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Japanese Tissues; Uses in Repairing Natural Science Specimens

- Simon Moore, Natural Sciences Conservator

Abstract

Japanese tissues are widely used by conservators, especially those who work with paper. Until recently their use had not been applied to Natural Sciences. This article shows how they can be used to create tidy and effectively strong repairs and gap fills for the repair of taxidermy specimens.

Introduction

There are three principal plants used in the manufacture of Japanese tissues*: Kozo, Mitsumata* and *Gampi*. These plants are grown, harvested and processed in small villages in certain provinces (e.g. Nara) after which the tissues are named. Purposeful additives (such as powdered shell and clay) are also listed resulting in some lengthy compound names for these tissues! The fibres in the bark are exceptionally long and strong which gives the tissues their characteristic strength.

The pulp from these plants is skilfully agitated and laid, using the finest of purpose-made wicker baskets, aligning as much of the fibre as possible and creating tissues of varying grades and weights (in grams per square metre). Since the plant fibres are mostly in alignment (Fig. 1a), thanks to the basket-layering process, the strength of the paper is amazing. The critical tearing mass (breaking strain across the grain) of a 1 cm wide length of 9 gsm Gampi (one of the thinnest papers) is an amazing 2.015 kilograms! The paper can also be torn by hand in a perfectly straight line along the grain.

These handmade papers are produced by a traditional craft industry after centuries of amelioration (some papers exist that are 1200 years old!). Unfortunate that the next generation are less interested in such tradition. The craft is gradually being subsumed by mass production of inferior tissues from Thailand and the Philippines, which do not possess the same physical properties as the more expensive but superior hand-laid papers. Holding a sheet of poorer quality paper up to the light reveals undesirable knots of fibres, unwanted particles of plant material and a poorly aligned grain structure (Fig. 1b). Although a single large sheet of traditionally made paper (1400 x 915mm) can cost £16 a great many repairs can be made using the one sheet combined with its strength and purity.

Used extensively in paper conservation for their combination of fineness and strength, these tissues also have found many applications in natural science specimen conservation.

Figures 1a-d. Samples of Japanese and other tissues magnified x 360 to show the more correct alignment of fibres in the traditional tissues opposed to the random grains structure of mass-produced tissue.

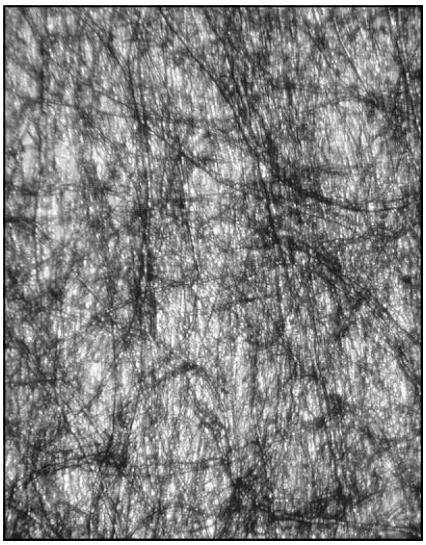


Figure 1a: 9 gsm traditional Gampi

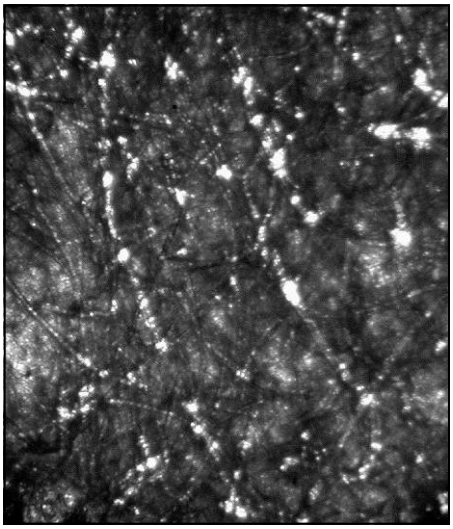


Figure 1b:'silk tissue' 10 gsm sulphite-free

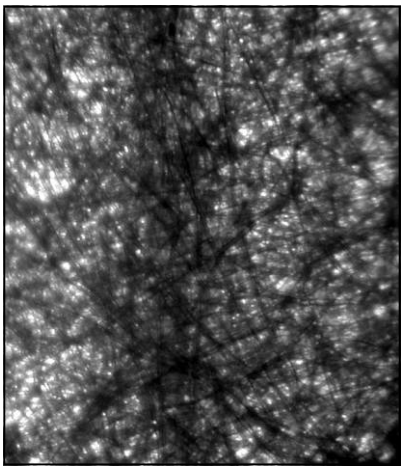


Figure 1c: 15 gsm traditional Kozo

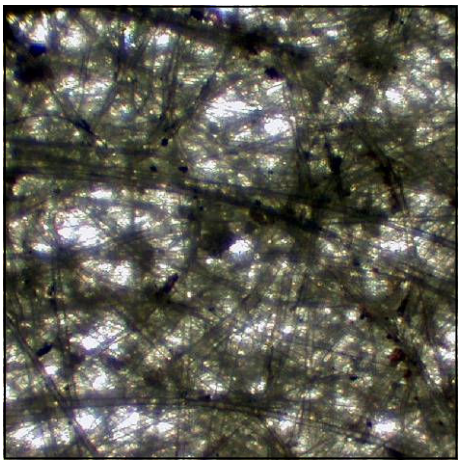


Figure 1d: 14 gsm Philippine Gampi

How the process works

A strong tissue, whose structure does not break down into a tangle of fibres when wet or in contact with an aqueous adhesive, is ideal for many types of repair work. The tissue acts as a stable bridge between the protein/amino acid or cellulose-based structures of animal or plant tissues and the associated adhesive has to penetrate deeply into the tissue and have a neutral pH. Neutral pH PVA is widely used in this context and bonds strongly with the micro-fibrous surface of the tissue.

Japanese tissue can also be used as a gap-fill: either as a simple surface cover that can be textured with a sharp point before painting, or as a deeper level fill (no more than 3mm for each layer or the whole becomes difficult to manage). The latter fill is similar to *papier-mâché* but has a harder finish.

Applications

So far I have found Japanese tissues to be useful for:

1 Rebuilding pest-shredded bird feathers

2 Re-mounting detached bird feathers.

3 Rebuilding fish mount fins that have been holed or eaten away by pests or have split due to prolonged low relative humidity.

4 Repair of lepidopteran wings. (All of the above due to the depredations of *Anthrenus* and other insect pest larvae.)

5 Textured gap fills for webbed feet, bird legs and mammal tails.

6 Repair of damaged mollusc shells.

It is also being tested for the repair of Botanical herbarium specimens but this area is presently incomplete.

Surface gap-fills

The strips of tissue must be torn so that the edges will blend into the background - cut edges remain noticeable, even when painted.

Textured gap-fills

These require pre-gluing of the tissue so that it can be folded in on itself. The plug is then inserted, shaped and the surface moistened with neutral pH PVA. The surface can then be deckled or textured using a pointed spatula until the desired effect is achieved (Fig. 5c). Various types and gsm grades of tissue can be used for this work depending on the area to be covered and the type of animal tissue. Always experiment with a small piece of tissue first if unsure, the process is always reversible.

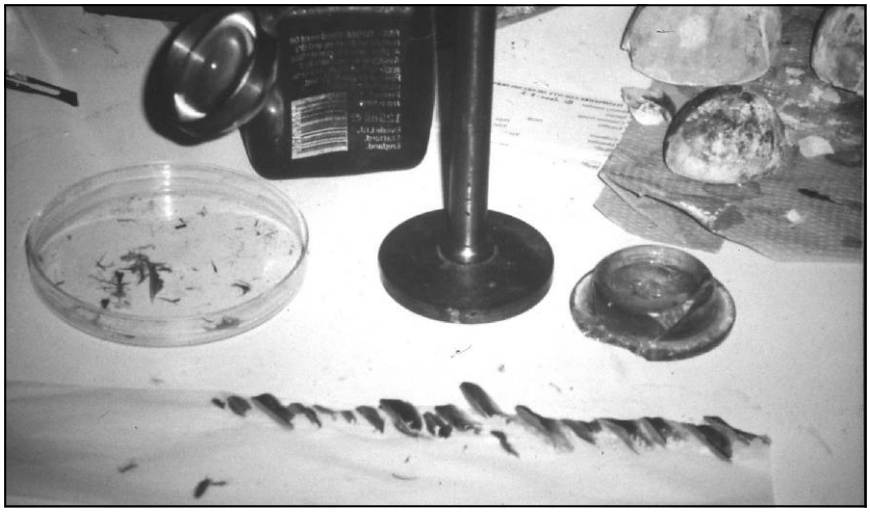
1-2 Bird feather repair and re-building obviously requires time and patience and is only carried out on specimens of great rarity or importance.

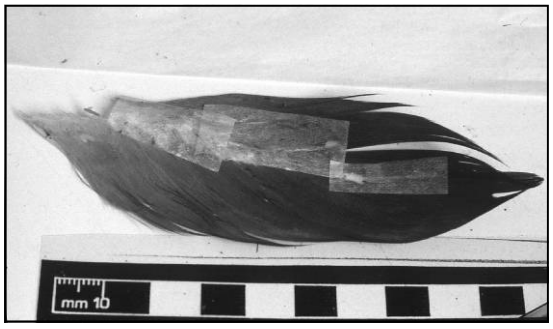
1. Barbs need to be graded, using a low-power microscope and kept in a draught free (lidded) container.

2. The barbs are then individually glued, using a tiny amount of 50% PVA onto the strip of low gsm Gampi (9 gsm is best). The glue is applied using an eyelash glued onto a small glass rod. Ensure that the tissue is partly placed under a strip of 2-3mm glass to prevent it from curling as it comes into contact with the water-based adhesive. Should the barbs adhere to the glass, the adhesion can be broken using a wedge-shaped scalpel blade (Swann-Morton No. 25 is best).
3. After c. 15 minutes the next barb can be glued.
4. Before replacement, the re-built feather may lie rather flat. Brushing a small amount of deionised water onto the back of the tissue will help the feather regain its natural curvature.
5. Once the feather has been rebuilt, the shaft base is wrapped in some tissue with PVA to increase the surface area of adhesion. Shaft bases are often brittle and this obviates recurrence of feather drop.
Where the skin has been eaten away by *Anthrenus* larvae, Japanese tissue can be used as a replacement skin with feathers added to it in swatches.

Tips
If repairs are going to be visible, ensure that all strips of tissue are torn and not cut. Straight (cut) edges can still be seen even if subsequently painted.
Heavier weights of tissue can be used for stronger joins but will need to be well moistened with adhesive.
Heavier tissues are also useful for internal repairs.
Note Lighter tissues will start to curl as soon as they become moist – if this effect is undesirable ensure that at least part of the tissue is held flat under a small sheet of glass. Bear in mind that lighter weight tissues will follow the natural curvature of a feather.

Figures 2a-c. Damaged feathers can be mounted barb-by-barb onto 9 gsm Gampi tissue strips.





Holes can be repaired with strips of Gampi tissue. Shafts can be tissue wrapped to give extra surface area adhesion.

3 Repairing fish mount fins

Fish fins provide an easy feast for pest larvae resulting in unsightly holes. If the relative humidity level of storage or display areas falls below 45% then fins and skin can start to split or crack. Japanese tissue provides a suitable medium for gap-filling.

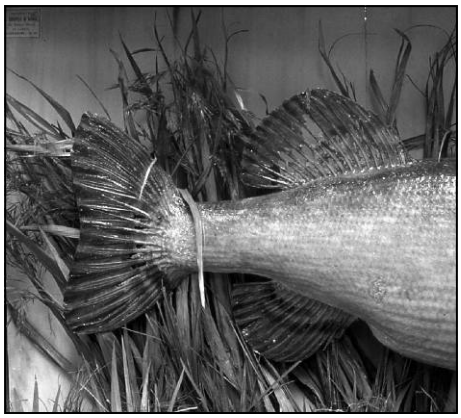


Figure 3a: Pike specimen with fins and tail holed by *Anthrenus* larvae

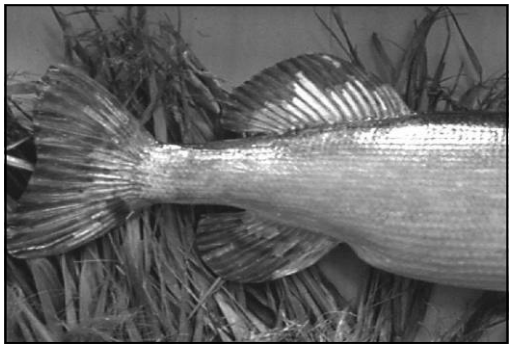


Figure 3b: 14 gsm Kozo tissue is applied in torn strips and glued onto rear side of fins

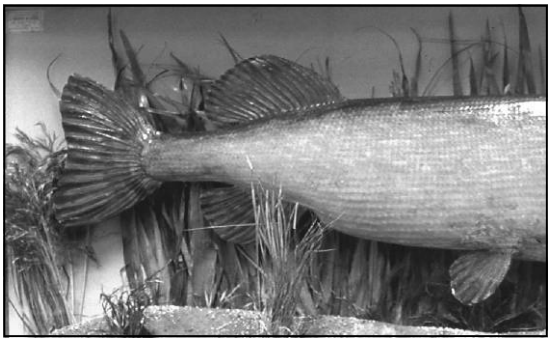


Figure 3c: Tissue in-fills are then painted and when dry are shellac lacquered

4 Lepidopteran wings

Stored and displayed insect specimens are also prone to pest ingress and ensuing damage.

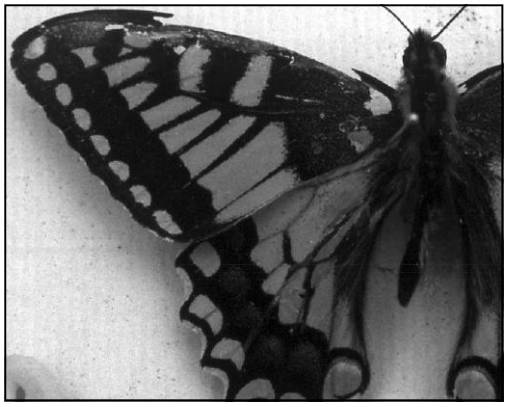


Figure 4: 9 gsm Gampi tissue provides a lightweight and strong enough backing, for painting into damaged display specimens

5 Textured gap-fills require some pre-gluing to the tissue so that it can be folded in on itself. The folded plug of tissue is then inserted, shaped and the surface moistened with neutral pH PVA. After about 20 minutes the surface can be deckled or textured using a pointed spatula until the desired effect is achieved. Various types and gsm grades of tissue can be used for this work depending on the area to be covered and the type of animal tissue. Always experiment with a small piece of tissue first if unsure, the process is always reversible.

Figure 5a: Broken bone of little grebe re-aligned and glued into place

Figure 5b: Glue-impregnated tissue tucked into place.

Figure 5c: Tissue gap-fill deckled with a spatula point

Figure 5d: Dried, coloured gap-fill textured using a sharp point

Figure 5e: Gap-fill coated with shellac lacquer. point

6 Repairing mollusc shells

The tissue acts as a bridge between the thin edges of the shell and forms a reinforcing plate internally so that a 'Paper Argonaut' shell can be more safely handled. Heavier tissues are also useful for internal repairs.

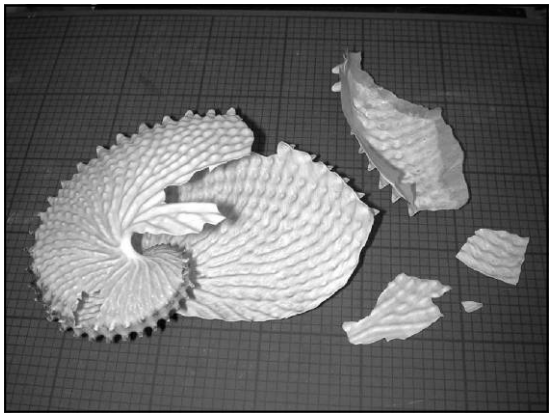


Figure 6a: Broken paper Argonaut shell repaired using 9 gsm Gampi tissue

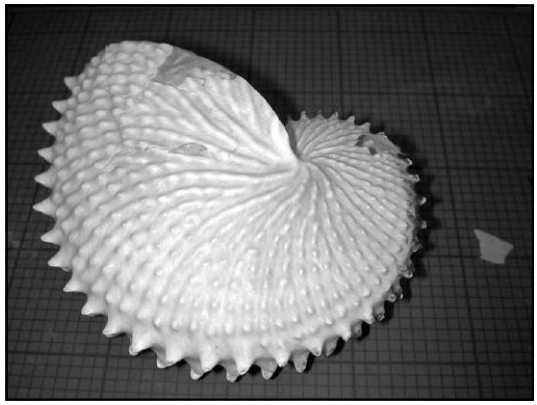


Figure 6b: The repair is so strong that the shell is now used as a handling specimen

Dry tissue strength table

Tissue type	weight (gsm)	breaking strain (g)
Acid-free wrapping	9.85	346
Gampi (traditional)	9	2015
Gampi (sulphite-free)	10	1845
Gampi (traditional)	14	2544
Philippine Gampi	20	2620
Sekishi Kozo	15	4580
Kozo	12.25	5705
Usumino Kozo	8.5	3960

Conclusions

Japanese tissue has been found to be an effective medium to support and strengthen adhesive to protein joints for deteriorated taxidermy and similar applications for other natural science specimens. The range of weights and tissue types will help to increase their versatility in natural science conservation repair work.