Photoplate Lithography

Additive Mark-making: An Alternative Approach

TMP research by Mike Feijen

Conducted at Tamarind Institute

2019-2020

Frederick Hammersley Apprentice Printer

Table of contents

With special thanks to Valpuri Remling and Brandon Gunn for their advice and guidance throughout the process of experimenting and writing this article.

Introduction

Before I began working as an apprentice at Tamarind Institute's professional workshop, I gave thought to what my research should be about. I have been interested in the application of new technologies in lithography, especially since the arts and printmaking have always been early adopters of the new.

Through conversations with Brandon Gunn, I came across laser-plate technologies, a new form of making photolithographic plates that would be more stable and could reach a higher DPI than we are able to produce. While looking into this, I quickly realized that although these laser-plates had potential, they also had a couple of drawbacks. The equipment set-up, which includes a special laser printer, is expensive and not readily accessible for Tamarind, let alone a smaller shop with fewer resources. It is also completely reliable on computer files, which would add an extra step that dilutes the artist's hand.

While this was an interesting avenue of exploration, I do not believe it to result in any practical application in the workshop of the average lithographer until the technology is more readily accessible. These first probes into laser-plate technologies allowed me to talk to a couple of people about photoplate lithography and working professionally has further exposed me to photoplates. I have seen the benefits and the potential problems of working with these plates.

The two major problems I have noticed in the last year-and-a-half are the decline of quality of the plates and their inflexible nature. Through the years production has stopped for a number of photoplate brands so we really don't have many options left. We have to work with what we can get. I intend to focus on finding a solution for adding image area to an already exposed and processed plate.

When we process a photoplate, we work with plates that are pre-coated with a light-sensitive emulsion, take the artist's drawing (on transparency) and place it on top of the plate, then expose it to a light source (the artist draws with materials that are UV-ray blocking). When the plate is exposed, the drawing will protect the plate from the light; in areas where there is no image, the light will be able to reach the emulsion and soften it up. We can then develop out the softened emulsion, leaving only the image in emulsion on the plate.

After the photoplate has been exposed, the artist's drawing becomes a printable base on the surface of the matrix. While we can easily and reliably delete image area after processing a photoplate, we lack a good way of adding to the image area. We can only remove emulsion, the main reason why I consider the photoplate to be inflexible.

Limestone and aluminum plate both allow reliable additions to be made. Theoretically, we should be able to add image area to a photo plate, but as of now, we have not tested or guaranteed working methods of doing this.

Intention/Goal

I’m trying to find an additive material that would be readily available at the average art supply store to be used by artists on photoplates. The materials have to be relatively easy to use; they mustn’t obstruct the creative process.

For my research, I simulated the stress our photoplates go through during proofing and editioning. My goal was to see if there are materials that could reliably be used to add image area to a photoplate that has already been exposed and processed.

My focus was also on minimizing waste and cost. By developing a way to add material, it would take away the need to shoot another photoplate if an artist wants to add image, thus saving the need to use an extra plate.

Another part of minimizing waste and cost is looking into reusability (i.e., reusing a plate that has served its purpose, after the edition is done). Can the image be completely erased, and the plate reused?

Materials

An overview of materials used for process and printing in this research. It's important to note that all findings were based on the use of these particular materials and compositions. I do believe the process can be reproduced with different brands of materials as long as the principles stay the same. Of course, when deviating from the materials used in this research, extra tests are required, and success is not guaranteed.

General materials

Matrix:	Eagle Pos1, made by American graphics distributors LLC. It is a positive working photolithography plate. Electrochemically grained and anodized on litho aluminum 1050 alloy.
press	Motor-driven Takach lithopress
Shellac:	300 ml butyl alcohol / 100ml denatured alcohol / 108 grams shellac flakes
Counter etch	1oz phosphoric acid / 1oz hydrochloric acid / 1 gallon of water
Inks	Roll up ink: graphic chemical shop mix
Printing ink	Printing ink: 2 parts fire red (CS-360) / 2 parts process cyan (CS-414) / 1 part tint base (CS-800) all inks were Hanco inks
Acetone	Made by Klean-Strip
Lithotine	Used to wash out plates and stones; from American graphics distributors. Alternative for Turpentine, lamp oil, or what is used in a shop to wash out ink from a stone.
Varn® True blue	Used for cleaning ink of photoplates, distributed by FlintGroup. Can be substituted for whatever the shop uses as a photoplate cleaner
Denatured alcohol.	Made by Klean-Strip
Glycerol	Made By MACRON Fine Chemicals™
Absolute 6036	Made by FlintGroup

Paper	Soft white Somerset satin 280grams
polyester film	A transparency often used as a drawing surface for artist, to be shot onto photoplates.
Gum Arabic	1 part water / 1 part gum arabic flakes/lumps
TAPEM	Comes from tannic acid plate etch; distributed by American graphics distributors' LLC.
50/50	1 part gum arabic to 1 part TAPEM
Talc	A powder protective layer against ink smudging, also known as talcum power or French chalk.
Misc.	Bowls, water (cold), composite roller, leather roller

Note: I chose Soft white Somerset satin as the default paper for testing because it's a very good ''standard'' paper, not too much texture, not too much seizing. In my opinion, it falls nicely in the middle of the paper spectrum thus is a good paper to do test on. Unless stated otherwise, "paper" refers to Soft white Somerset satin (280gsm).

Additive material

I used all materials on Eagle PoS1 Photoplate, which were fully developed, meaning all emulsion was taken off through light exposure of 2000 LU. I then counter etched the plate using counter etch according to the recipe in the materials list.

Material reaction to substances overview:

V = positive

X = negative

Nt = not tested (due to no access to workshop because of Covid-19)

X/V = semi result, concluded it's not reliable enough to use

For the specific type of pen/marker used, refer to the review on pages 11 to 16.

These tests and research were done accounting for True Blue being the substance used as a plate cleaner. If the workplace you are in uses a different cleaner, additional tests have to be done.

	withstands water	withstands True Blue	withstands counter etch	takes ink	wash out acetone
marker brand					
1. Pigma Micron	v	x	v	x	x/v
2. Sharpie	v	x	v	v	v
3. DecoColor	v	x	v	v	x
4. Yatsumo Y&C	x	x	x	x	v
5. Faber-Castell	x	x	x	x	x
6. Stabilo	x	x	x	x	x
7. Identi Pen	v	x/v	v	v	v
8. Lithco	v	v	v	v	v

9. Paper Mate ball point (ink joy)	v	v	v	v	x/v
10. Testor paint	x	x	x	nt	nt
11. ZIG Ppaque Pen	v	nt	v	nt	v
12. Essie nail polish	v	nt	v	nt	v


essie
nail lacquer
vernis
FABER-CASTELL
Pitt Artist Pen®
Black · Noir · Negro · 199
Y & C CALLIGRAPHY
NON-TOXIC
Conforms to ASTM D-4236 JAPAN
FINE LINE
DecoColor
OPAQUE PAINT MARKER
STABILO point 88 fine 0,4
ZIG OPAQUE PEN
PIGMA MICRON 01
ARCHIVAL INK
QUALITÉ D'ARCHIVAGE
IDENTI PEN
Permanent
Indélébile
Permanente
Cap tightly
Fermer Bien
Cerrar bien
Sharpie
FINE POINT

1. Pigma Micron 01

These pens are made by the Sakura color company; the ink is made from pigments instead of dyes, and it is fast-drying and acid free. The submicron-sized pigments allows the ink to flow easily through the smallest tips, making them ideal for fine line work. The ink doesn't sink into paper but dries on top of it which, in combination with the fact that they are acid free, makes them very archival.

When using this pen on a photoplate, the ink seems to flow over the plate nicely; it catches and the lines stay sharp. However, it dries slowly if at all. The ink seems to stay wet on top of the plate, and after two minutes it still smudges. (Dusting with talc might help it dry enough as to not smudge when processing.) It also doesn't take printing ink and so it doesn't have the necessary qualities to work as a straight additive material. But because it can withstand water and gum arabic and comes off with True Blue, it can be used as a drawing material. If we can create a gum adsorb on the plate and wash the material out, it can be put in a shellac base and printed. (Pg. 17,18)

This tool would be best used for artists who work precisely and who can keep in mind the drying time of the ink. The tight quality of the line would work beautifully for a draftsman.

2. Sharpie, fine point

Sharpie is a brand of markers (often permanent markers) manufactured by Newell Brands. They contain N-propanol alcohol, N-Butanol, and diacetone alcohol and a resin (most likely unsaturated polyester resin) that promotes adhesion thus making it permanent.

Although these markers are described as permanent, that mainly refers to their water resisting qualities. The ink is actually quite easy to remove. For example, non-acetone nail polish removes these "permanent" stains from fabric.

The flow of a Sharpie marker on the plates feels nice; it gives a glossy line that quickly turns matte as it dries. It dries almost immediately which counteracts any smudges that could muddy an image. While the ink does flow consistently, it tends to leave slightly lighter spots in the line when

making organic turns with the pen; it's just slightly less dark then the rest of the line, which can give a desirable or undesirable effect. It can be used as an additive material, but it doesn't withstand most solvents used for cleaning. Ink will wash off or fade rather quickly. It's not a material that can be used as a directive additive when the plates need to be stored/cleaned. Because it withstands gum arabic, it can be used in the same way as the Pigma Micron pen, by changing the plate into a shellac base (Pg. 17,18).

3. DecoColor

Made by Marvy Uchida, this paint marker contains Xylene. It is nice and consistent to draw with, but it doesn't lay flat on the surface and it creates a slight texture. It does take ink but, because of the texture it creates on the plate, it is not suitable in conjunction with imagery already on the plate. Because it washes out with True Blue, it could only be used for transforming the image into a shellac base. However, because of the texture, I would recommend using other tools that will give you the same flat line as the DecoColor marker.

4. Y&C Calligraphy 3.5 nib

I tested the Yastutomo Y&C marker and it washed out with water, rendering it not useful for lithography. It's a non-toxic pen made of water-based ink. It doesn't work with any of the processes used in this article. When using it as a drawing material on polyester film, it doesn't want to stick to the surface, rendering it useless for that application too.

5. Faber-Castell Pitt artist pen

I tested the Pitt artist pen and it washed out with water, rendering it not useful for lithography. It works well on polyester film and has good coverage, so it could be used as drawing tool for artists when working on polyester film to exposing onto a photoplate. This pen is often used on matte polyester film. It is an India ink-based pen that is said to be waterproof, which probably refers to the pen being used on paper and sinking into the drawing surface. When used on a photoplate, it doesn't sink in. I was able to remove it from the plate by rubbing, similar to a dry-erase board marker. It is not useful for working directly on a plate.

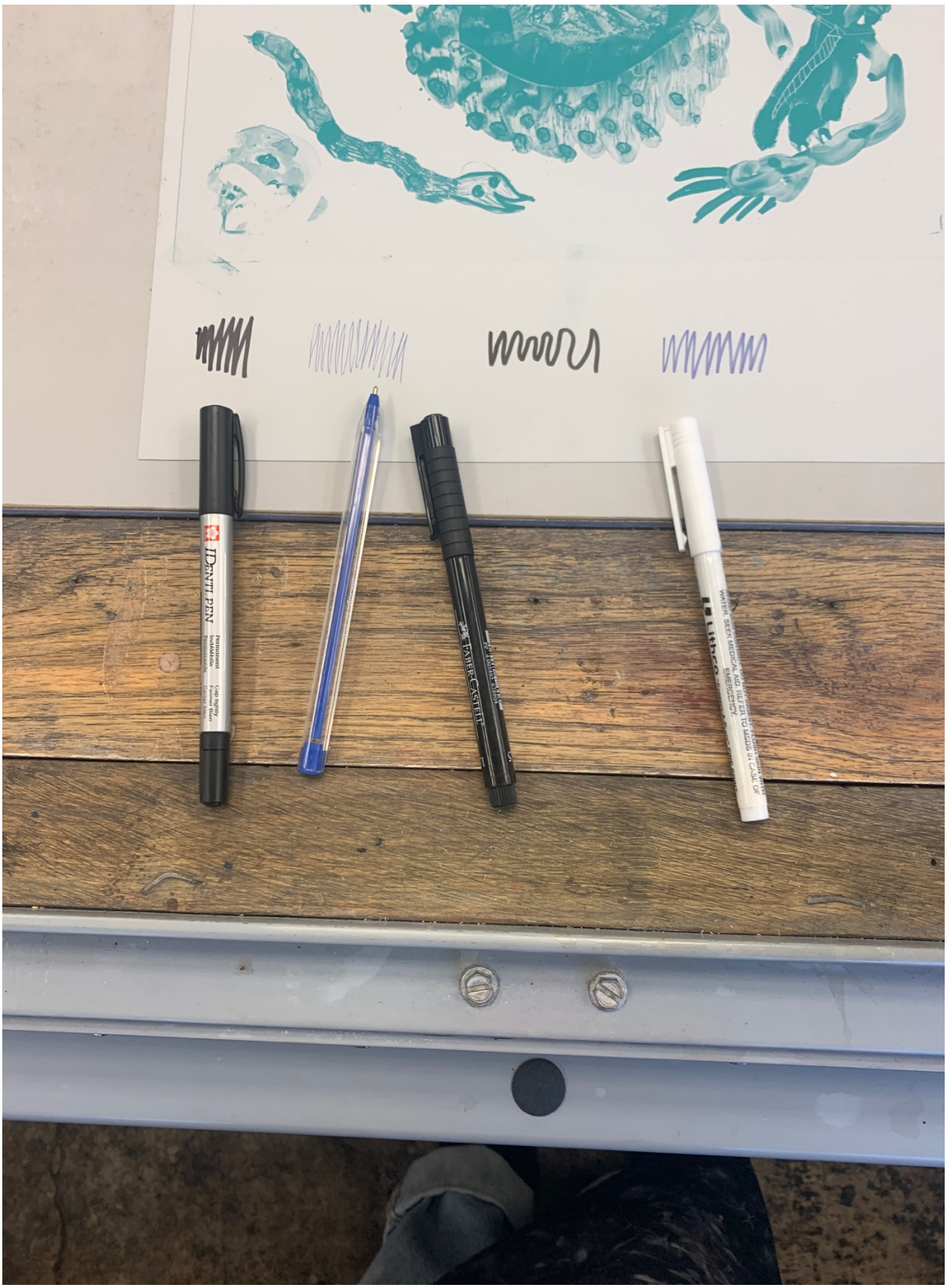
6. Stabilo, point , fine 0.4

The Stabilo pen also washed out with water, rendering it not useful for lithography. It also didn't work on polyester film —it doesn't want to lie down and dry on frosted polyester film so it cannot be used as a proper drawing material. Although the clumps of ink did prove to be a resist against light showing up consistently through multiple exposure heights, the way it lies down on polyester film doesn't show promise for any practical application.

7. Identi Pen dual tip (1.0/0.4)

Identi Pen is made by the Sakura color company just like the Micron pigma pens. It is a water-resistant ink which the company claims works on most nonporous surfaces. When testing the pen against a number of substances, it performed well.

It does take ink so it can be used straight on a plate as a printing base. It doesn't fully withstand True Blue, so it cannot be used as a straight additive material since the plates cannot be cleaned for proofing different colors or to be stored. It can however be used as a drawing material if the plate is processed into a shellac printing base. The pen has a great ink flow, creating a solid line and outperforming the Sharpie pen in consistency. It dries quickly on the plate (10-20 seconds) and it keeps the glossy shine. It works well on polyester film; it lies down flat, dries quickly, and withstands high exposure times.


IDENTI PEN
FABER-CASTELL

8. Lithco “Correct-A-Plate’’

The Lithco additive pen is specially made as a tool for direct addition to photoplate, and it lives up to its promise. I used the pen for a small addition to an artist’s print, in a small piece of a flat area that needed to be filled in. I printed 27 sheets of paper and it held up without any issues. It is good for straight additions.

However, it is a very dry pen, the ink flow is not great, and as a straight drawing tool it is difficult to get good consistent lines or areas. I would not recommend it as a drawing tool for artists; it is more of a technical tool for printers. It’s just not versatile enough to create art but great to fix miner problem areas.

Further research and contact with the supplier Lithco are needed to figure out the chemical makeup to understand what makes this pen so great. It would be wonderful to have a liquid product we could use and potentially give to artists to enhance working directly on the plate.

9. Paper Mate, ballpoint pen, ink joy 50, 1.0m

This ballpoint pen worked well. It holds ink and resists most chemicals. When the plate is cleaned after it has been printed, the ink does lose its shine, but the marks are still clearly there (it might fade over time). It takes some time to dry on the plate, and it will smear and smudge if touched too soon. Its loss of shine worries me a little bit, and there is a need for some more extensive testing to determine if ballpoint pens are good to use with artists.

It does work as a direct additive material, but as the Lithco pen is not an easy drawing material, the lines are irregular. It might cause an issue for specific drawings and would probably stand out in comparison with any previous images.

10. Testor enamel paint

In order to test a liquid paintable substance, I opted for an enamel paint hoping this would give a good printing ground. It didn't hold up to any substances test and I concluded it wasn't workable for lithography.

11. ZIG Opaque Pen

Because of its red color, the ZIG Opaque Pen is perfectly suitable for drawing on polyester film and has been tested as a great light blocking tool. It needs further testing but, from the tests I have been able to do, I concluded that this pen can be used as a drawing material if we opt to change the photoplate into a shellac base (Pg. 17,18).

12. Essie nail polish.

I added nail polish to the testing to see if this was a viable liquid material. The nail polish needs to be dried for at least two minutes on the plate, longer if the application is thicker because of the application, it lies on top of the plate and has a slight texture, so it wouldn't be suitable as a direct additive material nor has it been tested if it takes any ink at all. However it does resist water and washes out with acetone, so it could be used as a drawing material. The brush stroke of the nail polish almost mimics a thick application of tusche, giving a varied tonal line—this is an interesting development. We might be able to keep these tonalities with proper etching, but again this would need further testing. At least it is proven that it can be processed into a shellac printing base, and thus would be a valid drawing material.

Conclusion

Lithco "Correct-A-Plate" and the Paper Mate ballpoint pen seem to be the only drawing tools in this test study that can actually be direct additive materials. The other materials all have their individual pros and cons; although they may not have proven effective in this study, they can be used in other ways that would be beneficial to the printer's tool set.

Traditional materials and photoplate lithography

”Traditional materials” refers to drawing materials used with stone and aluminum plate lithography.

The main materials I used for researching this part are:

William Korn’s litho crayons	#1, #2, #3, #4, #5
Charbonnel tusche	Diluted with water
stick tusche	Diluted with water

Step-by-step:

1. Started with an undeveloped photoplate.
2. Drew an image on clear polyester film and added photographic material printed on clear polyester film to the image.
3. Shot the image onto a photoplate at 1200 LU and developed with a mkixture of of 4oz sodium metasilicate / one gallon of water.
4. Buffed in the plate with gum arabic to simulate a plate already printed put to rest.
5. Counter etched the plate using the Tamarind recipe (1oz Phosphoric acid / 1oz hydrochloric acid / 1 gallon of water). Three applications of counter etch for 1 minute each, following a pattern of tight circles up and down, left to right.
6. Added traditional drawing material to simulate multiple additions by an artist. **
7. Let the drawing material sit on the plate, especially when using tusche. Waited a minimum of 1 hour after the tusche was dry before processing further.***
8. Dusted the plate with talc, brushed so the entire plate was covered, and lightly buffed using a soft cotton pad.
9. Etched the plate using TAPEM, 50/50, and gum arabic.****
10. Buffed in the plate with gum Arabic using a cheesecloth and taking extra care to not be rough.*****
11. Allowed the plate to rest for at least 1 hour but preferably 4 to 8 hours, not being touched or disturbed.
12. Next, the image was ready to be washed out:
    -used Lithotine to wash out the traditional material
    -used acetone to wash out the photoplate emulsion******
13. Buffed in shellac base, tight circles using a rag/shop towel.

14. Flashed the shellac; used a hair dryer on hot function for approximately 20 seconds.
15. Buffed in asphaltum, tight circles using a rag/shop towel, made sure it was even and didn't have any streaks in it.
16. Let the asphaltum rest for about minutes.
17. Used a wet rag/shop towel on the plate in multiple directions; to remove any excess asphaltum.
18. Sponged with "dirty'' sponges and rolled it with a charged leather roller.
19. Switched to "clean" sponges and rolled up the image as normal.
20. Added talc to the plate in the same way as earlier.
21. Etched the plate, this time the image was in a shellac base so etching could proceed as normal. *******
22. Buffed in a gum arabic layer to strengthen the absorb.
23. Let the plate rest for at least 1 hour, preferably four to eight hours.
24. The plate is ready to be proofed or editioned. ********

** The drawing material should be left to dry. When trying to work too quickly, the tusche will not have ample time to adhere to the surface and establish some sort of base.

*** The drawing material should be allowed time to dry. Rushing the process might cause tonality to be lost, especially in tusche washes. Processing directly after drying the tusche resulted in loss of tone. Leaving the plate overnight has given great results, with beautiful reticulation and tonal values.

**** I made sure to handle the plate delicately as to not disturb the drawing too much.

***** Since the aluminum of a photoplate has a much smaller tooth than a straight aluminum lithoplate, extra care is necessary to make sure the drawing is smudged.

****** Acetone should be used to wash out the photo emulsion if you're going to buff in a shellac base. It's not recommended to use it as a deletion fluid because it can eat in to the aluminum thus creating areas that take ink, rather than stay open. I recommend using ''thick deletion gel positive'' from Masterproduct for small deletions.

******* "Normal" meaning how one would etch if it was a ball grained aluminum plate

******** Before editioning, I advise washing out and rolling up in black a couple of times to stabilize the matrix further.

Shellac change tests

The shellac changes are based on the same principal as aluminum ball grained litho plates. If an absorb can be established, we can basically mask a non-image area. By washing out all the material, we expose bare plate, and we can add a film of shellac base so it can be printed. The photoplates have a much finer tooth than ball grained plates, so the way material reacts might differ from what we expect to happen. We basically treat the photoplate as if it is a ball grained plate.

This was an image shot at 1150 LU, then traditional material was applied and etched with only 50/50.

I used a tusche wash the polyester film and it was interesting how well they looked after being put into a shellac base. Because of the higher contrast between plate and black, a plate and green emulsion almost looks better.

This observation leads me to believe putting a plate in shellac would be a good option for a particularly difficult plate that doesn't want to print the lightest parts of a wash. If there is image area, it can be washed out and replaced by shellac which will probably print better. These hypotheses will be tested once I can access a studio again, but by word of mouth I heard this was done before and it worked.

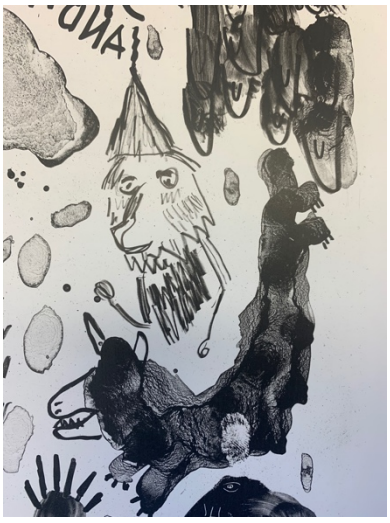
The image does seem to have a little more contrast. But I attribute this to the change of materials—the shellac and black ink. Perhaps the etching could have been done slightly differently as well. The way grease lays on the photoplate is different from the way it does on a ball grained aluminum plate. All in all this test was a success, tonality was kept, the image stayed the same, and there were no major dropouts.

As a caveat I would say the greasy Korn pencils worked better. I recommend #3, #2, or #1 for yielding the best results in tonality.

Images below: Details of the test plate showing tusche washes made on polyester film, then shot to the plate and finally changed into a shellac base.

(photoplate emulsion)

(photoplate emulsion with traditional material)



(photoplate in shellac base)

Stress test

For this test, I changed a photoplate into a shellac base and pursued to print an edition. I printed 27 sheets of paper with a loose gum for 45 minutes after the fifteenth print. The loose gum was to simulate a printing day where we would probably have a break in the middle of the edition.

I sponged with cold, filtered water with absolute 77 and glycerol added to it. I treated it as if I was printing a traditional positive working photoplate and pulled 27 sheets without any hiccups. The plate stayed consistent through the whole edition.

I conclude that this is printable. The test was good, and I will add it as an option from here on out.

Recyclability

My conclusion that a shellac base on a photoplate is viable and workable opens up the opportunity that a photoplate can be reused.

In the case of traditional positive working photoplate with no additive material, the edition is printed, and the plate has then served its purpose. Normally it would be discarded, crossed out, and recycled as scrap metal. However, we can expose the printed plate fully and develop it again, so that the entire image is gone, leaving us with a bare plate. Now the plate can be treated in the same way as a ball grained aluminum plate.

If ball grained aluminum plates are not available where you are in the world, but you have access to photoplates, you can use them as you would a ball grained plate, reduce waste and be more cost effective.

Conclusion

My tests on additive materials were semi-successful. The Lithco pen was the only one that did add material and was directly printable. The other pens and markers can be used in different ways and some could work perfectly fine as drawing materials, for example, in conjunction with changing a plate to a shellac base. The water-based pens are not useful. A change to a shellac base is possible and holds up through an edition. If an artist wants to add to a photoplate, there is no direct need to shoot another plate, traditional material can be used to add as well as some markers.

The test and research I've done have created more questions and topics to think about and I will continue adding to this article with new findings.

I would really like to continue exploring the possibilities of Y&C Calligraphy 3.5 nib, Faber-Castell Pitt artist pen, and Stabilo point 88 fine 0,4. Maybe their water soluble nature makes them suitable sketching tools on stones and ball grained plates.

I would also like to continue testing proper etching on photoplates.