

## PARCHMENT OVER BOARDS

This workshop will explore the binding of books in parchment over boards. Because of its' reputation, people tend to shy away from parchment as a binding material; it is the focus of this workshop to dispel some of that anxiety. We will explore techniques, which will enable you to work with parchment. You may not be able to completely control parchment, but you can learn to work with it to achieve excellent results.

For the purposes of simplicity, I will use the term parchment throughout. Vellum and parchment are often used interchangeably and structurally they are the same. Vellum, however, is the skin of a young (six months or less), unborn or stillborn calf, which has been limed, then dried, stretched on a frame. All other limed and stretched skins; sheep, goat, deer, etc. are referred to as parchment. With its' more supple nature and consistent surface, vellum is more often used as a writing surface, while the more robust parchment is used for binding. Practically speaking there is no difference.

Parchment differs from leather in its manufacture, its response to the environment and how it is worked. To get a better understanding of working parchment it is helpful to know how it is made and to see how it differs from leather. Working parchment merely requires techniques you already use with leather or cloth binding. The main difference is that parchment is stiffer and needs to be worked as dry as possible.

Because of its hygroscopic nature and great strength, parchment has been known to warp boards to an astounding degree. This is what gives one pause when beginning a parchment binding. We are going to explore two types of board construction that will give you the advantage with parchment. The caveat is that, in the end the parchment may still get the upper hand. The techniques explained here will give you a book with boards, which are flat. Parchment, however, is very susceptible to warping when poorly stored. Extreme humidity will permanently alter the physical structure of the skin and therefore cause the boards to warp. Extreme dryness will desiccate the skin also causing warpage, but proper re-humidification may bring the boards back into equilibrium. A temperature above 140°F (60°C) will also damage parchment.

## HISTOLOGY

For thousands of years animal skins have been treated in some manner to limit or halt putrefaction. Skins have been used for many purposes, among them: clothing, shelter, storage vessels and as a surface for writing. Without a means to halt the natural putrefaction from bacterial action, skins would soon decay. Most likely, through trial and error, methods were found using readily available materials to accomplish this. Early methods involved placing the skins, **flayed** from the animal, into a pit containing water, plant materials (such as leaves and bark), beer or animal dung. This crude method had the effect of removing the hair, destroying potentially harmful bacteria within the skin and tanning it. Refinement of those early methods have given the tanner more control over the end product and allowed the desired characteristics to be enhanced. A chemical reaction has transformed the skin so that putrefaction can no longer take place, thus creating a material that can be used in a practical manner.

Parchment and leather, even though they both start off as a flayed skin, are quite different materials. They are produced by divergent methods and the techniques for using them vary as a result of their differing natures. To understand parchment or leather, and therefore work either with more confidence, knowing how these treatments alter the skin is important. We will start by looking at the structure of the skin itself.

There are three main layers within a skin: the epidermis, dermis and the hypodermis. The **epidermis** is the outer layer. It is composed of **epithelial** (or lining) tissue. During the processing, this layer is removed along with the hair.



Below the epidermis is the **dermis**. The dermis itself is divided into two layers. The uppermost is the **papillary**, the layer from which hair grows and the layer that becomes the grain we associate with the processed skin. The epidermis dips down to the dermis at the point where hair follicles form. The hair grows from its base in the papillary layer of the dermis up through the epidermis. The hair is in fact, made of the same epithelial materials as the

epidermis. The **reticular** layer of the dermis contains the blood vessels which feed the hair, the **erector pili** muscles which cause the "hair on the back of your neck" to stand up as well as sweat and **sebaceous** (oil) glands.

The dermis also contains **ground substance**. This is a material made up mostly of mucopolysaccharides and proteins. It is a sticky, viscous material, which aids in lubrication of the dermal fibers and healing of the skin. For our purposes the most important aspect of the dermis are the ramified bundles of **collagen** (which means "glue forming") fibers. Ramified, means that the fibers branch as a tree. These bundles of fibers are tightly wrapped with fibers of the protein **elastin**. It is this layer, which gives the leather or parchment strength.

The third major layer is the **hypodermis**. That is the layer where the muscle and fat are found. A properly processed skin will have had this layer removed. In essence the processed skin is solely the dermal layer and papillary layer or grain.

## MANUFACTURE OF SKINS

The processing for either leather or parchment, as it is now practiced, follows a standard model. The chemicals may vary in order to give the skins differing characteristics, but the process follows the same basic model. Flayed skins are soaked in cold water to remove dirt and hydrate the skins. Next the skins are unhaired. This process is more important than the name would imply. Usually the skins are placed into a bath of lime containing sodium sulphide, which is used as a sharpener. The sodium sulphide reacts with **keratin** proteins, which make up the hair and epidermis. This aids the alkalis in loosening and dissolving the keratin, thus allowing the hair to be easily removed. During this process, the collagen fibers swell up when they come in contact with the alkaline (lime) solution. This swelling will aid the infusion of other solutions later in the process.

Following the unhairing, the skins are scraped. This may be done by hand, draped over a wooden beam and scraped with a blunt double-handled knife, or run through a machine, which performs the same task using rollers. This scraping removes any remaining hair and epidermal tissue not accomplished in the liming process.

Again, using the wooden beam and a sharp, double-handled knife, any hypodermal tissue and muscle not removed in the flaying, is shaved from the flesh side of the skin. As in many tanning operations nowadays, this **fleshing** too can be accomplished with machines.

At this point in the process, one could be working a skin to produce either leather or parchment. If parchment is what's required, the skin is then dried under tension on a horse or stretching frame. The damp skin is stretched by means of strings and clips or with strings wrapped around small pebbles embedded about the edges of the skin. The skin is allowed to dry on the horse. After drying, the skin is scraped to thin it while still taut. We will come back to a further comparison of leather and parchment after proceeding with the operations, which result in leather.

If leather is the material to be produced, the skins are taken from fleshing to **deliming**. The skins have to be placed into a weak acidic solution to reduce the pH. After deliming, the skins require **bating**. Bating was historically accomplished using dung from dogs or fowl. It is the enzymes in the dung, which are necessary for bating. Dung has been replaced over the years with processed enzymes, which accomplish the same thing. The reason for bating is to reduce the plump and swollen nature of limed skins. This gives the skins flexibility and drape. Bating dissolves and removes most of the remaining ground substance and weakens the elastin fibers, which bind the collagen fibers so tightly. This "relaxes" the skin making it more pliable. Imagine a bundle of flexible rods tightly wound with string, then the string is cut. Once the string (elastin) is cut and the ground substance is removed, there is movement of the fibers upon each other.

The final treatment for leather is the tanning. This involves an infusion of tannins, derived from plant material or certain metal salts (chromium, aluminum and zirconium), which bond to the proteins within the skin transforming the skin into a material, which resists putrefaction and does not readily absorb water. The result of tanning is a skin where the fibers have some loft, suppleness and stretch.

Parchment is completely different. Several things have happened in the parchment to bring about these differences. With the absence of bating there still remains some ground substance. This material acts like a glue. You can think of it as glue that has dried out and thereby limited the movement of the fibers upon each other. Another result of the lack of bating is that the elastin fibers are still tightly wrapped around the collagen fibers. The flexible rods are still tied. The string has not been cut and movement is restricted. Lastly, because of the skin being dried while stretched, the fibers themselves are laid over in an alignment parallel to the surface of the skin. This is quite unlike the more vertical nature of many of the fibers in leather. The result of these changes within the skin is the characteristic rattle of parchment, the great tensile strength and its ability to withstand tearing. The strength and tear resistance are what make it such a wonderful material for binding. Keep this aspect of parchment in mind when working with it. Disruption of this structure changes the nature of the skin. Unlike leather, parchment can revert back to a rawhide state and therefore, is also more susceptible to biological attack.

When working with parchment it is best to avoid using much water, as it will disrupt the structure. If you wish to soften parchment, the use of a 50/50 mixture of either water and isopropyl alcohol or water and ethanol will achieve this with less disruption to the structure.

### PARCHMENT BINDING

The first thing we want to do is to cut out a piece of parchment slightly oversized for covering the book. If one has a choice, when cutting the skin, take it so that the joints of the book are aligned with the spine of the animal. The final size for the parchment will be cut large enough to wrap around the book with about two centimeters, all around, for a turn-in. For this initial cutting, you should add about a centimeter more, in each direction in case the laminated parchment shrinks. The flesh (under) side of the parchment then needs to be lined with paper. The paper lining fulfills two distinct needs. It reduces the translucent nature of the parchment (assuming you are not utilizing that aspect of parchment) and allows you to use most any type of adhesive you wish when putting the parchment onto the book. Choose a paper with very little intrinsic characteristics, wove, with no watermarks or other features. These will “telegraph” through the final piece of lined parchment. The grain direction of the paper should, as usual, be running head to tail on the finished binding. You can use any of several types of adhesives for the purpose of laminating the paper to the parchment. I am currently using B9R which is a dextrin adhesive obtained from Northern Adhesives. Dextrin comes from plant materials. It is obtained from starches which are hydrolyzed by heat, acid or enzymes. You can use also gelatin, hide glue or parchment glue. Each of these glues are animal based and contain collagen, a protein found in dermal fibers of the skin, that makes them more suitable when adhering parchment. A reasonable mixture of gelatin is 10 grams into 30 milliliters of water. Some people add glycerin to the glue, but it makes parchment even more hygroscopic than it already is, softens it too much and gives a foothold to future mold growth. If gelatin crystals are used they should stand in the water overnight in order to swell. Powdered gelatin is ready to cook within twenty minutes. A double boiler or electric glue pot is a suitable container for heating the glue. Do not allow the glue to boil.

Paste will work almost as well as any hot glue such as gelatin or hide glue, in that it is a good adhesive and will bond well. Paste has an excessive amount of moisture for parchment, but does not harm the skin appreciably because the laminate is dried under tension. PVA doesn't have the chemistry to be as compatible as hide glues, but will also work. The various starch and collagen based adhesives work better. Whichever one is chosen, glue off both the paper and the parchment, keeping moisture to a minimum. The two materials are placed together and pressed between hollytex and blotters. Change the blotters often for the first hour or two, then daily until the laminate is completely dry. Several days are best to ensure the parchment dries fairly flat.

## BOARDS

Now we turn our attention to the boards. There are several ways to construct boards for parchment bindings. There is "cross-grain laminate" and a "floating board" construction. The **cross-grained** board is usually made with at least five, and sometimes more, layers of very thin board or card stock. It works by "muscling" the parchment. A properly made cross-grained board is harder for parchment to warp. Regardless of how many layers are used, there has to be an odd number. The layers should be made with stiff thin board around .010 - .015 thick. To make a board with five pieces, cut three of them with the grain going head to tail and two of them with the grain from spine to foreedge. The makeup of the cross-grained boards is a laminate with a long-grain board in the middle, two short-grain boards on either side of that and two long-grain boards on the outside of that. It is easiest to moisten the inner long-grain board, then glue off the two short-grain boards. Allow them to relax, glue them off again and place them on either side of the one long-grain board. Glue off the remaining two long-grain boards, let them relax, glue them off again and place them on either side of the sandwich.

More than five boards can be used to make a laminate but it is important to have the two outer boards be long-grain and to be sure that each board is glued to one having a different grain direction. It is this cross-graining that gives the board enough rigidity to remain flat when covered with parchment. Cross-grain boards can have a tendency to become saddle-shaped and it is for this reason that I don't recommend them for quarto or larger size books. To make cross-grain laminate boards even more rigid, soak the laminae in water. When thoroughly wet, take them out of the water and press to remove the excess water. Using paste instead of glue, assemble the boards as before. The paste permeates the boards and makes them more rigid. With either method, the boards will need to be dried in a very controlled manner. Press between hollytex and blotters and change the blotters often for the first hour or two, then daily until the boards are completely dry. If allowed to air dry the boards will warp into saddles. With either method of assembly, the finished boards should be lined with plain white paper and paste to add stiffness.

There is another type of board I have used for several years with good success. I believe it to be more common in Europe. I am calling this type a **floating board** construction. It takes advantage of the propensity for parchment to continue to change dimensionally through the years. Instead of fighting the parchment, it moves with it. On many parchment bindings, the parchment will shrink back from the fore edge causing the boards to warp and possibly pull the parchment from around the fore edge, tearing the pastedown. This board is built to help counter that tendency. It consists of a thick board and a thin board. The thick or "base board" board may be a laminate, like the previous boards, or

single-ply. On a quarto or less, single-ply is fine. For larger books, a laminate might be better. Depending upon how thick a board is needed, the base board laminate might be only three layers thick. If that is the case, don't cross-grain the laminate. Less than five pieces can make a cross-grained board more likely to become saddle-shaped. On large books you may want to make the floating board a laminate of two layers. Once you have the two components, they should both be lined with plain white paper and pressed until completely dry. When the boards are dry they should be trimmed to the proper height for the book. The base board can then be trimmed to the correct width. The floating board should be trimmed approximately a half-millimeter wider. Glue off a strip of the thin board, several millimeters wide, in from the spine edge, running from head to tail, and attach this to the baseboard so they are flush to the spine side. The result is two boards tipped together along the spine edge with the thinner one being slightly wider at the foreedge.

### TEXT BLOCK

Sewing a book for parchment binding need not be any different than for other books. They can be sewn on flat tapes, flattened cords and for the adventurous, raised cords. They can also be sewn onto parchment tapes. When sewing on parchment tapes, the tapes are often laced through the cover giving an added visual element to the finished binding. If you use parchment tapes, be sure to have the grain side of the tapes facing away from the spine during sewing. Endsections can be of your choice.

Parchment is not as flexible as leather and so does not lend itself to a tight-back binding. The use of a French groove accommodates parchment better. The book can be forwarded in the usual manner. The endsections should be sewn on, not tipped and there should be a sewn linen or cotton reinforcement. The reinforcement can either be loose or glued to the outer side of the pastedown. The backing should be to a forty-five degree angle and the spine lined with Japanese paper and paste. Endbands may either be sewn or stuck-on.

Once the book is up to this point, a hollow tube needs to be made. Using a strip of paper, stretched across the spine, make tick marks on the strip just below the apex of the joints, on the spine side of the joint. Using a piece of handmade paper at least three times the width and somewhat longer than the spine, transfer those tick marks across the bottom edge and top edge of the handmade paper so the paper will show the width of the spine, three times across. The third spine width should be approximately 1-2mm narrower than the tick marks. Using a straightedge and bone folder connect these marks so the handmade paper is folded into three sections. Lightly dampen the handmade paper and glue (60% PVA & 40% methyl cellulose) off the outer side of the narrow section. Fold down the narrow section and then the opposite section on top of it. Press down with hand pressure and while still damp mold the hollow over the spine, then glue it on. At this point the hollow is still longer than the spine. After the hollow is finished you will need another piece of handmade paper, the length of the hollow and around 5 - 6 cm wider than the spine. The hollow is glued off and this paper is placed over it, flush with the head and tail and the excess width evenly lain over either side of the spine. Place the textblock in a lying press or a backer to rub down and mould the paper to the spine. This procedure will leave two "wings", on either side of the spine.

## BOARD ATTACHMENT

Next we want to attach the boards to the textblock. For a book with boards of average thickness, a French groove of 3mm will work fine. To achieve this, lay an eighth inch wooden dowel or brass or acrylic rod on top of the paper wing, up against the shoulder of the book. Using 60/40 PVA/mc, glue off a section of the inner, spine edge of the board from head to tail, 1 cm wide. Place the board onto the paper wing, against the dowel. Check for an even square at the head and tail and press. Turn the book over and attach the other board, using a right angle to make sure the two boards are even, and press. When the attachment is dry, open the boards and remove the excess wing paper by tearing it at an oblique angle. This will leave a graduated surface where the paper is glued to the board.

## COVERING

Now we turn our attention to covering the book. Make a pattern for cutting the parchment by wrapping a piece of paper around the textblock and boards. Allow for a turn-in of 2 cm all around, mark and cut the paper. Lay the paper on top of your previously prepared parchment and cut. Measure and mark out the width of the spine onto the grain (upper) side of the parchment using only a pencil. Pencil marks can be easily removed later, with a vinyl eraser. Marks of any kind, on the paper lining, may show through the parchment when the binding is finished. Marks on the boards or spine may also show, so be aware. Mark out the head and tail turn-ins in the spine area. This will be your guide for thinning the parchment turn-ins at the spine, head and tail. To thin the parchment, you can use a high-speed sanding drum (such as a Dremel), sandpaper or a paring knife. If using a paring knife, mist the parchment in the area you wish to pare with a 50/50 solution of isopropyl/water. This will soften the parchment enough to allow you to pare it as if it were leather. It is best to keep the moisture to a minimum.

When the endband areas of the parchment have been pared, measure the distance around the spine of the book, including the French groove. Lightly transfer these marks to the lined side of the parchment, at the outer edge of the turn-ins, so they can't be seen in the finished binding. Place two pieces of low-tack masking tape along the length of the spine area of the parchment, connecting these marks from head to tail. This will define the spine area between the boards. This area will be glued with 60/40 PVA/mc. Before gluing the parchment, take a scalpel and slit the hollow at either end of the textblock, for about two and a half centimeters along the fold of each joint, so the turn-ins may later be slipped inside. After you do this, you will find a small bit of paper, from the hollow, stuck to the backside of the endband. Take a pair of scissors and trim it back level with the top of the endband, being careful not to trim the outer side of the hollow.

Using a cotton ball and 50/50 isopropyl/water, moisten the outer side of the parchment in the area to be glued. This will soften the parchment so the glued area can be more easily worked. Apply the glue and wait for a few moments for the parchment to soften from the lined side. Glue it off again, remove the tape and place the parchment around the spine of the text block, taking care to keep it even at the head and tail. Work the parchment into the French grooves, using a Teflon folder, then set dowels into the grooves and place the book into a press. If too much moisture is used, the parchment will become translucent in that area, so mind the amount of moisture and pressure. When the book is dry, remove it

from the press. Mark the corners of the boards on the parchment. Using scissors, cut the corners of the parchment off at a forty-five degree angle, leaving about one and a half to two board thicknesses from the board corner. Either sand the parchment corners, so they will lie flush when folded over, or mist them with 50/50 isopropyl/water and pare. Glue off the boards, lay the parchment down and press. Again, care should be taken when pressing damp parchment, as too great a pressure may cause it to become transparent. Once the boards are dry, remove the book from the press. Using the 50/50 isopropyl/water, and a cotton ball, dampen the top and bottom turn-ins. Glue them off with 60/40 PVA/mc. When you glue them off for the second time, apply some paste in the endcap area of the turn-ins, to extend the drying time so you can more easily mold the endcaps. As the turn-ins are made place some low-tack masking tape over them and onto the inside of the boards. This will help to hold them in place as you go from one turn-in to the next.

Moisten and glue off the foreedges, turn them in and form the corner as you would for a traditional cloth cover. Place some cardstock between the covers and the textblock for twenty minutes, under light pressure, before removing the masking tape. Place fresh card stock between the boards and the textblock and press the book under moderate weight overnight.

It may be best to allow the book to acclimate for a few days before trimming out, filling in and putting up the endpapers. You can then determine, depending upon how warped the boards are, if paste, PVA/mc or straight PVA should be used for these operations. Paste will pull the boards in more than PVA/mc and straight PVA will pull the least. If you glue off the trimmed out area of the board, instead of the fill material itself, there will be even less pull. The fill prevents the turn-ins from showing through the pastedowns in the finished book and gives a smooth inner surface to the boards. Trim out the turn-ins in an even and consistent manner, using a knife and straightedge. Choose a fill, which will bring the board surface up to the level of the turn-ins.

If you sewed the book onto parchment tapes, you will need to lace them through the cover before filling in. Carefully measure the width of the tapes. With a very fine awl, mark their exact width and location on the underside of the parchment. Do this by making two pricks, in the parchment, on either side of the tape. This is done just below the widest part of the spine of the book, on the side where the parchment goes down into the French groove. Lay a cutting plate far up, underneath the boards and using a sharp knife, cut through the parchment by joining the two prick marks. Be very careful not to cut the textblock. With scissors, trim the tapes to a point, lace them through the slits and bring them across the groove to the board. If the slits are too tight to get the tapes through, you may widen the slits with a small bone folder. Where the board meets the groove, prick two more marks for each tape and carefully cut those slits so the tapes can come through the parchment, back inside the cover. Again, use a cutting plate. The tapes can then be glued to the inside of the boards. If the tapes are thick, you might want to trace them onto the fill you will use and cut away the fill to avoid lumps. If the tapes are thin, this is not important.

Next, the endpapers are glued off and the boards are closed. Place some stiff card stock between the boards and the first flyleaf to keep the turn-ins from telegraphing through. Put the dowels/rods into the grooves and press. After a short time remove the

dowels/rods and continue to press. Leave the book under moderate pressure for a day or two, changing the card stock occasionally, until the book is completely dry.

If you follow these steps you will have a stable book, but as stated previously, parchment will change. To best maintain stable parchment covered boards, keep the book in an environment with a relative humidity of 50% and a temperature of 65F. The most important storage consideration is to keep the humidity and temperature constant.

### SOURCES OF INFORMATION

Specific references to publications consulted for this paper are not made even though they do exist. As opposed to footnotes I will merely list some of the sources from which this material has been gleaned. Some of those are:

Paper Conservation Catalog - Section 18 - American Institute for Conservation

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Parchment, The physical and Chemical Characteristics - Betty Haines, The Leather Conservation Centre

Conservation of Leather and Related Materials - Marion Kite and Roy Thompson

Ancient Skins, Parchments and Leathers - R. Reed

Bibliologia 14, Roger Powell The Compleat Binder - John L. Sharpe, editor

Modern Practice in Leather Manufacturing - John Arthur Wilson, Sc. D.

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