the paste. A small percentage of these later sherds also contain bits of bone or shell.

All pottery was coiled and most was smoothed while the clay was wet. This smoothing, done either with the hand or with a smooth object, closes the pores in the paste by floating the finer particles of clay to the surface. When a pot is finished in this way, its surface is smooth to the touch; the sandy grains being covered by a thin skim of finer particles. In some instances striations on the interiors of the sherds indicate that vegetable fibers were used for scraping and roughly smoothing the coils. On occasion sherds have a coating of asphalt on the inside. Although this material could have been used to waterproof porous vessels, it is equally likely that it is simply residue from the boiling of tar to drive out the volatile impurities. After the boiling, the asphalt was often used to



A

B

Fig. 13 - Vessel 1. a) exterior profile, b) top view of rim.

Fig. 14 - Vessel 2.

waterproof the cracks in broken pots whose edges were held together by binding through holes drilled in them.

Vessel shapes range from small bowls to large jars and deep vases (see Ambler 1967, Wheat 1953:187, this report). Only two vessels from the Fullen site could be reconstructed sufficiently to give some idea of shape and size (Figs. 13, 14).

Many forms of bases were in style -- flat, concave, rounded, noded and conical. Ambler (1967) and O'Brien (1971) speculated that flat bases may have been the first type of base used in the area, but the yield of base types at the various sites has not been high enough to lend much solid evidence (Table 5). The concave base is typical of much of the Louisiana pottery (Mandeville, Tchefuncte) but only two such bases have been recovered in this area.

Included in the sequence are vessels whose walls range in thickness from 2.2 mm. to 11.0 mm. and whose lips range from inverted to strongly everted to rolled (Fig. 15).

Decoration is by lip notching, (scoring the rim to resemble a pie crust), by incising, stamping, punctating, cord-marking and fingernail impressing (Figs. 16, 17).

The pottery sequence. Eight pottery types have been distinguished in the Galveston Bay region: Mandeville, Tchefuncte, San Jacinto Plain and Incised, Goose Creek Plain and Incised, Stamped and Red-Filmed. The chronological order of these types (Aten and Chandler 1971) is based on very few stratigraphic excavations but it is supported by excavations at 41 HR 82. Aten's chronology starts with the early types, Mandeville,

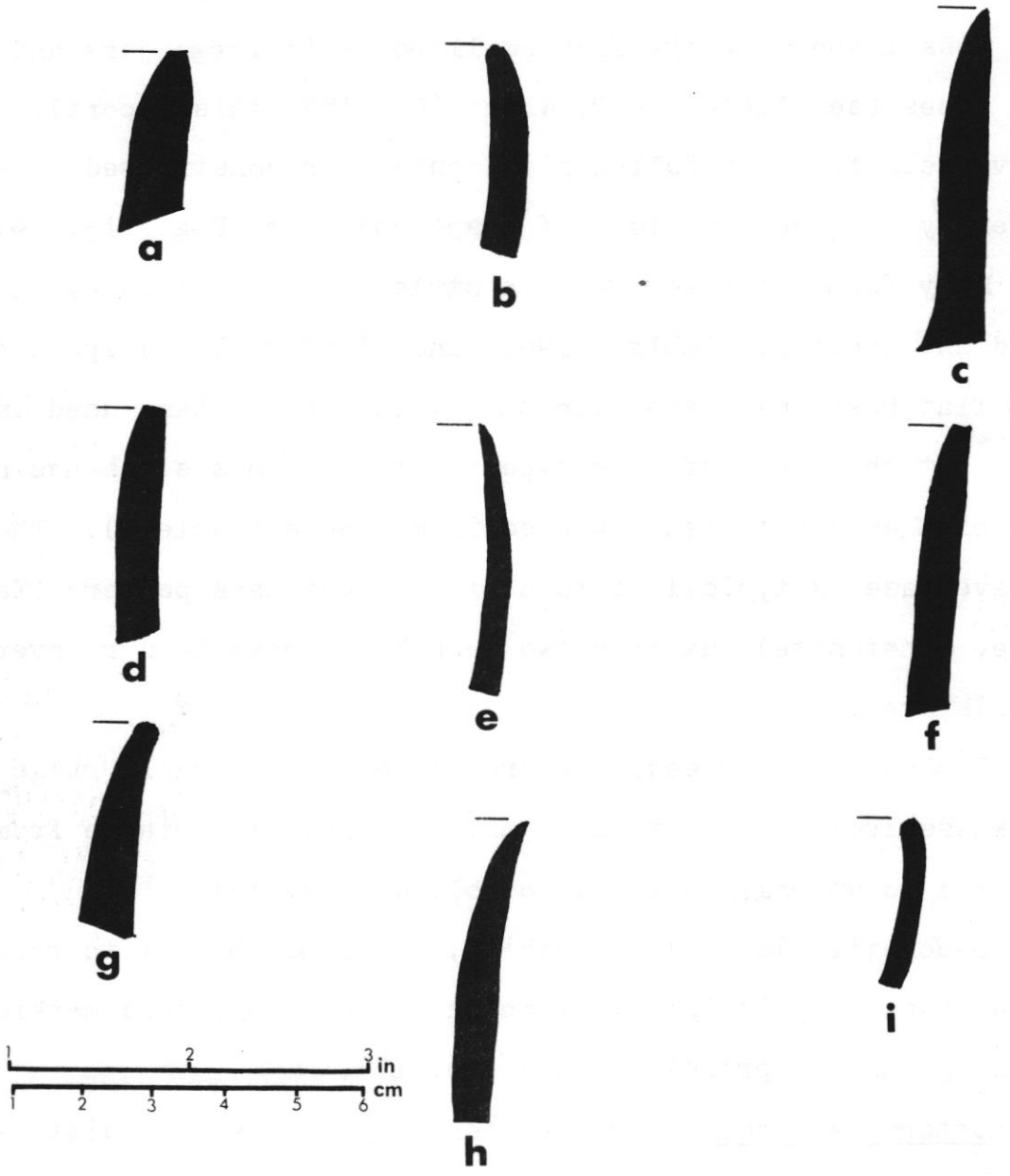


Fig. 15 - Rims and lip forms (interior is to left of profile). a) straight rounded, b) incurving rounded, c) straight pointed, d) outflaring flat, e) incurving pointed, f) straight flat, g) outflaring rounded, h) outflaring pointed, i) incurving flat.

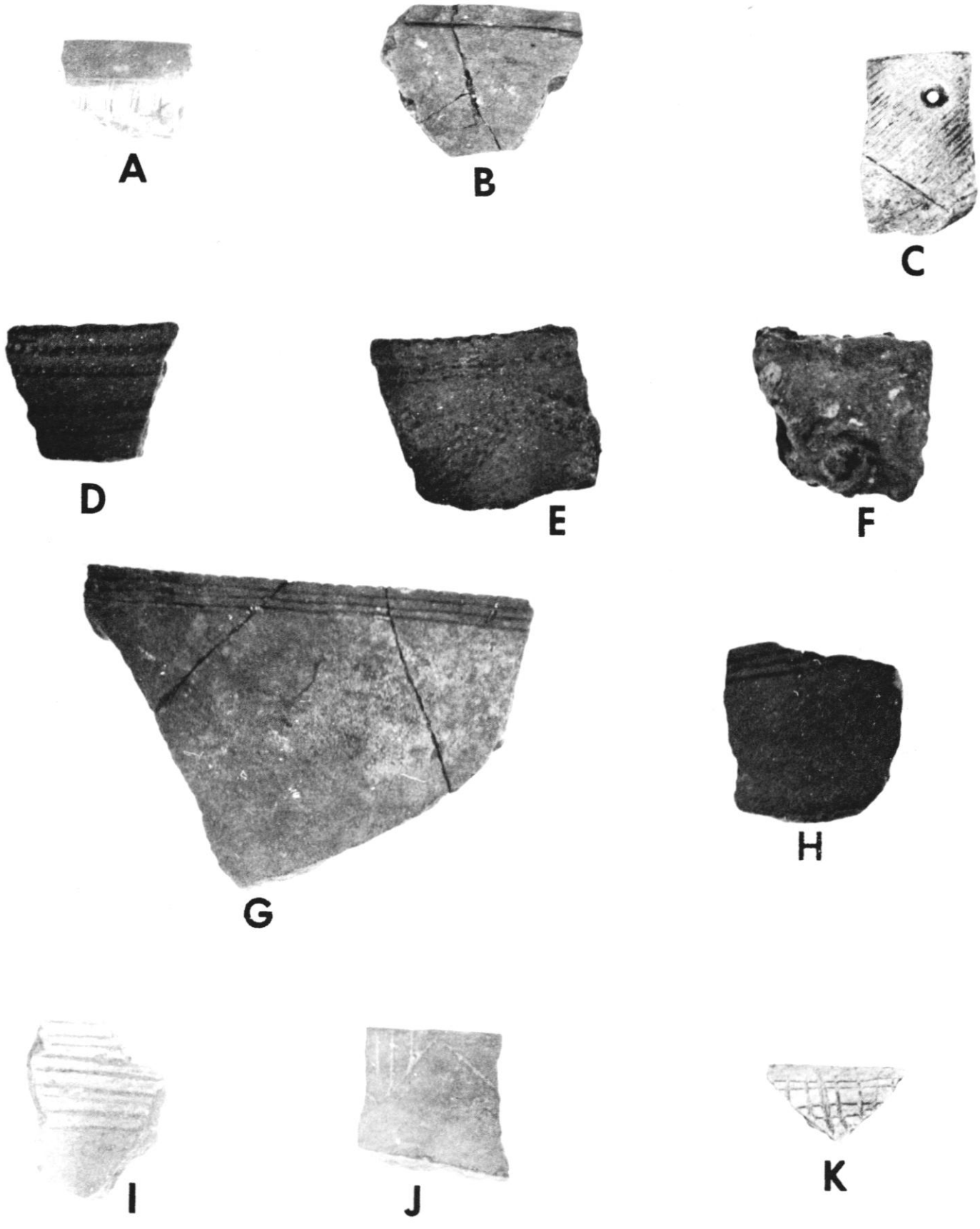


Fig. 16 - Decorated sherds from the Fullen site. a-c, g-k, incised; d, e, stamped; f, applique.

Tchefunct, Goose Creek Plain and Stamped, and continues through the later appearance of Goose Creek Incised and Red-Filmed, and finally San Jacinto Plain and Incised. Only Goose Creek Plain occurs throughout the entire sequence.

The single Tchefuncte sherd from 41 HR 82 occurred, as expected, in the lowest pottery-bearing zone. Two sherds of Goose Creek Stamped were also recovered in Zones II and III. Significantly, we did not find any Red-Filmed or San Jacinto Incised sherds. As expected, San Jacinto Plain occurs at the upper end of our sequence (Table 2). Although we do not have sufficient data to substantiate all of Aten's proposed chronology, there is nothing in our results which would disprove its validity. The Fullen site appears to fall somewhere in the middle of the presumed ceramic chronology.

Type descriptions

Type: Goose Creek Plain (Figs. 13, 14)

Sample: 2117 sherds
Temporal distribution: Throughout the ceramic levels at 41 HR 82; Clear Lake to Orcoquisac Phases in Aten's ceramic periods.
Appearance: A coiled, fairly hard ware which is usually very sand to the touch. Cores range from dark grey to brown and black.
Paste: Clay with grains of sand ranging in size from fine to coarse.
Temper: Although the paste contains abundant sand, we assume that these aplastic inclusions occur naturally in the clay.
Color: The paste is usually dark in color with surface color ranging from brown and black to yellow, orange and red. Many vessels are mottled.
Surface treatment: There is a range from unevenly smoothed to highly smoothed exteriors. When smoothing is done while the clay is still wet, the finer particles rise to the surface and result in a thin film that looks like a deliberately added slip. This effect was

evident on some of the sherds. No sherds show evidence of burnishing -- the smoothing to a high gloss of leather-hard green pottery.

Vessel forms:

rims: straight, incurving, outflaring. Lips may be pointed, flat or rounded and may be nicked.

bases: flat, round, concave, noded and conical.

wall thickness: 2.2 to 11.0 mm.

vessel shapes: Shapes are hard to determine because of lack of reconstructable vessels but they probably include deep bowls, cylindrical jars, wide-mouth shallower jars, and large convex-walled jars.

Type: Goose Creek Incised (Fig. 16 a-c, g-k)

Sample: 24 sherds

Temporal distribution: Occurring a little later than the beginning of Goose Creek Plain, it lasted throughout the sequence. Its beginnings are in what Aten has called the Turtle Bay ceramic period.

Appearance: Same as Goose Creek Plain except for incised decoration.

Decoration: Design elements consist of from one to six parallel horizontal lines just below the lip, sometimes accompanied by single rows of punctations; triangles occasionally filled with diagonal lines; diagonal ladders, diamonds and squares.

Type: Goose Creek Stamped (Fig. 16 d, e)

Sample: 2 sherds

Temporal distribution: Restricted by Aten to a very short period in the early part of the sequence and lasting only to the end of the Clear Lake ceramic period.

Appearance: Same as Goose Creek Plain except in design.

Decoration: Designs are made with both narrow, curved instruments and two-pronged instruments. The latter tool was used on the 2 sherds recovered from 41 HR 82. Sometimes the design is neat and complete, while at other times the impression was made only at the ends of the stamp when it was rocked forward.

Type: San Jacinto Plain

Sample: 22 sherds.

Temporal distribution: According to Aten, San Jacinto Plain and Incised appear much later than the Goose Creek assemblage and perhaps do not last throughout the sequence. Excavation at 41 HR 82 supports these.

Appearance: A coiled, fairly hard ware which is usually somewhat sandy to the feel and which has visible angular chunks of fired clay in the paste.

Paste: The clay contains 2 kinds of non-plastic inclusions, sand and fragments of fired clay.
Temper: Fragments of fired clay and/or crushed sherds. This material was deliberately included in the paste to retard shrinkage, while the sand was probably only a natural inclusion in the paste.
Color: Range is the same as that of Goose Creek Plain.
Vessel forms: Data are very sparse but rim and vessel forms appear similar to the Goose Creek forms.

Type: Caliche-tempered

A single rim sherd from Zone II contained numerous chunks of calcium carbonate in the paste. It is a rounded, straight rim, very sandy and rough.

Type: Tchefuncte Plain

Sample: 1 sherd, Zone IV.
Temporal distribution: This type is very prevalent in the Lower Mississippi Valley and recognized as a component of Aten's Clear Lake Period ceramic assemblage.
Appearance: A smooth-feeling pottery, this type is best recognized by its poor wedging, resulting in a contorted appearance to the paste when viewed across a section.
Paste: Depending on the geographic location of the sherd, it may or may not have sand present. The clay is usually very fine and smooth.
Temper: Louisiana Tchefuncte sherds contain varying amounts of clay temper, while Texas Tchefuncte sherds contain no temper.
Color: Paste color varies from light pink to orange to brown.
Vessel forms:
rims: straight, incurving and outflaring; lip may be rounded, flat or pointed.
bases: usually concave with tetrapodal supports. No examples have been found in the Upper Galveston Bay Area.
We do not have data on vessel shapes but Aten (1971) states that Tchefuncte Plain has a limited repertoire.

For descriptions of the Upper Gulf Coast types not discussed here, see Aten 1967 and Aten and Chandler 1971.

Analysis of ceramic attributes

Inspection of Tables 2-5 shows the advantage of studying attributes for the information they may give on chronology. In

Table 2, where sherds are designated by type, it is apparent that the bulk of pottery (some 98 per cent) is Goose Creek Plain. Furthermore, this type appears in this high frequency in all zones which have pottery. Thus, on the basis of a casual examination of sherds, it would not be possible to discriminate differences between zones. However, close inspection of the entire collection reveals that two relatively rare types are found almost exclusively in Zones II and III: Goose Creek Incised and San Jacinto Plain. On the basis of ceramics we could distinguish these two zones from Zones I and IV, but we could not distinguish them one from the other.

We can sharpen our perception somewhat by examining rim forms (Table 3 and Fig. 15). Here we find that a number of forms appear first in Zone III. They are Flaring Pointed Notched, Flaring Round Plain, and all of the Straight rims. Incurving rims are distributed throughout. Thus the distinction between Zones III and IV is easy. Rim form also allows us to distinguish between Zones II and III which we could not do by studying types alone. We find that Flaring Flat Notched, Incurving Flat Notched, and Straight Flat Notched rims are all confined to Zone II. In fact, a case might be made that flat rims of any kind are a late style.

Table 4 shows the distribution of styles of incising, a technique which, with one exception, is confined to Zones II and III. One example of cross-hatching comes from Zone IV, the only sherd with this style of decoration. Zone III has the most styles of interior incising, even though the quantity of sherds

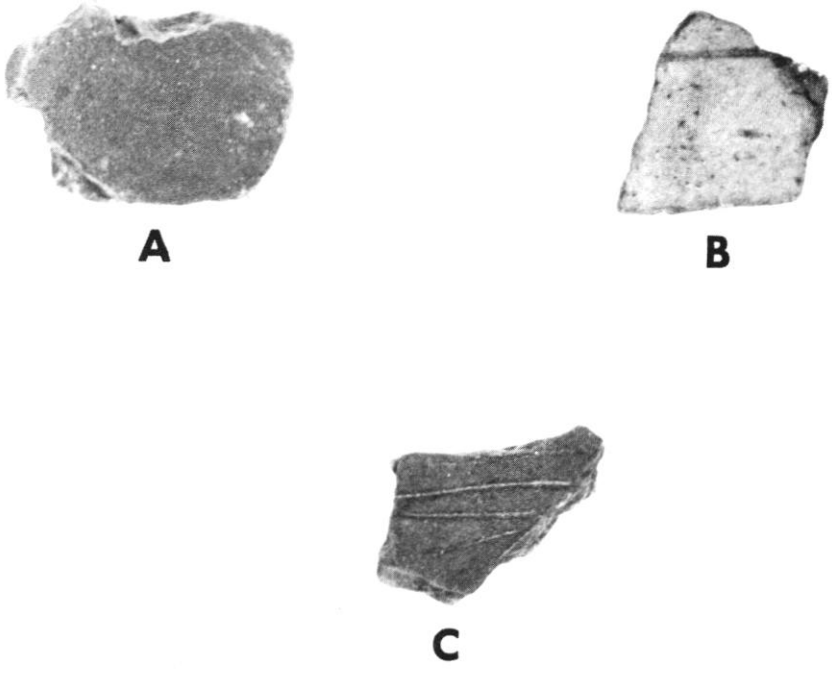


Fig. 17 - Sherds with interior incising from the Fullen site.

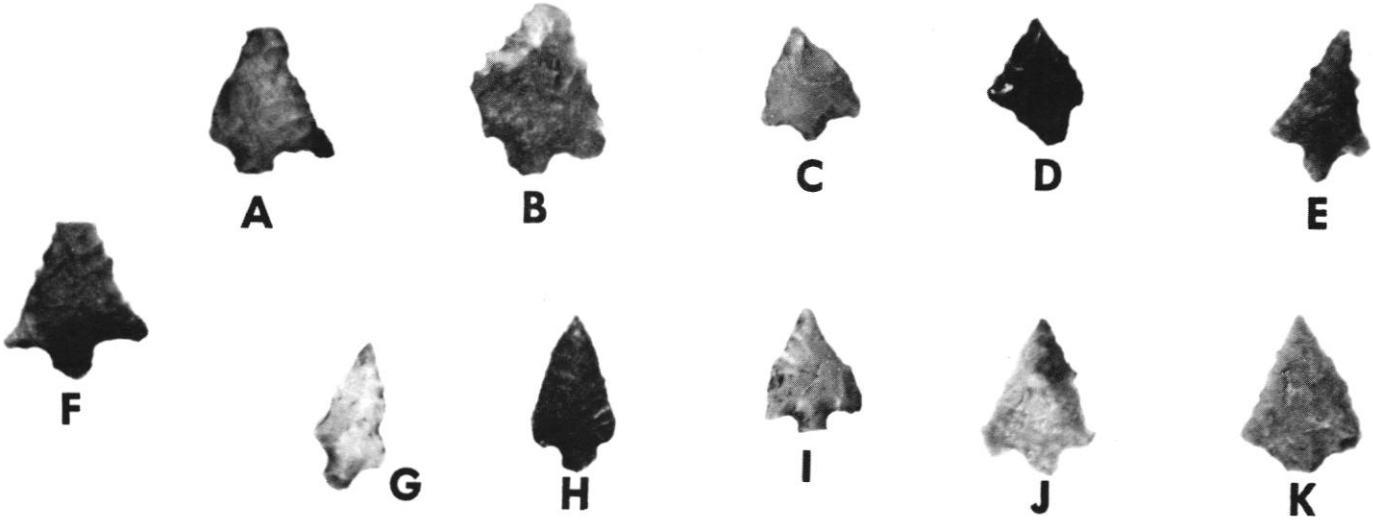


Fig. 18 - Arrow points from various sites.

in Zone II is about three times that of Zone III. Thus, by chance one would expect to find more incised sherds in Zone II if the styles were used in both zones. A case may be made, therefore, for distinguishing between Zones II and III on the basis of styles of incising. It is also to be noted that interior incising occurs on only three sherds, all of which are in Zone II.

Finally, we may look at Table 5 which shows the distribution of base sherds. Of the three styles, rounded bases occur only in Zone III.

With the information on distribution of attributes by zone, we may now look at the sherds from Area B (Table 6). Although there was no stratigraphy there and the area is not physically connected with our stratigraphically controlled excavation, we note that it contained only sherds of Goose Creek Plain, including one sherd with interior incising. According to our analysis above, Area B should be of the same age as Zone II.

Chipped and Worked Stone

Arrow Points. The 13 arrow points include 11 from the excavation and 2 from survey. All of the excavated examples are from Zones II and III. Because of the ambiguity surrounding the definitions of point types, none of the examples shown here (Fig. 18) has been named; all are duplicated at the Jamaica Beach site (Aten 1967).

Dart Points. Of the 11 dart points, 6 are from the Fullen site. One example from the site is of petrified wood, whereas two of

Depth (cm)	Percentages of total weight			Weight of Clam Shells
	Bone	Oyster Shell	Clam Shell	
0- 5	10	0	90	20 grams
5-10	40	0	60	66 grams
10-15	65	0	35	90 grams
15-20	22	0	78	557 grams
20-25	17	0	83	950 grams

Table 1a. Percentages of bone, oyster and clam shells by levels in Test Pit 1 at 41 HR 153. Percentages are based on the total weight of the three faunal components.

Depth (cm)	Percentages of Total Weight	
	Oyster Shells	Clam Shells
0-10	14	86
10-20	19	81
20-30	3	97
30-40	29	71
40-50	9	91
50-60	3	97

Table 1b. Percentages of oyster and clam shell by levels in Test Pit 2 at 41 HR 153. Percentages are based on the total weight of the two faunal components.

Zone	Square	Plain	Incised	Stamped	San Jacinto Plain	Tchefuncte Plain	Caliche Tempered	Totals
V	N2E1	2						2
	N3E1							0
	N4E1							0
	N1E2							0
	N2E2							0
	N3E2							0
	N4E2	1						1
Totals		2070[2]	18[2]	2	22[2]	1	1	2114

Table 2. Distribution of ceramics by type in Zones of Area A.

1/ Sherds found in pothole which cut through layers C1-C4 in part of square N1E2

2/ Sherds in pothole not included in totals.

Zone	Square	Goose Creek Plain	Goose Creek Incised	Goose Creek Stamped	San Jacinto Plain	Tchefuncte Plain	Caliche Tempered	Totals
I	N1E1	34			1			35
	N2E1	32						32
	N3E1	13						13
	N4E1	4			1			5
	N1E2	32						32
	N2E2	22			1			23
	N3E2	28						28
	N4E2	21						21
II	N1E1	197						197
	N2E1	220	1		1			222
	N3E1	189	1		2			192
	N4E1	152			2			154
	N1E2	164	2		1			167
	N2E2	131		1	1			133
	N3E2	112	2		2			116
	N4E2	164	1		5		1	171
III	N1E1	114	1		1			116
	N2E1	51	1					52
	N3E1	65	2					67
	N4E1	24	2		1			27
	N1E2	26+13[1]	2+2[1]		3[1]			28[2]
	N2E2	51	1	1	1			54
	N3E2	59			1			60
	N4E2	20						20
IV	N1E1	26				1		27
	N2E1	16						16
	N3E1	5	2					7
	N4E1	25						25
	N1E2	26						26
	N2E2	12						12
	N3E2	5						5
	N4E2	25			1			26

Zones	Flaring Rims					Incurving Rims					Straight Rims					Totals
	Pointed		Flat		Round	Pointed		Flat		Round	Pointed		Flat		Round	
	Plain	Notched	P	N	Plain	P	N	P	N	Plain	P	N	P	N	Plain	
II	7	1	6	1	3	4			1	1	5		10	3	7	49
III	9	4[1]			3		1			1	8	2[1]	1		1	30
IV	1		1			2		1								5
V																0
Other	2		1		1	1					5		5			15
Totals	19	5	8	1	7	7	1	1	1	2	18	2	16	3	8	99

Table 3. Distribution of rim types by zone in Area A

1/ Includes sherds in pothole.

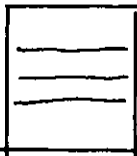
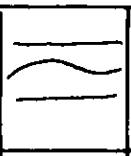
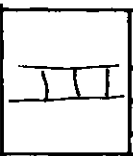
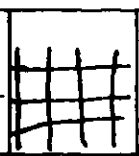
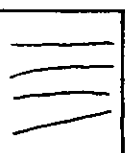
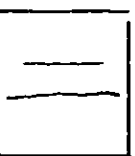
	Exterior Incising							Interior Incising				
Zone							Stamped					
II	3			3			1	1		1	1	1
III	3	1	1	1	2	1	1	1				
IV									1			
V												

Table 4. Distribution of styles of incising in zones of Area A. (includes sherds in pothole)

Zone	Flat	Rounded	Noded
II	1		2
III	1	2	3
IV			

Table 5. Distribution of base sherds by form in Area A. (All are Goose Creek Plain)

Square	Goose Creek Plain Body Sherds
N1E24	9
N1E25	12[1/]
N2E24	13
Total	34

Table 6. Distribution of sherds in Area B.

1/ Includes 1 interior incised sherd

the points found on survey are of this material. The types are not specifically named, although Gary and Bulverde types are included (Fig. 19).

Table 7 shows that the dart points are found below (Zones IV and V) and, consequently, earlier than the arrow points which are in Zones II and III. This finding is corroborated by the first season's work, although the stratigraphic controls at that time were not as good. The distribution in Area A shows no overlap in the chronology of dart and arrow points.

Bifaces. Each of the five pieces included in this category has bifacial flaking (Fig. 20 d-g). The two examples from stratified context were in Zone IV.

Unifaces. Both of these pieces are from surface collections and are grouped because of their secondary retouch along an edge. These are side scrapers (Fig. 20 c, j)

Drills. One is a thick piece of chert from which several flakes have been struck to form a double-ended tool (Fig. 21 a). The other example is a drill which was formed by steep chipping along both edges of a thick flake (Fig. 20 b).

Chopper. This single specimen is a small, semi-chipped core tool, half of which still retains its cortex (Fig. 21 c)

Retouched flakes. The two specimens are both secondary cortex flakes which have secondary retouch. On example 578 the retouch is on only one edge (Fig. 20 b). Number 112 is an end scraper, having fine retouch along one edge and rougher flaking on the other (Fig. 20 i).

Abraders. The three examples are all small pieces of sandstone

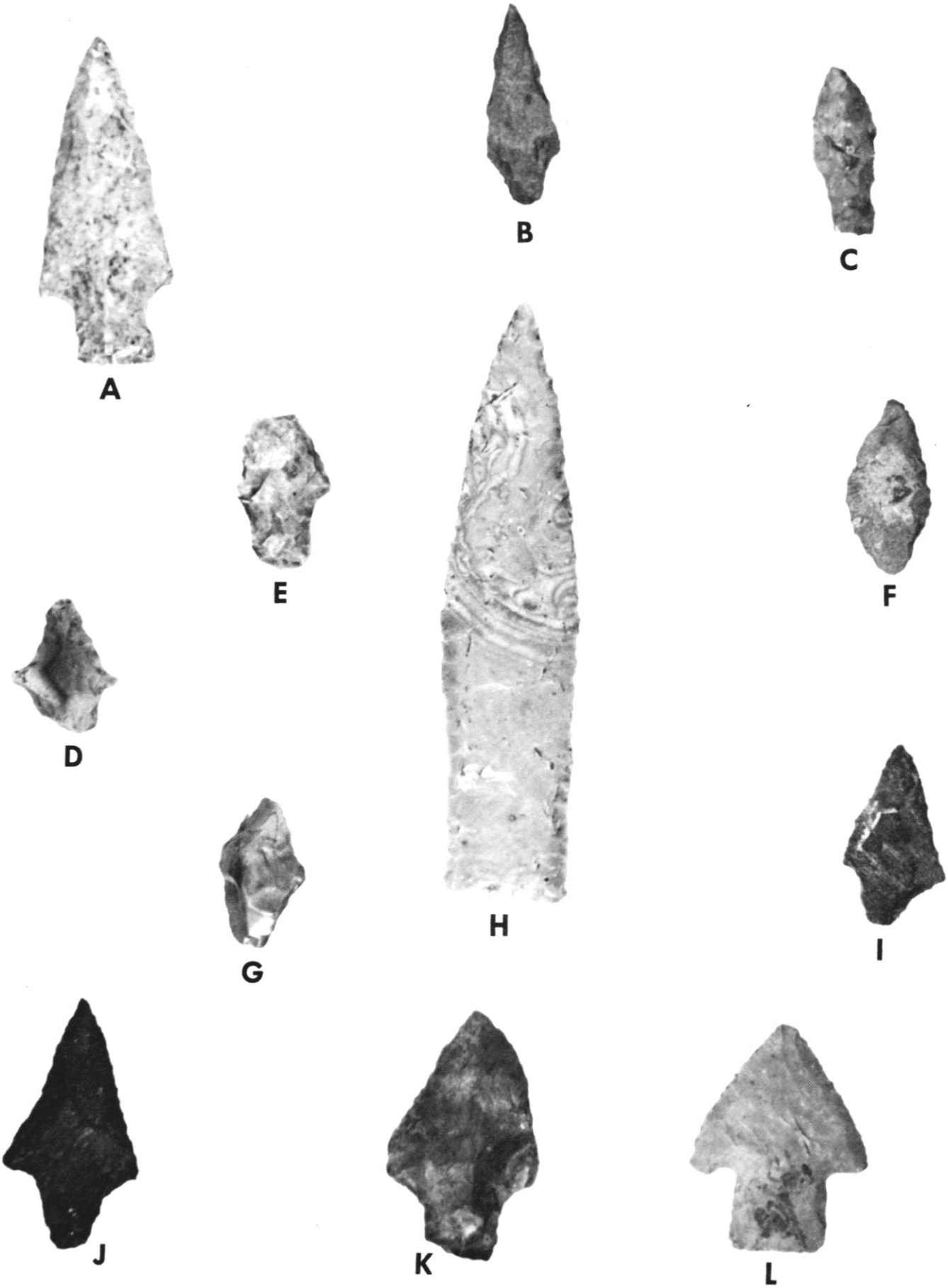


Fig. 19 - Dart points from various sites.

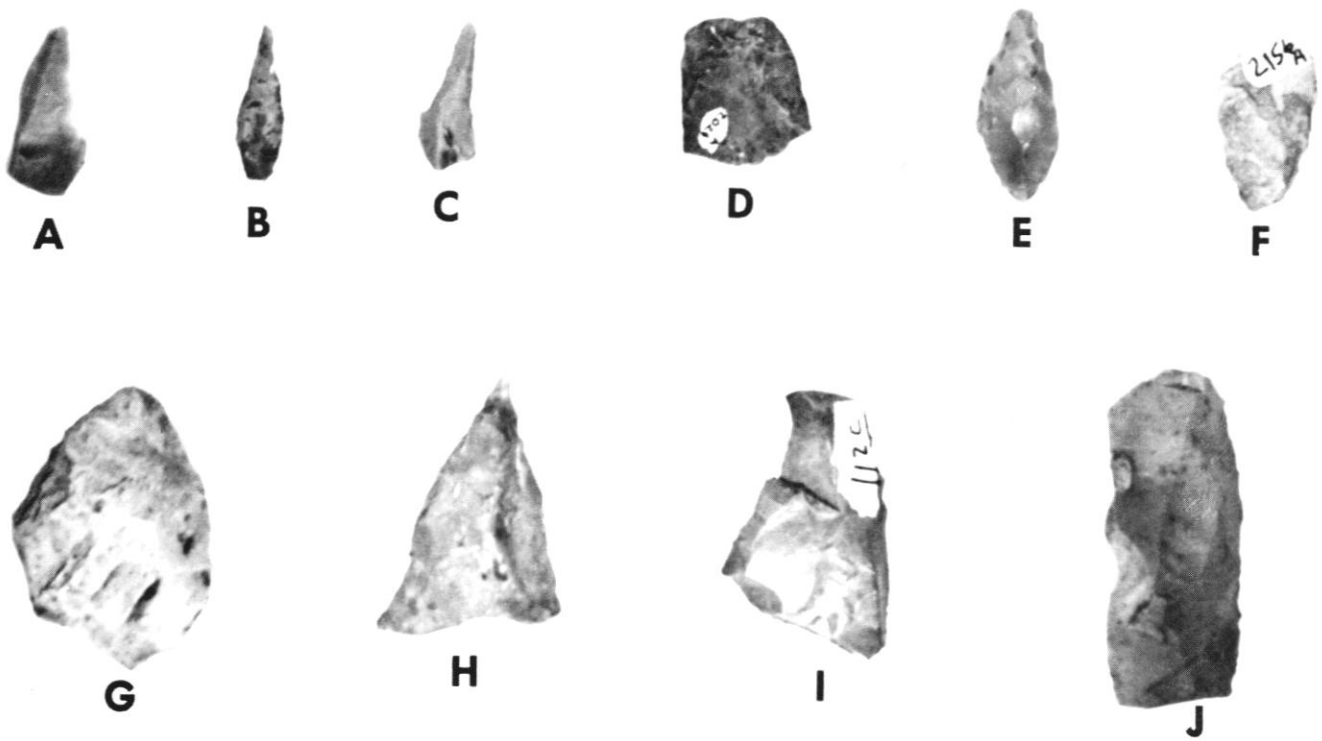


Fig. 20 - Flakes and bifaces from various sites. a) unretouched flake, b) drill, c) uniface, d-g) bifaces, h) retouched flake, i) end scraper on retouched flake, j) uniface.

Arrow Points

Provenience & Zone	Length	Width	Thick-ness	Stem length	Stem width	Material	Figure #	Field #
N1E2/B2 II	2.2	0.6	0.35	0.57	0.59	Chert	Not illus.	1052-A
N2E2/B2 II	1.7	1.4	0.32	-	0.43	"	24 i	538-A
N4E2/B2 II	2.1	1.1	0.29	0.52	0.52	"	24 h	493-A
N1E2/B5 II	2.1	1.9	0.28	0.48	0.63	"	24 f	778-A
N3E2/C1 III	2.1	1.4	0.30	0.40	0.46	"	24 e	1512-A
N1E1/C2 III	1.7	1.3	0.30	0.37	0.60	"	24 d	1412-A
N3E1/C2 III	2.2	1.7	0.30	-	0.50	"	24 k	1215-A
S1E5/S1	2.1	1.6	0.30	0.30	0.49	"	24 j	H-C
S1E5/S1	2.2	1.1	0.30	0.40	0.50	"	24 g	S
Scraped area	1.9+	1.6+	0.39	-	0.55	"	24 a -	X-A
Area E	2.1	1.2	0.36	0.22	0.31	"	Not illus.	Y
Kirby Mansion	1.6+	1.3+	0.37	0.20	0.31	"	24 c	KM 1
41/HR/141	2.3+	1.9+	0.30	0.30	0.65	"	24 b	CLC 1

Dart Points

N2E2/C6 IV	3.6	1.7	0.6	-	-	Chert	25 h	696-A
N2E2/C7 IV	3.0+	1.9	1.9	1.0	1.2	"	25 g	1965-A
N3E2/C8 V	5.3	2.8	0.7	1.3	1.3	Petrified wood	25 j	G-A
N3E2/C7 V	3.5	1.3	0.7	1.1	1.0	Chert	25 c	2000-A
Provenience lost	2.8	2.2	1.8	-	1.5	"	25 d	2054-A
S1E7/dirt	4.1	1.5	0.9	0.8	0.9	PW	25 b	1089-C
Kirby Mansion	3.1+	1.8	1.3	0.8	1.2	Chert	25 e	KM-2
41/HR/144	4.5	3.7	0.7	1.5	2.0	"	25 l	CLC 4
41/HR/146	3.6	2.0	0.6	0.6	0.9	PW	25 i	CLC 7
41/HR/150	6.8	2.7	0.9	1.3	1.5	Chert	25 a	CLC 11
41/HR/88	5.1	3.2	1.0	1.0	1.6	"	25 k	K

Table 7. Provenience and dimensions (in cm) of projectile and dart points.

Tool Type	Provenience and Zone	Length	Width	Thick-ness	Material	Fig. #	Field #
Bifaces	N1E1/C6 IV	-	0.83	0.73	Chert	20 d	2024
	N4E1/C6 IV	2.56	1.52	0.84	"	20 f	2156
	S1E5 Pothole	2.78	1.16	0.65	"	20 h	1233
	41/HR/88	4.2	3.76	1.21	"	20 g	J
	Road	2.65	1.42	0.70	"	20 e	RR
Unifaces		3.7	2.2	1.2	"	20 i	CLC 4
		4.8	2.6	0.6	"	20 j	CLC 8
Drills	N2E1/C8 V	4.8	2.9	1.8	"	21 a	2072
	S1E6/0-10	2.2	0.90	0.35	"	20 b	W-C
Chopper	N4E2/C5 IV	4.1	3.2	2.4	"	21 c	C-A
Retouched Flakes	N3E2/B2 I	2.12	2.60	0.64	"	20 a	578
	S1E5/S1	2.42	1.07	0.32	"	20 i	112
Abraders	N1E2/B1 II	6.0	3.5	2.0	Sandstone	21 e	908
	N4E1/C3 IV	7.6	5.9	1.5	"	21 f	1904
	Back dirt	3.3+	3.2	1.8	"	21 d	BP
Sinker	Back dirt	6.9	3.3	1.6	Conglom-erate	21 b	BD
Hammerstone	N1E1/C8 V	6.0	5.0	4.6	Chert	None	1979

Table 8. Inventory of miscellaneous stone artifacts.

which were probably used for sharpening awls, grinding down spatulas, and possibly for rough-shaping of pottery (Fig. 21 d-f).

Sinker. An ovate piece of conglomerate shaped liked a sinker (Fig. 21 b; of O'Brien 1971)

Hammerstone. A chert cobble whose abraded edges may have resulted from hammering. Similar objects are found in sites where nuts are pounded, flint chipped, and so on. This example was found on the same surface as Feature 1 in Zone V.

Unworked flakes.

Analysis was carried out on all flakes and other non-retouched lithics from Area A. A total of 357 pieces was examined. The three dimensional plotting of location of flint refuse on graph paper did not reveal any distinct chipping areas in the eight squares of Area A, so this approach was abandoned in favor of a closer examination of the pieces themselves. By dividing the flint into categories based on the condition of the pieces, it was hoped that changes in chipping patterns, either through time or by geographic location of sites, might be brought out. We thought that a comparison of these results with Area C might show intrasite differences, and that by comparing data from different levels and cross checking this with Area C, differences through time might be seen.

Below are listed flake and detritus categories established to facilitate sorting. Categories a, b, c, e and f are based primarily on definitions by Shafer (1969); e is based on a definition by Hester (1971: 106):

(a) INITIAL CORTEX FLAKES result from the removal of the cortex

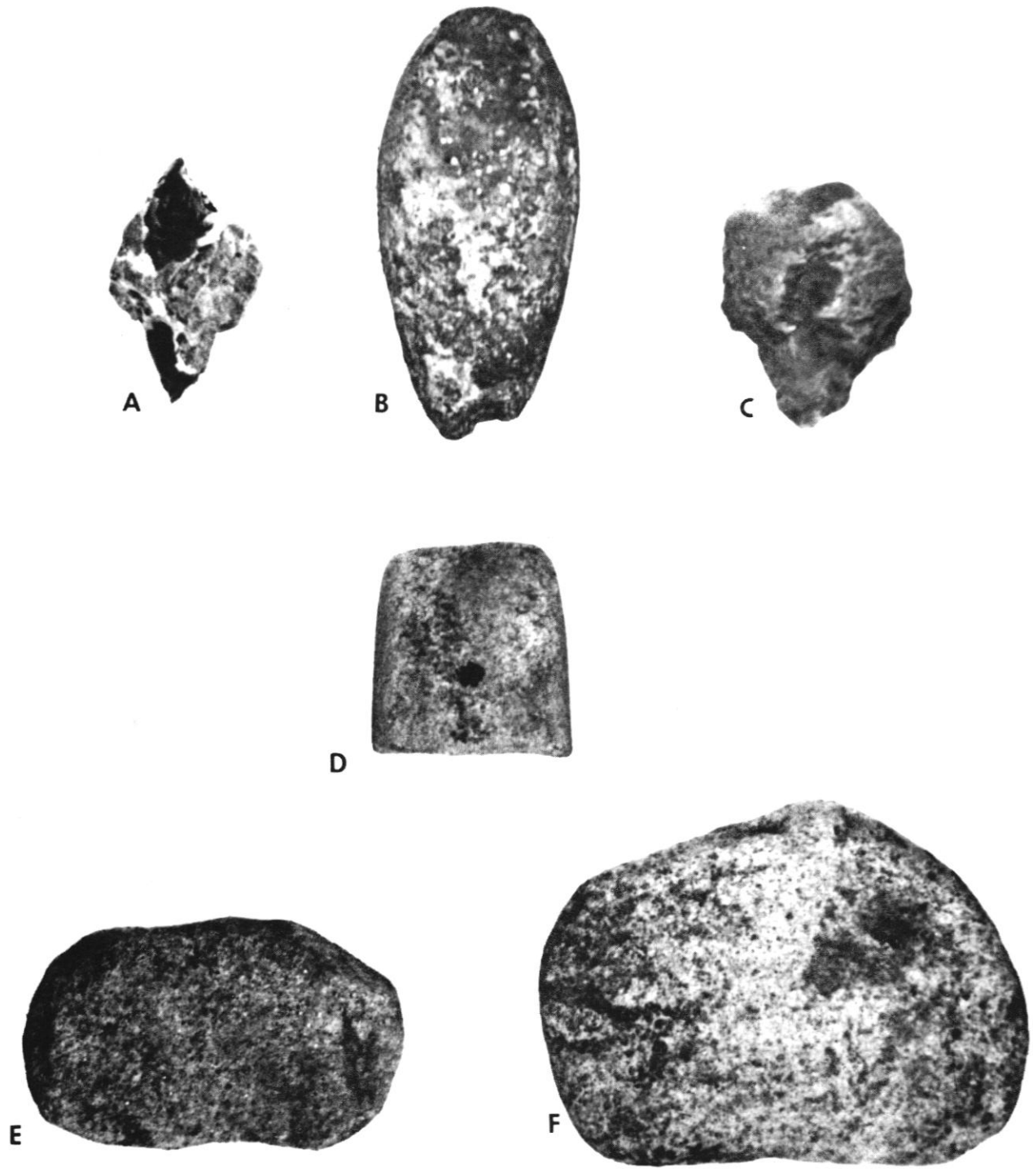


Fig. 21 - Miscellaneous stone artifacts from the Fullen site. a) drill, b) sinker, c) chopper, d-f) abraders.

from the nodule. The dorsal surface is covered with cortex.

(b) SECONDARY CORTEX FLAKES are characterized by the dorsal face being partially covered with cortex, but also exhibiting one or more flake removals.

(c) INTERIOR FLAKES have no cortex on either surface, since they have been removed from the interior of the core. Platforms are generally large and the vast majority of the flakes appear to have been struck from simple prepared platforms; a large percentage have cortex platforms.

(d) INTERIOR FLAKES WITH MULTI-FACETED PLATFORMS were recognized in the sample. These are interior flakes on which the platforms are formed by convergent planes. The flakes appear to have been struck at the peak formed by the convergent planes.

(e) LIPPED FLAKES are characterized by a diffuse bulb of percussion and an overlapping, or "lipped" multi-faceted striking platform. Generally, these seem to be the result of biface thinning activities. Only rarely does cortex occur on the dorsal surface and then only in small patches; however, this surface is always multi-faceted.

(f) FLAKE BLADES are narrow, parallel-sided flakes, usually twice as long as they are wide. All have either 1 or 2 median ridges on the dorsal surface. Platforms are always prepared.

(g) UTILIZED FLAKES are distinguished by light retouch along 1 or 2 lateral edges.

(h) CORE FRAGMENTS are chunks of chert or petrified wood which exhibit numerous flake scars.

(i) FLAKE FRAGMENTS are pieces on which the bulb of percussion

and striking platform are missing.

Examination of the flint makes it evident that all steps in the manufacture of stone tools took place in the area: cortex was removed, thinning flakes were removed, and cores were discarded.

What is interesting is the rise and decline in the total number of flakes throughout the zones (see Table 9).

Zone	Initial Cortex	Secondary Cortex	Interior	Interior with multi-faceted platform	Lipped	Flake Blades	Utilized Flakes	Flake Fragments	Core Fragments	Totals
I	1	1	1					3	1	7
II	17	19	29	1	2		1	19	5	93
III	8	12	8				1	9		38
IV	8	7	36	1	4			32	1	89
V	14	20	57	2	7	2		31	4	137

Table 9. Distribution of flakes and detritus in Area A.

Zone I contains almost no flakes, while Zone II contains 93. This is due, at least in part, to the considerable thickness of the latter level (Fig. 9). The total in Zone III decreases by a factor of over 2.5 while Zone IV shows a marked increase by almost the same factor. Zone V shows another increase.

The high number of pieces in all the categories of flint in Zone V, the pre-ceramic level, is interesting; there are different ways of interpreting these data. Two possibilities are

that more people lived there in the pre-ceramic time, and that Zone V was a chipping area. That the latter may be true is suggested by the extremely large number of petrified wood chips found in the level, especially in squares N4E1/N4E2. Fifteen pieces of dark petrified wood were found there which were easily recognizable as coming from the same core. Other chips of chert from this level were similarly easy to recognize and they were used to check correlations of levels between squares. An alternate hypothesis is that the chips were picked up from some other area and tossed to the spot where they were recovered. In either case, primary chipping of stone was done at the site.

In summary, the following conclusions can be derived from the lithic analysis:

(1) all chipping activities were carried out at the site -- removal of cortex through removal of small thinning flakes.

(2) chert and petrified wood were both used as material in the manufacture of projectile points. Chert predominates as the primary material in all zones; petrified wood follows closely in importance but decreases upward through the site.

(3) a chipping area may be present in the pre-ceramic zone of squares N4E1/N4E2.

(4) examination of chert found in different zones of Area A shows that the same sources were used repeatedly. For example, a striking pink and purple banded chert was found in N3E1, Zone II, N1E2, Zone IV, and N2E1, Zone V.

(5) the flint-working technology at the site appears to have undergone no significant changes throughout the occupation

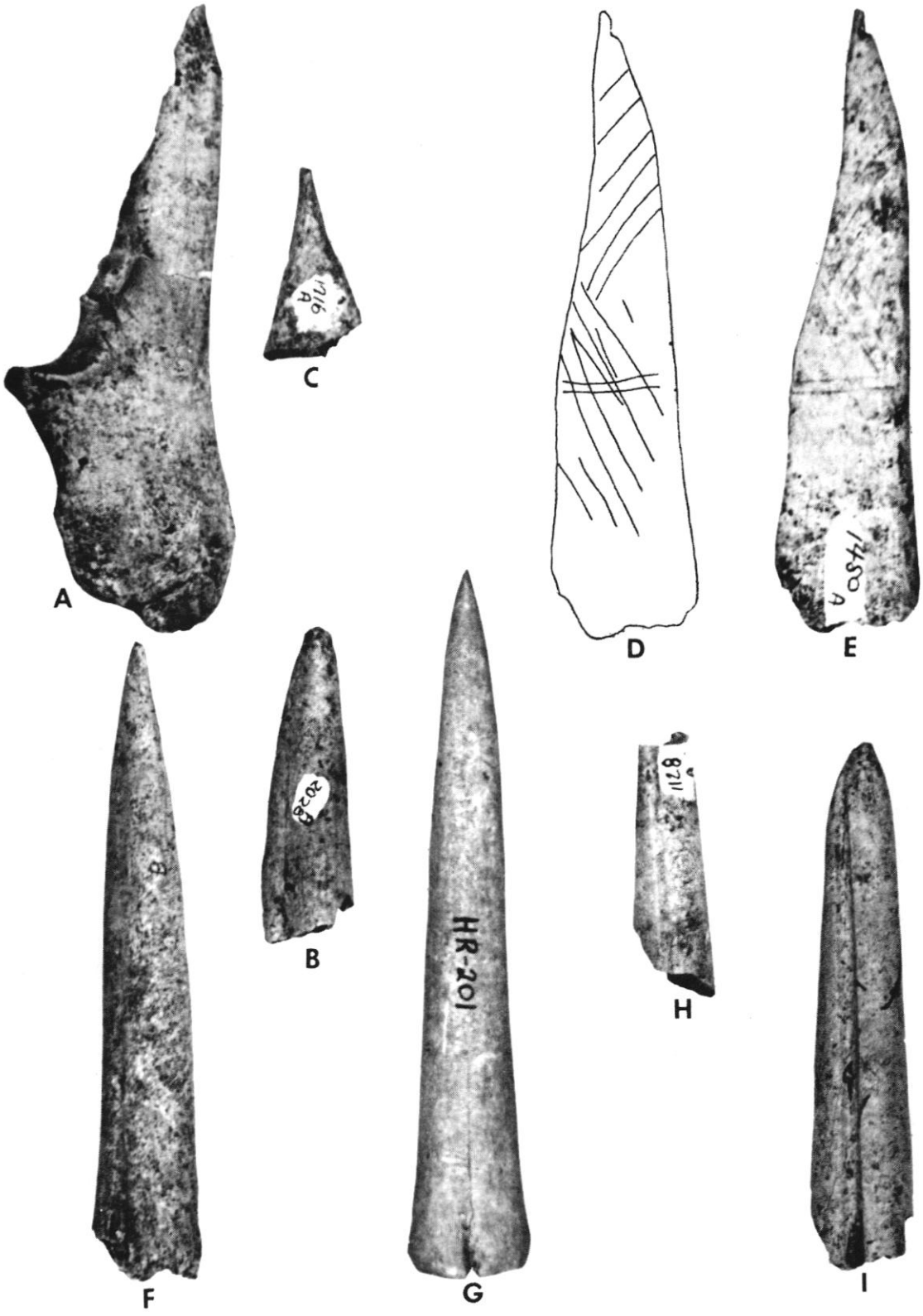


Fig. 22 - Bone awls from the Fullen site.

of the site.

Bone and Shell Artifacts (Table 10)

Awls. Four awls or fragments are made from the distal ends of deer petapodials, (Fig. 22 b, d, f, g). Four of these could have served as projectile points although the one complete specimen, which was found during the first season (Fig. 22 i), did not have asphaltum adhering to the proximal end. Thus, it seems likely that these artifacts are awls rather than points.

The three other awls include one made from a deer ulna; (Fig. 22 a) its distal end was cut or ground to a fine point. An engraved awl (Fig. 22 d, e) is from a deer fibula. The final awl is the tip only made of an unidentified bone (Fig. 22 c).

Flakers. These specimens all have a flat beveled distal end; three were made of deer antler and one is of an unidentified bone (Fig. 23 b-e).

Spatula. This artifact was made by cutting a deer metapodial lengthwise and crosswise and completely grinding it until it had a spatulate shape (Fig. 23 a).

Cutting platform. The marks on the end of this bone, along with the shaped polished ends, lead us to think that it may have been used as a base to slip under tendons which were being cut. It would then provide a solid platform on which to slice (cf Hole, Flannery and Neely 1969:192). This specimen was broken on top, possibly the result of hard, hammering blows (Fig. 23f).

Busycon shell "hammer". The only shell artifact found in the site was in the upper gumbo zone of square N4E2. It is a Busycon shell from which most of the outer portion has been chipped away,

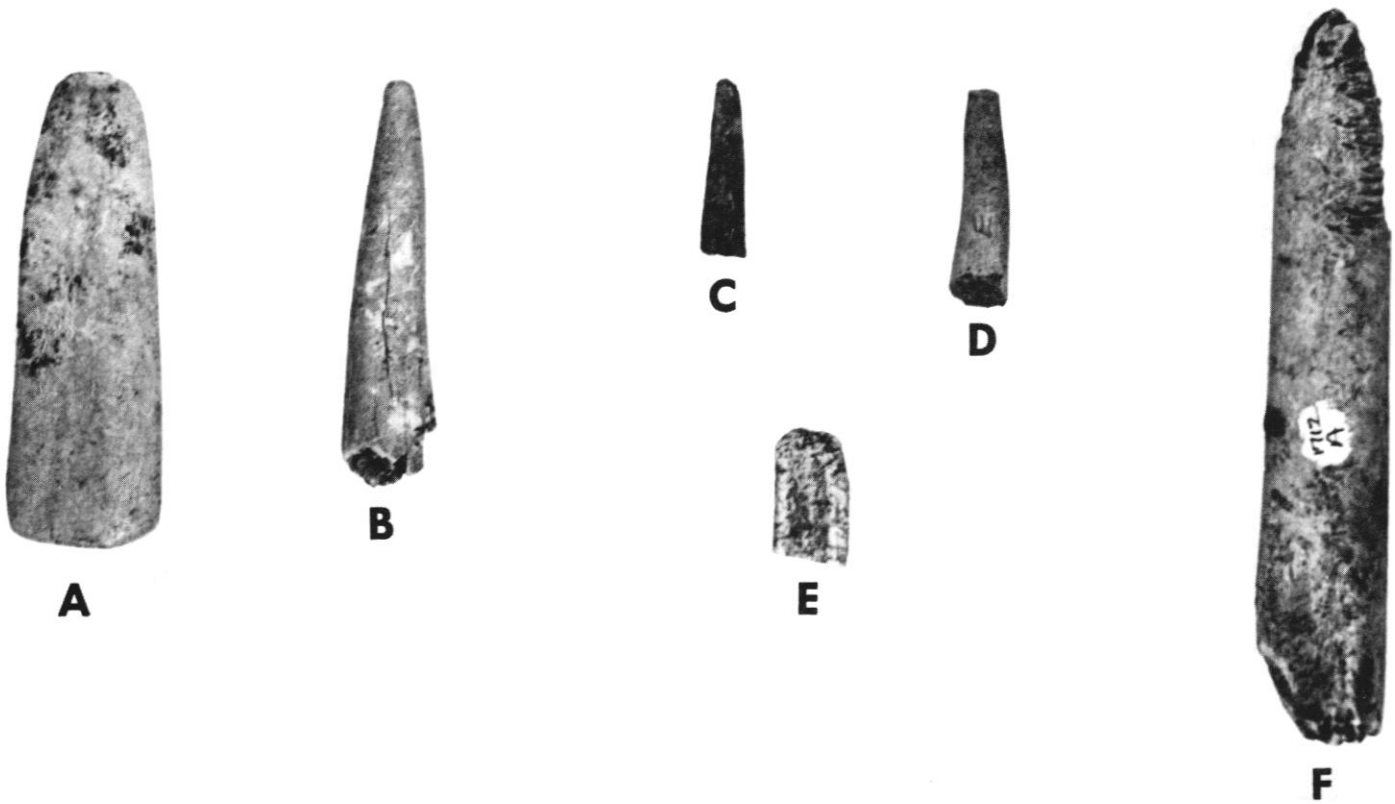


Fig. 23 - Miscellaneous bone artifacts from the Fullen site. a) spatula, b-e) flakers, f) cutting platform.

Fig. 24 - Busycon hammer from the Fullen site.

Artifact Type	Provenience and Zone	Length	Width	Material	Fig. #	Field #
Bone Awl	N1E1/B5 II	8.5+	1.5	deer metapodial	22 g	880-A
"	N1E1/C1 III	10.2	2.3	" fibula	22 d,c	1480A
"	N1E1/C1 III	-	-	" metapodial	22 b	1128-A
"	N4E1/C1 III	-	-	" ?	22 c	1716-A
"	N4E1/C4 III	10.1+	1.8	" metapodial	22 f	B-A
"	N1E2/C7 IV	10.3	3.2	" ulna	22 a	2028-A
"	N1E2/C7 IV	-	-	" metapodial	22 b	2028-A
Flaker	N4E2/B5 II	-	-	" antler	23 c	E-A
"	N4E2/B5 II	-	-	" "	23 d	E-A
"	N4E2/B5 II	-	-	" " ?	23 e	B-A
"	Area E	5.5+	1.1	" "	23 b	T-F
Spatula	S1E5/S1	10	1.8	" metapodial	23 a	1712-A
Cutting Platform	N4E1/C4 IV	10	1.8	" bone	23 f	1712-A
Busycon Hammer	N4E2/A I	10.5	7.7	Busycon shell	24	1175-A

Table 10. Inventory of bone and shell tools.

Level	Arrow Point	Dart Points	Bifaces	Retouched Flakes	Unworked Flakes, etc.	TOTALS	Abraders	Unifaces	Drills	Chopper	Sinkers	Hammerstones	TOTALS	Awls	Flakers	Spatulas	Cutting Platforms	TOTALS
II	4			1	93	98	1						1	1	3			4
III	3				38	41							0	3				3
IV		2	2		89	93	1			1			2	3			1	4
V		2			137	139			1			1	2					
Other	6	7	3	1		17	1	2	1		1		5		1	1		2
Totals	13	11	5	2	357	388	3	2	2	1	1	1	10	7	4	1	1	13

Table 11. Distribution of Non-ceramic Artifacts in Area A by Zone.
/"Other" refers to artifacts found in other areas - 41 HR 82 and to pieces collected on survey, see Tables 7-10 for specific proveniences - unworked flakes and chipping debris are given only for Area A./

leaving the central column and one segment of the outer surface of the shell (Fig. 24). The tip shows evidence of having been ground down to a point, perhaps to use as a digging instrument.

Bone material.

Kent V. Flannery originally agreed to help in the bone analysis during the summer of 1972, but since he was in Oaxaca, Mexico without access to comparative material, the study was severely hampered. All bone was, however, weighed by square and excavation level and grouped into zones (Table 12).

Flannery was able to identify the usual local fauna -- white tail deer, bobcat, gray wold, raccoon, gray squirrel, possum, box turtle, soft shell turtle, various species of snakes, drum, catfish, alligator, various species of waterfowl, and numerous small rodents. Without a detailed report of each species by zone, however, this information is of only casual interest.

The reason for weighing the bone was to determine if there were correlations with the shellfish data -- that is, if the amount of bone increased or decreased with the fluctuations in number and size of clams and oysters through the sequence. A glance at Table 12 will show that the weight of bone is greatest in Zone III. This certainly is not in keeping with the Rangia peaks (see Fig. 26). Again, a look at the profiles (Fig. 8) shows that Zone III is the thinnest of all the zones (in actual depth) but has 6,785 grams of bone in it, 31% of all the bone by weight. The Rangia are most abundant in number and weight in Zone IV. In this zone the bone weight is substantially lower than it is in Zone III -- 5,276 grams. The larger amount of bone in Zone III

Zone	N1 E1	N1 E2	N2 E1	N2 E2	N3 E1	N3 E2	N4 E1	N4 E2	Total Weight	%
I		35	100	32	25	148	46	71	457	2
II	449	768	962	589	1016	339	574	482	5,179	24
III	512	375	1084	747	940	1238	834	1055	6,785	31
IV	999	673	399	609	582	159	862	993	5,276	24
V	829	212	290	505[1]	1127	1086		23	4,072	19
								Total Weight	21,769	

Table 12. Weight of bone in grams from Zones I-V in 41 HR 82.

1/ N2E2 Level V also contains the 90 grs. found in level D.

may be due to a lower availability of Rangia. This is the period of highest availability of Crassostrea (Fig. 27), but the apparent lack of clams (perhaps they just were not harvested) may have forced the inhabitants to increase their intake of mammals, reptiles, etc. To test this theory, we would need to know how many individuals of each species are in each zone.

Calcium Carbonate Concretions

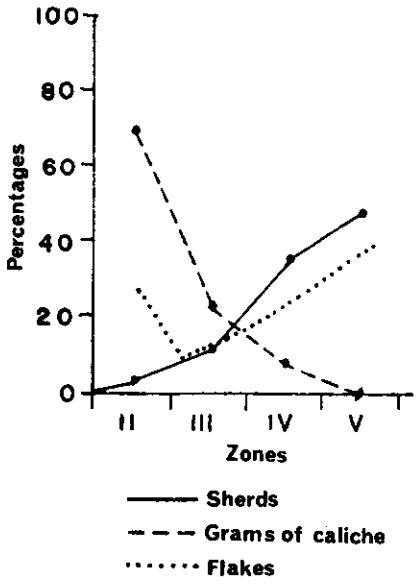
Aside from sherds, the most numerous inorganic objects in the site were lumps of calcium carbonate (caliche). This material precipitates as nodules in the light-colored B-zone in this region of the Gulf Coast. Observation of the steep bank of Armand Bayou north of the site during low water level shows this caliche in place today. The importance of this finding is that the caliche level is substantially below the plane of the site; caliche does not occur naturally on the clays at the base of the site. Thus they were brought to the site by the Indians.

Table 13 shows that the weight of the $CaCa_3$ concretions for each zone increases as one proceeds from top to bottom of the site. Even allowing for some movement of this material, especially into the upper layers, one is still left with the fact that it is nearly all concentrated into Zones IV and V.

It is not obvious at first glance what the use of these nodules may have been but it is perhaps instructive to look at the sherds counts in comparison (Fig. 25). Roughly speaking, the pottery and concretions are inversely proportional to one another with respect to quantity and/or weight in each of the Zones. This suggests a possible use for the nodules. They may

Table 13. Weight (in grams) of caliche. Levels which were not excavated in a square are marked with an X.

Zone	Level	N1E1	N2E1	N3E1	N4E1	N1E2	N2E2	N3E2	N4E2	Total Weight	%
I	A			5						5	
	B1		48	11	37						
	B2			2				7			
	B3	35						4	6		
II	B4		6								
	B5			X			X				
	B6	X	X	X			X	X	7		
	B7	X	X	X		X	X	X	X	163	4
	C1		35		9	12		4			
	C2		41		8	11		10	19		
III	C3	X	7	8	X		44		X		
	C4	X	4	X	X	X	10	47	X		
	C5	X	X	X	X	X	X	208	X	477	12
	C3	6	X	X	16	X	X	X	4		
	C4		X	X	12	4	X	X	127		
IV	C5	132			86	35		X	73		
	C6	198	79	X	83	51	64	60	28		
	C7	X	X	X	X	274	72	X	X	1404	37
V	C6	X	X		X	X	X	X	X		
	C7	147	277	256	42	X	X		37		
	C8	101	101	203	X	111	30	165	X		
	C9	308	X	X	X	X	X		X		
	C10	X	X	X	X	X	X	35	X	1813	47
								Total		3862	



	Sherds		Caliche		Flakes	
Zone	#	%	#	%	#	%
II	1352	70	163	4	93	26
III	424	22	477	12	38	11
IV	144	8	1404	37	89	25
V	5	-	1813	47	137	38

Figure 25. Comparison of numbers of sherds and flakes and weights of caliche in the zones of Area A at the Fullen site.

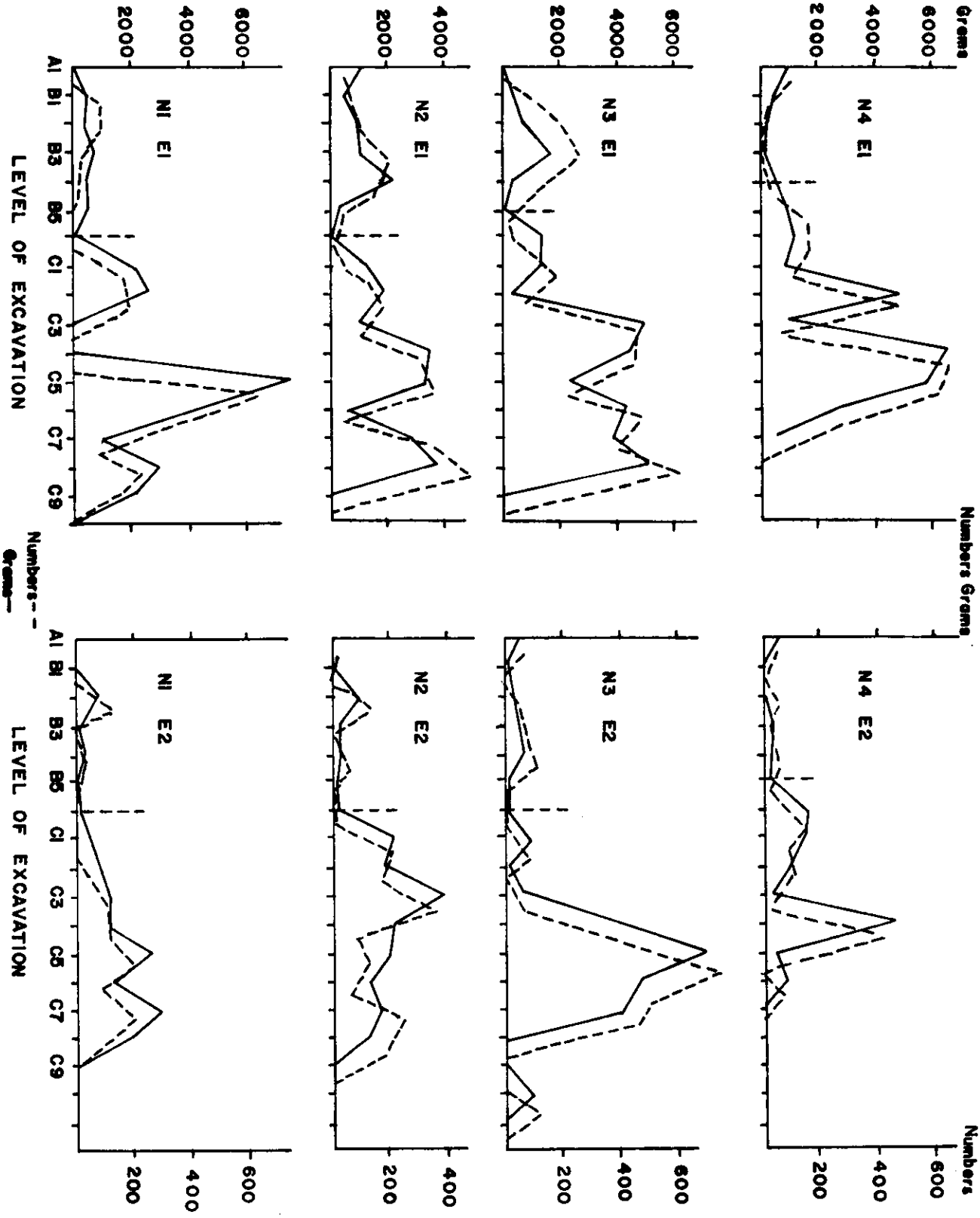


Fig. 26 - Weight and numbers of Rangia cuneata from the Fullen site by square and level.

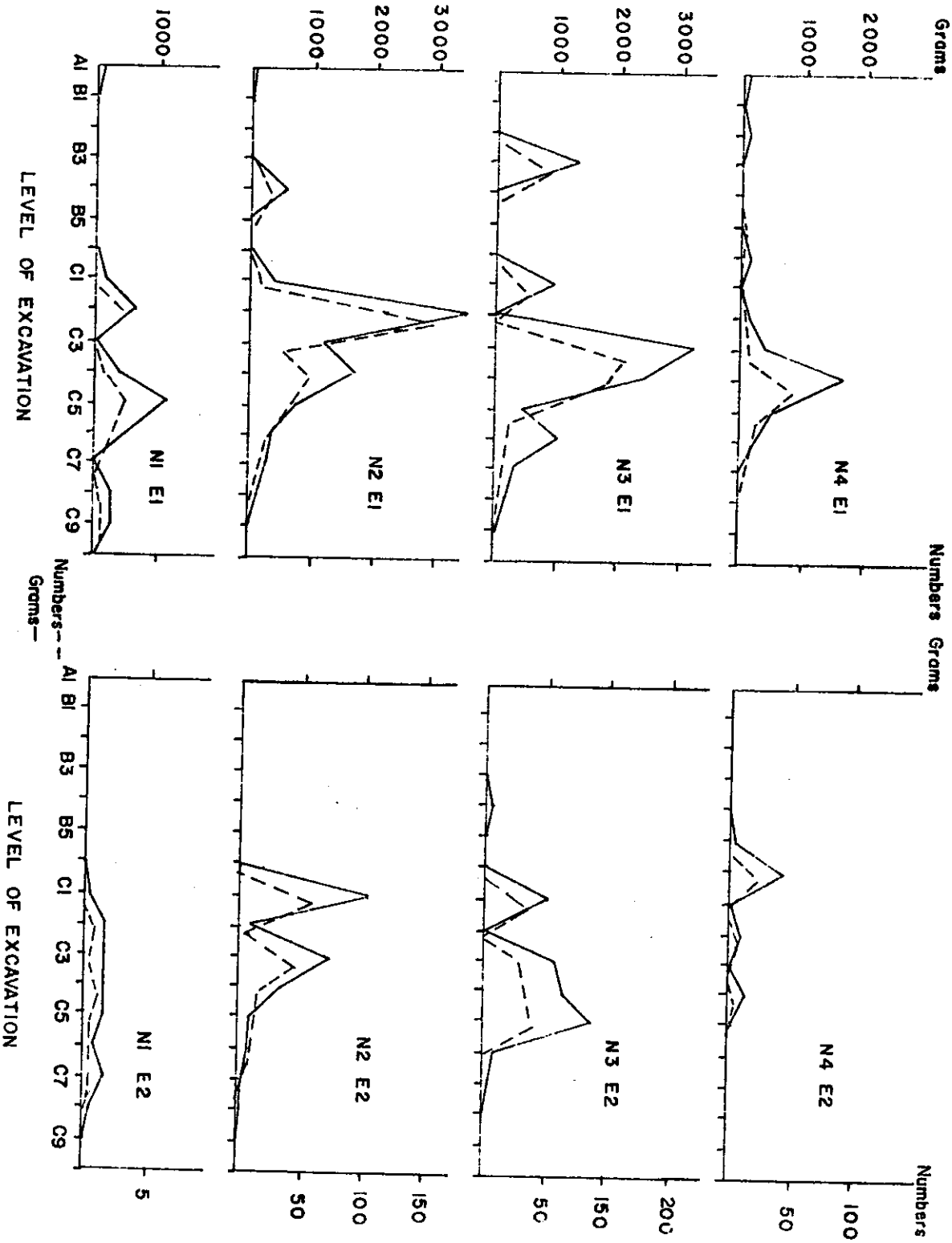


Fig. 27 - Weight and numbers of Crassostrea virginica from the Fullen site by square and level.

have been used as "pot boilers", stones which were heated and then put into baskets or skins to bring the water to a boil. As many ethnographic examples document, people do this to avoid burning the containers over an open fire, a problem which would no longer be present after pottery was in use, although the custom may have died slowly.

An alternative explanation is that the concretions are the remains of hearth linings. It has been suggested that the clay balls of Poverty Point were used in just such a fashion (Ford and Webb 1956).

Cultural Implications of the Excavation

The methods we used in digging and analysis proved worthwhile for distinguishing cultural stratigraphy. Although we cannot claim to have separated each episode in the use of the midden, it is apparent that we did dig finely enough to establish significant changes in the character of the artifacts throughout the midden. This alone is an important consequence of the work, for it enables us to make definite statements about the chronological implications of artifacts in this area. Further work of a similar kind should enable us to firmly place the entire archeological history of the region into a tightly controlled chronological framework. When this is done it will aid us greatly in assessing the age of sites found on survey and thereby to gain a much sharper impression of the characteristics of settlement.

Indians first visited the site during the late Archaic, at a time when pottery was apparently not in use. Zone V records

a period of unknown length during which Indians used dart points, hunted deer and collected shellfish. During one episode they gathered a large quantity of caliche and deposited it along with deer bones in a tightly packed cluster. Presumably this was the remains of a meal which was prepared by boiling water with heated chunks of caliche.

Other artifacts in this zone include a sandstone abrader, a chopper, a bone cutting platform, a chert hammerstone and a small drill. Bone awls were used from the earliest times throughout the site.

The first significant amount of pottery appears in Zone IV while dart points are still the only projectiles points in use. From this point onward sherds increase in frequency. One sherd with incised crosshatching is the only such example in the site and may represent an early style of decoration. Bifaces are another lithic tool found only in this zone.

The predominant ceramic type is Goose Creek Plain, and there were also two Goose Creek Incised, one piece of San Jacinto Plain, and the only piece of Tchefuncte found in the site. All of the rims are either flaring or incurving and most of the lips are pointed.

Caliche concretions continue to occur in high frequency, suggesting that potboilers remained in use after ceramics were introduced.

In Zone III we find a greater amount of ceramics than in Zone IV. Again, Goose Creek Plain accounts for nearly all of the sherds, but we find one stamped sherd and four of San Jacinto

Plain. Exterior incising is the only decoration. Several types of rim form first appear in this zone: Flaring Round Notched, Flaring Round Pointed and Straight rims.

Other artifacts include the first appearance of arrow points; dart points are no longer found, and bone awls. Caliche declines greatly in frequency and no longer seems to have been commonly used.

Zone II is composed of very tightly compacted shell which is separated from Zone III by a thin layer of sterile mud. This zone contains the greatest amount of ceramics, nearly all of which is still Goose Creek Plain. Along with this type, Goose Creek Incised declines somewhat in frequency from Zone III and San Jacinto Plain increases. Characteristic of Zone II are Flaring Flat Notched, Incurving Flat Notched, and Straight Flat Notched rims, all of which appear first in this zone. Other changes include less exterior incising and the only examples of interior incising.

Among other artifacts, we found antler flakers only in this zone; they were probably used in the chipping of the small arrow heads. Other artifacts include an abrader, a hammer and an awl.

Effectively Zone II marks the end of occupation of the Fullen site. Above its compact shell layers is a zone of gumbo in which we found a relatively few sherds, lithics and other material. There is nothing in Zone I to suggest an actual occupation.

The analysis thus allows us to define three distinct periods of occupation along Armand Bayou. What remains uncertain is the total time involved in these occupations, whether significant

periods have been overlooked, and whether the sequence that we have delineated will be supported by additional work. It is imperative now to conduct similar excavations at nearby sites as a test of these results if we are to use them confidently to build upon in our developing studies of Indian use of the region.

Aside from the fundamental implications of the stratigraphic work, the Fullen site has provided us with some useful information concerning Indian ways of life. First, it is apparent that the basic ways that the Indians used the site did not change throughout its history. In a sense, this is remarkable in view of the length of time implied in the succession of zones and in the fact that technological changes occurred. What is striking is that Indians who changed from dart to arrow points and who learned to use and make ceramics, apparently did not change their basic subsistence patterns. In all zones we find the hunting of deer, some fishing and the collecting of shellfish. Of the latter, there was variability in whether clams or oysters were collected, and in the sizes of these species, but in all zones one or the other or both were present. Thus, although the species collected may have differed, the habits of eating mussels did not change.

According to our historical information, the Fullen site was probably occupied during only part of the year, and perhaps not on an annual basis. The midden itself gives us no clues about the duration of annual occupations, although an analysis of the deer bones and further work with the shellfish might be helpful in this regard. What is more pertinent, is that the Indians were probably living at least in part off the mound itself.

Unfortunately we were unable to thoroughly examine this possibility. Artifacts and possible traces of structures in the nearby field suggest that a great deal might be learned of the settlement itself by examining the surrounding area extensively. It should be recalled, however, that the only way we can place such isolated material into its proper context, is to key it in with a controlled stratigraphic excavation. This we did in a tentative manner for Area B. Thus, the two kinds of excavation at the same site remain necessary at our present stage of development.

In summary, in accord with our general reconstruction of Indian patterns of life in this area, we propose that the Fullen site was a base camp which was used seasonally. To go further than this modest conclusion at the present time is unwarranted. The contributions of comparable results from the Boys School site and others along the bayou to this problem will be readily appreciated in this context.

Summary of Clear Lake Area Archeology

The 1970 archeological survey of Armand Bayou and immediate environs recorded 18 sites, two of which, 41 HR 153 and 41 HR 88, were briefly tested. Site 41 HR 146 was excavated and the second season of work at 41 HR 82 was completed in the spring of 1971. These results, coupled with Aten's work at the Boys School site, give us one of the most complete pictures of an area of comparable size along the entire Gulf Coast. Still, we have only scratched the surface of potential information. What we have done is to compile data which allows us to make some preliminary assess-

ments of Indian history and to provide sound data on which to build our reconstructions. We found nothing in these investigations to suggest that the basic patterns of Indian life changed during the periods under investigation, but we did find evidence of different types of settlements. These can be compared with our historical information and used as a basis for a preliminary reconstruction of how Indians used the area.

One of the most striking findings is the great difference in sizes of sites. We can go further and say that the largest sites are those where shellfish collecting was the richest. Thus we find that sites situated on the shores of Clear Lake are both deep with shells and extremely extensive. Indeed, the north and south shores of Clear Lake each comprise what is essentially one large midden, although it has been divided into separate sites by archeologists. The implication is clear that the lake was intensively exploited, probably annually by large bands of Indians, for shellfish.

Although none of these sites has been excavated and all are seriously imperiled, if not already destroyed, by storm action and motor boat wakes, they appear to be nearly solid shell with only a thin scattering of bone, sherds and lithics.

This picture changes as one moves up the tributary bayous. The largest sites lie closest to Clear Lake and they gradually decline in size to mere scatters of artifacts on sandy knolls. Again the implication is clear that the availability of shellfish was a prime consideration for Indians. As the shellfish decline in frequency upstream, the sites decline in size. Correspondingly,

we find that among the shellfish remains are quantities of deer and fish bones. A somewhat more diversified subsistence base is thus indicated at these outlying sites. It seems likely that smaller bands of people may have camped at them than did along the shores of Clear Lake which must have been the focal point of seasonal occupation for many bands which scattered throughout the year. Unfortunately we do not know as yet just which seasons saw the Indians in any particular site.

When we travel beyond the limits of shellfish distribution, in the upper reaches of the bayous, we find that sites are confined to sandy knolls and that their size is so small as to imply that they are overnight campsites. Such a site is 41 HR 146, which contained only the remains of one pot and a fire. Other similar sites may well be scattered through the woods along the bayou above Bay Area Boulevard.

Without stretching the evidence we can thus reconstruct three kinds of settlements or camps which were used by migratory Indians in their annual round of activities. To these we should add some special sites. It was reported in the late nineteenth century that shell was removed from a site at the mouth of Clear Lake to provide ballast for the railroad (Simmons 1903). In this site were reportedly hundreds of burials. If this statement is true, it suggests that Indians who camped on Clear Lake had a central burial area. Another burial site, the Boys School, was excavated by Aten and Gramley. According to Aten's interpretation, the site may not have been used for occupation once it was used for burials. Whether this is true or not, it is noteworthy that

we did not find burials in the Fullen site, and burials have not been reported at most sites. Thus, one can make a case, albeit a weak case, for there being special burial sites. These would usually have been former occupation sites where the mound of shells provided easy digging for the interment of bodies.

One other kind of special site, chert quarries, should be mentioned. The Indians used chert and petrified wood. The latter does not occur locally but chert may have been obtained at local exposures. Although sedimentation has covered the abundant sources of chert in the area, it is possible that there are local exposures where Indians could have obtained their raw material. What is certain is that small river rolled nodules were used and that all stages of chipping were done locally. Thus, the Indians did not travel very far to get their material.

Our picture of local archeology is presently only a rough sketch. We do not yet have a clear idea of how the settlement picture outlined above may have changed and, if so, what factors could account for the changes. Nor do we have any useful information on the domestic parts of the campsites. We have not yet identified with certainty any houses and we do not have even a rough approximation of the numbers of Indians who may have lived at the camps. Finally, although we know that all recorded sites are along the bayous, there remains the possibility that other sites occur farther from water. Such sites, presumably without shellfish remains, would be hard to find but likely places to look are on sandy knolls. Farther inland, we know that sites are also situated alongside water, even in the absence of shell-

fish. It is likely that such locations provided both a necessary source of water and were along natural routes of travel, especially by dugout canoe. However, we know from some historic sources that Indians did camp away from water where there was an abundant vegetable food in season. Such sites have not been found in the Gulf Coast area by archeologists.

Although we have made some significant beginnings in recovering and interpreting local Indian history, we must be impressed by the amount of work that remains to be done. To accomplish similarly significant advances in our knowledge will require both hard work and haste, for commercial development of the Gulf Coast threatens the few remaining sites that are worthy of careful investigation.

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III. ANALYSIS OF THE MOLLUSCS

by Bonnie Hole

Research Goals

The analysis and interpretation of molluscs found in shell middens is a vital part of the investigation of the prehistory of the Texas Gulf Coast. The problems surrounding the study of molluscs from these middens are complex and, while they do not lend themselves to immediate solution, they are solvable. In time and with systematic investigation, archeologists may begin to understand what molluscs do and do not tell us about man's past on the Texas Gulf Coast.

This study is our first attempt at systematic research into the molluscs found in archeological sites in one area of the Gulf Coast, the Mud Lake-Clear Lake region in the vicinity of Galveston Bay. As such it serves primarily to indicate the directions of our research.

Our analysis was shaped by two considerations - 1) what we already knew about molluscs found in archeological sites in the area, and 2) given what we already knew, what were our immediate, realistic research objectives.

In spite of the fact that several archeological investigations have been carried out in the immediate and neighboring areas of the coast, there is relatively little we can say with any degree of certainty about the molluscs found in middens along Armand Bayou and their bearing on interpretations of prehistoric life. Information about shells in sites comes primarily from two sources, site surveys and excavations. Site survey reports often contain information that is so sparse as to be of

little value in view of current research interests.

Although site reports by their very nature offer more details on molluscs from archeological contexts, excavations in the area have yet to focus in depth on molluscan remains as a separate line of archeological evidence. A perusal of the literature on archeological sites in the Clear Lake area reveals that the only information on molluscs which has been published to date is the relative proportion or amount by weight of Rangia cuneata to Crassostrea virginica and even this has been reported for only two sites.

In 1969, Rice University students opened up eleven one meter test pits at the Fullen Site, 41 HR 82. Subsequently, Robert Lankford correlated his proposed schema of recent environmental change in the area with the relative proportion of Rangia and Crassostrea found in the test excavation. Lankford concluded that

> "In an attempt to set limiting dates for the occupation...the following is proposed: the basal midden unit consisting of 100% Rangia would document a weakly brackish environment which would post-date the formation of the barrier across Clear Lake. The barrier could not have been initiated until after...about 4000 years ago...the Rangia environment is not older than about 2500 years. The subsequent occurrences of Crassostrea most likely represent short-term, drought-induced occurrences of higher salinities and, as yet, cannot be fixed in time." (Lankford 1971:5).

In reporting on the Harris County Boys School Site, 41 HR 80, Richard Ambler (1970:1) also used molluscan data to infer chronology. He concluded that

> "The occupation area, as revealed by the presence of shells is roughly divided into two portions by a

small ephemeral creek draining into Taylor (actually Armand) Bayou. The portion of the midden north of this drainage was not tested but appears to be composed of about 50% Rangia clam shells and 50% oyster shells. The southern portion of the site contains a much higher percentage of Rangia shells, at least in the upper portions of the midden. The high percentage of oysters in the northern portion of the site suggests that the area was the first to be occupied, at a time when oyster grew in closer proximity to this area.

While the above explanations are plausible, in fact they represent speculation based on limited data. Moreover, these reports are indicative of the current lack of facility we possess for dealing with molluscan evidence from archeological sites. This point is not intended as criticism of excavations whose primary purpose was not to conduct an intensive analysis of the molluscan remains at the site. It is intended to establish the baseline from which our research was conceived. In summary, at the beginning of our work, we knew next to nothing about the molluscs which, with the possible exception of soil, constitute the most abundant constituent in shell middens along the Texas Gulf Coast.

Because so little was known about molluscs from archeological contexts in the area, we began with relatively simple questions about how shells were deposited in the site. We limited our analysis to the eight squares of Area A at the Fullen site and tried to discover how the shells accumulated and what possibilities for further studies are implied. We concentrated on establishing reasonable sampling procedures which could be implemented in future excavations. We also studied variability of

the shells within the site and compared our shells to shells from collections we made at other sites in the area. Our goal was to begin to understand the variability of molluscs in coastal shell middens in the Mud Lake-Clear Lake area. Some specific questions we tried to answer were:

(1) How shells can be used to discern layers within the site?

(2) How many strata are there in the site and how do they differ?

(3) What do the layers in the site reveal about prehistoric utilization of the area - i.e., was the site occupied once or several times in the past, for a long or short period of time?

(4) What do the shells reveal about the past environment of the area - can we discern changes in the environment, is it substantially different from today, can we see effects upon the environment that we can attribute to prehistoric man's influence?

(5) In what ways does this site differ from other shell middens in neighboring areas and to what factors might we attribute these differences?

Method of Analysis

To answer any of these questions, an understanding of the stratification of the site was absolutely essential. Thus our first step was to work out in detail what molluscan remains were found in every level of each of the eight test squares under consideration. From this we then constructed our interpretation of the depositional history of the test area. This was done independently of the analysis of the distribution of artifacts and bones and constitutes a separate line of evidence for the stratigraphy of the site.

Mollusc shells and pieces of shell caught in the $\frac{1}{4}$ in.

screen during excavation of eight adjacent one-meter squares (N1E1, N2E1, N3E1, N4E1, N1E2, N2E2, N3E2, N4E2) were returned to the lab for processing. They were washed and sorted by species. With the exception of fragments from a few other species (Buscycon perversum and Dinocardium robustum), all shells were Rangia cuneata or Crassostrea virginica, the local species of clam and oyster, respectively. Each species was separated into whole shells and incomplete shells. These categories of shells were then analyzed in more detail.

Quantity. Whole Rangia shells were counted and weighed. Because the dorsal portion of shells was generally better preserved than other areas on the shell, we reasoned that by counting beaks of shells we could obtain our best estimate of the number of broken shells in the excavated area of the site. Thus, broken pieces of shell containing beaks were also counted and weighed. Bits of shell not containing beaks were weighed for each excavated unit. The numbers and weight of Rangia for each square is indicated in Fig. 26. Whole or nearly whole oysters from each level were also counted and weighed (see Fig. 27), but fragments of oyster were only weighed.

Stratification. Several lines of evidence were used to explore the possibility of stratification in the site. To try to find changes within the excavated levels, we looked for abrupt changes in the shells. We reasoned that discontinuities in the distribution of molluscs (number, size, condition, etc.) indicated discontinuities in the use of the site and, therefore, would indicate its stratigraphy.

Condition. For example, we examined the condition of mollusc shells in the various levels. We reasoned that there might be some relationship between the preservation of mollusc shells and the rate at which the midden accumulated. We felt that, all other things being equal, levels of poorly preserved shells might represent layers which were exposed to the elements longer than levels of well preserved shells. Thus they might indicate periods in which the midden accumulated very slowly, or periods during which the site was not occupied. At any rate, abrupt changes in the condition of shells certainly indicate discontinuities in the factors which affect the condition of shells, and, therefore, reveal some kind of stratification in the site. The cultural interpretation of these layers will depend not only on shell data, but on evidence from other sources as well.

We used the percentage of whole, unbroken Rangia to the total Rangia as our measure of preservation of mollusc shells in each level. The percentage by weight of whole to total Rangia is shown in Figure 28. Several observations are worth noting. First, almost all the shells found in the upper portions of the site are broken. The few shells from levels B5-B6 were also in poor condition. While shells in the lower levels of C1-C10 of the site are generally better preserved, four of the eight test squares have exactly one level with more than 90% broken Rangia and one square (N4E2) has three levels.

Size and Age: To make these apparent changes in shell deposition clearer, we studied changes in the size of molluscs through the levels in the midden. Although this turned out to be a very

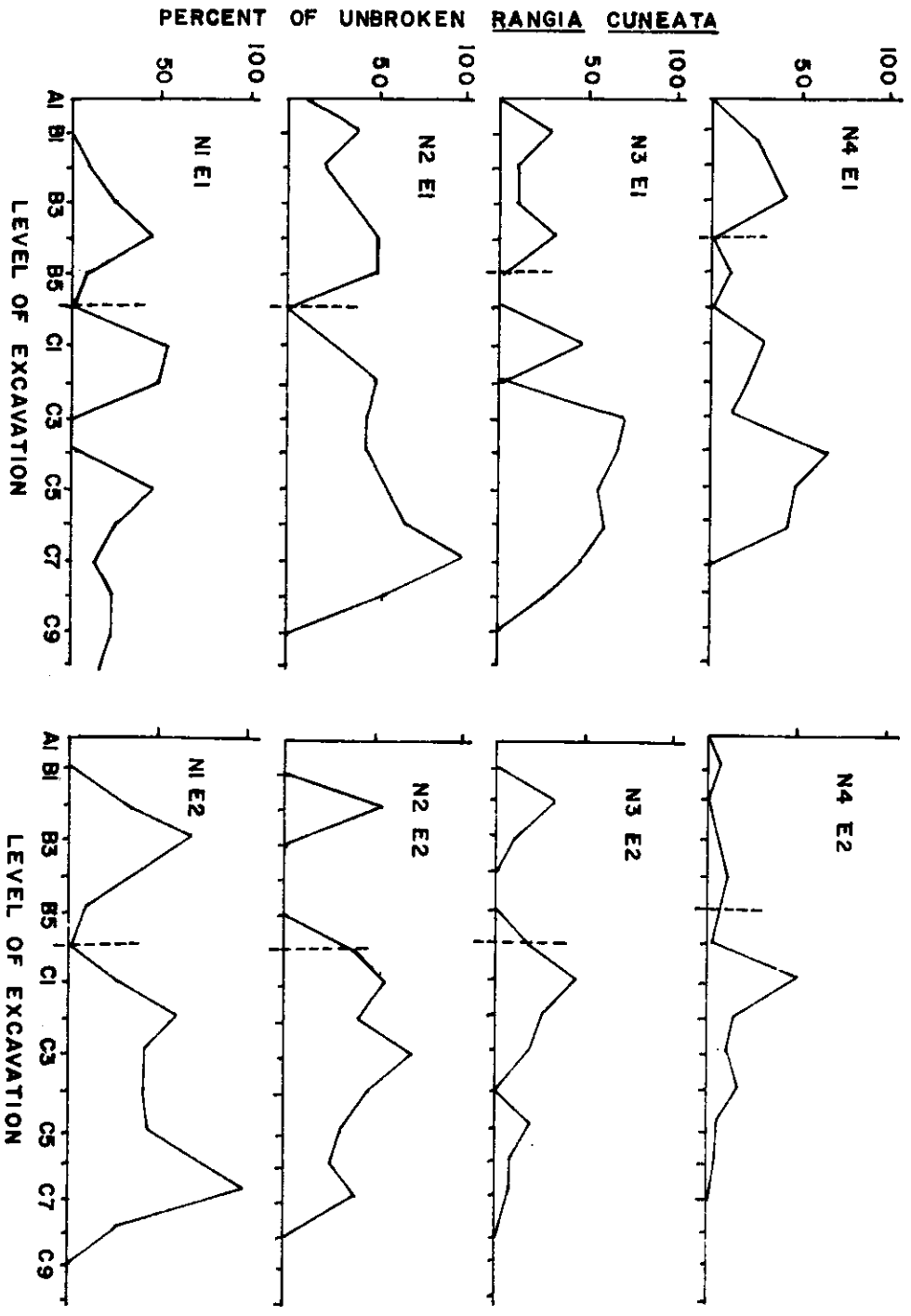

Fig. 28 - Percentages of unbroken Rangia cuneata from the Fullen site by square and level.

tedious and time-consuming process, the information obtained expanded our picture of the stratigraphy of the test pit considerably and suggested new questions.

Analyzing the size of molluscs found in archeological sites is not nearly so straightforward a task as it might appear. Unlike specimens dealt with in biological and ecological investigations, shells from prehistoric middens are often broken and in poor condition. The usual measurements of size, length and width, are frequently not preserved on the archeological remains of molluscs. Moreover, changes in the size of shells are much more understandable when the age of the animals is taken into account, but often it is impossible to age shells found in archeological contexts. We wanted to establish a measure of the size of shells which would handle these problems effectively.

It is impossible to distinguish whole, unbroken oysters from oysters from which many layers have peeled or eroded away. This uncertainty about the "real" size of an oyster as opposed to the size of the shell which finally reached the lab can be attributed to the fact that these shells tend to break in layers which correspond to the growth rings of the mollusc; thus a "broken" shell might be mistaken for a younger shell. For this reason, we confined our work on size of the excavated material to the clams alone. Although clams also tend to break along their growth rings, these breaks are usually easy to discern because they leave the margin of the shell much thicker than the edge of unbroken shells.

The ideal method for reporting the size and ages of clams

would have been to work with only the whole shells in each level of each square of the test area and to assume that the broken shells were similar. Unfortunately, it is not intuitively obvious that there is not some systematic way in which shells in a midden are broken so as to make the whole shell an unrepresentative sample of the total. In fact, this possibility is not without precedent. Radhakrishna Rao (1952) reported a study on crania which supported the idea that small skulls tend to be better preserved than large skulls: "the...data suggest that skulls damaged to such an extent that cranial capacity cannot be measured are on the whole larger. This raises a serious issue: Are not the published mean values gross underestimates?" If, in fact, in our situation, there exists some unusual relationship between shells which get into a midden and those which are well preserved in a midden, our data might be incomparable from level to level unless we can discover this relationship. Moreover, our data would be incomparable to shells from other sites which suffered different weathering, as well as to data from biological research.

In order to test the hypothesis that the size of broken shells differs in an important way from the size of whole shells in the midden, we needed a measure of size that could be performed on all shells. Generally, the best preserved portion on the excavated Rangia was the umbo region. One might use the width (see Fig. 29) of the umbo as a measure of the size of a clam, but there are several disadvantages to this approach. First, this measurement is fairly difficult to carry out consist-

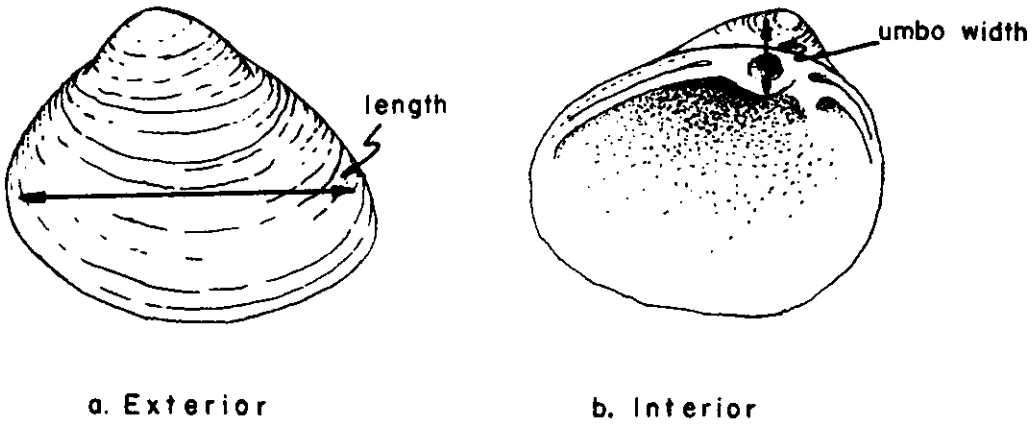

Fig. 29 - Measurements on Rangia cuneata.

ently as it depends rather sensitively on the angle at which the shell is held for measuring. More important, this measure of size is highly unusual in biological studies. If we were to confine our work to this unit of size, our data would be incomparable with work which has already been done on Rangia by biologists. For these reasons, we used umbo measurements, the only indicator of size on fragmentary shells, to establish the relationship of whole to broken shells in each square. Once this was accomplished, we worked strictly with lengths of whole shells, the usual measure of size of clams.

To test the hypothesis that there is no significant difference in size between broken and unbroken shells in the midden, we took a sample of excavation units from the test area and compared umbo widths of broken and unbroken Rangia in each sample by means of T-tests. On the basis of our profiles of the excavation and our preliminary ideas about strata in the site, we divided the excavation units into nine levels from which we took one sample each. We decided to sample something from each square. The level sampled from each square was chosen by means of a random number table. Since there were 9 levels and eight squares, one square chosen randomly, N2E1, was sampled twice.

The results of the T-tests comparing the umbos of broken and unbroken shells in each square are indicated in Table 14. In no instance was there a significant difference in umbo widths at the 90% level of significance. It should be noted here that individual T-tests on the excavation units constitute a very

conservative statistical test for these differences. At this point, the evidence suggests that there is no appreciable difference between the umbos of Rangia which get broken and those which remain whole within the midden. Thus, there is no compelling reason to measure every fragmentary Rangia in every level of every square.

In order to justify changing over at this stage to measuring the lengths of whole shells rather than the umbo widths, it was necessary to convince ourselves that similarities between the dimensions of the umbo are indicative of similarities between lengths of shells. Previous work by biologists on the relationship between different measurements on clams, specifically lengths and widths, suggests that these relations can be expressed successfully by linear equations. Consequently, we explored linear dependence of length of the unbroken Rangia upon the width of the umbo in each of our nine sample units through linear regression. The results of this analysis are shown in Table 15. Correlation coefficients for the nine regressions ranged from .75 to .93. The high correlations within each square suggest that there is a strong relationship between umbo width and total shell length. Therefore, we felt justified in operating under the hypothesis that, because umbo widths from broken and unbroken shells do not differ, neither do their lengths. From this point on, we used the lengths of the whole shells from the remaining excavation units of the site as estimators of the size of shells in the midden.

In addition to measuring the lengths of whole shells from

Excavation Unit	Difference in Means	Degrees of Freedom	Observed Value of (t)	Table Value of (t)
N2E1 C 7	.02	146	1.23	1.29
N2E1 C 6	.02	125	1.27	1.289
N4E2 B 6	.25	20	1.14	1.325
N1E2 C 1	.12	46	1.20	1.30
N1E1 C 5	.22	106	1.23	1.29
N1E1 C 8	.06	64	.62	1.30
N2E2 C 3	.29	20	1.26	1.32
N3E2 C 4	- .07	19	.88	1.33
N4E1 B 2	- .11	35	1.29	1.31

Table 14 - Results of T-test comparing umbos of broken and unbroken clam shells in Area A at the Fullen site.

Excavation Unit	N	Slope of Regression Line	Intercept of Regression Line	Sum of Sqs. Total	Sum of Squares of Regression	% of Variation of Length Explained by Variable Width	Correlation Coefficient
N2E1 C7	53	.78	3.40	39.5	28.5	.72	.85
N2E1 C6	12	.84	3.92	1.96	1.40	.71	.84
N4E2 B6	12	.69	3.53	8.19	7.09	.87	.93
N1E2 C1	11	.64	3.70	6.63	3.70	.56	.75
N1E1 C5	35	.72	3.68	24.75	18.26	.74	.86
N1E1 C8	23	.79	3.54	8.08	5.50	.68	.82
N2E2 C3	18	.68	3.34	24.45	14.35	.59	.76
N3E2 C4	10	.71	3.87	4.99	4.18	.84	.91
N4E1 B2	8	.85	3.04	1.15	.81	.70	.84

Table 15 - Results of linear regression performed to check dependence of length of unbroken clam shells upon the width of the umbo in Area A at the Fullen site.

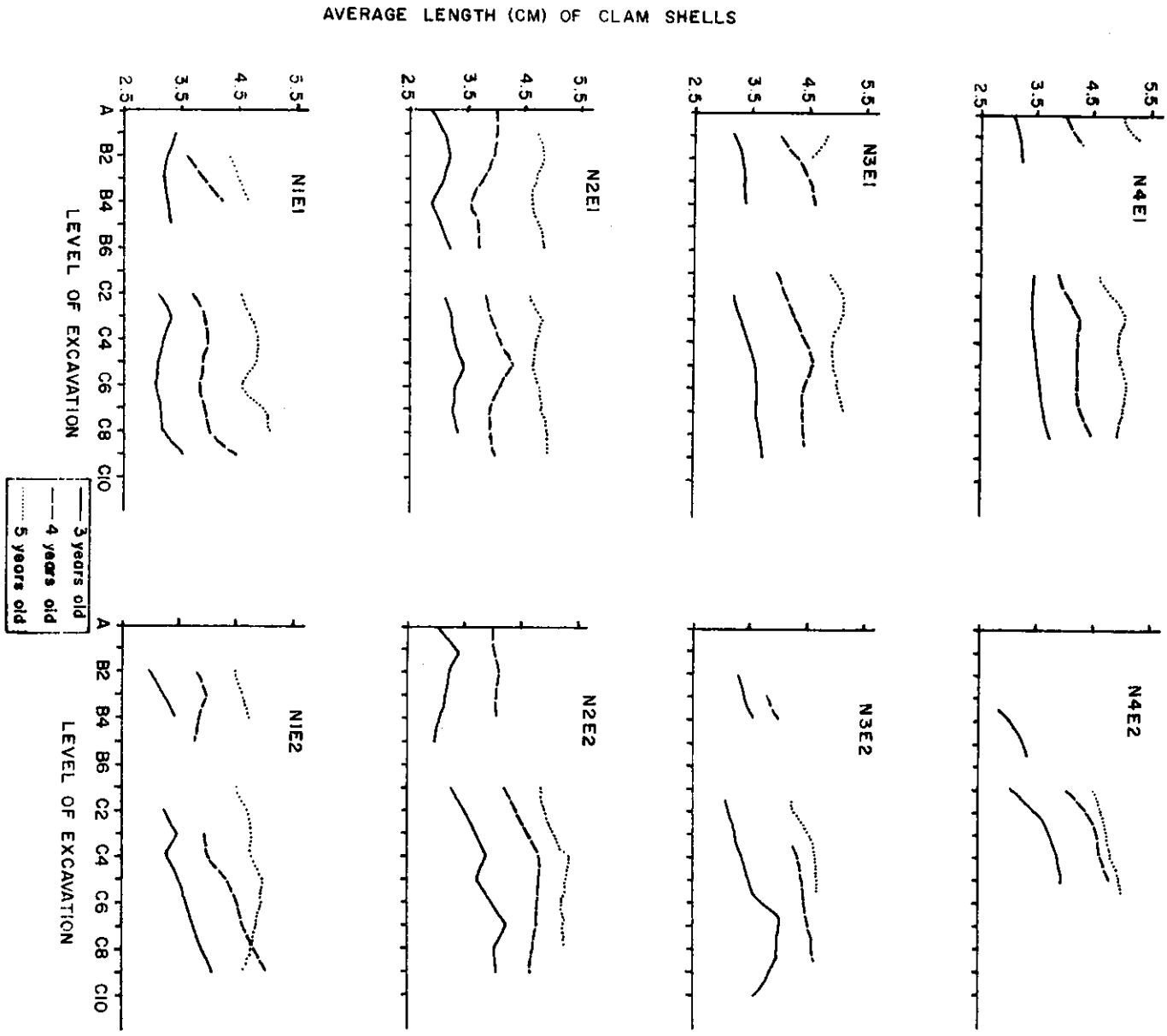

Fig. 30 - Size range for age groups of Rangia cuneata from 41 HR 82.

the excavation, we estimated the age of each shell by its pattern of growth rings, assuming each break in the growth rings represented one year. Although this method of aging clams has been criticized, especially for warm geographic regions, this was the only technique we could come up with, given our limited experience with molluscs and the great number of specimens with which we had to deal. The method was to count the number of major divisions of the growth rings on the exterior of the whole shells. All the excavated material possessed 2 to 7 marked divisions of growth rings and most shells fell in the 3 to 5 year age group.

Although these estimated ages are the weakest link in our research, they suggest interesting possibilities for interpreting the stratigraphy of the midden. If we assume that since there is no selective breakage in shells with respect to size, that there is also no differential breakage of Rangia of a given age, (a hypothesis we cannot test at present because we do not know how to age a broken clam), then we can seek trends in the sizes and ages of clams. When one examines the size of shells in each level of the site, controlling for the age at which the animals were harvested (Fig. 30), he can see both abrupt changes in the size of shells in the midden which are explained by sudden changes in the ages of shells collected, and he can see less severe changes in the size of animals of a given age set.

Interpretation of the stratification of the site

The most apparent change in the molluscs in the site was the lack of both oysters and clams in most squares at the bottom of the B levels and again at the bottom of the C levels (Figs. 26

and 27). The absence of shells at the bottom of the midden marks the beginning of the site. The discontinuity of shell deposition in the lower B levels might indicate a substantial period during which the site was not accumulating shells. This hypothesis is strongly supported by the evidence on shell age and size, for there is a marked change in both the average age of Rangia and the mean size of Rangia of each age at this level in the midden. Thus, the data on molluscs point to at least two periods of deposition of shell interrupted by a period which must be interpreted with reference to other archeological data.

Observations in the field during excavation indicated that, where they occurred in the upper levels, oysters were found with few, if any, clams. Therefore, we divided the upper levels of the excavation into two separate categories - those that contained mostly clam and those few which had concentrations of oysters. Levels N3E1-B2 and N2E1-B3 of Zone II contain oysters and the remainder of the upper squares are almost exclusively Rangia. The data confirm no further divisions within the upper strata. Although the percentage of whole Rangia suggests that there might possibly be remains of two well-preserved layers, interspersed by levels in poor condition in the upper portion of N3E1, N2E1, and N4E2, there are no supporting changes in the size or age of Rangia in these levels. Thus, we concluded that in the upper portion of the site, there are at least two, if not more, discernible episodes of mollusc deposition, one of Rangia and one of Crassostrea. Interrupting this are squares having little or no shell.

Below this, the picture becomes more complex as there are no clear stratigraphic breaks to structure interpretion. However, in the lower portions of the test pit, almost every square shows three peaks in the number of Rangia, weight of Rangia, and the percentage of whole Rangia. While these data by no means constitute separate lines of evidence for three levels of Rangia deposition, they do suggest the possibility that we are dealing with layers of clams.

In the lower levels of the site, most of the squares have at least two peaks of oyster deposition and these correspond to the first two peaks of high concentration of Rangia in good condition. There are almost no oysters in the third peak of Rangia numbers. Thus, on the basis of oysters, we can discern two groups of excavation units, one containing the first two concentrations of Rangia and oysters, the other containing only Rangia.

Data on Rangia sizes and ages do not indicate conclusively whether we are dealing with three or fewer real episodes of molluscan deposition. Figure 30 indicates that with the exception of a few layers at the bottom of the site (which are discussed below), Rangia increase in age steadily with the depth of the deposit. Figure 30 also reveals that shells of every age increase in size virtually monotonically with depth in the pit. The only exceptions to this trend are a profound drop in average age of Rangia at the bottom of the site (roughly Zone V of the aceramic). This drop in age was not accompanied by any significant change in the size of Rangia of any age group. In fact, inspection of the material from these squares indicates that the drop in average age

of Rangia was caused by the inclusion of an extraordinary number of very young specimens in these levels. Thus, in seven of the eight test squares, the concentration of Rangia in Zone V has an age structure noticeably different from that of the rest of the midden tested. One could argue on the basis of this different age structure and lack of oyster that this group of excavation units, including the last peak of Rangia deposition, could be considered distinct from the levels above.

Summary of Results

Our limited work on shells at 41 HR 82 supports several ideas on molluscs in middens along the Gulf Coast. The two species we find in abundance, Rangia cuneata and Crassostrea virginica, to the virtual lack of other edible species, indicate that the people who used the midden utilized two fairly specific zones of their environment. While a number of environmental zones ranging from river-influenced to open bay (Parker, 1960: 313) were available, the shells at 41 HR 82 indicate that the river-influenced and oyster reef zones of the Galveston Bay area were the only two to be extensively harvested. This pattern is typical of that of many other middens in the Clear Lake area.

Our analysis on molluscs from the two test pits at the site has revealed several important facts about the discovery of changes in molluscs. First, there is indeed a discernible, although at times intractible, pattern to the molluscs found in shell middens. Shells change through the levels of the site. In our data, we can see changes in numbers as well as condition, sizes and ages of the animals. These changes are not without relevance to the under-

standing of the deposition of the midden. In our data we can see abrupt changes in the remains of molluscs in the site, as well as a gradual trend toward larger and older Rangia in the lower levels of the midden. While we cannot say conclusively what these changes mean at the moment, they add a new dimension to the archeological data and, when combined with the analysis of the other remains from the site, they tell us a great deal about the midden.

Moreover, the analysis of shells from 41 HR 82 has given us a new perspective on the variability of molluscs from a shell midden. Heretofore we really had no idea of what kind of variation to expect within the levels of a midden. Inspection of the various figures should impress even the most casual observer with the variability from square to square in the numbers, condition, species, etc., of the molluscs. Although trends through time in the data are clear (Figs. 26 and 27), one cannot help but appreciate the different views of the site one might get if he excavated only one of the eight squares.

After many hours of excavation, followed by more hours of counting and weighing and measuring of remains of molluscs, we were surprised at how few shells were actually present. The total number of oyster shells found in the test squares, 1189, as well as the number of clam shells, 5004, is really very small when one considers how many of these creatures might conceivably constitute a prehistoric meal. In spite of the fact that mollusc shells constitute a great deal of the bulk of shell middens, their numbers are not extraordinary.

The molluscan data raise several questions about 41 HR 82

which we may or may not be in a position to answer. The significance of the trend in the site from larger and older specimens in the lower levels to smaller and younger shells in the upper levels can only be determined by analyses independent of the shells themselves. Are we dealing with a continuous occupation of the site during which the environment is changing and becoming gradually less favorable to Rangia, or are we dealing with separate occupations of the site during which these changes are occurring? Do we in fact have evidence for over-collecting of Rangia from the area? That is, are the shells found in the midden becoming smaller at the top because all the larger animals had been harvested previously? What relationship do the oysters have to the clams in the site? If the sizes of Rangia serve as environmental indicators, why do we find the greatest depositions of oysters along with the largest Rangia? What does this tell us about prehistoric collecting of shellfish?

Finally, what do the group of small shells at the bottom of the site indicate about the past? Are we dealing with a marked environmental change in time from the preceramic period? (Note that the smaller clams occur without oysters while the largest clams occur along with the largest oysters.)

Comparison of Shells from 41 HR 82 with other Shells

To try to answer some of the above questions as well as to describe the relationship of our shells to those from other sites in the area, several sites on different occasions were visited making notes and taking collections. In addition, we examined existing collections from archeological sites in the region.

In our own collecting we sought out places in middens where we could obtain a large sample of shells with a minimum amount of digging effort, while still making sure that the shells were in archeological context. However, once we began to collect, we stayed in one area until we had a sample of 50-100 shells. The motive behind this procedure was to avoid consciously picking up "typical" size shells which more often than not turn out to be very typical (see Hansen et al.; 1953: 72-73). This sampling technique was a hasty grab-bag operation, but we felt that it gave us a good first approximation of what shells from other middens in the area look like and how they differ from our material at 41 HR 82. Figure 32 shows data on Rangia numbers and sizes from a large site on Burnett Bay. In Figure 31, Rangia sizes are given for shells from three different sites on Peggy Lake. Figure 33 shows the sizes for some Rangia that were excavated at the San Jacinto Battle Grounds (Hole 1972).

Several differences between Rangia from other sites and 41 HR 82, were apparent from our visits to middens in the vicinity. First, the shells from 41 HR 82 are in much worse condition than the shells from other sites visited thus far. Our excavated shells had a chalky, crumbly feel that was distinctly softer than the material from other places. Moreover, the large shells at 41 HR 82 are larger than the large Rangia at other sites, (Fig. 34). In fact, the large Rangia at 41 HR 82 are huge in comparison to any other Rangia we know from archeological contexts in the Houston area. One wonders what made the environment at 41 HR 82 so favorable to clams and whether human or natural forces account for the

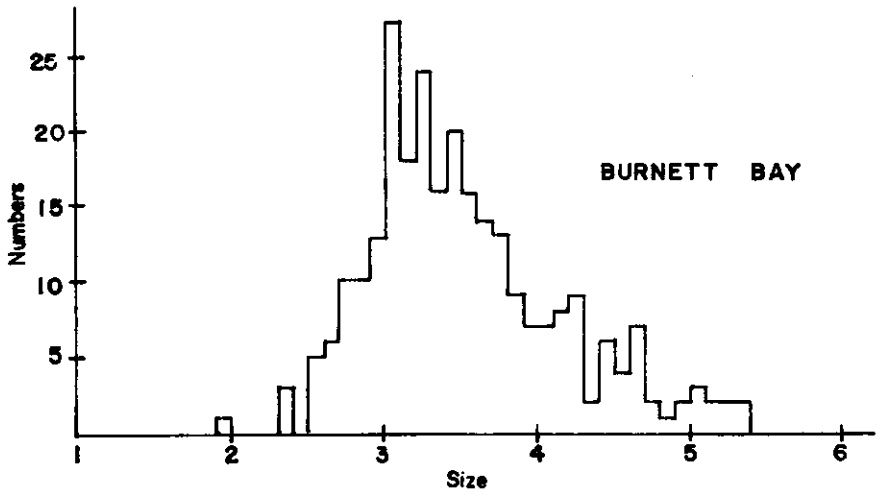

Fig. 31 - Number and size of Rangia cuneata from a midden on Burnett Bay.

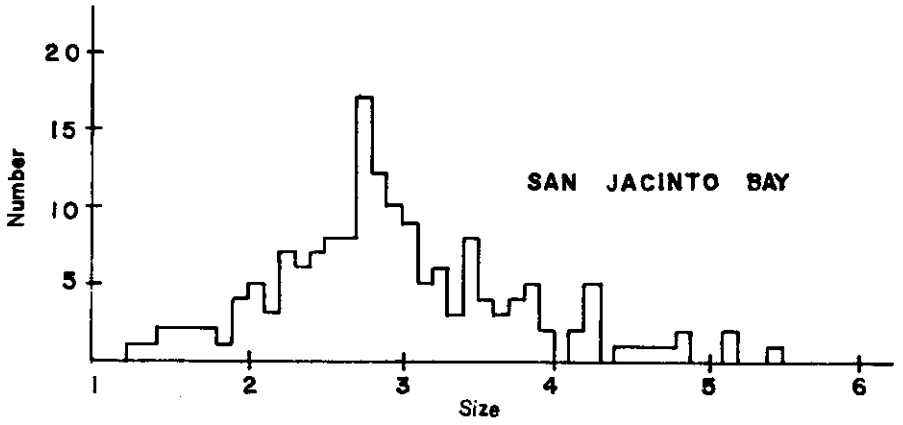

Fig. 33 - Number and size (in cm) of Rangia cuneata from a natural deposit at the San Jacinto Battleground.

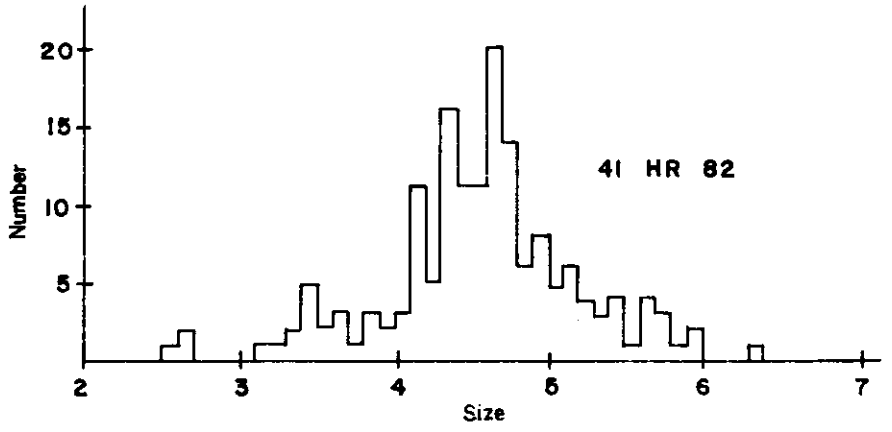

Fig. 34 - Number and size of Rangia cuneata from the Fullen site.

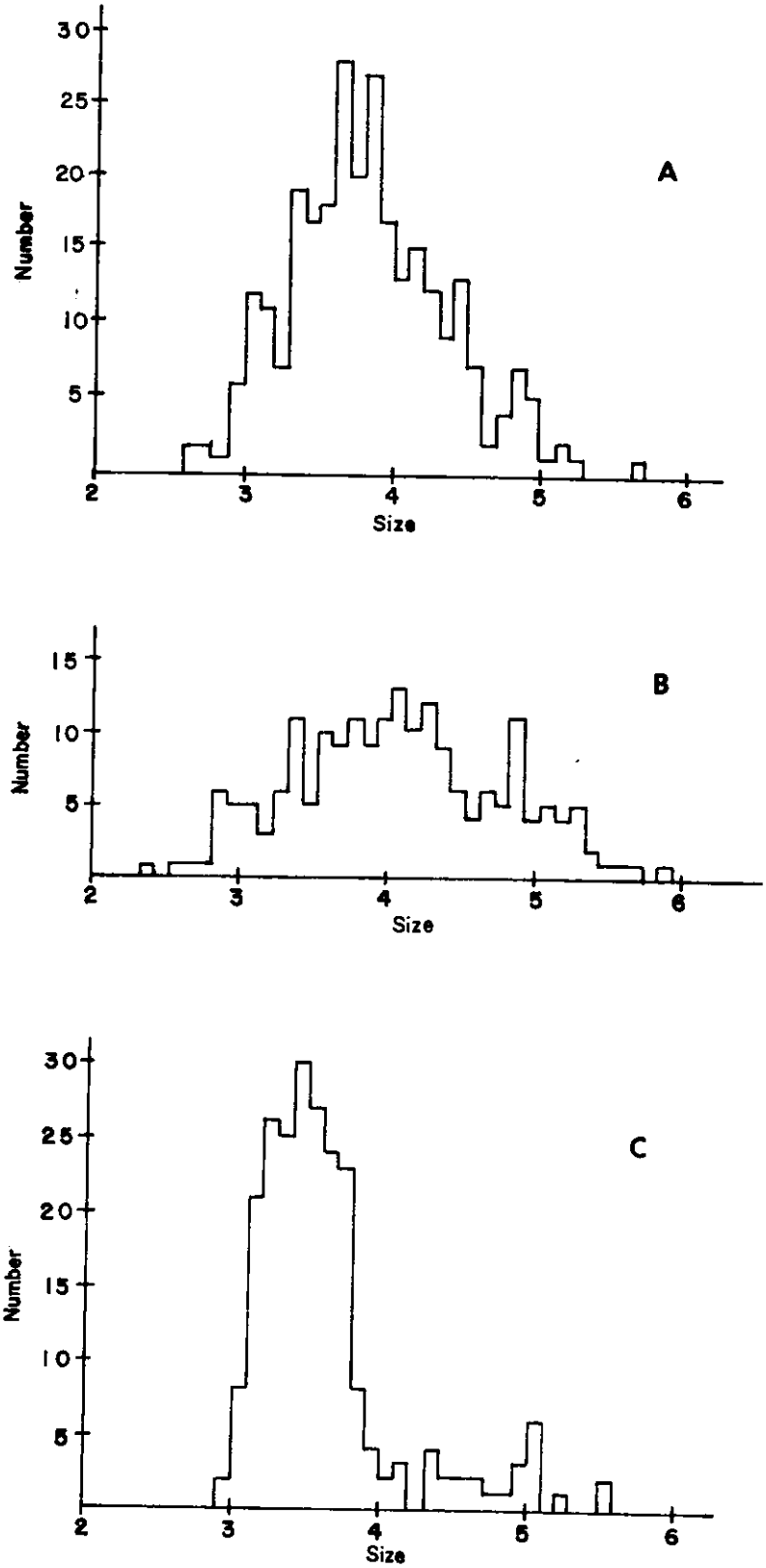

Fig. 32 - Number and size of Rangia cuneata from three middens on Peggy Lake.

change to smaller clams at the top of the midden.

Although we made a special effort to look for oysters in sites we visited, we found so few as to make any comparisons impossible. However, when we did find an oyster, without exception we found several. This indicates that it is possible that there is some clustering of oysters in the middens we visited. This is certainly in line with what we found at 41 HR 82.

Lessons Learned

Although we gained some valuable insights by looking at the remains of shellfish in some detail, we also found, in retrospect, that much of the effort was wasted. For example, in our work, we washed all the material from every level of every square, yet for the kinds of analysis we did, this turned out to be non-essential. Moreover, we found close relationships between certain kinds of data like numbers and weights of shells. Looking back, it appears as if numbers, sizes and ages of shellfish are the most meaningful measurement to consider; knowing that 600 shells were in a level gave us a better understanding of the midden than knowing we had 6000 gm. of shell. In addition, we found that in our test area the breakage of Rangia seems to be related to the number of Rangia in a given level. This seems reasonable and suggests that it is no longer useful to count or weigh every little scrap of shell to get a picture of the deposition of the site.

In fact, perhaps the single most worthwhile result obtained from the analysis was the conclusion that if one wants to get a clear picture of the shells in the site with no duplication of measurements, he should consider only the whole shells in each

excavation unit. On Rangia, he might measure only the size and age of each whole shell. From this he can reasonably expect to infer the structure of the molluscan remains in his excavation, finding possible breaks in the stratigraphy and also changes in the ages and sizes of the molluscs deposited within the site.

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