THE MATTASSEE LAKE SITES

Archeological Investigations Along the Lower Santee River in the Coastal Plain of South Carolina

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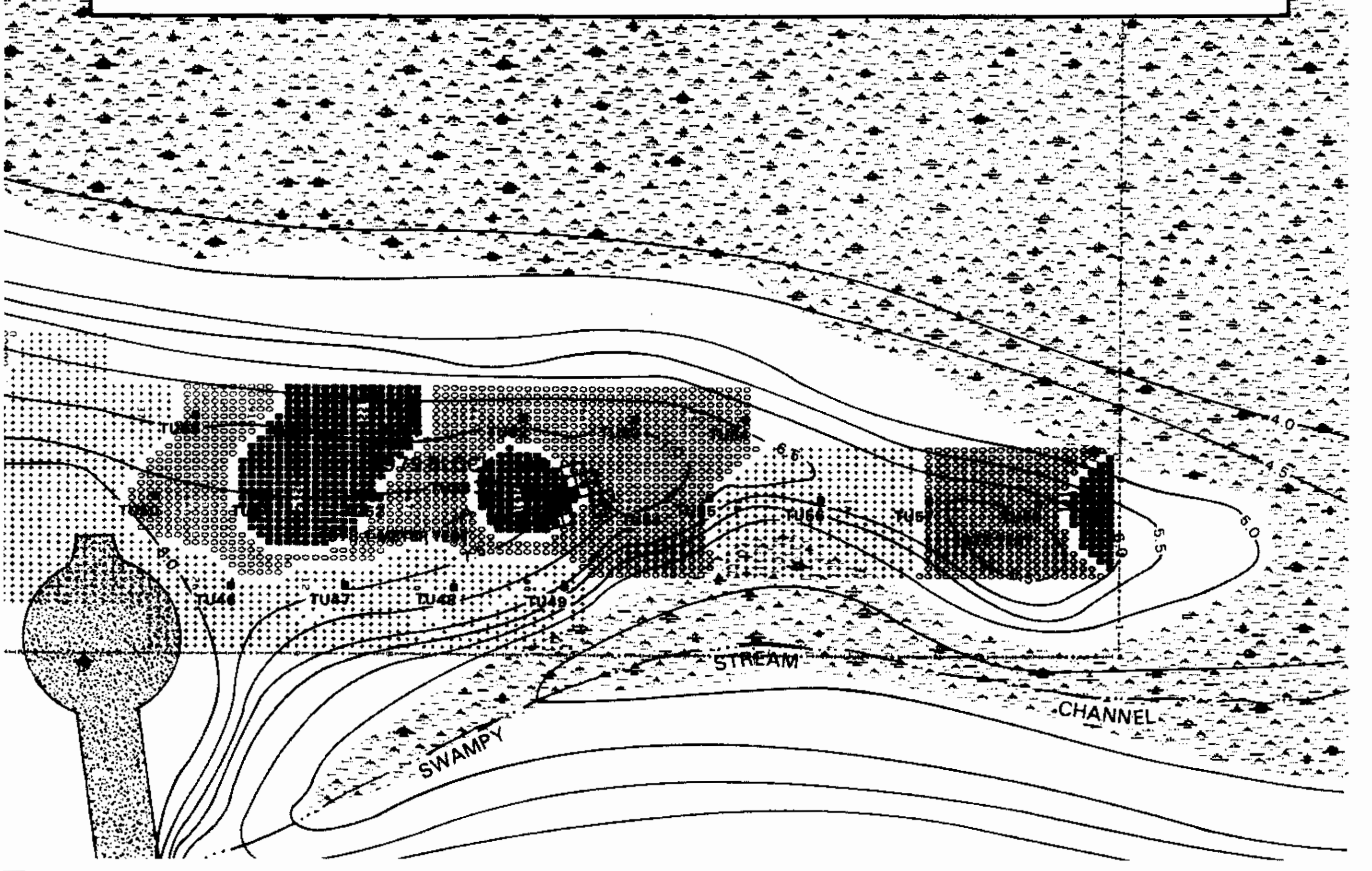

COMMONWEALTH ASSOCIATES INC.

THE MATTASSEE LAKE SITES: ARCHEOLOGICAL INVESTIGATIONS ALONG THE LOWER SANTEE RIVER IN THE COASTAL PLAIN OF SOUTH CAROLINA

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CHAPTER 6

LABORATORY ANALYSIS PROCEDURES

INTRODUCTION

In this chapter three aspects of the Mattassee Lake project analysis are examined in depth. These topics are: (1) assemblage processing, cataloging, and curation procedures; (2) criteria for the identification of lithic raw materials, and (3) specific taxonomic (monothetic subdivisive clustering) procedures used to examine the hafted bifaces and ceramics. Each area is directly subsumed under major goals advanced in the project research design: effective assemblage documentation, lithic raw material source areas and procurement patterns, and the evaluation of existing taxonomies (Chapter 4). The analytical procedures discussed in this section are general in nature, and provide a background framework to the more specific artifact or category-oriented analyses reported in succeeding chapters. They are also important enough, and of sufficient complexity, to warrant separate treatment. The thin section descriptions reported here were prepared by Dr. Gerald R. Baum of the College of Charleston, while the discussion on numerical taxonomy was written by William A. Lovis and Randolph E. Donahue of Michigan State University.

LABORATORY AND CURATORIAL PROCEDURES EMPLOYED AT MATTASSEE LAKE

Over the last decade, members of the Council for Museum Anthropology along with other interested individuals have advocated the need for careful curation of archeological assemblages. Two recent studies, by Ford and Lindsay (1979), Williams-Dean and Haas (1979), have focused on the condition of anthropological collections and records in institutions today. Several other authors have stressed the need for the long-term care and management of archeological assemblages and documents, and have offered methods for achieving this goal (e.g., Butler 1979; Ford 1980; Novick 1980; Wilcox 1980). Curation guidelines used by several archeological repositories, including the University of Kentucky Museum and the Arkansas Archeological Survey, were recently published by the Council for Museum Anthropology, Cambridge, Massachusetts. A recent trend that appears to be spreading, involves charging fees for access to or storage of research collections. Some institutions routinely levy fees to individuals and organizations who wish to gain access to archeological records and/or to deposit archeological collections for long-term storage. These examples indicate that the profession is becoming increasingly aware of the value of research collections, and the need for their effective management. The laboratory and curatorial procedures used during the Mattassee Lake project were implemented with this perspective in mind. A primary goal of the Mattassee Lake investigations, noted in the Research Design (Chapter 4), was to effectively inventory and document the assemblages and analyses used during the project. This responsibility was additionally clearly stated in the project contract, where provisions were included for the cataloging and temporary storage of the assemblage, prior to permanent curation. All of these thoughts guided the Mattassee lake documentation/analysis/curation effort.

THE 1979 FIELD LABORATORY

As noted previously, a fully operational field lab was maintained during both the testing and subsequent excavation seasons in 1979. During the testing program, in March and early April, the field lab was maintained at the Corps of Engineers headquarters maintenance building in St. Stephens. All three projects used this area during the testing program, through the courtesy of the local Corps of Engineers staff. During the subsequent mitigation stage excavations the Corps building was too cramped, and each project made other laboratory accommodations. To process the Mattassee Lake assemblage, a room was rented in a local warehouse, which was used for bulk sorting and processing, and for storage. Final cataloging and analysis during the excavation season was done at the crew's quarters, a house in St. Stephens.

As artifacts were uncovered in the field, they were stored in "zip-lock" plastic bags accompanied by a yellow 3x5 inch file card labeled with the field provenience number and other relevant locational information (e.g., site number, unit number, level, date, and excavator's name). All materials recovered in the screen were initially bagged together. Specimens that were piece-plotted (mapped in three dimensions within the unit level) were bagged individually with an identifying label, or were marked in the field with a number or letter using a Sanford Sharpie permanent marker. This symbol written on the artifact itself, corresponded with an exact location on the field map. The general level fill and piece-plot bags were returned to the field lab each night, where they were stored for eventual washing and sorting. The bulk of the assemblage was washed in the parking area of the local Army Corps of Engineers Office in St. Stephens, South Carolina. The Institute of Archeology and Anthropology Cooper River Rediversion Canal project used the Corps headquarters area as a lab, and graciously shared their washing equipment, which consisted of screens set in a large holding tank. Artifacts were emptied into the screens and then hosed down and scrubbed. Clean artifacts were removed from the screens, placed on styrofoam meat trays, along with their provenience cards, and set in the sun to dry. Mud from the washing activity was released from the holding tank after each bag load, and passed through a screen to collect material that might have fallen or floated out of the washing screen. When dry, the artifacts were placed in clean "zip-lock" bags with their original provenience cards.

The washing operations at the Corps headquarters focused on the general level fill. Piece-plotted artifacts were washed separately, at the lab set up in the crew house. Each day as artifacts were brought in from the field they were sorted. The general level bags were dropped off at the Corps headquarters where they were (temporarily) stored prior to washing. The piece-plot bags were taken to the crew house/lab, where they were washed and cataloged. At this lab the plotted artifacts were removed from their bags and placed in alphabetical or numerical order on paper, and were then washed individually. Since the washing occasionally removed the field markings, the artifacts were cataloged as soon as they were dry, to prevent information loss. Both the piece-plotted and the general level artifacts were ultimately stored in boxes, by provenience, by the end of the fieldwork.

After the artifacts from the general level fill were dry, they were also sorted and cataloged. A coding sheet was used (Figure 52), to serve the dual role of a catalog form and a preliminary analysis record. The general level fill was emptied onto a table surface for sorting and cataloging. Each major artifact category was bagged separately, using plastic "zip-lock" bags. All immediately recognizable tools were set aside to be cataloged with an individual number. Debitage was sorted by lithic raw material type, counted, and bagged, as was all pottery. Weights and/or counts were recorded for fired clay, ferruginous sandstone, bone, baked clay objects, steatite and charcoal. Unmodified rock and gravel was also sorted, weighed and bagged. This was by far the most common material recovered (and the most time consuming to sort through); almost 1000 kilograms of rock were found in the 1979 excavation units.

THE CATALOGING SYSTEM

Artifacts were cataloged according to the system used at the University of South Carolina's Institute of Archeology and Anthropology (IAA). Two major reasons prompted the selection of this system. First, it was assumed that the artifacts would be stored at the IAA, where the initial Rediversion Canal collections were maintained. Second, the authors and most of the crew members had worked at the IAA, and were familiar with this system. This familiarity helped avoid mistakes during both the fieldwork and the subsequent analyses. It should be stressed that for consistency only a select number of individuals actually cataloged the assemblage.

COOPER RIVER REDIVERSION CANAL PROJECT
COMMONWEALTH ASSOCIATES INC.
THREE PREHISTORIC SITES

LABORATORY CATALOG/ANALYSIS SHEET
1979 TESTING AND MITIGATIONS

TENTATIVE AGE OF PROV. ________

SITE ________
UNIT ________
LV/F ________
PROV. # ________
RECR. ____/____

LITHICS	DEBITAGE		TOOLS		POINTS	
QUARTZITE	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
CHERT	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
QUARTZ	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
RHYOLITE	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
O ____	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
O ____	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____
O ____	N= ____	Cat # ____	N= ____	Cat # ____	N= ____	Cat # ____

POTTERY N= ____ Cat # ____

THOM'S CREEK PUNCTATE	N= ____	PLAIN (SAND)	N= ____
REFUGE DENTATE STAMPED	N= ____	PLAIN (FIBER)	N= ____
DEPTFORD LIN. CHECK ST	N= ____	BURNISHED PLAIN	N= ____
CAPE FEAR CORD MARKED	N= ____	SIMPLE STAMPED	N= ____
CAPE FEAR FABRIC IMP	N= ____	BRUSHED	N= ____
HANOVER CORD MARKED	N= ____	O ____	N= ____
HANOVER FABRIC IMP	N= ____	O ____	N= ____
COMPLICATED STAMPED	N= ____	NONDIAGNOSTIC	N= ____

OTHER ARTIFACTS

FIRED CLAY WT= ____grams Cat. # ____
FERRGNS SS WT= ____grams Cat # ____
BONE N= ____ WT= ____grams Cat # ____
BAKED CLAY OBJECTS N= ____ WT= ____grams Cat # ____
FIRE CRACKED ROCK N= ____ WT= ____grams Cat # ____
STEATITE N= ____ WT= ____grams Cat # ____
CHARCOAL WT= ____grams Cat # ____
UNMODIFIED GRAVEL/ROCK N= ____ WT= ____ Cat # ____
O ____ ____ Cat # ____
O ____ ____ Cat # ____
O ____ ____ Cat # ____
O ____ ____ Cat # ____

COMMENTS:

FIGURE 52
THE FIELD CATALOG/ANALYSIS SHEET
USED DURING THE 1979 EXCAVATING

All of the project personnel, however, were involved in the initial washing and sorting activities, at one time or another, together with the YCC students provided by the U.S. Forest Service. Whenever preliminary sorts were made by untrained volunteers or by the YCC students, their work was checked by permanent project personnel before being bagged. The preliminary sorting procedure greatly facilitated the actual cataloging process, giving project personnel more time to both catalog and actually analyze the artifacts in the field.

A short summary of the IAA cataloging system is presented below. Using this system, it is possible for archeologists to correlate catalog numbers with actual field locations in a way that is more readily interpretable than systems using only a museum accession number. Although both systems have advantages and disadvantages depending on what they are used for, this particular system works well with archeological assemblages.

Each catalog number has three components. For example the catalog number 38BK226-102D-2, is interpreted as the site number, followed by the provenience number (which corresponds to an excavation unit), followed by the artifact catalog number. Before any cataloging began, provenience numbers were assigned to all excavation units and features. The first provenience numbers for the three project sites had been assigned in 1978, to material recovered during the 1977 intensive survey by IAA personnel (Brockington 1980). This initial cataloging was conducted by Claudia Wolfe under the supervision of A. Lee Novick who was, at the time, the lab director at the Institute. A second set of consecutive provenience numbers was established by A. Lee Novick during the March-April 1979 testing program. During the subsequent mitigation stage excavations from May through August, 1979, excavation units were assigned a third set of consecutive provenience numbers correlating with all units, levels, and features. A listing of all proveniences and catalog numbers employed during each season of work at Mattassee Lake is provided in the Data Appendix Volume. A provenience number has two components: a number followed by a letter. In the example, 38BK226-102D-2, 102 represents an excavation unit (in this case EU20), and the letter D signifies the fourth level in the excavation unit, 15-20 centimeters below the surface. All letters correspond to stratigraphic zones or arbitrary levels beginning at the surface with an A and proceeding with depth B,C,D, etc. In this way, examining an individual artifact, without field notes, it is possible to ascertain its relative depth. Although the number 102 may seem rather high for Excavation Unit 20, it is important to remember that IAA personnel excavated a number of test pits at the site in 1977 and that the spring 1979 testing program included the excavation of 64 test units. All of these units were assigned provenience numbers prior to the summer 1979 excavations, when EU20 was dug.

During the cataloging process, efforts were made to catalog chipped stone tools first. Individual catalog numbers were used for each tool, which were described on the recording sheet using one of several preliminary categories (i.e., projectile points, bifaces), unifaces, and cores). Following IAA procedures, a toluene solution of DuPont acrolid B72 was brushed onto the artifact with a small artist's paint brush. From a conservator's standpoint this is a preferable procedure because the catalog number can be removed by rubbing with pure toluene without damaging the artifact. Because the lithic material in the Mattassee Lake assemblage was so irregular (rough), this coating made a smooth writing surface that ink would not penetrate, facilitating the actual numbering and protecting the artifact. A quill tip pen and Faber-Castell Higgins black, waterproof india ink were used to catalog light colored artifacts. Although some catalogers brush a small spot of white, typing correction fluid (e.g., Liquid Paper, White-out) or white paint on a dark colored artifact to serve as the base for a black ink catalog number, this base coat often cracks and peels off, resulting in the loss of an artifact's identification. Cataloging with white ink applied directly onto dark colored artifacts is preferable from a perspective emphasizing both long-term storage and safety in future analysis. Because it blends more easily than some ink and remains in a suspended mixture longer, Speedball waterproof, white drawing ink was selected for cataloging dark artifacts. Steatite fragments, baked clay objects, abraders, and other unusual artifacts were also cataloged with individual numbers. Categories with extensive quantities of artifacts, such as debitage, pottery, fired clay, ferruginous sandstone, bone, fire cracked rock, charcoal, and unmodified rock and gravel were assigned lot numbers. That is, one catalog number was assigned to all the artifacts of a given category, for example, to all the pieces of debitage made from one type of lithic material. These lots of artifacts were stored in "zip-lock" plastic bags with the catalog number written on the outside of the plastic bag with a permanent marker.

As noted above, piece-plotted artifacts were treated separately. These artifacts were taken out of their field bags and laid out in alphabetical or numerical order. In many instances piece-plotted artifacts were listed on the field provenience cards, in other cases field notes were checked. A listing of piece-plotted artifacts was made on the back of the catalog/analysis sheet. This information included the original field number, an assigned catalog number, and a description of the artifact. An outline of unusual projectile points was also drawn at this time. Artifacts were washed individually and then replaced in order. When dry these were cataloged in the usual manner. Piece-plotted artifacts, rather than being stored with similar tools or ceramics, from the unit level or feature bag, were kept together in a separately marked piece-plot bag.

THE USE OF RESEALABLE PLASTIC BAGS

During the course of the project a number of individuals inquired about the cost and rationale for using sealable ("zip-lock") plastic bags. The storage of artifacts in plastic bags, particularly .004 mil "zip-lock" sealed bags, may seem extravagant to some; however, they offer a number of advantages. Years ago all institutions and archeologists used brown paper bags to collect and store artifacts. Since field notes were often written on the field bag, the system was maintained and is almost an institution in some areas. Unfortunately, paper bags tend to mold and mildew in damp storage conditions, or fall apart when wet. The growth of mold or bacteria can be a serious problem in some collections, particularly those with bone, cloth, friable ceramics, or ethnobotanical remains present. Paper bags also conceal artifacts and must be continually opened and closed. Perhaps the worst danger with paper bag storage is insect or rodent infestation. Unless the storage area is air tight and can be fumigated it is virtually impossible to kill these pests. Open (i.e., with no closure) plastic bags offer several advantages over paper bags, but still have problems. Artifacts stored in clear envelopestyle bags are visible, not susceptible to infestation, and protected, to some degree, from moisture. A major disadvantage with plastic bags lacking built-in closures is the need to seal the bags with tape or staples, which are both impermanent and damaging. Gummed tape will dry and fall from the bags (or conversely sometimes stick too well and tear the bag on removal), while staples will rip the bags as they are pulled out. The "zip-lock" top plastic bags offer the same advantages, without the disadvantages. One point to be made about both types of plastic bags is that if artifacts are damp, the bag should not be sealed until the contents are thoroughly dry, otherwise the moisture will cause mold and mildew to grow on paper labels in the bags, as well as on the contents.

As might be expected, there is a direct correlation between storage cost and storage quality. Labor costs are also something to consider. At some collection repositories all artifacts are cataloged; in large scale excavations, however, the costs of cataloging every flake or sherd is prohibitive (and given the volume of material, somewhat absurd). Prices of both paper and plastic bags vary by supplier, quantity ordered, shipping/freight cost, and cash discount. For example, at paper suppliers near Jackson, Michigan, prices for small 6x8 inch brown paper bags are about $10/1000 while .004 mil "zip-lock" plastic bags the same size cost $50/1000 (1981 prices). While the greatest savings would appear to come from using paper bags, the long-term "hidden" costs may make them actually more expensive. When paper bags are used in the field provenience information is typically written on them, sometimes in prestamped recording blocks. Unless care is taken (i.e., permanent ink, dry field storage conditions), however, the provenience information may be lost if rain occurs. Damp bags may break and mix proveniences, another "expensive" loss (given field recovery costs). Even under the best of conditions paper bags suffer some attrition, and after laboratory washing and sorting many must be replaced outright. The provenience information must be cut from the old bag and transferred (or copied), a time consuming task that can also result in expensive information loss. Finally, if the bags are opened repeatedly while in storage, more replacements may be necessary. Finally, the storage environment itself must be fairly rigidly controlled, to prevent deterioration of the bags. In this light, paper bags are probably at least as "expensive" as plastic bags, and a potential source of considerably more trouble.

In contrast, plastic bags are tough and durable, and have tremendously long use lives. They can be washed and reused in both the field and the lab (a common procedure during the Mattassee Lake project), and the provenience data, on a card inside the bag, can be readily transferred yet at the same time is protected from loss or damage. The use of bright, color coded cards, furthermore, minimize errors in both the field and the lab, particularly on large or complex (i.e., multi-site) excavations. In summary, while initially more expensive, resealable plastic bags are actually a cost and information saving innovation.

CRITERIA FOR THE IDENTIFICATION OF LITHIC RAW MATERIALS FOUND AT MATTASSEE LAKE

Lithic artifacts from the excavation assemblage at Mattassee Lake were sorted into 28 raw material categories, established on the basis of macroscopically visible characteristics such as color, texture, and inclusions. The identification and classification of lithic raw materials has been receiving increasing attention in the Southeast Atlantic region in recent years (e.g., Novick 1978; Goad 1979; House and Wogaman 1978; Anderson 1979a; Claggett and Cable 1982), and the terminology selected to describe the Mattassee Lake assemblage was chosen to generally complement, and build upon, earlier investigations. A listing of the lithic raw materials found at Mattassee Lake, and references for formal descriptions of many of these categories, is given in Table 7. In order to continue the development of a standardized terminology, 21 raw material samples from the site assemblage and from local outcrops were submitted for thin sectioning and technical description. The technical analyses and descriptions concentrated on raw materials that had not previously been reported, or reported in detail, in the literature (Table 7). The majority of the specimens were orthoquartzites and cherts thought to be of local origin, from along or near the Santee River basin.

The technical thin section descriptions reported here were prepared by Dr. Gerald R. Baum of the Department of Geology at the College of Charleston, Charleston, South Carolina. Dr. Baum has conducted extensive research on the geological formations of the central Coastal Plain in recent years (Baum 1977; Baum and Powell 1979; Baum et al. 1981; Powell and Baum 1981) including criteria for the identification of specific facies, investigations essential to the determination of potential raw material source areas. Appropriate geological terminology characterizing each thin section is provided, although throughout the report the more concise, non-technical terms for each category, given in Table 7, are used. It should be emphasized that this effort should be viewed as an initial, preliminary study. Ideally, large numbers of samples should be examined for known outcrops, to establish specific faunal lists and other sorting criteria (e.g., Baum et al. 1980). The results reported here are encouraging, however, and should prove a useful guide to future research.

Orthoquartzite

The vast majority of the debitage assemblage at Mattassee Lake consisted of a light brown (5YR6/4) to white material variously described as sandstone (Brockington 1980), quartzite (Anderson, Lee, and

TABLE 7

REFERENCES FOR THE IDENTIFICATION OF LITHIC RAW MATERIALS FOUND AT THE MATTASSEE LAKE SITES

Raw Material	Number of Artifacts	Published General Descriptions^{-1}	Published Thin Section Descriptions^{-1}	Thin Section/ Descriptions in This Report
Orthoquartzite	81,794	1,3	3	X
White Fossil- iferous Chert	2,294	-	-	X
Flow Banded Rhyolite	1,483	1,2,3	2,3	X
Quartz	1,163	1,4,5	-	-
Allendale Chert	677	3,6	3	X
Ferruginous Sandstone	497	3,6	3	-
Porphyritic Rhyolite	214	1	-	-
Tan Fossiliferous Chert	177	-	-	X
Gneiss	130	3	3	-
Green Siltstone	127	-	-	X
Blue Fossil- iferous Chert	95	3	3	X
Quartzite	75	1	-	-
Manchester Chert	61	3	3	X
Argillite	55	1,3,4,5	3	X
Chalky Chert	27	-	-	X
Welded Tuff	27	1,3	3	-
Petrified Wood	16	-	-	*
Unidentified Chert	8	-	-	X
Steatite	8	1,4,5,6	-	X
Igneous/Metamorphic	6	-	-	*
Unidentified	4	-	-	*
Purple Siltstone	3	-	-	*
Crystal Quartz	3	1,5	-	-
Tuff	2	1	-	-
Diorite/Basalt	2	1	-	-
Gray Porphyry	2	-	-	*
Crystal Quartz	2	1	-	-
Brown/Gray Unknown	1	-	-	X

* Description Only

-1 Reference Key

1. Novick 1978
2. Weisenfluh 1978
3. Anderson 1979a
4. House and Wogaman 1978
5. Taylor and Smith 1978
6. Anderson, Lee, and Parler 1979

Parler 1979), or orthoquartzite (House and Wogaman 1978). Thin section analysis of an artifact recovered from a site near the Fall Line indicated that the material (if similar) was a chalcedony cemented quartz arenite (Anderson 1979a:35), probably from either the Upper Cretaceous Black Creek formation or the Paleocene/Eocene Black Mingo Formation, both of which outcrop in the Coastal Plain. Large boulders of the material were observed on the lower slopes of the terrace at Mattassee Lake and this, coupled with the large quantities of debitage and cracked rock in the site deposits, strongly suggested on-site quarry/reduction activity. To examine this possibility, samples of orthoquartzite were collected from the outcrops, and compared with thin sections of artifacts recovered in the excavation units.

Some cautionary remarks are in order before the results of the thin sectioning are presented. Formation identification based upon small fragments which are not in situ is generally difficult for two reasons: repetition of similar lithologies of different ages; and lack of identifiable fauna indicative of age. Many of the artifacts found at Mattassee Lake, however, appear to derive from local outcrops. By examining the lithologies of local formations, therefore, it should be possible to make a reasonable judgement as to the formation and source area of both individual artifacts and raw material categories. Along the middle course of the Santee only two principal formations occur, the Santee Limestone and the Thanetian Black Mingo Formation. In the vicinity of the Rediversion Canal the only lithofacies of the Santee Limestone present are limestones (biosparrudites and biomicrudites). There are no terrigenous (extrabasinal) facies present. The limestones are characterized by a lack of detrital quartz (generally less than two percent by weight). The Thanetian Black Mingo Formation has three lithofacies: a claystone (never present in the Santee Limestone); a quartz arenite (sandstone) (never present in the Santee Limestone); and a limestone. If silicification has not obliterated the original sedimentary textures and allochems, generally the Thanetian Black Mingo Formation limestones and Santee Limestones can be differentiated by the dominant fauna (e.g., Baum et al. 1980). The Black Mingo limestones are dominated by pelecypods; the Santee limestones are dominated by bryozoans.

The larger cobbles on the terrace at Mattassee Lake have been interpreted as lag deposits, materials exposed and eroded from the underlying Black Mingo Formation by the action of the river. After the terrace was cleared in late 1979 access to the outcrops, formerly in densely overgrown hardwoods, was greatly improved. Several collections were made over the terrace in 1980, to gather materials for the lithic reduction/replication experiments (Chapter 7), and to collect outcrop samples for comparative analysis with site artifacts. Drs. Baum and Katuna, project geological consultants, supervised the collection activities. Two orthoquartzite samples, collected from large, in situ boulders, were thin sectioned, the first from the terrace slopes adjacent to the 38BK226 block, and the second from the slopes below the 38BK229 block:

Specimen 1 - Orthoquartzite (outcrop below 38BK226 excavation block)

Megascopic (Visual) Characteristics: Chert cemented quartz arenite (chert cemented sandstone).

Microscopic Characteristics: Fine, subangular, well-sorted quartz with minor amounts of feldspar and heavy minerals; hematite dust rings surround quartz grains; chert and chalcedony occlude interparticle porosity.

Source Area: Thanetian Black Mingo Formation.

Specimen 2 - Orthoquartzite (outcrop below 38BK229 excavation block)

Megascopic (Visual) Characteristics: Chert and chalcedony cemented quartz arenite (chert and chalcedony cemented sandstone).

Microscopic Characteristics: Fine, subangular, well-sorted quartz with minor amounts of feldspar and heavy minerals; chert and chalcedony occlude interparticle porosity.

Source Area: Thanetian Black Mingo Formation.

Both specimens were quite similar in composition. The presence of macroscopically visible chalcedony in the sample from the 38BK229 area, something not observed in the sample from the 38BK226 block area, suggests that the material may have been of better knapping quality. This inference, intuitively noted while collecting knapable material for the replication experiments (see Chapter 7) is additionally supported by the excavation assemblages. A far higher proportional occurrence of orthoquartzite reduction debris was recovered at 38BK229 than in the 38BK226 block, suggesting a greater incidence of quarrying/reduction behavior in that area. These topics are discussed in some detail in Chapter 7.

To check the possibility that some or all of the orthoquartzite artifacts from the Mattassee Lake excavation assemblage could have come from the terrace outcrops, several artifacts were thin sectioned. Specimens were chosen in an effort to accommodate the perceived variability in the material; samples of differing colors, or with unusual (typically chert) inclusions were submitted for analysis. The vast majority of the site orthoquartzite debitage assemblage was either light brown or grayish-white in color; samples of each color were examined for possible differences in composition or source. This was done because the grayish-white material appeared to be slightly better knapping material. No evidence to support this was indicated by the thin sectioning, and all of the specimens were found to be generally similar to one another:

Specimen 3 - Orthoquartzite, tan-colored (interior chunk; 38BK246 EU6 10-20 cm)

Megascopic (Visual) Characteristics: Chert cemented quartz arenite (chert cemented sandstone).

Microscopic Characteristics: Well-sorted, rounded quartz with minor mica and feldspar cemented by chert.

Source Area: Thanetian Black Mingo Formation.

Specimen 4 - Orthoquartzite, tan-colored (interior chunk; 38BK229 EU3 10-20 cm)

Megascopic (Visual) Characteristics: Chert and chalcedony cemented quartz arenite (chert and chalcedony cemented sandstone).

Microscopic Characteristics: Well-sorted, subangular quartz with minor mica and feldspar cemented by chert and chalcedony.

Source Area: Thanetian Black Mingo Formation.

Specimen 5 - Orthoquartzite, white/gray (interior flake; 38BK246 EU6 10-20 cm)

(Characteristics and Source Area the same as Specimen 3).

The tan and white/gray orthoquartzite specimens from 38BK246 were identical in general composition, while only minor differences were apparent in the tan orthoquartzite specimens, which came from separate excavation blocks. All three artifact thin section descriptions are quite similar, furthermore, to the descriptions of the material from the outcrops (Specimens 1 and 2). A few of the orthoquartzite artifacts from the terrace had distinct pockets or bands of chert or fossiliferous inclusions; samples of these were examined to see if potentially different materials or source areas were represented:

Specimen 6 - Orthoquartzite, white/gray; with numerous inclusions of white fossiliferous chert (interior flake; 38BK229 EU16 5-10 cm)

Megascopic (Visual) Characteristics: Chert cemented quartz arenite (chert cemented sandstone).

Microscopic Characteristics: Poorly sorted quartz with minor amounts of bone and pelecypods cemented by chert; pelecypods replaced by chert.

Source Area: Thanetian Black Mingo Formation.

Specimen 7 - Orthoquartzite, tan-colored, with blue chert inclusions (interior flake; 38BK229 EU25 25-30 cm)

Megascopic (Visual) Characteristics: Contact between two lithologies; dense chert/chalcedony cemented quartz arenite (chalcedony cemented sandstone).

Microscopic Characteristics: Sub-angular quartz cemented by chalcedony.

Source Area: Thanetian Black Mingo Formation.

Specimen 8 - Orthoquartzite, tan-colored, with tan chert inclusions (interior flake; 38BK229 EU14 30-35 cm)

Megascopic (Visual) Characteristics: Chalcedony cemented quartz arenite (chalcedony cemented sandstone).

Microscopic Characteristics: Well-sorted quartz and minor heavy minerals cemented by chalcedony.

Source Area: Thanetian Black Mingo Formation.

While there are minor differences in the orthoquartzites characterized by inclusions, all appear to derive from the Black Mingo Formation. Some chert bands or pockets would appear to be present in this formation; recognizable fauna, as expected, were pelecypods (where present). It is not currently known if chert pockets of sufficient size for knapping are present in the orthoquartzite outcrops and strata in the vicinity of Mattassee Lake. Chert quarries are reported from the Black Mingo Formation further up the river, in Sumter County (see the discussion below on Manchester chert), but little evidence for deposits of this magnitude is known locally. One possible outcrop, a collection of highly weathered chert cobbles noted a few miles to the north of the Mattassee Lake sites, was reported by Asreen (1974), but no evidence for quarrying was detected at this site.

The dominant fauna of the Black Mingo Formation are pelecypods, and detailed species lists are available to facilitate specimen identification (e.g., Baum et al. 1980: 25-26). While identifiable remains are more likely in chert deposits, fossils preserved in or with orthoquartzites can help identify this material. This is particularly important in the general South Carolina area, since silicified and/or metamorphosed quartz arenites are known to occur in the Piedmont (e.g., Camp et al. 1962:6). A minor constituent of the Mattassee Lake assemblage, classified as quartzite (N=75 artifacts; Table 7), may, in fact, be of Piedmont origin. This material, characterized by an absence of fossils and a granulated structure, appears to derive from one or a few cobbles; it generally fits Novick's (1978:433) description for quartzite, and is reported here under that category.

Source areas for aboriginally-exploited lithic raw materials in the general South Carolina area are illustrated in Figure 53. On the basis of the thin section/microfaunal analyses, most if not all of the material described in this report as orthoquartzite appears to have originated within the Black Mingo Formation. Potential outcrop areas along the lower Santee and Black Rivers are illustrated in Figure 53; the analyses of the Mattassee Lake assemblages additionally support the inference that at least some of this material could have come from the outcrops directly on the sites.

White Fossiliferous Chert

The second most common lithic raw material found in the 1979 excavation units at Mattassee Lake was a light grayish-white fossiliferous chert (Table 7). Although fossiliferous cherts had previously been reported from along the Santee drainage (e.g., Anderson 1979a; Anderson, Lee, and Parler 1979), none closely resembled this particular material in either color or texture. Cherts from the Buyck's Bluff quarry (38CL17) on the upper Congaree (e.g., Michie 1977,1980) were characterized by unusually large fossiliferous inclusions, while cherts reported from both the Lake Marion area and from along the Wateree in Sumter County had a distinctive bluish hue (Figure 53). Due to its incidence in the excavation assemblage a comparatively local origin was inferred; thin sectioning was conducted in an effort to locate the probable source area:

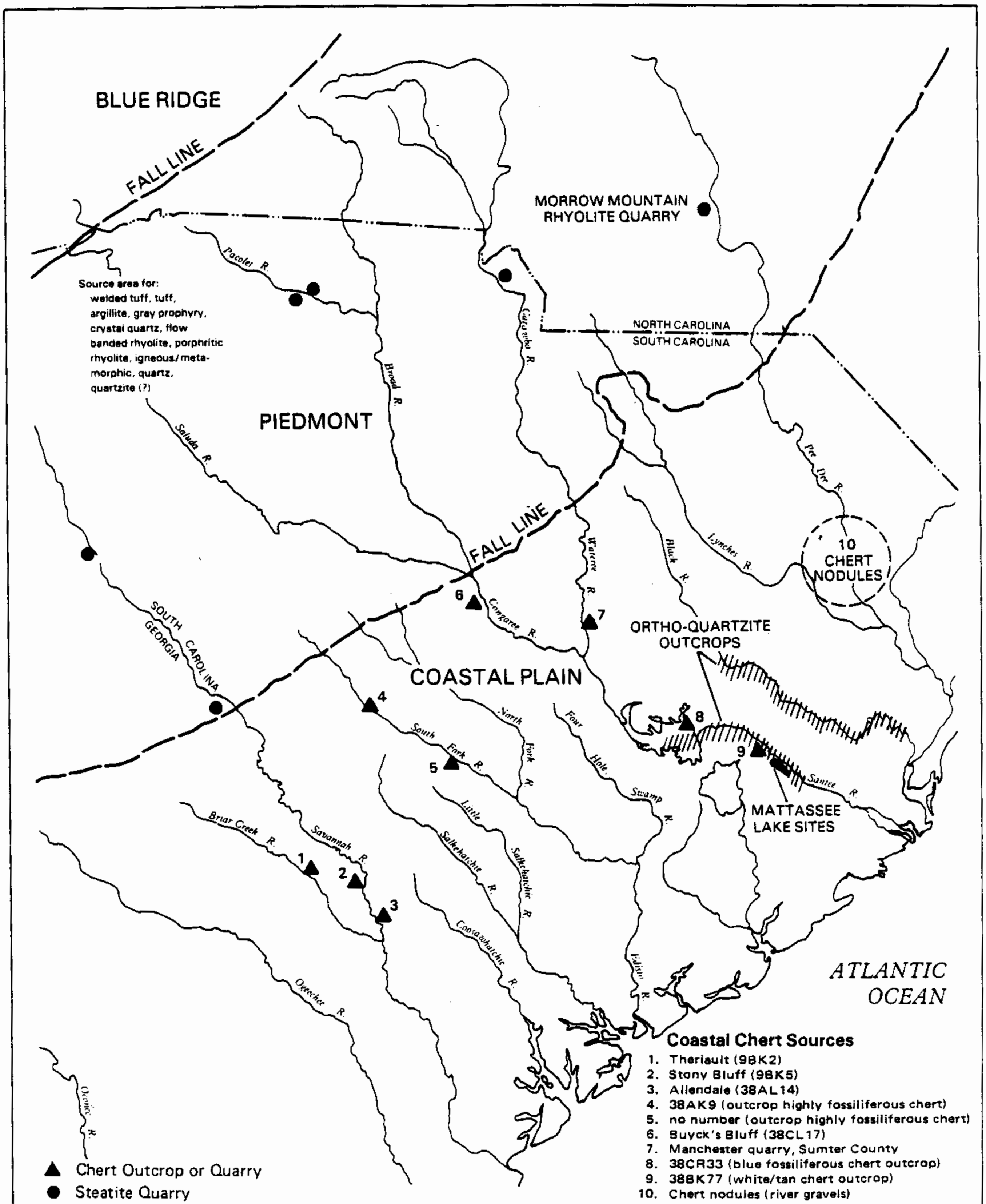
Specimen 9 - White fossiliferous chert (chunk; 38BK226 EU26 40-45 cm)

Megascopic (Visual) Characteristics: Chert replaced biosparrudite (chert replaced limestone).

Microscopic Characteristics: Bryozoans, pelecypods, corals, scaphopods, gastropods and fecal pellets replaced by chert; interparticle porosity occluded by chert.

Source Area: Santee Limestone Formation.

The white fossiliferous chert apparently derives from the Santee Limestone, which outcrops further to the north (upstream) near Lake Marion and to the west on the upper Cooper River drainage (now under Lake Moultrie). No quarry sites are currently known, although it is probable that sources will be encountered given greater survey coverage of the area where the Santee Limestone outcrops.



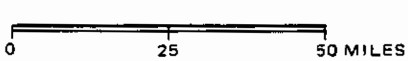


FIGURE 53

LITHIC RAW MATERIAL SOURCES
IN THE SOUTH CAROLINA AREA

MATTASSEE LAKE EXCAVATIONS

U.S. Army Corps of Engineers
Cooper River Rediversion Canal Project

Allendale Chert

The second most common chert in the Mattassee Lake assemblage, slightly lower than the white fossiliferous chert in incidence, was a fine-grained brownish yellow (10YR6/8) to very pale brown (10YR7/4) material described locally as "Allendale Chert" (Table 7). Outcrops of similar material occur on the lower Savannah River, at the Rice Site (38AL14) in Allendale County, South Carolina (Stoltman 1974). Quarrying debris is extensive at these outcrops, and the material dominates site assemblages in the Coastal Plain between the Savannah and Edisto Rivers (Hanson, Most and Anderson 1978; Anderson, Lee, and Parler 1979). Allendale chert is perhaps the highest quality, readily available chert in the general South Carolina area; it certainly was widely preferred, since artifacts of this material have been found throughout the state (e.g., Taylor and Smith 1978; Cable and Cantley 1979; Anderson 1979b; Charles 1981). Although described as "Allendale" chert, the material should perhaps be more correctly called lower Savannah River chert, since at least three major outcrops are reported from this area (Figure 53). Materials from these outcrops are virtually indistinguishable, at least macroscopically, although no technical analyses similar to those reported here have been conducted in an effort to differentiate the sources (cf. Goad 1979).

Thin section descriptions, of both unaltered and thermally altered samples from the Allendale quarry, have been previously reported (Anderson 1979a:31-32). Two samples of Allendale chert from the Mattassee Lake assemblage were thin sectioned, for purposes of comparison with the original analysis, and to see (if possible) whether the material was, indeed, correctly classified:

Specimen 10 - Allendale Chert (interior flake; 38BK226 EU8 25-30 cm)

Megascopic (Visual) Characteristics: Chert and chalcedony replaced(?) biosparrudite (chert and chalcedony replaced limestone).

Microscopic Characteristics: Bryozoans, gastropods, pelecypods and(?) corals replaced by chert.

Source Area: Unknown.

Specimen 11 - Allendale Chert (cortical flake; 38BK226 EU1 20-40 cm)

Megascopic (Visual) Characteristics: Chert replaced(?) biosparrudite (chert replaced limestone).

Microscopic Characteristics: Bryozoans, corals, foraminifera, pelecypods, and echinoids replaced by chert.

Source Area: Possibly Santee Limestone Formation?

The thin section descriptions for both samples are in general agreement with previous descriptions of Allendale chert (cf. Anderson 1979a:31-32). The uncertainty about the source area is encouraging and supports an origin other than along the Santee; when the samples were submitted for descriptive analysis the geologist was not told that an extralocal origin was possible. If the source for Specimen 11 is, indeed, the Santee Limestone, though, than there may be pockets of comparatively high quality chert in this formation which could be confused with the Allendale material. This is considered unlikely, but the results suggest that local fine-grained, light colored cherts should not be arbitrarily categorized as "Allendale" without some recognition of the possibility for error.

Tan Fossiliferous Chert

A comparatively minor constituent of the Mattassee Lake assemblage was a light brown to light yellowish-brown (10YR6/4) fossiliferous chert (Table 7). Except for the color, the material was similar in appearance to the white fossiliferous chert described previously. No quarries of the material are known, although Asreen (1974) reported finding weathered chunks of a whitish-tan chert at 38BK77, a site on the Rediversion Canal route a few miles to the north of Mattassee Lake, on the terrace overlooking the Santee River swamp. During the lithic artifact analysis the tan and white cherts were assumed to be closely associated, possibly reflecting color variation within a single outcrop or deposit. This finding was supported by both the thin section descriptions and by the discovery of several artifacts in the collections with inclusions of both colors.

Specimen 12 - Tan Fossiliferous Chert (interior flake; 38BK226 EU8 15-20 cm)

Megascopic (Visual) Characteristics: Chert replaced biosparrudite (chert replaced limestone).

Microscopic Characteristics: Bryozoans, scaphopods, corals, pelecypods, gastropods and fecal pellets replaced by chert; interparticle porosity occluded by chert.

Source Area: Santee Limestone Formation.

Specimen 13 - Tan Fossiliferous Chert/ White Fossiliferous Chert Mixture (interior flake; 38BK226 EU5 10-15 cm)

Megascopic (Visual) Characteristics: Chert and chalcedony replaced biosparrudite (chert and chalcedony replaced limestone).

Microscopic Characteristics: Bryozoans, corals, pelecypods, foraminifera and gastropods replaced and cemented by chert and chalcedony; a few fine, subangular quartz grains.

Source Area: Santee Limestone Formation.

Like the white fossiliferous chert, the tan fossiliferous chert found at Mattassee Lake is assumed to originate a short distance to the north or west of the project sites, in the portions of the upper Cooper River or middle Santee drainages where the Santee Limestone outcrops. Much of this area, unfortunately, is now under Lakes Marion and Moultrie, and the discovery of sources may prove difficult.

Blue Fossiliferous Chert

Among the several different cherts observed at Mattassee Lake was a bluish-gray (5B5/1) fossiliferous material of unknown, but presumably local origin (Table 7). The material was similar in appearance to a blue fossiliferous chert previously reported from a possible workshop/quarry area (38CR33; Figure 53) located to the north of the Lake Marion dam, in Clarendon County (Anderson, Lee, and Parler 1979:11-12; Anderson 1979a:32). A second bluish-colored chert, from Sumter County, is also known (discussed below under "Manchester chert") and thin section analysis was considered essential to help resolve possible source areas for the Mattassee Lake material.

Specimen 14 - Blue Fossiliferous Chert (interior flake; 38BK226 EU27 20-30 cm)

Megascopic (Visual) Characteristics: Chert and chalcedony replaced biomicrudite (chert and chalcedony replaced limestone).

Microscopic Characteristics: Pelecypods, corals and micrite matrix replaced by chert and chalcedony; some detrital quartz.

Source Area: Thanetian Black Mingo Formation.

The blue fossiliferous chert from Mattassee Lake appears to more closely resemble Manchester chert than it does the material from the outcrop in Clarendon County, at 38CR33. The Clarendon County chert was dominated by bryozoans, a characteristic of the Santee Limestone, while both the blue fossiliferous chert from Mattassee Lake and Manchester chert are dominated by pelecypods and are (probably) from the Thanetian Black Mingo Formation. While the blue fossiliferous chert from Mattassee Lake is similar to Manchester chert, it differs enough in minor respects to at least suggest the possibility of a separate source area, although this remains to be demonstrated.

Manchester Chert

A second purplish fossiliferous chert was found within the Mattassee Lake assemblage, and was classified "Manchester chert" because of its similarity to material from an outcrop on the upper Wateree River, in the Manchester State Park, Sumter County, South Carolina (Table 7). This material differs from the blue fossiliferous chert reported previously in that it is somewhat darker and more lustrous, due in part (apparently) to a higher incidence of chalcedony in the matrix. Material from the Sumter County outcrop has been thin sectioned (Anderson 1979a:32), permitting comparison with artifacts of the material from Mattassee Lake:

Specimen 15 - 'Manchester' Chert (interior flake; 38BK226 EU8 35-40 cm)

> Megascopic (Visual) Characteristics: Chert and chalcedony replaced(?) biosparrudite (chert and chalcedony replaced limestone).
>
> Microscopic Characteristics: Allochems replaced by chert (pelecypods?); interparticle porosity occluded by chalcedony.
>
> Source Area: Thanetian Black Mingo Formation.

The description of the specimen from Mattassee Lake is similar to that for material from the Sumter County outcrop, and an origin at or near that source would appear supported. Further investigation of the occurrence and sources of Manchester chert would appear warranted since, with the possible exception of some materials from the Buyck's Bluff quarry, it appears to be the best quality chert found to date along the Santee drainage.

Chalky Chert

A comparatively minor constituent in the Mattassee Lake assemblage was a very pale brown (10YR7/4) to light yellowish-brown (10YR6/4) material categorized as "chalky chert" because its general color and texture resembled that substance. The material has a weathered appearance, and may reflect patinated specimens of one or more of the other site cherts; alternatively it may reflect a poor quality source that, from its incidence at Mattassee Lake, was not extensively exploited (Table 7). No outcrops are known, and the material has not previously been reported in the literature.

Specimen 16 - Chalky Chert (interior flake; 38BK226 EU14 15-20 cm)

> Megascopic (Visual) Characteristics: Chert replaced biomicrudite (chert replaced limestone).
>
> Microscopic Characteristics: Chert has replaced matrix (micrite), pelecypods, and (?) scaphopods; some quartz grains and dolomite; some hematite staining.
>
> Source Area: Thanetian Black Mingo Formation.

The analysis supports a local origin for the material; the presence of quartz grains additionally suggests that it might occur in or near orthoquartzite-producing deposits, possibly as an inclusion. This, of course, remains to be demonstrated.

Unidentified High Quality Chert

Five pieces of unknown, fine-grained materials assumed to be cherts were recovered in the excavation assemblage at Mattassee Lake (Table 7). The category was something of a catch-all, to accommodate specimens that did not resemble the major chert categories described above. All of the specimens were very fine-grained, and fossiliferous inclusions, ubiquitous in cherts from the lower Savannah and Santee Rivers, were absent. Origin in the Piedmont, or some region other than the Coastal Plain, may be possible given the absence of microfauna (cf. Novick 1978: 432). One piece of the material was very dark gray (10YR3/1) to black in color; due to a considerable local interest in the occurrence and possible sources of "black chert" (e.g., Goodyear, House, and Ackerly 1979:185-187; Anderson 1979a: 33-34) the specimen was submitted for thin sectioning:

Specimen 17 - Black (Unidentified High Quality) Chert (interior flake; 38BK229 EU16 10-15 cm)

Megascopic (Visual) Characteristics: Chert cemented quartz arenite (chert cemented sandstone).

Microscopic Characteristics: Well-sorted, fabric supported fine quartz with minor amounts of feldspar (microcline), mica and heavy minerals; hematite dust rings surround quartz grains; chert occludes interparticle porosity.

Source Area: Thanetian Black Mingo Formation.

As can be seen from the description, the "black chert" is not really chert at all, but a fine-grained orthoquartzite of (probable) local origin. The color and texture appear to reflect variation within the formation; the specimen itself serves to highlight the problems of identification associated with this material (cf. Goodyear, House, and Ackerly 1979:186-187). The Mattassee Lake specimen is somewhat duller in luster than some of the material classified as "black chert" or "Ridge and Valley chert" in the Piedmont; this is probably due to a lower incidence of chalcedony in the matrix. Regardless of the origin, the material would appear to be extremely rare, since only one flake was noted in a lithic artifact assemblage of over 88,000 items.

Brown/Gray High Quality Unknown

One flake of a brownish-gray translucent fine-grained material tentatively identified as a chert was recovered at Mattassee Lake. The specimen was sufficiently unusual to prompt thin sectioning:

Specimen 18 - Brown-Gray High Quality 'Chert' (flake of bifacial retouch; 38BK246 EU1 0-20 cm)

Megascopic (Visual) Characteristics: Altered(?) tuff.

Microscopic Characteristics: Amphibole and biotite in a clay matrix.

Source Area: Piedmont(?).

The material is similar to what Novick (1978:428) has called welded vitric tuff. A number (N=27) of readily identifiable flakes of that material were found at Mattassee Lake (Table 7), however, characterized by a greenish-gray to olive green appearance. The single specimen examined here may reflect color variation within the category or, alternatively, may indicate another formation and/or source.

Argillite

A minor constituent in the Mattassee Lake assemblage was a greenish-gray (5GY5/1) to grayish-green (5G5/2) fine-grained material classified as argillite (Table 7). A common occurrence on sites along the Fall Line and throughout the Piedmont (e.g., Taylor and Smith 1978; Goodyear, House, and Ackerly 1979; Cable and Cantley 1979), the material is only infrequently noted in the lower Coastal Plain (e.g., Anderson, Lee, and Parler 1979; Trinkley 1980a). Origin as a (metamorphosed) sedimentary material (e.g., Novick 1978:431) was supported by the thin section description:

Specimen 19 - Argillite (weathered flake; 38BK226 EU2 0-20 cm)

Megascopic (Visual) Characteristics: Hematite stained claystone.

Microscopic Characteristics: Laminated claystone; hematite along bedding planes, some biotite.

Source Area: Unknown (Piedmont?).

Similar in general appearance to the material classified as Green Unknown (discussed below), the Mattassee Lake argillite assemblage may derive from (roughly similar) source areas.

Green Unknown

A second light greenish-gray (5GY5/1) fine-grained material was recovered at Mattassee Lake, and was initially classified as a green siltstone. The material had a weathered appearance, and had not previously been recognized, or separated from other fine-grained material in the area. While the possibility of variability in Piedmont metavolcanics may be explicitly or implicitly recognized, most investigators working in the Coastal Plain of South Carolina have tended to lump them together under single categories such as "slate", "argillite", or "rhyolite". In an effort to determine the nature of this material, and its relationship with other categories, particularly argillite, a thin section was prepared:

Specimen 20 - Green Unknown (interior flake; 38BK246 EU11 20-30 cm)

Megascopic (Visual) Characteristics: Alkali rhyolite.

Microscopic Characteristics: Contains amphibole, quartz, epidote, and mica - may be slightly metamorphosed.

Source Area: Piedmont.

The analysis indicates that the category is distinct, reflecting a different origin (formation) and possible source from otherwise similar site materials such as the argillite reported above.

Steatite

Several fragments of carved steatite, from vessels and/or cooking stones, were recovered in the excavation units at Mattassee Lake (Table 7). The material has been widely noted on archeological sites in the South Carolina area, although local technical descriptions and attempts to investigate sources are still relatively infrequent (e.g., T. Ferguson 1976; Novick 1978; Elliot 1981; Dickens and Carnes 1976; Dickens, Carnes and McKinley 1981). One specimen from Mattassee Lake was thin sectioned, more in an effort to delimit gross composition than to document specific source areas:

Specimen 21 - Steatite (carved sherd(?) fragment, 38BK246 EU6 20-30 cm)

Megascopic (Visual) Characteristics: Biotite shist.

Microscopic Characteristics: Holocrystalline, phenocrysts of biotite.

Source Area: Piedmont.

Investigating source areas for steatite artifacts has been the subject of considerable research in the Southeast in recent years, primarily due to the potential for identifying specific outcrops through neutron activation analysis (e.g., Allen 1975; Luckenbach et al. 1975). Several different sources have been reported in and near the South Carolina Piedmont (e.g., Lowman and Wheatley 1970; T. Ferguson 1976; Elliot 1981; Figure 6), including some within the Santee drainage basin. Specific source identification should, therefore, be possible for artifacts from many South Carolina sites; a local (Piedmont) origin appears probable.

Other Lithic Materials

Several minor lithic raw material categories were established in the Mattassee Lake assemblage that have not been previously described in the local literature, including petrified wood, unknown igneous/metamorphic, purple siltstone, gray porphyry, and an unidentified category (Table 7).

Several were only represented by a few flakes, for which descriptions are presented below:

Petrified Wood

Petrified wood does occur in the unconsolidated sediments of the Coastal Plain. The few specimens found were variegated and ridged with a yellowish-brown color (10YR5/4-5/8).

Unidentified Chert

All chert that could not be identified as Allendale, Manchester, etc., were included in this category.

Igneous/Metamorphic

Flakes that were not rhyolite, tuff, etc., or identified as specific igneous or metamorphic types were included in this category.

Unidentified

Lithic materials that were not identified were included in this category.

Purple Siltstone

These flakes have a weathered appearance with a brownish cast. Color varies but ranges from a reddish-gray (10R5/1) to a weak red (10R5/2,4/2) with a very pale brown (10YR7/3,7/4) patina. Grain size is small and the soft nature led to the siltstone classification, however, it is possible that this material is a weathered basalt.

Gray Porphyry

This is a dark gray (N4/1) volcanic rock with white phenocrysts of quartz or feldspar. It is similar to porphyritic rhyolite.

MONOTHETIC SUBDIVISIVE ANALYSES OF PROJECTILE POINT AND CERAMIC ASSEMBLAGES FROM MATTASSEE LAKE

Cluster analyses were performed on two data sets recovered during the field phase of the Mattassee Lake Project. In large part these analyses were to be undertaken as a test of existing typological constructs of projectile points and prehistoric ceramics currently in use in the project area. As such, the primary goal of these analyses was to isolate significant attribute dimensions in such a manner that the traditional typologies might be either verified, or altered to better accommodate local type variations.

Any cluster analytic procedure is, in fact, an inductive search procedure and, as has been discussed elsewhere (cf. Goldstein 1980), it is the responsibility of the investigator to interpret the results of such an inductive procedure. In other words, the outcome of the cluster analysis per se may not produce meaningful analytic units, rather it is the interpretation of the outcome in terms of specific problem sets that lends value to the procedure. While this may sound rather straightforward, even the outcome states of a cluster analysis are subject to variations from several more or less controllable factors. Specifically, the scale of the data (nominal, ordinal, or interval), the grouping procedure (divisive or agglomerative), the algorithm used to produce clusters, and the measure of similarity employed to determine the relationship between individuals or attributes may affect the results. Thus, the type of clustering which is appropriate for a specific data set is only partially conditioned by the data and the problem, while differences in the various measures may produce marked differences in the outcome. Decisions made throughout the research design, therefore, become of paramount importance to the interpretability of groups resulting from a cluster analysis in terms of a specific problem.

Projectile Point Analysis: Problem Orientation and Research Design

The sample of 477 intact and fragmentary projectile points from the three sites were in many cases capable of being "typed" according to traditional classification systems. However, there were several aspects of the traditional type systems as applied to these assemblages which posed specific problems, and which warranted an alternative view of the regularities and variability observed. Among these were: 1) the wide range of rework or different reduction stages present in the sample; 2) the majority of artifacts were manufactured on coarse raw materials which apparently did not allow refined "thinning", and 3) the several time periods and cultural stages represented in the sample. The latter problem posed particular difficulties due to the range of overlap present in the traditional type definitions. That is, they appeared to be polythetic sets with, in some instances, few mutually exclusive attributes by which to distinguish between classes.

In large part it was the latter which conditioned the direction of the projectile point analysis in that the formal variability encountered in the first two cases could be analytically subsumed under the third. Broadly speaking, the problem was to create more mutually exclusive type definitions which would replicate at least portions of the original typology, yet also isolate other attribute dimensions. These dimensions would be important in refining the traditional typological systems in order to accommodate the effects of rework, reduction stages and raw material variability.

Thus, the goal of the analysis was to create groups maximally homogeneous and by definition distinguishable from all other groups. This immediately reduced the potential cluster analytic procedures to monothetic subdivisive approaches (c.f. Whallon 1971,1972; Peebles 1972; Goldstein 1980), whereby successively smaller and more homogeneous groups are created based upon the presence or absence of a specific variable(s).

A critical choice for application of this approach is the measure employed for isolating that variable(s) upon which partition is to occur. This choice is partially problem dependent since different measures behave in different fashions. Because cluster analysis is an inductive method summarizing a data set, it behooves the analyst to employ a partitioning statistic which implicitly or explicitly extracts pertinent information in the reorganization of the data (Goldstein 1980; Peebles 1972). Thus, Whallon (1972) employs a measure of association (sum chi square) in the analysis of ceramics, whereas mortuary studies have often used an information statistic.

While there may be disagreement on the choice of a specific measure, the real proof of a measure's utility is whether or not it creates meaningful (i.e., interpretable) groups in the context of the problem being approached. Choice of measure in this analysis was premised on the following: 1) some of the nominal scale data displayed skewness; 2) specific projectile point types in traditional typologies from the area are viewed as tightly defined temporal/spatial markers implying stylistic features and regularities which may be symbolic of cultural contexts, and 3) the projectile point data included reworked items which suggested that there was a procedural dimension to certain of the attributes, i.e., that specific attributes of rework might be limited to specific "types".

While our initial inclination was to employ an information statistic in the analysis, this was subsequently discarded in favor of a measure of variance (error sum square). As has been noted, information measures were developed for and highly suited to analysis of symbolic content (Clifford and Stephenson 1975), are insensitive to skewness (Peebles 1972), and when employed in a monothetic subdivisive algorithm are susceptible to procedural treatment as formal keys (cf. Goldstein 1980). However, following data cleaning skewness was not a significant problem, and we could not definitely attribute dimensional regularities to symbolic causes. Therefore the choice was made to employ a measure which would result in statistically homogeneous groups.

Projectile Point Analysis: Data Preparation

The projectile point data had been coded by the Commonwealth Associates staff prior to receipt by the authors, Lovis and Donahue. Each projectile point was entered on a two card record using Binford's (1963) projectile point attribute list. In this data set there were 16 interval scale variables, with the remainder being either multistate, dichotomous, or ordinally coded multistate variables (see the Data Appendix Volume for a complete listing). While the interval scale variables were subjected to basic descriptive statistics, correlation and the generation of scattergrams, they were eventually deleted from further analysis. The ordinally coded multistate variables were subsequently recoded as dichotomous multistate variables, and frequency distributions and crosstabulations were generated using the Statistical Package for the Social Sciences (Nie et al. 1970). Those variables displaying at least one of the following characteristics were then deleted from further analysis: 1) those variables which occurred on no observations; 2) those with expected cell frequencies of less than five, and 3) those displaying a highly dispersed frequency distribution with no uni- or multimodal tendency. Given the large number of observations (i.e., projectile points) with missing information a decision was made in collaboration with Commonwealth Associates that only intact projectile points would be employed. This resulted in a sample of n = 121 to be analyzed.

Projectile Point Analysis: The Structure of the Analysis

Clustan Version 1C (Wishart 1975) was implemented with Procedure DIVIDE. The nested division option was chosen with eight divisions specified, the latter allowing a potential maximum of 128 separate groups to be created. The eight division option was chosen so that smaller groups or terminal clusters could be aggregated through the hierarchy to the division node which either conformed to a traditional "type", indicated a procedural stage, or which demonstrated the greatest reduction in error mean square. Thus, the emphasis was on interpretability rather than the statistical significance of the groups created, although it should be recognized that significance tests for optimal partitioning are available (Hartigan 1975:135-137).

Upon completion of the cluster analysis several visual displays were created to aid interpretability. A dendrogram was created using Procedure PLINK, a key diagram constructed identifying the position of key partitioning variables, and the 121 artifact sample sorted into groups based upon the key variables defined by the analysis. This information was then transmitted to Commonwealth Associates, Inc., where it was used to help prepare the projectile point taxonomy presented in Chapter 7. In general, the defined clusters were found to be quite useful as a basis for establishing the taxonomy; many of the analytical groups directly corresponded to locally established types.

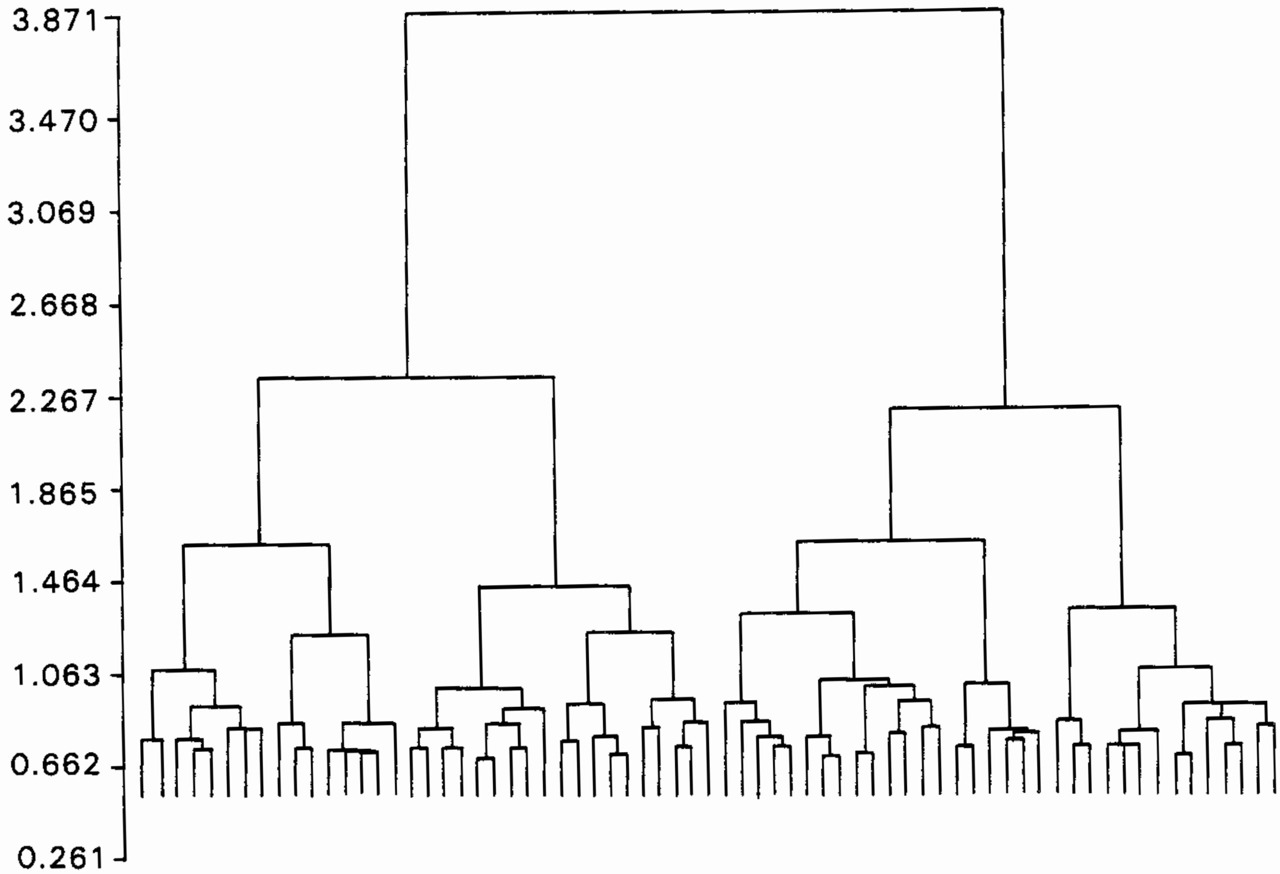
Ceramic Analysis: Problem Orientation and Research Design

The pottery sample from the three sites (N=324 rimsherds) under consideration posed a somewhat different type of problem than that encountered with the projectile points. The problem was defined in a communication from David G. Anderson:

> Using traditional typologies about 20-30 "types" are present in the Mattassee Lake ceramic assemblage; some of these types are poorly defined, however, and crosscut several periods. I hope to be able to (minimally) refine the existing types, and develop reliable criteria for sorting wares that are currently poorly located in the sequence. To elaborate, there appear to be fabric impressed, simple stamped and plain wares present all through the Woodland and into the Mississippian in the area. A finer breakdown for these and other finishes would be useful....(letter of 6/30/80).

It should be further noted that both absolute dating and relative stratigraphic positions of some traditional types suggested that revision was necessary; an independent analysis of the assemblage would therefore afford an opportunity to assess either a replicated or revised typology. As noted above, however, it appeared that a revised typology was necessary. Poor definitions of some types (i.e., overlapping criteria, polythetic sets) and a lack of temporal integrity for some types, appeared to be the primary problem areas. This variability appeared to occur within gross categories of exterior surface treatment; plain, fabric and simple stamped (Figure 54).

Monothetic subdivision and its application to ceramic classification in archaeology has been the subject of ample discussion in the past ten years (e.g., Whallon 1971,1972; Brashler 1973,1981). As such, its comparability to other methods, and its conformity to traditional typological approaches is rather well-known. Its implementations in archaeology have most commonly been through the use of Program TYPE (Whallon 1971), and through differing versions of the CLUSTAN package (in this case, Version 1C, Wishart 1975). These programs, however, have some points of difference which must be taken into account for purposes of interpretation. The two signal differences between them are that the latter (CLUSTAN) does not accommodate redundance in multistate nominal scale variables (i.e., dependent relationships), nor will it compute Yate's correction (c.f. McNaughtonSmith 1965; see also Whallon 1971:17-18). On the other hand, Clustan does allow the use of the nested division option, a more efficient subdivision



Note: (Monothetic Subdivisive Cluster Analysis)

FIGURE 54
FABRIC IMPRESSED RIMSHERDS CLUSTER ANALYSIS DENDROGRAM

MATTASSEE LAKE EXCAVATIONS
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Cooper River Rediversion Canal Project

procedure. In most other respects the programs are substantially similar. Thus, in this case, it was feasible to employ sum of chi squared as the measure of association in conjunction with a nested monothetic subdivision, the sum of chi squared statistic having demonstrated utility in ceramic analysis (c.f. Whallon 1972).

Due to the structure of the classificatory problem(s) being addressed, a problem of class definition, and the critical defining variables both within and between gross ware groupings (i.e., fabric impressed, cord marked, and simple stamped), several cluster analyses needed to be performed. Independent analysis was undertaken on each of the previously mentioned ware groupings, and an "omnibus" analysis of the pooled ceramic sample (all rimsherds in the special sample) was also conducted to aid in clarification of between-ware relationships. In all, four analyses were performed, and were used to help prepare the ceramic taxonomy/sequence presented in Chapter 8 (Figure 55).

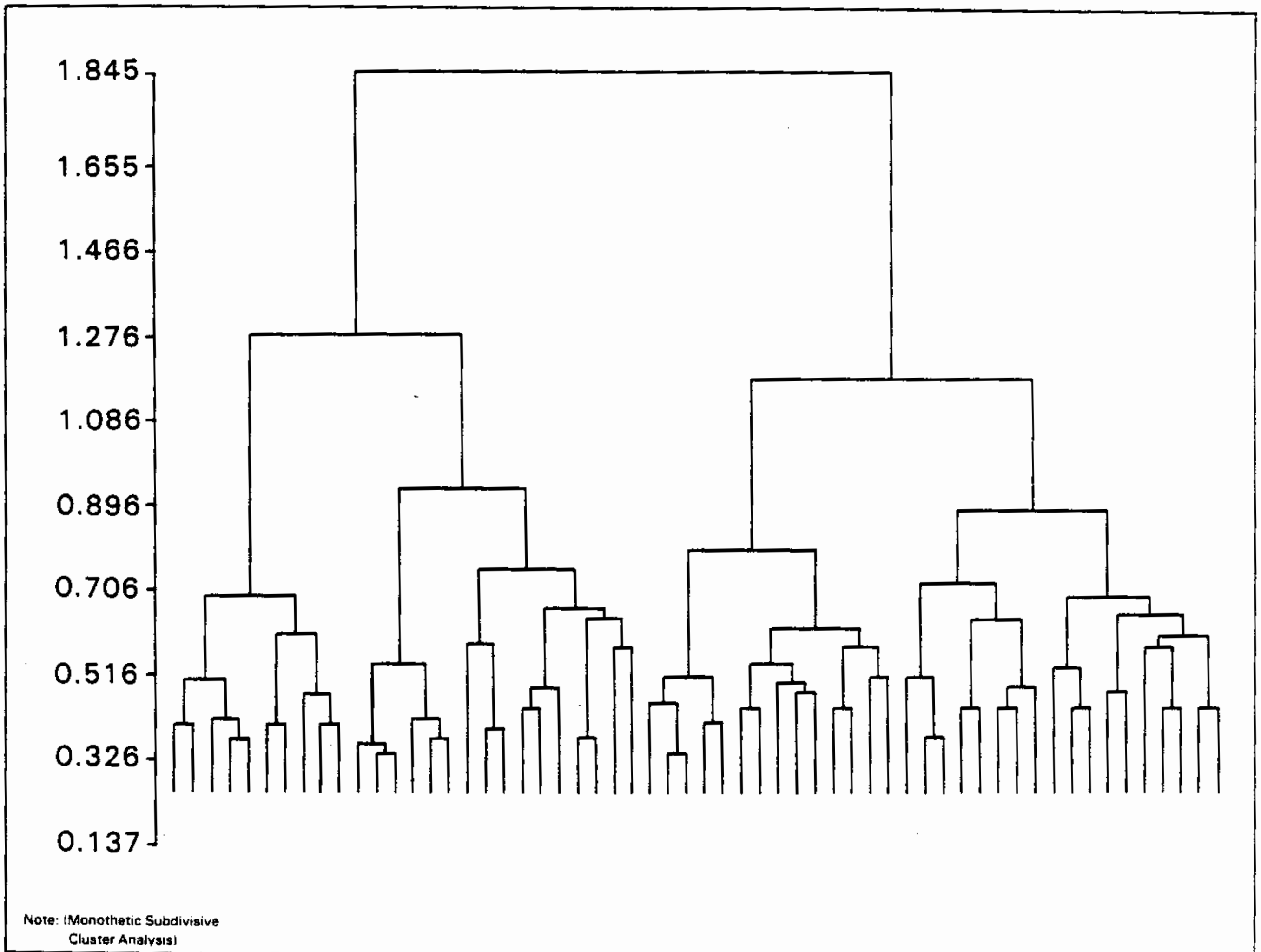

FIGURE 55
SIMPLE STAMPED RIMSHERDS CLUSTER ANALYSIS DENDROGRAM

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Ceramic Analysis: Data Preparation

In most respects data preparation for the ceramic analysis conformed to those procedures presented earlier for the projectile point data. The major difference between the two data sets was the virtual absence of interval scale data in the ceramic analysis. Thus, the data included multistate, dichotomous, and ordinally coded multistate variables with the latter requiring recoding to conform to the input format for CLUSTAN. Similar cleaning procedures were followed for deletion of variables.

Conclusions

Five nested monothetic subdivisive cluster analyses were undertaken on projectile point and ceramic samples from the Mattassee Lake-Cooper River mitigation project for Commonwealth Associates, Inc. These were designed as inductive pattern recognition procedures to be employed in reappraisal of existing typologies critical to reconstruction of regional time-space systematics. Discussions about the interpretability and usefulness of these analyses are presented in Chapters 7 and 8.