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A quarterly journal of reports and activities of mutual interest to the individuals and organizations within the framework of the Institute of Archeology and Anthropology at the University of South Carolina and for the information of friends and associates of the Institute.

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THE SEARCH FOR SIXTEENTH CENTURY SANTA ELENA

Stanley South

A fort site on the southern tip of Parris Island, South Carolina, has been of interest from the 1850s, when Captain George Parsons Elliott and the historian Jeptha R. Simms dug looking for the gate (Hoffman 1978: 5). Other digging was done in 1916, and 1918 and in 1923, with the latter work by Major George H. Osterhout being the most revealing (Hoffman 1978: 14). As a result of Major Osterhout's work the site was designated as the site of the French "Charlesfort" of 1562 (Hoffman 1978: 14-20; Osterhout 1923).

A controversy developed soon after when historians Mary Ross in 1925, and A. S. Salley, Jr. in 1927, clearly identified the fort site as that of the city of Santa Elena and its forts San Felipe I (1566-1570), San Felipe II (1570-1576), and Fort San Marcos (1577-1587) (Hoffman 1978; Ross 1925: 356-57; Salley 1925; 1927: 113-124). In 1957 the artifacts from the 1923 dig were identified by Albert Manucy of the National Park Service as Spanish in origin (Manucy 1957). With the identification by these historians of the Parris Island site as that of the Spanish colonial city of Santa Elena of 1566 to 1587 and its protective forts, and the research by historian Paul Hoffman of Louisiana State University who concurred with these interpretations (Hoffman 1978), the next step was archeology on the site to test these determinations.

A proposal for funding exploratory archeology on the site of Santa Elena and its forts was submitted to the National Geographic Society in May, 1979, after an earlier proposal had been turned down by the Research Committee. More specifics were desired by the Committee as to location of the Santa Elena site and a one week expedition was launched by the Office of Research and the Institute of Archeology and Anthropology at the University of South Carolina on July 1, 1979, to obtain such specific information. The discovery of Fort San Felipe II and the probable location of one structure in the city of Santa Elena resulted from this one week project. These discoveries were followed by the approval by the National Geographic Society's Research Committee of a grant for the purpose of conducting a seven month project of exploratory archeology in order to assess the potential the Parris Island sites have for extensive archeological research. This project was completed in the fall of 1979 with Stanley South as Principal Investigator and Robert L. Stephenson as Project Director.
If the "Charlesfort" site on Parris Island was actually the site of the Spanish Fort San Marcos of 1577-1587, then documents suggested that the site of the city of Santa Elena would be found to the north of Fort San Marcos during the period from 1566 to 1576, and adjacent to the fort during its occupation. Somewhere to the north of Fort San Marcos the earlier fort of San Felipe II was known to have been located, having been lost to the Indians in an attack in 1576 when the town and fort were abandoned (Hoffman 1978). Archeological testing on the high ground of Fort San Marcos seemed advisable and it was here that a sampling strategy was undertaken to discover the remains of the structures once a part of this capitol of Spanish Florida.

The major evidence expected was Spanish pottery of the sixteenth century and fired clay daub which would have been produced when the structures in the town burned in 1576. The structures were known to have been made of wood and clay, and were probably thatched with local materials such as palmetto leaves.

Given this means for identifying the location of burned clay-daubed structures it is possible to conduct a stratified systematic unaligned (Redman and Watson 1970) sampling design which will allow clustering of concentrations of daub fragments (representing houses) to be seen on a map as printed by a computer (Dudnik 1971; South and Widmer 1977: 119; Lewis 1977: 151). Such clustering would then allow pinpointing of specific sites for further more detailed excavation. It was expected that such a sampling method applied to the suspected site of Santa Elena would reveal house locations through fired daub fragments. Artifacts, whether nails, Spanish pottery or other objects would also reveal clustering provided they were present in quantities large enough to be revealed by the sampling units. It was expected, however, that because of the large quantities of fired daub compared with other artifacts left by Spanish occupation that daub would be the major means for identifying house sites through a sampling strategy.

The area to be tested was located between the Marine Corps golf course and the marsh, an oak-covered site about 200 feet wide and several hundred feet long. Such an area cannot be adequately sampled in a one week project so a smaller zone 90 by 420 feet was selected and divided into 42 thirty-foot squares. Inside of each of these large squares a single three-foot square was chosen for excavation and the contents sifted through a ½ inch screen. This sample represents a 1% sample of the entire area of 37,800 square feet.

As excavation of the 42 sample squares was being carried out toward the goal of locating the houses in Santa Elena some of the squares were found to reveal the edge of a ditch which was in surprising alignment with the archeological grid. When exploratory trenches were cut from these squares to determine the width of the ditch it was found that a large ditch 14 feet in width had been found. When other exploratory trenches were cut to determine the extent of this impressive ditch a two-bastioned moat for a fort was revealed (Fig. 1). From the documentation on the Spanish occupation, it was apparent that we had discovered the moat of Fort San Felipe II, which guarded the town from 1570 to 1576 (Hoffman 1978). The moat itself, however, dated from 1574 to 1576, and was in use only two years.
Figure 1
The discovery of this bonus was exciting but nevertheless resulted in cutting down the area in which potential structures could be delineated as revealed by the clustering of fired clay daub and Spanish pottery. However, when the computer-printed map of the concentration of these artifact classes was in hand a suspected house site was pinpointed at the southwest edge of the research frame (Fig. 2A and 2B). The one week project had resulted in the discovery of the fort of San Felipe II and the site of one of the structures in the town of Santa Elena. As a result of these discoveries a more intensive assessment of the archeological potential of the site was funded by the National Geographic Society.

The concentration of daub and Spanish pottery was thought to be a certain indication of a Spanish structure of Santa Elena, but the demonstration of this was not possible until an area 20 by 30 feet was removed from over the area of the concentration and the posthole pattern for a Spanish hut was revealed. The three-foot sample square had been placed at the entranceway to a "D" shaped structure twelve feet wide having a burned hearth area in the center (Fig. 3). The structure was built of posts set into holes five feet apart. Large nails found beside each post reveal that horizontal timbers were fastened to each post. Cane impressions in the fired clay daub found beside each post revealed that canes were likely woven vertically between the horizontal timbers and the entire fabric plastered with gray clay to be found beneath the marshes of Parris Island. As the vertical posts burned, the clay wall in the immediate area was fired to an orange to red brick color and crumbled to the ground to lie beside the posthole for four hundred years until again seeing the light of day as a result of the archeological removal of the soil blanket covering the site. The quickness with which the town was set on fire after the fort of San Felipe II was abandoned in 1576 (Connor 1925: 201) suggests that the structures were roofed with highly flammable roofs, probably locally available palmetto thatch.

The discovery of the small "D" shaped hut constructed of local materials and probably once housing a single soldier or perhaps a slave was a demonstration that the combination of elements of fired clay daub, Spanish pottery, and a posthole are positive clues to the location of a structure in Santa Elena. With this knowledge in hand three other research frames were established for sampling using the three-foot square approach found to be so successful in the first project. This time it was found that those sample squares placed away from the edge of the shoreline revealed less Spanish pottery and almost no evidence of such structural clues. Those squares placed along the shoreline between the two forts, however, revealed a dozen areas where the proper combination of daub-pottery-posthole was present. These data suggest that each of these holes represents a structure in Santa Elena.

One of these areas was expanded and a large rectangular posthole pattern was seen, revealing that much larger structures than the little Spanish hut are to be found on the site of Santa Elena. In addition to the twelve structures, a large hole nine feet wide was found, possibly a well. The alignment of this well and ten of the twelve structures suggests a row of houses has been found extending along the edge of Parris Island as it is seen today. However, the fact that two of the bastions of Fort San Felipe II have been washed away by erosion suggests...
Concentration of Fired Clay Daub

- Sample point
- Value range 60-250 gms.
- Value range 250-1712 gms.

Concentration of Sixteenth Century Spanish Pottery

- Sample point
- Value range 21-30 sherds
- Value range 31-40 sherds

COMPUTER PROJECTED ARTIFACT DENSITIES AT THE SITE OF FORT SAN FELIPE II IN SANTA ELENA, S.C.

Figure 2
The Site of a Spanish Dwelling (Ruin #1) at the First
SANTA ELENA (1566-1576)
(38BU162A)
on Parris Island, South Carolina
Excavated September 10-28, 1979
A Joint Project of
THE INSTITUTE OF ARCHEOLOGY AND ANTHROPOLOGY
University of South Carolina
and
THE NATIONAL GEOGRAPHIC SOCIETY
in Cooperation with
THE U.S. MARINE CORPS

NOTES ON THE DWELLING
12 foot wide D-shaped structure with door on straight side.
Horizontal slots spiked to upright posts were faced with vertical cones.
Fiber-tempered daub was hand-smoothed against the cove latticework.
Dirt floor with central hearth.
Smokehole in peaked, palmetro thatched roof.
The alignment with Fort San Felis is that used from 1566 to 1576.
The dwelling was burned, probably in 1576, by Indians.
Household refuse (Indian and Spanish pottery, animal bone, etc.),
was discarded near the door.
The dwelling is a product of the blending of Spanish and
Indian building materials and methods.
The site was used as a vineyard during the period of the
second Santa Elena (1577-1587) when vineyard ditches
aligned with Fort San Marcos intruded on the dwelling ruin.
A thriving vineyard was at Santa Elena in 1568.

Huffaker, Paul E., Sixteenth-century fortifications at
Parris Island, S.C. Monograph,
Lyons, Eugene, The Extensive of Florida, The University

Figure 3
also that a block or two of the town of Santa Elena may well have been washed away and what we are seeing is the row of structures remaining on the back side of town.

To obtain a sample of the moat of Fort San Felipe II a ten-foot wide section was excavated across the fourteen foot wide moat near the center of the west curtain wall. As a result it is clear that the moat at this point was backfilled with the exception of a small accumulation of humus at the bottom of the five foot deep ditch which had built up during the period from 1574 to 1577 when the ditch stood open. This is consistent with documentation which reveals that the fort was leveled in 1577 to prevent Indians from using it as a protection from which to launch an attack against nearby Fort San Marcos (Eugene Lyon, personal communication). Large fragments of majolica, olive jars, and a whole bullet mold were found in the fill soil of the moat.

An additional aspect of the assessment phase of the Santa Elena Project was the excavation of exploratory squares over the four walls of Fort San Marcos to locate the palisade posts seen in 1923 by Major Osterhout (1923). Such posts were indeed revealed as well as the neat trenches cut by the Major. Work at this fort site revealed that the fort has great potential for revealing architectural data of great value in interpreting this last Spanish fort on Parris Island.

A search was made for the site of the first Fort San Felipe (I), with negative results. It is apparent that this fort was located in an area now seen to be tidal marsh and locating the site of San Felipe I and recovering data of archeological value is highly unlikely.

Now that the site of the capitol of Spanish Florida has been located with two of its forts (Figure 4), extensive archeological excavation is needed on the three sites to reveal the story lying beneath the soil of Parris Island. The book has been found. It remains now to read and interpret the pages this archeological treasure has to reveal. We hope to do this in the years to come.
Acknowledgements

The one week project at Parris Island was a low budget, largely volunteer effort for which help was received from a number of people. Special acknowledgement is due to Dr. A. Riley Macon, Associate Provost for Research, at the University of South Carolina, through whom the grant from the Committee on Research and Productive Scholarship was obtained. Special acknowledgement is also due to Dr. Robert L. Stephenson, State Archeologist and Director of the Institute of Archeology and Anthropology and Parris Island Project Director, through whose office the expedition was undertaken.

I would like to acknowledge the financial support of the Committee for Research and Exploration of the National Geographic Society which funded the second phase of the project in conjunction with the Institute of Archeology and Anthropology.

I would like to thank Joseph R. Judge, Associate Editor of the National Geographic Magazine, and Dr. Paul E. Hoffman, Consulting Historian at Louisiana State University for introducing me to the site of Fort San Marcos and Santa Elena in September 1978, and sharing with me their research suggestions as to the location of the city of Santa Elena and the three forts which guarded her gates. Hoffman's research synthesis was an invaluable document which guided our research strategy throughout the project.

The fullest cooperation was received from the United States Marine Corps Recruit Depot, Parris Island, South Carolina, through the office of Colonel C. W. Schreiner, Jr., Assistant Chief of Staff G-4, and Captain R. W. Kelemen, assistant to Col. Schreiner, and Master Sergeant Jerry M. Walker, Public Affairs Chief. This cooperation is a most appreciated and vital aspect of the archeological research program on Parris Island. Thanks also to Mr. Dave Todd, Golf Pro/Manager of the Parris Island Golf Course and Mr. Woodrow Garvin, Greens Superintendent.

Thanks are due those individuals who assisted with the excavation and other logistic and professional help with the successful completion of these projects at Santa Elena. These are: my wife, Jewell, and children David, Robert, and Lara; excavators Joe Joseph, Mike Harmon, James Scurry, Helen Haskell, Darby and Pelham Erd, Robert Parler, Sammy Lee, Larry and Lisa Lepionka, Emmit Bufkin, John and Jane Picking, Stanton and Sheryl Horowitz Green, Annette Ferguson, Woody and Mark Williams, Marvin Smith, Bob Strickland, Alexander Tallant, Carol Libby, Darla Johnson, Emily Short, and photographers David Brill, Larry Cameron, and sound man Ed Breeland. Special thanks go to the crew members who carried out with me the second phase of the project: Leland Ferguson, Michael Hartley, John Goldsborough, and Bryan Watson. Other assistance was provided by Bill Monteith for the loan of a metal locator and Charles Gay for the loan of a photograph of Parris Island. Others who were helpful and to whom acknowledgement is due are: Paul Brockington, Richard Taylor, Gordon Brown, Jim Sexton, Kenn Pinson, Angela Talaber, Cindy Mahoney, and William Marquardt.
Valuable comments and interaction on Spanish artifacts was provided by Charles Fairbanks of the University of Florida who consulted with me in this area. Thanks too to Leland G. Ferguson, Michael O. Hartley, John Goldsborough, Kenneth Lewis, Eugene Lyon, Kathleen A. Deagan for valuable interaction.

Appreciation is expressed to Joseph R. Judge and his staff at the National Geographic Society office for the press conference held on July 12th at which the discovery of Santa Elena and Port San Felipe II was announced. Thanks also to Joseph R. Judge for funding the analysis phase of the project through the National Geographic Magazine.

A special word of thanks is given to Consulting Archeologist, Rex Wilson, of the Interagency Archeological Services Division, Office of Archeology and Historic Preservation, through whose office the Federal Antiquities Act Permit No. 79-SC-077 was issued, under which the Parris Island Project was carried out.

Thanks are also expressed to the media representatives who have taken such an interest in the discoveries resulting from the project.
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ROSS, MARY
SALLEY, ALEXANDER S., JR.


SOUTH, STANLEY A.

SOUTH, STANLEY and RANDOLPH WIDMER
THE RECORDING AND ANALYSIS OF PRIVATE RELIC COLLECTIONS AND ASSOCIATED ARCHEOLOGICAL SITES IN SOUTH CAROLINA: A PILOT STUDY

By Tommy Charles

A growing concern for the rapidly increasing destruction of our prehistoric archeological sites over the past several decades has prompted the South Carolina Department of Archives and History to join with the Institute of Archeology and Anthropology, University of South Carolina, to fund jointly a systematic search of the state for collectors of Indian artifacts, believing their collections to be the best source of information about sites that have been or are in the process of being destroyed.

Trained archeologists and the funds to investigate the many sites destroyed yearly are simply not available. On the other hand, there is hardly a cleared site in the state that is not being collected by one or more amateurs. The knowledge to be obtained from these collections and the observations of those that collected them are too great to ignore. Unfortunately many of the older collectors have died without any chance to share their knowledge with us and have left no records of their finds.

Still there are hundreds of active collectors around the state today, and the number grows yearly. For many this is the only phase of archeology to which they have been exposed. In addition to the knowledge obtainable from them, the survey offers a golden opportunity to establish a new spirit of cooperation between the professional and collector, and a chance to impress upon them the importance of preserving the heritage of our state, and a feeling of being a part of the archeological process of our state.

METHODS AND PROBLEMS

After ironing out last minute details, the survey was begun October 1, 1979, in Beaufort, that area being chosen because James L. Michie, Archeologist with the Institute, was conducting a survey of archeological sites in Port Royal Sound Broad River estuary, and in the process had acquired a number of collectors' names for me. At the same time, Stanley A. South, also an Archeologist with the Institute, was conducting a preliminary excavation at Santa Elena on Parris Island. This had created a great deal of interest in the area and I felt it might be beneficial to take advantage of this.

Contacting collectors referred by Michie as a starting point, some were quickly eliminated because they had disposed of their collections. Several in this category were widows who did not share their husbands' interest and did not know where the materials were collected or where the collections were presently located. This has since proven to be a common occurrence.

My first appointment was with the owner of a modest collection by some standards, and even though I had established in my mind procedures I would use, trial and error changed some of these, as could be expected. The logistics of getting even a small collection out of storage and spread around a room to inspect and photograph involved a little more than I had expected.
Fortunately most of the collections in the area were small and no major problems were encountered.

Basically Beaufort was a learning experience, and after my first week in Beaufort I found the telephone to be my greatest timesaver. Failure to get as much information as possible can result in a lot of wasted time. One half day was spent waiting to see a "collector"; it turned out he had two points! Qualifying the collector is a must; time spent on the phone is more than made up in time saved not making non-productive trips.

In making appointments, usually a number of introductory calls are made, explaining what we are attempting to accomplish, and in doing so trying to establish some priorities: which collection is oldest; which collection is largest; which collection is local; which collection is statewide; which collection is bought; which collection is traded. All these enter into making a decision as to whom to visit first.

While we certainly want to give priority to the elderly collectors, we can ill afford to neglect the conscientious young collectors who may have only a few artifacts, but if encouraged to record their finds and to keep good site records, may prove to be more valuable than some of the elderly who have acquired large but poorly recorded collections.

The first visit with the collector is seldom more than a goodwill mission: to get a feel for the situation and to work out details, such as work area, time allowable, etc.

Normally a collection will be photographed first if it is conveniently displayed. If stored, artifacts are recorded, and ones to be photographed are kept out until later. If artifacts are separated by site, they are recorded as such. Few collectors have done this even though they record the sites. Usually they display them by types, materials, or whatever pleases them.

All artifacts are recorded by types and material. Any that are rare or unusual are recorded and photographed separately. Any unusual raw materials or alteration of artifacts (heat treated chert, for example) are noted. All available sites, collected or not, are recorded.

Each collector is given an application for the Archeological Society of South Carolina and urged to join; if they indicate their friends might be interested, several forms are left for them.

One of the problems most difficult to overcome is the inability to keep to a planned schedule. Invariably, the best laid plans fall prey to snow, sickness in the family, death of a friend, job demands, etc. All of these have been cause for delay during the past several months.

Some second thoughts have occurred about trying to record 100% of a collection. Time consumed in counting even a modest collection can sometimes be prohibitive, depending on how they are displayed or stored. Do they have to be moved to another area of the house? Can they be photographed without being moved? As an example, 25 days, working 4-5 hours a day were spent recording only 11,581 artifacts. Most of the artifacts were packed
away, resulting in cramped quarters. On the other hand, 13,415 artifacts were recorded in only five days under ideal conditions and with help from the collectors.

Perhaps we should count only a portion of each large collection, and based on the percentages of types and materials, estimate the rest, taking care to record the more unusual or rare items, and perhaps taking more photos. This would give us time to visit more collectors. I feel in the long run we will gain far more than we lose, particularly site information.

WHO COLLECTS?

The greatest number fall into the "farm boy" category: a person who has a cigar box full of artifacts collected from the family farm, but who lost interest at an early age. The collections are put away, to be forgotten or perhaps to find their way into the hands of collectors that buy artifacts.

Most of the hard core collecting is being done by young to middle-aged married couples that simply like to get out and ramble. Some of them collect only in a radius of a few miles of their home, others cover several counties or even several states. Most only surface collect, but a few are very destructive, digging mounds and shell middens, and diving in rivers and streams for artifacts.

Most collectors prize their artifacts highly and will not buy, sell or swap. Others have acquired large collections by buying, swapping, etc.

A few have a lot of fake material, but will swear it was found almost in their backyard.

Excellent records are kept by some, others have none at all. It seems the young people are doing a better job in this respect than the old. Maybe the young are becoming interested in our heritage at an earlier age than our parents. In the last two months teachers from Aiken and Blackville have asked for information on books about Indians and archeology for students in elementary and junior high school. The avid collector will have from one to a dozen books concerning Indians, mostly artifact oriented, Discovering South Carolina, by Bert W. Bierer being a particular favorite.

Collecting varies from individuals that spend several days a year at their hobby, to family outings complete with picnic several times a month. The lakes and coastal islands are favorite collecting areas.

THE IMPACT OF COLLECTING

The impact of all this collecting has been considerable. Anyone who has collected for several years will say that the artifacts are not as easy to find as when they first started. The thinly soiled sites of the Piedmont, once
discovered, are quickly collected. Paper companies seem to be responsible for most destruction in the Piedmont and Fall Line regions. After clearing stumps, weeds, vines, etc., artifacts are often pushed down hill to the bottom completely denuding hills that quickly erode down to red clay. Large collections are taken from these sites in a relatively short time.

With many hundreds of sites destroyed yearly from the standpoint of doing meaningful archeology, it could be argued that collectors of these sites could become more beneficial than harmful if encouraged to keep good records and work with the Institute.

An example of this is the Moody site, 38ED31, on Catawba Timber Company land, Edgefield County, South Carolina. All work on this site has been done by amateurs.

It seems our best bet is to encourage the preservation of deep sites, and there is still a large number of these. Although they appear to be exhausted of artifacts, just below the plow zone several feet of undisturbed history may lie. The greatest danger to these does not appear to be collectors but progress. They are a particular favorite of the state and county highway department for borrow pits. I have checked some of these excavations and found artifacts as deep as five feet, safe from the collector that does not dig, but destroyed nevertheless. Can anything be done to salvage these sites?

VALUE OF THE SURVEY

The urgency of the collections survey was shown shortly after it began. Three elderly collectors, Mr. Ed Crawford of Winnsboro, Mr. J. E. McTeer of Beaufort, and Mr. Roy J. Lyons of Aiken, passed away. Mr. Lyons died two days before my appointment with him. Another collector has a terminal illness and is too sick to visit.

In the past year one collection has been sold out of state and another is for sale at this time. A collector moved to Virginia and took a large number of artifacts from Bamberg County. Two other collections have been stolen. There must be many other instances of which I have not learned.

There is a ready market for all kinds of artifacts, and the price offered for choice items is persuading many collectors to part with some of their best artifacts. Some sell not realizing how rare an item might be. For others, the chance for profit cannot be refused. Such activities are impossible to stop, but if a spirit of caring for our heritage can be instilled, perhaps it can be held to a minimum.

SUMMARY

Looking back on the first phase of the collections survey there is a certain amount of satisfaction about some of the accomplishments: response and cooperation has exceeded my expectations. The names of 291 collectors
have been acquired. One hundred nine have been contacted by phone or personal visits. Thirty collections have been recorded and three are in process, and one hundred twenty-one sites have been recorded.

These activities required trips into 19 counties for a total of 78 days and 27 nights out of town.

Although I was optimistic when the collections survey started, I feel even better today about our chances of obtaining meaningful information. I expect the survey upon completion to provide information that will be useful to students of South Carolina archeology for years to come.

The enthusiasm of the majority of collectors to become involved with the survey has made the task a pleasant undertaking. If we but take the time and put forth the effort to channel this enthusiasm in the right direction, archeology in South Carolina will have taken a step forward.

SITES RECORDED

Aiken - AK 368
Allendale - AL 116-117
Charleston - CH 440
Chester - CS 115-116-117-118-119
Georgetown - GE 194
Hampton - HA 71-72-73-77-78-79-80-81-82-83 74-75-76
Jasper - JA 62-63
Kershaw - KE 47 through 77
Lancaster - LA 64 through 96
Laurens - LU 127
Lee - LE 89-90
Lexington - LX 234-237
Orangeburg - OR 82-83-84-85-86-87-88
Richland - RD 217
Union - UN 139-140-141-142
York - YK 86
Archeological research in the flood area of the proposed Richard B. Russell Reservoir on the upper Savannah River in Georgia and South Carolina began in 1969. A brief survey that year was done by the University of Georgia. Three similarly brief surveys were done in 1970-74 by the Institute. The major, comprehensive survey of the entire flood pool area was begun by the Institute in 1977 and completed in 1979. This latter survey included a system of transects supplemented by probabilistic sampling as well as extensive testing. In all, there were 490 archeological sites recorded, representing 818 distinct components almost evenly divided between the Georgia and South Carolina sides of the river. Approximately 24% were Archaic, 3% Woodland, 4% Mississippian, 26% historic, and the rest non-diagnostic prehistoric sites. The majority were lithic scatters with potential for further development but there were also large Woodland and Mississippian villages, large plantations, and industrial mills. The 1977-79 survey was followed by a season of test excavations at 84 of these sites by the Institute during the latter half of 1979. The final report on this work is in preparation. The research has been made possible by contracts with Interagency Archeological Services - Atlanta, funded by the U.S. Army Corps of Engineers, Savannah District.

SAVANNAH RIVER PLANT

The Savannah River Plant Archeological Research Program, directed by Glen T. Hanson, has continued both prehistoric and historic research under the sponsorship of the Department of Energy throughout 1979. The central purpose of the research has been the thorough investigation of settlement distributions within the area, which lies in the Upper Coastal Plain physiographic province adjacent to the Savannah River. During 1979 the major focus was on the survey and test excavation of sites within the Four Mile Creek Watershed using an environmentally stratified sampling design. An ongoing project has involved the testing of a Late Archaic - Early Woodland adaptive change model which will attempt to explain a major shift in settlement location in terms of population and environmental variables. As part of this research, the complete descriptive analysis of Tinker Creek (38AK224), a Stalling's Island Archaic/Thom's Creek/Deptford site, has been completed and a preliminary report will be finished in July 1980. Historic research on the Savannah River Plant has been focused on the preparation of a well documented historical overview of the lower Savannah River area. This research is being conducted by Richard D. Brooks. Results of all research will be published through the Institute of Archeology and Anthropology, University of South Carolina.
COOPER RIVER REDIVERSION CANAL PROJECT

Intensive testing and excavation was conducted by the Institute of Archeology and Anthropology at four Middle-Late Woodland/Mississippian sites located in the interior Lower Coastal Plain of South Carolina along the Santee River. Field work was conducted intermittently from March through October, 1979. The project was sponsored by the U.S. Army Corps of Engineers, Charleston District, and coordinated by Interagency Archeological Services - Atlanta. Dr. Paul E. Brockington, Jr. was Principal Investigator and Mark J. Brooks served as Field Director.

Two of the sites are particularly noteworthy because of the presence and/or evidence of structures, various other features, and preserved animal and human bone. Specific activity areas were also delineated. Analysis will be conducted during 1980 under the direction of Veletta K. Canouts. Regional and site level subsistence settlement and intra-site patterning will be emphasized.

HOLOCENE SEA LEVEL VARIABILITY

During the past two years, research has been conducted by Mark J. Brooks, Institute of Archeology and Anthropology, University of South Carolina, and Donald J. Colquhoun, University of South Carolina Department of Geology, regarding the effects of Holocene sea level variability on prehistoric human adaptations in the Lower Coastal Plain of South Carolina. In order to establish a framework for this research, construction of a detailed sea level curve using archeological and geological data is necessary. Some preliminary results of this research have been presented by Brooks and Scurry (1978) and Brooks et al. (1979).


Brooks, Mark J. and James D. Scurry
1978 An intensive archeological survey of Amoco Realty Property in Berkeley County, South Carolina, with a test of two subsistence-settlement hypotheses for the Prehistoric Period. University of South Carolina, Institute of Archeology and Anthropology, Research Manuscript Series 147.

SURVEY OF PORT ROYAL SOUND

An archeological survey of Port Royal Sound was conducted by James L. Michie in the fall of 1979, assisted by a grant from the South Carolina
Department of Archives and History. This survey was oriented towards the recognition of settlement and subsistence patterns and the effect that fluctuating sea levels have had on these systems. The survey yielded sites and cultural materials that date from Paleo-Indian through the Historic Period. This report will be completed in June of 1980.

SURVEY OF CONGAREE SWAMP

An extensive reconnaissance survey was conducted by James L. Michie within a virgin forest composed of some 15,000 acres. The wet bottomlands failed to yield many prehistoric sites, and those that were found are small. The cultural remains were represented by thinning flakes and occasional biface fragments. These sites apparently represent limited activity and probably the extraction of flora and fauna. The historic occupation is represented by two forms of large earthen structures: cattle mounts and dikes. These structures are associated with raising of livestock and the probably cultivation of corn during the 19th century. This research was sponsored by the South Carolina Department of Archives and History. The report will be completed in March, 1980.

THE MANNING SITE

Albert C. Goodyear has recently completed an excavation of a multi-component prehistoric-historic site near Columbia, S.C. This was done as a project with the Archeological Society of South Carolina, a joint amateur-professional society. Society members contributed labor and equipment resulting in the excavation of an area over 2,500 square feet. In 1977-78 efforts at the Manning site (38LX50) concentrated on a prehistoric area of the site revealing in situ Early and Middle Archaic lithic materials under a deep plowzone. The 1979 season completed excavation of a mid-18th century settler homestead. A post-in-pit daub structure was exposed with suggestions of activity and refuse patterns nearby. Analysis is now underway to produce reports treating both the 18th century and prehistoric occupations of the site. These will be published as monographs by the Archeological Society of South Carolina.

LITHIC RESEARCH

Goodyear is also working on projects related to Paleo-Indian and Early Archaic lithic technologies. A general model potentially cross-cultural in nature has been formulated that explains cryptocrystalline raw material selection for Early Man tool kits. A version of this paper is available as Research Manuscript Series No. 156 from the Institute. Also, a techno-functional and geographic distributional study of a special Early Archaic tool known as the Edgefield Scraper will be undertaken in the spring of 1980 by Goodyear, James L. Michie, and Dr. Barbara Purdy (University of Florida). Several hundred will be measured and photo-
graphed from specimens available in museums and universities and private collections from Tampa, Florida to the Santee River in South Carolina, the area of greatest known concentration. This study will be an effort to reconstruct patterns of tool use, manufacture, maintenance and any recycling using quantified lithic attributes. An attempt will be made to discern regularities and anomalies in the tool form over a 500+ mile region on the Atlantic and Gulf Coastal Plains. Travel for this study is sponsored by The American Philosophical Society and Sigma Xi.

FORT SAN MARCOS, FORT SAN FELIPE II, AND SANTA ELENA

A sixteenth century research program has been implemented at the Institute of Archeology and Anthropology in conjunction with the National Geographic Society. Robert L. Stephenson is project director and Stanley South is the principal investigator.

Two phases of the project were undertaken during the summer and fall of 1979, resulting in the discovery of Ft. San Marcos and Ft. San Felipe II as well as twelve structures in the city of Santa Elena, once the capital of Spanish Florida. The site, occupied from 1566 to 1587, is on Parris Island, South Carolina, and is being excavated through the full cooperation of the United States Marine Corps. Further phases of a long-range research program are planned for the years to come, with another project in the field anticipated for the fall of 1980.

MIDDLETON PLACE PLANTATION

In November 1978, the Institute of Archeology and Anthropology carried out exploratory archeological investigations at Middleton Place Plantation in Dorchester County. These excavations were conducted under the direction of Kenneth E. Lewis and Donald L. Hardesty. Because little documentary information exists concerning the actual layout of this 18th-19th century rice plantation and the different types of activities carried out there, the project was designed to provide basic evidence relating to the plantation's form and content. The excavations at Middleton Place were carried out by a stratified, systematic, unaligned sample of 58 5x5 foot squares laid out south and west of the main house.

The presence of a substantial quantity of "Colono-Indian" pottery at Middleton Place is also of interest. This unglazed earthenware has been found on many plantations of the colonial period and there is some evidence to suggest it was manufactured by Black potters following West African ceramic traditions. Its widespread occurrence at Middleton Place and elsewhere may indicate that it played an integral role in food preparation during the 18th century. The research at Middleton Place was supported by the Middleton Place Foundation and the South Carolina Department of Archives and History.
HAMPTON PLANTATION

In April and May 1979 the Institute of Archeology and Anthropology carried out exploratory excavations at Hampton Plantation in Charleston County. These excavations were directed by Kenneth E. Lewis. Hampton, an 18th century rice plantation on the Santee River delta, is currently being developed as a state park by the South Carolina Department of Parks, Recreation and Tourism and the archeology was undertaken to assist in their interpretation of this historic site. Because standing ruins apart from the main house were absent and documentary information was limited, the primary goal of the archeological work was to ascertain the form and extent of the plantation settlement. This information was obtained through the use of a stratified, systematic, unaligned sample of 1% of the site contents. In addition to revealing the colonial and antebellum settlement pattern at Hampton, analysis of the archeological data has provided clues to activity variation there as well as to status and ethnic differences among its inhabitants. The widespread use of Colono ceramics at Hampton mirrors the occurrence of this ware at other plantation sites in the South Carolina lowcountry, adding further support to the assumption that Colono pottery played an integral role in food preparation on 18th century plantations.

WANDO RIVER TERMINAL

During February and March of 1979, the Institute of Archeology and Anthropology conducted an intensive archeological survey of the proposed Wando River terminal facilities near Charleston, South Carolina. The survey was initiated by the South Carolina State Ports Authority in response to current environmental legislation and was oriented toward long-term management of the cultural resources located within the project area. Thirty-eight prehistoric and three historic period sites were recorded for the area. The prehistoric sites were primarily Middle to Late Woodland, while five were Wilmington shell midden sites. Several shell columns were removed and analysis is being conducted on the shell remains, including radiometric dating, at one of the sites. Documentary evidence indicated that one of the historic period sites represents the remains of a Colonial period shipyard, but no identifiable diagnostic shipyard associated artifacts were recovered. Analysis and documentary research is currently in progress and the results should be available in April, 1980.

In addition to the land survey, the underwater division of the Institute, under the direction of Alan B. Albrigh~t, conducted an underwater survey of the areas of the Wando River which will be impacted by the construction. This survey consisted of examination of the river bottom using remote sensing--magnetometer and side-scan sonar--and visual techniques. Although minimal, artifacts ranging from 18th through 20th century were recovered.
HAMPTON PLANTATION

In November and December 1979 the Institute of Archeology and Anthropology of the University of South Carolina conducted further archeological investigations at Hampton plantation on the Santee River in Charleston County, South Carolina. Hampton, an eighteenth and nineteenth century rice plantation, is currently being developed as a state park by the South Carolina Department of Parks, Recreation and Tourism and the archeological work there has been designed to assist in the interpretation of the site as well as to investigate various aspects of plantation form and function. The excavations were directed by Kenneth E. Lewis and sponsored by the South Carolina Coastal Council. This project expanded the previous stratified, systematic, unaligned sample in order to investigate the nature and disposition of structures and activities in the vicinity of the main house. The locations of two dependency structures, symmetrically placed with regard to the main house, were discovered and their function as specialized domestic activity areas identified on the basis of archeological evidence.

Intensive excavations at a subterranean feature uncovered during the previous sample excavations at Hampton were carried out in order to ascertain the feature's form as well as the nature of activities associated with it. These investigations revealed a circular pit, probably an industrial feature, that had later been filled by two successive refuse deposits. The presence of Colono ceramics in an apparent mid-eighteenth century European domestic refuse context may indicate an expanded role for this enigmatic ware on colonial plantations.

COLONO CERAMICS FROM HAMPTON PLANTATION

Helen Haskell and James Scurry of the Institute of Archeology and Anthropology are conducting a study of Colono ware from Hampton Plantation and other eighteenth century South Carolina sites. Colono contributed 31% of total ceramics at Hampton and has been found on other low-country plantations in quantities ranging up to 55%. A preliminary analysis of the Hampton Colono supports indications from other sites that Colono ware in South Carolina was extensively used by both whites and blacks, and that its popularity declined throughout the eighteenth century until it fell into disuse in the first quarter of the nineteenth century. The final report on this research will include a statistical analysis to determine possible temporal changes in Colono manufacturing techniques, a comparison of Hampton Colono ware with Colono reported from other historic period sites, and an overview of Colono usage throughout the Southeast.
SILVER BLUFF PLANTATION

Archeological investigations began in January 1980 at Silver Bluff Plantation near Aiken, South Carolina. This site has long been recognized as a major historic site in the state and is the site of Galphin's Trading Post, a Colonial period trading center. Some historical documents suggest that the site may also represent the location of a large Indian village encountered by early travelers through the state. The current project was funded by the South Carolina Department of Archives and History and is a cooperative effort of the Archeological Society of South Carolina, the Augusta Archeological Society, the National Audubon Society and the Institute of Archeology and Anthropology, University of South Carolina. The purpose of the project is to intensively surface collect those portions of the area which are presently being cultivated in order to define spatially various occupation areas at the site. This information will provide a basis for more intensive subsurface testing in the future. In addition to the archeological work, an intensive historic document search is also being conducted for the site. By combining the historic and archeological data the research efforts should lead to better definition of the site patterning and function. J. Walter Joseph, Jr. is the Principal Investigator for this project and directed the field collection while James D. Scurry directed the laboratory analysis and will be the primary author of the report.

WANDO RIVER SURVEY

During February and March of 1979, the Institute of Archeology and Anthropology, University of South Carolina conducted an intensive archeological survey of the proposed Wando River Marine Terminal facilities near Charleston, South Carolina. The survey was funded by the South Carolina State Ports Authority and designed for the recovery of both prehistoric and historic sites in the project area. Thirty-eight prehistoric and two historic period sites were located. The historic sites represent the remains of Belleview plantation and Linn's Shipyard. Documentary evidence indicates that the economy of Belleview plantation experienced various shifts in orientation and intensity during its occupation. The early to mid-eighteenth century economy was oriented towards the commercial cultivation of oranges, followed by a shift during the 1760's to shipbuilding and subsistence agriculture. During the nineteenth century the economy shifted again to primarily residence and subsistence agriculture with some small scale commercial production. This pattern continued until the late 1950's when the property was sold to an industrial firm. Historic documents also indicate that Linn's Shipyard was owned and operated by David Linn during the 1760's and 70's. Although shipbuilding data is sketchy for South Carolina, the available information suggests that Linn's Shipyard was probably oriented toward manufacture of small riverine vessels and repair of ships visiting Charleston Harbor. The field work and analysis for the historic portion of the Wando River survey are being conducted by James D. Scurry.
The Division of Underwater Archeology of the Institute of Archeology and Anthropology conducted eight weeks of field work (Oct. 12-Dec. 7, 1979) in Wadboo Creek, Berkeley County, South Carolina. The Wadboo Creek Bridge area (38BK285) was the site of several Revolutionary War skirmishes. The project was funded by special appropriations from the State Legislature, with particular thanks to Senator Rembert C. Dennis of Moncks Corner, South Carolina, who was instrumental in acquiring the funds.

Alan B. Albright, head of the Underwater Division, was the principal investigator, with a crew consisting of Ralph L. Wilbanks, Assistant Underwater Archeologist, James A. Williams, Underwater Archeological Assistant, two contract divers, Steve Howard and Kevin Rooney, and a three-person support crew of Anthony Brinson, Ellen Gingell, and Mary W. Edwards.

A 70'x120' grid was established underwater and broken into 5'x5' squares. An unusually large number of historic and prehistoric artifacts was recovered. Of particular interest were more than 200 buttons, numerous coins from the 18th century, and the largest number of projectile points yet recovered from an underwater site in South Carolina (over 30). The analysis and final report will be completed late in 1980 and will be published in the Research Manuscript Series of the Institute.

CONSERVATION OF ARTIFACTS

Katherine R. Singley, Conservator, reports that current work in conservation involves stabilizing a range of historical materials from both land and underwater sites, including Santa Elena, Hampton Plantation and the Wadboo Creek. Artifacts being processed include ceramics, iron, glass, pewter, and brass.

A new facility for the conservation of large-scale waterlogged timber is in the planning stage. The facility has been made possible by the Historic Preservation Fund, Heritage Conservation and Recreation Service and the University of South Carolina.

NEW PERSONNEL 1979

The Institute is pleased to welcome the following seven persons to the permanent staff.

VELETTA K. CANOUTS, Archeologist II, began work in November 1979, replacing Paul E. Brockington, who resigned to take a position at the University of Kansas. Canouts will serve as Principal Investigator of the Cooper River Project analysis and manage the environmental impact archeology division of the Institute.
TOMMY CHARLES, Archeological Assistant, was hired in October 1979 to undertake a survey of artifact collections in South Carolina.

KEITH M. DERTING, Archeological Assistant, began work February 1, 1980 on the Cooper River Project. Derting will assume major responsibility for the analysis of lithic artifacts.

MICHAEL O. HARTLEY, Archeologist I, has been employed since August 1979, working primarily with Stanley South on the Santa Elena project excavations and analysis.

HELEN W. HASKELL, Archeological Assistant, joined the staff February 1, 1980. She will be responsible for a major portion of the ceramic analysis on the Cooper River Project.

WILLIAM H. MARQUARDT, Associate Director, joined the Institute in July 1979. In addition to sharing administrative duties with Robert L. Stephenson, Marquardt has continued to pursue his research interests in southeastern archeology, primarily in western Kentucky.

JOLEE A. PEARSON, Associate Curator, began work on January 1, 1980. In addition to managing the Institute collections and the statewide site records, Pearson's duties include special analyses of ceramics from the Cooper River Project.

NEW GRADUATE PROGRAM

The Department of Anthropology and the Institute of Archeology and Anthropology will jointly administer a program offering an M.A. in Public Service (Conservation) Archeology. The program has been made possible by a grant from the Department of Transportation. For further information, write to Dr. Leland G. Ferguson, Director of Graduate Studies, Department of Anthropology, University of South Carolina, Columbia, South Carolina 29208.
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GOODYEAR, A. C.

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1979 Archeological reconnaissance and testing along the Broad River, Richland County, South Carolina. University of South Carolina, Institute of Archeology and Anthropology, Research Manuscript Series 153.

GOODYEAR, A. C., J. H. HOUSE, AND N. ACKERLY

LEWIS, K. E.

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MICHIE, J. L.
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SOUTH, S. A.
1979 The general, the major, and the angel: The discovery of General William Moultrie's grave. University of South Carolina, Institute of Archeology and Anthropology, Research Manuscript Series 146.

1979 The search for Santa Elena on Parris Island, South Carolina. University of South Carolina, Institute of Archeology and Anthropology, Research Manuscript Series 150.
Through his research in the records of the British Board of Ordnance, Seymour de Lotbiniere of Brandon, England, has established (1977) beyond any reasonable doubt that the English were engaged in the production of spall-type gunflints throughout the 18th, and extending back into the 17th centuries. He has also found (1980) Board of Ordnance minutes, dated July, 1775, which describes a letter from William Levett offering the Board "the best musket flints of the New Construction." Levett enclosed samples with his offer and the Board immediately ordered 200,000. We can conclude that this, in all probability, marks the introduction of the manufacture of flake-type gunflints into England. Of course, as in France, the new manufacturing technique did not replace the old immediately, but by the end of the century it was well established in England, and the center of gunflint making gravitated toward Brandon, where the flint was peculiarly suited to the striking off of long flakes.

If, then, both the French and the English were making spall-type gunflints during these years, is it possible to distinguish between the two? In an attempt to answer this question, the Mackinac Island State Park Commission and the Southeast Archeological Center sent me all the gunflints so far recovered at Michilimackinac and Fort Frederica.

Fort Michilimackinac was built around 1717 by the French and surrendered to the English in 1763 at the close of the French and Indian War, so it was occupied by the former for around 45 years and the latter for about 20, when it was moved to Mackinac Island in 1781. Therefore, there should be a good mix of gunflints dropped by the two forces and their civilian populations. Since the major part of the British occupation was before the introduction into England of the flake-gunflint technique of manufacture, any gunflints dropped by the British would be either French flake-type or their own British gunspalls. Of course, there is also the possibility that they might have bought French gunspalls as well, but we know from de Lotbiniere's findings that the British Board of Ordnance was a heavy buyer of English spall-type gunflints throughout this period.

The Michilimackinac gunflint collection is now so large that it numbers in the thousands. It was pointless to attempt a count of the total, but, as it will be reported later, I did weigh certain divisions. When spread out and viewed as a whole, it is immediately seen that the majority of them were made from a dull, translucent flint, ranging in color from a light brownish gray to a paper-bag brown. Small white flecks were present in many. The spalls themselves are in all sizes and surprisingly uniform in outline, with well rounded heels, trimmed sides, and—usually—reverse trimmed edges.

In order to bring this material into comprehensible proportions, all of the gray to brown gunspalls were picked out and those in mint, near mint,
or measurable condition were placed in their respective groups (Fig. 1). The broken and fragmented pieces went into another. These broken and fragmented pieces weighed 13 pounds, 2 ounces (Fig. 2).

Since the gunflints from this site have been reported by Stone (1971), those of the French flake type were reboxed. There were also several small boxes of flints of various kinds which represented the type specimens set up by Stone, as well as some selected by Witthoft. These were also ignored because they were not great enough in number to affect the study one way or the other.

Figure 1: A representative sample of "French" gunspalls from Michilimackinac. In addition to the flint used, these are uniform in outline and more carefully trimmed than those thought to be of English origin.

After having removed all of the foregoing, both spall and flake, there remained a respectable number of gunspalls of a nondescript sort. These were also checked over and the broken ones returned to their box. The broken nondescript flints weighed 2 pounds, 2 ounces, and represent a reasonably accurate proportion of the whole collection. In other words, there are by weight approximately six to seven times as many of the gray to brown gunspalls as there are all of the other kinds of spalls combined.

Fort Frederica, in being from 1736 to 1749, when the garrison was withdrawn following the signing of the Treaty of Aix la Chapelle, was an English fort on St. Simons Island, Georgia. The village lingered on with a greatly
Figure 2: Twelve sets of matched chert or flint gunspalls from two separate sites. The Fort Frederica spalls are on the left and those from Michilimackinac are on the right. They are assumed to have been of English origin.

reduced population until a fire in 1758 destroyed most of the buildings of the town. All occupation may be considered at an end with the signing of the Treaty of Paris in 1763.

The gunflints are not catalogued individually, but by the feature, so all of those from a given feature bear the number and are packaged together in plastic envelopes. The gunflint count broke down as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Total</th>
<th>Used</th>
<th>Mint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spall-type</td>
<td>278</td>
<td>203</td>
<td>75</td>
</tr>
<tr>
<td>French Flake-type</td>
<td>113</td>
<td>110</td>
<td>3</td>
</tr>
<tr>
<td>English Flake-type</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Obviously, the two English gunflints were dropped by some passing hunter long after Fort Frederica was abandoned.

The Frederica gunspalls are a motley lot, ranging all the way from excellent black flint, such as is normally associated with the best from Brandon to common cherts. One is immediately impressed with their similarity to the heterogeneous spalls from Michilimackinac, for there are only two
which might match the gray to brown majority there. Practically any flint or chert gunspall in the Fort Frederica collection can be matched by eye with another from Michilimackinac. The following are representative examples:

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalogue Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dull white chert</td>
<td>6301</td>
</tr>
<tr>
<td></td>
<td>6225</td>
</tr>
<tr>
<td>Dull black flint shading into white</td>
<td>5286</td>
</tr>
<tr>
<td>Glossy black &quot;Brandon&quot; flint</td>
<td>6463 (a)</td>
</tr>
<tr>
<td></td>
<td>6463 (b)</td>
</tr>
<tr>
<td></td>
<td>6463 (c)</td>
</tr>
<tr>
<td>Gray-black flint with white inclusions</td>
<td>6670</td>
</tr>
<tr>
<td></td>
<td>6139</td>
</tr>
<tr>
<td></td>
<td>5286</td>
</tr>
<tr>
<td></td>
<td>812</td>
</tr>
<tr>
<td></td>
<td>6463 (a)</td>
</tr>
<tr>
<td></td>
<td>2080</td>
</tr>
<tr>
<td></td>
<td>2283 (a)</td>
</tr>
<tr>
<td></td>
<td>Msl</td>
</tr>
<tr>
<td></td>
<td>2283 (b)</td>
</tr>
<tr>
<td></td>
<td>3034</td>
</tr>
</tbody>
</table>

The list could be extended endlessly, but the above should be enough to show the possibility that the two lots came from the same sources of supply and, by extension, it seems logical to assume that the heterogeneous gunspalls from Michilimackinac are English in origin.

It is true that the British Board of Ordinance furnished the garrison at Fort Frederica with fine grade French flake-type gunflints, and, presumably, could also have furnished French spall type. But, if they had done so, why are there none of the gray to paper-bag brown flints, such as those found in abundance at Michilimackinac? The very fact that these distinctive spall-type gunflints are not to be found at Fort Frederica indicates that they are the French gunspall, and that the gunspalls shipped to Frederica were made in England. It follows that the heterogeneous spall-type gunflints at Michilimackinac may also be of English origin.

ACKNOWLEDGMENTS

James W. Stoutamire, Director of the Southeast Conservation Archeology Center, Tallahassee, furnished the Fort Frederica gunflints for this study and Donald Heldman, Chief Archeologist at Michilimackinac, those from that site.

In the initial stages of this study George R. Fischer acted as my sponsor to Dr. Stoutamire.
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THE GEOLOGY OF GUN SPALLS

By K. O. Emery

INTRODUCTION

During 1978, T. M. Hamilton asked me to attempt to distinguish between gun spalls of French and English origin collected from the 18th century Fort Michilimackinac (northern Michigan). The French ones were left during French occupation between 1717 and 1763, terminating at the end of the French and Indian Wars in the United States and Canada. English gun spalls were left at Fort Michilimackinac between 1763 and 1781; for comparison, other gun spalls were provided from the exclusively English occupation of Fort Frederica (St. Simon Island, Georgia) between 1736 and 1749. Gun spalls preceded the production of blade-like flakes, and their plano-convex shape is the natural result of hammer blows on flint that tends to have conchoidal fractures.

Identification of the flints used for French in distinction to English gun spalls requires that there be some lithological differences between the flints from France and those from England in spite of their being the same age: Late Cretaceous—a time of widespread shallow seas in Europe 100 to 65 m.y. ago. A complicating factor is a chance that some of the English gun spalls were reused French ones and that one or both nations may have made or purchased gun spalls from flint that was mined in the other country. Nevertheless, 12 gun spalls from Fort Michilimackinac had been attributed archeologically to the French, 6 others from Fort Michilimackinac to the English, and 5 from Fort Frederica are English in origin. These three groups were selected by Mr. Hamilton as being most typical of many hundreds of specimens that were available.

ENVIRONMENT OF DEPOSITION

The Late Cretaceous sea of western Europe occupied a broad region mostly distant from the shores that were so low that they supplied little detrital sediment (Fig. 1). Predominant beneath the sea were beds of white chalk and limestone that contained thin nodular layers of flint (dark chert). Some beds of shale were present especially near France, but only the purest chalk contained the flint beds. After deposition of the sediments and during the subsequent 65 m.y., the region was slightly uplifted, warped, and eroded so that the upturned edges of the chalks were removed, leaving residual concentration of flint nodules that were discovered early and used by man as tools, weapons, and fire makers. As the use of flint increased, even early man began to mine the flint layers, first, at outcrops, and later, from drifts and shafts that he dug (Bosch 1979).
FIGURE 1: Distribution of flint-bearing Upper Cretaceous strata in Western Europe (closely-spaced hatching) and original distribution of deposits (wide dashed hatching). Some of original deposits have been buried beneath thick later sediments and some have been removed by erosion. Data are from Brinkmann (1960), von Gaertner and Walther (1973), Pegrum et al. (1975), and Ziegler (1975). Dots indicate some of the English areas where gun spalls were produced according to T. M. Hamilton (from north to south; St. Albans, Erith, Swanscombe, Northfleet, and Salisbury); French production centers are unrecorded.
With the introduction of firearms during the 16th century, the flints served as igniters for flintlocks and other guns that were carried by European armies from the middle of the 17th century until the middle of the 19th century. Thus the gun spalls and gun flints are to be found wherever Europeans traveled and traded during more than two centuries of world exploration and colonization.

The very presence of bedding in outcrops indicates that vertical changes in rock succession due to changes in relative volumes and kinds of source materials can be greater than those to be expected laterally over long distances. Even in beds of flint, one can observe vertical changes in hardness, color, and composition, so that there was bias by the choice of the miners for the best flint for gun spall making and by the quantity of the best flint that was available locally.

Flints like those from which the gun spalls were made have long been studied in Europe and America because their origins are somewhat enigmatic. Evidence is overwhelmingly in favor of deposition of the flint beds or nodules contemporaneously or penecontemporaneously with deposition of their enclosing limestones. However, the evidence is less clear about whether the flints were mainly deposited as primary silica gels (Tarr 1917; Taliaferro 1934), or as replacements of calcium carbonate grains by silica deposited from interstitial or overlying waters (Sollas 1880: 449; Van Tuyl 1918; Cayeux 1929). Arguments and data for these questions and for others about the origin of the silica were marshaled by Twenhofel (1932: 534-546), Pettijohn (1957: 435-444), Carozzi (1972: 315-324), and others. Many of the uncertainties come about from obscure details caused by progressive crystallization of the amorphous silica (opal) to chalcedony and then to quartz with the passage of tens of millions of years. Perhaps we have reached the point of diminishing returns from geological and mineralogical studies, and now must rely upon new studies from scanning and transmission electron microscopy and other physical measurements, and from several new geochemical approaches all mainly associated with the Deep Sea Drilling Project (Aubry 1972; Calvert 1974; Heath 1973; Hurd et al., in press; von Rad and Rosch 1974; Wise and Weaver 1974).

CHEMICAL COMPOSITION

The flint nodules or beds from which the gun spalls were made consist mainly of quartz and some calcite, both drawn from overlying waters. Trace elements can be expected only within detrital clays, and these clays are themselves only minute constituents of the flints. Trace elements do serve as "finger prints" for obsidians, because obsidians are highly varied in composition, being quickly-cooled glasses that would have developed into different kinds of igneous rocks if they had been allowed by nature to cool very slowly. Thus the geochemical properties of flints are far more homogeneous than obsidians and other igneous rocks. Obviously, if the French and English gun spalls are to be distinguished, the distinction will have to be on mechanical rather than chemical composition.
HAND SPECIMENS

Colors of the French gun spalls range from brown to yellow-brown to gray (Table 1), with some of the brown ones being honey-colored and translucent. The English ones range from gray to yellow-gray to dark gray. The colors appear to be due to trace impurities, with darkness caused by finely divided organic matter in a reduced state; in fact, many black flints have a fetid odor when freshly broken. Banding (gray to brown or shades or gray) is present on about one-third of the gun spalls, testifying to sudden changes in depositional conditions. Flecks of lighter color occur on nearly all of the French and most of the English gun spalls, usually being slightly less evident at the surface than in the interior. Clearly, the ratios of color, banding, and flecks can be obtained more precisely from the many hundreds of gun spalls in the source collections than in the mere 23 of the present study group.

THIN-SECTIONS

Thin-sections are slices cut from rocks and ground smooth to a thickness of only 0.03 mm (0.001 inch). In this form the rock is transparent, and its component minerals can be identified by their many optical properties through use of a petrographic microscope. This kind of microscope has two filters that polarize light at right angles to each other, one filter beneath the thin-section and one above it.

Each of the 23 gun spalls was cut along its major plane using a diamond saw, and one of the halves was polished, cemented with epoxy onto a glass slide, and ground to proper thickness on a lapidary wheel using a fine abrasive. The final thin-sections have areas of about 2x3 cm. Examination with a petrographic microscope at magnifications of 50 to 300 times served to identify the minerals and to determine their relations to each other. The thin-sections possess certain characteristics in common. Among them are the same flecks that are evident in hand specimens; in thin-section, they appear to be fecal pellets (Fig. 2-1) that contain concentrations of particles which are less densely distributed outside the flecks. These flecks, or fecal pellets, are more visible in thin-section than in hand specimen, because most are too small to be seen easily with the unaided eye. Also present in all thin-sections are many lath-shaped series of interlocking quartz crystals commonly 0.02 to 0.06 mm wide and 0.05 to 0.50 mm long (Fig. 2-2). Cross-sections of the laths are disk shaped. These are sponge spicules whose original opal composition has altered to quartz, in the process blurring the outline of the spicules and obliterating an axial hole. The spicules are the dominant organic remains in the flints.

Most of the area of each thin-section consists of quartz matrix that is finer grained than the quartz of the spicules. This matrix averages 48% of total area for the French gun spalls and 60% for the English ones. Most quartz grains in the flint matrix are believed to be primary
FIGURE 2: Photographs of thin-sections of flints from gun spalls: 1.) Fleck, of fecal pellet, in French gun spall from Fort Michilimackinac--#4464; 2.) Quartz-replaced opal sponge spicules. Longitudinal sections of spicules appear as laths, cross-sections as disks. This is from English spall at Fort Frederica--#5706, but spicules occur in every thin-section; 3.) Linonite-filled biserial pelagic foraminiferal test (Heterohelicid) in French spall from Fort Michilimackinac--#2261; 4.) Quartz-replaced walls and quartz-filled globular pelagic foraminiferal test (Hedbergellid in English spall from Fort Frederica--#6463. Careful examination reveals ghosts of several other globular foraminifers in the photographs; 5.) Cross-section of bryozoan fossil in French spall from Fort Michilimackinac--#248; 6.) Linear sections of bryozoan fossil in French spall from Fort Michilimackinac--#2093. In right-hand half of the photograph is a nearly circular cross-section of another bryozoan. Note finer-grained matrix in English spalls (2 and 4) than in French ones (1, 3, 5, and 6). Scale bar represents 0.1 mm on thin-section photographs.
<table>
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<th>Original Archeological Attribution</th>
<th>Specimen Number</th>
<th>Color</th>
<th>Banding</th>
<th>Flecks</th>
<th>Thin-Section</th>
<th>Matrix</th>
<th>Inoceramus (Mollusk)</th>
<th>Number Bryozoans</th>
<th>Number Foraminifera</th>
<th>Number Fecal Pellets</th>
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<td>P</td>
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**TABLE 1**

Characteristics of Gun Spalls

<table>
<thead>
<tr>
<th>Hand Specimen</th>
<th>Thin-Section</th>
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<tr>
<td></td>
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<td>ENGLISH</td>
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trans. = translucent
int.  = intermediate
op.   = opaque
C     = coarse-grained
F     = fine-grained
O     = absent
trs.  = trace
P     = present
in origin and deposited as opal from silica gel of overlying water or silica-rich solutions in interstitial waters. These amorphous (non-crystalline) minerals first filled the interstices between previous grains, and then in a secondary mode opal gradually replaced nearly all of the original grains of calcium carbonate themselves. During subsequent millions of years, the opal slowly crystallized into chalcedony and then into quartz, whose grains are small in the matrix, larger in replaced shell debris, and still larger in cavity fillings. Some calcite remains unreplaced particularly in the gun spalls of English origin, where it is typical for shells of mollusks especially those of *Inoceramus* with its characteristic prismatic layering.

As a whole, the thin-section analyses indicate that the flint consists of about 99% SiO₂, 0-1% CaCO₃, and 1-0% organic matter. Clay minerals may be present, but if so they are too small and too rare to measure optically.

There are some interesting aspects of the thin-sections that may allow one to distinguish gun spalls of French origin from those of English origin. The matrix of the thin-sections of French gun spalls is much coarser grained than 9 or the 11 gun spalls that originally were assigned to English origin (averaging larger than about 0.02 mm for the French and finer than 0.01 mm for the English flints--Table 1, Fig. 2). This difference is attributed to the replacement of finer-grained calcite in English than in French proto-flint sediments. Paralleling this difference is the much greater abundance of thin-walled foraminiferal tests in the fine-grained matrix of the English flints (Table 1). Most tests are about 0.4 mm in diameter with walls about 0.01 mm thick. Virtually all of the walls of these foraminiferal tests in English flints are replaced by quartz; whereas many of those in the French ones remain as calcite or are partly altered only to chalcedony. The quartz of most walls is bordered on one side by fine-grained quartz of matrix and on the other by coarser quartz that fills the inner cavity. This makes foraminiferal tests in the English flints (Fig. 2-3) difficult to recognize without polarized light and a rotatable stage on the petrographic microscope. Foraminiferal tests in the French flints are even more obscure, because they were largely destroyed by growth of the coarse-grained quartz in the matrix. A few tests are filled with an opaque mineral—probably limonite (Fig. 2-3). Dominant are tests of pelagic globigerinids (chiefly Hedbergellids—Fig. 2-4) and biserial heterohelicids (Fig. 2-3). Both French and English flints contain some additional benthic biserial and uniserial foraminiferal tests having thicker test walls than the pelagic ones. Included are specimens of lenticulinids (nodosariids).

An even more striking difference between the French and English flints is the presence of pieces of bryozoans, a somewhat plant-shaped animal in the thin-sections of French flints (Figs. 2-5, 2-6). Some sections are longitudinal and elongate, and others are transverse and more or less circular. The cells range up to about 0.06 mm in diameter and are arranged lengthwise in adjacent serial rows and radially in transverse sections. The original calcite structure has been replaced by chalcedony and quartz, but some resistant original organic matter of the animal remains as brownish amorphous masses. The bryozoan fragments are rare and much smaller in the English flints, occurring largely as fibrous debris too small to reveal
cells. In contrast, thin-sections especially of English flints contain broken pieces of several mollusks and echinoids too fragmented for definite identification. Also present mainly in the English flints, though of minor utility because of rarity, are broken siliceous skeletons of animals and plants (radiolarians and diatoms). The various animals and plants seen in the flints are the same kinds that have been found and carefully studied in the enclosing beds of chalk in France (Aubry 1972, 1976).

CONCLUSIONS

The thin-sections of gun spalls can be classed in two groups (Table 1). One group has coarse-grained matrix, many cellular bryozoan remains, very little calcite, and few foraminiferans; the other has finer-grained matrix, some comminuted debris of bryozoans, more calcite, particularly from mollusk shells, some foraminiferal tests, and many foraminiferans, especially thin-walled pelagic species. The first group of flints is considered Santonian in age (82-78 m.y.), and the second group Campanian (78 to 70 m.y.), with dates in years according to van Hinte (1976).

The Santonian was a time of somewhat shallower seas than the Campanian (about 50 m shallower, Aubry 1972). Thus more land was exposed and a higher percentage of the sea area was shoals surrounding the land. Santonian flints should be expected to contain coarser matrix, higher percentages of shoal-preferring bryozoans, and lower percentages of depth-preferring Inoceramus mollusks and pelagic foraminiferans. Moreover, the shallow Santonian sea should have been more subject to wave and current action that would have tended to winnow away the finer calcium carbonate grains of the matrix and cause them to become concentrated in deeper water perhaps outside the areas of investigation. Superimposed upon the general difference in average depths of Santonian and Campanian seas were local differences in depths near shore and far from shore in both seas. Reference to Figure 1 shows that deeper water (farther from shore) is more to be expected in the area of England than of France.

Belonging to the Santonian flints are all the gun spalls from Fort Michilimackinac attributed archeologically to the French, and two (#2111 and #3314) of the six gun spalls from Fort Michilimackinac assignable to the English. Belonging to the Campanian group are the four other gun spalls from Fort Michilimackinac attributed archeologically to the English and all those from Fort Frederica. If only two of the so-called English gun spalls from Fort Michilimackinac are French rather than English gun spalls, we may have a reliable method of determining national origins of French and English gun spalls. As the English occupied Fort Michilimackinac after the French, they could have used some gun spalls abandoned or discarded by the French occupiers.*

*Flint Nos. 2111 and 3314, identified by Dr. Emery as French origin, were found in British contexts. This does not nullify our thesis because a majority of the population at Michilimackinac remained French after the British occupation in 1763, and many of the flints of presumed French origin are found in the British areas. On the other hand, no gun spall of presumed English origin has been found so far in French contexts laid down before the British takeover.
On the other hand, flints of both Santonian and Campanian ages crop out in both France and England, but evidently the Santonian flints were more accessible or preferred in the regions of France where gun spalls were made; Campanian flints, in the region of England. This difference in use of source materials in the two countries may restrict the accuracy to identify the source for gun spalls by age of flint stock, but it is a potential basis for identification pending study of larger collections of gun spalls whose source is known, preferably supplemented with flints from outcrops in both countries. For the time being, the petrographic analysis is a tool to be used for such archeological purposes, but with some caution.

ACKNOWLEDGMENTS

Appreciation is due Maria-Pierre Aubry for advice about the Upper Cretaceous chalks of France and their organic constituents, and to W. A. Berggren for identification of foraminiferal tests. They, and D. Milliman, who kindly reviewed the manuscript, are staff members of the Woods Hole Oceanographic Institution. Finally, without the persuasion of T. M. Hamilton, this study would not have been undertaken.
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