FINAL SCRIPT: APPROVED FOR FILMING

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Title: Using Archival Japanese Paper and Thermoplastic Resins to Prepare Fossils for Storage, Display, Transport, and Radiography

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Author Questionnaire

1. Microscopy: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **NO**

2. Software: Does the part of your protocol being filmed include step-by-step descriptions of software usage? **NO**

3. Filming location: Will the filming need to take place in multiple locations? **No**

4. Testimonials (optional): Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **No**

Current Protocol Length
Number of Steps: 18
Number of Shots: 42

Introduction

Videographer: Obtain headshots for all authors available at the filming location.

1.1. **Dava Butler:** My research investigates paleopathologies in fossil mammals and uses patterns of population health to infer past environmental conditions

1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

What technologies are currently used to advance research in your field?

1.2. **Dava Butler:** In paleontology, we use many of the same tools you would see in veterinarian medicine. For my research, I review X-rays or CT scans of bones to assess the health condition of a fossil animal.

1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B roll: Figure `14*

What advantage does your protocol offer compared to other techniques?

1.3. **Lindsey Yann:** The Mayborn Method is an easy to learn archival method that is completely reversible. The protocols can be used from discovery to curation on a wide variety of cultural and natural resources.

1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

How will your findings advance research in your field?

1.4. **Lindsey Yann:** Even the most delicate or fragmented materials can be preserved for future generations. Thanks to the added stability, researchers can ask new and exciting questions about specimens that were previously unavailable for research.

1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera. *Suggested B roll: 4.2.2.*

What research questions will your laboratory focus on in the future?

1.5. **Lindsey Yann:** Thanks to these methods, the WMNM fossils are telling unique stories of life and death 65,000 years ago. We are investigating multiple deposits, how they were preserved, and the paleoenvironment of Central Texas.

  1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera.

Videographer: Obtain headshots for all authors available at the filming location.

Protocol

2. Designing External Bandages for Cortical Bone

Demonstrator: Dava Butler

2.1. To begin, select the most suitable kozo paper **[1]**. Arrange all required tools on the workspace, including kozo paper, tweezers, adhesive, consolidant, acetone, and preferred application tools **[2]**. Lay out more swabs and toothpicks than are likely to be needed **[3]**.

2.1.1. WIDE: Talent examining different kozo paper options and choosing one.

2.1.2. Talent neatly laying out tools, including adhesive, tweezers, and acetone, on a work surface.

2.1.3. Talent placing extra swabs and toothpicks beside the tools.

2.2. Then, measure the length of the seam between two fossil fragments to determine the size of the bandage needed **[1-TXT]**.

2.2.1. Talent measuring the seam between two fossil fragments using calipers. **TXT: Width: 0.25 - 1 cm**

2.3. Tear the selected kozo paper to the desired dimensions instead of cutting it **[1]**. Then, fray the edges by gently pulling the fibers to create a soft boundary **[2]**. Align the paper over the target seam before moving forward to check the fit of the paper **[3]**.

2.3.1. Talent tearing a strip of kozo paper to size.

2.3.2. Talent gently tugging the edges of the torn paper to fray the fibers.

2.3.3. Talent placing the torn paper over the fossil to test its fit.

2.4. Using a brush or appropriate tool, apply a broad and thin layer of adhesive to the target area on the fossil **[1]**. Use tweezers to place the prepared kozo paper bandage over the adhesive-coated area **[2]**.

2.4.1. Talent applying adhesive evenly across the fossil seam.

2.4.2. Talent holding the kozo paper strip with tweezers and placing it onto the fossil.

2.5. Using the chosen tool, gently press the paper into the contours of the specimen **[1]**. Smooth down the fibers at the edges of the paper to ensure they adhere to the surface **[2]**. ~~If the tool begins to stick, replace it with a fresh one **[3]**.~~

2.5.1. Talent pressing the paper onto the fossil surface using a toothpick.

2.5.2. Talent smooths the frayed edges of the paper into the contours. **TXT: If required, use the toothpick side to push air bubbles to the edges**

2.5.3. ~~Talent discarding a sticky tool and picking up a new toothpick or swab.~~ **NOTE**: Deleted

2.6. Once the paper is fully positioned, use a dropper to saturate it with consolidant, applying approximately 1 to 2 drops per square centimeter **[1]**. Allow the bandage to dry completely before moving the specimen **[2]**.

2.6.1. Talent using a dropper to apply consolidant over the kozo paper.

2.6.2. Shot of the specimen kept for drying on the workspace.

3. Making Acrylic Struts for Mammoth Femur

Demonstrators: Dava Butler and Jeff Huckeby

3.1. To begin creating acrylic struts, measure the height of the space where they will be placed **[1-TXT]**. Subtract 0.5 centimeters from this measurement to calculate the final length **[2-TXT]**.

3.1.1. Talent measures the vertical gap under the specimen. **TXT: Specimen: Mammoth femur WACO 1003**

3.1.2. Talent calculating the desired strut length and width based on the measured height. **TXT: Select 1 - 2 cm width for easy placement**

3.2. Cut the acrylic to the desired dimensions **[1]**. If using sheet acrylic, cut it with a saw **[2]**. Lay out the required tools, including personal protection equipment **[3-TXT]**.

3.2.1. Talent marking the acrylic for cutting.

3.2.2. A close-up view of talent using the saw.

3.2.3. Talent neatly arranging all tools, materials, and the cut acrylic on the workstation. **TXT: Lay out cut acrylic, paper, adhesive and consolidant**

3.3. Then, tear a piece of thick kozo paper into a rectangle large enough to wrap around the acrylic strut, leaving a 1-to-2-centimeter overhang at each end **[1]**.

3.3.1. Talent tearing a strip of thick kozo paper and measuring it against the strut to confirm appropriate overhang.

3.4. Apply a broad, thin layer of adhesive to one side of the paper **[1]**. Wrap the adhesive-coated paper around the acrylic strut and press it tightly in place so that the paper adheres to itself **[2]**.

3.4.1. Talent applies adhesive to the kozo paper.

3.4.2. Talent wrapping the coated paper around the strut and firmly pressing the overlap to seal it.

3.5. Place the strut on the workstation with the seam side facing downward **[1]**. Saturate the paper wrapping with 3 to 4 drops of consolidant per linear centimeter and allow it to dry completely **[2]**.

3.5.1. Talent positioning the wrapped strut seam-down on a clean surface.

3.5.2. Talent using a dropper to apply consolidant evenly across the paper-covered strut.

3.6. Using scissors, cut the excess paper at both ends into box-shaped flaps **[1]**.

3.6.1. Talent trimming the ends of the wrapped paper into four flaps using small scissors.

3.7. Flare out the paper flaps **[1]**. Apply adhesive to both the visible end of the acrylic strut and to the flared flaps **[2]**. Cover the exposed end with a small piece of thin kozo paper, making sure it conforms to the flared shape and fully encases the acrylic in composite material **[3]**.

3.7.1. Talent spreading the cut flaps outward evenly.

3.7.2. Talent applying adhesive to the flared flaps and the exposed acrylic end.

3.7.3. Talent applying a small piece of thin kozo paper to the end of the strut and shaping it around the flared composite.

4. Installing Acrylic Struts

Demonstrators: Dava Butler and Lindsay Yann

4.1. To identify the ideal location for placing the strut, select a weight-bearing area where both ends can make direct contact with the fossil specimen **[1]**. Arrange all necessary tools, including paper, prepared struts, tweezers, adhesive, consolidant, acetone, and preferred implements **[2]**. Lay out more swabs and toothpicks than are likely needed **[3]**.

4.1.1. Talent examining the fossil and pointing out a structurally supportive location for strut placement.

4.1.2. Talent organizing tools, including struts, paper, and adhesive, on the workstation.

4.1.3. Talent placing extra ~~swabs and~~ toothpicks nearby for easy access.

4.2. Apply adhesive to the selected location on the fossil **[1]**. Place the prepared strut onto the adhesive spot **[2]**. Use a toothpick, or a paintbrush soaked in acetone to gently press the flared edges of the strut into the surface of the fossil **[3-TXT]**. Apply an additional layer of adhesive to the base of the strut and let it dry for several hours before moving forward **[4]**.

4.2.1. Talent applying adhesive to the fossil at the selected placement site.

4.2.2. Talent positioning the strut onto the adhesive-coated area.

4.2.3. Talent using a toothpick to press the flared edges onto the fossil. **TXT: If the tool begins to stick, replace it with a fresh one**

4.2.4. Talent applying more adhesive at the strut base and keeping it aside.

4.3. To test the firm placement of the strut, apply gentle pressure with fingers or tweezers **[1]**. Once confirmed, apply adhesive to the free end of the strut and points of contact on the specimen in preparation for securing the next fossil fragment **[2]**.

4.3.1. Talent gently testing the strut for movement ~~using tweezers~~.

4.3.2. Talent applying adhesive to the exposed end of the strut.

4.4. Place the next fossil fragment onto the prepared adhesive, using assistance if needed **[1]**. Use sandbags or foam blocks to support and stabilize the fossil fragment in position while the adhesive cures. **[2]**.

4.4.1. Talent positioning the second fossil fragment onto the adhesive end of the strut with help from an assistant.

4.4.2. Talent arranging small sandbags or foam blocks around the fragment to hold it steady.

4.5. Once the strut and attached fossil fragments are stable, use a toothpick or a paintbrush soaked in acetone to press the flared end of the strut firmly into the surface of the fossil **[1-TXT]**. ~~Apply internal or external bandages where necessary to ensure that both ends of the strut maintain full contact with the fossil~~ **[2]**. Apply additional internal or external bandages to stabilize the newly positioned fragment or strut **[3]**.

4.5.1. Talent using a toothpick to gently press the flared strut end onto the fossil. **TXT:**

If the tool sticks, replace it; Place additional sandbags, foam blocks, or other supports as needed

~~4.5.2. Talent applying a paper bandage over the strut's ends to secure them in place.~~**NOTE**: Delete

4.5.3. Talent applying another bandage to reinforce the newly positioned fossil fragment.

Results

5. Results

5.1. The specimen remained structurally intact and could withstand vertical positioning without damage after reconstruction **[1-TXT]**.

5.1.1. LAB MEDIA: Figure 14A. **TXT: Specimen: WACO 1000**

5.2. During imaging, X-rays showed limited visibility of composite repairs **[1]**, while the acrylic struts appeared translucent and produced no imaging artifacts **[2]**.

5.2.1. LAB MEDIA: Figure 14D.

5.2.2. LAB MEDIA: Figure 14D. *Video editor: Highlight the region marked by the yellow arrows*

5.3. Computed tomography scans from the University of Texas CT Lab revealed faint shadows for the composite material **[1]** and uniform gray for the acrylic struts, both free of imaging artifacts **[2]**.

5.3.1. LAB MEDIA: Figure 14E. *Video editor: Highlight the faint gray areas surrounding the bone*

5.3.2. LAB MEDIA: Figure 14E**.** *Video editor: Video editor: Highlight the region marked by the yellow arrows*

5.4. No beam hardening artifacts were observed in the acrylic or composite materials during computed tomography scanning **[1]**.

5.4.1. LAB MEDIA: Figure 15.

- **Kozo**

Pronunciation link:
https://www.howtopronounce.com/kozo
IPA: /ˈkoʊzoʊ/
Phonetic Spelling: KOH-zoh

- **Consolidant**

Pronunciation link:
https://www.merriam-webster.com/dictionary/consolidant
IPA: /kənˈsɑːlɪdənt/
Phonetic Spelling: kuh-SAL-i-dant

- **Acetone**

Pronunciation link:
https://www.merriam-webster.com/dictionary/acetone
IPA: /ˈæsɪˌtoʊn/
Phonetic Spelling: AS-i-tohn

- **Femur**

Pronunciation link:
https://www.merriam-webster.com/dictionary/femur
IPA: /ˈfiːmər/
Phonetic Spelling: FEE-mer

- **Artifact**

Pronunciation link:
https://www.merriam-webster.com/dictionary/artifact
IPA: /ˈɑːrtəˌfækt/
Phonetic Spelling: AR-tə-fakt

- **Tomography**

Pronunciation link:
https://www.merriam-webster.com/dictionary/tomography
IPA: /təˈmɑːgrəfi/
Phonetic Spelling: tuh-MAHG-ruh-fee

- **Translucent**

Pronunciation link:
https://www.merriam-webster.com/dictionary/translucent
IPA: /trænˈsluːsənt/
Phonetic Spelling: tran-LOO-suhnt

- **Composite**

Pronunciation link:
https://www.merriam-webster.com/dictionary/composite
IPA: /kəmˈpɑːzət/
Phonetic Spelling: kuh-PAH-zut