Historical recipes for preparatory layers for oil paintings in manuals, manuscripts and handbooks in North West Europe, 1550-1900: analysis and reconstructions

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Publication date
2014

Citation for published version (APA):
### Table 15.1 Analyses of pigments and binding media of streaky imprimaturas in Rubens’s paintings

<table>
<thead>
<tr>
<th>medium (method of analysis)</th>
<th>pigment (method of analysis)</th>
<th>painting, collection</th>
<th>thickness of imprimatura</th>
<th>publication date/analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil with indications of protein addition: emulsion (microchemical tests) Kockaert 1992a: 64, 67</td>
<td>Lead white, charcoal black, chalk (optical microscopy, microchemical tests, electron microprobe) [Kockaert 1992: 64]</td>
<td>Elevation of the cross, Cathedral, Antwerp</td>
<td>10-60 μ</td>
<td>1992</td>
</tr>
<tr>
<td></td>
<td>Lead white, organic black (not specified) Van Hout 2005: 163</td>
<td>The three graces, Prado Museum, Madrid</td>
<td></td>
<td>1993</td>
</tr>
<tr>
<td></td>
<td>Lead white, charcoal black, yellow-brown earth (not specified) Kamba 2004: 77</td>
<td>The flight of Lot and his family from Sodom, John and Mable Ringling Museum of Art, Sarasota, FL</td>
<td>30-80 μm</td>
<td>1994</td>
</tr>
<tr>
<td>Drying oil (SIMS/FTIR)</td>
<td>Lead white, charcoal black, 'Modello' for the Assumption of the</td>
<td></td>
<td>20-22 μm</td>
<td>2005</td>
</tr>
<tr>
<td>medium (method of analysis)</td>
<td>pigment (method of analysis)</td>
<td>painting, collection</td>
<td>thickness of imprimatura</td>
<td>publication date/analysis</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>---------------------------</td>
</tr>
<tr>
<td></td>
<td>Lead white, earth pigments, black (optical microscopy) Verhave, Statens Museum, pers comm. 26 February 2007</td>
<td>The Ascent to Calvary. The Bearing of the Cross (c.1634), Statens Museum for Kunst, Copenhagen.</td>
<td>20 μm</td>
<td>Unpublished research, 2007</td>
</tr>
</tbody>
</table>
Table 15.2. Pigment composition for second ground layers on panel in historical recipes

<table>
<thead>
<tr>
<th>date</th>
<th>author</th>
<th>pigments</th>
<th>binder</th>
<th>application details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1550</td>
<td>Vasari 1550 (1568): 52 (transl. Maclehose and Brown 1960:230)</td>
<td>lead white, umber, earths</td>
<td>linseed or nut oil</td>
<td>plastered over, beaten with hand</td>
</tr>
<tr>
<td>1620-44</td>
<td>De Mayerne 1620-44: 11</td>
<td>lead white, umber</td>
<td>unspecified</td>
<td>‘a light layer’</td>
</tr>
<tr>
<td></td>
<td>De Mayerne 1620-44: 90v</td>
<td>ceruse [lead white], umber</td>
<td>oil</td>
<td>[1 layer]</td>
</tr>
<tr>
<td>1634</td>
<td>Peacham 1634: 130</td>
<td>Red lead or some other colour</td>
<td>unspecified</td>
<td>‘prime with’</td>
</tr>
<tr>
<td>1640</td>
<td>Norgate 1640 (transcr. Hardie 1919: 91)</td>
<td>lead white</td>
<td>oil</td>
<td>[1 layer]</td>
</tr>
<tr>
<td>1653-57</td>
<td>King 1653-57: 52</td>
<td>ceruse, charcoal black, red lead</td>
<td>unspecified</td>
<td>[1 layer]</td>
</tr>
<tr>
<td>1664</td>
<td><em>Art of painting in oyle</em> 1664: 97</td>
<td>unspecified</td>
<td>unspecified</td>
<td>‘priming layer’</td>
</tr>
<tr>
<td>1672</td>
<td>Salmon 1672: 141</td>
<td>lead white</td>
<td>oil</td>
<td>[1 layer]</td>
</tr>
<tr>
<td>1676</td>
<td>Félibien 1676: 407</td>
<td>chalk, red earth</td>
<td>oil</td>
<td>‘oil priming’</td>
</tr>
</tbody>
</table>
Table 15.3. Preparation details of reconstructed imprimaturas

Unless stated otherwise, imprimaturas are pigmented with stack-process lead white, raw umber and charcoal black. For reasons of safety, lead white was always ground with the medium before other pigments were added. Other pigments were mixed with the paint using a palette knife or ground into the paint on a granite slab.

<table>
<thead>
<tr>
<th>binder type</th>
<th>binder preparation details</th>
<th>ground on slab</th>
<th>mixed with palette knife</th>
<th>paint preparation details and comments</th>
<th>pre-wetting of brush</th>
<th>application details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Imprimaturas without chalk</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole egg</td>
<td>Egg whisked until liquid.</td>
<td>X</td>
<td></td>
<td>Distilled water was used to dilute the paint. Easy preparation</td>
<td>dist. water</td>
<td>Spreads well but medium stiffens quickly.</td>
</tr>
<tr>
<td>Egg yolk</td>
<td>Yolk whisked until liquid.</td>
<td>X</td>
<td></td>
<td>Easy preparation</td>
<td>dist. water</td>
<td>Spreads well but medium stiffens quickly. Only repeated brushing removes most of the air bubbles.</td>
</tr>
<tr>
<td>Egg white</td>
<td>Egg white shaken and left to settle. Liquid used.</td>
<td>X</td>
<td></td>
<td>Easy preparation.</td>
<td>dist. water</td>
<td>Spreads well but medium stiffens quickly.</td>
</tr>
<tr>
<td>Sheep parchment glue</td>
<td>Glue boiled from sheep parchment and distilled water (5% w/w).</td>
<td>X</td>
<td></td>
<td>Difficult grinding because paint dries. Water added in one reconstruction.</td>
<td>dist. water</td>
<td>Easier to apply over oil isolation layer than non-isolated area. <strong>Imprimatura over glue isolation layer cannot be reworked because it swells glue isolation layer.</strong></td>
</tr>
<tr>
<td>Calf parchment glue</td>
<td>Glue boiled from calf parchment and distilled water (5% w/w).</td>
<td>X</td>
<td></td>
<td>Difficult grinding because paint dries. Water added in one reconstruction.</td>
<td>dist. water</td>
<td>Easier to apply over oil isolation layer than non-isolated area. <strong>Imprimatura over glue isolation layer cannot be reworked because it swells glue isolation layer.</strong></td>
</tr>
<tr>
<td>Goat’s skin glue</td>
<td>Glue boiled from alum tawed goat’s skin and distilled water (7% w/w).</td>
<td>X</td>
<td></td>
<td>Difficult grinding because paint dries.</td>
<td>dist. water</td>
<td>Easier to apply over oil isolation layer than non-isolated area. <strong>Imprimatura over glue isolation layer cannot be reworked because it swells glue isolation layer.</strong></td>
</tr>
<tr>
<td>Gum Arabic</td>
<td>Gum dissolved in boiling dist. water (1:2). Filtered</td>
<td>X</td>
<td></td>
<td>Difficult grinding because paint dries. Water</td>
<td>dist. water</td>
<td>If paint too thin it forms air bubbles and pools on section with</td>
</tr>
</tbody>
</table>

402
<table>
<thead>
<tr>
<th>binder type</th>
<th>binder preparation details</th>
<th>ground on slab</th>
<th>mixed with palette knife</th>
<th>paint preparation details and comments</th>
<th>pre-wetting of brush</th>
<th>application details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gum Tragacanth</td>
<td>Gum swollen overnight in distilled water, heated and stirred (0.2 % w/w).</td>
<td>X</td>
<td></td>
<td>Difficult to grind. Becomes sticky during grinding.</td>
<td>medium</td>
<td>Spreads well. Some air bubbles.</td>
</tr>
<tr>
<td>Raw linseed oil</td>
<td>Raw oil pressed from organically grown <em>Electra</em> linseeds.</td>
<td>X</td>
<td></td>
<td>Easy preparation. Pigmented with vine black instead of charcoal black.</td>
<td>medium</td>
<td>Very hard to spread. Requires repeated brushing, which results in loss of streaks</td>
</tr>
<tr>
<td>Litharge treated linseed oil</td>
<td>Litharge and raw oil (1:2) heated to 150 °C and cooled to ambient temperature.</td>
<td>X</td>
<td></td>
<td>Paint mixed with palette knife to investigate formation of lead white conglomerates. Vine black instead of charcoal black.</td>
<td>medium</td>
<td>Very hard to spread. Requires repeated brushing, which results in loss of streaks</td>
</tr>
<tr>
<td>Fat oil/egg emulsion</td>
<td>Whole egg and litharge treated oil (1:2) shaken together to emulsify. Diluted with drops of distilled water.</td>
<td>X</td>
<td></td>
<td>Easy grinding because oil prevents paint from drying.</td>
<td>medium</td>
<td>Needs repeated brushing for spreading, but does not lose streaks so much</td>
</tr>
<tr>
<td>Lean oil/egg emulsion</td>
<td>Pigments ground with whole egg. Raw linseed oil added drop wise until paint thickens.</td>
<td>X</td>
<td></td>
<td>Easy grinding, though medium tends to dry a little during grinding.</td>
<td>egg</td>
<td>Easy to spread thinly, very silky and pleasant.</td>
</tr>
<tr>
<td>Fat oil/glue emulsion</td>
<td>Sheep parchment glue (5% w/w) added to litharge-treated oil/lead white paint, mixed and ground on slab.</td>
<td>X</td>
<td>X</td>
<td>Easy grinding because oil prevents paint from drying.</td>
<td>medium, dist. water</td>
<td>Can only be brushed out slowly because the paint is very sticky</td>
</tr>
<tr>
<td>Lean oil/glue emulsion</td>
<td>Pigs skin glue ground with pigments, raw linseed oil added drop wise until paint thickens.</td>
<td>X</td>
<td></td>
<td>Easy grinding, though medium tends to dry a little during grinding.</td>
<td>glue</td>
<td>Easy to spread thinly, smooth feel because of oil component.</td>
</tr>
<tr>
<td><strong>binder type</strong></td>
<td><strong>binder preparation details</strong></td>
<td><strong>ground on slab</strong></td>
<td><strong>mixed with palette knife</strong></td>
<td><strong>paint preparation details and comments</strong></td>
<td><strong>pre-wetting of brush</strong></td>
<td><strong>application details</strong></td>
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</tr>
<tr>
<td>Fat oil/gum Arabic emulsion</td>
<td>Gum dissolved in dist. water (1:2), lead white ground with gum. Litharge treated linseed oil added drop wise. (1 pt gum: 2 pts oil)</td>
<td>X</td>
<td></td>
<td>Oil mixed with gum Arabic paint very easily. Paint very gritty. Water added and reground. Complicated preparation.</td>
<td>dist. water</td>
<td>More water added for application. Easy to apply.</td>
</tr>
<tr>
<td>Linseed oil/ turpentine oil</td>
<td>Litharge treated linseed oil with addition of Kremer turpentine oil (2:1).</td>
<td>X</td>
<td></td>
<td>Easy preparation.</td>
<td>turpentine oil</td>
<td>Easy to apply.</td>
</tr>
<tr>
<td>Linseed oil/ spike oil</td>
<td>Raw linseed oil with an addition of spike oil (7:2).</td>
<td>X</td>
<td></td>
<td>Easy preparation.</td>
<td>spike oil</td>
<td>Easy to spread.</td>
</tr>
<tr>
<td>mastic/ linseed oil /turpentine varnish</td>
<td>Mastic varnish (mastic heated with gum turpentine 1:2) and litharge treated linseed oil heated (2:1). Ground with lead white, turpentine oil added.</td>
<td>X</td>
<td></td>
<td>Difficult to prepare. Sticky binding medium causes difficulties during pigment grinding.</td>
<td>medium</td>
<td>Difficult to apply due to stickiness. Not possible to go over same area twice without lifting layer applied before.</td>
</tr>
<tr>
<td>Copal oil varnish</td>
<td>1 pt. Powdered Kauri copal heated to 355 °C, cooled to 260 °C, 2 parts pre-heated linseed oil added, boiled together for 1 hour to max 300 °C. Cooled to 204 °C, 3 parts turpentine oil added Medium prepared in 1993 (Carlyle 2001: 49)</td>
<td>X</td>
<td></td>
<td>Sticky binding medium causes difficulties during pigment grinding.</td>
<td>medium</td>
<td>Difficult to apply due to sticky paint.</td>
</tr>
<tr>
<td>Colophony/oil / turpentine varnish</td>
<td>Colophony powder heated in turpentine oil to 95 °C (1:2) until resin has dissolved. Poured off, mixed with litharge treated linseed oil (2:1).</td>
<td>X</td>
<td></td>
<td>Sticky binding medium causes difficulties during pigment grinding.</td>
<td>medium</td>
<td>Paint runs off palette knife but sticks to brush. Difficult to apply. Very sticky and gives crumbly result.</td>
</tr>
<tr>
<td>Binder Type</td>
<td>Ground on Slab</td>
<td>Mixed with Palette Knife</td>
<td>Paint Preparation Details and Comments</td>
<td>Pre-Wetting of Brush</td>
<td>Application Details</td>
<td></td>
</tr>
<tr>
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<td>----------------------------------------</td>
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<td>---------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Imprimaturas with chalk added to general pigment mixture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drying oil/ turpentine oil</td>
<td>X</td>
<td></td>
<td>Turpentine oil mixed in with palette knife on slab.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat oil/ egg emulsion</td>
<td>X</td>
<td></td>
<td>Turpentine oil mixed in with palette knife on slab.</td>
<td>medium</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imprimaturas with chalk, without lead white</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drying oil/ turpentine oil</td>
<td>X</td>
<td></td>
<td>Chalk mixed into oil with palette knife before adding other pigments.</td>
<td>Turpentine oil</td>
<td>Paint easy to spread, good streaks. Needs some extra brushing.</td>
<td></td>
</tr>
</tbody>
</table>