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Thermal Transfer Printers - Applications in Wet Collections

Andrew C. Bentley
Natural History Museum and Biodiversity Research Center, University of Kansas, Dyche Hall, 1345 Jayhawk Boulevard, Lawrence, KS 66045; tel: (785) 864-3863; fax: (785) 864-5335; email: abentley@ku.edu

Over the years, various methods and materials have been used for producing labels for wet collections preserved in alcohol or formaldehyde. Some methods have been more successful than others. The two best methods up until now have been:

1. Dot matrix printer printing onto Byron Weston Resistall paper (University Products Inc., P. O. Box 101, 517 Main Street, Holyoke, MA 01041; (800) 628-1912; www.universityproducts.com) (28# or 36# weights in laser or continuous pin-fed sheets) using ribbons re-inked with non-bleed alcohol resistant ink (previously obtainable from Charley Chapman, Automated Office Products Inc., 9700-A Martin Luther King, Jr. Hwy, Lanham, MD 20706; (800) 673-8553).
2. Laser printer printing onto Byron Weston Resistall paper using ribbons re-inked by Charley Chapman with alcohol resistant inks. These are then post treated by baking in an oven at 300°F for 5-10 minutes or spraying the label with a clear acrylic spray. This process secures the ink more permanently to the paper.

These techniques are, however, fraught with numerous problems:

1. Dot matrix printers are becoming more and more difficult to purchase and when you can find them drivers, in a lot of cases, do not exist for later versions of Windows.
2. Byron Weston Resistall paper is fairly acidic (pH 5.5-6.5) and leaches this acidity into the alcohol. No research has been done on the degree of elevation of acidity due to this paper over time and what effect this may have on specimens.
3. Charley Chapman of Automated Office Products is deceased and the company has been sold to Mr. Min Ming. It is now called Access Computer Printer Products Inc. (1213 Crockett Lane, Silver Spring, MD 20904; tel (301) 384-1398; fax (301) 384-1944. Through various personal communications it has become apparent that the quality and consistency of these ribbons is poor. Mr. Ming is also not convinced there is a market for these ribbons and as such availability may be subject to change.
4. Laser printing of labels is not as effective as the impact printing of dot matrix printers. Most laser printers apply toner through a static mechanism. Some laser printers (usually mainframe printers) apply toner under pressure using high heat. Even so, and even with subsequent baking of labels, the print is liable to "float" off the paper in alcohol. It was also found that oils leached into the alcohol from specimens were liable to break down the acrylic coating thereby making the labels susceptible to abrasion once again. Both of these techniques were found to only delay the inevitable abrasion and loosening of print on labels.

It was due to these problems that we sought a better solution for producing labels for our ichthyology and herpetology collections here at the University of Kansas Natural History Museum and Biodiversity Research Center.

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This technique makes use of a technology which is common in the label printing industry (this technology is also used to print luggage tags by all major airlines, store price tags and bar codes) known as thermal transfer printing. A thermal transfer printer is a non-impact printer that uses heat to register an impression on paper. A thermal transfer printer has a print head containing many small resistive heating pins that on contact, depending on the type of thermal transfer printer, melt wax-based ink onto ordinary paper or burn dots onto special coated paper. A microprocessor determines which individual heating pins are heated to produce the printed image. The print head spans the entire width of the paper or medium to be printed on. There are two types of thermal transfer printers: direct thermal and thermal wax transfer.

Direct thermal: The direct thermal printer prints the image by burning dots onto coated paper as it passes over the heated print head. Direct thermal printers do not use ribbons. Early fax machines used direct thermal printing. Direct thermal printing requires that the media be heat sensitive.

Thermal transfer: This type of printer uses a thermal transfer ribbon that contains wax-based ink. Heat is applied to the ribbon using a thermal print head that melts the ink, transferring it to the paper where it is permanent after it cools. Thermal transfer printing can print on almost any type of media including metal, plastic, paper, etc.

There are various companies that produce thermal transfer printers – Datamax, Zebra, Intermec, Sato, etc. They come in various sizes and styles ranging from small portable desktop versions to larger industrial versions for large volume printing. They also vary in the quality of print with two variations common on the market – 203dpi and 300dpi.

The system we are presently using is the Datamax Prodigy Max 300 which is a 300dpi desktop, direct thermal/thermal transfer printer available for about $1300.00 (Figures 1 and 2). We use this printer as a thermal transfer printer using an SDR ribbon which is a combination resin/wax ribbon with excellent smudge and scratch resistance. This printer also comes with various options including a present sensor for sensing label sizes and a cutter and tray for cutting and collecting labels.

Alpha Systems, a leader in automated data collection, mobile computing, bar code equipment, and media, has come up with a museum tag solution using this technology for printing labels for wet collections.

Using the thermal transfer printer technology together with the SDR ribbon and a 5.0 mil top-coated spun bound white polyester tag medium, they have produced a durable, long-lasting, scratch and smudge resistant tag which is unaffected by long-term exposure to alcohol or formaldehyde solutions and also does not leach any chemicals or substances into the alcohol or formaldehyde solution.

The spun bound polyester tag medium has been tested under standard ASTM code conditions in simulated long-term trials (Table 1).

Together with these supplier-provided statistics I have been conducting unscientific trials of my own ever since we began using this system. I placed printed labels into solutions of 99% ethanol, 70% ethanol, 40% formaldehyde and 10% formaldehyde. One set has been placed in the collection to simulate collection conditions while another set has been placed on a window ledge of an office in the museum in full sun to simulate the extreme. Over the two plus years that I have

Table 1: Testing standard ASTM code conditions of spun bound polyester tag medium

Physical properties	Value	Test method
Thickness (or compressibility)	5.0 +/- 10%	ASTM D 3652
Dimensional stability (%)	MD: 2.0 TD: 2.0	5 min at 394°F (190°C)
Tensile strength (psi)	MD: 17 000 min. TD: 21 000 min.	ASTM D 882
Elongation (%)	MD: 70 min.	ASTM D 882
Abrasion resistance	Slight scratching & dulling of surface	CS-17 wheels, 250 gm load, 50 cycles
Resistance to cleaning solution and water	Excellent	5 cycles, 10 minute immersion
UV light resistance	Slight yellowing and embrittlement of film	ASTM G 53 500hr
Service temperature	-40°F to 302°F (-40°C to 150°C)	

MD = minimum distortion
TD = total distortion

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observed these samples I have not detected any changes in label media or solution. The labels have remained the same color (no yellowing of the polyester media), the printing has not faded or released from the media in any way and the alcohol and formaldehyde solutions appear to be unaffected.

Alpha Systems (Alpha Systems Inc., 13509 East Boundary Road, Midlothian, Virginia 23112; Tel: (804) 744-9870; http://www.alphasystemsva.com (look for the "museum tags" information tab on the left); email: alphasys@erols.com) sells printers, polyester media and ribbons to the public under the banner of "Museum Tag Solutions".

The printer they are now selling with this package is the Datamax DMX-I-4206 which retails for about $1300.00

The white polyester label media comes in rolls of 600 feet and either 3" or 4" wide. Prices are in the range of $200-300 depending on how many rolls are purchased. The SDR ribbon comes in 4" width only and is 1200 feet long, enough to do two rolls of media. Price is $72.00. (Figure 3)

This works out to between 41 and 72 cents per foot of media (depending on how many rolls are purchased, including the ribbon but not including the initial outlay for the printer), 1.5 to 3 cents per inch of label.

Thermal transfer printers, due to the print head configuration, are sensitive to dust and particulate matter adhering to the media and causing inferior printing, i.e. lines of no printing due to dust particles sticking on the head. Alpha Systems has begun installing brushes anterior to the print head to remove particles from the media and ribbon to deal with dusty environments. They will do this free of charge (or a nominal labor charge) if installation is done at time of order. They have also started vacuum-sealing the preservation tag to protect from dust and dirt during transport and storage.

Another good source for printers is Label Match (110 W. Streetsboro St., Unit 1-C, Hudson, OH 44236; (800) 726-7334; http://www.labelmatch.com).

Figure 1: Datamax Prodigy Max 300dpi thermal transfer printer printer showing front mounted optional cutter.

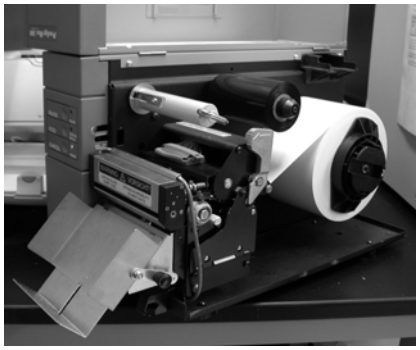

Figure 2: Datamax Prodigy Max 300 printer opened, showing internal components and loaded media and ribbon.

Figure 3: Rolls of 4 inch spun bound polyester media and SDR ribbon as obtained from Alpha Systems. Both are shrink wrapped to prevent dust and dirt accumulation.

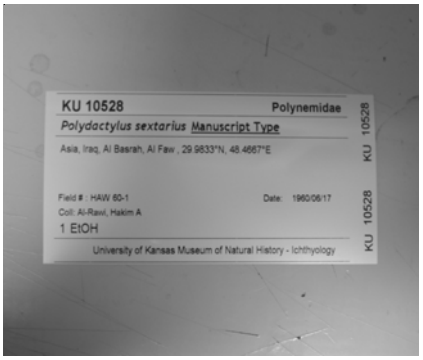

Figure 4: KUNHM Ichthyology wet collection label (4 inches wide X 2 inches high.)

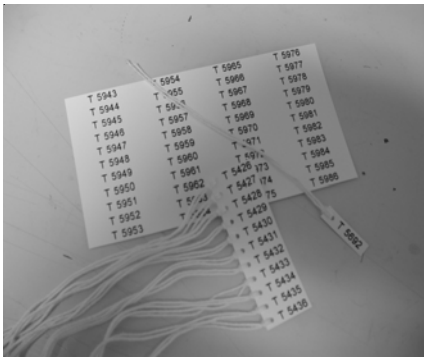

Figure 5: KUNHM Ichthyology tissue labels printed in four rows, cut, hole-punched and threaded for attachment to voucher specimens.

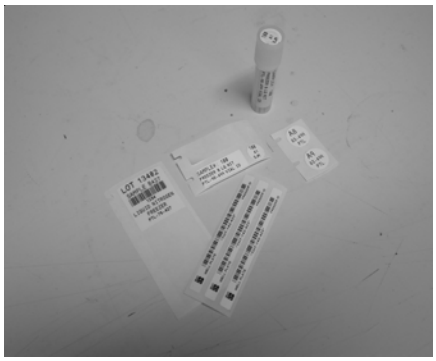

Figure 6: KUNHM Ichthyology peel-and-present labels (various sizes) used for applying to tissue cryogenic vials.

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The Prodigy Max printer functions much the same as a normal printer, i.e. you can print directly to the printer from any Windows application including most database programs. If you are working from a database that generates labels it is not necessary to purchase the software that sells optionally with the printer. We print labels directly from Specify (www.specifysoftware.org) to the printer. The printer can also be used over a network using a print server (additional purchase).

The ichthyology and herpetology divisions of the University of Kansas Natural History Museum are using this system to print all labels for alcohol specimens (Figure 4). The botany division and the entomology division are also testing this application in their collections for herbarium sheets and insect pin labels. We have found that the printer will print as small as 4 point font without any visible degradation of resolution.

In the ichthyology collection I am also using this system for printing tissue voucher tags (Figure 5 and 6). These are printed in batches, four columns wide on the 4" media, after which they are hole-punched, strung and cut for use in tagging vouchers of tissues and also tank specimens.

For further information or samples of preservation tag or labels please contact the author.

Publications of Interest

Change of duties. — Paula T. Work has relinquished her responsibilities as the chair of the Citations Subcommittee. I would like take this time to thank Paula for all of her hard work and a job well done. This section is from the Conservation Committee and is now chaired by Marcia A. Revelez of the Citations Subcommittee. Citations were provided by Ann Pinzl, Diana Dicus, and Marcia Revelez. Contributions, suggestions, and comments may be submitted to Marcia A. Revelez, Sam Noble Oklahoma Museum of Natural History, 2401 Chautauqua, Norman, OK 73072; (405) 325-7988 (voice); (405) 325-7699 (fax); mrevelez@ou.edu (e-mail).

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