



Preparing to Paint and Painting in Distemper, Tempera, and Oil

Dr .Erma Hermens, 2016

Please note: this presentation has been superseded by subsequent research. Please seek out further research – this presentation is intended for consultation only.

Workshop Drawings,
Transfer methods,
Underdrawings



The Drawing Academy of the Goldsmith, Baccio Bandinelli, Eneo Vico, c.1540-67



Filippino Lippi used one of his assistants as a model

Filippino Lippi (Florentine, probably born 1457, died 1504)
Standing Youth with Hands Behind His Back, and a Seated Youth Reading, ca. late 1470s–early 1480s
Metalpoint, highlighted with white gouache, on pink prepared paper (24.5 x 21.6 cm), BM



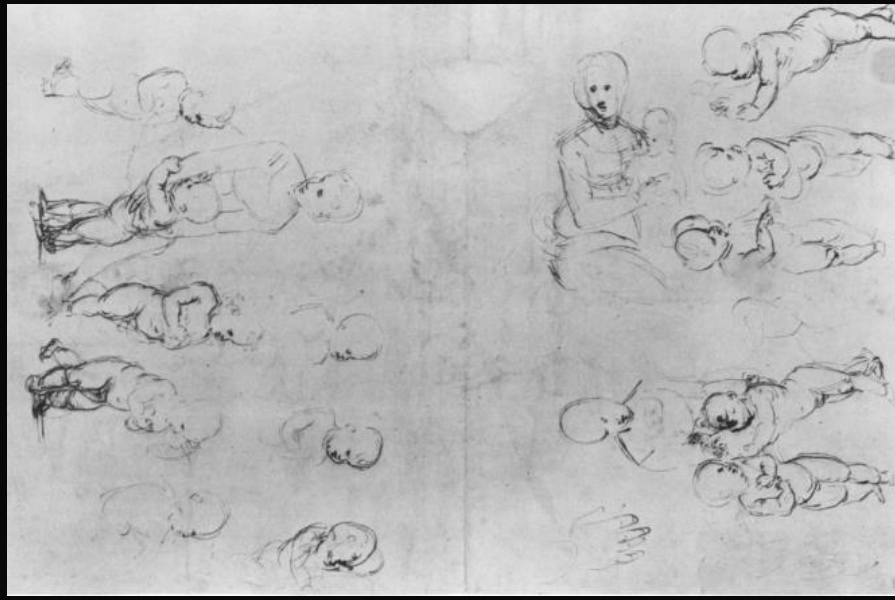
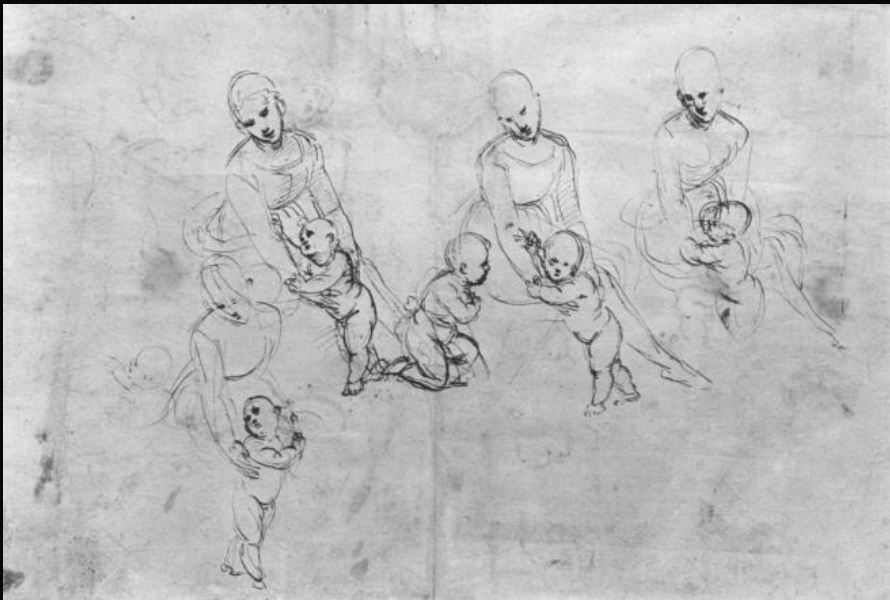
Michelangelo, Study for the drapery of the Erythraean Sibyl, 1508-12, brown wash with dark brown ink over a black chalk under drawing, British Museum, London.



Leonardo da Vinci, Drapery study, c. 1470, Brush and grey tempera on "tela di lino" prepared in grey, 26.6 x 23.3 cm Louvre, Paris.



Giovanni da Modena |
Procession, detail of | 1410-
20 | Traces of black chalk,
pen and brown ink, brush and
brown wash, white
heightening, on blue laid
paper, with some pricking |
342 x 460 mm | Kupferstich-
Kabinett | Dresden



DESIGN FOR PAINTING



Raphael (Raffaello Sanzio or Santi) (1483–1520)
Madonna and Child with the Infant Saint John the Baptist; Study for the Right Arm of the Infant Saint John (upper left); Study for Drapery (upper right), Red chalk (22.4 x 15.8 cm), Metropolitan, New York

SQUARING



Correggio (Antonio Allegri) (Italian, Parma, died 1534)

The Annunciation, ca. 1522–25

Pen and black ink, brush and gray wash, highlighted extensively with white gouache squared in red chalk, on pink-washed paper (9.5 x 17.2 cm)

Metropolitan Museum new York

SQUARING



CARTA LUCIDA



Three nude men
standing, after Pollaiuolo;
Pen and brown ink, on
vellum 1448-1498

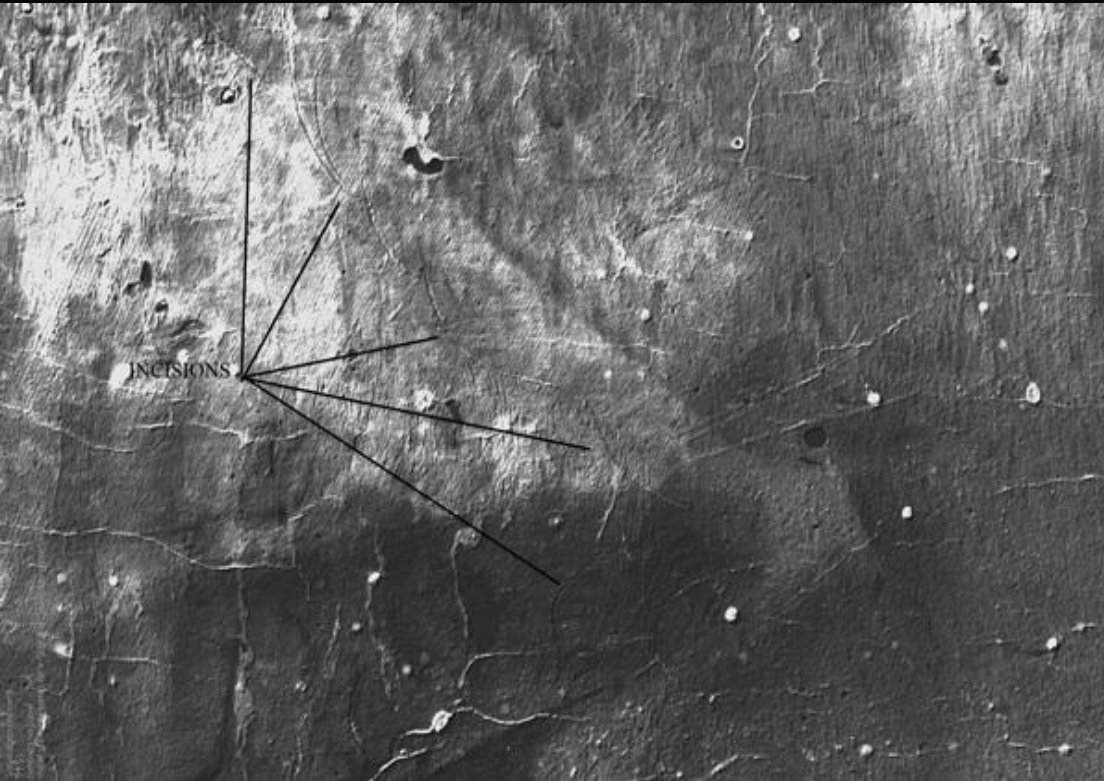
Cennini describes to make carta lucida by soaking sheets of paper or parchment with linseed oil, or making a transparent film by pouring hot fish glue onto a polished stone and allowing it to solidify, Da Vinci describes this as well and notes how, after use, you can sponge off the drawing
Raffaele Borgini (Il Riposo), describes both methods as well..



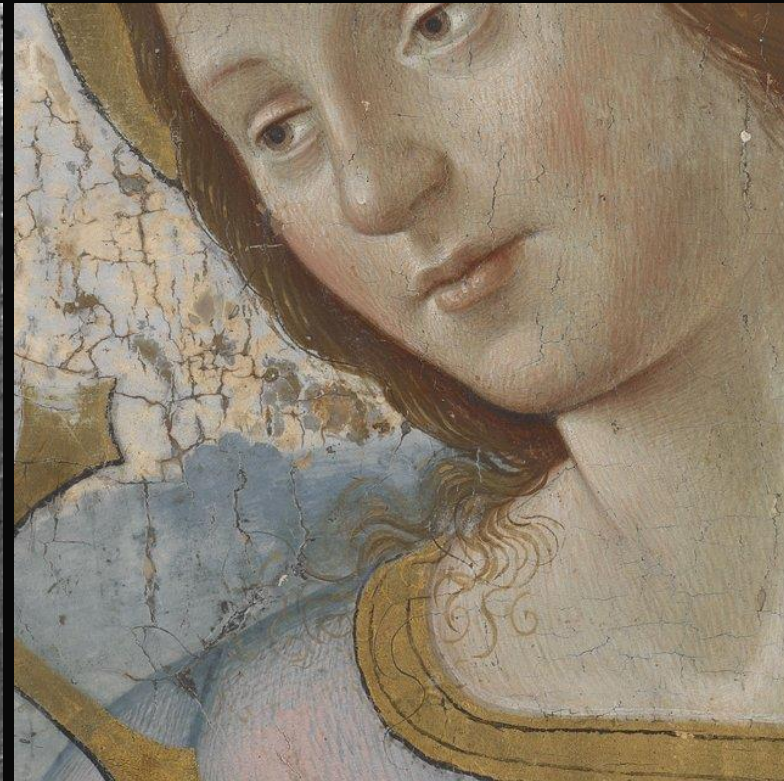
Anonymous, 16-
17th century?,
Figure of a horse,
Gabinetto Disegni
e Stampe Uffizi.

Paper here is no longer transparent, and has not got the heavy consistency of oil. Likely that an essential oil was used: turpentine as in the Paduan manuscript (*Ricette per far ogni sorta di colore*) where *oilo di abezzo* (turpentine) is recommended: the volatile essential oil distilled from pine resin.

INCISIONS



Incisions made using a stylus or other sharp tool, seen in raking light



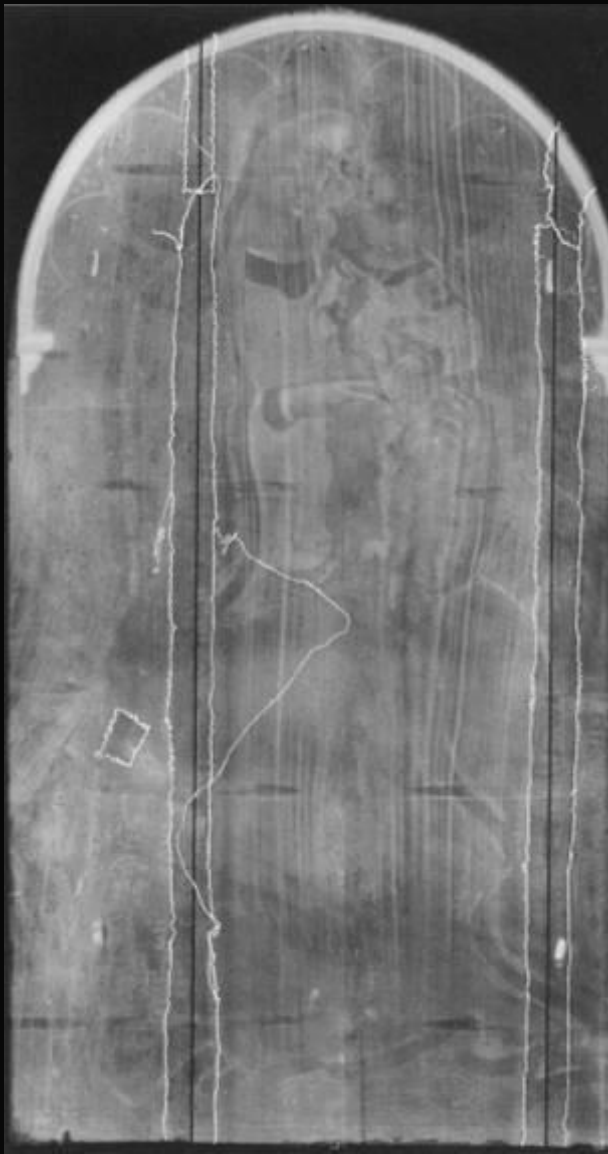
Detail Sebastiano Mainardi altarpiece, Indianapolis Museum of Arts.

SPOLVERO



Renaissance

Tempera, *tuchlein*, and distemper



X-radiograph



Andrea di Bartolo, 1387-1428,
Sienna, ca. 1415, egg tempera on
panel, 110 x 59.5 cm

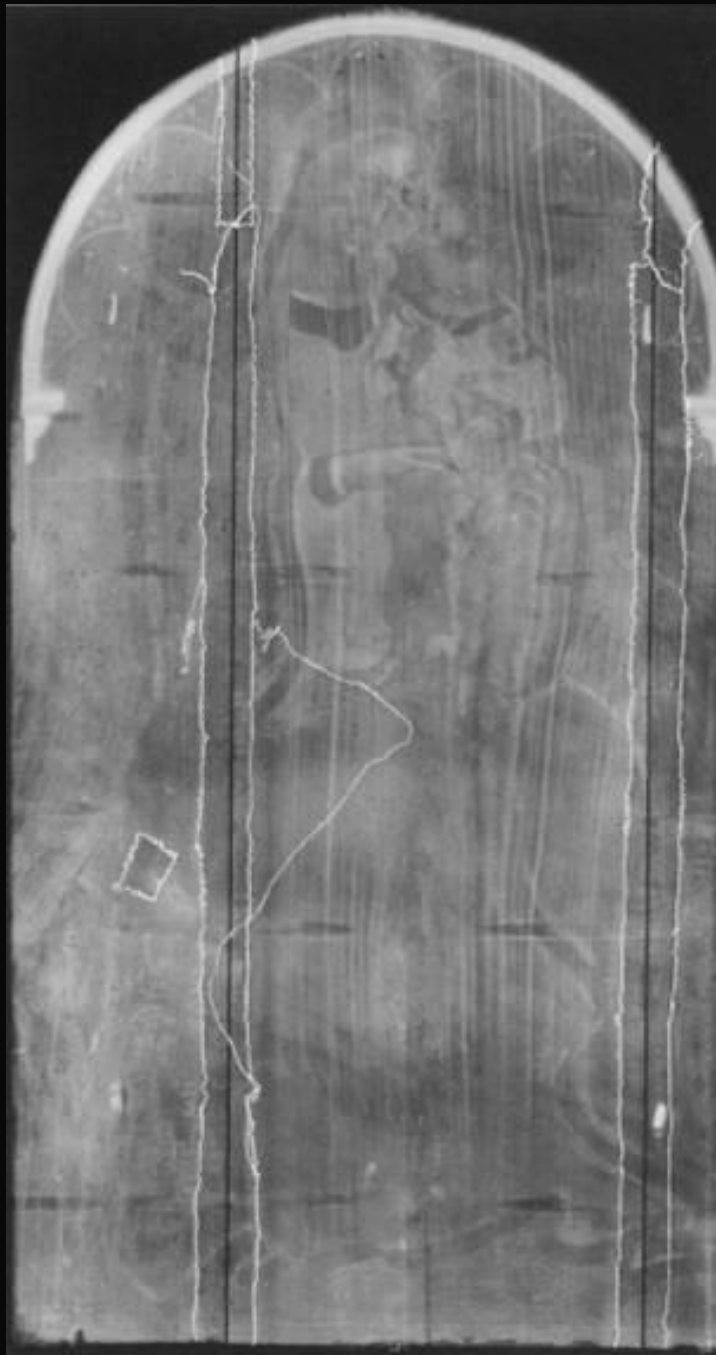
The *Madonna and Child* was pieced together from three planks of poplar, reinforced with wood dowels placed across the joins before the planks were glued. Linen strips were applied over the joins.

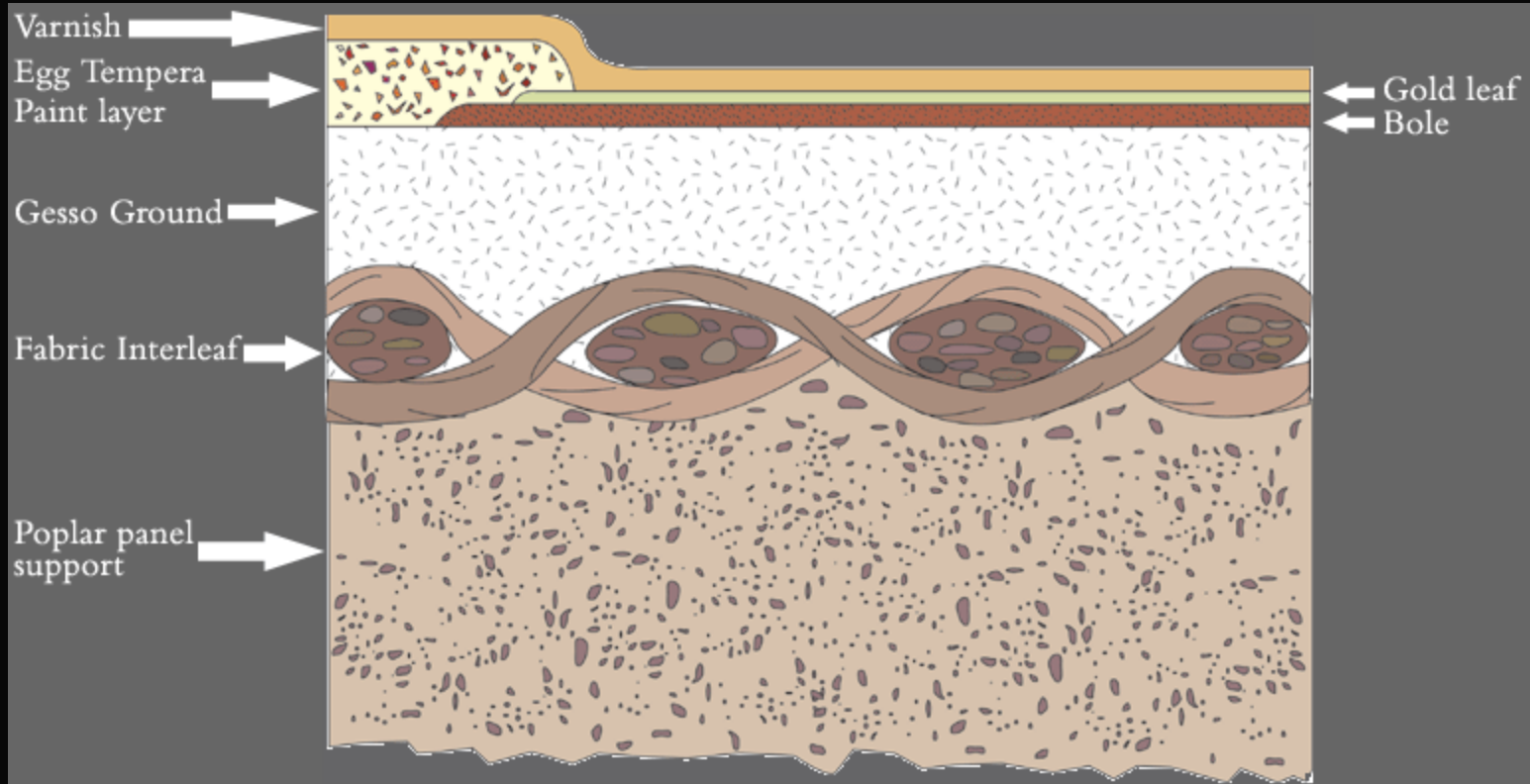


Reverse of panel

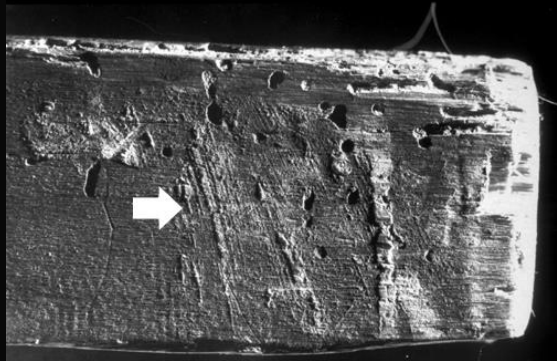


toolmarks





Gesso



Gesso grosso: anhydrite from of calcium sulphate produced by heating lumps of mined calcium sulphate in a kiln to remove the water molecules.

Often mixture of anhydrite and dihydrate [contains 2 molecules of water]. Probably due to the uneven heat in early Italian period kilns.

Cennini mentions gesso grosso Volterriano as a form of alabaster (natural gypsum dihydrate). If this is fired on moderate heat, it converts to hemihydrate, so-called plaster of Paris.

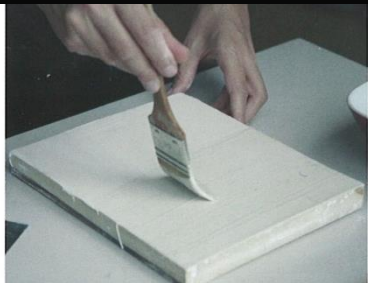


Applying gesso grosso



‘Slaking’ gesso grosso: ...some of the same gesso but purified for a whole month by being soaked in a bucket. Stir up the water every day, so that it practically rots away and every ray of heat goes out of it and it will come out soft as silk’.

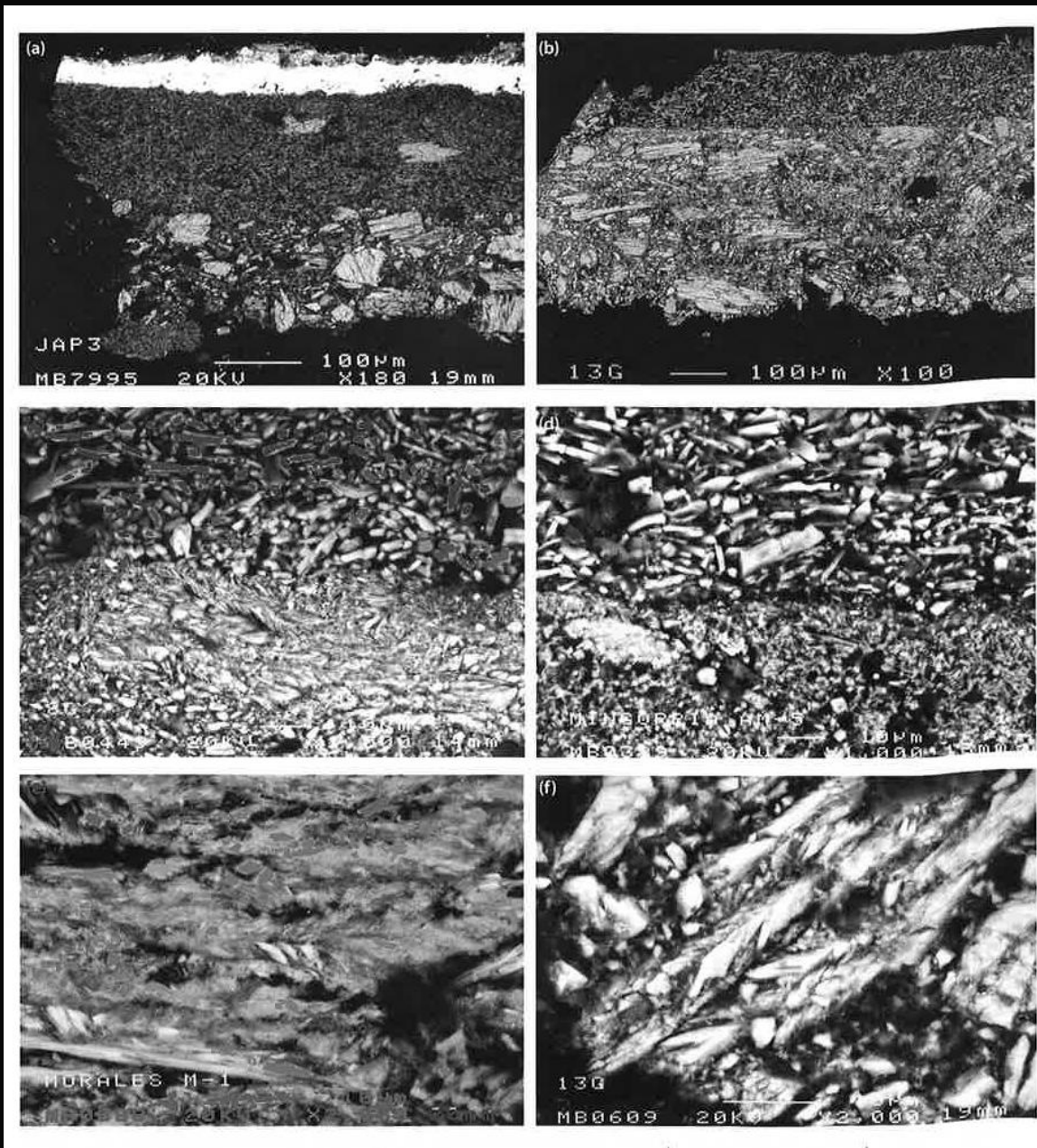




Dry loaves of gesso sottile are soaked in water and then ground very fine

They are then placed on a cloth and water pressed out of them. The small damp loaves are put in a bowl and mixed with glue

The mixture needs to easily run off hands, then it can be brushed on the gesso grosso layer and rubbed out/in with fingers.



- a. Altarpiece, 16th C, anonymous, Burgos
- b. B. Gypsum (*lapis specularis*) heated at 300 o C (gesso grosso) and corresponding gesso sottile.
- c. Altarpiece, anon. 16th C, Avila
- d. Gypsum heated at 110 oC and corresponding gesso sottile
- e. Piety, altar piece, attr. Luis Morales, 17th C, gesso grosso detail
- f. Gesso grosso prepared from *lapis specularis*.

Lapis specularis is a variety of gypsum (selenitic) that forms crystal sheets

Calcined gypsum:
 anhydrous, mixing with water: slaking > sottile

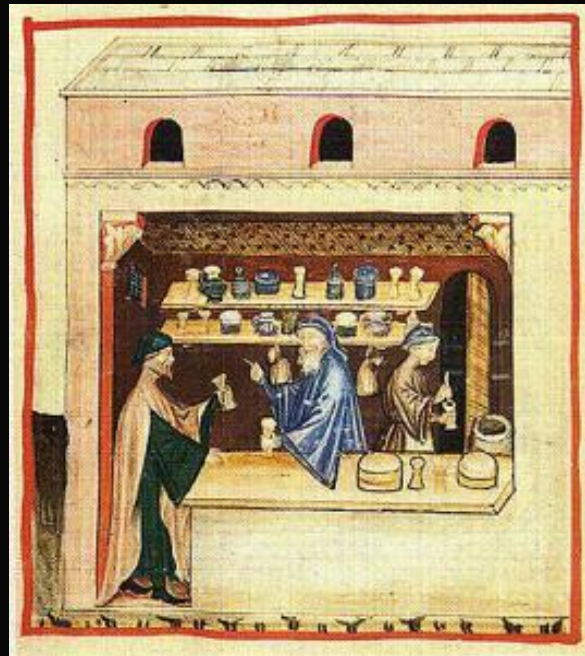
Das Keigister



Auree alexandri an dem
 lxxxviii. blat
 Abdiana. cccxxxix
 Acosi conditi. ccliiii
 Acaristum. cccxxxix
 Arsanasia magna. cccxxvi
 Antidotum emagogu. ccl
 Aromatici rosati descriptione Gabuensis.
 cccxii
 Aromatici rosati Desue. cccviii
 Aromatici gariofilati. cclix. vnd. cccvi
 Aromatici muscati. cl. vnd. cccxvi
 Aromatici nardini. cliiii
 Acetum squilliticu. cclvii
 Benedicta. ccclii
 Blanca. cccxxxix
 Conditum de aconis in A
 Conditum de bancia. cccxxxix
 Conditum de citro. cl
 Conditum febulis. cclvi

Illustration of an apothecary lesson

Hieronymus Brunschwig, Liber de Arte Distillandi de Compositis, 1512



And this gesso is sold to us painters by the apothecaries' (Cennini, Ch. CXVI)

Apothecary, c. 1400, Tacuinum Sanitatis, Vienna





Florence, ca. 1450,
Apothecary

Tempera Egg!



- Egg has probably been used as a binder for pigments since antiquity: it is mentioned by Pliny the elder (ad 23/4–79), its use has been identified on some Roman Faiyum portraits and it was, and remains, the principal paint medium for the icons of the Greek and Russian Orthodox churches. In Western painting the technique is particularly associated with Italian panel paintings from the 13th to the 15th centuries, although the medium was widely used throughout Europe.



Preparing the egg binding medium only using the yolk



Mainardi altarpiece details showing the paint handling in egg tempera using tiny, hatched brush strokes

Early
use of oil



*Tresfjord
church,
Norway, ca.
1325-1350*

Pine wood, chalk and glue ground, silver leaf plus yellow glaze for 'gilding'.

Pigments: azurite, verdigirs, orpiment, yellow iron oxide, yellow lake, vermillion, red lake red lead, red iron oxide, lead white, black. Binding medium: drying oil.



Tingelstad I (ca. 1275-1300) frontal

[Unn Plahter](#), [Erla B. Hohler](#), [Nigel J. Morgan](#), [Anne Wichstrøm](#), Painted Altar Frontals of Norway, 1250 - 1350, Volumes 1-3, Archetype Publications, London, 2004



Gilding: silver leaf with yellow lake oil glaze.



X-radiograph showing construction, poor quality wood with knots, filled with chalk and glue



Detail, showing the crackle due to the use of a drying oil. Layers with azurite and ultramarine, and orpiment contained an egg tempera/oil emulsion.





Jan (en Hubert) van Eyck, Ghent Altarpiece, Ghent Cathedral, 3.5 x 4.6 m, c. 1430-32

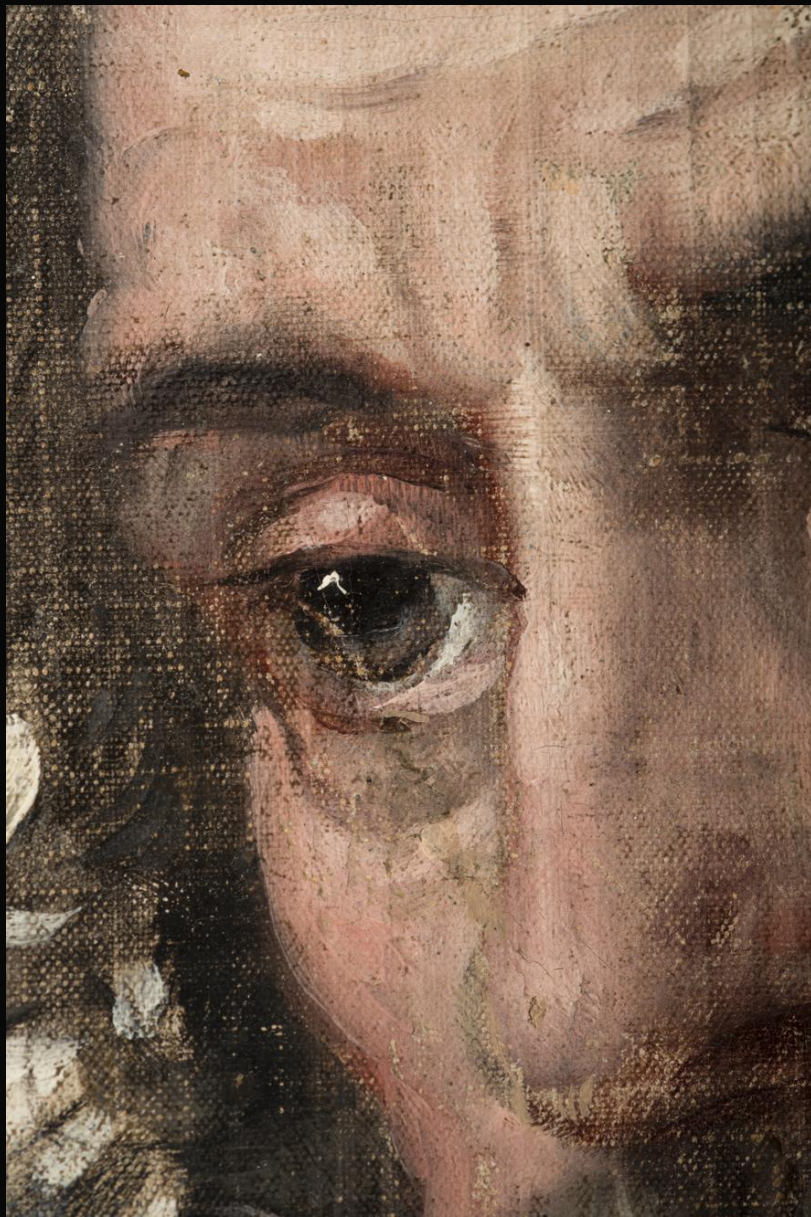




Maerten de Vos, oil



Mainardi altarpiece tempera



Maerten de Vos, Saint Paul,
Cuautitlán, Mexico



Maerten de Vos, Saint Paul, Brussels

Tüchlein technique

Early paintings on textile supports

Tüchlein technique

- Fine canvas support
- Aqueous medium: animal glue, vegetable gum, egg
- No thick isolating ground layer
- Canvas weave remains visible
- Matt powdery surface
- Unvarnished
- Canvas was used from 12th Century onwards
- Term from Albrecht Dürer

Very few survive

- Fragility: sensitive to humidity, insects
- Often meant for temporary function
- Andrea Mantegna often described as only artist using it, but many others did. He uses his paints rather opaque and thick
- Northern Netherlandish painters used it more transparent and fluid, leaving the canvas visible.



16th-17th C, Parable of the Prodigal son, 762.50cm wide x 334 cm high, Private Collection

Prior More's possessions at Battenhall, Worcester:

“Ye hangyngs of ye Newe parlor at Barnall, Item bowht at London the peynted clothes, That hangeth in the low New parlor next, Ye chappell at Batnall conteynyng in length, Xxiii yeards/s ij yeards iij quarters depe at 5 ½ d, Ye yearde/lxvi yeards of folery worke with , Dyvers beestes and fulls (fowles-birds), Item payd to Hew Adams man John for carriage, Of bokes and ye peynted cloths, From London, Bowht at London peynted cloths, Conteyning LXIX yeards price the, Yearde 5 ½ d, John Taylor Moris Taylor and Anne, Purser sewing the hangnges in the corte chamber “. Prior More also gives accounts of his painted cloths at Crowle and Grimley, Worcestershire in his diary of 1532.

Painted cloth as wall decoration, Owlpen Manor estate, Near ULEY
GLOUCESTERSHIRE



They are of the kind recommended by Falstaff to Mistress Quickly, so she should pawn her 'fly-bitten tapestry':
and for thy walls, a pretty slight drollery, or the story of the Prodigal, or the German hunting in water-work is worth a thousand of these fly-bitten tapestries
(Shakespeare ,2 Henry IV, II. ii).



Joseph's brothers lift him from the pit to sell him to the merchants from Gilead

THE LIVELY PAINTED CLOTHS in Queen's Margaret's Chamber at Owlpen are said to be unique as a complete decorative scheme of such work still *in situ* in England. They are certainly the best example surviving of what was once a very common form of interior decoration.

These are painted in distemper, a tempera technique where the earth pigments are bound with glue size, on 42-inch unbleached canvas-linen strips. Duty marks stamped on the back date them to after 1712: ten years later they are recorded as being at Owlpen.



Pintoricchio, San Agostino, 104 x 72 cm, distemper on silk, Galleria Nazionale dell'Umbria, Perugia

Example of banner of confraternity



Niccolo da Foligno,
Saint'Antonio Abbate, 221 x 114
cm, c. 1470s, Pinacoteca,
Deruta

Banner with on other side
Saints Francesco and
Bernardino



Lorenzo Monaco (Piero di Giovanni) ca. 1370–1425
Florence (?), **The Intercession of Christ and the Virgin**, before 1402, Tempera on canvas, 239.4 x 153 x 2.5 cm



Fine linen
No ground layer
Canvas was sized
Paint quite thick stays on top of weave
Detailed underdrawing in dry material in St
Jerome, in fluid medium in rest
Binding medium gum

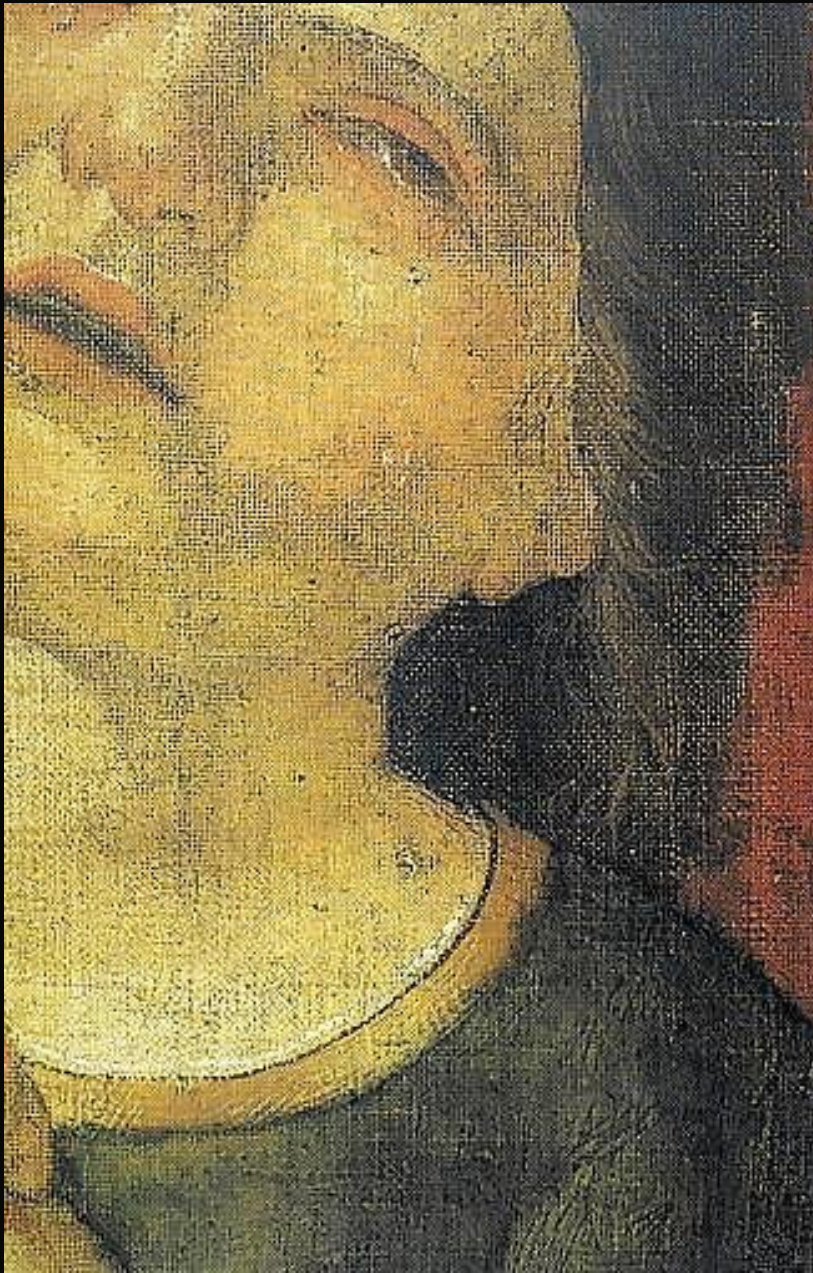


SAINT Jerome in the desert,
Emilian anonymous,
22 x 16.5 cm, Bonnefanten
Museum, Maastricht.



- Tightly woven canvas
- No ground layer
- Canvas was thoroughly sized
- Paint quite thin but does not penetrate canvas
- Binding medium plant gums/fruit tree gum: gum tragacanth
- Gilded halos

Dead Christ supported by Mourning Angels, Veneto anonymous, 1475-1500, Bonnefanten Museum, Maastricht. 58.8 x 40.3 cm



*Detail of Dead Christ
supported by Mourning
Angels*

Anonymous, Venice

c. 1475-1500

distemper on linen

58.8 x 40.3 cm



Andrea Mantegna, Holy Family, 1485, oil and tempera on canvas, Dresden Picture Gallery



Andrea Mantegna, Adoration of the Magi, c. 1495 – 1505

Distemper on linen

19 1/8 x 25 13/16 in. , John P. Getty Museum





Justus van Ghent, *Adoration of the Magi*, ca. 1470, distemper on cloth, 109.2 x 160 cm. The Metropolitan Museum of Art

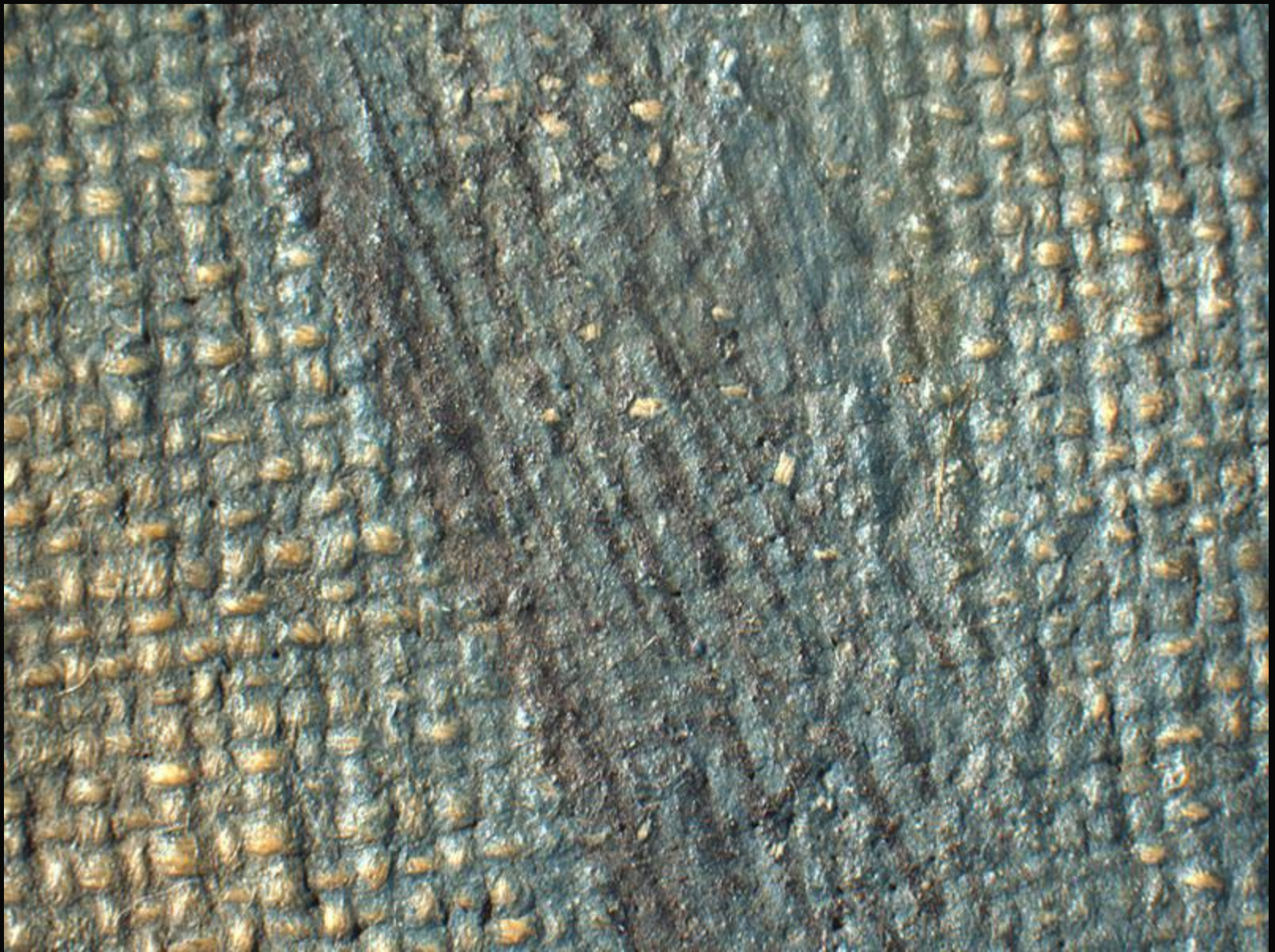


Adoration of the Magi, X-radiograph







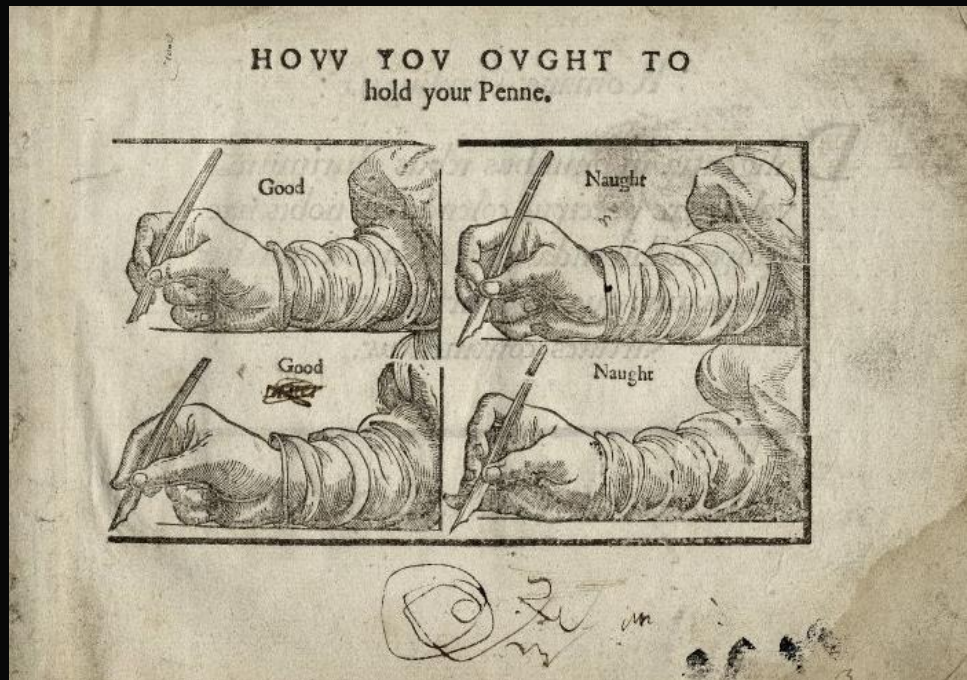






Hugo van der Goes, *Meeting of Jacob and Rachel*, pen and brown ink, brush and brown pigment, white highlights on slate-gray paper, 33.8 x 57.2 cm. Ashmolean Museum, Oxford, Christ Church

BnF Ms Fr 640 recipes some annotations...*



- Translations in these recipes have been revised
- Please refer to Ms. Fr 640 folios in [Secrets of Craft and Nature](#)

'<m>geiete</m>'**> gaiete>jaiet>jet**

<id>p065r_1</id>

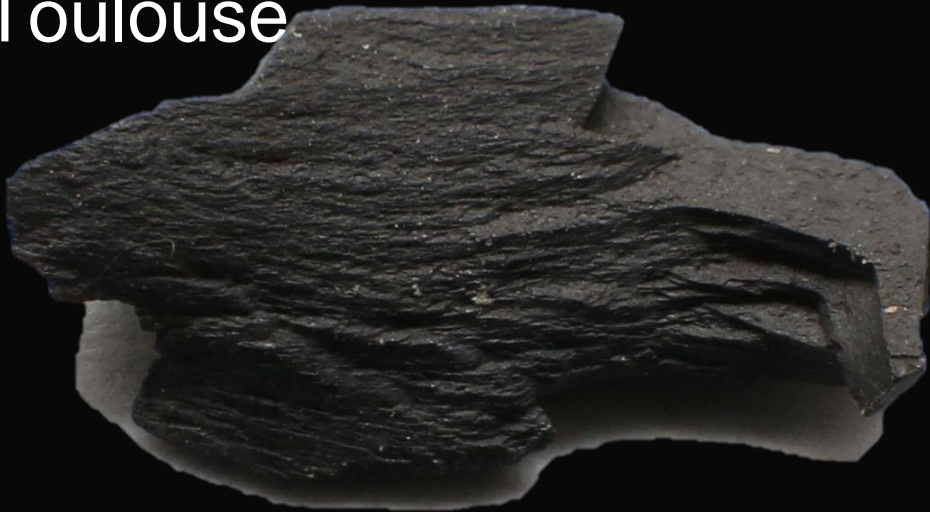
<head>Shadows</head>

<ab> Because blacks appear in different hues, some reddish black, others bluish, and others greenish, choose those verging on yellow in order to obtain beautiful shadows in <m>oil</m>, for shadows are yellowish, especially those of men. And for this effect use very strongly crushed <m>jet</m>, which you mix with a bit of <m>yellow ocher</m> and <m>white lead</m>. Or else, after you have crushed your <m>white lead</m> and gathered it with the <figure/>, crush the <m>jet</m> into it. Thus it ^{the black} will be more desiccative, and a yellowish black on its own. When mixed with a bit of white, it will be perfect for men's shadows. Blacks which appear greenish black are appropriate for women's shadows. Take then some black of <figure/>, a little <m>sap green</m> and some <m>bistre</m>, and you will have a perfect woman's shadow in distemper.</ab>

<note><margin>lefttop</margin>

The powder of orbere <m>grain</m> is duller than <m>umber</m> and when you lack <m>umber</m>, the aforesaid powder may be used, but it lacks body.</note>

- Jet, or Jaiet
- France: Aude, south east of Toulouse



Old French: *Jaiet*, and into English: *Jet*. Jet was formed from wood that fell into stagnant water and which then became fossilised in much the same way as coal was made. The wood originally came from trees similar to the modern day Monkey Puzzle or *Araucaria*. Jet has been used in jewellery since about 1400 BC. Pieces of worked Jet have been found in prehistoric burial mounds and in the 1st Century AD Pliny ascribed a variety of medicinal properties to Jet. Jet is a semi-precious stone which, when polished, takes on an intense deepest opaque black hence the use of the term 'jet-black' in literature since the eleventh century. The rich black colour never fades, and the shine which can be achieved is such that polished jet



16th century piece of jet polished into a faceted shape that would function as a small personal mirror.



Detail 16th century Tudor portrait. Jewellery containing jet.



Coal-like pigments

In some samples the particles were so sharp edged that they could be mistaken for charcoal but they missed the woody cell structure which is often visible in charcoal particles under high magnification.

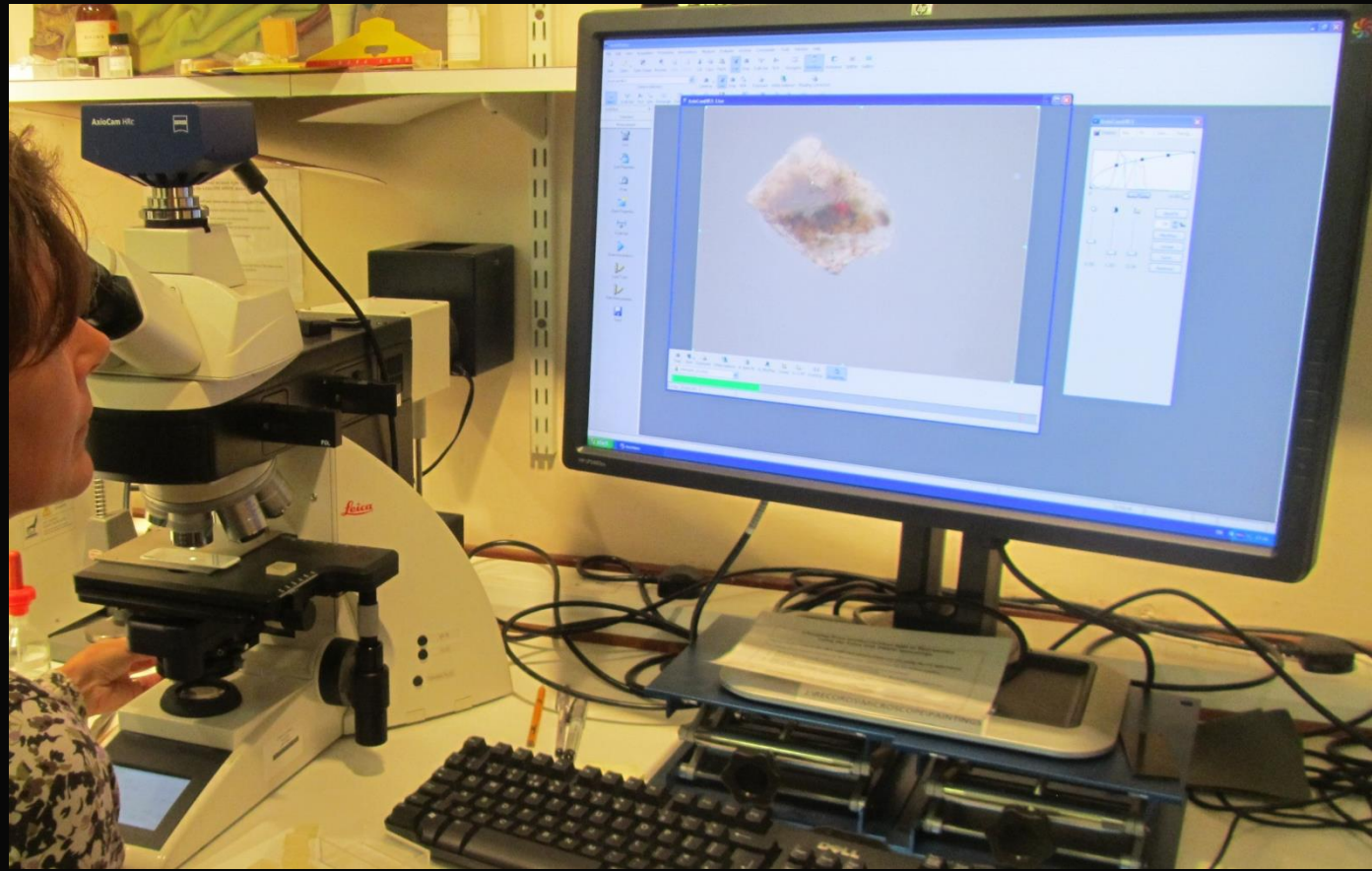
The large particles seem hard, intensely black, and small and thinner particles have a brownish hue.

Coal is a carbonaceous sedimentary rock, formed through partial decomposition of woody plants and trees, formed millions of years ago.

Lorenzo Costa, Portrait of Battista Fiera, c. 1570-8, oil on panel, 51.4 x 38.7 cm

Cross-section
of paint layers

Microscopy with
normal light and
ultraviolet light

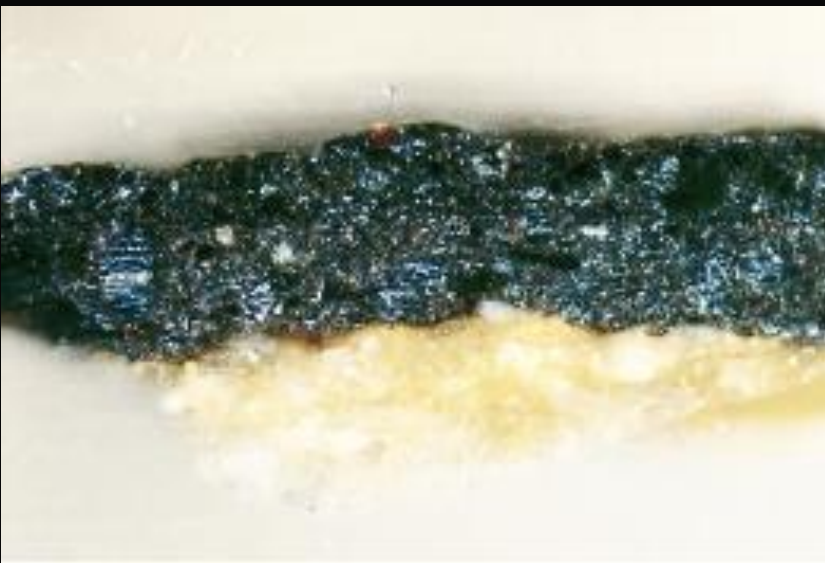


Embedding of
cross-sections





Lorenzo Costa, *The Concert*, about 1485-95
Oil on wood, 95.3 x 75.6 cm, National Gallery,
London



Cross section black background

- Gesso ground layer
- Thin oil isolation layer
- Black layer containing splintery and shiny coal particles, a little verdigris and some siliceous material.



Jacopo Bassano and workshop, Purification of the Temple, 1580, Oil on canvas, 160.5 x 267.5 cm, NG London



Cross section of the orange highlight on the garment of the man in the front left corner showing a priming on the canvas all consisting of coal

Bistre

<title id="p093v_a1">Faces [painted] with distemper</title>

<ab id="p093v_b1">Because colors [painted] with distemper dry quickly and one would not have enough time to complete the shadows and touches on the face, one wets the reverse of the face, on canvas, with a wet sponge. Then, with a small brush, one does the shadows, which don't come off. Then one lays the flesh tones, which does not prevent the already painted shadows from showing [through]. And one touches again the more prominent areas with brighter flesh tones. And with another brush one does the shadows in hatching.

The strokes [that make up] the shadows do not come off because they are [made] of bistre, which stains the canvas like rust. The said bistre is good for painting the shadows in distemper, for in oil it lacks body and would dry with great difficulty.

One should mix the said bistre for shadows with ocher de rux and a little sap green. The best bistre is the fat shiny one from the fireplaces of large kitchens. It is difficult to grind and grates on the marble slab.</ab>



'Clay' hills in Vacluse, France: yellow and red iron oxides

Vert de vessie: bladder green; sap green; buckthorn green

Buckthorn berries should be picked at a certain date to make green:

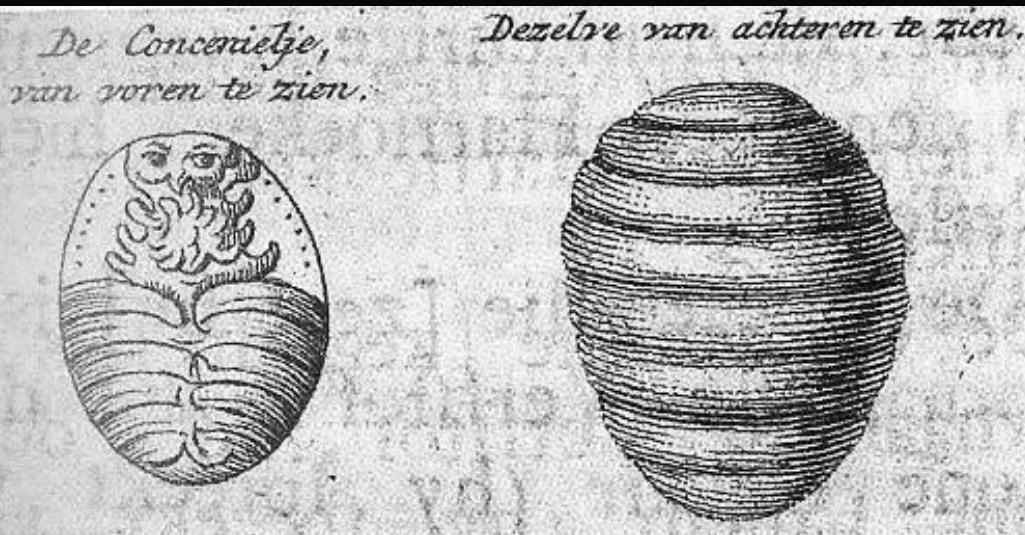
1549 Boltz von Ruffach: 14 days before Michaelmas



Rhamnus
cathartica L.
Three stages of
ripeness<

Red dyestuffs and lakes

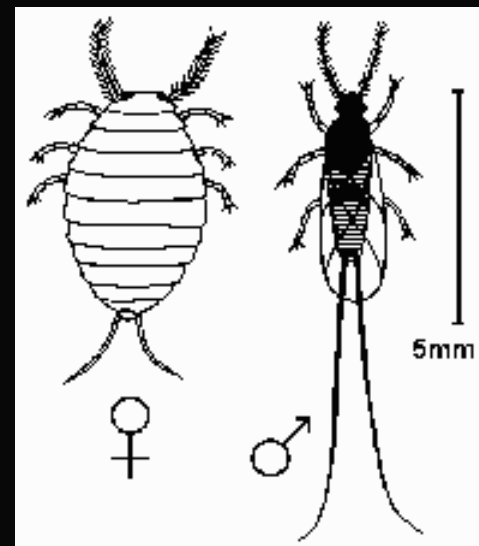
- Redwoods: *Caesalpinia Sappan* L.(from c. 1140 Japan, Sri Lanka); *Caesalpinia brasiliensis* L. (The New World: Brazil)
- Red insect dyes: kermes and cochineal



Cochineal used in Florentine Lake



Cochineal insects live on cacti in Mexico and South America



Coccus Cacti beetles.
Only the female will yield the red colourant

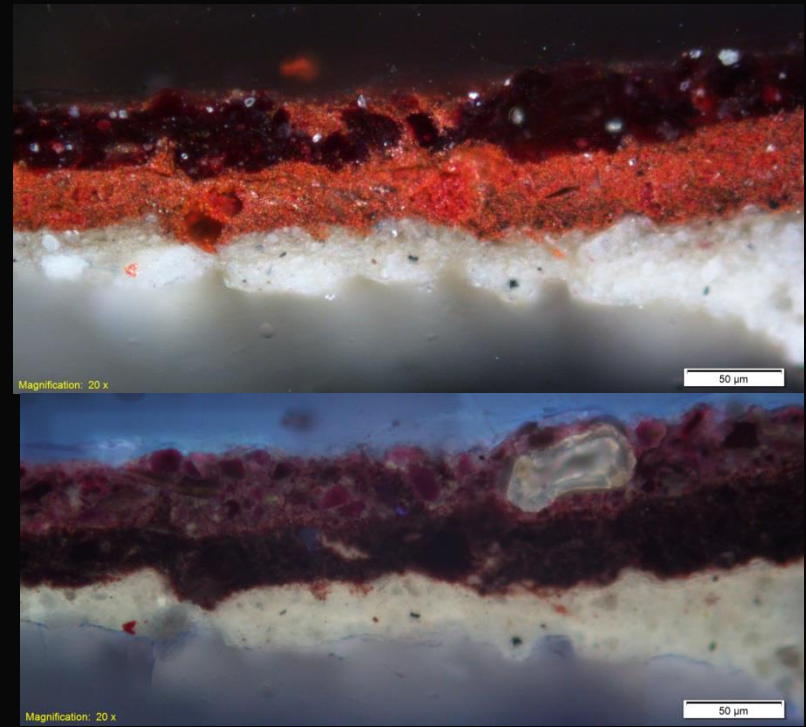


Dried insects





Maerten de Vos, St Michael, c. 1581,
Mexico Cathedral



Definition of a (red) lake pigment
A pigment made by precipitating (or adsorbing) a dye onto an insoluble, relatively inert substrate. The traditional definition gives the substrate as hydrated alumina.

The pigment thus has two parts, the coloured dye and the substrate, and characteristics such as opacity and working properties are determined by the substrate.



<id>p056v_1</id>

<m>Lake</m> takes a long time to dry in <m>oil</m> and for that reason you have to crush <m>glass</m> with it, but you have to choose <m>crystallin</m> because it is neater. And since it would be too difficult to be crushed by itself, you have to heat it red hot, then, when it is entirely red, throw it into cold <m>water</m> and it will crumble and pulverize itself to then be crushed easily. After being crushed with a lot of <m>water</m>, it looks like crushed <m>lead white</m>, but for this reason it has no body. I think it could be good for casting.</ab>
<ab>

Experiments to follow....

Lead white is made with lead sheets beaten gently and put under some manure.



Native metallic lead was extracted from ore by smelting it at ca. 300 degrees Celsius as described by Giorgio Agricola in his 16th-century treatise on mining and metallurgy. Lead strips were exposed for four to twelve weeks to acetic acid in terra cotta pots, buried under manure. This treatment would raise the temperature and provide carbon dioxide. Combination of acetic acid vapours, carbonic acid, and heat slowly converted the metallic lead into white basic lead carbonate.

Azurite: basic copper carbonate, found in copper mines together with malachite (green)



Azurite crystals on malachite



Earth with copper carbonate crystals



Microscope image with transmittant light



Pigment: coarsely ground gives a more intense colour than finely ground

<id>p063r_6</id>

<head><m>Verdigris</m> and another very beautiful, gay
green</head>

<ab>One must not crush it with <m>water</m> alone, because that
makes it fade. To make it beautiful in distemper, some crush it with
<m>vinegar</m>, but that makes it turn pale and become whitish. To
make it beautiful, crush it with <m>urine</m> and leave it to dry. Then,

whenever you like, crush it with <m>oil</m>. And after you have
collected it with the palette, before you finish cleaning the
<m>marble</m>, crush it ^{there} with <m>stil de grain
yellow</m>. And you will have a very beautiful green.</ab>

</div>



Verdigris



"A color know as verdigris is green. It is very green by itself. And it is manufactured by alchemy, from copper and vinegar." - Cennino Cennini, Il Libro dell' Arte.

Reconstructing complex recipes

Recipe for *Giallo de' Vasari* - Potters' Yellow - in the Mariani-Cibo treatise

Giallo de' Vasari

Il giallo de' Vasari è un bellissimo giallo fatto da loro ilquale lo fanno di due sorte vna che riesce più sottile e riesce bene a colorire i disegni & un'altro che riesce con più corpo. Il primo fanno così pigliano cinque lb di piombo abrugiato in polvere e sedacciato, e lb tre d'Antimonio e doi lb di sal comune, il tutto si pesta e sedaccia come s'è detto e si distendono bene unite le poluere insieme sopra diversi piatti di terra ^{no} vetri.

vetriati grasso un mezzo di to acciaio si calcini meglio e si mette poi alla fornace loro a calcinare vna o doi volte al medesimo fuoco che si cuociono i lor vasi. Il secondo modo è tale: pigliano 3 lb di piombo abrugiato lb 2 d'Antimonio e lb una di feccia di vino, calcinato il tutto disposto come l'altro di sopra si pone alla fornace a calcinare. ma questa mistura vuol più foco della prima. Si fa ancora tal giallo più carico di colore e più bello con prendere 6 lb di piombo abrugiato & 4 lb d'Antimonio

monio e lb 2 di turia Alessandrina e lb una di sale e meschiato tutto insieme si pestano sottilmente e si pongono sopra piatti come gl'altre ma si cuociono fuori della fornace alli sfiatatori e se per caso non venisse cotto a bastanza, si rimette di nouo fin che sia cotto ma se per caso riuscisse troppo cotto che venisse fuoco e colato si rimacina di nouo e pesta sottilmente rimettendo la materia sopra nuovi piatti, si ripone a fuoco più lento & occorrendo si farà più d'una volta e così verrà in tutta beltà. Il gi.

Potters' yellow Potters' yellow is a very beautiful yellow made by the potters, which they make in two types, **one which appears to be more subtle and works well for colouring drawings, and another which shows more body.** The first they make like this: take five ounces of burnt lead in powder and sieved, and three ounces of antimony and two ounces of plain salt. All this is crushed and sieved as is said and after the powders are well-united they are spread on several not glazed terra cotta plates half a finger thick to make them calcine better and then you put it in their [the potters] furnace to calcine one or two times in the same fire where they bake their pots.

The second way is the following: one takes 3 ounces of burnt lead, 2 ounces of antimony and one ounce of calcined wine residue. You place all this, arranged like the others mentioned above, in the furnace to calcine, but this mixture needs more fire than the first one. [c. 16r]

You can also make this yellow of **a fuller colour and more beautiful** by taking 6 ounces of burnt lead and 4 ounces of antimony and one ounce of Alexandrine Tutty and 1 ounce of salt, and this all mixed together you grind it finely and put it on plates like the others, but you heat it outside the furnace at the ventilation pipes, and if by chance it will not get hot enough you will put it there again until it is done. But if it will come out too much cooked and if there is a fire, and it is melted, then you will grind it finely again, putting the material back on new plates, you will put it on a lower fire and if necessary one will repeat it several times and this way it will turn out beautifully.



LI TRE LIBRÌ DELL ARTE DEL VASAÏO

*Nei quai si tratta non solo la
pratica ma breuemente
tutti gli secreti di*

essa

Cosa, che per sino al di d'oggi è stata sempre tenuta oscura.

Del Cavalier Cipriano Piccolpasso

Durantino.

IMPORTVNUM.



Example of Majolica Durantina

*Li tre libri dell'arte del vasaio,
1548, Victoria & Albert Museum*

Note on yellow enamel glass made by mister Giacinto Manfreo; January 20" 1653 burnt lead £6; antimony £4; tuccia £2; calcina £4, everything very well ground to a fine powder. Of all these well united powders I made a fry in a furnace in two creppe di olla, giving them three firings 24 hours each, and in 3 days I had my powder in a beautiful color. Of this powder I took 13 pounds, 7 pounds of common minium; quogli 2 pounds and 3 ounces, and therefore all together 22 pounds and 3 ounces. I poured the mentioned powder in a pan on high fire. After two hours I found an animo of very beautiful yellow full of body and immediately I added 5 pounds of crestallo cotto better a bit more than less and I mixed it very well and I had a yellow glass enamel with body in a wonderful color and this method I did in 6 hours and not 17 more.

Ricettario Darduin, Archivio di Stato, Venice, fol. 95v .
Rx. CCXC11I

For the reconstruction experiments use was made of PbO [PDF 38-1477], Sb₂O₃ [PDF 5-534], Sb [PDF 35-732], Sb₂S₃ [PDF 6-474], SnO₂ [PDF 41-1445], NaCl [PDF 78-0751], ZnO [PDF 36-1451] and KOCO(CHOH)₂COOK [PDF 1-205] of various suppliers. X-Ray Powder Diffraction (XRPD) was used to ascertain the identification of these materials. Several mixtures were made of the ingredients on the basis of the recipes and interpretations. The ingredients were mixed in a mortar and ground to a fine powder. The mixtures were put in high temperature crucibles (crucible type 131-01, Haldenwönger, Berlin, Germany). The powder mixtures were then heated in an oven (type LF1, Vectstar, Chesterfield, UK) at various temperatures.





Three groups of reconstruction experiments were carried out with Sb, Sb₂O₃ and Sb₂S₃ as possible translations of antimonio. The mixtures were calcinated for 24h at various temperatures.

Potters' yellow type II was made in a similar way, by heating a mixture of PbO, Sb₂O₃ and K-tartrate, in the weight ratio mentioned in the recipe. Also the third type of Naples Yellow was reconstructed in this way with zinc oxide and tin oxide as possible translation of tutia.

SCIENTIFIC ANALYSES AND INTERPRETATION

'Subtle-more body': study possible differences in optical refractive properties between type I and type II.

X-Ray diffraction of the resulting yellows indicated which of the antimony compounds was most likely used:

Antimony sulfide gave a blackish colour

Metallic antimony: although yellow gave a very low yield, and stuck to the crucible!

Antimony oxide provided highest yield, with porous structure and could easily be removed from crucible



Knowledge

- Adopting 'knowing' : as a processual interpretation of knowledge and recasting it as a more active form
- Artisanal 'knowing': proprietary, situated and often site-specific
- Characterised by application of skills, recourse to personal judgement and extensive and repeated hand work from individuals or small groups

Skills

- Reproduced through a combination of learning by doing, and recurrent trial and error
- Artisanal practices demand the routine use of personal judgement in the application of inherently tacit knowledge to particular situations
- Knowing: connection between mind and hand (Richard Sennett, *The Craftsman*)

Artisanal knowing 16th century

Sensory judgements 'control points'



Variability in production processes



Idiosyncrasies

Residual level of variation:

- tacit knowledge

- implied level of things that were assumed

Interpreter sensible or skilled enough to know

Thank
You!

