Making Basic Period Pigments at Home

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Contents

Introduction

This class is not intended to be an all-encompassing course on how to make every pigment known to medieval illuminators, nor will it cover how to make or use the more dangerous pigments such as orpiment, realgar, and lead-based paints. Rather, we will discuss how to make a basic non-toxic set of pigments at home, using common ingredients.

Students who wish to explore making pigments further will have several good resources with which to pursue their research. I encourage anyone digging into this field to do so safely, using appropriate personal safety gear, ventilation, and with good research before starting their project.

Safety Rules:

1. Assume any pigment or substance used to make pigments is toxic, whether it is labeled as such or not.
2. Anything ingested or coming into contact with broken skin should be reported to a poison control center.
3. Anything ingested or contacted in enough quantity may be toxic.
4. When creating pigments, utilize nitrile gloves and at least a face mask that filters fine particulate matter.
5. For known and highly toxic matters such as lead, arsenic and such, please utilize higher standards of personal protection.
6. Never work with pigment creating materials around food, children, or pets. This includes keeping food preparation materials separate from your pigment preparation tools, and working in a separate, well-ventilated area from food preparation and child-care areas.
7. Never place any item used for pigment preparation in your mouth.
8. Do not eat or drink while preparing pigments.
9. Cover your work area in a disposable tablecloth.
10. Wash your hands thoroughly with a grease-dissolving soap (such as Dawn dish soap) immediately after removing your nitrile safety gloves.
11. Dispose of safety gloves, masks, and table cover immediately after your work session and seal the trash disposal bag.
12. Pigment preparation often involves creating extraordinarily fine particulates as well as thin liquid films. These may not always be visible to the naked eye.
13. Protect yourself and your family from cross-contamination.

Basic References

Students interested in creating their own pigments like those used in medieval times have many resources available for free on the internet. Others can be purchased for very little through used bookstores or through Amazon used booksellers. The field of research into medieval pigments grows constantly, as researchers have discovered new, non-destructive ways to examine manuscripts and learn the techniques used by our ancestors. Had I taught this class 30, or even 10 years ago, the information would have been vastly different.

Students are encouraged to find a way to access academic research if possible (Academia, JSTOR), as these have rabbit hoes of information I cannot begin to cover in this class. Things like RAMAN spectrometry inspection of manuscripts has taken us light-years beyond what we though we knew about how medieval illuminators worked.

Here are a couple of super geeky spectroscopy examples:

(www.interscience.wiley.com) DOI 10.1002/jrs.2231

The examination of the Book of Kells using micro-Raman spectroscopy

Susan Bioletti,[a]* Rory Leahy,[b] John Fields,[b†] Bernard Meehan[a] and Werner Blau[b]

Appl. Phys. A 92, 203–210 (2008)
DOI: 10.1007/s00339-008-4482-6

Applied Physics A
Materials Science & Processing

L. BONIZZONI[1]
S. CAGLIO[2]
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G. POLDI[2,4]

A non invasive method to detect stratigraphy, thicknesses and pigment concentration of pictorial multilayers based on EDXRF and vis-RS: in situ applications

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[4] LANIAC, Università degli Studi di Verona, via san Francesco 22, 37129 Verona, Italy

Other important references:

Artists' Pigments: A History of Their History and Characteristics (FREE! Downloadable! You really should get these, because FREE! DOWNLOADABLE!)

VOL 1 (Link)

VOL 2 (LINK)

VOL 3 (LINK)

Any illuminator in the SCA should have these three references below. They are simply non-negotiable. They are available for pennies on the dollar used on Amazon. You can also set up Amazon Smile to donate to the SCA, so really there is no excuse.

De diversis artibus Theophilus

Libro dell'arte by Cennino Cennini

Thompson, Daniel V. The Materials and Techniques of Medieval Painting. New York: Dover Publications, Inc., 1956.

While you are shopping, these two books are highly rated by pigmenters. I have not purchased them yet, but they are on my wish list.

The Art of All Colors – Mark Clarke

The Craft of Lymmyng and The Maner of Steynyng: Middle English Recipes for Painters, Stainers, Scribes, and Illuminators (Early English Text Society Original Series) – Mark Clarke

Online and therefore free websites.

If you go nowhere else, visit Master Ranulfr. He is the master of Masters on all things medieval illumination. In addition, he has done card art for Magic the Gathering (among many other things). On his site you can download two Original Treatises on medieval illumination and pigment making (direct links below). This is worth its weight in gold leaf!

A Medieval Artist In The 21st Century - Randy Asplund (Master Ranulfr, SCA) http://randyasplund.com/ Since so many people have wanted to read more about how medieval paints were made and used, I have decided to put the Google Books public domain copy of Merrifield's collection of Treatises from the 12th to 18th Centuries here. This edition dates to 1849 and is the most comprehensive collection in one place. http://randyasplund.com/pages/article/Original_treatises_dating_from_the_XIIth%20Vol1.pdf

And http://randyasplund.com/pages/article/Original_Treatises%20Vol.%202.pdf

****Download both these links for immensely valuable resources on making and using period pigments from the master of masters in the SCA!!***

A Database on Colour Practice and Knowledge https://arb.mpiwg-berlin.mpg.de/node/2

This site has a glossary, mixing guides etc.

Finally, **go to this link**. It is the Yale "Traveling Scriptorium" PDF of swatches from their collection of historical pigments. If you can, arrange to print it out on the highest quality color printer you can locate. Pay for it to be printed at Kinkos, Office Max, Staples, or where-ever you can, if you can. It shows you exactly what color the real colors look like. They sample the historical ones side by side with the ones you can buy at modern suppliers like Kremer. I have one copy. You will see me waving it around in class for a good reason. You want this booklet, but you can't have mine 😊

https://travelingscriptorium.files.wordpress.com/2012/03/scopa-pigment-swatches_web.pdf

Blacks

Black pigment was the first human pigment used, when our distant ancestors put sticks in a fire, burnt the ends and drew on the walls of caves. Today, hundreds of thousands of years later, the cave drawings in France, Spain and elsewhere still resonate with us. The black, red, and white colors are vivid. The handprints echo through time and speak of artists like us, leaving their mark for generations. If you are a little like me, you want to put your hand on that handprint and say, “I hear your brother or sister. I am here, too.”

Black pigments come in three easy to make varieties: Vine black, bone black, and lamp black. Other blacks, such as those made using peach pits, are simply variations on the theme.

Lamp black is simply soot from an oil lamp or even a kerosene lantern or hurricane lantern. Cennini says to get an oil lamp, fill it with linseed oil (*do not use BOILED linseed oil – ask me how I know this!), hold a pane of glass over the flame, and when enough soot has collected, scrape the soot off “with a card.” I assume he means a scrap of stiff vellum. This is essentially the process.

Take a flame – candle, oil lamp, lantern, etc. – place some sort of collection material over it, collect the soot. When you have enough, remove the collection piece (a pane of glass from a reclaimed picture frame from a thrift shop), and scrape the soot into a coffee filter. The soot will be very fine already, usually even smaller particles than talcum powder, so be aware it will get everywhere.

Add a drop of honey or gum Arabic to your muller (not a mortar and pestle), then start mulling in the soot. When the stuff is very gooey, add another drop of binder, then keep adding soot and mulling till you have all your mixture used up and it is all the consistency of very thick paint. Add a teeny drop of water and mull that in very thoroughly. You should now have a blob of deep, jet-black lamp black paint. Scrape it into a small Dinky-Dip type paint pot with a lid for storage. Finished lamp black is a blue-black to jet-black color.

Vine black

Vine black is traditionally made from willow twigs or grape vines. When finished, the black pigment is a charcoal gray-black color rather than a deep black. For both vine black and **bone black**, you will need a hot hardwood fire, such as that created with apple, cherry or walnut wood. You can do this in a metal BBQ grill or in a firepit. Be aware that the cheap pot-metal grills may melt after a few very hot fires (ask me how I know *this*!)

For both vine and bone black, build your hardwood fire and let it burn hot for a while, until there are white hot coals throughout. You should have a while where getting within a couple of feet of the fire is noticeably difficult. Of course, use all applicable fire safety rules! Keep a fire bucket and fire extinguisher handy. The hardwood fire will smell good, too, so if you are a meat eater, plan to have a grill and meat ready to grill ☺ The method for making both vine black and bone black is that of making charcoal. My example is on a smaller scale. You can scale it up by substituting larger sealed containers.

Materials for **vine black**:

- Altoids size tin with a lid, not hinges
- Enough very dry vines to fill the tin completely
- Screwdriver and hammer
- Long tongs and a BBQ mitt

Bone Black

Materials for bone black:

In addition to the above:

- Very dry chicken wing bones, all meat, skin and fat removed (prepare in advance) – broken into pieces to fit the Altoids tin

Process:

- Punch one hole in the top only of the tin. This needs to be the only air vent in the tin, which is why Altoids tins are not the best (their hinges have air space). Other similar mint tins have completely removable lids, and they work better. You can also buy blank/empty tins at craft supply stores and online.
- Fill the tin with your vines or dried bones. Leave as little air space as possible, but make sure the lid still goes on securely.
- Using the tongs, place the tin with the lid up on the white-hot coals. Do not place coals on top of it, and do not place it in the flames or over the flames of the fire.
- Watch the hole in the lid. Especially with bone black, you will soon see a jet of green or purple and green gas coming from the tin. This is the bones off-gassing as they are (essentially)

cremated inside the tin. What you have created with the tin is an anerobic (oxygen-free or oxygen-deprived) chamber. The vines and bones are not using oxygen to burn up (that would create ash) but rather to carbonize and create pigment.

- Once the tin has no more gas coming from it (for bone black) or after about 20 minutes on the white-hot coals (for vine black), use the tongs to remove the tin. Do not open it! Set it aside until it is cool to the touch. Only then can you open it. All the bones/vines should be completely blackened. If they are not, or mostly not, you can close the tin and put it back on the white-hot coals for another round.
- If the vines/bones are mostly blackened, remove them and grind them first with a mortar and pestle and then eventually using your muller. You may need to remove some un-burnt portions from time to time, keeping only the fully carbonized pieces.
- After you have ground and mulled the particles to a very small size, lavage (wash) and strain them to help remove further impurities and uncarbonized pieces. The pieces you do not want will float to the top and you can remove them.
- Continue to mull the pigment combined with binder until you have the paint consistency desired. Keep in mind that you want to achieve pigment particles that are infinitesimal, otherwise your paint will be grainy.
- **Vine black** will create a charcoal-gray black pigment, while **bone black** ends up as a browner black color.

Side note: The hardwood ashes from the fire we are using can be later mixed with water to create potash. **Potash** is **lye** and has many uses – including making some of our pigments, as well as soaps!

Whites

Contrary to our past belief, most white colors in medieval manuscripts were not lead white. This is one of the newer discoveries that science has brought us. Until recently, it was scripture that the whites in the Book of Kells, for instance, HAD to be lead white, because anything else would be too transient to have survived this long.

Chalk

However, non-destructive RAMAN studies have shown the whites to be almost always chalk. This stands to reason, given the prevalence of chalk throughout the British Isles. Other instances of white in manuscripts have been found to be **ground seashells** (simply another form of calcium carbonate), **gypsum**, **lime**, **ground marble** or stone, or even **blank vellum**. Lead white has been found more often used as an under-layer in paintings.

Preparing and using chalk for painting is done the same way now as it was in medieval times. A quantity of the raw material is gathered, ground, washed under water to remove impurities, then left to settle out and dry in vats. The process is repeated until the material is pure and ground finer than talc. Mix it with a binding agent and use. We still use chalk to bulk up modern paint in this manner. The same can be done with ground shells, gypsum or other minerals, although each of those is a sturdier thing to have to grind than the soft chalk.

Reds

Red is another of our primal colors, found in the caves of the ancestors.

Red ocher

They used red ocher; an earth color found around the world. Red ocher was used throughout the Middle Ages and continues to be used as a pigment today.

Preparation is easy. Find the red earth, as it often occurs in conjunction with yellow ocher, wash it out to separate impurities, allow it to settle, grind it repeatedly with washings between grindings to remove more impurities, and eventually mix it with binder to use it as paint.

I find red and yellow ocher easily as I drive in the Midwest, usually where crews are digging along the road to add a drainage pipe. It is soft, nearly the texture of greenware clay, and not at all difficult to

grind. However, as the cave walls will testify, it is very permanent in both powder and liquid form. Keep this in mind when choosing what clothes to wear when you are grinding and mixing the pigment.

The final color can be anywhere from a rich blood-red to a red orange, depending on the amount of iron oxide in the ocher and the level of purification you obtain. In period, there is some evidence they mixed it with other reds to obtain a deeper color, too.

Red Oxide (Rust)

Rust, or red steel or iron oxide, is the essential ingredient that makes red ocher. You can create a purer version, which is also period, by simply making rust and skipping the earth part.

Materials:

- Steel wool
- Water
- Shallow container that is deep enough to submerge the steel wool in water
- Vinegar

Wear gloves (!!! Ask me how I know this!!) to wash the steel wool with dish soap and cleaning vinegar. Rinse it thoroughly. Put the steel wool in the container and fill it completely with water so the steel wool is completely submerged. Let it sit for several days uncovered.

The water will evaporate, and the steel wool will rust away into dust in the bottom of the jar. Scrape out the "rust dust" and store it in a lidded container. To filter out the rust pigments from any impurities, you can use a magnet. Grind, grind, grind them some more until they are pigment-fine. This will create a metallic red color that is best for a pigment glaze or to add to your red ocher to deepen the color and give it a sheen.

Above – red oxide pigment

Note: If you dissolve the steel wool in an oxidizing agent like bleach or hydrogen peroxide, it will oxidize (rust) much faster. Even saltwater is a faster oxidizer than plain water.

Brasilwood

In medieval times, they used Brasilwood to make a red-brown ink and pigment. The recipe for this is in Ceninni and Thompson. I had available to me a sizeable amount of purple heart wood shavings, thanks to a woodworker housemate. Purple heart is of the same family as Brasilwood, with many of the same properties. I wondered if it, too, would make a pigment. Using the Ceninni recipe, I decided to find out.

Materials

- 1-pound dry purple heart shavings to start
- ½ oz. powdered alum
- 2 oz. calcium carbonate (ground and powdered eggshells)
- Strainer, cheese cloth, coffee filters
- Enameled pan
- Several glass bottles (i.e. half gallon milk bottles)

Process:

To extract the pigment, I used water and treated it with potash, alum and calcium carbonate. Add enough water to cover the dry material, boil until the water is half gone. Add 2 oz calcium carbonate and ½ oz powdered alum to the boil, allowing then the water to cool as I removed it from the heat. I stirred continuously the entire time. I then strained the fluid containing the extracted pigment through a fine mesh strainer, leaving a "mash" of the purple heart shavings.

At this point, you have options. If you want red ink, you can simply add some gum Arabic to the liquid until it is the consistency of ink and be done. If you want pigment, you need to dry the liquid. For that, you will need to let it sit in some sort of large, shallow container until the water evaporates. Then, the remaining color is scraped out, ground very fine and mulled with the binder of choice.

Alternate methods:

Recipe 2: Extract the pigment from the plant material using lime water. Pour the lime water over the shavings until they are completely covered, leaving them to soak until the color comes out. Heat the entire thing and then strain it through a cheese cloth to remove all the shavings. Take equal parts finely ground chalk and alum and mix them in thoroughly with the liquid, making sure none of them remain on the surface. Let the mixture stand until the water is clear is the added substances have settled. Decant off the liquid. The remaining solids at the bottom contain your pigment substance. It can be ground and used with an alum solution or a thin gum Arabic solution for painting.

Lime water recipe: Soak 100 gm calcium hydroxide in 2.8 liters distilled water for 2 weeks. This will provide a 3% solution of lime water with a pH of 12. Filter it before using it.

Recipe 3: Add about 1 pound of finely cut plant material to a boiling pot of water. The water should be enough to just cover the shavings. Boil until the water is reduced by half. Add a pound of alum and let it boil until the mixture becomes red. Remove it from the fire until it is cool to the touch. Add a strong lye solution (i.e. the potash from your hardwood fire, above, very well strained until there is no particulate matter remaining).

According to the ancient recipes, this will give "a very red color such as the cardinals wear" if one is using Brasilwood. Boil this mixture until the liquid is reduced by 2/3. Let it cool, then strain out the plant matter.

Above: Brasilwood extract - https://woolery.com/brazilwood-extract.html?gclid=Cj0KCQjw3uboBRDCARIsAO2XcYB6eE1pVO5hbY_wZWRJef7li6TdvvhOZsYWeVgGC30NR8jX5-96_MsaAhLqEALw_wcB

Recipe 4: This recipe is from a later Bolognese manuscript. It recommends soaking the Brasilwood "in lye as strong as you think proper" for three days. Next, boil the mixture in a glazed (enamelware) pot over a slow fire until it is reduced by ¼. Add some alum and mix it in thoroughly and let the mixture cool. Strain the mixture thoroughly and let it evaporate down.

Recipe 5: This Brasilwood recipe comes from a mid-15th century German text. It is said to give a rose-pink pigment rather than a deep red color. It mixes the pigment extract from the wood with some form of calcium carbonate like chalk, ground marble, etc. or sometimes gypsum, plus alum. The pigment itself is extracted from the wood using water, alkali (lye), vinegar, wine, or a mixture of those.

Note: You can re-strain the mash several times to get out more pigment, eventually using cheesecloth to squeeze out the drippings. I had to strain the fluid multiple times to get out all the debris, each time using a finer mesh and eventually straining through cheesecloth and then coffee filters. The liquid color was a deep wine red!

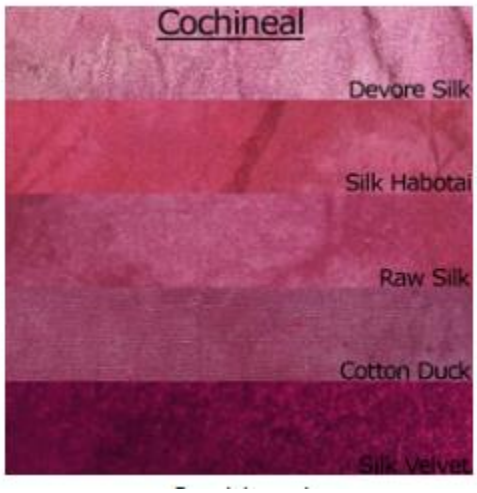
Above: Cloth dyed with Brasilwood

Above: Yarn dyed with Brasilwood http://www.wildcolours.co.uk/html/brazilwood_dyeing.html

Second Note: I learned from my friend that purple heart wood (also Brasilwood) darkens when exposed to sun. The next batch I decanted using a lye method like that used to make walnut and oak gall ink and had the decanting bottle sitting in the sun to darken the liquid. This produced a spectacularly good result.

Third Note: I also learned that **beech trees** have a similar thing going on, but produce a more purple pigment, as they take up magnesium in the soil. When this is released via the extraction process, the pigment is more purple. I have not yet verified this.

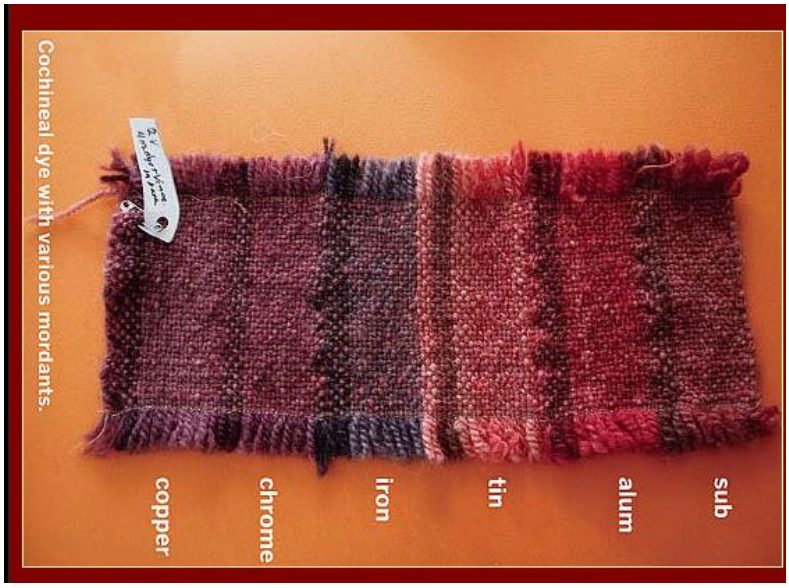
Kermes/Cochineal: These insects are used to make the very red color carmine. They are still farmed and available today.



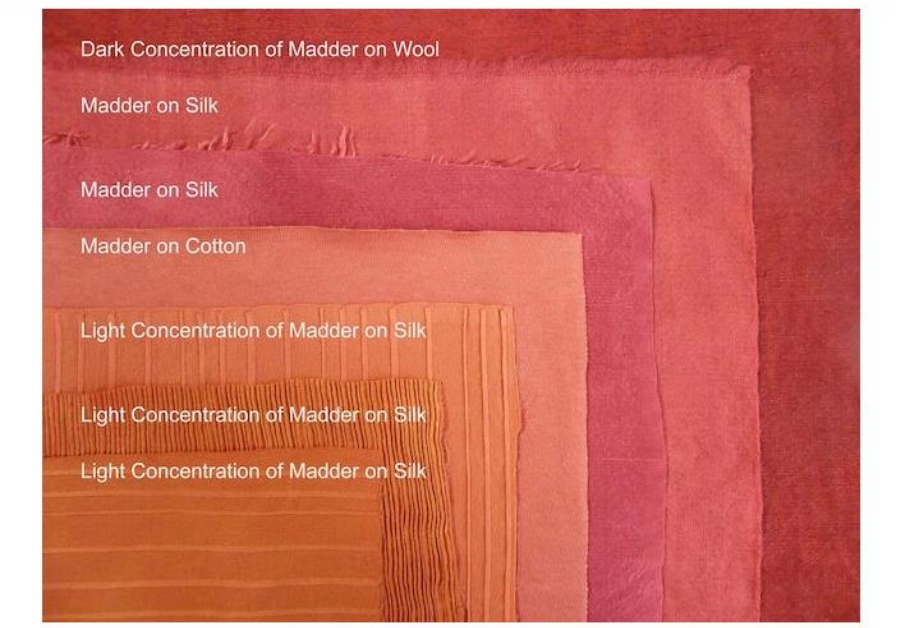
Cochineal – above https://www.dharmatrading.com/dyes/cochineal.html?lnav=dyes.html

Dyeing wool with cochineal: It takes about ¼ million kermes or cochineal bugs to make 1 kg of dye. They are boiled, removed, ,dried and powdered to make the dye. Add 1 kg of the powdered dye to warm water and stir until it is the consistency of milk. Add 280 g (10 oz) tartaric acid and a heaped cup of dye salts. Stir in and leave the mixture for 12 hours, stirring occasionally. It will expand and thicken. Add this mixture to 35 litres of warm water, remove all the lumps, then heat and simmer for 15 minutes.

Add previously mordanted wool fabric (I would assume the same for other fabric). Simmer the fabric for 30 to 35 minutes, then cool and rinse the fabric until the water runs clear. Hang the fabric to dry in the shade. The process will yield a bright red fabric that is color fast. The dyebath can be reused until all the color has disappeared. http://www.azerbaijanrugs.com/arfp-natural_dyes_insect_dyes.htm



Madder**:** Madder roots produce a rose-red color for textile dyes and pigment.



Above – Madder. https://botanicalcolors.com/2018/10/05/feedback-friday-this-week-in-natural-dye-questions-69/

Yellows

Many of the yellows used in period were lead- or arsenic based. Another used later in period was **Indian yellow**, made from the urine of cows fed solely on mango leaves.

Yellow ocher

For the purposes of this class, however, yellow ocher is the primary yellow available. As with red ocher, yellow ocher is an earth color. The instructions for preparation are the same as with the red.

Plant dyes

Recent non-destructive studies have found, however, that many manuscripts used plant-based dyes and pigments for yellows. These were prepared just as textile dyes, and then stored on clothlets (small pieces of linen) until needed for painting. The pigment dye was then mixed with a binder and perhaps also something like alum or chalk to give it body.

This is an area of research that is new and opening many avenues for study. Lichens and flowers all give many more options for yellows than ocher alone-and provide answers to the vast color array seen in early manuscripts. Certainly yellow lead and arsenic were used, and in great quantities, but not exclusively. Yellow ocher was also used very frequently, especially in early works.

Above – lambswool dyed with **tansy**. http://midgaardshave.com/tansy-experiments/

Above- yarn dyed with **weld**. http://www.wildcolours.co.uk/html/weld_dyeing.html

Blues

Ultramarine

Mineral blues such as ultramarine are one of the areas we are finding great revelations thanks to RAMAN and other new technologies. It used to be "known" that ultramarine was the blue that was used on the Book of Kells, for instance. Now, however, we find it was not used at all! The blues in Kells are woad and indigo! How those plant-based dye pigments have lasted over 1200 years is something scientists are still working to understand.

Above – ultramarine blue pigment

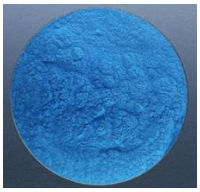
Azurite

Ultramarine comes from lapis lazuli, a hard-semi-precious stone found only in Afghanistan, Russia and South America. It is difficult to process and the cost in the Middle Ages was often more per ounce than gold. As such, illuminators often used mineral pigments made from azurite or other stones that were less expensive. Any mineral pigment will involve the general process of grinding the stone into very fine particles, removing the impurities, and eventually mixing the particles with a binder to form pigment.

Above – azurite blue pigment

Egyptian Blue

However, we have many ways of making and using some of the non-mineral blues used in period, too. Short of growing your own indigo plants (which would be awesome) and setting up indigo vats, we can make Egyptian Blue (used up until about the 8th century AD) and blue folium (turnsole). However, these involve growing plants or creating a very high-heat kiln.



Above – Egyptian Blue pigment https://shop.kremerpigments.com/en/pigments/kremer-made-and-historic-pigments/4405/egyptian-blue

Woad/Indigo: Both plants are still farmed and available today for dyes and pigments. Indigo is the color used for denim.

Above - Woad. https://blogs.brighton.ac.uk/inkdyegarden/tag/woad/

Each dip accumulates more pigment on the fabric. This stepped cloth shows the saturation from 0-10 dips in an Iron Vat.

Above -Indigo. http://www.grahamkeegan.com/indigo-vat-basics

Roman Blue Vitriol

Roman Blue Vitriol is copper (II) sulfate $CuSO_4$

It resides disguised on the shelves of your hardware store as a fungus killer for the garden. All you need to do is pour, grind, filter out impurities, and proceed. Hard to believe.

Grind the slightly moist granules – they turn much lighter blue as they dry. Add water to strain out impurities. Allow to dehydrate, the grind and mull again.

Greens

After the bad news about blues, the good news is that greens are a lot easier to replicate. Of course, malachite green, a mineral pigment, is notoriously difficult and dangerous to grind and manufacture. However, several non-mineral greens were used throughout the Middle Ages.

Terre Verte

Terre verte, meaning literally green earth, is a green clay found throughout Europe and the Americas. It was used by many cultures as a pigment. Preparation is as simple as locating the clay, collecting and drying it, washing it under water to remove impurities, filtering/straining it, dehydrating it and grinding it into pigment to mix with a binder. The process is unchanged since ancient times.

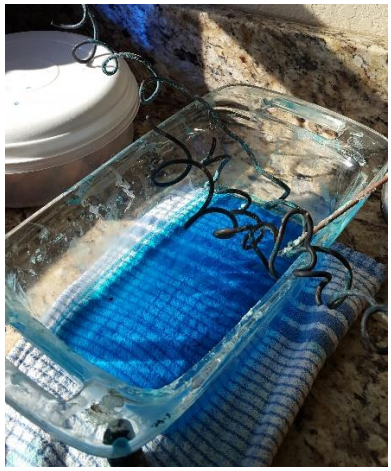
Above – Terre Verte https://www.naturalpigments.com/verona-green-earth-pigment.html

Verdigris

Verdigris, or copper green, is created by the oxidation ("rusting") of copper. It is the patina you see on copper domes and weathervanes. Since nature makes it already, you can guess it is simple to make at home.

Materials:

- Shallow glass pan
- Cleaning vinegar (regular vinegar works, too)
- Salt
- Flat strips of copper from the hardware store (Copper tubing, copper wire, etc. also work)



Process

Pour cleaning vinegar in the pan and stir in some salt. Lay the copper pieces in the pan until they are submerged completely. Leave them there a day or so, then take them out and lay them across the top of the pan to drip dry or lean them in the pan so they are partly submerged. Watch the verdigris crystals grow on the copper and watch the vinegar solution turn a beautiful teal/aqua green. When your copper is covered in verdigris, scrape it off. Repeat until you have enough verdigris to grind into pigment.

Others recommend boiling the vinegar and suspending the copper over the "vapors" (steam) of the vinegar. This works, too. I just don't like the smell of boiling vinegar all over my house.

I have made verdigris using a glass milk bottle filled half-way with the vinegar solution. I put thick copper wire from the hardware store in the bottle, and let it sit. The verdigris crystals grew up the wire. I would scrape them off from time to time.

Grind the crystals very fine, then mull them even finer than you think you need to.

NOTE: Verdigris does not do well with an egg tempera binder. The egg (yellow) makes it turn a nasty goose-poop green brown. I don't yet know if glair (also egg protein) will do the same thing.

Second Note: For a deeper, bluer "Sea Verdigris" – add more salt to the vinegar mixture. This changes the basic verdigris -- copper carbonate, ($Cu_2CO_3(OH)_2$) into basic copper chloride ($Cu_2(OH)_3Cl$). Instead.

Browns

Browns you can make at home include oak and walnut gall ink and pigment, using the extraction techniques mentioned above for Brasilwood. You can also find brown ocher earth pigment clays from time to time and prepare them just as you would red or yellow ocher. Other clay or earth-based pigments include umber and sepia. As mentioned before, bone black produces a warm, brown-black tone. Many times, browns were made from mixing other colors.

Above – brown ochre pigment https://shop.kremerpigments.com/en/pigments/earth-pigments/4997/brown-ochre-light

Above – raw sienna pigment https://shop.kremerpigments.com/en/pigments/earth-pigments/5011/raw-sienna-brownish

Above- burnt umber pigment https://shop.kremerpigments.com/en/pigments/earth-pigments/5042/burnt-umber-brownish

Purple

Orcein: New research shows that the lichen used to produce orcein dye is what was used to create the purples in the Book of Kells. This, along with turnsole/folium, are the primary sources of purple in early manuscripts. Don't let anyone tell you purple is not period in early manuscripts! It is, and it is a vegetable dye that has remained vibrant for over 1000 years! It is also a stain commonly used today in microbiology to stain cells for study in the lab.

Above – Orcein Purple from the article below:

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The Politics of Purple: Dyes from Shellfish and Lichens

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