**East Carolina University**
**Conservation Laboratory**
**Treatment Report**

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| **Lab Number:** ECCL.2013.010.0001 | **External Number:** 35-05-09 |
| **Object Title:** Map of Fort Nooherooka | |
| **Object Dimensions:** | |
| *Map*: 25 ¼ in x 16 5/8 in | |
| *Map with Canvas*: 28 ¼ in x 19 3/8 in | |
| **Date Received:** October 22, 2012 | **Date Completed:** March 21, 2013 |
| **Requestor:** South Carolina Historical Society | **Conservator:** Susanne Grieve |

**Object BT Description (attach sketches and photographs separately):**

An important stronghold during the Tuscarora War, the fort at Nooherooka (Neoheroka, Neyuherú:kę) was home to over 950 Native Americans from the Tuscarora tribe. Located in modern day Greene County, North Carolina, it was constructed in a European style and provided protection and food storage until it was burned and razed by Colonel James Moore on March 23, 1713.

During that time, or shortly thereafter, a map was made of the fort and surrounding area by an unknown illustrator (Figure 1 and Figure 2). This map in conjunction with archaeological evidence is an important part of United States history and our understanding of the founding of America. This project hopes to evaluate the condition of the map and perform non-destructive analysis to better understand the composition and stability.

**Figure 1: Obverse view of the map.**

**Figure 2: Reverse view of the Nooherooka Map**

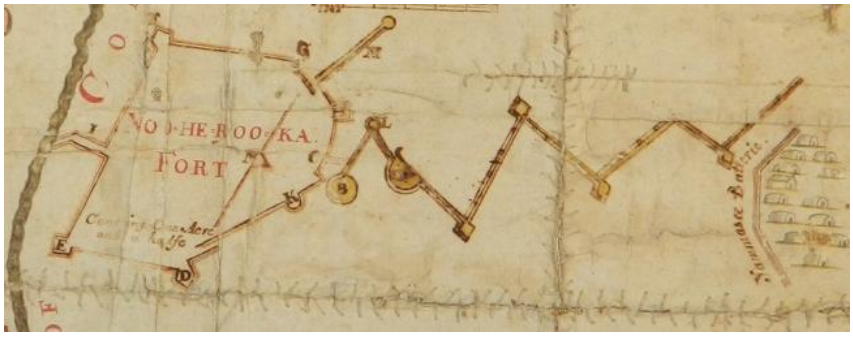
## Map Description and Condition

The Fort Nooherooka map is currently stored in the South Carolina Historical Society archives in Charleston in a climate controlled secured facility and is described in the accession records as:

> Map, 50 x 68 cm or smaller, of James Moore's attack against Tuscorora Fort Nooherooka. Includes Connectan Creek and the names: Capt. Maurice Moore, Col. Mackey, Capt. Pearce, Capt. Canty, Capt. Hastings, Capt. Harford, and Capt. Thurston

Very little is known about the map due to its fragility and uniqueness and there is little information available on how the map was obtained. Figure 3 below shows the details of the map and indicates Fort Nooherooka and the surrounding area.

**Figure 3: Detail of Nooherooka Fort from the map.**



The South Carolina Historical and Genealogical Magazine from January 1909, describes the map as being "backed with canvas" causing some of the wording to become illegible indicating that this was not an original feature of the map. The text in the large lower left panel is reported in the same publication above as stating:

"After the Trenches were carried on with good success and a Triangular Block house finished att A and a Battery att B so high that from them they might Fire over the Ene-my's Fort and Mine carried under the Enemy's works to C and every Person ordered to his Post ready for a Gener-al! Storme on Friday the 20*** March 171 2/3 about tenn of
the clock in the Morning the mine was sprung but with very little Success the Powder being damnified. However att the sound of the Trumpet the Assault was made. Capt Stone with 12 white Men from L. and Capt Moore with his Brother (illegible) Capt Hastings Capt Harford Capt •Alexander Mackay, who was major in Barnweirs Expedition and who had remained in North Carolina with a body of Yemassees. He was afterwards Lieut Colonel with Barnwell iiT the Yemassee war of 1715.
Lewis Mitchell — or Louis Michell — a Swiss gentleman, who had accompanied the Baron De Grafenried to North Carolina, and obtained with him a grant of land for the settlement of a number of Palatines, and Swiss at Newbern or New Berne. He was much praised by Barn-well and on all sides for his skill as an engineer.

Thurston with other white Men and Indians from under cover (illegible) the creek side. Presently made them-selves Masters of the Enemies works from G to K with very little Loss of Men, Notwithstanding the Enemy Fired very briskly through the same Loopholes that our menmattacked them att. Capt Maul who was ordered from the Mulberry Battery to make his Attack bettween D. and K Imagining, he had some better advantage or mistaking his orders marched between Bastions E and D. from which Bastions the Enemy made very great Fire, and of which Company (illegible) 20 Escaped being Killed or wounded, being the greatest Loss sustained dureing the attack. Capt Canty from the Yamasee Battery was ordered to at-tack the same place which Capt Moore was ordered to,Seeing Capt Moore was gon on the wrong side off the Bastion and that his Indians did not come up readily went
to the Commander in chief who was in the Battery B. [(Two lines here illegible) wounded] immediately followed with the same Story and added that unles he was relieved they would all perish; Coll Moore immediately ordered to make all the Fire that could be made from Battery B upon the two Bastions E and D. and Capt Maul retreated. At the same time Coll:Moore observing that the small Lodgment made on the Ennemys work att G. was not sufficient to shelter above three Men he (illegible) spades to them with which they (illegible) to the Northeast capable to shelter a great number from the Fire of the Enemy made from F. and then commanded the work K to be set on Fire ; from thence the Commander in Chiefe went to Capt Hastings who be-haved himself very bravely att G. and ordered Fire putt(illegible) and by the next morning that was (illegible)with the Bastion of Block house F. and several houseswithin the Fort.

The Enemy made verry great resistance and chose ratherto perish by Fire with' the Bastion than to retreat in the Caves made under ground from whence some haveing time-ly made their Retreat and gott in the Caves did verry much
mischief the next day and part of the Day following about tenn of the Qock we were entirely Masters of itt the last place which was held out being the wattering place J. which some of the Enemy had Fortified more strongly after the Fort had ben sett on Fire.

T. N. this Action is computed by our enemies on Account their least Loss was two hundred and seventy of their Briskest men besides others aged and young Fellows. And with what prisoners were taken their whole Loss cannot be Less than Eight hundred.

Loss on our side. Twenty two white men killed, Thirty six white men wounded, whereof twelve Killed fifteen wounded of Capt Maul's company (illegible) Indians Killed Fifty Eight Wounded."

This was also confirmed through close examination by David Fictum, a graduate student in the Department of History. In addition to being mounted on an unknown canvas material, the map was sewn together. The East Carolina Conservation Laboratory (ECCL) operated by the Department of History and the Department of Anthropology at East Carolina University collaborated with the South Carolina Historical Society (SCHS) in an effort to determine the

condition of the map and determine the possibility of non-destructive testing to reveal further details that may assist in interpreting the historical record. The goals of were to:

- Utilize Non-destructive/ non-invasive technology
- Provide a baseline of information (condition, changes, materials)
- Recommend strategies for long term preservation to the South Carolina Historical Society
- Contribute to the research questions:
  Who made it?
  When was it made?
  How was it made?
  How was it used?

**Object BT Condition (note corrosion, deterioration, stability, wear):**

**Obverse**

The front of the map contains many unique features that can affect the overall condition. The pigments appear stable and well adhered to the surface of the paper. There is evidence of abrasion of the pigments in some areas, but this appears to have occurred during the use life of the map. The pigments still appear vibrant and colorful with little fading evident.

The paper itself is torn in several areas in the center and has been historically repaired by stitching with spun plant based fibers. This appears to be a stable and successful repair as there is no additional tearing around the stitch holes. The paper is also folded over itself on the surface indicating that it experienced a high humidity environment at some point where the paper became creased and then relaxed into a folded position. Evidence for the map encountering moisture is also present on the reverse side (see below). Along the edges, the paper is fragmenting and detaching, but this can be reduced by minimizing handling. Overall, the paper had a slightly yellow hue to it, but it appears to be chemically stable. A pH test was not conducted because researchers did want to subject the paper to water or chemical exposure. The paper remains flexible and stable.

The canvas backing which is adhered to the map also appears structurally stable. There is a uniform brown color on the exterior of the fibers indicating the discoloration is a result of aging. The canvas itself remains flexible, but has several creases and folds on the edges. The ends are also fraying to some degree.

**Reverse**

Due to the fact that the map was adhered to the canvas, there is little information about the map itself that is visible on this side. One major feature is a discolored area on the canvas indicating water staining along the bottom. There are also four noticeable holes in the canvas on the right side. The canvas is also folded and creased which indicate where the canvas is tightly adhered to the paper.

**Test/Analysis (ie: pH, material type):**

*Raking Light*: Raking light is a technique used by conservators to reveal information about the surface condition of objects. By placing one light source on a flat plane with the surface being examined, the contours and relief areas of the surface are more visible. Painted areas that are raised can indicate where several layers of pigment have been applied or in the case of paper, can indicate cockling, warping and tearing. The results of this analysis are visible below and provide surface variation that is not evident under direct visible light sources.

*Transmitted Light*: Transmitted light is where a light source passes through a material and we view what the material transmits as visible light. This may reveal signatures on the back of the map or details about the map imagery or construction.

*InfraRed Imaging*: Infrared light is a form of electromagnetic radiation which has wavelengths just above the visible light spectrum. This form of energy interacts with materials which absorb or reflect light. A lot of artist's materials tend to absorb or reflect this light strongly including charcoal, graphite, various binders, and modern synthetic materials. These generally show up as a strong black color and can be in the form of under sketches, drawings, or signatures.
This is possible because many artists' materials are quite thin and translucent to infrared light. The results of the infrared imaging are discussed below. The map was photographed using InfraRed filters which allowed conservators to see under sketches and details under the pigments. For our analysis we used a Canon 5D Mark II that was modified for infrared lenses. Joe Barricella, the production coordinator in digital collections from the Joyner Library, obtained and edited the images as part of this project. We only worked with reflected light which is where the map was exposed to white light and the reflected image was captured using infrared filter lenses.

*X-Ray Fluorescence*: This technique provides non-destructive testing for the analysis of inorganic materials. In order to identify if the pigments were authenticate and to determine what time period they may relate to, we examined the inorganic components using x-ray fluorescence or XRF. This technology has developed into a portable resource and is most widely used by recycling centers to sort metals, for soil and geological sample analysis, and is increasingly being used by conservators and scientists to examine artworks and archaeological materials. This analysis was performed by Dave Keifer with interpretation by Bruce Kaiser, both from Bruker analytics. Elements are composed of atoms which have protons and neutrons in their nucleus which are then surrounded by shells or rings of electrons. An x-ray or radiation source from the XRF gun is aimed at the sample. This radiation causes the electrons in the atoms to eject electrons and change shells or rings. The detector in the XRF gun reads this change in electron shells and registers it as a specific element which then gets fed back to a computer that performs the interpretation. This type of analysis looks at a spot size of up to 25 microns or micrometers. This is slightly over half the width of a human hair. This analysis is only considered to be a surface analysis, but it can penetrate the material up to a millimeter. It is also important to remember that this technology works only with inorganic materials and only detects elements

from calcium and upwards on the periodic table of elements. The results from that analysis are included with this report below.

*Ultraviolet Light*: The map was examined using an ultraviolet light source. The light interacts with organic and synthetic material by exciting the electrons and causing them to fluoresce. This fluorescence is emitted as visible light and we see it as a purple, black, bright white or mustard yellow color depending upon the material. In this instance we examined the surface for any evidence of restorations or modern materials which would fluoresce a bright white color. We also examined the surface to confirm the presence of other organic materials that would have been used in a contemporary setting with the map as adhesives, binding agents, or coatings. These areas would be visible as a mustard yellow hue upon exposure.

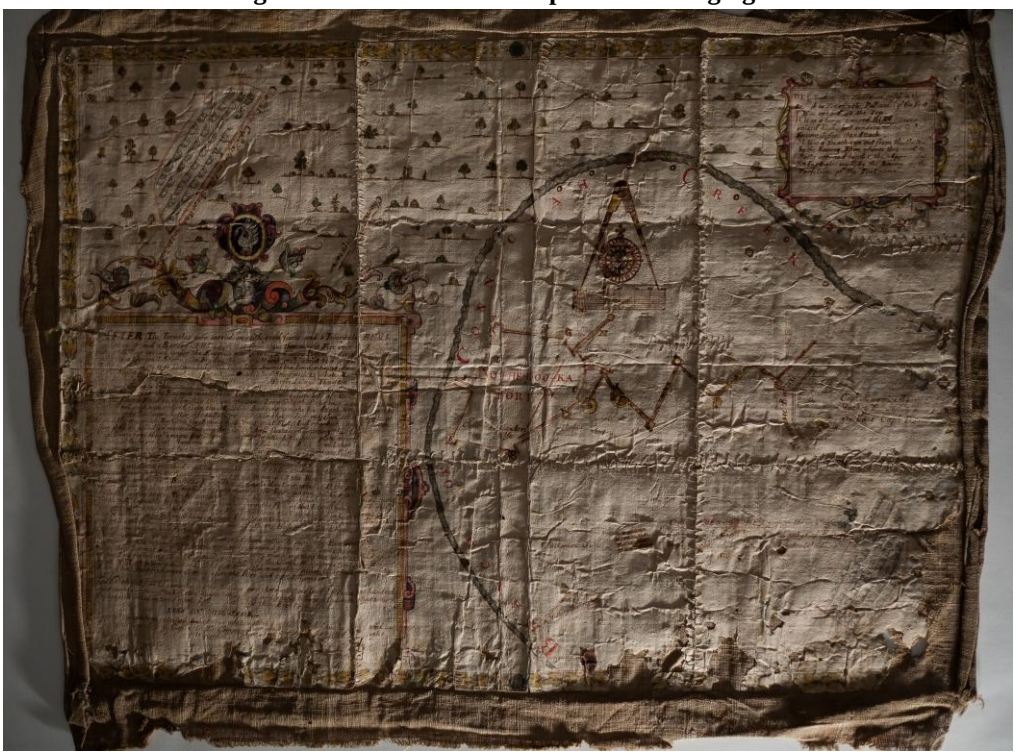
**Treatment (note date and details):**

*October 22*: The map was transported to ECU in a secured and padded box by Dr. Larry Tise and Susanne Grieve.

*January 23*: We briefly exposed the map to ultraviolet light or UV light. There were no reactions between the map and the ultraviolet light indicating there were no modern or historic restorations as far as the map surface. No evidence of synthetic materials was found. Several areas demonstrated a slight yellow hue, but due to the fact that the paper is organic and could have been treated, it was difficult to distinguish between the material manufacturing methods and accidentally or intentionally applied materials.

*February 6*: The map was photographed and examined under raking light which allowed conservators to see the three dimensional surface. This process helped reveal areas that were damaged or where the map had been folded. The sequence of use for the map based on the evidence of wear is indicates that first the map was folded repeatedly and carried causing the inks to become worn and rubbed off in some areas. The repeated folding and abrasion also caused tears along crease lines. This was mitigated by stitching the folds. The map does not appear to have been refolded after it was stitched. The map was then hung, using pins with a circular body, in all four corners. There is no evidence of the pin holes causing tearing which would have been caused by repeated hangings or touching of the map while it was pinned to a surface. The map was then adhered to a canvas, likely with animal based glue. The canvas was mounted onto a frame at some point based on the thin rectangular bar impressions around the edges of the canvas. The presence of strontium in the elemental analysis potentially indicates it may have had a glass cover as well.

**Figure 4: Obverse of the map under raking light.**



*February 13*: Close examination of the maps surface using transmitted light did not reveal any unique features other than globules of adhesive that were used to secure the map to the canvas and overlapping areas of paper sections that were used to make the map. We also see areas where the paper is missing due to deterioration indicated by the white light passing through.

**Figure 5: Obverse view of the map using transmitted light.**

**Figure 6: Reverse view of the map using transmitted light.**

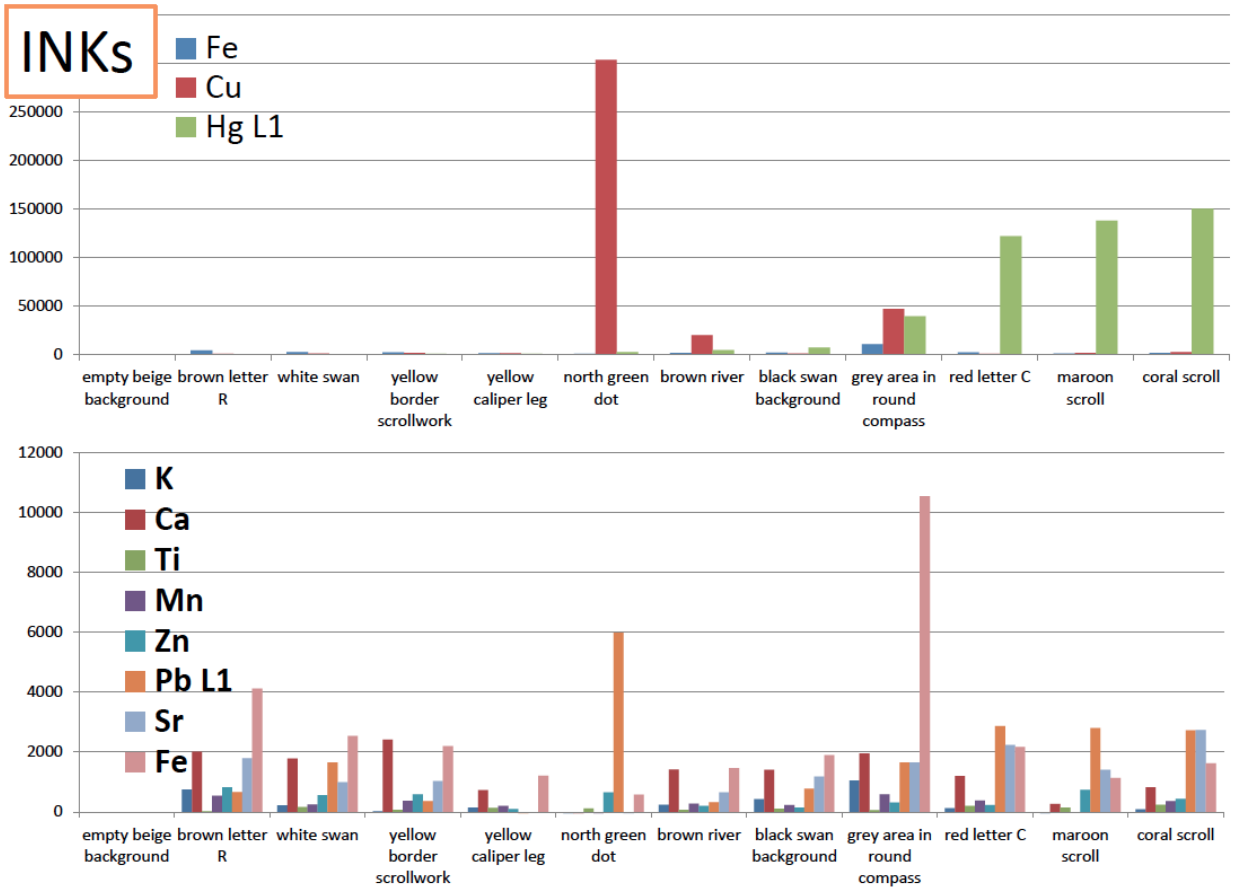
*February 16*: Several areas on the map were analyzed using XRF. The analysis takes approximately 60 seconds per spot area analyzed. In conclusion, the brown pigments contained mostly iron, the green colors were created with copper based pigments, the yellow and white pigments were mostly based on calcium compounds, and the red and pink colors contained mostly mercury. Mercury is a component of vermillion which is a common pigment used during this time period. The odd element is the presence of strontium. Strontium wasn't widely used or discovered as an element until the 1790's. It is very commonly used in the production of glass and as a radioactive isotope.

**Figure 7: Susanne Grieve and Dave Keifer analyzing the map using XRF.**

**Figure 8: Net number of photons per element proportional to concentration.**

| | K | Ca | Ti | Mn | Zn | Pb | Sr | Fe | Cu | Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| empty beige background | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| brown letter R | 754 | 2008 | 31 | 550 | 831 | 666 | 1799 | 4127 | 748 | 270 |
| white swan | 221 | 1790 | 164 | 254 | 564 | 1655 | 991 | 2543 | 1012 | 342 |
| yellow border scrollwork | 30 | 2423 | 68 | 374 | 587 | 363 | 1038 | 2202 | 1745 | 575 |
| yellow caliper leg | 151 | 732 | 137 | 209 | 96 | -271 | -8 | 1214 | 1329 | 835 |
| north green dot | -94 | -524 | 122 | -184 | 661 | 5991 | -1008 | 582 | 304084 | 2302 |
| brown river | 239 | 1419 | 74 | 274 | 207 | 326 | 650 | 1468 | 19924 | 4619 |
| black swan background | 435 | 1417 | 106 | 232 | 151 | 782 | 1189 | 1905 | 1073 | 6972 |
| grey area in round compass | 1053 | 1950 | 64 | 587 | 321 | 1655 | 1654 | 10548 | 46819 | 39350 |
| red letter C | 128 | 1204 | 205 | 385 | 232 | 2869 | 2248 | 2176 | 925 | 121917 |
| maroon scroll | -52 | 270 | 146 | -17 | 749 | 2805 | 1412 | 1139 | 1778 | 138232 |
| coral scroll | 91 | 825 | 238 | 362 | 437 | 2725 | 2740 | 1628 | 2568 | 150193 |

**Figure 9: Graph depicting relative concentrations of each element.**



*February 20*: The map was photographed using InfraRed filters which allowed conservators to see under sketches and details under the pigments. Even though no specific details were visible that could not be seen with visible light, certain pigments became filtered out at high wavelengths which corresponded with elemental composition (ie: iron based pigments were more visible under higher wavelengths).

**Figure 10: Obverse view of the map photographed with Infrared filters at 715 nanometers.**

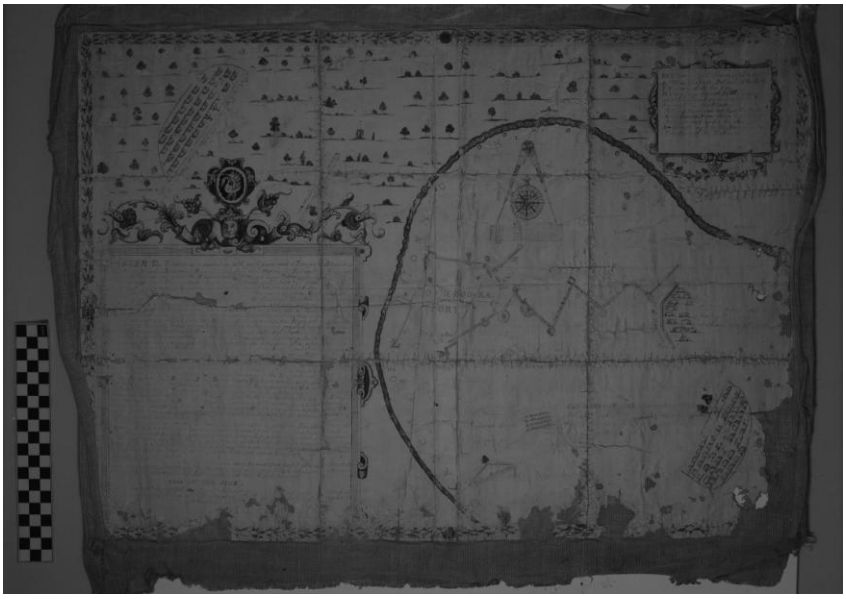


**Figure 11: Obverse view of the map photographed with Infrared filters at 830 nanometers.**

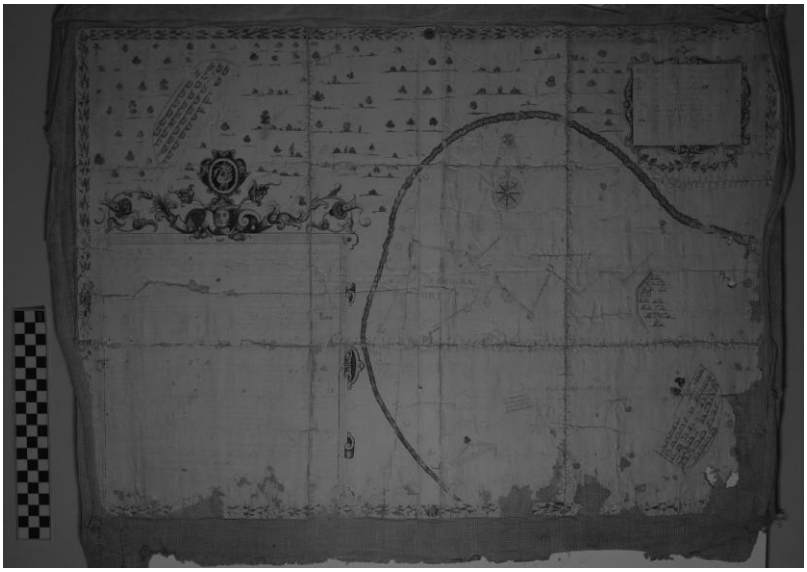
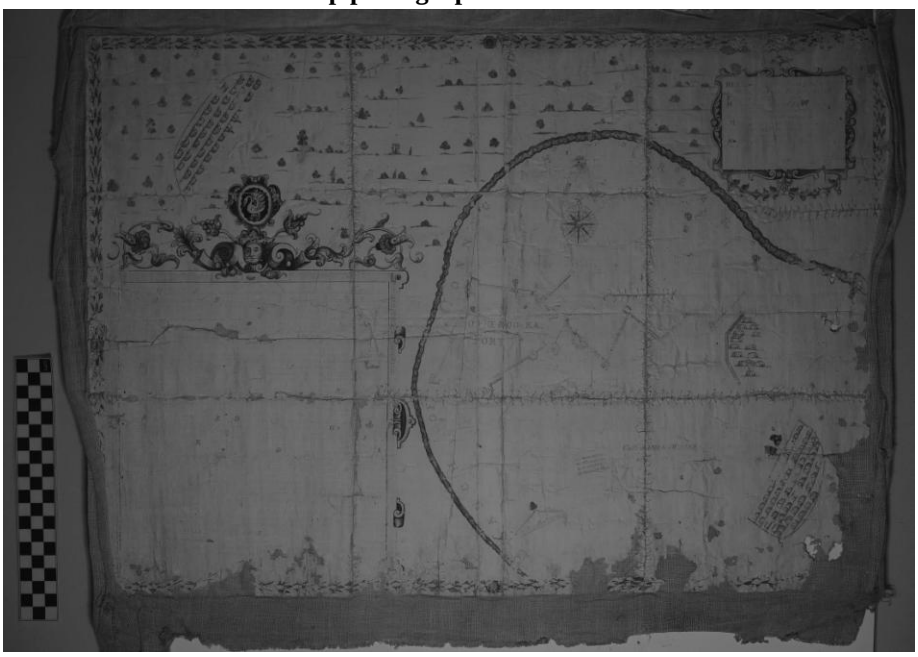


**Figure 12: Obverse view of the map photographed with Infrared filters at 1000 nanometers.**



*February 27*: We examined the three main fibers that the map was composed of. This included the material the map was drawn on, the textile support backing and the stitches that were used to repair the map before mounting. Before examining the map closely, we predicted the map would be composed of paper or animal skin in the form of parchment or vellum. These of course have major differences in the way they react to the environment, in the construction and preparation of the map, and in how it is preserved.

Microscopic examination revealed that the map is indeed paper. The processing technique to make the paper has made it difficult to identify the fiber type, but in this image we can see thick fibers which may indicate that there was minimal processing. Some suggestions have included that this is a very common or cheap type of paper.

At some point the map was adhered to a canvas textile. This has browned over time uniformly indicating that this is not a recent occurrence. The textile appears to be plant based, most likely hemp or flax with twisted fibers that have been woven into a plain weave pattern.

The last fiber we examined was the stitching used to sew the map together after the creases weakened the paper. We can see that these are also plant based and appear to be a twisted strand of fibers.

**Figure 13: Plant fibers from the map.**

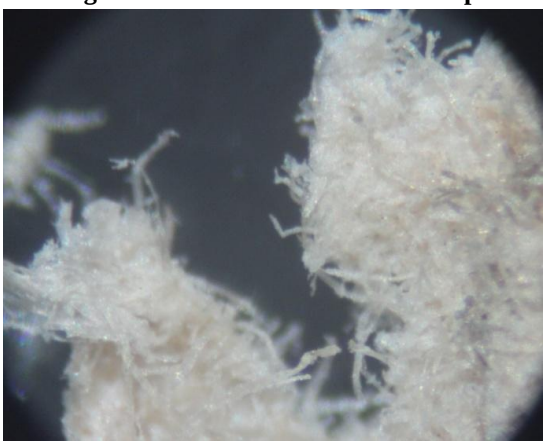


**Figure 14: Plant fibers from the canvas the map is mounted on.**

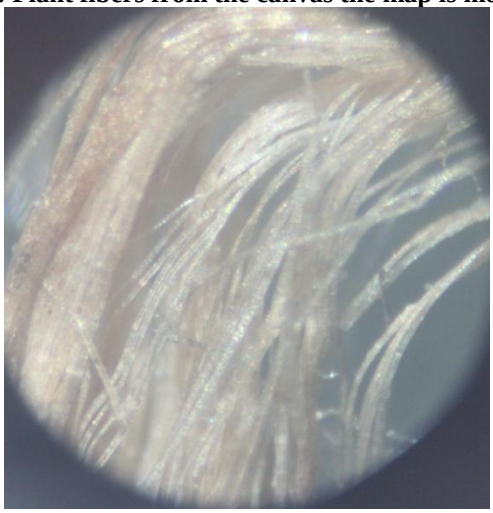
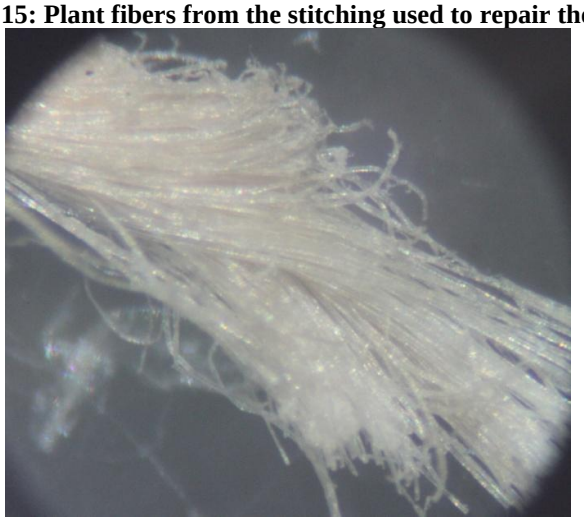


**Figure 15: Plant fibers from the stitching used to repair the map.**



*Conclusion*: This invaluable historical resource continues to be a mystery and elicits various reactions. The map is confirmed as being composed of paper with mineral inks used for the image. The map is authentic with the time period and there are no modern (post 1950's) restorations. The use of the map, going from folded and abraded, to stitched, to hung, to mounted, suggests that, just like today, the map has had numerous values through its use life before being donated to the South Carolina Historical Society.

**Exhibition/Storage Suggestions (ie: light levels, humidity):**

The main concern when handling the map was the stability of the pigments. Closer examination has revealed that the pigments are well adhered to the paper and can withstand analysis and research. Consolidation of the pigments is not recommended.

The paper also appears to be stable and does not display characteristics of brittleness or flaking that would prohibit it from display or handling. Neutralization of the paper is not recommended. With that said, handling of the map should be kept to a minimum and a rigid support should always be used underneath it.

With either display or storage, direct light should be avoided. If displayed, artificial lighting in low levels of 55 lux can be utilized. An alternative would be to have the light on a timer or only used when the map is being viewed.

As an organic material, paper should be kept in a 40% to 50% relative humidity which will provide enough moisture to prevent brittleness, but will not encourage hydrolysis of the paper fibers.

Future analysis that could be conducted includes determining the adhesive used to mount the paper to the canvas to assess for long term stability. This and further treatment should be performed by a qualified paper conservator.