

sandbox

The "Sandbox" space makes available a number of resources that utilize and explore the data underlying "Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640" created by the Making and Knowing Project at Columbia University.

[View the Project on GitHub](#) `cu-mkp/sandbox`

VERDIGRIS PIGMENT "GROWING" RECONSTRUCTION

HIST GU4962: Making and Knowing in Early Modern Europe: Hands-On History

The Making and Knowing Project, Columbia University

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Safety Note: Nitrile/latex gloves must be worn when handling verdigris. Do not touch your mouth or bare skin. Do not scrape or grind the verdigris on food preparation surfaces.

Verdigris is a blue-green pigment prepared by exposing copper to acetic acid (vinegar), forming a basic copper acetate.

This activity asks you to "grow" verdigris at home — a process for which you will assemble the equipment, plan, carry out, monitor, and document over the coming weeks. It takes time for the crystals to form, you will need to start this assignment as soon as possible. You will likely need to plan for a few weeks of growth before you plan to use the verdigris (e.g., for painting).

Historical Recipe Examples

There are a number of recipes for "growing" verdigris across Medieval and Renaissance painter's manuals. Try searching for these in recipe collections, such as:

- Cennino Cennini, *The Craftsman's Handbook, 'Il Libro dell'Arte'*, trans. by Daniel Thompson (New York: Dover, 1960).
- Mary P. Merrifield, *Medieval and Renaissance Treatises on the Arts of Painting: Original Texts with English Translations* (Courier Dover Publications, 2012).
- *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*, edited by the Making and Knowing Project, et. al. (New York: the Making and Knowing Project, 2020), <https://edition640.makingandknowing.org>.

One particularly illuminating recipe is from the "Bolognese Manuscript" of Jehan le Begue (late 14th or early 15th century) in *Medieval and Renaissance Treatises on the Art of Painting*.

How to make the green from brass which is called Greek or common green

If you wish to make the copper-green which is called Greek, take a new jar, or any other concave vase, and put it into the strongest or most acid vinegar, so as not to fill it and put strips of very clean copper or brass over the vinegar, so as that they may not touch the vinegar or each other, being suspended to a stick placed across the vase. Then cover the vase and seal it, and put it into a warm place, or dung, or underground, and leave it so for six months, and then open the vase and shake out what you find in it, and on the strips of metal, into a clean vase, and put it in the sun to dry.

Merrifield, Mary P., *Original Treatises Dating from the XIIth to XVIIIth Centuries on the Arts of Painting*, 2 vols (London: John Murray, 1849), vol. 1, pg. 124.

Modern Recipe Resources

Familiarize yourself with growing verdigris by browsing the [From Dirt to Shirt](#) blog which details various recipes for verdigris (note that this blogger prepares verdigris in order to eventually use it as a *dye* while we will be using it as a *pigment*).

You will notice that some recipes call for urine in the place of vinegar. Should you want to try to grow verdigris with your own body fluids, consult this [Reconstruction of a verdigris recipe that includes urine](#).

For more information about verdigris, please also see these scientific articles:

- de la Roja, J.M., V.G. Baonza, and M. San Andrés. "Application of Raman Microscopy to the Characterization of Different Verdigris VARIANTS Obtained Using Recipes from Old Treatises." *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 68, no. 4 (2007): 1120–25. <https://doi.org/10.1016/j.saa.2007.06.053>.
- Chaplin, Tracey D., Robin J. Clark, and David A. Scott. "Study by Raman Microscopy of Nine Variants of the GREEN-BLUE Pigment Verdigris." *Journal of Raman Spectroscopy* 37, no. 1-3 (2006): 223–29. <https://doi.org/10.1002/jrs.1469>.
- San Andrés, M., J. M. de la Roja, V. G. Baonza, and N. Sancho. "Verdigris Pigment: A Mixture of Compounds. Input from Raman Spectroscopy." *Journal of Raman Spectroscopy* 41, no. 11 (2010): 1468–76. <https://doi.org/10.1002/jrs.2786>.

Materials

Material	Notes or substitutions
½ pint glass mason jar & metal lid	This can always be scaled up or down. There are two important elements: 1) a jar large enough to accommodate suspending the copper above the vinegar without being submerged in it, and 2) a tight-fitting lid and a container that can withstand the corrosive vapors of the vinegar and eventually the copper acetate crystals.
Copper sheet, about 2"X2" (Blick 60503-8110 - Maid-o'-Metal, St Louis Crafts Inc)	Any small piece of copper metal can be used, such as copper piping from a hardware store (cut to size that will fit inside the jar, about an inch or so in diameter and an inch or two in length). Make sure that whatever you use is 100% and not an alloy or only copper-coated.
~5" piece of cotton twine	This is what you will use to suspend the copper above the vinegar in the jar. Any piece of twine or string that will fit across the diameter of the jar with some extra length to hang over the sides will work
About 50ml vinegar	
(or urine)	Try experimenting with different types of vinegar and make a note of their acetic acid concentration (most are diluted to 5% - check the label). Apple cider vinegar with the "mother" is ,brlikely the most similar to historical vinegar.

To harvest the verdigris:

nitrile or latex gloves, table covering (such as a sheet of newspaper or paper bag, plastic sheeting), ceramic or glass plate (or other flat surface), palette knife (or other sturdy flat instrument such as a butter knife or metal spoon - just make sure not to use it for anything else after!)

Instructions

Below is a basic recipe designed to be a straightforward version of a historical example. Don't let that limit you in your experimentations! If you wish, try to reconstruct variations of recipes you found, like different types of vinegar or sources of copper, substituting urine for the vinegar, or creating a warm environment that would mimic the horse dung described in the example above.

1. Fill the jar about $\frac{1}{4}$ full with vinegar (about an inch from the bottom of the jar)
2. Attach the copper foil to the twine (e.g., by folding or crimping an edge over the string; or piercing a hole in the copper and threading the twine through). Make sure it is secure
3. Suspend the copper about an inch or more above the vinegar with the string hanging over the top and sides of the jar (you can tape the string in place on the sides of the jar so the copper does not fall into the liquid). Do not allow the copper to touch the vinegar
4. Screw the jar lid on tightly, making sure that the copper is held above the liquid
5. Put the jar in a warm spot where it will not be disturbed
6. Observe your verdigris every few days and keep records and photos in your fieldnotes of what you observe. Take photos.

Make sure to keep the jar closed and do not let the liquid touch the copper.

Material Safety Information

Verdigris is a basic copper acetate, a material which can pose some safety risks. To determine how to work with it safely and what precautions to take, we consult the [Material Safety Data Sheet \(MSDS\) for copper acetate](#). Key points are summarized below.

Formation of copper(ii) acetate from Cu(s) and acetic acid.

- Common Name: **Verdigris**
- Chemical name: Copper(ii) acetate
- Solubility: soluble in H₂O and alcohol
- Melting point: 115° C

Hazard statements, flashpoints, combustion points, interactions, etc.

- H302 harmful if swallowed;
- H315 causes skin irritation;
- H410 very toxic to aquatic life with long lasting effects;
- H335 may cause respiratory irritation;
- H319 causes serious eye irritation

Safety precautions

- P271 use only outdoors or in a well-ventilated area;
- P261 avoid breathing dust/fumes;
- P270 do not eat, drink or smoke when using this product;
- P273 avoid release to the environment;
- P280 Wear protective gloves/protective clothing/eye protection/face protection.

Waste management

- Do not wash down the sink or throw away in household or regular trash
- Any items that have come in contact with verdigris or that have any verdigris residue must be disposed of in hazardous waste containers

- In the Making and Knowing labat Columbia University: verdigris is “hazardous waste” (we follow the recommendations of [Columbia Environmental Health & Safety](#))
 - Solid/Liquid, non-oil, hazardous; or
 - Solid/Liquid, oil, hazardous

“Harvesting” (or Preparing) the Verdigris for Painting - DO NOT DO THIS AT HOME

CAUTION: Verdigris is toxic.

Do not carry out these instructions at home, only in a laboratory or approved studio setting.

Ensure the setting you are working in is equipped to prevent harmful ingestion to you or others as well as to prevent harmful release to the environment.

The longer you keep the jar closed, the more verdigris "growth" you will have. After a few weeks, you should have enough to yield a good amount with which to paint.

1. Secure the ends of the string hanging down the sides of the jar. You may wish to tape them in place to ensure the copper will not drop down into the vinegar when you open the jar
2. Carefully remove the jar lid, making sure that the liquid does not come in contact with the copper pipe.
3. **Using latex or nitrile gloves**, carefully remove the copper from the jar and place copper into a zip-top plastic bag or other sealable container. Bring the bag/container into the lab.
4. Do not try to transport the verdigris while still suspended in the vinegar jar - the liquid will splash up and you can easily lose your crystal growth!
5. Using a stainless steel butter knife or spoon, scrape the crystal growth onto the plate. Using a palette knife, a butter knife, or the back of a stainless steel spoon, scrape the green crystals from the copper. Gently crush the crystals to a fine powder
6. **NOTE: Never carry this out in a setting other than a lab or approved studio where safety precautions can be followed to avoid hazard to you or the environment.**
7. Be sure to cover the surface you use with old newspaper or paper bags (which you discard immediately after use).
8. Do not touch your mouth or eyes while doing this.
9. When complete, thoroughly clean all surfaces with which the verdigris came into contact.
10. Remember to avoid disposing of verdigris down the drain or into household trash.

Once crystals have been scraped off of the copper, you can return it to your jar-and-vinegar setup to grow further. This can be repeated until the copper is too degraded to hold its shape.

Painting with verdigris in BnF Ms. Fr. 640

While there are no references to the process of making verdigris in BnF Ms. Fr. 640 (the 16th-century artisanal/technical manual studied by the Making and Knowing Project), there are a few notes about its use or application in painting. The manuscript also mentions verdigris as a material in processes other than painting, including casting, etching, and dyeing.

Making and Knowing Project, Pamela H. Smith, Naomi Rosenkranz, Tianna Helena Uchacz, Tillmann Taape, Clément Godbarge, Sophie Pitman, Jenny Boulboulle, Joel Klein, Donna Bilak, Marc Smith, and Terry Catapano, eds., Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640 (New York: Making and Knowing Project, 2020), <https://edition640.makingandknowing.org/>, <https://doi.org/10.7916/78yt-2v41>.

For all instances in Ms. Fr. 640, search for “verdigris” in [Secrets of Craft and Nature](#).

Excerpts from Ms. Fr. 640 about using verdigris in painting:

Fol. 63r suggests crushing the crystals with vinegar or urine, allowing the mixture to dry, then mixing that with binder.

Verdigris and another very beautiful bright green

One ought not to grind it with water alone, for that makes it die. To render it beautiful in distemper, some grind it with vinegar, but that makes it turn pale & become whitish. To render it beautiful, grind it with urine & leave to dry. Then, whenever you like, grind it with oil. And after you have collected it with the spatula, before finishing to clean the marble, grind stil de grain yellow on it. And you will have a very beautiful green.

Fol. 58r says that grinding it with urine will prevent the verdigris color from "dying."

Painter

... Verdigris and orpiment must first be ground with urine before thinning them with oil. Thus they are beautiful & do not die. ...

Fol. 6r recommends verdigris and turpentine varnish to create green burnished gold.

For laying down and seating burnished gold and giving red or green or blue

... For green, temper verdigris with walnut or linseed oil & grind it, next mix in turpentine varnish and not spike lavender varnish, which is not suitable for verdigris. ...

- Fol. 39v uses verdigris, turpentine, and mastic resin for the background of reverse-painted glass.

Tracing some history on glass

...then you shall fill the background with azur d'esmail or verdigris or fine laque platte ~~platte~~ tempered with clear turpentine, mixed with a little of tear of mastic if you want that the colors are more even & do not spread. ...

Fol. 64r explains that verdigris does not require two layers of application.

Double layer

Verdigris does not die, & thus does not need to be layered twice. But lake & others, & principally flesh colors, ~~the~~ require two layers. Colors hardly change when they are dry.

Fol. 65v states that verdigris has no body and is thus good for glazing, but that it is also harmful to other colors.

Glazing

One commonly glazes with colors that do not have body, such as lake & verdigris. However, to use other colors, one mixes in a quantity of calcined & ground cristallin, which also has no body & makes lightens the density of the others.

Imprimatura

One needs to be quite careful about this, & not make it, as some will, with gold color which is made with the washings of oil paintbrushes, because verdigris & other corrosive colors which are in it will in the end make the colors die that are ~~meu~~ layered on next. It is good to do it with ceruse, & a bit of yellow ocher, & a little massicot, & make it not very thick in order that it does not crack.

Fol. 66r also comments on verdigris' harmful properties.

Or mat

... Gold color that is made of different colors cleaned from paintbrushes for oil is not so good, & with time, tarnishes the gold because of the verdigris. ...

Fol. 105r states that verdigris should be added to certain other pigments to help them dry in oil.

Drying colors

Soot black & others would not dry in oil if one did not put verdigris with it.

Fol. 129r offers ways to color objects cast in metal (specifically, snakes).

Viper color

... Its true color is made with good verdigris ground well with some good vinegar, if it is of lead or tin. And if it is in some place darker, fumigate this first color with sulfur, as you know. ...

Fol. 158v has another way to give color to metal casts (here, leaves).

Colors for green leaves

... For green, the verdigris has depth & is too dark. If it is a yellowish green, you can mix with the verdigris a little yellow ocher & stil de grain yellow. If the green is dark, put with it charcoal of peach tree pits, which makes a v greenish black, in the same way that black of ox foot bone looks bluish. And thus, by judgment & discretion, put the color on the natural flower or leaf to see whether it comes close. ...

This project is maintained by [cu-mkp](#)

