The Fiberglass Tissue Method:
A Technique for Lining Fragile Iron Prior to Desalination

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1. Introduction

This poster focuses on the development of a stabilization technique by conservators at CWF to improve the safety of fragile iron artifacts during desalination. CWF's Archaeological Conservation laboratory uses a simple desalination method in which objects are immersed in an alkaline solution that is changed at regular intervals. The artifact is then rinsed, dried, and coated. Desalination is a crucial step for slowing long-term deterioration. However, it can be intense for objects, particularly if they are fragile.

Over the years, conservators have noticed that artifacts can unexpectedly fragment during desalination, Figures 1-2. These artifacts are typically small or have thin or delicate areas, but still this deterioration is often unpredictable. This poster will outline the testing that was undertaken to determine an appropriate method to protect at-risk iron during this crucial treatment step.

2. Research Population and Methods

A group of thirty artifacts were tested during this process. Half of the objects were lined, and half of the objects remained unlined. The objects varied in size from small to large, but all objects had thin or fragile areas susceptible to deterioration. Four artifacts will be highlighted in this poster, Figures 3-14, to discuss the lining method.

All lined objects received 1.0 oz/sq. yard fiberglass tissue lining on one side of the object. The lining was adhered with 20% w/v Paraloid B-72 in acetone applied by soft brush. Objects were only lined on one side, instead of both, to allow full access of one side for the desalination process and to reduce material use, treatment time, and post-desal intervention. Three of the fifteen lined artifacts were lined with discrete strips to test further reducing material use.

4. Results

Of the objects that received fiberglass tissue support, thirteen out of fifteen were desalinated without deterioration occurring, Figure 15. Artifact "B" fractured during desalination, but the fragments were held together by the fiberglass tissue, Figure 7. The other object, not pictured, experienced spalling on the unlined side of the artifact. This object, along with two others, were lined using discrete strips. The strips performed similarly to overall lining.

The objects that were unlined experienced more deterioration. Six out of fifteen objects had some form of deterioration occur (spalling and/or structural detachment). Artifact "C" showcases fragments that detached during desalination. Nine out of fifteen unlined objects experienced no deterioration. Artifact "D" provides an example of a successful treatment without lining, despite its size and thinness. Two objects experienced notable structural fragmentation and detachment. One artifact was lined, Artifact "B", and one was unlined (not pictured).

Figure 1: Image of an iron object prior to desalination.

Figure 2: Image of the same object after desalination. Significant structural damage and spalling occurred.

3. Treatment Method

Clean
- Prepare iron for desalination (coating removal, air abrasion, etc.)

Line
- Line 1 side of object or any fragile areas with 1.0 oz/sq. yard fiberglass tissue adhered with 20% w/v Paraloid B-72 in acetone

Desalinate
- Immerse object in simple desalination bath (2% w/v NaOH in deionized water (DI)). Change bath and measure chlorides until minimum detection levels consistently reached.

Rinse
- Immerse object in DI rinse bath. Change bath and measure chlorides until minimum detection levels consistently reached.

Dry
- Dry object in oven at 225°F for 3 hours. Place lining side up to allow adhesive to melt into any fractures on the object and avoid adhering to container.

Remove lining
- Remove lining carefully using acetone brushing and tweezers. Do not introduce solvents to the artifact before determining if fractures or spalls are present.

Mend/Support
- Mend any fractures that occurred using Paraloid B-72.
- Adhere new fiberglass tissue support if needed.

Inhibit and coat
- Apply 2 coats of 5% tannic acid followed by 2-3 coats of low concentration Paraloid B-72. Note: This step may need to occur before mending to prevent resolubilization.

5. Discussion

Results showed that objects lined with fiberglass tissue were better protected against deterioration. Although structural fragmentation occurred in Artifact "B", the fragments were not dissociated. This allowed for easy and accurate mending post desalination.

The other lined fragment that experienced deterioration had spalling occur on the unlined side of the object. The side with lining remained intact, indicating the lining provided meaningful support during treatment.

When fragments detached in unlined objects during desalination, e.g. Artifact "C", reassociation and mending post-treatment was more time-intensive and sometimes not possible to accomplish with accuracy for all fragments.

The objects that were supported with discrete strips also performed well. This indicates it can be a useful technique, though condition and form of the artifacts should dictate lining style. The strip technique was notably useful at reducing material use for large areas requiring support. However, this technique may not be as effective at preventing smaller detachments (e.g. spalling) on the lined side if narrower strips are used.

Finally, as the research population consisted of approximately half freshly excavated and half retreated iron, it is suggested that this method can be used successfully on iron at different stages and be used by a larger range of conservators.

6. Conclusion and Further Questions

The fiberglass lining technique for supporting fragile iron improved stability during desalination and allowed for easier and more accurate reconstruction when required.

Although this technique adds treatment steps, conservators feel it saves time overall by preventing detachments and dissociated fragments. This, along with the primary benefit of decreased deterioration in artifacts, is why the CWF Archaeological Conservation team has decided to implement this technique as standard treatment practice.

As always, this research has produced additional avenues of research and consideration, including:

1. Would lining both sides be helpful for artifacts with greater risk of spalling?
2. Does lining prolong the desalination process?
3. Would this technique be compatible with electrolytic reduction?
4. Is there a difference in future rate of change between lined and unlined artifacts?

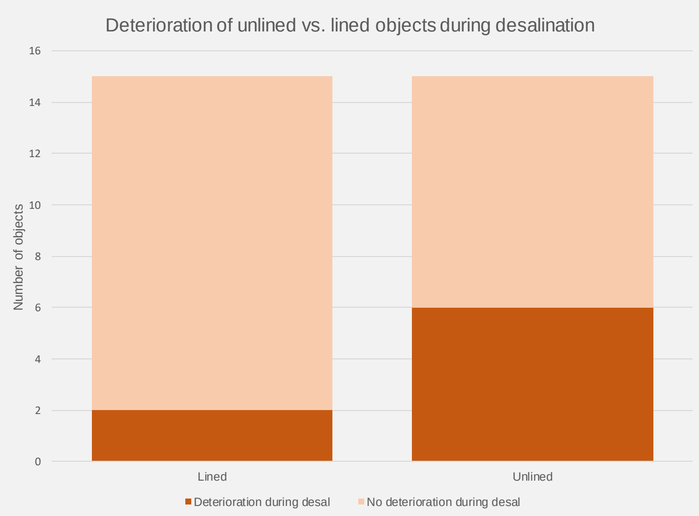
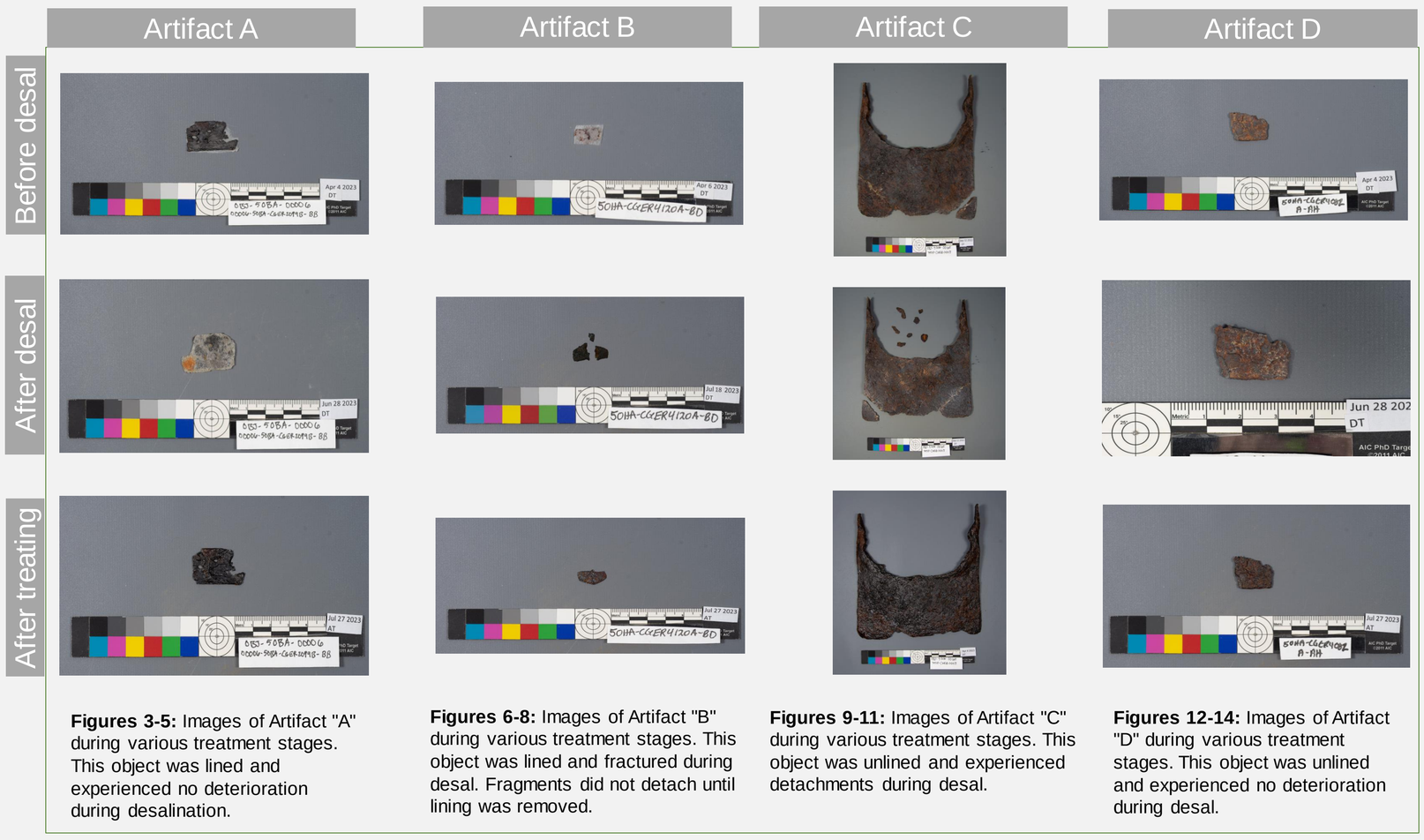


Figure 15: Chart highlighting deterioration of unlined versus lined objects during desalination. Note: Deterioration is qualified as any fracturing, spalling, or larger detachments.



Figures 3-5: Images of Artifact "A" during various treatment stages. This object was lined and experienced no deterioration during desalination.

Figures 6-8: Images of Artifact "B" during various treatment stages. This object was lined and fractured during desal. Fragments did not detach until lining was removed.

Figures 9-11: Images of Artifact "C" during various treatment stages. This object was unlined and experienced detachments during desal.

Figures 12-14: Images of Artifact "D" during various treatment stages. This object was unlined and experienced no deterioration during desal.

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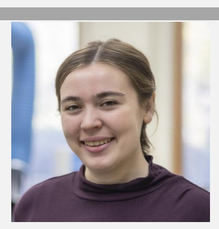

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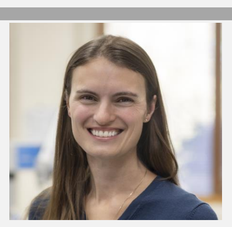

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