

## Translation:

I would like to share your work in the following order: base material, color transfer agent, and coloring material. First of all, how do you prepare the base material, linen cloth for painting, or paper for drawing or painting? Do you do the work yourself?

I prepare everything in my studio with help from my assistant. I use a high quality Belgian linen which is usually stretched and glued to a wooden panel and sometimes a light weight modern panel for works over two meters. Also for large works, I stretch the linen on a wooden stretcher frame. In order to glue the linen to a panel I usually use hide glue (100 grams to 1 liter of water). With stretched linen, the linen needs a first preparation of dilute rabbit-skin glue which also tightens the linen. I usually do not need to prepare paper since I use either arches or Fabriano papers (300 gram) for drawing or rag paper for small studies with natural mineral pigments in rabbit skin glue, or casein. If I use silver point for drawing (this was common before the invention of the graphite pencil) then I apply a thin layer of gesso (see next question). What is the difference between your painting ground and that of Renaissance painters? There is little difference. The most common gesses were with natural whites such as gypsum or chalk and marble dust mixed with a hide glue. My personal choice is with an extra white marble dust mixed with a rabbit-skin glue. The glue is prepared by soaking pieces of glue in water overnight and then warming the swollen glue pieces in a double boiler until it is all dissolved (40 grams glue to 1 liter of water). Once the linen has received the first coat of hide glue, the warm gesso mixture is applied and brushed onto the linen. With linen that is glued to a panel, a roller can be used. On stretched linen, I usually have two to three thin layers and when each layer dries, it is sanded to make it smoother. With linen glued to a panel, I may have more layers due to the weave of the linen especially if I am going to apply gold leaf. Once the preparation is complete, I let the canvas stand for a week. There seem to be several ways to paint by mixing oil and resin as a vehicle.

Please tell us the reason for mixing these and the color additives you currently use the most and their recipes. Not only will it be necessary advice for oil painting students, but it will also contribute to broadening the concept of colorants for painting students.

The European tradition developed quite differently from the Asian and Persian traditions. Instead of just hide glues or gum Arabic and tragacanth, other binders offered interesting alternatives such as diluted egg yolk and egg white, casein from the curds of milk and a variety of oils such as walnut, linseed and poppy seed as well as the fir-balsam resins such as Strasbourg and larch which were also used for the distillation of the diluent turpentine. Due to the refractive index of the pigment some colours appeared quite different in different binding mediums. For instance, with lazurite from lapis lazuli in a fir-balsam resin and drops of walnut oil, I usually build 5 to 6 layers from small to large particle to produce an amazing deep blue. With this greater range of binding mediums with the natural mineral pigments there were many more problems such as the discoloration of some colors in oil. This became one of the main issues of my research and took three years to solve.

I realized for the first time how different the pigments used in Renaissance European paintings were from tubes of modern oil paints, which use synthetic mineral pigments, which are dry pigments bound in oil or acrylic.

When one goes to a museum either in the U.S. or Europe, the works of Renaissance artists are often separate from the Impressionists and twentieth century and modern works. With the industrial revolution in the 19th century artists' colors changed dramatically from natural minerals pigments from rocks and crystals to chemically produced pigments stored in tubes. What is the difference? The answer is pigment particle size which produces a different chroma. For instance, lazurite from lapis lazuli may have a workable particle size from 10 to 80 microns where as French ultramarine will only have one particle size between 1 to 2 microns (1 micron is a thousandth of a millimeter). At present, the Metropolitan Museum in New York has recently rearranged its European galleries after restoration of the skylights. In one room an El Greco painting is shown next to a Picasso. Unfortunately, the red of the Picasso is rather dead where as the colors of the El Greco seem to glow with light. Analysis of binding media, often in many publications, shows that the binder was linseed oil containing traces of fir-balsam resin or pine resin. Indeed, this question of binding medium analysis from the conservation literature was difficult to resolve because pigments such as azurite (blue), malachite (green) and even lazurite (blue) usually discolored quite badly in oil alone. The clue was "traces" of pine resin. After 500 years, the volatile elements of a binder would read quite differently compared to fresh paint. The Vienna University of Technology in Austria carried out seven year aging tests of azurite in many different binding mediums for me and the results showed quite clearly that the pigments of low refractive index remained stable in a diluted fir-balsam resin with drops of walnut oil. I have now documented which binders can be used with each pigment.

Could you please tell me more about where you purchase the ore and the current process of your assistant's work? Readers may be curious about this part. To be more specific, please explain in detail the process of turning the three mineral pigments: stone sulfur (yellow), stone (red), stone blue (blue), and stone (green) into pigments.

The Renaissance artist was more limited in the purchase of minerals and pigments. Today we have the Internet and many mineral dealers generally sell to collectors of crystals. Some rocks I find on eBay and some of the natural ochres I have collected myself in the field. The argument about the limited range of natural colors is for me irrelevant. Of course, if you only buy your ready-made natural minerals from the few producers and art shops, there is a limited range, but if you crush and prepare your own colors, the range of rocks and crystals on this planet is unlimited. One does need to understand the basic chemistry and refractive index of the pigment. Then there is the scale of hardness (the Mohs scale 1 (soft) to 10 (hard)). For instance, the golden yellow of orpiment and the orange of realgar are relatively soft. The reds of cinnabar from orange red (small particle) to deep red (large particle) is also quite soft. Azurite on the Mohs scale 3.5 to 4 is fairly hard with small particle pale blue to large particle a beautiful deep blue. Lapis lazuli is quite hard, on the Mohs scale between 5 to 6). With each color you need to have a variety of pigment particle sizes. After the initial crushing with a pestle and mortar, the sieved powder is levigated with a weak solution of casein. This separates the large and smaller particles and removes impurities. The water is poured off and the pigment dried. If the particles are still too large they are ground down further and levigated again. One needs patience!

I heard that there is a difference in the processing method of Azurite and Lapis Lazuli. Please briefly mention this. As mentioned, azurite like most other pigments is levigated with a weak casein solution. The rocks of lapis lazuli are chemically quite complex. The most well-known method of extracting pure lazurite from the crushed rock is in Cennino Cennini's "The Painter's Handbook" of 1395. It is a complex method using resin,

wax and oil. In 2017, I published my protocol in "Renaissance Mysteries" using a warm lye solution and magnet to remove pyrites followed by further casein levigations.

In the East, Azurite was mainly used, but this seemed to be because Azurite did not go well with oil and did well with glue. What do you think of this view?

In both Asia and Europe hide glues were used for works on paper. In Asia silk required a water based binder where as the development of the use of wooden panels and linen prepared with gesso allowed the use of oils and resin which are unsuitable for paper and silk. The use of resin and oil with azurite in Europe was not consistent. There were differences between the Flemish and Italian artists with some works with azurite in oil alone discoloring. It was common knowledge that adding a little lead white to azurite generally stopped the discoloration.

This is a part about the techniques you use when painting with mineral pigments. Please tell us about the method of painting by stacking/layering primary colors (intermediate color technique) and the method of drawing by mixing other colors in advance on a palette (color mixing technique).

Generally, the layering of colors is preferable to mixing. The main reason is to do with pigment particle size. First of all, in order to obtain chromatic depth (that is the effect of light passing through semi-transparent layers of paint and being refracted and reflected back from the white gesso ground), the first layer should contain the smallest particle size. This first layer is often with a water based binder. This layer is sealed with a dilute resin-oil. The particle size of each subsequent layer is then increased slightly. For instance the blues of azurite and lazurite often require five to six layers to achieve a full chromatic intensity. Likewise with malachite, chrysocola and green jasper. Pigments of higher refractive index such as orpiment, realgar and cinnabar require fewer layers. With resin-oil binders usually one needs one to two days to let each layer dry. In order to mix pigments one has to have the same particle size. I rarely mix pigments. One exception is with purples which are generally limited to gem stones. Purpurite varies between purple-brown to dark brown. Therefore, a medium size particle of lazurite from Lapis lazuli mixed with a very small amount of medium red cinnabar can produce a powerful purple.

What are some Western dye pigments? Before the discovery of the New World, Kermes was the most common red dye which was replaced by cochineal. Otherwise, there are a variety of red dye pigments from the madder roots and indigo as a dark blue. Links in the article:  
<https://www.youtube.com/watch?v=MBhJP0OqqkE>  
<https://renaissancemysteries.com>