FACULTY RESEARCH GRANT

FINAL REPORT

AN INVESTIGATION INTO THE MONOTYPE-INK RESIST/RELIEF ETCHING TECHNIQUE

submitted by

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The Monotype-Ink Resist/ Relief Etching Technique

When working with the monotype-ink resist/ relief etching technique, the artist sees formal relationships which are normally (in other intaglio or etching processes) not visible until much later in the printmaking process. This enhanced capacity to work and develop the image directly and spontaneously is an important aspect of the technique. The resistant and impervious surface of copper provides for a fluid, direct application and working of the ink. Ink, in contrast to the traditional intaglio acid resists of asphaltum and resin varnish, does not dry quickly, is easily removed and reapplied, and when properly dried, is a superb acid resist capable of maintaining its integrity through twenty-five hours in an acid bath. Graphic qualities (textural, linear, etc.) unique in character and unity can be achieved by this process. Using the ink, an image can be developed and unified, hardened to become an acid resist on the plate matrix, and through one deep etch permanently embedded in the plate. The determination of the simplest possible route to this transformation was the purpose of this investigation.

The initial phase of the investigation involved the mixing of a range of pigments and oils. This involved hand mixing using an ink muller on a stone slab. The following is a listing of the ink mixtures utilized:

<table>
<thead>
<tr>
<th>Ink Pigment Combinations</th>
<th>Burnt Plate Oil Number</th>
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</thead>
<tbody>
<tr>
<td>3 Bone to 1 Vine</td>
<td>#3</td>
</tr>
<tr>
<td>2 Bone to 1 Vine</td>
<td>#3</td>
</tr>
<tr>
<td>3 Vine to 1 Bone</td>
<td>#3</td>
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<tr>
<td>1 Bone to 1 Vine</td>
<td>#3</td>
</tr>
<tr>
<td>1 Bone to 1 Vine</td>
<td>#00</td>
</tr>
<tr>
<td>1 Carbon to 1 Vine</td>
<td>#3</td>
</tr>
<tr>
<td>1 Carbon to 1 Bone</td>
<td>#3</td>
</tr>
<tr>
<td>Vine</td>
<td>#3</td>
</tr>
<tr>
<td>Bone</td>
<td>#3</td>
</tr>
<tr>
<td>Bone</td>
<td>#00</td>
</tr>
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Two commercially made inks were also utilized during the experiments. Graphic Chemical Lithographic Black 1796 and Graphic Chemical Etching Black 514.

It was determined that burnt versus raw linseed oil was best. Linseed oil is partially oxidized during the burning process of manufacture thus shortening the drying time dramatically. When burned, the super oily constituents of linseed oil burn away leaving a "short" oil which acts very effectively as a dispersion agent for the pigment, speeding the adsorption during the mixing process. The ink was milled to a "stiff" consistency, and stored in airtight plastic containers. During the ink mixing, it is best to "high load" the oil with pigment- to drive as much pigment into the oil as possible. When actually used, oil was added to the ink to produce the desired consistency- long (oily) or short (stiffer). It was determined that the ink used in the process is most reliable and workable when it is mixed to have a very slight "fall" (a bit short). When the ink used was very long (oily) it gradually ran together in the delicate textural or linear areas after application destroying their potential graphic effects. When the ink was too short, it was much less workable in terms of application and deletion. It was tougher to push around on the plate, and difficult if not impossible to achieve desired textural qualities.
It was determined that copper plate was superior to zinc as a matrix material. Copper is hard, has a consistent structure, and stands up well to the pressures of the printing press. Unlike zinc (which has a grain to it), copper will not bend or warp at high baking temperatures. This is vital to the success of inking and printing a relief etching. A warped plate would prove to be almost impossible to ink properly in a relief manner. The copper used was 16 gauge full hard, cold rolled, mirror finish Revere copper.

The copper plate was cut to the desired size using a foot operated squaring shears. Forty plates varying in size from 3" x 5" to 7" x 9" were utilized in the experiments. The surface was prepared first by polishing with putz pomade. Then it was cleaned with kerosene, soap and water, whiting powder, and finally totally de-greased with alcohol. This surface proved to be suitable for the technique, as the ink resist when properly adhered would not lift during the etching sequence. Two plates, after preparation, were open bit in nine to one Dutch mordant acid for a few minutes to provide a coarser surface for ink adhesion (this technique is employed in photo-etching for resist adhesion). Two problems grew out of this experiment. First, the coarse surface made deletion and reworking of passages very difficult since the ink "grabbed" the surface. Second, with the natural mirror finish of the metal destroyed by the etching, it was visually difficult to distinguish different areas of the image as it was being worked on the plate. The mirror finish of the metal is vital because it enables the artist to perceive the graphic qualities of the work in progress.

The ink was applied to the plate in many different ways. Stiff bristle brushes were used which gave a fluid dry brush effect. Textured objects (sponges, brushes, material, etc.) were used to apply ink in a coarse or fine grainy pattern. The palm of the hand when patted into ink and on the plate produced a very fine texture of ink. The image was then worked using mat board to squeege off ink for deletion, different sized ball burnishers to apply linear passages, reapplication and overlapping of textures, and totally darkening or closing off areas using the hand or an inked brayer. One approach involved using a brayer to ink the entire plate black. Then, lines were drawn through this dark ground using ball burnishers of various sizes. Once the image was realized on the plate, the problem became one of attaching it firmly to the plate so it would function as an acid resist.

Heating the plate so as to oxidize the ink and attach it to the plate succeeded on occasion, but at other times produced undesirable results. When the ink ground failed, it would peel off the plate in various places after only an hour or so in the acid. At first it was thought that this was due to not having cleaned the plate properly during preparation, but later it was determined to be due to the uneven application of ink to the plate. Two different baking procedures were used. The first involved heating the inked plate on the hotplate at 500 degrees Fahrenheit. After a short time the ink ground would begin to smoke slightly, and the sheen on the surface of the ink would disappear as areas dried. When all areas were dry, the plate was immersed in a water bath. The second baking procedure involved slower drying of the inked plate at 110 degrees Fahrenheit on the hotplate. In order to dry the ink thoroughly it took between four to six hours.
It was determined that the heating method of drying the ink ground was reliable and effective only when the layer of ink on the plate was uniformly even. A uniform layer of ink was easily achieved by application with the brayer. Otherwise, one had to be conscious of the necessity of even application when working with other application tools. The application of ink and working of the image normally, however, resulted in uneven layers of ink. This was due to the proximity of heavily worked areas which had built up layers of ink and areas where the initial application was sufficient for the desired effect. When the drying took place on the hotplate, the thinner areas of ink dried first, and the plate continued to bake until the thicker areas dried. This resulted in the overbaking of the thinly inked areas rendering them brittle and apt to lift from the plate prematurely during etching. One other negative aspect of the heating technique turned out to be the fact that when heated, the ink (even though it was moderately stiff) spread slightly on the plate closing off the finest textural and linear effects. This was unacceptable because it resulted in a loss of richness in the image.

Experiments determined that by allowing the ink resist to air dry, one could get excellent and reliable results. Ink grounds air dried three to ten days proved to be superb acid resists—withstanding the action of the acid for up to twenty-five hours. With this approach there was rarely if ever a lifting off of delicate areas of the resist during the first few crucial hours of the etch. Ink grounds air dried for less than three days would not lift from the plate during the etching, but would change substantially in character. Textural and linear areas would change in shape, size, and pattern. If not sufficiently air dried, the character of the image would change unacceptably during etching.

Commercial inks which had been utilized in the image making process (Graphic Chemical Etching Black 514 and Rembrandt Etching Black) proved to be unpredictable and often unsuitable. It was determined that the problem lay with the additives, dispersal agents, dryers, extenders, etc., which manufacturers of ink mix in with the pigments and oil. With these inks, areas which after applying the ink appeared clear and open for biting, remained impervious to acid for up to sixteen hours. This never occurred with the handmade inks. (Graphic Chemical Lithographic Black 1796 was an exception in that it worked reliably and as well as the handmade)

Two acids were used during the deep etch phase of the process: Dutch mordant acid (a mixture of potassium chlorate crystals and hydrochloric acid) and ferric chloride. Both acids have a long history of use in the etching of copper plates. Nitric acid was not used because of its unpredictability and its tendency to undercut. Through experimentation it was determined that a nine to one strength of Dutch mordant (nine parts water to one part basic stock solution) was the optimal acid strength. This acid bites straight down and does not threaten to undercut delicate textural passages. The etch is weaker in strength than solutions suggested in many print technique books. As a result it is less corrosive, takes longer to do the job, and is less apt to break down the more delicate areas of the ink resist. Ferric chloride proved to be a much more corrosive acid, etched faster, and afforded one less control over the result. It was, however, a very useful acid when the need arose to open bite large flat areas of the plate.
During the etch sequence, the plate was removed from the mordant every hour, rinsed in water and the progress checked. The periodic rinsing helped speed the etching by cleaning out the bitten areas. When the plates were etched in a ferric chloride bath, they were inverted so that the iron oxide which formed in the bitten areas could drop out and not inhibit the biting. For safety purposes, eye protection and a respirator were worn during the etching procedures.

The nature of relief etching is such that those areas which have been lowered by etching are not substantially lower than the original surface, but low enough so that they will not pick up ink from a brayer. An experiment was undertaken to determine the minimum etch time necessary to provide the desired result—namely relief printing. Using a nine to one Dutch mordant acid with a water rinse each hour, it took between two and a half to three hours to achieve enough erosion to produce the desired result. With full strength ferric chloride with a water rinse each half hour it took one and one half hours.

As delicate areas of the ink resist break down during the deep etch procedure, one can dry brush (delicately) asphaltum over them to stop out the raised areas so they will not etch away. This generally only works well after the fourth hour in the mordant. If the resist on a large heavily textured area breaks down moderately far along (four to six hours) in the etch cycle, the whole area is stopped out with asphaltum. Later, after completion of the etch cycle and cleaning of the plate, the plate is surface rolled with ink. The ink is allowed to dry and a 4th plate is etched for from four to eight more hours to firmly establish the textural areas. (Graphic Chemical Lithographic Black 1796 works well for this process)

Most plates were bitten at least ten hours. Plates which had a combination of textural and linear quality and large open exposed areas were etched in steps. The textural and linear areas were etched sufficiently (from six to twelve hours). Then they were stopped out with asphaltum. The open areas were allowed to etch a long time (twenty-five hours) and in some cases with vast open areas, the plate was additionally etched in the stronger iron perchloride. This deeper etching helped solve the problem of properly inking complex relief images with the brayer. The required depth to which the white areas of the image had to be etched for success varied depending on the nature of the image, and the size and location of textural and open white areas. Some areas of the plate might only have been bitten for six hours (yet sufficient for relief printing) while large open areas which print white may have been etched for up to thirty hours. This was necessary to enable one to successfully "relief roll" the plate for printing purposes.

Cross section of etched plate-

When the deep etch procedure was complete, the ink was cleaned off the plate. Kerosene and fine steel wool were sufficient to remove ink which had been air dried. Ink which had been baked on the plate was much more difficult to remove. Lacquer thinner and vigorous work with the steel wool was necessary
to remove it. Following the cleaning, the plate edges were beveled with a hand file, and the resulting texture on the edges burnished away with a burnisher and oil. At this point the plate was washed with kerosene, soap and water, and alcohol, and a proof impression pulled from the plate (printing procedures will be discussed after a discussion of reworking methods).

Once the initial impression is "pulled" (printed from the plate), the determination is made as to whether the image is finished or if reworking is desired. Since relief etching is a reductive technique, the further working would involve removal of areas and the establishment of line and texture in the remaining areas of the original plate surface. The engravers burin and gouge provide for direct reworking in a linear, losenge, or dot pattern manner. The finest mark established by the burin (even the small #2) produces sufficient depth to print white. The gouge opens up large areas readily, and also leaves a unique texture on the plate which shows up in the print as an embossed texture. This unique quality can be incorporated into the print when desired.

Textural modification can be achieved using the traditional resin aquatint technique. The desired density coverage of powdered resin is applied to the plate and then bonded by baking at 550 degrees Fahrenheit. Stop out asphaltum is applied to those areas where etching is not desired and the plate is immersed in nitric to one Dutch mordant. Three hours of etch provides sufficient depth for relief printing. The danger here is when one applies too fine a resin coverage. The ideal coverage is 75% which results in very coarse large particle coverage sufficiently resistant to withstand the three hour bite. A 50% coverage would break down before sufficient depth was achieved. The resulting textural effects can be controlled by paying attention to density of resin coverage and by repeat procedure. A coarse or grainy texture becomes finer through this procedure, and a relative tone becomes lighter.

By surface rolling the plate with ink, one can rework areas with ball burnishers, mat board, and textured items. The ink is air dried as before and the plate deep etched. A traditional asphaltum ground can also be applied and linear or stipple effects deep etched through the ground.

When the image has been resolved and the plate matrix considered finished, it is ready for printing. The standard approach in printing a relief etching is to ink the surface with a brayer and print onto dampened paper using an intaglio printing press. The brayer used must be of sufficient hardness (50-70 Durometers) so that when rolled over the plate, foul inking will not occur (foul inking takes place during the roll up when ink not only is applied to the plate surface, but also gets into areas which have been etched slightly away---this means that either the roller was too soft and sagged into the bitten area touching the surface, or that the depth of the etch in the foul inked area was not sufficient to allow proper inking).
A major problem when printing an impression from the relief etching occurs when a proof contains a double or blurred image. Since, with an inked plate, the ink is sitting up on the surface of the plate, it will come off to the touch. If one places the paper over the plate as with an intaglio print, the action of the press will stretch or lengthen the paper leaving a double impression in areas of the print and along one edge.

Following is the solution to this problem:

Crank press to engage felt and printing paper. Hold both felt and paper taut with the left hand above the press bed. Insert the inked plate into the proper position. Crank the plate through while continuing to hold up the felt and paper. This way, the paper does not touch the inked plate until the actual moment of printing. The result is a clean crisp impression.

A range of different inks were used for the actual printing of the plates. They included Graphic Chemical Lithographic Black 1796, Graphic Chemical Etching Black 514, Rembrandt Etching Black, Daniel Smith Traditional relief Black No. 79, and the handmade black inks. It was determined that the best ink for relief printing in black and white is the Daniel Smith ink. It yields a uniform velvety black, will not fill or clog finely bitten areas, and produces the finest articulated linear and textural effects.

A number of printing papers were utilized. Hosho was found to be unsuitable because the amount of ink required to produce a solid black would clog the finely bitten areas of the plate. Arches Cover White proved to be a superb paper when soaked for five minutes in a water bath and blotted. It yielded a rich velvety black and a full range of textural quality. Rives BFK was also excellent as a brilliant white background for the image.

A printing technique investigated which yielded interesting results was that of inking the plate intaglio with silver ink, wiping the surface clean with tarratans; and printing onto black Arches paper. Here, the silver ink which was printed out of the bitten areas gave a different visual effect than that of the white of the paper in the relief printed impression. The black paper surface in the intaglio print replaced the black ink of the relief print.
Another possibility in printing technique was investigated. This involved putting a warm color (an ochre) down in the bitten areas, wiping the surface of the plate clean with the tarlatan, and then relief rolling the surface of the plate with black mixed with a cool color (blue). The resulting impression was very interesting with ochre color in the light areas of the image and a cool black in the dark areas. The push and pull of the warm and cool colors was visually rich and exciting. One other possibility here was to print the ochre separately, let it dry on the paper, then print the black over it offsetting the registration slightly so as to get white as well as ochre in with the black.

A printing technique was devised so as to successfully register and print Chine Colle from the relief matrix. Chine Colle is a process whereby a piece of thin rice paper of a desired color or texture is placed between the inked plate and the printing paper. Rice paste is used for bonding, and during the printing process the image is printed onto the rice paper which simultaneously bonds to the backing paper.

To achieve full or partial Chine Colle:
- Position newsprint on the press bed- tape down one end.
- Place the uninked plate in the middle of the newsprint. Draw a pencil line around the plate to locate its position (remember which way the image is positioned).
- Dampen printing paper for five minutes, blot it, and center it over the plate. Register the location of the paper with a T bar at one end and a line at the other end.
- Place one felt over the paper and run the plate through at a bit less than actual printing pressure (the imbossed inkless image will show on the paper).
- Remove paper and set aside to dry.
- Remove the plate and determine the size and shape of the Chine Colle piece. Cut it out of the Chine Colle paper.
- Ink the plate with a brayer for printing.
- Dampen and blot the paper again. Carry it over to a table with the Chine Colle piece, rice paste, and a brush.
- Brush the paste onto the proper side of the Chine Colle paper. Pick it up and place it in the proper spon on the printing paper (one can easily see where it goes). Pat it down gently by hand so good contact is made.
- Properly register the printing paper on the press bed (one can tape the edge of the printing paper to the newsprint to assure proper positioning). Place the felt over the paper so that the edge of the felt and the edge of the paper are aligned. Set the press for printing pressure. Crank the press to engage the felt and the end of the paper.
- With left hand raise the felt and paper taut above the bed. Place the inked plate in the exact registration position with the right hand.
- Crank through slowly- always holding the felt and paper above the plate so no double impression will occur.
- Remove felt and paper slowly from the plate.
- Tape up print to stretch dry or place between blotters under weight.
The research was carried out in the print shop at Morehead State University, and helped generate student interest and enthusiasm in technical experimentation in printmaking. Students in printmaking have expanded their technical knowledge to include lino cut, woodcut, multi-block color relief print, wood engraving, monotype, etching, relief etching, aquatint, soft ground, lift ground, roulette, mezzotint, burin engraving, multi-plate color intaglio, "photo etching" (both intaglio and relief), and crayon and tusche stone lithography.

The investigation was exciting and a successful and reliable monotype-ink resist/relief etching technique was determined.