Care and Conservation of Natural History Collections

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Appendix II

Papers, inks and label conservation

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(with contributions from David Bedford, Dick Hendry and Simon J. Moore)

Introduction

When considering the suitability of any paper or ink, it is the combination of the paper and ink which is critical and the two are usually difficult to consider in isolation. For instance, an ink recommended for writing on dry insect labels may not be suitable for writing on a Tyvek label. The same principle will apply to computer-produced labels. Moreover, it must be remembered that manufacturers can change the formulae and names of their products without reference to their customers and periodic checks should be made to maintain standards.

Paper

Three major uses of paper in natural history collections are for labels, for documents and for specimen mounts including protective folders. In nearly all cases it is important that the paper should be of archival quality.

The longevity of papers covers a wide range. At one end of the scale are the poorest types of wood-based paper which are highly bleached and contain many of the original raw components of the wood, such as lignin. These characteristics lead to increasing acidity and rapid deterioration. Examples include newspaper and the whitest and smoothest surfaced papers. The latter are extensively bleached and are then combined with fillers (mostly kaolin clays) to produce a smooth white surface. Medium quality papers include bond papers, such as photocopy bond, which are bleached papers without fillers and therefore have a slightly textured surface. Paper with the longest life expectancy is made from pure cellulose, either from cotton rag or delignified wood pulp. Different characteristics of papers include the fibre lengths of the cellulose compounds, giving different strength, stiffness and folding characteristics, as well as different surface smoothness. The thickness or substance of the paper is expressed as a weight in grams per square metre (gsm), with heavyweight paper the thickest. In the USA the thickness of the paper may be expressed as a unit of thickness (`mil' or `point) rather than as a weight. A useful summary of terms used in the paper industry is provided by Bridson and Forman (1992).

As herbarium specimens are mostly fastened on to sheets of paper and stored in paper folders, particular importance is attached to the archival quality of the materials used. For further detail, reference should be made to Chapter 3 on vascular plants.

Any label immersed in liquid must be printed in permanent ink on 100% rag paper. Pitkin (1995) recommends Wiggins Teape HWS WT 550, Wiggins Teape Goatskin Parchment (120 gsm) or Resistall (Byron

Weston Paper Company: supplied by Preservation Equipment Ltd, UK and University Products, USA) as suitable papers. Some papers tend to break up over time. Carter (1996) mentions problems with a batch of archive paper which disintegrated on immersion in fluid and, on enquiry to the manufacture, he discovered that it was apparently due to a change in production methods, and this should be borne in mind when selecting a paper. Carter (1996) recommends Resistall as the preferred choice of paper for fluid collection labelling and Goatskin Parchment as a second choice, noting that the more waterbased the solution, the softer the Goatskin Parchment becomes and the more easily the print is abraded from the surface, although provided the paper is handled reasonably carefully this should not be a problem.

Pettitt (1976) recommends the spun polyethylene sheet Tyvek'*M* (available from Preservation Equipment Ltd) as a suitable label paper substitute over Goatskin Parchment for providing strength and a writing surface for immersion in liquid, but interestingly this recommendation does not seem to have been universally accepted in the literature or taken up by museum curators. Horie and Barry (1990) used Tyvek as one of their test substrates in a series of experiments testing the solvent resistance of marking pens and found that the Edding 1800 Profipen (0.1) was the best to write on this surface. All specimens preserved dry require a label printed on 100% rag paper, acid-free and archival quality. Pitkin (1995) recommends Goatskin Parchment or thin card (Mellotex Smooth Ultra White 135 gsm from Tullis Russell) for pinned insect collections.

For microscope slide labels, Pitkin (1995) recommends using a foil-backed self-adhesive label (available from Preservation Equipment Ltd or University Products Inc.) or archival quality paper gummed directly on to the glass slide. Some insect collections use slide labels made from squares of four-ply Bristol board which is gummed down with white, neutral (acid-free) PVA (polyvinyl acetate) glue. The advantage of this system is that the thick card protects the coverslip when the slides are stacked one on top of each other for travelling or handling.

A word of caution must be expressed over the use of steel eyelets, often used for tags fastened to large specimens such as animal skins. These corrode over time, resulting in the labels becoming detached from the specimen. Brass or plastic eyelets are the most suitable although brass is susceptible to some corrosion.

Each new batch of paper should be checked against the last batch, particularly for weight, texture and any watermarks. A useful pH check for new batches of paper can be made using a simple pH testing pen such as the Lineco pH Testing Pen which will give warning of significant changes. More precise testing can then follow using an electronic pH meter, or the matter can be referred hack to the manufacturer.

Inks and pens

As Wood and Williams (1993) point out, the written record associated with an object often is as valuable as the object itself, and for this reason inks used in collections should be of archival quality and not soluble in water, alcohol or other commonly used fluids. Some early inks based on oak gall and iron sulphate are highly acidic and in some cases have eaten completely through the paper (Hadgraft and Swift, 1994; James *et cal.,* 1997) (Plate 37). Inks should dry before immersion in fluid. Specimen annotations should always be allowed to be made with long-lasting, preferably archival, writing materials to ensure that they will last for future workers. While graphite pencil is archival and useful for temporary field labels, it is erasable and can be hard to read in poor light or when wet, and is not recommended for critical annotations such as locality labels or determinations.

The most stable inks are those based on carbon particles which can be destroyed only by burning (Horie and Barry, 1990) and many inks are compounded from both carbon pigment and dyes in order to increase the blackness. The most common black ink is usually referred to as `India' or `Indian' ink, as used in refillable technical drawing pens (e.g. Rotring). This ink becomes embedded between the fibres of the paper, is waterproof and extremely resistant to fading. Technical drawing pens can be difficult to maintain as they easily dry up or become clogged. Special

cleaning fluids are available from some manufacturers. Matthieson (1989) recommends desk-top ultrasonic cleaners for this purpose but the health and safety risks involved in their use must be borne in mind.

Williams and Hawks (1986) performed laboratory tests on a range of drawing inks and listed the following elements as those that make a suitable ink:

- Neutral to mildly alkaline (pH 7.0—8.5).
- Non-corrosive.
- Low to moderately fluid and uniformly opaque.
- Above 0.18 g of solids per millilitre of fluid.
- Dry in 90—180 seconds.
- Equal in colour value to 16 or above on the Kodak Grey Scale.
- Light-fast.
- Resistant to fluids.
- Low to moderate in cost.

The authors found only Rotring 17 Black (591017) good in all categories, but Pelikan 17 Black (later changed to Pelikan Drawing Ink FT, Black — see Williams and Hawks, 1988), Higgins T-100 and Hunt Speedball Super Black India were acceptable.

Some recently available disposable pens are labelled as having permanent ink and Williams and Hawks (1986) have given the results of tests on twelve disposable pens. They considered that the best disposable pen for museum use should, above all other criteria, be resistant to light, most fluids and smearing or flaking. The disposable pens judged to have the most desirable characteristics for museum documentation included the Pigma pen and the Marsgraphic Pigment Liner pen. Murphy (1986) considered the Pigma pen suitable for herbarium use but Bedford has found with accelerated ageing tests (in which inks are exposed to bright daylight conditions) that it faded significantly more than India ink.

In a study of the solvent resistance of marking pens, Horie and Barry (1990) tested forty black pens and reached the conclusion that only Pigma Ball was unaffected by all of their chromatography tests, but this pen did not write well on Tyvek. Of all the samples the authors tested, the Edding 1800 Profipen (0.1) and the Pigma Ball most satisfactorily met the test criteria. It is recommended that this paper is consulted when considering the type of pen for use in natural history collections. Wood and Williams (1993) mentioned the brands Uniball Deluxe Micro Pen and Permaroller as the best rollerballs as long as they are used on paper substrates. A Museum Documentation Association factsheet (anon., 1995) suggests Shachinata Artline 70 for writing on polythene bags.

The use of coloured inks on labels is a somewhat contentious issue, as many coloured inks are notorious for fading while others may leach out into the preservative and stain the specimen. The Natural History Museum has in the past used printed colour-coded labels for its insect collection cabinets and record cards (to indicate geographic region) but many have faded badly, particularly those (on the outside of cabinets) that are regularly exposed to light. Attempts at colour coding individual specimen labels using coloured inks have also tended to fade over time. In spite of fading, red labels are often used to indicate type specimens, particularly in dry stored collections and on the external labels of fluid collections jars.

Some coloured pens have been used successfully in collections, for example Ball Pentel R50 colour pens are currently in use at Kew Herbarium where they have proved to be stable in alcohol (Edmondson, pers. commun.) while Sakura Pigma pens using pigment-based inks are available in black, red, blue and green. Perma Dry coloured ribbons used with a Citizen Printiva 6000 show promise for labels in alcohol (Pitkin, pers. commun.). However, because none has been in use for more than a few years, it is recommended that all coloured inks be tested by an accelerated ageing regime such as that employed by Carter (1996).

Inks used in typewriter and computer printer ribbons are not guaranteed to be fadeless, and some fade relatively quickly. The same is true of stamp pads, although archival stamp pads are available from Preservation Equipment but we are unable to comment on their durability.

Printers

Pitkin (1995) gives detailed information on the merits of various printers and the immersibility

properties of the print, and it is recommended that this publication and Carter (1996) should be consulted when considering any computer-driven label system. Carter notes that Indelible Ink is unsuitable for use in fluid collections although it will retain a readable image in alcoholic fluids. He recommends PermaDri ink as being very satisfactory (both supplied from Misco Computer Supplies). Three types of printers can be used for printing nonimmersible and immersible labels: laser printers, inkjets and dot matrix.

Laser printers

Labels printed on Laserjet printers can be used for non-immersible labels but Pitkin (1995) cautions that Hewlett-Packard cartridges only should be used and not a less expensive alternative. The paper should be of archival quality. Labels printed on LaserJet printers or photocopied appear to suffer toner degradation if submerged in an ultrasonic cleaner (Sims, 1989) and are subject to abrasion and excess heat (Daly and Jordan, 1989). However, Pitkin (1995) notes that for many applications (i.e. insect labels) abrasion is unlikely to occur and recommends that if there is a risk of abrasion then labels should be printed on a Hewlett-Packard Deskjet printer using a cartridge filled with indelible ink (see below). Key (1996) warns that resin-based pigments used in laser-printed and photocopied labels are soluble in some organic solvents such as ethyl acetate. To overcome the problem of laser-printer labels running in alcohol, the New Zealand Arthropod Collection bake their Goatskin Parchment paper labels by preheating a small oven to 160°C. The oven is then turned off and the labels inserted for thirty seconds to a minute. This apparently gives enough time for the pigment to fuse, but it is a short enough time to not affect the paper. A pocket-knife was used to scrape the print in the test runs. It was found that after twenty seconds the print could he scraped off easily but after thirty seconds the print particles were fused together and they stuck to the paper. Four minutes was too long. Although only two years have elapsed, there are apparently no signs of problems with label print running (Crosby, *pers. corn n a iii.).* Another technique of 'baking' labels is also practised in some institutions by using an ordinary domestic hand-iron.

Inkjets

Pitkin (1995) mentions that Hewlett-Packard Deskjet printers can be used to print permanent immersible or non-immersible labels provided that the cartridges are refilled with indelible ink. He recommends M6651 (available from Misco Computer Supplies Ltd) as a suitable ink but comments that, before use, any printed label should be washed in alcohol to remove excess ink prior to use in fluids. Carter (1996) investigated further the qualities of two printer inks manufactured by Graphic Utilities. These were the black indelible ink mentioned by Pitkin and PermaDri black pigmented ink, both of which are available as refill kits for deskjet cartridges. The labels were printed on Resistall and Goatskin Parchment. The author found, through a set of rigorous tests, that the PermaDri ink kept a better image than the indelible ink whilst the Resistall paper had a better image abrasion resistance.

Dot matrix

As with the Deskjet printers, dot matrix systems can be used for immersible or nonimmersable labels provided that the ink is alcohol-resistant. Ribbons can be re-inked with alcohol-resistant ink available from Automated Office Products, but Pitkin (1995) comments that, before use, any printed label should be washed in alcohol to remove excess ink prior to use in fluids. Moore recommends that freshly printed labels either from a dot matrix or Inkjet printer should be immersed in alcohol for least twenty-four hours prior to use in fluids.

Labels

Labels immersed in liquid must be made from 100% rag paper that will stand long-term immersion in any fixative or preservative without softening or discolouring. Many old jars and other storage containers have labels glued to the outside. Ultraviolet light gradually discolours them over the years and fades the

ink. Such labels are frequently found in a fragmented condition and need to be replaced. They can be treated as follows:

1. Before carrying out any treatment, record all available data from the label. Faded labels can sometimes be read with the aid of an infrared lamp.
2. Test the ink for solubility in water.
3. Remove any specimens from the container. If it is a jar, stand it upside-down (if the label is at the top) in warm water for about five to ten minutes.
4. Remove fragments of labels as they become detached and place them (together) between two discs of filter-paper with a weight on top. If there is some glue still adhering to the label, place the label on thin plastic film (the type used for wrapping food).
5. Once the entire label has been removed it should be dried in filter-paper with a weight to keep it flat. Allow it to air-dry for several days.
6. The old label can be removed to an archival file, where it should be mounted on acid-free board and a new label placed on the container with a cross-reference to the old label in the file.
7. Repairs to old labels can be made using Japanese Kozo tissue.

Laponite (Conservation Resources (UK) Ltd) dissolved one part in twenty-five parts water has been successfully used to remove labels from old collection jars at the University Museum, Oxford (Hall, pers commun.) but this technique is still at the developmental stage and requires further assessment. For alternative methods of repairing and archiving old labels see Kishinami (1989). Van der Reyden (1985) also describes techniques for storing archival documentation.

Trade labels are an important part of the history of taxidermy and should be treated with the same care as other natural sciences documentation. If any labels are to be exhibited they should be protected from light with a hinged, acid-free card cover. If there is any deterioration of the labels, they should be removed, de-acidified and stored separately in Mylar envelopes and cross-referenced with photographic records of the case. Many such labels have, unfortunately, been painted over by past curators and conservators (1920s-1960s). Paint removal from fragile labels has been tried, with partial success, using such solvents as white spirit or acetone in conjunction with gentle cotton-bud brushing, but this process depends on the residual strength of the paper (Moore, *pers. comuun.)*

Pitkin (1995) advises that, in addition to labelling microscope slides with a unique identification number, it is good practice to inscribe this number on to the glass slide using a diamond point, so that even if the label becomes detached the mounted specimen can still be associated with its data.

Further information on the merits of computer-printed labels is given in Pitkin (1995). Carter (1996) details their use in fluidpreserved material. Pitkin (1995) also presents a detailed account of a programme to produce labels, but he emphasizes the real difficulties arising when designing such applications. There are many different methods of generating computer-driven specimen labels but the most important point to remember is that the materials used must be as permanent as possible.

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References

Anon (1995). *Labelling and marking museum objects.* Museum Documentation Association Factsheet.

Bridson, D. and Forman, L. (1992). *The Herbarium Handbook,* Revised edn. Royal Botanic Gardens, Kew.

Carter, J. (1996). A comparison of two papers and two inks for use as computer generated labels in fluid preserved collections. *The Biology Curator, 7, 5-7.* Daly. H.V. and

Jordan. C.L. (1989). Computer generated collection labels: They are fast, but will they last. *Insect Collection News 2,* 26.

Hadgraft, N. and Swift, K. (eds) (199i O. *Conservation and Preservation in Small Libraries.* Parker Library Publications, Cambridge.

Horie, V. and Barry, J. (1990). Solvent resistance of marking inks. *Conservation Netts,* 41, 11—12.

James, C., Corrigan, C., Enshaian, M.C. and Greca, M.R. (199'). *Old Master Prints and Drawings.* Amsterdam University Press.

Key. R.S. (1996). The durability of laser printer and photocopier toners for data labels. *The Coleopter7st,* ***5,*** 20—21.

Kishinami, C.II. (1989). Archival storage of disintegrating labels from fluid-preserved specimens. *Collections Forum.* **5,** 1-4.

Matthieson, D.G. (1989). The curation of avian osteological collections. In *Notes From a Workshop on Bird Specimen Preparation (S.P.* Rogers and D.S. Wood, eds), pp. 71-110. The Carnegie Museum of Natural History. Pittsburgh.

Murphy. N. (1986). Pigma pens. *Herbarium News. 7.* ·5—76.

Pettitt, C. (1976). Label materials for wet-preserved biological specimens..11useums *journal,* **75,** 175-176.

Pitkin, B. (1995). Labelling specimens in the life science departments at The Natural History Museum, London using computers. *The Biology Curator,* 4, 24-27.

Sims. L.L. (1989). Howe permanent are they? *Insect Collection News, 2. 26.*

van der Rev den (1985). Paper documents. In *Storage of Natural History Collections: A Preventative Conservation Approach* (C.L Rose, C.A. Hawks and H.H. Genoways. eds), pp. 327-345. Society for the Preservation of Natural History Collections, Iowa.

Williams, S.L. and Hawks, C.A. (1986). Inks for documentation in vertebrate research collections. *Curator,* ***29,*** 93-108.

Williams, S I and Hawks, C.A. (1988). A note on `inks . *SP_AHC Newsletter 2,* 1.

Wood, R.M. and Williams, S.L. (1993). An evaluation of disposable pens for permanent museum records. *Curator,* **36,** 189—200.

Suppliers

Automated Office Products Inc., 9700 Martin Luther King Jr Highway, Lanham, MD 20·06, USA. **Conservation Resources (UK) Ltd.** Units 1, 2 and 4 Pony Road, Horspath Industrial Estate, Cowley, Oxford OX4 2RD, UK.

Lineco Inc., PO Box 60 Holyoke, MA 01041—2604. USA. **Misco Computer Supplies Ltd,** Freepost. Wellingborough. Northants NN8 6BR, LK.

Preservation Equipment Ltd., Shelfanger, Diss, Norfolk IP22 2DG, UK.

Tullis Russell, 20 Farmhouse Way. Shirley, Solihull, West Midlands B90 4E11, UK.

University Products Inc., PO Box 101, 517 Main Street, Holyoke, MA 01041. USA.

Wiggins Teape (now Arjo Wiggins), Sample and Advisory Service, 130 Long Acre, Covent Garden, London C2, UK

Other useful conservation suppliers

BioQuip Products, 17803 LaSalle Avenue, Gardena, CA 90248-3602, USA.

Conservation By Design Ltd, Timecare Works, 60 Park Road, West Bedford MK41 7SL, UK.

Secol Ltd., Photographic and Archive Polyester Product Range, Howlett Way. Thetford, Norfolk IP24 1HZ. UK.

Plate 37 Example of an early acidic 'iron gall' ink which has eaten through the paper (reproduced with kind permission from the National Museums and Galleries on Merseyside).

Plate 38 Accession record books in a library labelled with a top priority (red) marker which indicates that these books must be salvaged first (The Natural History Museum).

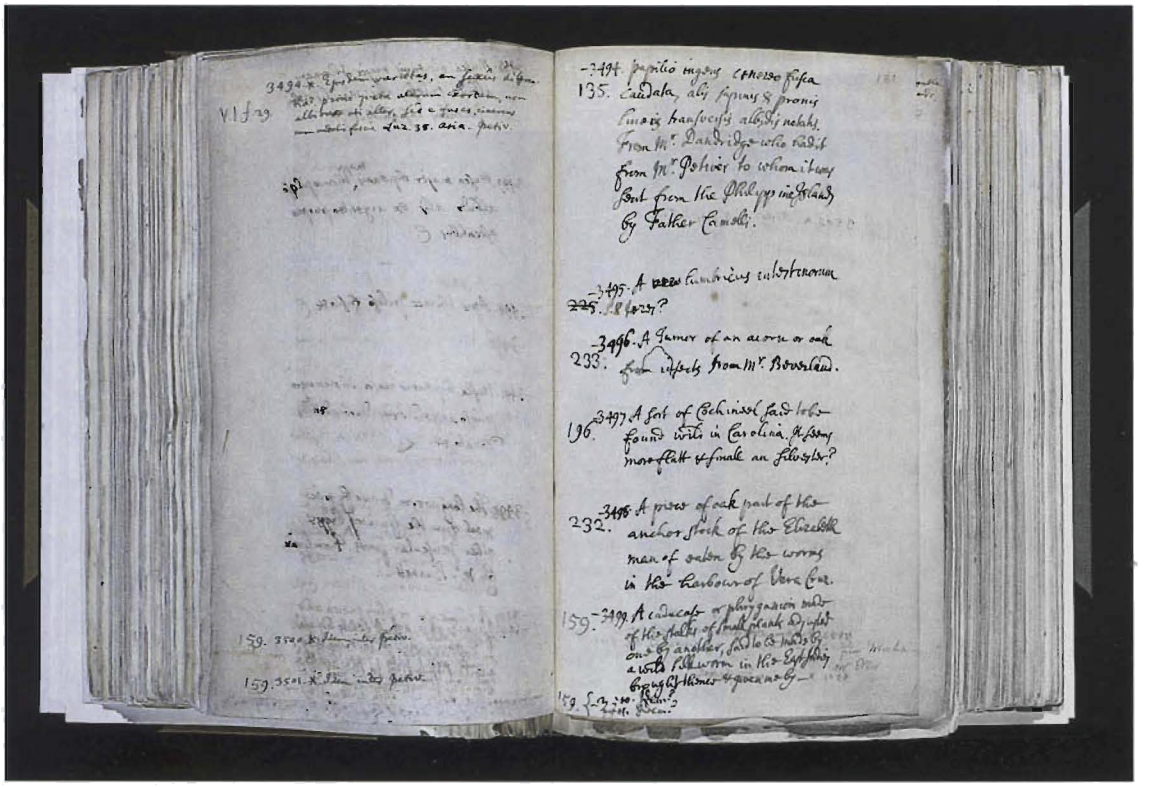

Plate 39 An example of an early register from Volume 2 of the Sloane Collection Catalogue of Insects (early eighteenth century) deposited in the Natural History Museum, London. Note the interesting entry number 3498: 'A piece of oak part of the anchor stock of the Elizabeth man of [war] eaten by the worms in the harbour of Vera Cruz' (The Natural History Museum).