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Conservation of James Sowerby's Fungi Models

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Abstract

The Natural History Museum, London (NHM) holds 29 models of fungi created between 1796 and 1815 by the naturalist and illustrator James Sowerby. These models are interesting composites of painted unbaked clay, wood, metal and dried plant matter. This article outlines the techniques and materials used to clean, stabilise and re-house these model fungi. Remedial treatments were kept to a minimum but aimed to improve stability. They include the use of Lascaux for adhesion and consolidation, and the use of Groom/Stick® and smoke sponge for dry cleaning. The models were finally stored in bespoke acid-free cardboard boxes with inert foam inserts.

Keywords: James Sowerby; Models; Fungi; Remedial conservation

Introduction

James Sowerby (1757-1822) made many contributions to botanical works during his life-time, and also produced extensive volumes on mycology, conchology and mineralogy. Sowerby was one of the contributors to the first ever British botanical magazine, whilst one of his most famous works: "The English botany; or coloured figures of British plants , with their Essential Characters, Synonyms and Places of Growth", featuring nearly 2500 colour illustrations, is still regarded as an authoritative reference source. Sowerby differed from contemporary botanical illustrators in that he produced paintings for science rather than for a wealthy patron (Walsh ,2003). His other work includes "Coloured figures of English fungi or mushrooms" and the creation of 193 fungi models to educate the British public about poisonous species. Sowerby opened his home twice a month, inviting the public in to view the models and learn to identify those safe (and unsafe) to forage (Smith, 1888). The Natural History Museum bought the fungi models in 1844 from Sowerby's son, James De Carle Sowerby (Carruthers, 1888) but only 29 survived the extensive damage suffered by the museum collections during World War II (Tribe, 1995).

The majority of the surviving models are composed of unbaked clay mounted on metal armatures and coloured with oil paints. Smith (1888, 223) describes some of them as having parts fabricated from wire, wood, sheet iron, card and leather. He even notes that some models are 'the real fungi themselves, dipped in some hardening solution and then painted'. The models were originally mounted on blocks of wood, or sometimes cork, surrounded by real moss (Smith, 1888). In preparation for an exhibition at the NHM, Worthington G. Smith describes how he repainted the models using oil paints, and remounting them in a more 'natural' setting by surrounding them with dead leaves, branches, horse-dung, beech-nuts, and acorns (Smith, 1888).

The models are now suffering from deterioration due to their brittle substrate (possibly exacerbated by mercuric chloride or similar biocides), failed adhesives and poor storage conditions. Many of them are chipped, broken, cracked, abraded, have loose fragments or detached labels. It was decided that flaking paint and cracks would be consolidated and the models would be lightly cleaned. Due to the uncertainty of their restoration history, the areas of paint loss were not renewed.

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Fig 1. Cleaning with smoke sponge and Groom/stick.

Methods for Repairing and Cleaning the Models
Discrete areas were cleaned using different techniques to establish a suitable method. These included dry brushing, localised vacuum, smoke sponge, Groom/Stick®, low-pressure air jet, distilled water and laser ablation. Dragging a smoke sponge (vulcanized rubber) gently over smooth surfaces, followed by dabbing with Groom/Stick® (natural rubber) was found to be the most appropriate method of cleaning (Fig 1). The Groom/Stick® was not found to leave a residue behind on the surface, as it can with some materials, when used in this light dabbing technique to remove the particulates. It was found to be impossible to clean the decoration on the mounts without causing damage. Repairs were made using Lascaux 498HV (acrylic adhesive): broken surfaces were dusted with a large soft brush to remove loose particles, consolidated with Lascaux 4176 (acrylic dispersion), and the adhesive was applied using a small brush. The two surfaces were then pressed together and allowed to air-dry. The cracks were consolidated by injecting 15% (v/v) Lascaux 4176 and deionised water (Fig 2). Lascaux was chosen for its workability, elastic strength, pH, ease of application, low toxicity, final appearance and long-term stability (Becker, 2014; Hedlund & Johansson, 2005; Millard, *et al*. 2011).

Methods for the Stabilisation of the Organic Substrate
The leaves and twigs which decorated the plinths were loose and becoming detached and lost every time the specimens were moved or air currents reached them. It was essential to stabilise these as part of the object. The most suitable method for stabilisation was established through tests on a variety of similar plant fragments which were collected from the museum grounds and then air-dried naturally within the laboratory. These dried stems, leaves and flower petals were placed on top of squares of acid-free card. Lascaux 4176 was applied to each group using a different technique: nebuliser, brush, spray bottle and pipette. A range of dilutions were also tested using these different styles of application. The tests aimed to discover a method that would strengthen the plant fragments and adhere them to the card bases, but that would not cause changes in lustre or colour.

The first test used a nebuliser to apply a mist of 100% solution of Lascaux 4176 to the plant fragments. This dilution proved too viscous to work effectively with the nebuliser, resulting in spits and dribbles rather than mist formation. A 25% concentration of Lascaux 4176 in distilled water was therefore used to generate a mist. The nebuliser proved difficult to control: Pointing it directly at an area caused loose material to be blown away, whilst tilting it caused the consolidant to bubble up and overflow. At greater distances the cloud dispersed before it had a chance to settle. A make-shift enclosure was constructed to allow settling and the nebuliser was used in repeated short bursts in an attempt to build up a sufficient layer (Fig 3). This worked well to give an even coating on the organic fragments and the resulting appearance was good, but it failed to adhere them to the card.

Fig. 2. (left) One of the models before treatment. (right) After cleaning, repair and consolidation.

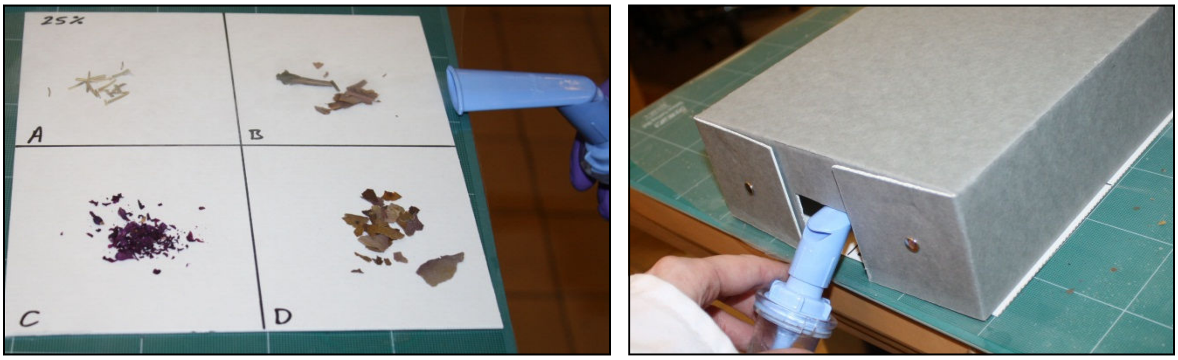

Fig. 3. (left) Consolidant cloud creation using a nebuliser. (right) Make-shift enclosure to prevent cloud dispersal.

A higher level of control was achieved by flicking consolidant onto the fragments with a brush. This technique resulted in a low penetration level and uneven coverage. Different concentrations of Lascaux 4176 were tested with this method, but the amount of dilution did not make a difference in appearance or success of the consolidant. Application with a spray bottle also proved unsuccessful because the force was too strong and it mostly blew the loose material around.

A pipette proved to be the easiest and most successful way of applying the consolidant. It provided the most control, coverage and penetration. The 100% and 25% solutions completely flooded the samples so lower concentrations were also tested. The most suitable dilution proved to be 15% Lascaux 4176 in distilled water: All of the material was consolidated into place and it had not gained a lustre or changed colour.

Re-housing the Models

The models had already been stored in acid-free boxes, as part of an earlier collections care project, but they were still vulnerable to physical damage (Fig 4). Many of the boxes were much too large for a single model, so in several cases multiple small objects were stored in one box. These could slide around and collide during transportation. The gaps between models were filled with tissue paper, causing abrasion if movement were possible, and compaction damage when packed too tightly. In addition, since the models could not be viewed without opening the lid and removing the tissue, the mass and weight distribution could easily be misjudged, leading to accidents.

An acid-free cardboard tray was therefore created for each individual model (the example can be seen in Appendix 1). This was lined with 2mm plastazote® foam (cross-linked closed cell polyethylene nitrogen expanded foam), to protect the model from vibrations. A snugly-fitting recess was then carved into 10mm plastazote in the shape of the footprint of the plinth. Finger-holes were cut on each side to enable access, although the low tray was designed to allow study without direct handling. An acid-free box was then created with a drop-down front to allow easier removal of the model, by sliding the low tray out horizontally, rather than lifting from above. The boxes were also given polyester windows to enable better-informed handling and transportation of the models when they are needed for research (Fig 5). The boxes were held together using nickel plated rivets from Conservation by Design. The cardboard used for this particular project was grey/white acid-free and lignin-free E-Flute corrugated boxboard (Conservation by Design). The polyester for the windows was 75 micron (Preservation Equipment Ltd.) and the double-sided tape used to position them prior to riveting was double-coated 3M #415 polyester transparent tape (Preservation Equipment Ltd.). This box design derives from best practise for general object storage developed over several years within the Conservation Centre at the NHM. All storage materials were chosen for their low chemical reactivity and have passed the accelerated aging test as described by Thicket & Lee (2004).

Fig 4. One of the previously existing storage boxes.

Fig. 5 Above: One of the new bespoke trays with cut-out foam.
Right: One of the new boxes which has a drop-down front. The window enables identification and aids handling.

The ideal storage environment for the models is problematic because they are composite objects. Table 1 below, shows a few of the contradictory recommendations for relative humidity found within the literature. In this case, the most sensible option was to choose 45 +/- 5% RH with as little fluctuation as possible (see references in Table 1). Lux and UV of the storage environment are at zero, to prevent fading and other photo-oxidative reactions. Temperature is managed at an achievable ideal of 21 +/- 3^{o}C.

Material Type	Recommended RH	Source
Mixed Collection	55%	Staniforth, 1994, 237
	60-70%	Pye, 1994, 400
	40-55%	Stolow, 1987, 252
	45-55 or 50-60%	Thomson, 1997, 268
Iron	40-45%	Shearman, 1990, 21
	<50%	Wang, 2007, 126
	40-45%	Staniforth, 1994, 237
	15-40%	Stolow, 1987, 16
	<30%	Erhardt, *et al.* 2003, 155
Brittle ceramics	>40%	Erhardt & Mecklenberg, 1994, 37
Ceramics[(i)]	45-55%	Uprichard,1990, 30
	48-52%	Buys & Oakley, 1998, 30
	40-65%	Bradley & Daniels, 1990, 1
	55-60%	Daintith, 1994, 358
	20-60%	Stolow, 1987, 16
	0-45%	de Guichen, 1988, 68
Ceramics (with salts)[(ii)]	<55%	Erhardt & Mecklenberg, 1994, 34
Stone (with salts)	<60%	Munday & Dinsmore, 1990, 42
Stone (clay-rich)	30-40%	Bradley, 2005, 163
Organics	<70%	Florian, 2004, 54
	50-60%	Pye, 1994, 401
	50-65%	de Guichen, 1988, 68
	<60%	Erhardt, *et al.* 2003, 154
Adhesives[(iii)]	40-70%	Erhardt & Mecklenberg, 1994, 34
	<50%	Daintith, 1994, 358

Table 1. Some recommendations of ideal RH levels. Notes: (i) High temperature fired pottery is very durable, but poorly fired ceramics are fragile, because not all of the clay minerals have been altered (Uprichard 1990, 27). Unbaked clay is therefore very sensitive to fluctuation. (ii) Clay and ceramics which have been contaminated with soluble salts during burial are susceptible to flaking and crumbling under variable RH (Uprichard, 1990, 29). (iii) Polymers will craze, chalk, embrittle or become tacky, depending on environmental fluctuations (McNeill 1992, 14). This will affect joint strength, particularly important with brittle materials like unfired clay, prone to breakage if pieces fall.

Summary
Museums hold cultural heritage in trust for society and it is their duty to balance access with preservation for future generations. Historical collections, whether composed of actual specimens or representative information, like James Sowerby's fungi models, are a non-renewable resource. They hold value as comparisons against modern material, as a document of collectors and collecting, and often contain or represent species that are no longer extant or readily obtainable.

In addition these particular models serve to preserve fungi in 3-dimensions, as they appeared during life, augmenting information from illustrations and forms of preservation such as dried or spirit collections. Proper care and storage is therefore essential.

This project has ensured the stabilisation of the models, allowing them to continue to be used as a teaching collection, through the use of conservation-grade materials that reduce risk from handling but do not contribute to chemical deterioration.

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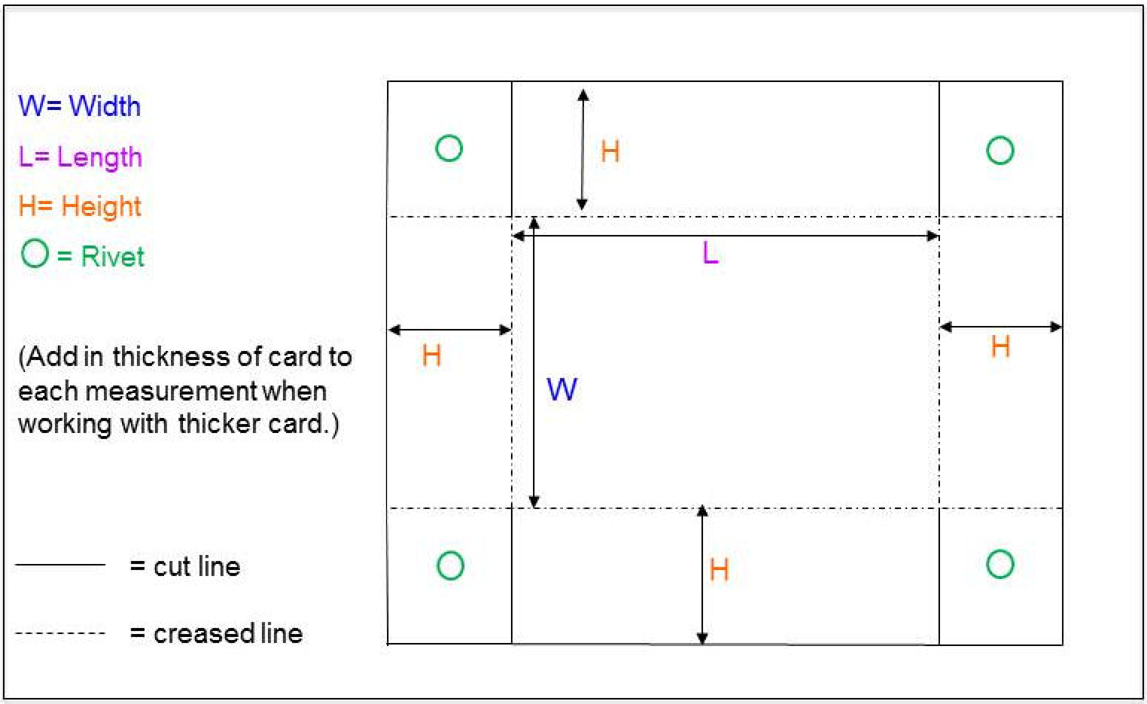
APPENDIX 1.

The tray and lid template (developed by staff at the Conservation Centre, NHM)



The box template (the window can be cut into the front drop-down side of the box or into the lid, depending on storage style).