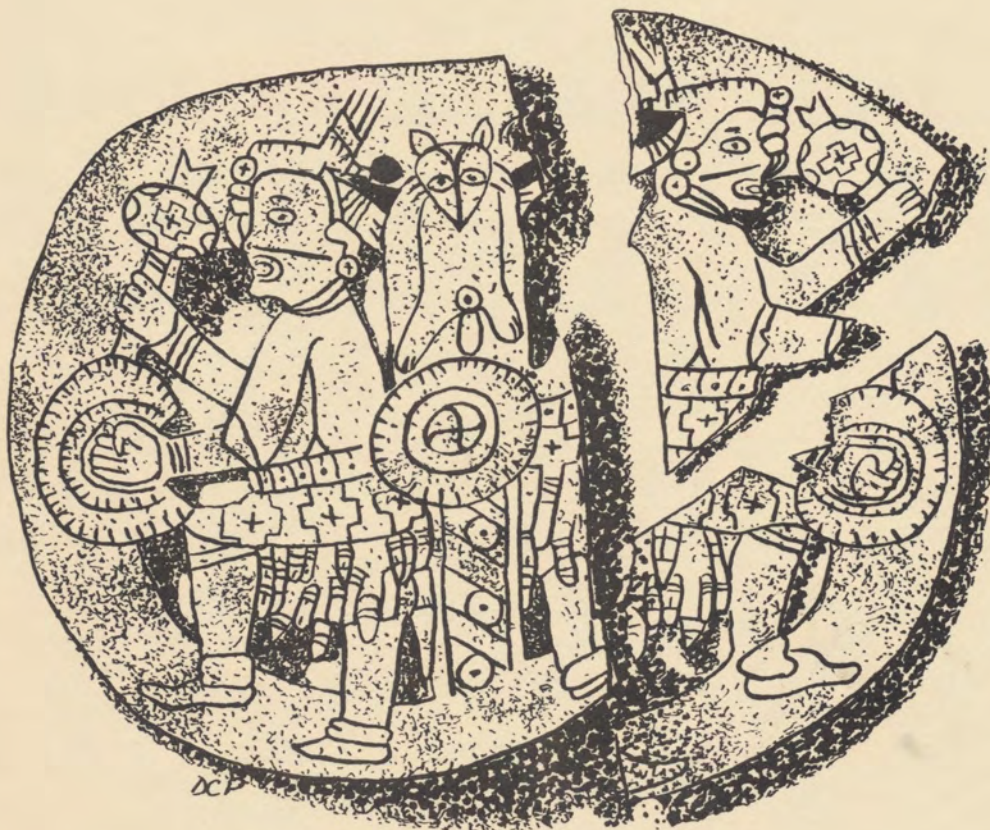


**The Conservation of Fragile Specimens
from the Spiro Mound,
Le Flore County, Oklahoma**

Joan S. Gardner



**CONTRIBUTIONS FROM THE
STOVALL MUSEUM, UNIVERSITY OF OKLAHOMA, NO. 5, 1980**

THE CONSERVATION OF FRAGILE SPECIMENS
from the
SPIRO MOUND, LeFLORE COUNTY, OKLAHOMA

A report submitted to the National Science Foundation,
Grant # BNS 7817778.

by

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A project jointly sponsored by the Stovall Museum and
Department of Anthropology, University of Oklahoma

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FOREWORD

This report is concerned with the conservation of fragile specimens found at the Spiro mound in eastern Oklahoma. The report and work accomplished was done by Joan S. Gardner in 1979 at the laboratories of the Stovall Museum, University of Oklahoma, Norman, Oklahoma. Funding for the project was obtained from the National Science Foundation under grant #BNS-7817778. We are indebted to Ms. Mary Greene of the National Science Foundation for guiding our research proposal and bringing it to fruition. The Office of Research Administration implemented the grant accounting and paperwork, and the Department of Anthropology and Stovall Museum staffs assisted in obtaining supplies or resolving emergency needs. In short, many persons contributed to this project and its successful conclusion, and their help is gratefully appreciated.

The Spiro mound site includes a number of mounds but the majority of archaeological specimens recovered from the excavations came from the large burial or mortuary mound known as the Craig mound. This mound undoubtedly contained one of the richest deposits of archaeological materials that has been discovered in the United States. This included many articles of a perishable nature such as basketry, matting, fabrics, engraved shell, wood, etc., that are not normally preserved for the archaeological record. A huge amount of this material was destroyed or sold as relics by the commercial diggers that looted the mound. The professional excavations, however, were successful in salvaging much information and artifacts from the site. This material that was recovered in archaeological context constitutes the primary resource base, and our knowledge, understanding, and interpretation of the Spiro site must rely on this data. Consequently, the survival of these specimens through proper conservation merits high priority - the goal of this project.

The University of Oklahoma excavations at the Craig mound under the direction of Forrest Clements were initiated in June 1936 and continued until November 1937 at which time the mound was leveled and work was shifted to other localities. The materials recovered were shipped or transported to Norman where laboratory crews washed, catalogued, and restored the more impressive artifacts. These specimens were exhibited and photographed for publicity purposes as proof of success by the WPA archaeological activity. Less important artifacts or minor debris recovered remained in field bags in storage areas. At the time of

my arrival in Oklahoma during the summer of 1947, a large amount of the Spiro artifacts were on display in the Department of Anthropology museum located in the basement of the Law Building. The rest of the material, including collections from all other sites excavated by the WPA, were stored underneath one wing of the stadium which functioned as a dead storage area for numerous departments.

At this time, chiefly under the leadership of J. Willis Stovall, Department of Geology, efforts were made to consolidate the numerous university collections in one central place for a single University Museum. The R.O.T.C. facilities were obtained, including the headquarters, gun sheds, and stable which formed a compact unit and which houses the present Stovall Museum. Remodeling of the new quarters, however, required time and financing which was difficult to obtain. Work started at the headquarters or exhibit building and the Anthropology collections, formerly displayed in the Law Building, were transferred to the new building by December 1949. It was not possible to remove the collections stored underneath the stadium until the following year. A special grant of funds to the Department of Anthropology financed the remodeling of the stables for conversion to a laboratory and storage area for the archaeological and ethnographic collections. These were moved and in their new quarters by the summer of 1950. Although the available space was crowded and many boxes of material remained as they arrived from the field, they were more accessible and less subject to damage than previously.

Early in the 1950's an effort to improve the storage situation was made by constructing large wooden drawer cabinets which could be used for storage of archaeological materials. These cabinets were acquired slowly over a period of several years and at this time most of the specimens have been transferred from cardboard cartons into the wooden drawers. The available space, however, is not adequate and the specimens are packed tightly in order to fit them into the available space.

Although Forrest Clements had every intention of preparing a report on the excavations at Spiro, he was too occupied with administrative work to do anything about it. With the outbreak of World War II in 1941 Clements soon left the University of Oklahoma for a position with the Department of Agriculture in Washington, D.C. which he held throughout the balance of his career. Thus removed from the Oklahoma scene, he did not revive his interest in writing his

report after the war years. Consequently, nothing was available regarding the work at Spiro other than some summary assessments by Orr (1946, 1952) or an occasional brief note.

The need for this information, however, remained urgent, and Dr. James A. Brown was brought to Norman for the purpose of preparing a report on the Spiro excavations. Brown spent two years at the Stovall Museum from 1963 to 1965 working with the Spiro records and collections supported by the National Science Foundation. During this period he gathered together all of the information and artifacts, not only from the Craig mound, but also from other portions of the Spiro site and nearby occupations. The collections were rearranged and stored in the available wooden cabinets, or when space was not available, in boxes on top of the cabinets. It was noted at this time that some specimens were deteriorating and in need of conservation but only limited treatment could be applied. The crowding of specimens into the limited space available constituted an additional problem in storage and accessibility.

Although commonly frustrated by incomplete records, ambiguous accounts, missing specimens, or conflicting reports, Brown has successfully published several reports and papers resulting from this effort (Brown 1966a, 1966b, 1967, 1971a, 1971b, 1975, 1976; Brown and Bell 1964; Phillips and Brown 1978).

Although the need for conservation and improved storage facilities was fully appreciated, the Stovall Museum does not maintain a conservation specialist. In 1978 I learned that Ms. Gardner had been involved with the conservation of Spiro materials housed at the Smithsonian Institution. Her work there was about completed and she would be available to do conservation work elsewhere. With her established interest and concern with specimens from the Spiro site, she represented an ideal candidate for this task at Stovall Museum. Consequently, after consultation the proposal for conservation of the Stovall collections was submitted to the National Science Foundation and this report presents the results of this effort.

At this time, fragile specimens of the Spiro mound collections have been properly preserved and are now housed in metal cabinets in a systematic order so access to them for study purposes is highly improved. Their continued survival is assured by application of the best conservation techniques currently known. Deterioration, damage from handling, or improper storage has been eliminated for the more fragile specimens, and revised storage for the more durable items (pottery, stone, etc.) is slowly being implemented as time and funds permit.

As one final note, I would like to mention that many of the items were "preserved" by the best known methods at the time of excavation 40 years ago. Some specimens have suffered from these efforts but others would not have survived without them. In short, although some mistakes were made, without the serious concern for preservation at the time, many of the specimens would not now be available.

Robert E. Bell, 1 May, 1980

ACKNOWLEDGMENTS

I would like to thank the members of the Department of Anthropology, University of Oklahoma, especially Dr. Stephen Thompson and his wife Tami, Dr. Joseph Whitecotton, Dr. Chet Lancaster, Dr. Jane Lancaster, Lynne Kellar, James Tribble, Wanda Downs, and Vera Gibson for the many courtesies extended to me during this study.

Candace Green, Judy Jordan, Judy Whitecotton, Keever Greer, Peter Tirrell, Mike McCarty, and Peter Graves, members of the staff of the Stovall Museum, were also helpful in a multitude of ways.

Two other departments at the University of Oklahoma, Chemistry and Microbiology, loaned or gave lab supplies and small amounts of solvents as well as distilled water to assist in specimen treatments. Bev Grabenbauer of the Chemistry Department was particularly helpful.

Various personnel from the Oklahoma Archeological Survey offered encouragement and/or assistance while the study was underway. I would like to thank Don Wyckoff, Timothy and Susan Baugh, Larry Neal, Lois Sanders, Keitha Bollinger, and most especially, Cheri Clark, for their many efforts.

Those persons at the Smithsonian Institution who gave advice and other assistance when called upon were Dr. David vonEndt, Edith Dietz, Carolyn Rose, and Cathy Valentour.

Appreciation is also extended to Phyllis Taylor who typed the manuscript and assisted in preparation of final copy. Also, to Don Pearson, our artist who designed the cover.

It was a great privilege to be associated with Dr. Robert E. Bell during the course of this work, for without his commitment this study never would have materialized. I shall always treasure his recounting of the many phases of Spiro's history.

INTRODUCTION

The following report is divided into sections based on the materials used to fabricate the Spiro specimens: wood, bone, basketry, textiles, stone, mica, shell, copper, and leather. A small report on repair of casts (of specimens in the Spiro collection) is also included. Each of these sections discusses treatments utilized in the study and re-storage methods adopted. The treatments are explained in nontechnical language and are accompanied by photographs that illustrate the conditions discussed in storage or in treatment. It does not seem to be generally understood that storage is an important part of conservation, but great emphasis is placed on storage in the various sections of this report.

It is of much concern to this researcher that the Spiro collection is housed in a building that has no fire protection and in a room with no climate control (not even air conditioning in the summer or heat in winter). The keen interest and concern of the North American archeology curator, Dr. Robert Bell, has been a major factor in the survival and publication of the collection. I should add that the museum administration is concerned about the storage problem at the North Lab, but no source of funding has been located.

GENERAL INFORMATION FOR USERS OF THE SPIRO COLLECTION

A good deal of time and thought have been expended in organizing and properly storing the Spiro collection at the Stovall Museum. Your help in keeping it in this condition will be appreciated. A high percentage of the specimens are fragile and need to be handled with great care (i.e. know where you are going to place something before you lift it, never lift an object by its rim or protrusions, always use both hands to lift a specimen). It is critical that specimens of this nature be handled as minimally as possible.

Chemically stable and inert bubble pack has been arranged around the objects to provide maximum protection, and cards with the specimen number are with each one so that it does not have to be touched or lifted to ascertain the number.

The collection has been expanded from 5 wooden storage cabinets to also include 5 steel storage units. Each drawer in both these storage cabinet types has a label stating the material (wood, stone, shell, etc.) and/or the kind of specimen (pipe, earspool, etc.) that can be found inside. In addition, the contents of each drawer are listed on a master card(s) in a plastic container placed in a noticeable spot in the drawer. The list is arranged by columnar headings of "B" for specimens with burial association, "D" for those from "disturbed" area locations, "A" for an artifact with no provenience within the mound, and "Lf40" to designate Craig Mound as the provenience. Each heading has the appropriate specimen number under it. Other columnar headings that designate the specimen as being from Le Flore County but not Craig Mound itself are "Lf46," "Lf51," and "Lf53."

A photocopy of the appropriate catalogue cards may also be enclosed in the above-mentioned plastic holder. Xeroxed catalogue cards were produced for the following specimen groups: pipes, copper, earspools, textiles, leather, basketry, and bone. Specimens numbered Lf40, Lf46, Lf51, and Lf53 do not have catalogue cards typed up (exception--a few were typed for specific groups such as the basketry specimens) but are listed on a master ledger.

Each specimen from the collection is in a separate box with a card that has the specimen number clearly printed on it or is enclosed in a Plexiglas mount with the number engraved into the top layer. A few specimens were sewn

to Mylar but are not enclosed in Plexiglas and this has been noted on the box. All this has been done to prevent unnecessary handling. When possible, additional information regarding publication of the specimen has been noted on the card.

In addition to the Spiro specimens in storage, six are located in the hall safe in the North Lab. They were re-stored during this study. This group is composed of four stone pipes, 1 engraved shell fragment, and 1 quartz boatstone. A list of their numbers may be obtained from the North American Archeology Curator.

It is hoped that the drawer labels, the drawer lists, the xeroxed cards, and the individual card labels with each specimen will greatly aid the researcher so that minimum touching and/or displacement of the specimens will occur. This will insure that the Spiro collection will remain in the best possible condition for future researchers.

Those specimens which require total support and no handling (exception--when in the presence of the North American archeology curator/conservator), such as the fabrics and the copper falcon plates, are enclosed in Plexiglas mounts. These mounts are resting on Upson board which does not scratch Plexiglas. They should NOT be placed on surfaces which have the potential of scratching. These mounts are to be unscrewed only by the curator and/or conservator. Other very fragile specimens (some leather, fabrics, and basketry) are sewn to Mylar and/or carefully surrounded by bubble pack. These are not for casual perusal or handling. Your careful attention to the specimens labeled "FRAGILE" in red ink is crucial to the survival of these objects.

WOOD

The wood specimens from Spiro exhibited the warpage and dessication that accompany varied conditions faced by the specimens since fabrication such as interment in a burial mound, subsequent retrieval and handling, and finally, storage in a museum located in a climate that has drastic summer and winter changes. These problems would have been greatly reduced by storage in an area which has controlled relative humidity. However, the Stovall Museum has been unable to provide its archeological storage with even air conditioning in the summer or heat in the winter.

Since wood is anisotropic (exhibiting different degrees of hardness and toughness in different directions) and hygroscopic (capable of absorbing moisture from the atmosphere) and requires a certain percent of moisture in order to maintain its shape, it is susceptible to great stress whose consequent results are splitting, cracking, and warping. Thus it may be said that the Spiro wooden specimens all exhibited different degrees of desiccation, warpage, fracturing, twisting, and abrasion. Abrasion has been exaggerated by improper storage within the museum such as lack of padding, wrong size boxes, shifting of specimens when the drawer was opened or closed, etc.

Upon inspection, if a Spiro specimen appeared to be in a stable condition, it was nestled in bubble pack in a box of the proper size and replaced in storage. A card with the specimen number (in heavy magic marker) was enclosed with it. The lid of the box was also labeled with the number and the object name such as "wood earspool." This has hopefully eliminated the necessity to touch the specimen to locate its number.

The specimens that were considered unstable were treated by impregnation with 10% PVA (polyvinyl acetate, a synthetic resin that has proven to be stable through time) in acetone. The specimens were left overnight in the solution so that all the air was replaced by the PVA (i.e. it no longer bubbled), thus insuring that the oxidation process was effectively stopped and the life of the specimen prolonged. They were then renumbered and stored in proper size boxes, nestled in bubble pack, and clearly labeled.

Please see the conservation notebook labeled "WOOD" for summaries of the individual specimen treatments (their numbers are listed below). This notebook (along with the others labeled "Metals," "Textiles," "Stone," etc.) contains

specimen reports, sketches, procedures initiated in treatment with explanations, descriptions, etc.

Wood specimens treated: B10-30; B29-12; B36-11(2); B51-7; B51-28; 51-45a, b; B52-4a; B62-18(2); B108-133a, b; B137-3a; B157-7b; B172-8; B181-4a, b; D289.

Wood specimens not treated, condition noted or explanation given: B6-9; B9-25; B36-12; B36-13; B51-7; B53-15a, b, c; D17; D296; D311-2, 3; Lf40-828(B48).



Figure 1a. Storage drawer containing mixed wood and bone specimens as found before this study commenced.

Figure 1b. One of the wood storage drawers at the end of the study. The boxes all have lids, with the specimen numbers and kind of specimen printed on top. The plastic container with its list of specimens in the drawer and xeroxed catalogue cards is at the center, left.

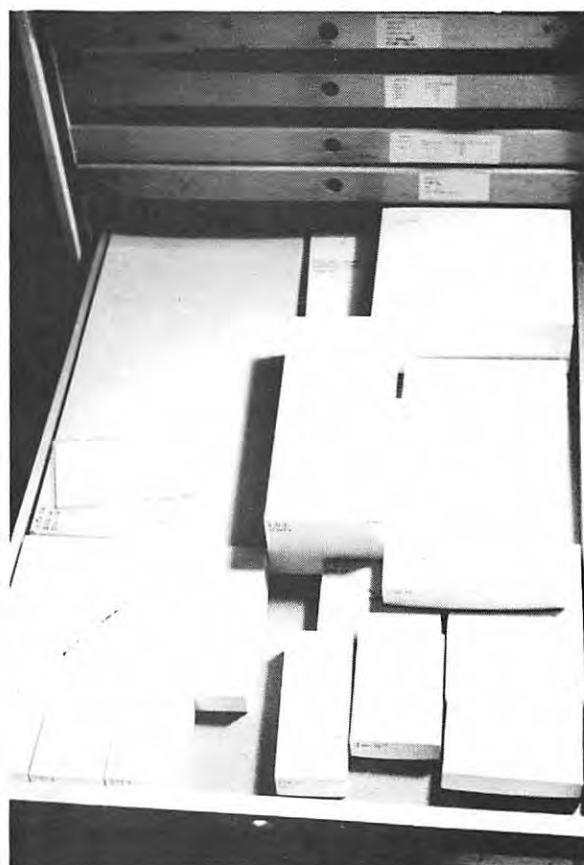




Figure 2a. Wood earspools BEFORE consolidation and mending.



Figure 2b. Wood earspool AFTER consolidation and mending. (In the photo above, it is at left, top.)

BONE AND ANTLER

Overall, the bone specimens from Spiro were disorganized, crowded, and had a layer of dust (if the box in which they were stored had no lid). As many as 30+ fragments were in some boxes, which had resulted in undue battering. A few bones exhibited reasonably new fractures, however, I was unable to find the parts to re-attach them.

At some previous time, a consolidant (?) appears to have been applied to some specimens (see the individual reports in conservation notebooks). It was most likely ambroid or formalin, but no record of what it was has been located.

The bone objects were in different drawers so organization was at a minimum. The tape previously applied over the numbers was often missing, thus some specimens "stuck" to others; on others only a portion of the number remained after the tape came off. A smooth, shiny patina (probably from use) was exhibited by many specimens and these were generally in better condition.

The range of bone specimens included animal jawbones, animal scapulae, and various other small animal bones that had been fashioned into pointed instruments, pendants, shaped ornaments, etc. The human bones from the site were in another storage area and were not encompassed by this study.

Those specimens that were brittle or weak or desiccated and needed consolidation were immersed overnight in 10% PVA in acetone. This allowed the PVA to replace the air in the bone structure (when this occurs the bubbles no longer escape from the specimen) and halt the oxidative process. It is anticipated that this treatment will greatly prolong the survival of the Spiro bone. Broken bone specimens were mended with 20% PVA in acetone. Two bone specimens had precarious breaks encompassing areas of loss that needed infilling with a supportive substance. Whiting (ground calcium carbonate) was used in these areas of loss as it is somewhat similar in composition to bone. The whiting was easily shaped and adhered into the missing areas by mixing it with 10% PVA in acetone. Inpainting with acrylics blended the new area into the color of the bone so it was not so glaring. Complete matching was not attempted in order that the infill areas can easily be recognized and removed if this is ever necessary.

Bone specimens treated: B10-35; B145-10b; B172-5b, c; D292 (antler); Lf40-290(B58); Lf40-897; Lf46-775.

For other information, see conservation notebook labeled "Stone, Bone, Mica, etc."



Figure 3a. Two antler (left, middle) and one bone (right) specimen with fractures infilled with whiting and PVA in acetone. The fill areas were smoothed with a scalpel and by brushing with acetone on swab and removing excess.

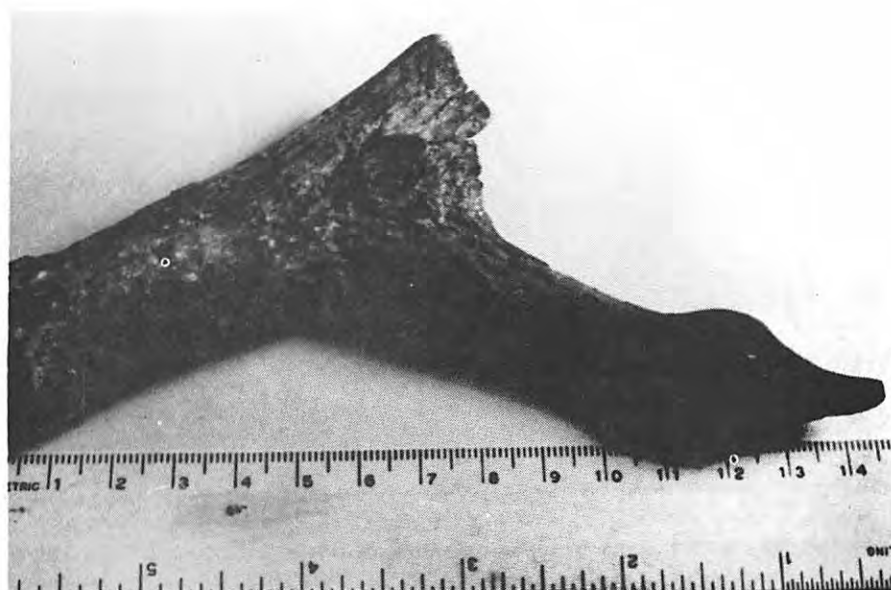


Figure 3b. The antler shown above after inpainting with acrylics.



Figure 4a. Bone pendants (?) BEFORE conservation.

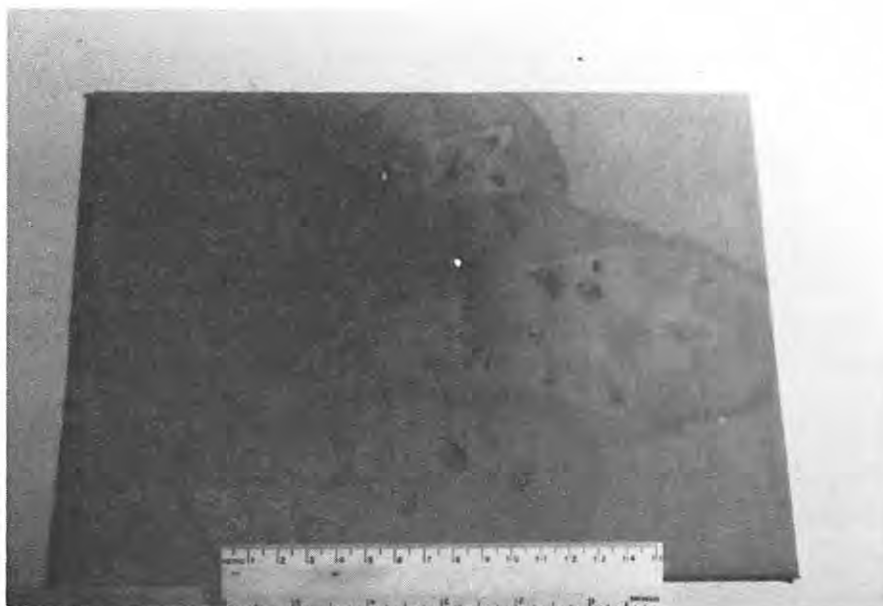


Figure 4b. After removal of bone pendants, the fabric revealed the old glue spots where they had been adhered.

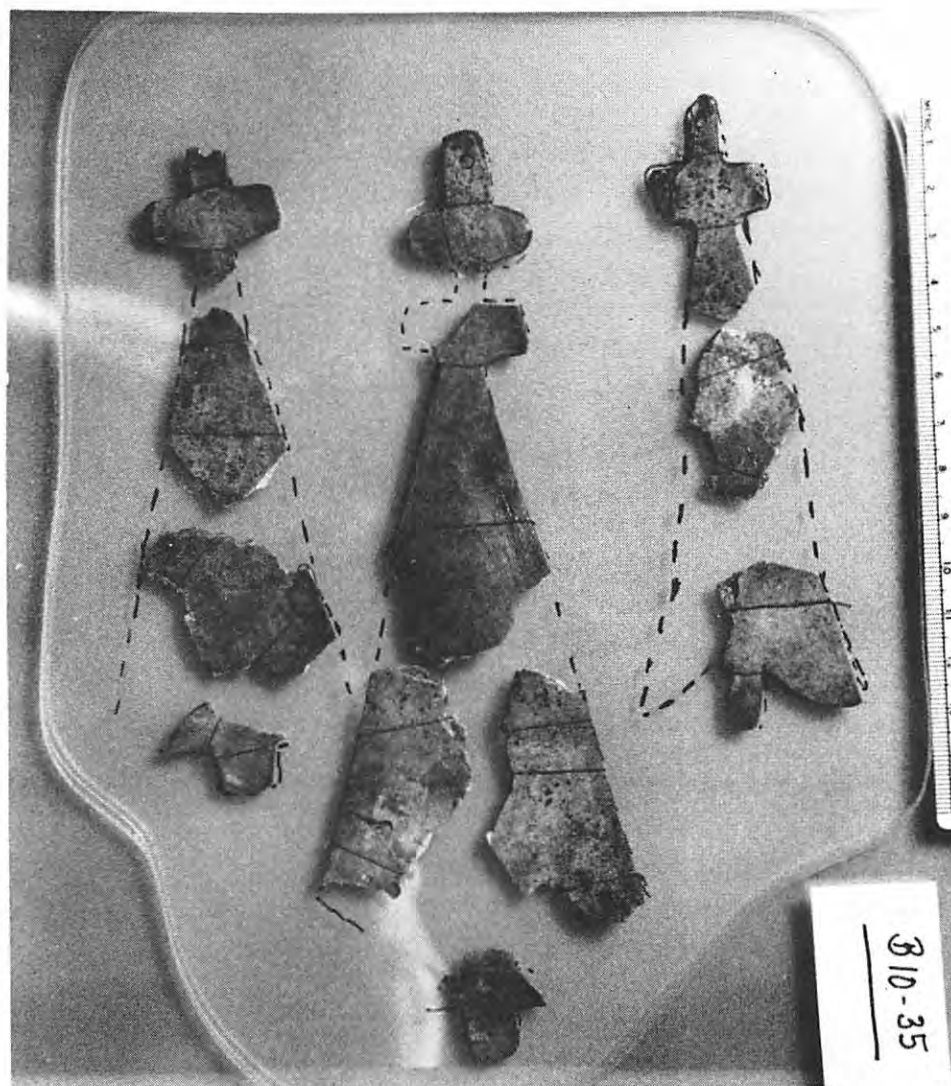


Figure 5. Bone pendants (?) after stabilization with PVA in acetone. The fragments are sewn to Mylar with cotton thread. Missing areas outlined with broken magic marker lines. The entire group is sandwiched between three Plexiglas layers with the middle one cut out the shape of the pendants. Thus they are not held in place by pressure which could deform them through time. The outer layers of Plexiglas are UV (ultraviolet filtering), which should also increase their survival potential.

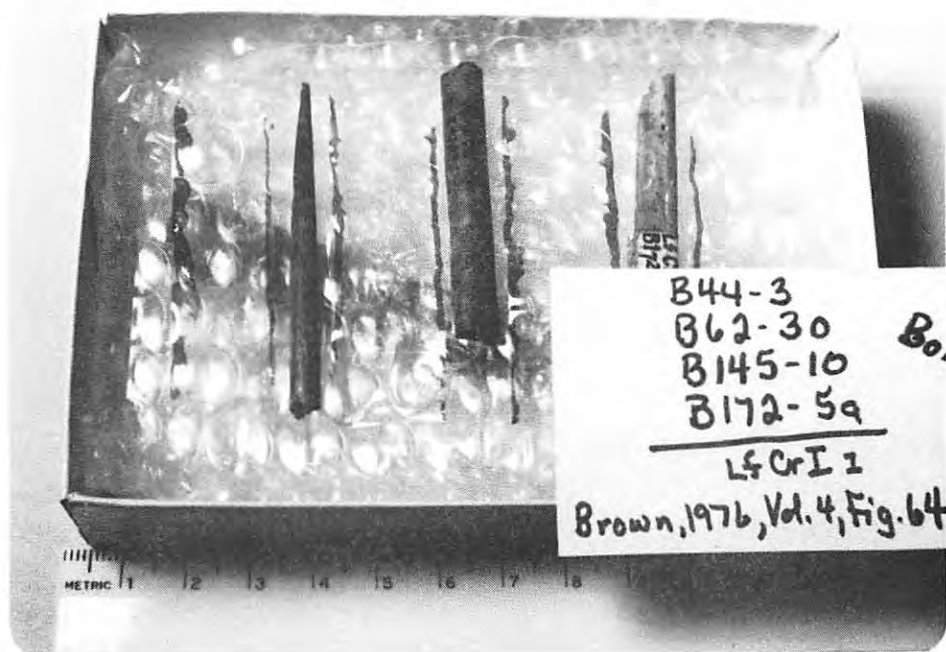


Figure 6a. Bone fragments re-stored in two layers with bubble pack between them (lower specimen can be seen faintly). The top layer has bubble pack spacers (outlined with magic marker) to keep the three objects apart. PVA was used to adhere the spacers to the bubble pack separator.

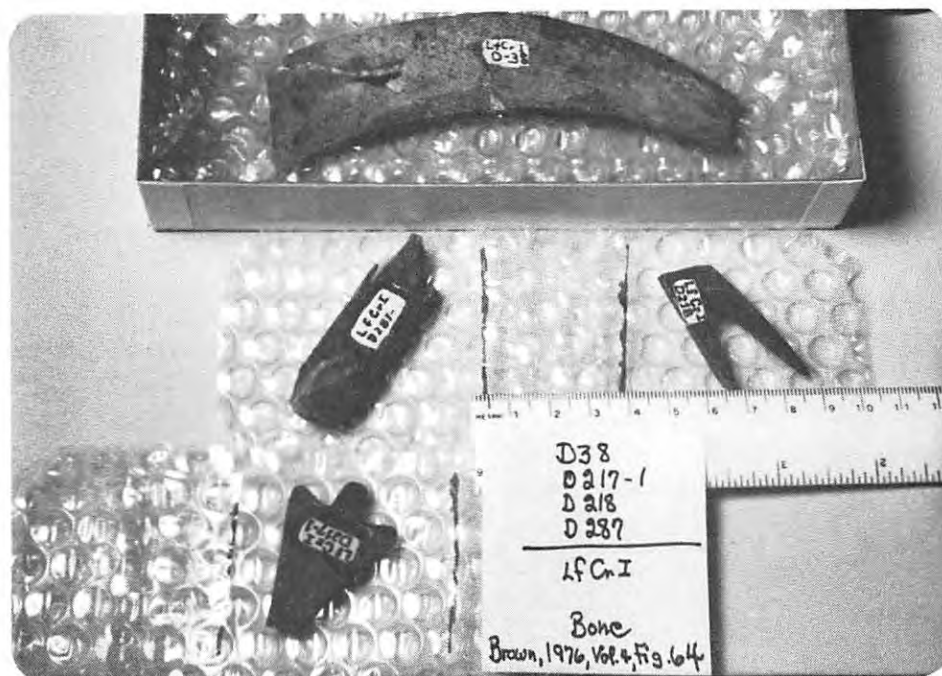


Figure 6b. Another box of bone specimens with the different layers separated. Again, the bubble pack was used as spacers. These spacers were adhered with PVA in acetone. The cards in these photos are the ones now in use in storage and, in this case, cite their publication.

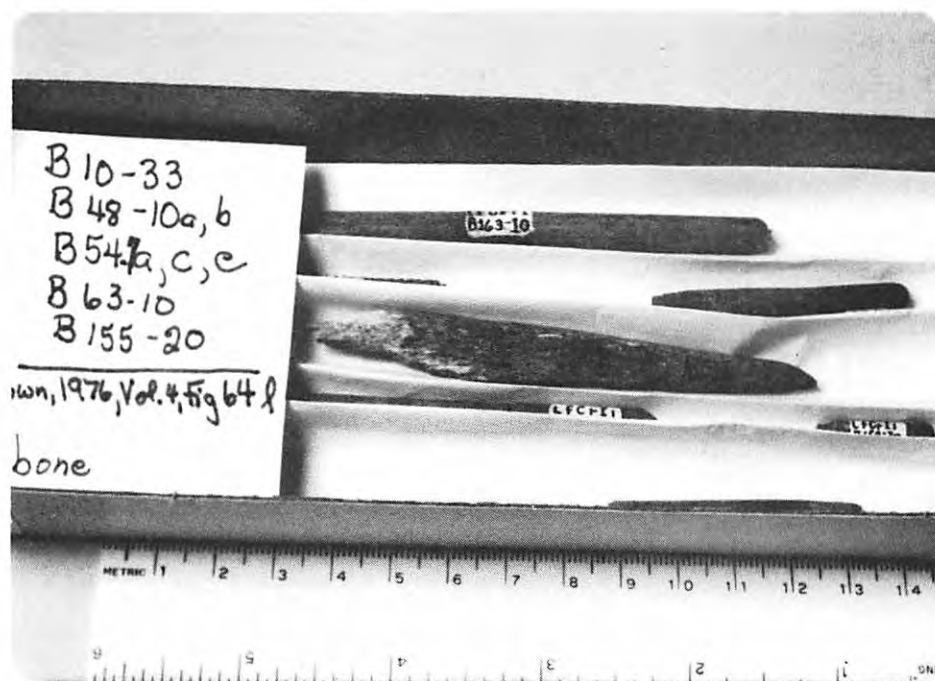


Figure 7. A few bone fragments were stored with pinched-up pleats of acid-free tissue to separate them.

BASKETRY

The basketry specimens from Spiro were in a stable condition so conservation treatment was not necessary, except for re-storage. There were no complete baskets. The collection consists of fragments of varying sizes (the largest measured 25.0 cm X 22.1 cm) and small boxes of detached splints and basketry debris. The specimens were previously stored either in boxes with no padding or with cotton used as padding. Both these conditions had resulted in abrasion of the edges of the fragments; those with cotton used as padding had innumerable broken bits of basketry embedded in the cotton matrix. These were salvaged and enclosed in acid-free tissue, then placed with the proper basketry fragment.

After some research into basketry storage and in consideration of the materials that were on hand that could be utilized in re-storing the basketry fragments from Spiro, the following storage was effected at the Stovall Museum:

- the cotton that surrounded some specimens has been removed as much as possible with tweezers.
- boxes of the appropriate size in width, depth, and height were constructed of cardboard. A piece of poster board, cut somewhat larger than the basketry fragment, was covered with bubble pack and placed in the bottom of the box. Thus each basketry fragment rests on inert, soft yet firm and supportive plastic.
- to inhibit sliding of the fragment, a cut-out was made the shape of the fragment in another piece of bubble pack and this was placed around the fragment. It was adhered to the solid layer of bubble pack beneath by 10% PVA in acetone.
- this entire arrangement was then enclosed in a "bag" of polyethylene that was sealed on one side and paper clipped on three sides. Thus the bag can be opened without having to slide the fragment.

A card with the specimen number clearly printed on it was then placed under one paper clip.

The above-described enclosure allows the specimen to be viewed through the plastic and to be lifted with complete safety (the cardboard supports it). The specimen can be physically inspected, if necessary, by removing the paper clips. It can then be reversed so that the opposite side is in view by inverting it onto a piece of board such as poster board. When the inspection is completed, it can again be inverted into position with the cut-out surrounding it.

Three charred or partially charred basketry and/or sack fragments (see Rachlin in Brown 1976) needed special mounting in Plexiglas containers. Two

fragments had been partially flattened due to having been glued into a glass-fronted frame. One that was partially charred was stored unsupported in a box. The framed specimens that had been glued to cardboard were freed by soaking with acetone. The adherent which was used (ambroid?) had not cross-linked, and eventually they were pried loose with a spatula in conjunction with the dissolving property of the acetone. Due to their fragility and brittleness, these fragments were sewn to an inert Mylar sheet with long couching stitches and enclosed in a 3-part Plexiglas mount (described in the textile section of this report). The third fragment, which was much larger, was also mounted in a Plexiglas frame. These three fragments, listed below, were the only basketry fragments mounted in this way.

B155-15

D134-8

Lf40-824

It is anticipated the storage design previously described for basketry will protect the specimens (especially their fragile edges), and yet allow the researcher accessibility to each fragment. See the Basketry section in the conservation notebook labeled "WOOD" for further information regarding these specimens.

Basketry specimens re-stored: B51-44; B52-4b; B108-60; B155-14; Lf40-763 (in 14 boxes); Lf40-824 (may be charred cloth).



Figure 8a. Basketry storage at the Stovall before this study began.

Figure 8b. Basketry storage as it is now. Black magic marker outlines the cut-out of bubble pack. Basketry storage was expanded from two drawers to five.



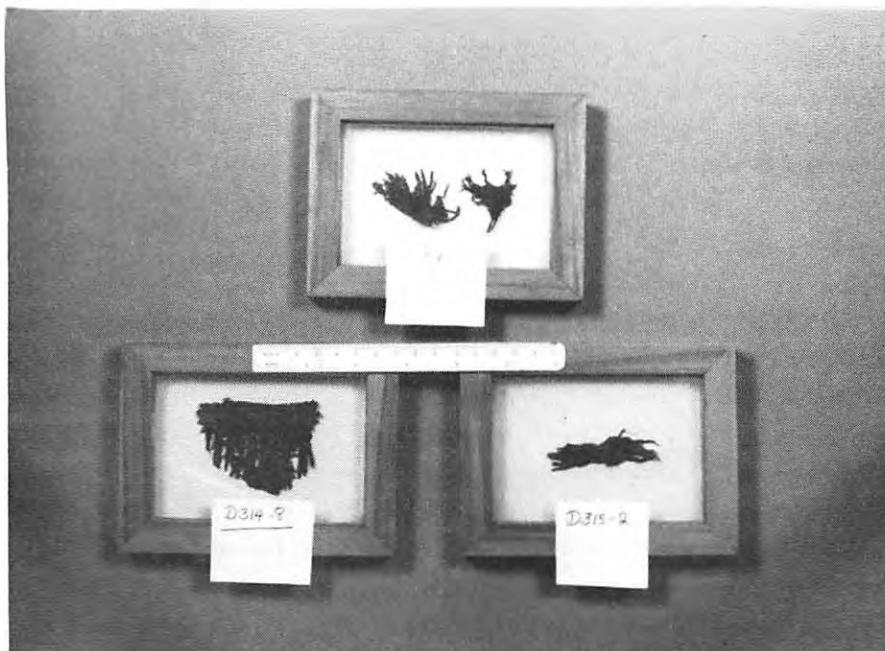


Figure 9a. Basketry and fabric fragments that had been glued to poster board and flattened somewhat by the pressure of the glass in the frame.

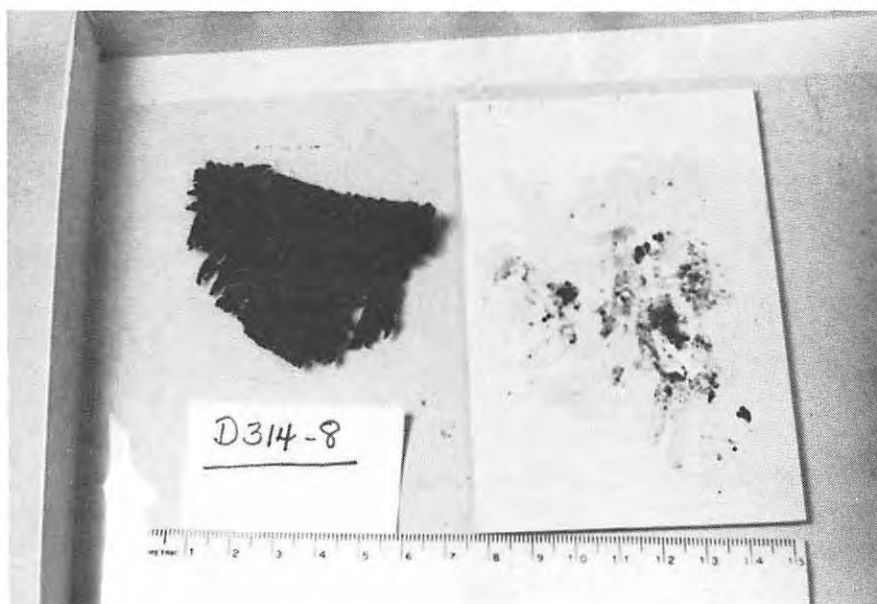


Figure 9b. One of the above fragments after removal from the frame and backing (with acetone and spatula). The old glue (ambroid?) and basket debris can be seen on the board.

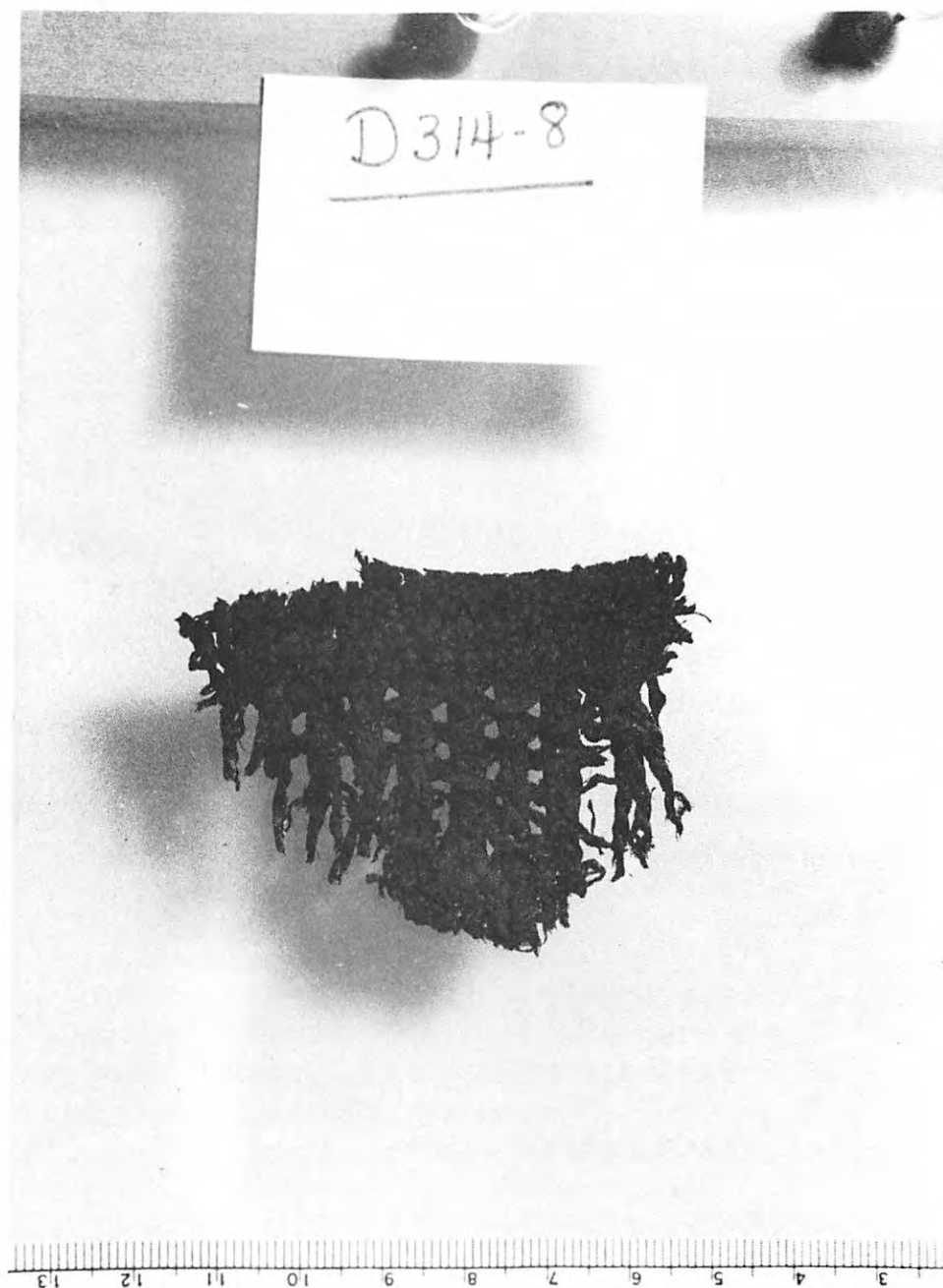


Figure 10. The same basketry fragment as in the previous photo (Figure 9b), sewn to Mylar. Its Plexiglas mount was not ready at the time of the photo.



Figure 11. Partially charred basketry or sack fragment, Lf40-824. It was particularly fragile so enclosure within Plexiglas was important. The Plexiglas mount is explained in the "Textile" section. The long threads which can be seen are the stitches used to anchor the specimen to Mylar, which is chemically inert.

STONE

Though there are several hundred specimens fashioned from stone in the Stovall's Spiro collection, only 38 needed conservation treatment. Several earspools that had soft, chalky surfaces (manufactured from mudstone and other similar materials) had to be consolidated with 10% PVA in acetone (applied with a brush).

All the other specimens had one or more breaks. Two of the stone objects (one mace and one blade) were re-adhered with 20% PVA in acetone.

The smoothness of the broken surfaces and the heaviness of the remaining stone specimens required a tighter bond to hold them together. A two-part E-Pox-E glue (Duro brand) resin was chosen as it has proven to be the only adherent that did not deform (bend or break) or shrink upon drying. The old adhesive used on many of the breaks had reopened due to both of the above conditions. The effectiveness of this E-Pox-E resin was noted three years ago at the Smithsonian Institution when I tested several adherents trying to find one that would hold together New World stone objects. There is no way to reverse this glue at the present time.

In order to remove the join made by E-Pox-E resin, a separator layer of 20% to 40% PVA in acetone should be brushed onto the edges to be mended and allowed to dry before the E-Pox-E is applied. If and when the mend is reversed, application of acetone will dissolve the PVA and the two stone fragments will separate from the indissolvable E-Pox-E resin.

All of the stone specimens from Spiro are now stored in proper sized boxes with protective plastic bubble pack surrounding them. Each also has a card with the number printed on it so the specimen does not have to be touched in order to determine its number. They are now housed in 10 drawers (previously they were in four). The projectile points were so numerous, especially the small ones, that it was decided to try plastic boxes with dividers (such as small tackle or bait boxes and sewing boxes) that could be found in local hardware stores. These boxes worked very well; several small points of the same type can be stored in each compartment by placing bubble pack between them for spacers and to prevent abrasion.

Four stone maces were too long and heavy for the storage boxes at the Stovall, so a special mount was constructed for them. Peg board was heavy enough to adequately support them so it was cut into proper sizes and covered with inert bubble pack. Strips of the latter were then wrapped over the specimen and taped

to the underside of the board. A cap of bubble pack was made for each end so the specimens cannot slide out of these "slings." Two of these maces had been broken in storage, most likely from sliding unprotected in the drawers.

For more specific information see conservation notebook labeled "STONE, BONE, etc."

Stone specimens conserved: B10-4; B10-3; B10-11; B23-6; B23-32; B48-32a, b; B49-4a; B51-31; B51-43a, b, c, d; B54-1g, 1k; B54-4c; B58-1; B62-21; B99-7; B99-12a, b; B101-27, 49, 50; B137-11b; B188-1a, b; D24; D30; D75-3; D169-14; D271-9; D271-32; D285-3; Lf40-?; Lf40-560; Lf40-567; Lf40-720; Lf40-889; Lf46-372; Lf58-56.

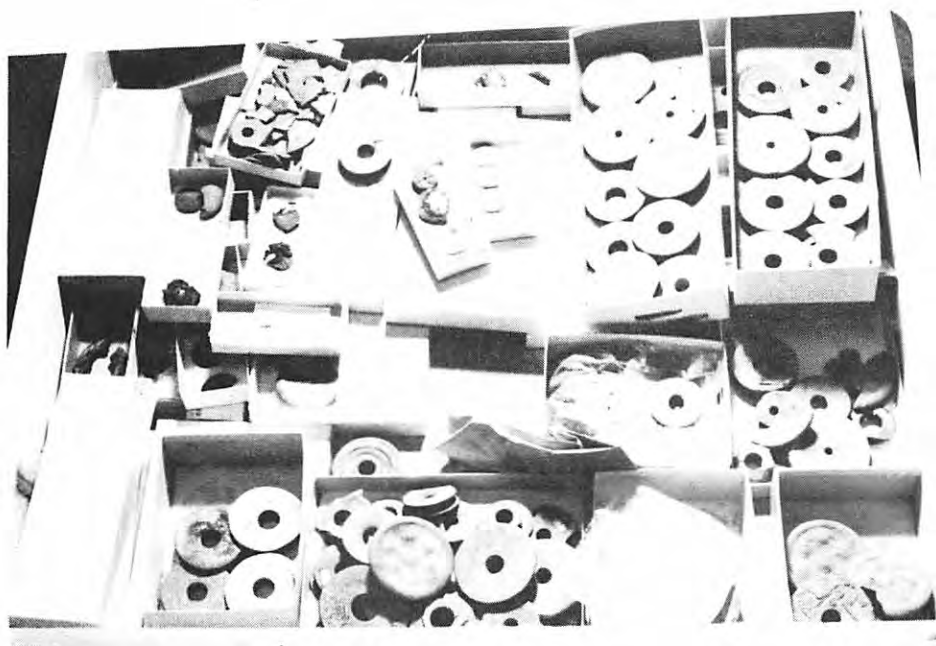


Figure 12a. Stone earspool storage before this study.

Figure 12b. Present stone earspool storage drawer (there are 2 more).

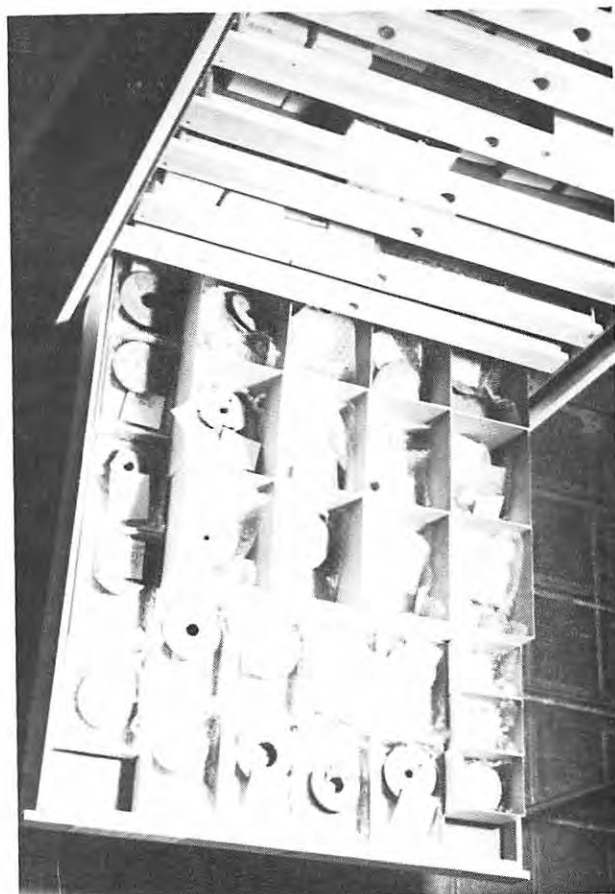




Figure 13a. Stone earspools that had been glued to cotton revealing loss of some of the outer layer due to this use of the adherent.



Figure 13b. Stone earspools that had been glued to cotton with subsequent loss to the outer layer. The specimen on the left reveals that the tape over the gesso layer on which is printed the number, has cotton embedded in it.

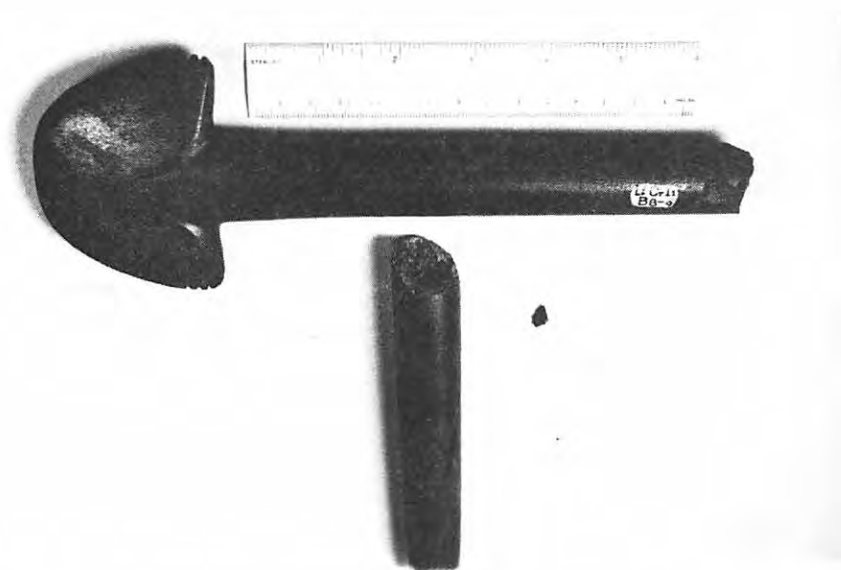


Figure 14a. One of the stone maces or spuds before repair.

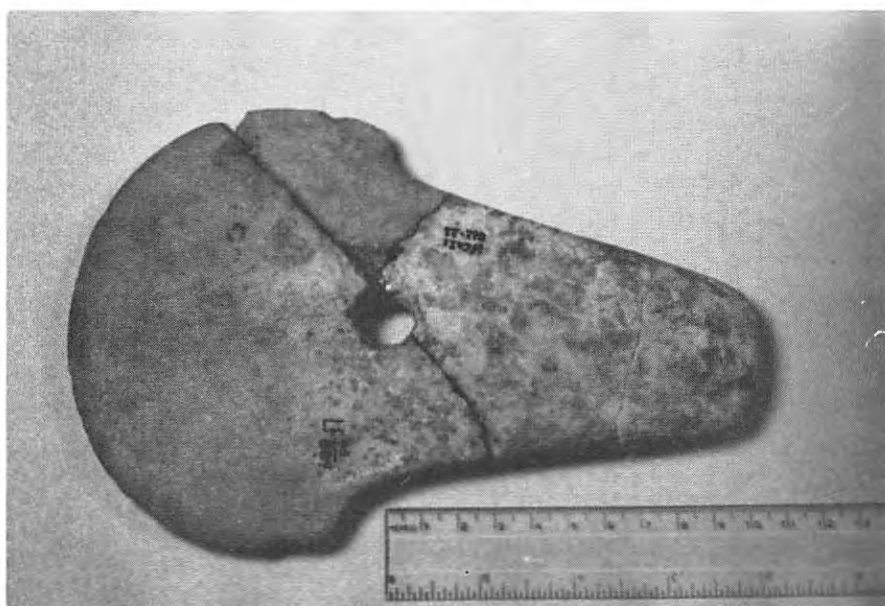


Figure 14b. A different stone mace after repair with E-Pox-E resin.



Figure 15. Stone storage at completion of the study. The objects are surrounded with bubble pack, they are in proper sized boxes, each has a card with its number, and the list of specimens in this drawer can be seen in its plastic jacket on the left.

COPPER

The Stovall Museum Spiro collection of copper contains over one hundred small fragments of all sizes as well as three large falcon plates and one bird plate (woodpecker). The plates and many of the fragments are paper-thin and quite fragile, especially at the brittle edges. Three plates had one to four breaks that had been "mended" with masking tape.

The fragments were stored in boxes without padding, which had resulted in battering over the years as the drawers were opened or closed. The plates were stored in boxes with cotton for padding. Unfortunately the cotton had discolored, indicating deterioration, and the irregular edges of the copper had become tangled in the cotton and caused more fracturing. At some previous time the copper plates had been chemically "stripped," which can cause surface pitting. The Spiro plates reveal this kind of surface when inspected closely. It is likely they had patches of carbonates (malachite which is green, or azurite which is blue) because all the fragments were covered with this patina (mostly malachite). It is regrettable that they were "stripped," since carbonates can be protective, and this kind of surface pitting could have been avoided. At any rate, there is no record of what was used to remove the patina.

Conservation treatment of the fragments involved proper re-storage. The copper fragments were stored in layers with bubble pack used between layers and on top of the groups to pad the box up to the lid. There is very little movement when a box is properly packed.

Conservation of the falcon plates required that the masking tape holding the fractures together be removed from the reverse side. This was accomplished by applying a cloth pad saturated with acetone. The breaks were then mended utilizing nylon net fabric and/or acrilan fabric with Acryloid B-72, a thermoplastic acrylic resin (ethyl methacrylate copolymer) that dries to a very hard film and is often used in conservation of metals. The concentration of this adherent was 20%, with toluene used as the solvent. Inpainting with acrylic paints was necessary so that the repair was not glaring but still could be seen upon close inspection. After mending, the plates were in good condition and so were degreased with ethanol to remove any oils left from touching them with human hands. They were then enclosed in Plexiglas frames to prevent further damage in the future from handling. Each was overstitched to Mylar and had a 1/4" Plexiglas cut-out center layer so that no

pressure was exerted on it by the outer two layers of Plexiglas. This frame allows them to be studied both from obverse and reverse sides. The specimen number was engraved into the Plexiglas frame with an electric carbide-tipped pen.

For further information, see the conservation notebook labeled "STONE, BONE, MICA, COPPER, etc."

Copper plates conserved: A6-4; A6-9; A6-6; B122-25a.

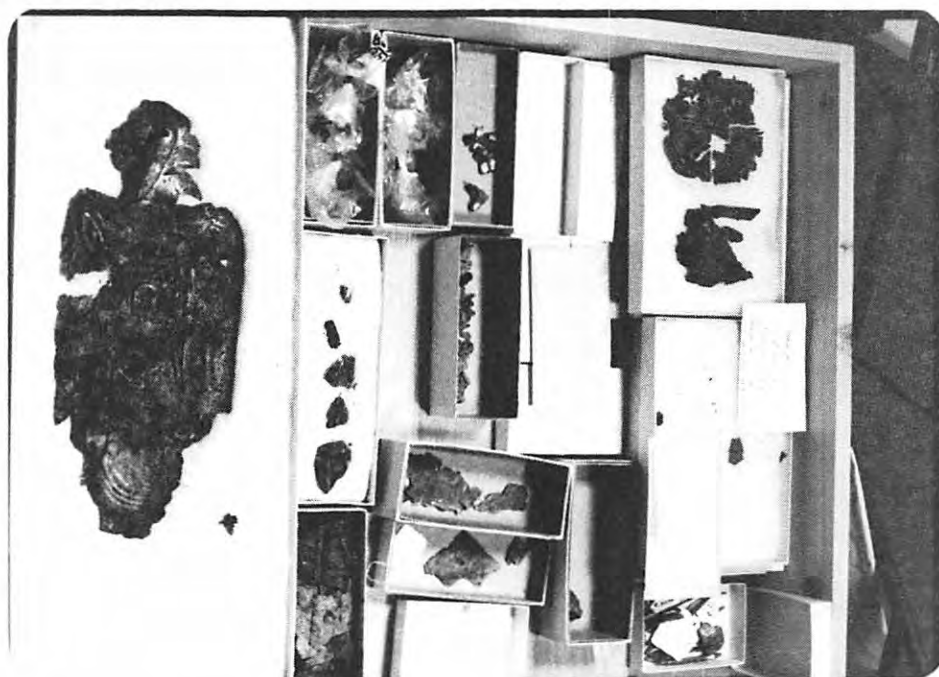


Figure 16a. Copper storage drawer before this study.

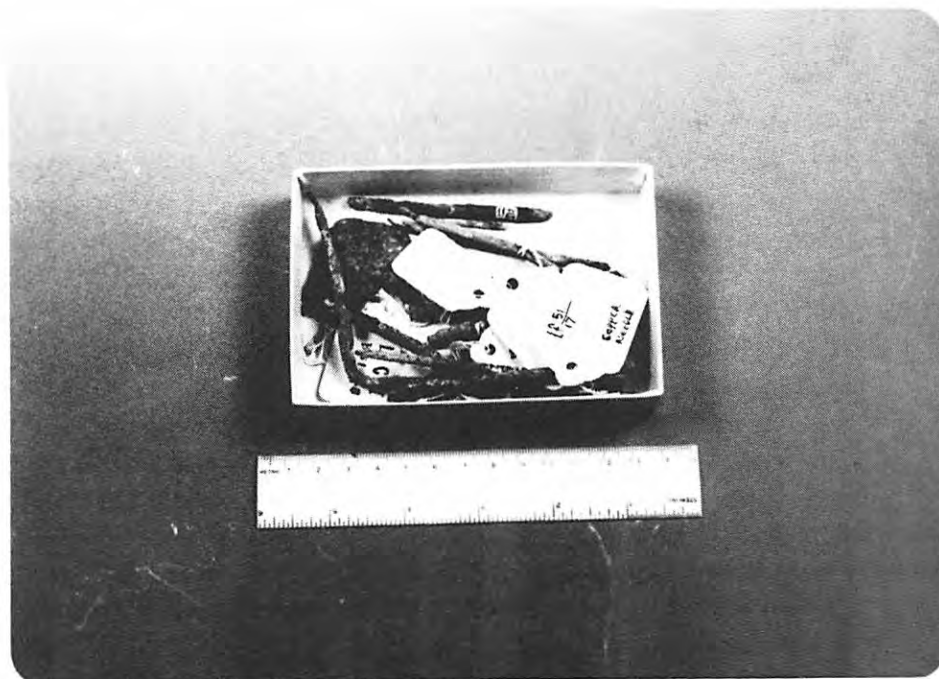


Figure 16b. Over 20 specimens were contained in this box with no padding.

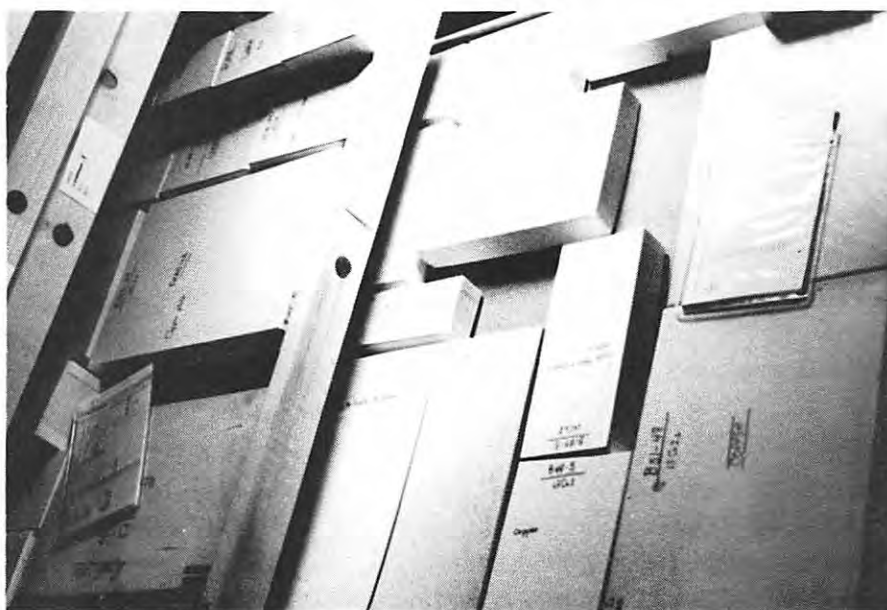


Figure 17a. Copper storage as initiated in this study. It was expanded from one to four drawers. All the copper fragments are now in padded, closed boxes with the tops clearly marked.



Figure 17b. Falcon plates as they rest in storage now. The Plexiglas mounts are clearly visible. The bottom of the drawer has a lining of Upson board which does not scratch Plexiglas.



Figure 18a. Two of the three falcon plates had breaks that were previously mended with masking tape. This had to be removed by soaking with acetone (applied in a cotton pad).

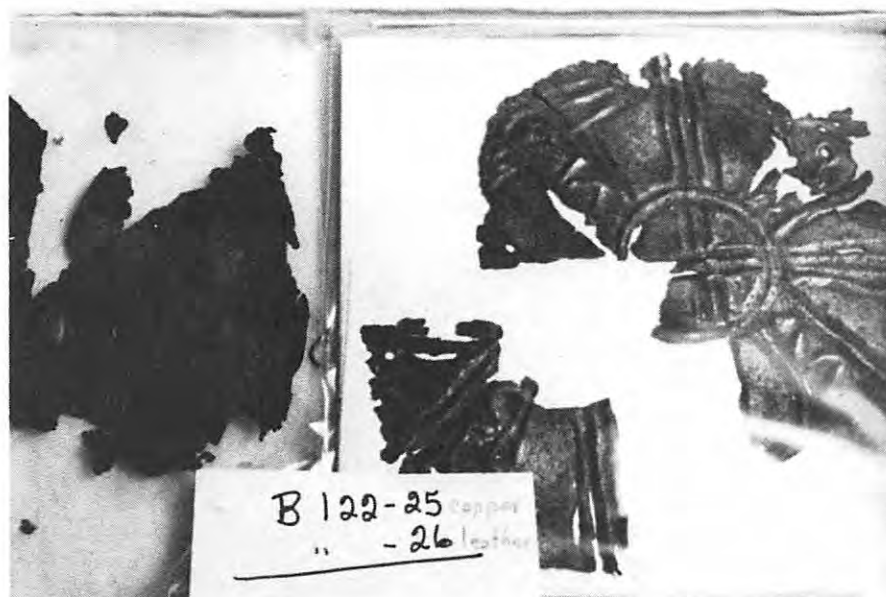


Figure 18b. The bird plate had fractured into two pieces. One small fragment (not in the photo) had been detached, probably by the cotton.



Figure 19. Copper falcon-man plate, obverse side, before mending and sewing it to Mylar.



Figure 20. Enlarged photo of repaired fracture of one falcon plate. Cotton thread was used to attach it to the Mylar sheet. This is, of course, the reverse side.



Figure 21. Copper falcon plate after removal of masking tape, mending, and sewing to Mylar sheet. The center cut-out of Plexiglas can be seen around its edges. The top Plexi layer was removed for this picture to reduce the glare.

SHELL CUPS, GORGETS, AND ORNAMENTS

The shell and pottery specimens are probably the largest groups of objects in the Stovall Spiro archeological collection. Since this grant did not include conservation of the ceramics, the shell became the focus of my initial activities at the Stovall. The conservation of these shell cups, beads, gorgets, and other various ornaments continued to almost the last day of the study.

Problems pertinent to the engraved and unengraved shell groups (other than disorganization) were:

- a great many fragments were not in boxes, but loose in the drawers.
- several fragments were in one box (sometimes 50+ were stored together with no padding).
- entirely too many specimens per drawer with consequent abrasion and breakage when drawers opened or closed.
- no supportive padding for the majority of the fragments.
- some fragments had been previously glued to cotton, which still adhered.
- a majority of the specimens had areas of active oxidation or chalking; quite a few had lost much of the exterior or interior surfaces.
- many fractures or breaks had occurred and detached portions littered the drawers.
- many gorget fragments were stored on cotton which had become entangled and caused further breakage.
- pieces of scotch tape had been stuck to the top of a gesso layer on which was printed the specimen number. The tape had yellowed (indicating deterioration) and lifted off or nearly off, fracturing the fragile surface layer of shell where it had been stuck.
- quite a few specimen numbers were unreadable due to absorption into the gesso layer and/or peeling scotch tape.
- small fragments were stuck together from scotch tape residue.

Perhaps the cause of much of the damage to the engraved shells was handling, since in order to find the specimen sought, each one in the drawer had to be picked up and examined. In order to minimize handling and maximize research potential, it was decided to categorize the shells into engraved and unengraved cups, gorgets, beads, and finally ornaments and then within these categories to separate them according to their location within the mound or site. Shell storage was also expanded from 7 drawers (in the old wooden cabinets) to 13 and an additional steel storage unit with 9 more drawers.

Any researcher seeking to locate the shell fragments from a specific burial will find all the engraved cups in one drawer, the unengraved cups in another (in numerical order as much as size and shape would allow), all the gorgets together in another drawer, and the shell beads and ornaments would be in still another drawer. If the researcher cannot remember from which drawer the specimen(s) were removed, he/she can cross-check with the label on the front of the drawer, the list on the interior, and since the specimens are now in boxes, a space will have been left by its removal.

The card on the exterior of the drawer does not always list the numbers on the interior, as they were usually too numerous. However, the list on the interior of the drawer will do so. Again, the categories are "B" for burial association, "A" for artifact (see the introductory section for a summary of what these and other initials represent).

Each complete shell specimen is contained in a box lined with bubble pack and has a card with the appropriate number printed on it. The fragments are usually one per box packed as above, however, there are some boxes with several tiny fragments. Bubble pack was used to separate them, to reduce further fracturing.

Treatment of the chalking areas or fractured areas of shell was accomplished for both the engraved and unengraved pieces, which was a great relief as it had not been expected in the initial planning to be able to accomplish this much. Areas of shell surfaces that were stable were not touched; consolidation of chalking or weak spots was accomplished by brushing on one or more layers of 10% PVA resin in acetone. For repair of broken areas, 20% concentration of PVA in acetone was required. All specimens were renumbered as the scotch tape was too unstable to leave. It and the gesso layer were removed with acetone. Renumbering involved brushing on a layer of 20% PVA, allowing this to dry, numbering with India ink, then coating this with another layer of 20% PVA. Care was taken to see that the numbers were printed smaller and in less noticeable places. Some stains resulting from the scotch tape were not removable as the yellow had soaked into the surface layer of the shell.

Quite a few of the unengraved shells and fragments had been previously coated with some material (ambroid?) which had yellowed and often came off in sheets. This suggests that the shell had been dipped in the material without concern for the difference in absorption between normal and chalking areas. Thus some spots of the shell surface did not absorb the consolidant and it could be peeled off. It also might indicate that the solution was too viscous to be absorbed where the

shell surface was not chalking. Much of this old material was removed with acetone, however, when it appeared to have accomplished consolidation it was left on the surface.

Specimens that had been adhered to cotton were removed from it by acetone and careful use of scalpel and/or tweezers. All cotton was removed from the shell, and bubble pack (which is flexible but supportive of fragile edges) now surrounds the shell objects.

For further information on the consolidation of shell, see the 3 conservation notebooks labeled "SHELL." The specimens were too numerous to list here.



Figure 22a. Engraved shell cup fragments storage before this study began.



Figure 22b. Unengraved shell cup storage before this study began.

Figure 23a. Shell gorget with previously mended glue that has broken loose.

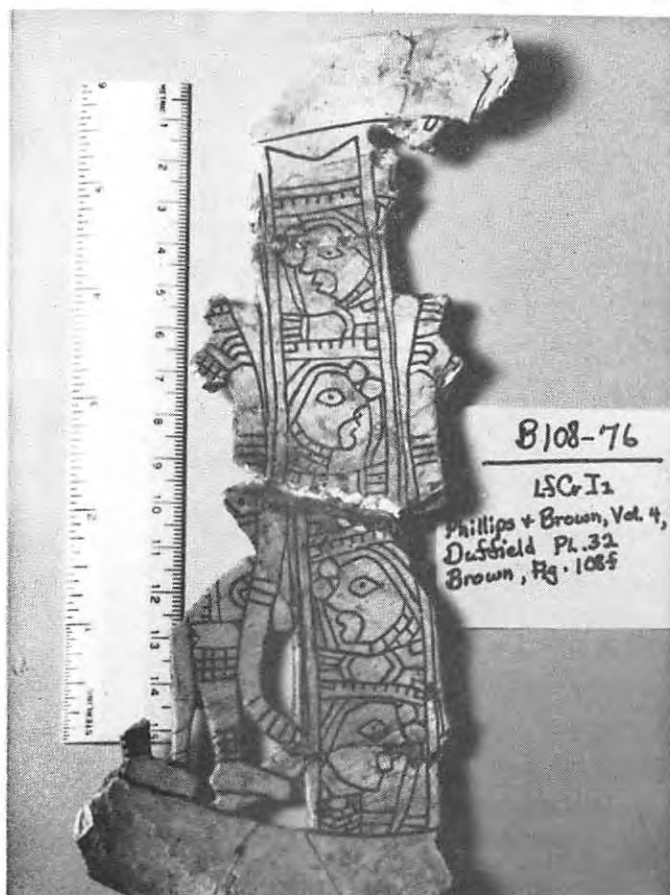


Figure 23b. Reverse side of the above gorget. Kraft paper has been glued to this side to reinforce the earlier mend that has since separated. I removed the paper and all the old glue, mended the fracture with 20% PVA in acetone and embedded a small steel nail (with the head removed) that had been bent to conform to the shell's contour in the PVA. This plus extra padding so that the shell is properly supported should prevent its coming apart in the future.



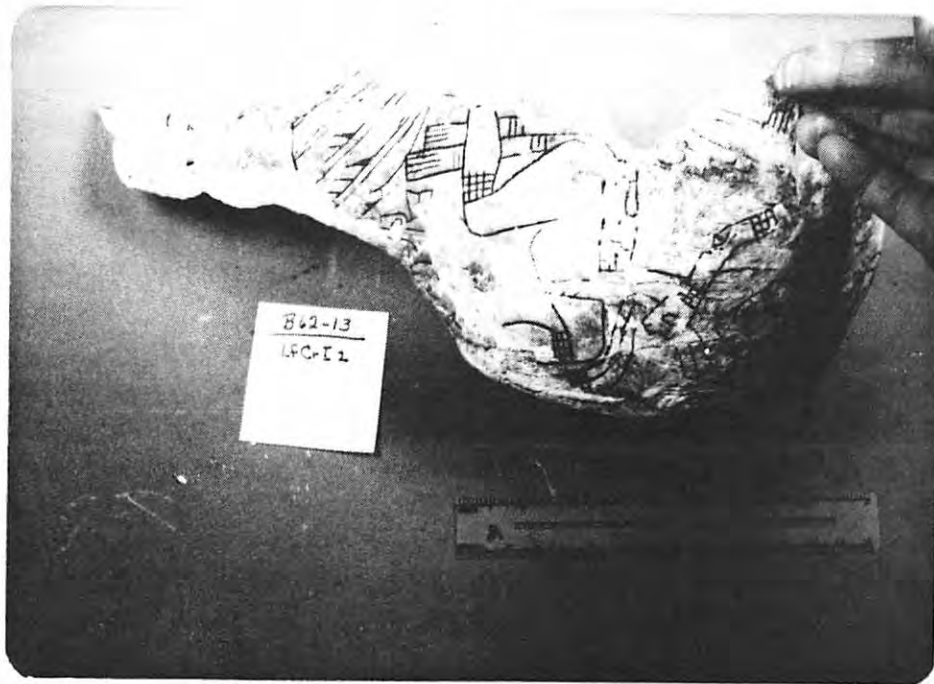


Figure 24a. Shell cup showing a badly deteriorated surface that is actively chalking. Bits of shell surround it. The chalking areas were consolidated by one or more layers of 10% PVA in acetone during this study.

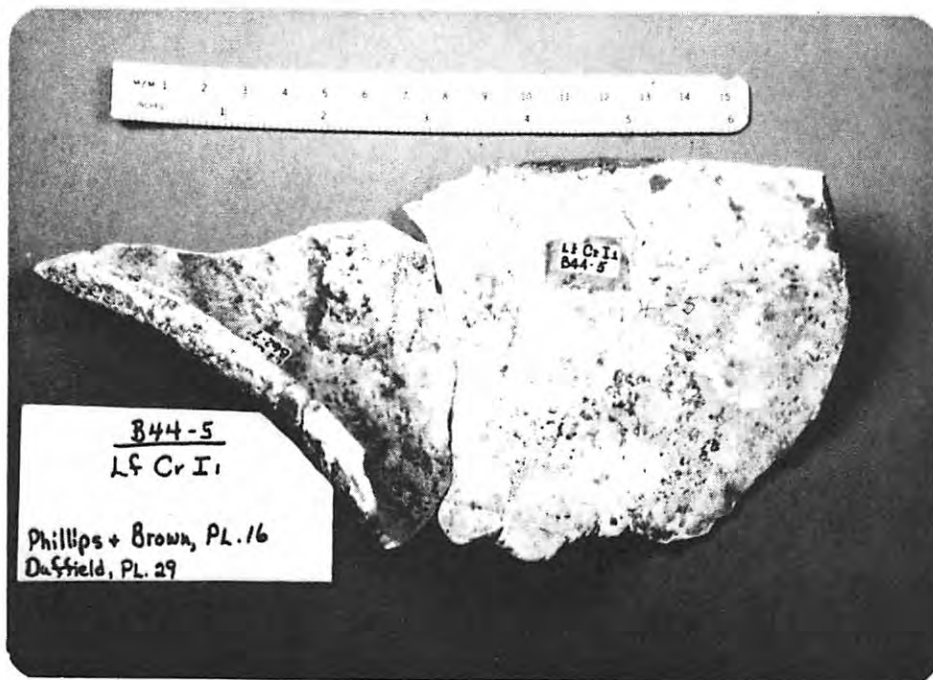


Figure 24b. The reverse side of an engraved shell cup in which the peeling scotch tape can be seen. Many times this shattered the surface to which it was attached. This was removed with acetone and renumbered as reported in this section.

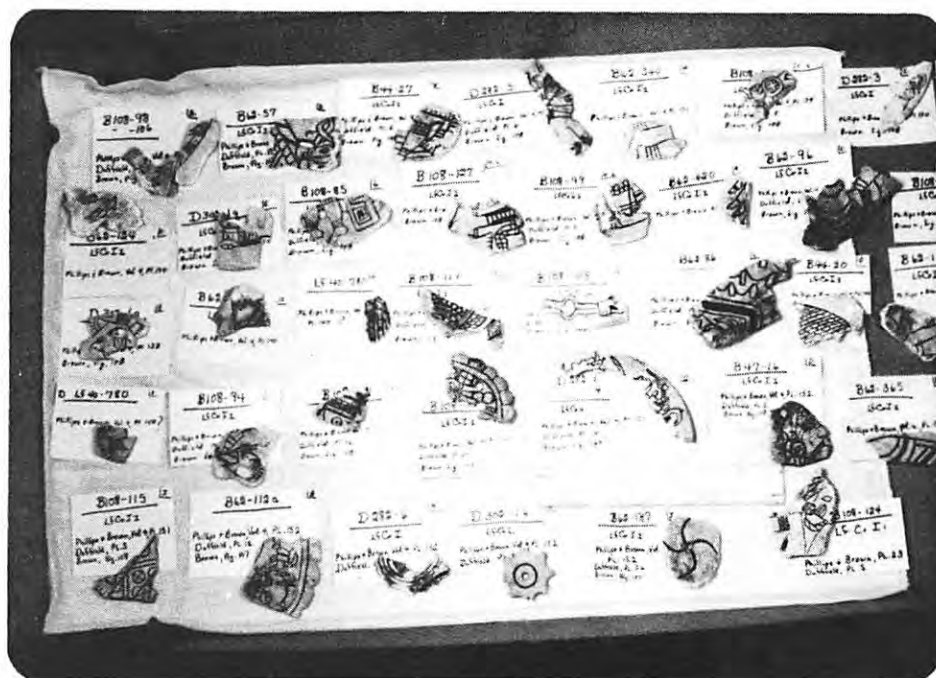


Figure 25a. Organization of the engraved gorget fragments during the study with citation of publication on the card accompanying each specimen. Documentation in this manner is important in keeping collections up-dated for research.

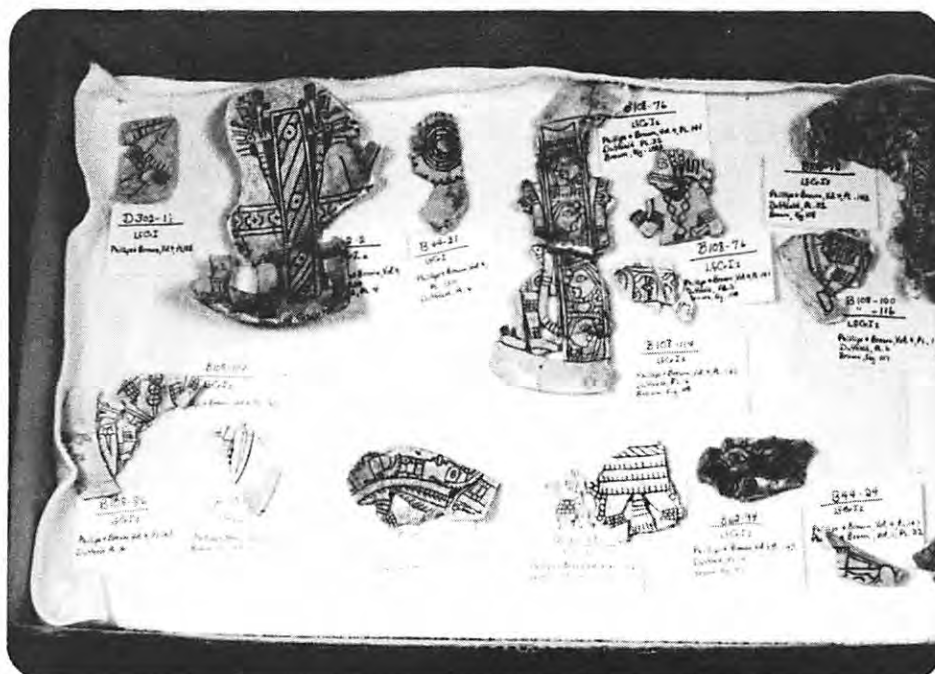


Figure 25b. Another photo of the reorganization necessary to group the engraved gorgets into the categories of "B" for burial, "D" for disturbed (see text for the explanation of the groupings), etc.





Figure 26a. Shell conservation area at the North Lab of the Stovall Museum during this study.

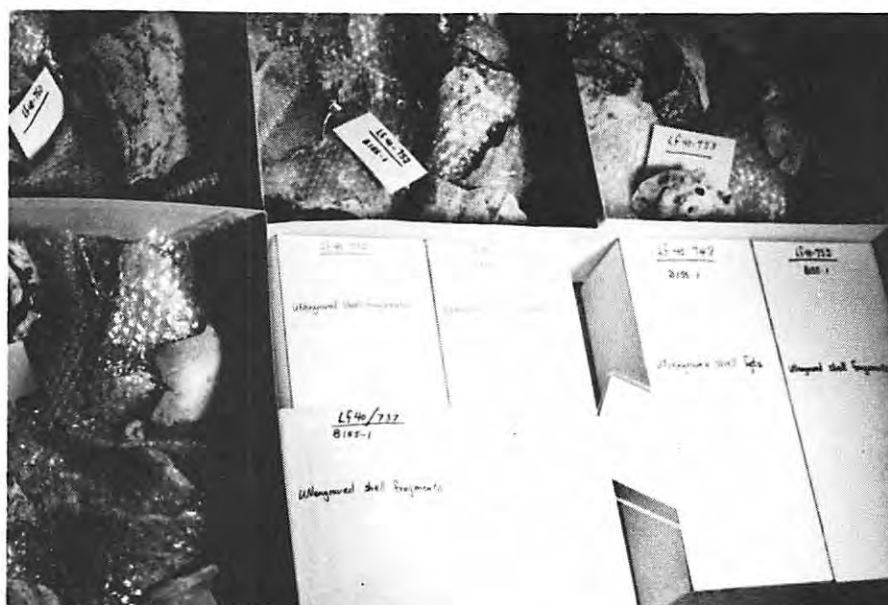


Figure 26b. One drawer of shell cup fragments storage (unengraved) at the end of the study. Bubble pack has been used to separate the many fragments, and boxes enclose smaller fragments. There were too many fragments to enclose each in a separate box. The unengraved shell storage area was doubled during this study.

Figure 27a. In this photo the new steel storage cabinet with more shallow drawers can be seen. Shell gorgets with accompanying cards are in the drawers; on top is work-in-progress area.



Figure 27b. One drawer of the above engraved shell gorget storage area pulled out fully for viewing.





Figure 28a. Engraved shell fragment drawer after re-storage during this study. Each specimen has a card with it and the card listing all the specimens in the drawer can be seen at the bottom center.



Figure 28b. Large, almost complete engraved shell storage at the end of the study.

SHELL BEADS

Upon examining the hundreds of thousands of shell beads in the Stovall's Spiro collection, it was discovered that they had become greatly disarranged, and were spread between several drawers and jars (some of which were located on top of the storage cabinets), in no apparent order. Consequently, it was decided that the first step with respect to their conservation would be to reorganize the area storage so that the beads catalogued as burial associations, artifacts, disturbed area, Lf40 in general, the Hamilton collection, Lf46, Lf51, Lf53 would be located in separate sections of the storage drawers in a roughly numerical order. They are now housed in 5 drawers in the wooden cabinets.

In cases where several beads in a deteriorated condition were to be stored in one box, or where the box contained beads that were designated as having been measured and unmeasured, the bubble pack was pinched up to form deep ridges separating the beads. In some boxes the number of beads designated as measured was relatively small, and instead of making a separate compartment for them, they were wrapped in acid-free tissue and placed on top of the upper layer of bubble pack. Bubble pack was used to separate the beads into layers. Compartments were made to lessen movement by adhering cut bubble pack spacers to the base layer with 10% PVA in acetone. Any bits of broken beads and powder that remained in the bottom of the old boxes after repacking were wrapped in acid-free tissue and placed in the new box.

Previously the beads were stored in a variety of ways which included having been strung on nylon, wire, or cotton cord and then coiled, placed on top of cottonpads or glued to cotton, or heaped into large boxes (sometimes thousands were in one box), or envelopes where abrasion and breakage was maximized when the containers were shifted by opening the drawer. Extensive damage to some of the shell beads had already occurred with only small pieces of broken shell and powder left to verify the fact that the box or envelope had once contained some type of shell bead.

Those beads that had been strung on wire were restrung on nylon or cotton thread. Wire is harder than the shell and abrades it. All the strung beads were then placed in boxes containing a bubble pack cut-out, glued to the bubble pack lining of the box using 10% PVA in acetone. The purpose of the cut-out was to separate the strands and reduce the amount of movement and possible abrasion. A pad of bubble pack was then placed on top to provide further cushioning. Due to

the space limitations in the storage area, it was necessary to coil the very long bead strings in boxes lined with bubble pack. However, bubble pack was layered in between the separate coils to prevent the abrasion that would normally have occurred between the coils.

Any beads that had been glued to or incorporated into the cotton lining of some of the boxes were removed from the cotton. They were then re-stored in boxes lined with bubble pack. The glue was removed with acetone applied with eyedropper or swab.

After repacking the beads, a small white card with the appropriate catalogue number and bead type (see Brown 1976:343-375) was placed inside the box where it would be readily visible. The catalogue number and bead type was also written on the exterior of the box.

(This section of the report was prepared by Lynne M. Kellar, student volunteer with the shell bead storage.)

Those beads that were chalking or were in fragments were consolidated by brushing on one or more applications of 10% PVA in acetone, letting each dry and if still chalking, applying as many layers as necessary to stop this condition. Only those areas that were chalking were treated; it is not necessary or desirable to treat areas that are stable. The beads that were fractured or broken were repaired with 20% PVA in acetone. PVA can be applied in an emulsion (with water as the base) or in a solvent such as acetone or ethanol. The latter were chosen as water would tend to erode the chalking surface further.

Please see the two conservation notebooks labeled "SHELL BEADS" for itemized list of shell beads consolidated and repaired. Several hundred specimens were conserved and several thousands re-stored.

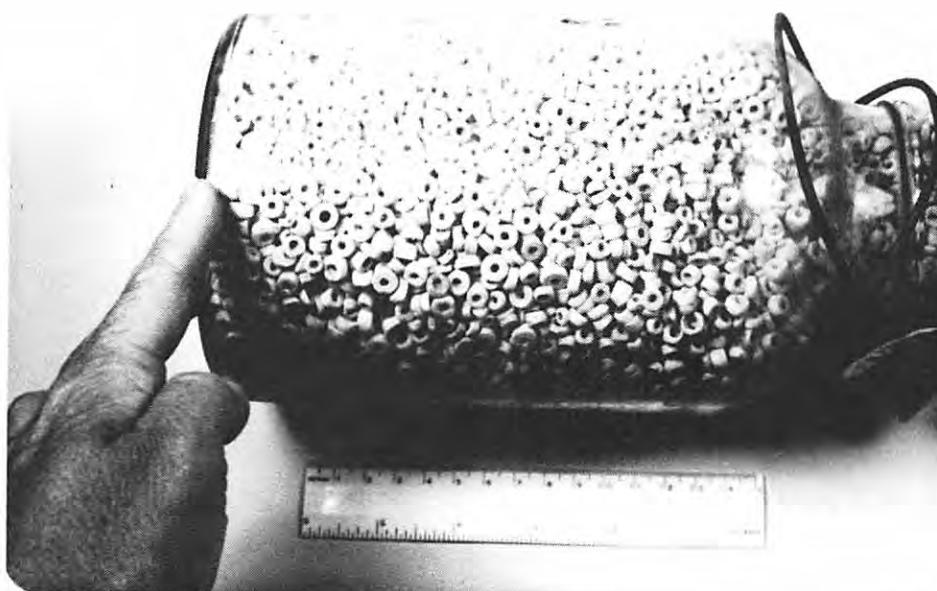


Figure 29a. Shell beads previously stored in glass jar.

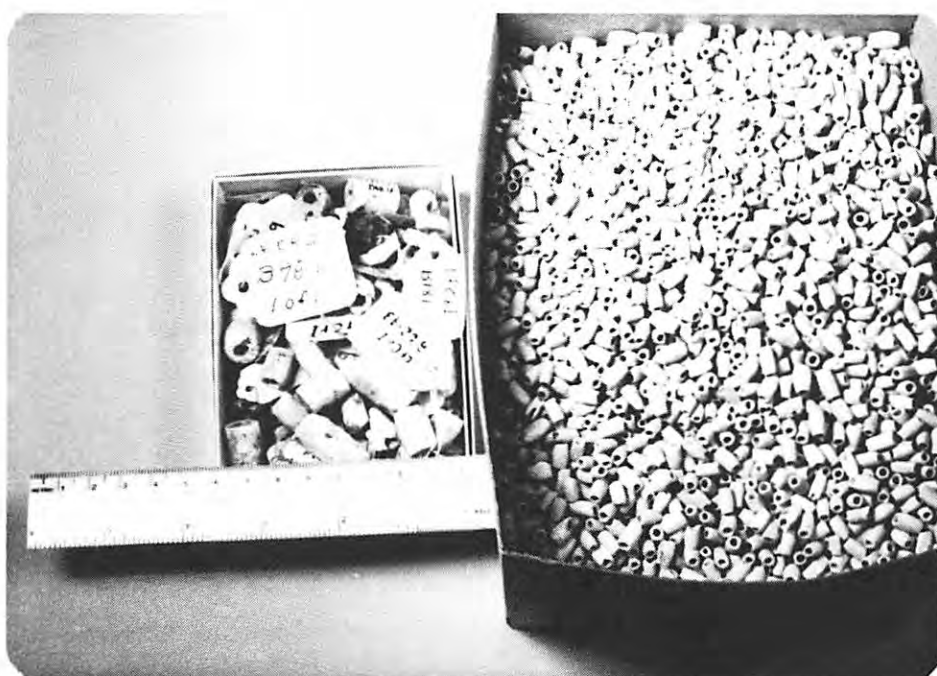


Figure 29b. Typical shell bead storage methods before this study was initiated.



Figure 30a. A shell bead storage drawer at the end of this study. The bead types and numbers are printed on each box and the drawer list is at the center bottom.



Figure 30b. Interior of shell storage box with pinched area to separate measured and unmeasured groups. Atop this would be one or more bubble pack layers to inhibit movement within the box.

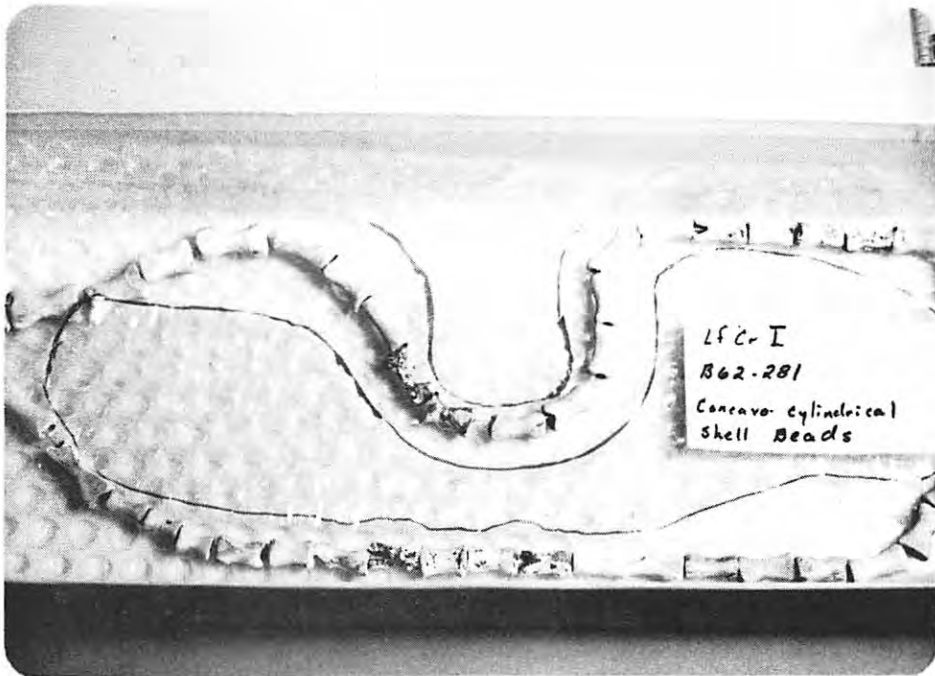


Figure 31a. Shell bead necklace after removal of wire and restrung on heavy cotton thread. Bubble pack cut-out is outlined in magic marker. It was constructed to keep the beads from abrading each other.



Figure 31b. Re-storage methods as utilized in this study. The beads on the left are stored as above. The ones on the right have bubble pack spacers to keep them separate.

MICA

The 40+ mica fragments that are part of the Spiro archeological collection of the Stovall Museum were quite small, the largest measuring 4.5 cm by 5.0 cm. Many exhibit surfaces that appear to have been "cut" or "worked." No easily recognizable outlines or shapes were noted.

The mica fragments had been previously stored loosely in boxes (thus aiding in breakage and abrasion) or glued to cotton. The latter was probably well-intentioned, however, it was considered an undesirable storage method to continue since old glues often cross-link and become unremovable. Acetone, applied with an eyedropper, loosened the old glue; then tweezers and scalpel were applied with the slightest force necessary to dislodge the cotton. Remaining small deposits of glue were removed with acetone on a swab.

These mica fragments are now stored inside folded acid-free paper cut just slightly smaller than the box in which it rests. Each "folder" is thus easily lifted without touching the specimen itself and, in addition, no fragment is free to slide into and abrade another.

Cards with the specimen number and site data are inside the boxes and the boxes clearly labeled on the exterior for greater accessibility. It is anticipated that further fracturing of the mica specimens will be reduced by this storage.

LEATHER

Several small, fragmentary leather specimens were located in the Stovall Spiro collection. One had been treated at some previous time and was covered with a white "bloom" which will be discussed shortly. The other leather fragments were twisted, desiccated, brittle and cracking. Leather is one of the more difficult materials to conserve, so a review of conservation data regarding this material and its treatment was conducted before actual treatment commenced.

Polyethylene glycol (PEG, a polymer formed by the condensation of ethylene glycol), a wax-like water soluble material, has been applied to some archaeological leathers with varying success in relieving desiccation and restoring pliancy. However, it had been used several years ago on a larger piece of Spiro leather (at the Smithsonian Institution) and had darkened the piece considerably. The treatment left the fragment with a waxy feel that I did not particularly want, as this can attract dust and dirt.

After reviewing the problem with associates, Carolyn Rose and Edith Dietz of the Anthropology Conservation Lab at the Smithsonian, I tested one tiny fragment with a formula recently published by them (1978) which was based on a formula first published by Margaret Kimball Brown (1974). This treatment consists of mixing Ethulose 400 (ethyl-hydroethyl cellulose, a water-soluble non-ionic cellulose ether) and PEG in water and adding a fungicide. Shaking the jar in which they were contained (Brown's instructions) did not produce dispersal of the Ethulose, but continuous stirring (Rose and Dietz's suggestion) did produce the proper consistency. A problem with the formula resulted from my having to use Polyethylene 1500 instead of 400 (the latter is more flexible upon drying), but the 400 was not on hand in Oklahoma and there was no time to order it before the grant was finished. The fungicide used was Thymol, so it was dissolved in water and six drops added to the mixture.

The twisted leather was immersed in the above formula and after several hours was flexible enough to straighten the folds. This was accomplished by working slowly and carefully with spatulas while the leather was still in the solution. The fragments were left overnight in the solution to assure penetration. The next morning Plexiglas was inserted underneath each leather fragment in order to slowly lift it from the bath. To remove surface excesses distilled water and ethanol were applied in a cotton pad. Then another piece of Plexiglas

was placed on top to weight the specimens so they remained flat, though they never were totally flat. After slow drying during the day and night, I again removed excesses with ethanol, sewed the leather fragments with over-stitches to Mylar, and placed them in storage in proper sized boxes with bubble pack underneath and on the sides to restrict movement. One leather fragment has the general outline of a copper falcon plate, suggesting that perhaps the plate was kept in a leather container. The leather also had indentations from basketry, suggesting that it was also contained in a basket. The leather fragment located with the copper bird plate had its form pressed into the leather so we know it was in direct contact, possibly surrounding the plate.

The leather specimen that had been previously treated and was now covered with a white "bloom" was relieved of this (probably ambroid applied in too viscous a solution) by acetone saturated in a cotton pad. It took several applications, but the beige-colored leather underneath was revealed. The surface of this specimen is flaking, so it may indeed need further treatment in the future. The specimen had worked holes around its edges, or at least those edges that were present.

Specimens treated: B51-29a; B122-26; B51-49; Lf40-739; Lf40-767.



Figure 32a. Leather fragments as found in the collection--twisted, desiccated, brittle.



Figure 32b. The above leather fragment when treated and opened to its real shape. Its outline suggests that it surrounded a copper falcon plate (i.e. a pouch which contained the plate).

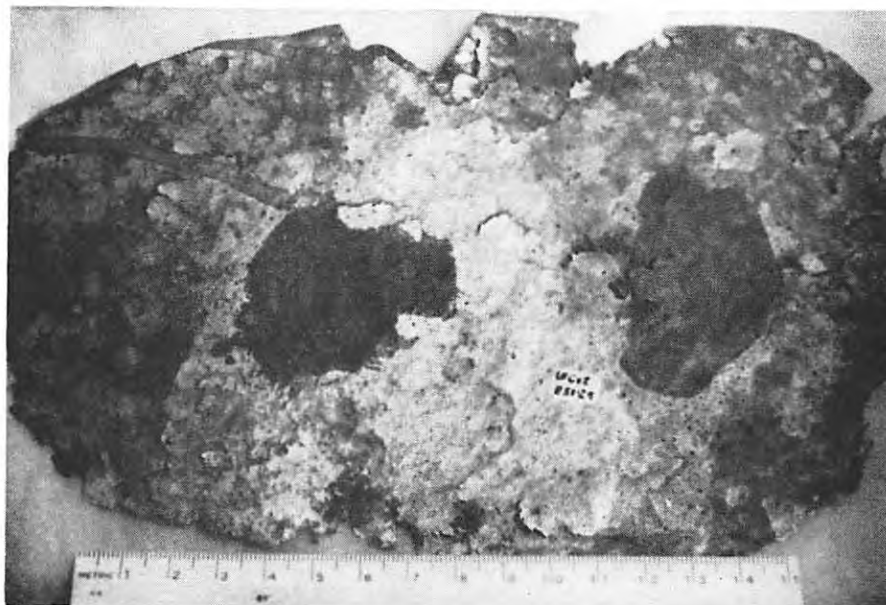


Figure 33a. Leather specimen covered with a white "bloom," from previous treatment (consolidant unknown).



Figure 33b. The same specimen after removal of the "bloom" (excessive ambroid?) with a pad saturated with acetone. The flaking surface layer is now clearly revealed, as are the worked holes around the edges.

CASTS

There were over 25 plaster of Paris casts of Spiro stone and shell specimens. All except one were in good condition, but they were covered with heavy museum dust and were improperly stored. Fortunately, the broken cast (of an engraved shell gorget) had all the pieces still present.

The dust was carefully removed with a vacuum and brushing with a medium stiff brush. The broken cast was mended with Jade 403 (a PVA emulsion, one of the synthetic "white glues" that does not have the impurities found in other brands). To obtain a good join, dilute Jade 403 was brushed onto the edges to be mended so it could readily penetrate the interstices of the plaster. When dry, full strength Jade was applied (with a brush also) and the cast was propped in a sand box overnight to dry.

In the photos, a previous mend and the one made in this study illustrate the difference that taking the time to do careful work can make in a repair.

This group of specimens was re-stored in proper sized boxes with bubble pack surrounding them.

Specimen mended: B108-4, Cast LfCrI.



Figure 34a. Cast of shell gorget with new breaks, as found at the beginning of this study.



Figure 34b. Repaired cast. Previous mend is on the left figure (excess glue can be noted in raccoon skirt, to left of striped pole). Repairs made during this study are on the right side of the photo.



Figure 35a. Groups of shell gorget casts as found. Broken one is on the right, top.



Figure 35b. Casts of stone and shell specimens as restored during this study.

TEXTILES

The fabrics from the Spiro site were noted to be quite varied in construction and in condition upon the initiation of this study in 1979. There are no "complete" specimens, i.e. with all four selvages present. Some of the fabrics were recovered in the WPA excavations in the 1930's whereas others were received from Henry Hamilton who in turn had obtained them from the looters of the mound in 1935-36. Thus all the fabrics had spent about 40 years in storage at the Stovall Museum under conditions not at all conducive to preservation of fragile textiles.

In addition to the storage mentioned above, past conservation and exhibition at the museum have subjected a few of the more spectacular specimens to different environments, such as being mounted tightly in picture frames or in closed exhibit cases with no protection from light damage. In spite of these environmental variations, many fragments were in good condition or still somewhat soft and moveable, though twisted and "dusting," with tiny bits and pieces of the deteriorating yarns surrounding the fragments. The majority of specimens were found to be somewhat desiccated with little or no pliancy and flexibility.

The conservation of the fabrics was accomplished with two different methodologies--one for the charred fabrics and another for the uncharred specimens. Within each group, the treatment varied according to the condition of each fragment. The conservation notebook labeled "TEXTILE" contains the specific information about each fragment.

The drawers of the storage units that house the fabrics and basketry were coated with two coats of polyurethane resin to prevent the escape of volatile and harmful wood resins.

Uncharred Fabrics

The conservation of the Spiro fabrics encompassed promoting flexibility and softness in the yarns in order to properly align the warps and wefts and to unfold the fragments when necessary. Though some specimens were in good condition, they were twisted and/or folded. The fabrics were not dirty and in the process of treatment extraneous bits of dust and/or dirt were flushed out of the masses. The sharp edges of these impurities can damage aged, fragile yarns.

Color fastness was tested with each color in the fabrics by applying distilled water on a swab to an unobtrusive spot on each color and immediately applying a Kimwipe (lab tissue) to the spot to determine if the color "ran" or "bled." All of the yarns were colorfast, as were the Spiro fragments previously treated at the Smithsonian Institution in 1977.

Glycerine in 5% and 10% concentration in distilled water was effective in restoring yarn pliancy and relieving desiccation. Ethanol as a solvent was tested as well as distilled water, but the latter appeared to penetrate into the fibers better. Ethanol tended to evaporate before the glycerine could be transported to the inner cell structure of the yarns. Since glycerine is hygroscopic (capable of absorbing moisture from the atmosphere), some of it remains in the yarns after the fragment has dried and thus reduces rapid dehydration. The fragments usually required from one to three applications of the glycerine in distilled water solution to realign the yarns. Careful attention was exercised so that the minimal amount of solution needed was used. Too much swelling and drying can cause loss of resiliency rather than being beneficial.

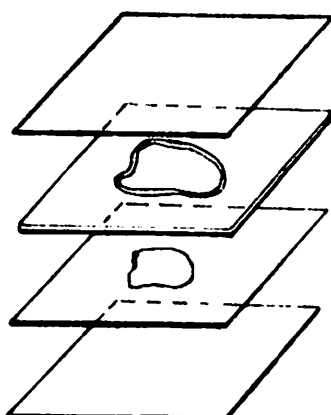
When the fabric masses were still damp the yarns were gently aligned with a stainless steel spatula. The solution was applied to the fabrics with eye-droppers and with a fine spray nozzle. They were saturated, excess water blotted from around the edges, and allowed to dry in darkness on chemically inert sheets of polyethylene. The fragments were usually inverted during treatment so both sides could be dealt with.

After being properly aligned, the fragments were inverted onto a sheet of 5 mil thick Mylar, a clear polyester film. This film is neutral, is pH, and has been used in conservation/restoration of photographs and sketches.

In order to protect the Spiro specimens from further handling and to minimize the stresses due to Stovall's fluctuating humidity and temperature, it was decided to mount them in a 3-piece Plexiglas system designed for the Smithsonian's specimens (Gardner 1979). Much of the following explanation has been borrowed generously from this article. The mount was also used to enclose the Stovall's fragile copper falcon plates and some bone pendant fragments. In order to exhibit the specimen, it is necessary only to clean the exterior Plexiglas layers. If the fragment ever needs to be touched or remounted, the mount can be opened by unscrewing the brass screws that hold it together.

Proper analysis of Sipro's fabric specimens requires that they be studied from both sides, therefore transparent Mylar and Plexiglas were logical choices. Plexiglas is an inert (poly)methyl methacrylate. The fabric only touches the Mylar sheet in this mount; it does not come into contact with the outer two Plexiglas layers (see the schematic sketch below). The inner layer of Plexiglas is cut out in the general shape of the fabric. This prevents crushing the fabric between the outer layers of UF3 Plexiglas. The outer two layers, being ultraviolet filtering material, protect the fabric from light-induced damage, thereby greatly extending specimen life.

Schematic sketch of Plexiglas mount for Spiro specimens.



UF3

Clear Plexiglas, cut-out to shape
of textile, either 1/8" or 1/4" thick

Textile sewed to Mylar sheet

UF3

When a fabric backing is used in a textile mount, it is usually secured to an unfinished wooden frame which produces volatile resins that would be harmful and affect the fabric over a long period of time. The use of Mylar and Plexiglas eliminates this problem, but presents some other ones. This mount system does not provide the flexibility that a fabric backing would. And although this mount is not air tight, there is certainly not the exchange of air that would be found if the mount had a fabric backing. If it is found desirable at some later time to allow for more air exchange, small holes will be drilled and/or cut in the center Plexiglas sheet from the outside. Perhaps establishing a "mini"-environment inside the mount that is not so dependent on exterior conditions may be the best choice for storage in an environment with drastic changes in humidity and temperature such as is present at the Stovall Museum.

Another possible problem associated with the use of Plexiglas is that of static electricity. Rubbing builds up a static electrical charge on the surface of the Plexiglas, but this can be dissipated with a damp chamois cloth. However, since the mounts will not be moved about nor rubbed, except in cleaning (when anti-static cleaners and water may be used), it is not likely that static electricity will be a problem. It is hoped that improvements in the field of conservation materials may some day provide the "ideal" backing material for textiles, but until that time, currently available materials must be adapted as well as possible.

Both cotton and silk threads were considered for use in sewing the fabrics to the Mylar. However, cotton was used as it is more compatible with the properties of the yarns. The threads chosen blend into the fabric, but can be readily distinguished from it. Polyester "invisible" threads were shiny and unacceptable.

The most difficult problem associated with the textile mount is the jagged edge created when a needle is pushed through the Mylar backing. To overcome this, the Mylar is punctured from the top with a stainless steel push pin, then a beading needle with thread attached is brought back through the hole from the underside, and the stitch is completed from the upper side. This simple procedure adds a good deal of time to the mounting of the fabrics. By using a couching stitch damage is presented from sewing too much or too tightly.

Another problem in sewing fabrics to Mylar is that the Mylar "bounces" slightly as the pin or needle penetrates. To prevent this from moving the specimen, the fragments are anchored with several stitches across the fabric's width before it is sewn to the Mylar.

The ends of the sewing thread are secured on the obverse side by a knot and by a small drop of a 20% solution of polyvinylacetate (PVA) in acetone. The latter substance is clear-to-white in color and is not noticeable from the reverse side of the mount. Any Mylar that extends beyond the edge of the plexiglas frame can be easily trimmed off with a scalpel.

The three Plexiglas layers and the Mylar sheet are all secured with at least four countersunk brass machine screws. The screws are flathead rather than roundhead for aesthetic reasons. Brass screws were chosen over steel because the slot in the head of the screw retains its groove longer and there is no danger of rust if the mount is in a humid environment. Catalogue numbers were engraved at the edge of the mount with an electric pencil engraver with a

tungsten carbide tip. Finally, the mount was stored on sheets of Upson board which has a special surface on one side that does not scratch Plexiglas.

The mount designed to enclose the Spiro specimens at Stovall Museum was originally designed in 1977 for the Spiro fabrics located at the Smithsonian Institution. The publication of the Smithsonian study, which also received NSF funding, will be forthcoming under the authorship of co-directors Dr. Mary Elizabeth King (University Museum, University of Pennsylvania) and Joan S. Gardner (Carnegie Museum of Natural History).

Not only does the mount protect the fabrics from handling, it allows total visibility and can be utilized in storage and in exhibition.

Charred Fabrics

Within the charred fragments group were two large, finely executed specimens, one of which was manufactured in lace openwork technique. They had been glued to a white (now yellowed) mat board and were further held in place in a frame by pressure from its glass front. Though many of the older glues contain impurities and may be chemically unstable (resulting in shrinkage and irreversibility), their use may indeed have been the only procedure that could have held the brittle fabric fragments together as they were subjected to poor storage, handling, and then exhibition. It was determined that they were much too brittle to remove the old glue with which they were saturated. To attempt to dilute this glue with a synthetic resin such as PVA (polyvinyl acetate) might only complicate the problem, and by leaving them "as is" there will only be one adhesive to reverse, if that is ever possible or necessary. If the old glue has chemically cross-linked it cannot be removed from the fabric. These fragments are now preserved in the special Plexiglas mount discussed in the uncharred fabric section. The center layer, however, is cut out so as to hold the old mount board in place, so it is not the shape of the fabric fragment. The specimen still does not touch the Plexiglas. Since the fragments are charred and no longer react the same as organic materials it was not necessary to have the exterior layers cut from UF3 Plexiglas, however, it was less confusing to do so since the mounts were constructed at the same time and in the same manner.

It is hoped that in the future some way will be found to deal with the charred specimens that remain adhered to the matboard. At this point in time, the fibers were considered much too thin and/or brittle to withstand the soaking in acetone and subsequent pressure of a spatula to release them from the matboard.



Figure 36a. Textile storage at the beginning of this study. Not only is there disarray but the glass-fronted frames do not protect the specimens from light, some specimens are in plastic bags with no further support, specimen numbers are hard to locate, etc.



Figure 36b. Textile storage after treatment of fabrics and mounting in Plexiglas.

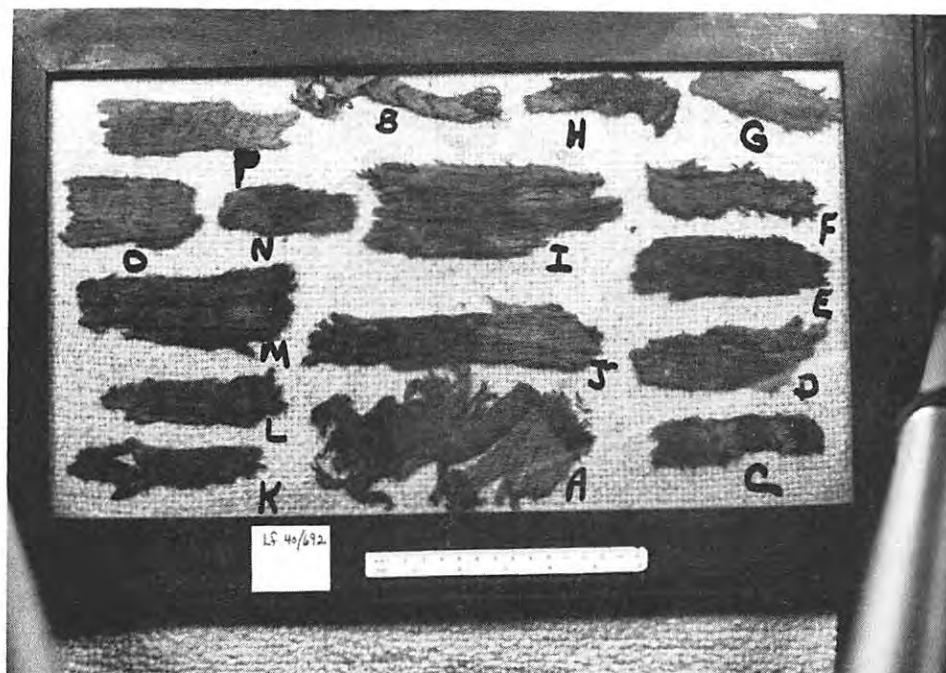


Figure 37a. Fabrics held in place by pressure from glass-fronted frame. These fabrics were not glued to the monk's cloth on which they rested.

Figure 37b. The above fragments are in the small boxes on the right of this photograph. All the fabric fabrics are now enclosed with inert polyethylene or are sewn to inert Mylar inside boxes that are clearly labeled.



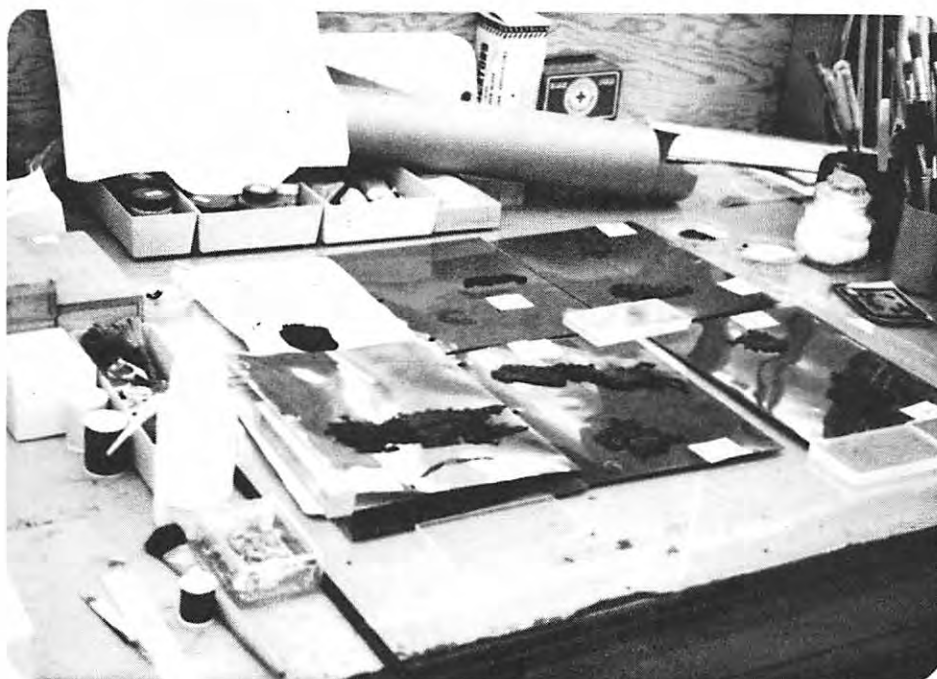


Figure 38. Laboratory work area where fabrics were conserved. The matboard that shielded them from light has been removed for the photo.



Figure 39a. Multi-color fragment as left by a previous worker years ago. Steel pins that had been used in an attempt to align the yarns were left in the fragment.

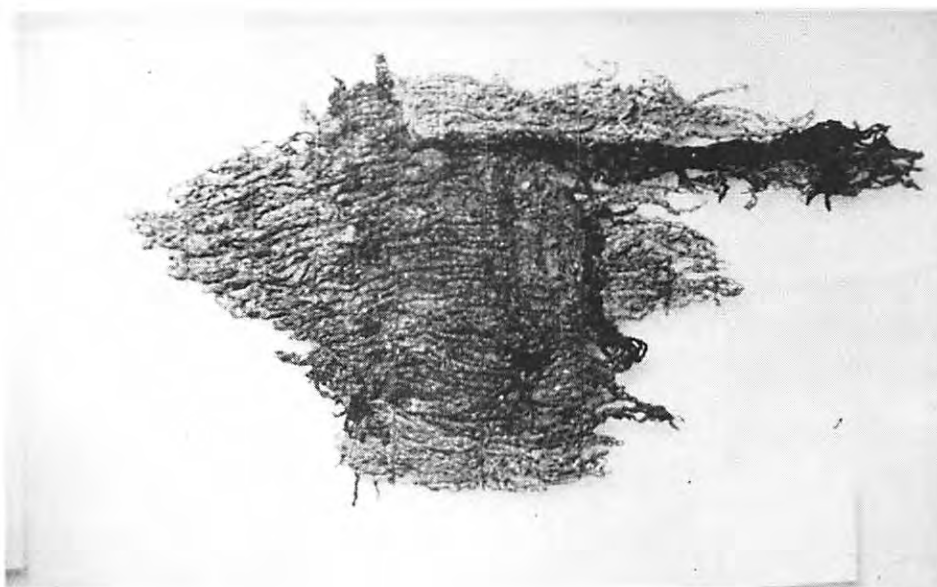


Figure 39b. The same fabric above, after conservation and alignment of the yarns during this study. The fragment has been sewn to Mylar but was not yet enclosed by Plexiglas mount.



Figure 40a. Various multi-color fragments enclosed by two glass sheets. The fragments shifted about in the frame when it was moved.

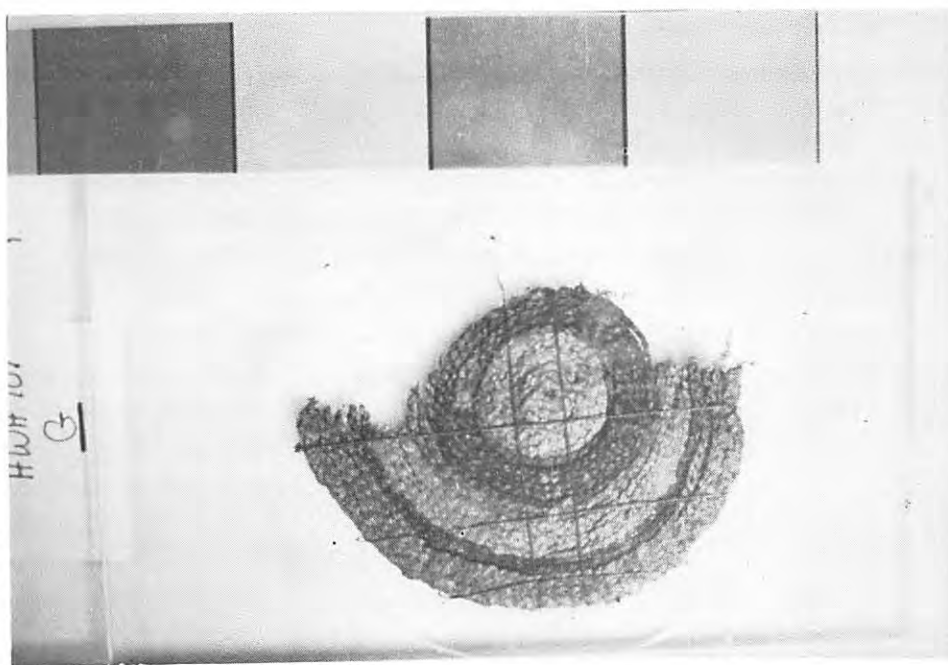


Figure 40b. Fabric fragment "G" from above photo after conservation during this study. It has been sewn to Mylar; the edges of the cut-out layer of Plexiglas can be seen surrounding the fragment. The top UV3 layer of Plexiglas was removed to take this photo.

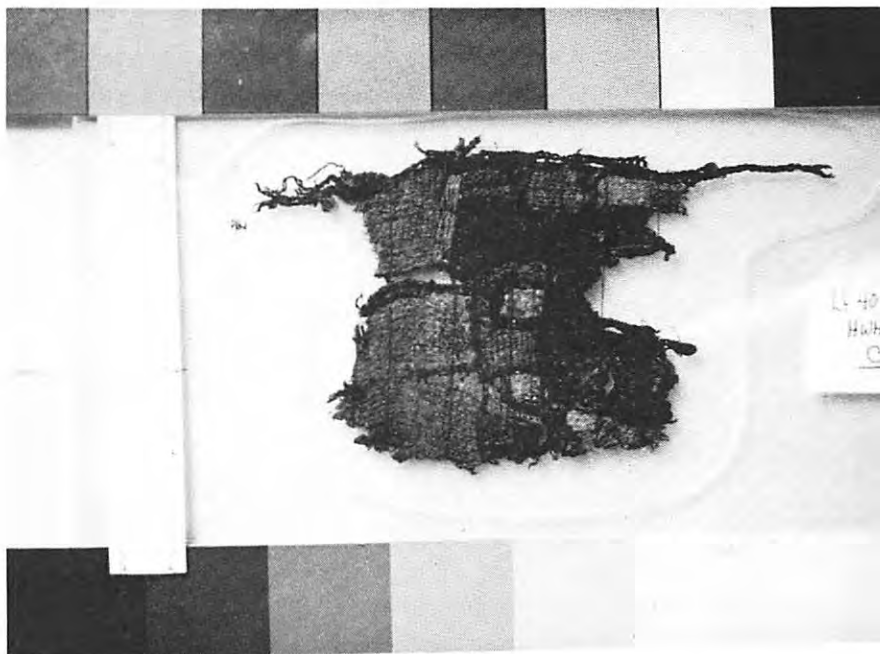


Figure 41a. Multi-color fabric fragment "C" from preceding page. The colors are red, pink, two shades of brown, beige, and black (which is actually a very dark brown).

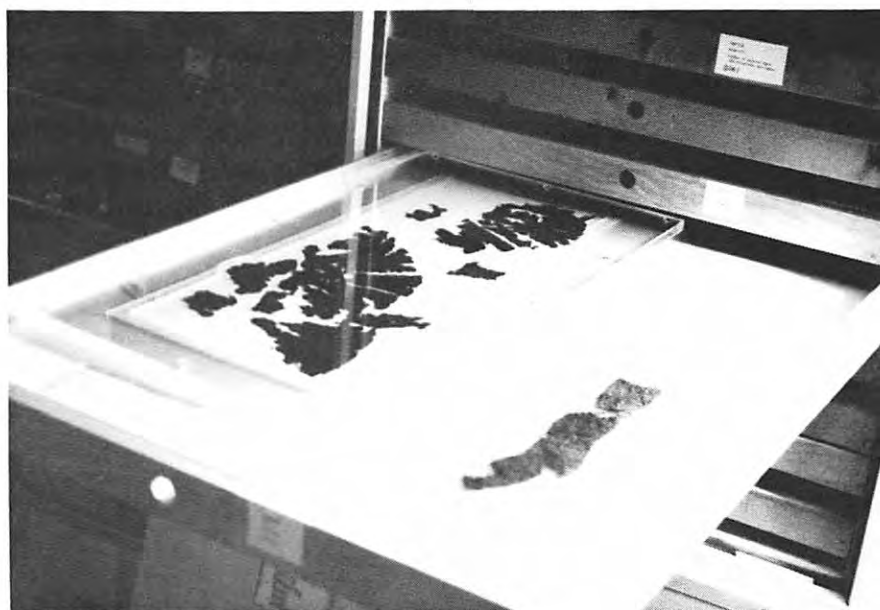


Figure 41b. One of the two large, charred fabric fragments now enclosed in its Plexiglas mount, on the left of the photo. The specimen to the right is a charred basketry fragment.

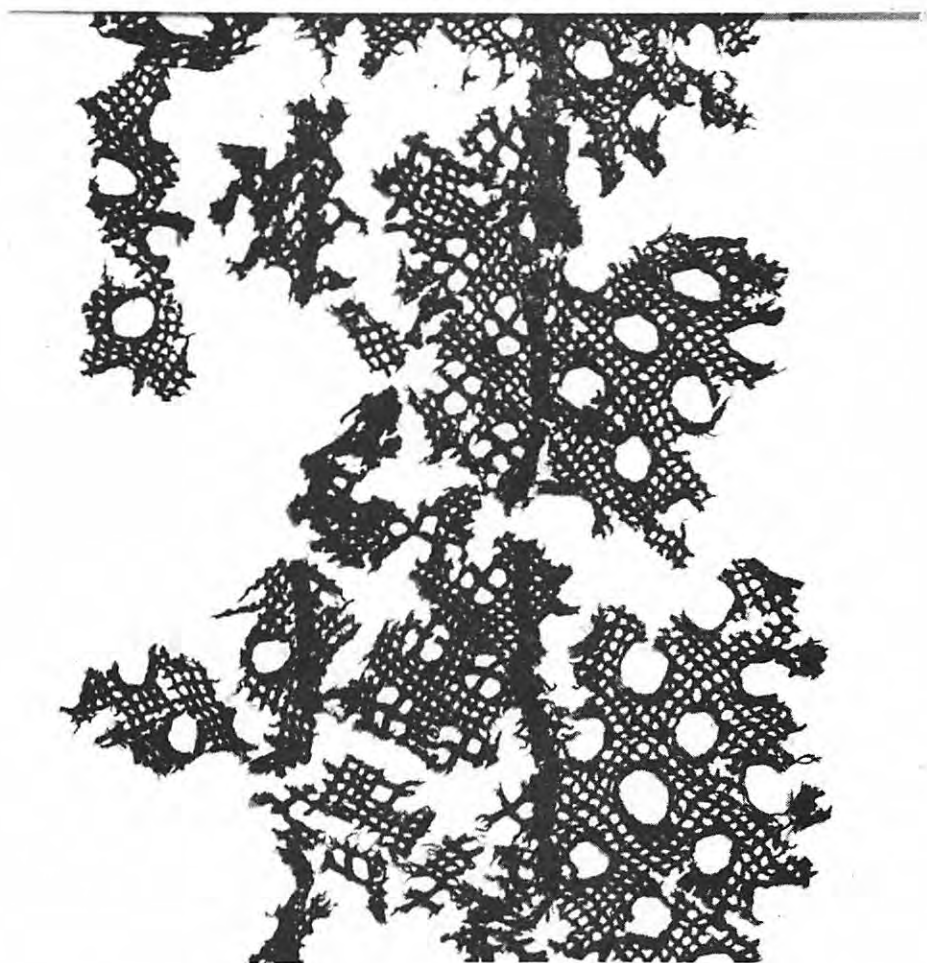


Figure 42. The lace openwork charred fabric fragment. Its Plexiglas mount looks very much like the one on the preceding page.

SPECIMENS LOCATED IN SAFE, NORTH BUILDING

B177-1 quartz effigy boatstone
B36-9 shell engraving - man in boat
A14-4 double bowl stone pipe
B99-2 pipe, man smoking large pipe
B99-3 pipe, "Lucifer"
A9-1 pipe, painted pipe-smoker

SOURCES OF MATERIALS USED IN THIS STUDY

Bubble pack, "Astro Bubble" -- Capitol Paper Company
Oklahoma City, OK

PVA-AYAF and AYAT -- Union Carbide Corporation
120 S. Riverside Plaza
Chicago, IL

Mylar, 2 rolls -- Plastic Suppliers
Dallas, TX

Distilled water, some solvents -- Chemistry Department
University of Oklahoma
Bev Grabenbauer, stockroom

Lab glassware and deionized water -- Microbiology Department
University of Oklahoma

Art board, pens, push pins, blotter -- Student Union
University of Oklahoma
Barbara (in art department)

Solvents, glassware, Kimwipes, bottles -- University Stockroom
University of Oklahoma
Les Wilkerson

Photographic help -- James Tribble
student, Department of Anthropology

Magnifying lamp -- Dale's Office Equipment
Norman, OK

Acid-free tissue -- Talas
130 Fifth Avenue
New York, NY 10011

Plexiglas sheets, UF and clear -- Cope Plastics
105 N.E. 38th Terrace
Oklahoma City, OK

Thread, 100% cotton -- Hancock Fabrics
Norman, OK

Circline lamp for magnifier -- Waters Electric
Norman, OK

Microcrystalline wax -- Petrolite Corporation, Bareco Division
6910 E. 14th Street
P.O. Drawer K
Tulsa, OK 74112

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