

# Non-invasive technical investigation of English portrait miniatures attributed to Nicholas Hilliard and Isaac Oliver

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## Supplementary Materials – XRF and Raman results

### P.154-1910 – Richard Hilliard



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A-B, 01- 05)	Top, proper left side, and cheek	<u>Pb</u> , Fe, Ca, (Hg)	Hematite, amorphous iron oxides	White matrix with dull orange, dull red, maroon and some yellow particles
Inner corner (06)	Proper left eye	-	Hematite	made of a lake, with very few maroon particles, some black and occasional orange ones
Eyelid	Proper left eye	-	Carbon black, vermillion	made of black and dark brown particles, and a lake may or may not be present
Eyebrow	Proper left eye	-	-	It is a more diluted version of the eyelid line, with more brown and occasional orange.

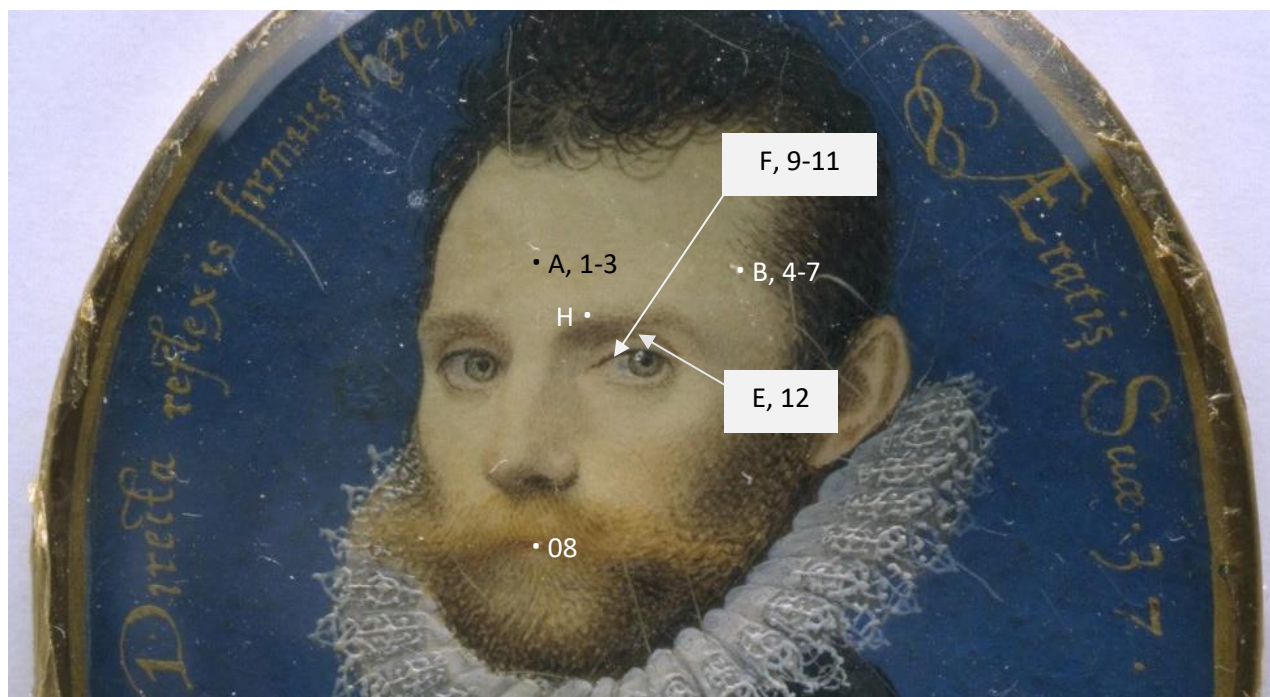
### P.155-1910 – Self-portrait, aged 30



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A, 01-03)	Top, proper left side	<u>Pb</u> , Au, Fe, Ca, (Cu)	vermilion, hematite	White matrix with crimson and maroon particles
Mouth (04)		-	vermilion	The horizontal line of the mouth has a high content of a burgundy lake
Inner corner (05)	PR eye	-	vermilion	
Cap – green (B, 06)		<u>Cu</u> , Au, Pb, Ca, (Fe)	brochantite	
Cap – orange under gilding (C, 07-08)		<u>As</u> , Fe, Pb, Ca, Au, (Cu)	pararealgar, lead tin yellow	
Cap – yellow under gilding (D, 09)		<u>Pb</u> , <u>Sn</u> , Cu, Au	lead tin yellow I	

## E. 1178-1988 – Unknown man



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, B, 1-7)	Forehead (A, 1-3)	<b>Pb</b> , Ca, Fe, (Mn), (Hg)	Vermilion, red lead, hematite, (disordered) pararealgar	White surface scattered with crimson red, dark orange, maroon and dull orange particles	Pararealgar was found only in one case
	Temple (bluer area) (B, 4-7)	<b>Pb</b> , Ca, Fe, (Mn)	Carbon black, pararealgar	Dark brown, maroon and bright yellow particles	Hematite (no spectra collected)
Mouth (08)	Central area	-	-	Particles that looked like vermilion mixed with black ones	Probably a mixture of vermilion, carbon black and a pink lake
Eyes (C- E, 12, 16-19)	Inner corner	<b>Pb</b> , Hg, Ca, Fe	Vermilion	Crimson red particles	
	Eyelash (C, 9-11)	<b>Pb</b> , Fe, Ca, (Cu)	Vermilion, hematite(?), carbon black	First discontinued line, made of finely divided red particles. Second dark brown line: black particles in a medium-rich layer	
	Eyelid (D, 12)	<b>Pb</b> , Fe, Ca	-	Finely divided vermilion- like particles mixed with black and brown	The second line appears brown in comparison to the black eyelash line



## P.21-1942 - Unknown man clasping a hand from a cloud



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A, B, 01, 02)	forehead	<u>Pb</u> , Fe, Ca	Hematite, vermillion, lead white, calcite	Light orange, light red, bright yellow and occasional maroon particles were seen
Mouth (03-05)		-	Red lead, ultramarine	Many orange particles, rare blue ones
Inner corner	PL eye	-	-	Only the regular flesh tones were seen, no additional pigment was used to mark the corner

### P.8-1945 – Unknown Lady

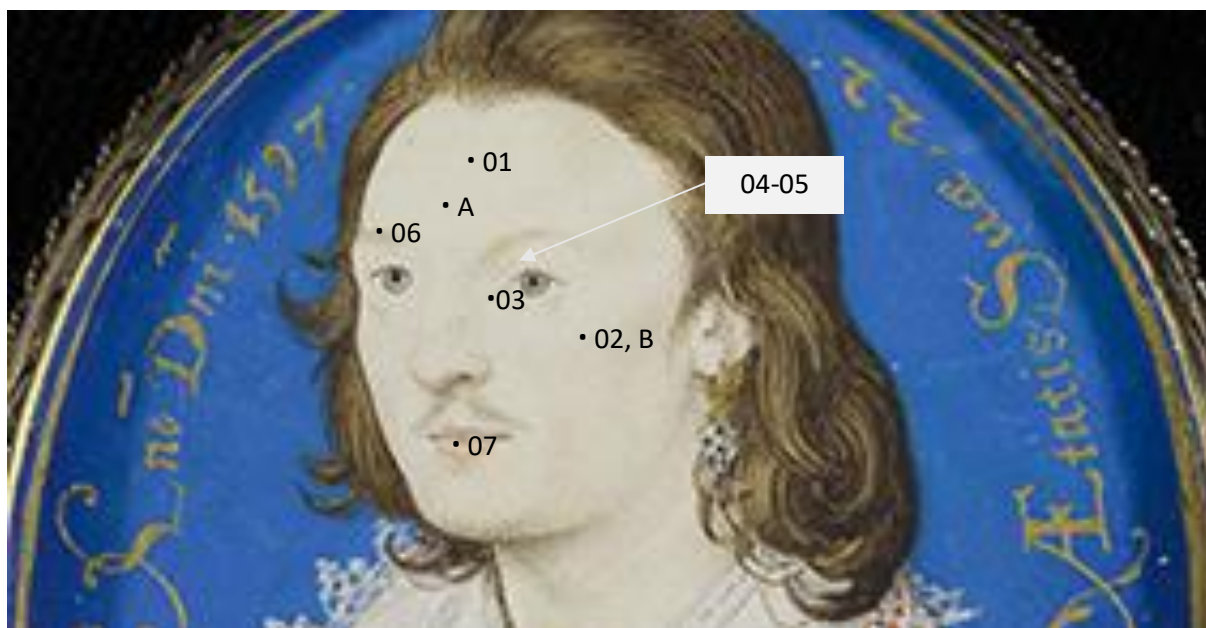


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (01-03)	Forehead and PL cheek	-	Red lead, azurite, goethite	Mixture of white, black, blue, orange particles (orange and dull orange)	Yellow dye
Mouth (04, 05)		-	Red lead	Mixture of red lead, lead white, pink dye and carbon black	Gold paint was also present
Eyes (06-10)	Inner corner (06)	-	Red lead	Orange particles mixed with black ones	
	Eyelash line (07)	-	Carbon black	Outer side: mixture of black and brown particles Inner side: indigo or very finely divided carbon black	2 <sup>nd</sup> black line applied on top
	Eyelid line (08)	-	-	mixture of white and finely divided black or blue particles	It looked like carbon/soot
	Eyebrow (09)	-	-	Mixture of black and brown	
Dress (A-C, 10-15)	Green details (10-13)	<b>Cu, Pb, Ca, Fe</b>	Azurite, indigo, lead white and calcite	Mixture of blue and bright yellow particles	Raman spectrum of a bright yellow crystal not identified
	Orange lace (14,15)		Pararealgar (intermediate phase)	Dark orange particles	
Neck pendant (D, E, 16-20)	Dark orange area	<b>Pb, Fe, As, Sn, Ca</b>	Pararealgar (intermediate phase) Lead tin yellow type I	Mixture of dark orange and bright yellow particles and rare dark red ones (hematite?)	
	Pale orange area	<b>Pb, Fe, As, Sn, Ca</b>	Lead tin yellow type I Pararealgar (intermediate phase) Red lead	Mixture of pale yellow and dull orange particles and a few bright orange ones	
Tiara (F, G, 21-26)	Dark orange	<b>Cu, Pb, Fe, K, As</b>	Red lead Pararealgar (intermediate phase) Lead tin yellow type I Massicot (1 particle)	mixture of pale yellow, warm yellow, bright orange and light brown and dark orange particles	The dark orange crystals gave no Raman spectrum (iron oxide?)
	Yellow	<b>Cu, Pb, Fe, Sn</b>	Lead tin yellow type I	Uniform pale yellow pigment	



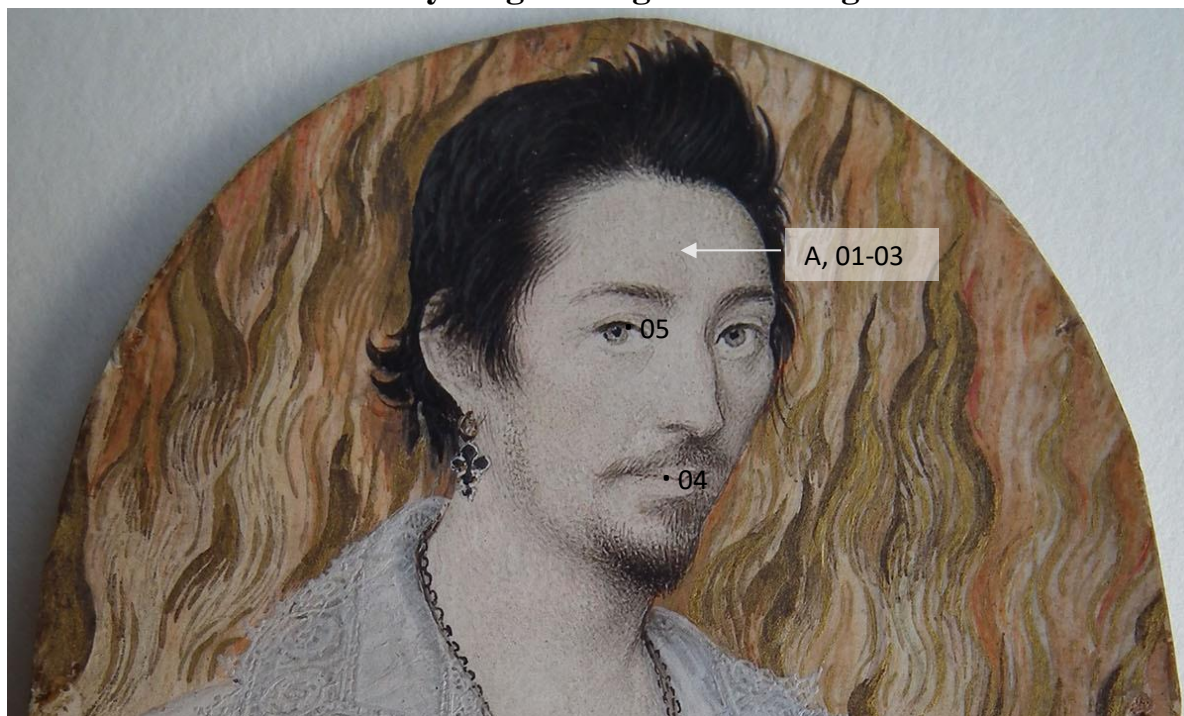
## P.5-1944 – Unknown man



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A-B, 01, 02)	Forehead	Pb, Ca, Fe	red lead, lead tin yellow I	White matrix scattered with a few orange and pale yellow particles
	PL cheek	Pb, Ca, Fe	red lead, lead tin yellow I, hematite	White matrix scattered with a few orange and pale yellow particles and a few dark red ones
Eyes (03-06)	Inner corner (03)	-	no signal	Pale pink dye
	Eyelash line (04)	-	carbon black	Mixture of black and brown particles
	Eyelid line (05)	-	carbon black	Diluted mixture of black and brown particles
	Eyebrow (06)	-	carbon black	Mixture of black, brown and dark yellow particles
Mouth (07)		-	vermilion	Mostly vermilion

### P.5-1917 - Unknown young man against a background of flames



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A, 01-03)	Forehead	<b>Pb</b> , Fe, Ca	vermilion, hematite, red lead	White matrix with crimson particles and rare maroon and orange ones
Mouth (04)	-	-	no signal	It appears painted only with a lake
Inner corner	-	-	-	no pigment present
Eyes – eyelash lines (05)	proper right one	-	carbon black	mixture of dark brown and black particles



## FM 3882 – Unknown man



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Eyes (A, 01-03)	Proper left inner corner	Pb, Ca, Fe, Hg	Indigo, vermilion	Finely divided black and dark blue particles, some tiny red ones	Carbon black
Flesh tones (B, 04-05)	Forehead, on the centre and near the hair	Ca, Pb, Fe, Al, Si, Cl, Hg	Vermilion	White matrix with black and red particles	Lead white, carbon black Higher amount of red and black particles on the central area (spot 04)
Mouth (C, 06)		Ca, Pb	Vermilion	Red lake covering the mouth. On the proper right side the lake is thinner and some red and black particles can be seen	Red lake

## FM 3883 – Unknown woman

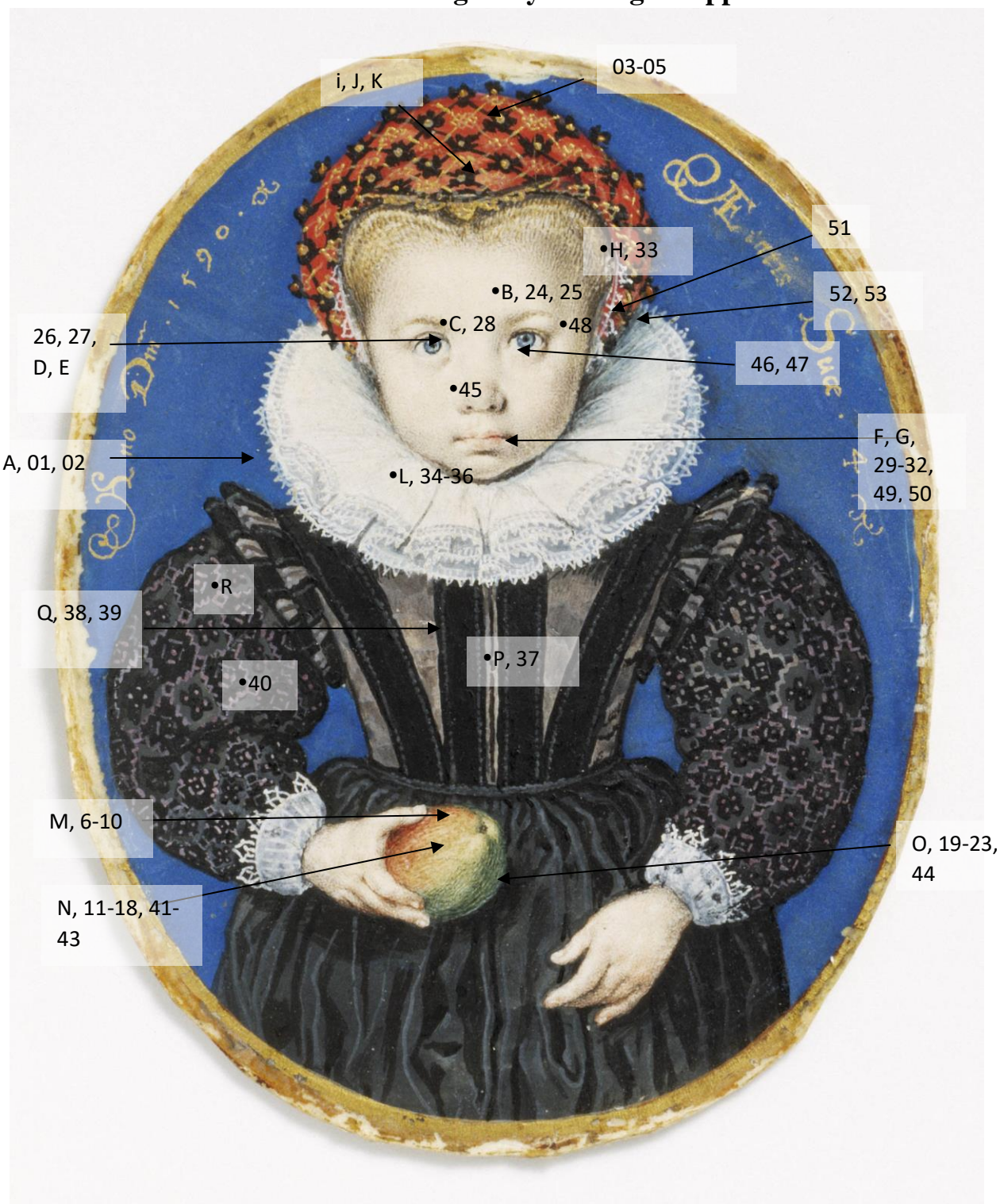


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, 01, 02)	Temple and under the nose	Pb	Red lead, vermilion	Mostly white with a few orange and pale blue particles, and rare red ones. Some bright yellow staining.	Azurite?
Lips (B, 03-06)	Upper and lower lip	Pb, Hg?	Vermilion, red lead	Upper lip: pale pink lake and orange particles underneath. Darker pink lake on the central line. Lower lip: pale pink lake and red particles underneath	Pale pink and darker pink lakes not detected



## P.145-1910 – Young Lady holding an apple



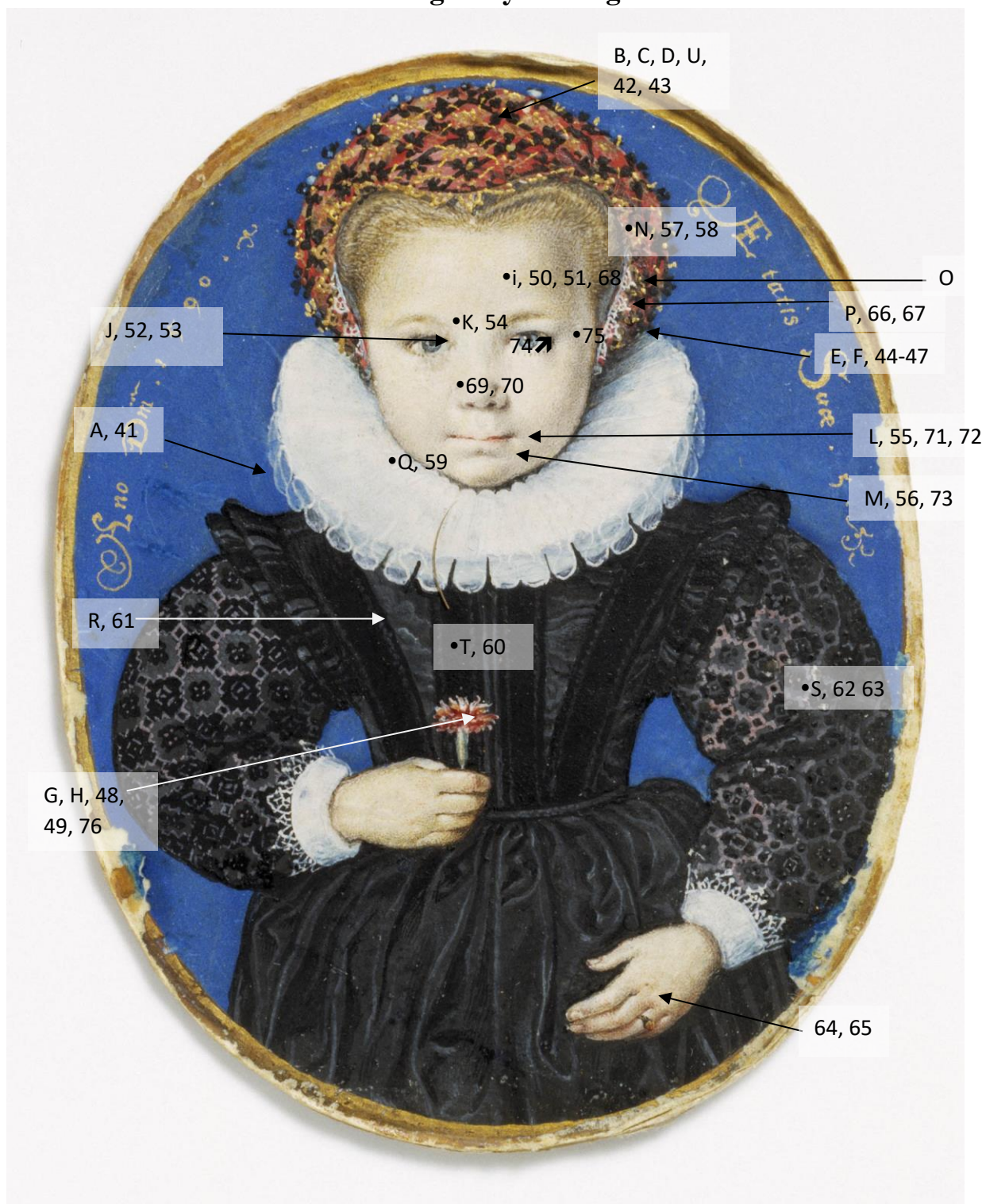
Analysis sites: letters indicate XRF spots, numbers mark Raman spots.



Area	Detail (analysis sites)	XRF	Raman	Visual examination	Notes
Blue background	Left side (A, 01, 02)	<b>Cu</b> , Pb, (Ca), Fe	Azurite, (quartz)	A few orange, brown and translucent white particles within the subdued blue matrix.	
Flesh tones	Forehead (B, 24, 25)	<b>Pb</b> , Fe, Ca	Lead white, vermilion	White and bright with very fine red and black particles	
	PR cheek (45)		Vermilion, red lead	Red particles and a few orange ones	
	Pink area (under lips) (G)	<b>Pb</b> , Fe, Ca	Hematite, indigo	Tiny dark red, maroon particles	
Eyebrow	Left one (C, 28)	<b>Pb</b> , Ca, Fe, Cu	-	Some brown particles	The presence of carbon black is assumed, but no spectra were obtained
Eyes	White glint (D)	<b>Pb</b> , Fe, Ca	Lead white	In relief, purely white	
	Blue iris (E, 26, 27)	<b>Pb</b> , Fe, Ca, (Cu)	Indigo	Dark blue particles mixed with brown ones	
	Inner corner (46, 47)		Indigo, hematite, carbon black	mixture of black and maroon particles	
	Eyelash line (48)		Indigo, hematite, carbon black	black and maroon particles	A second thick and black line was applied only above the iris.
	Eyelid line				Similar to the eyelash A second line made of a brown pigment is applied on top
Lips (F, G, 29-32, 49, 50)	Lower lip, right side	<b>Pb</b> , Fe, Ca, Cu, (Hg), (Au)	Vermilion, red lead	Medium-sized orange particles, small-sized red ones and very fine black ones.	Pink dye in the separation line and dark red dye in the corners Carbon black
Hair (H, 33)	Right side	<b>Pb</b> , Fe, Mn, Ca	Red lead	Stripes made of dark orange, dark brown and black particles	Presence of a light brown dye and gold
Headdress (i-K)	Red areas (i, 03, 04)	<b>Pb</b> , Hg, Fe, Ca, (Cu)	-	Red particles	
	White areas (J)	<b>Pb</b> , Hg, Fe, Ca, (Cu), K	Vermilion, carbon black	Very finely divided red and black particles	Presence of a pale pink lake K-containing compound

	Gold areas (K)	<b>Au</b> , Cu, Fe	-	-	The gold is applied on the white
	Black areas (05)	-	Carbon black	Black particles	
	Blue line (51)		Indigo	Finely divided blue particles	
	Orange areas (52, 53)		Pararealgar		
Ruff (L, 33, 34)	Left side	<b>Pb</b> , Ca, Fe	Lead white, azurite, indigo	Some blue and very finely divided black particles	Details in relief are pure lead white. Blue particles look like azurite
Dress (P-R, 37-40)	Black stripes (P, 37)	<b>P</b> , Ca, <b>Pb</b> , Fe	Carbon black (bone black)	Black particles	
	Pink stripes (Q, 38, 39)	Ca, <b>Pb</b> , Fe, Cu, Co	Massicot, vermillion, indigo	White, beige, dark red, light blue and purplish blue, finely divided black particles.	Blue particles look like azurite and smalt
	Pink details on sleeves (R, 40)	<b>Pb</b> , Cu, Fe, Ca, (Hg)	Indigo		Presence of a pink lake
Apple (M-O, 6-10)	Red area (M, 6-10)	<b>Pb</b> , <b>Hg</b> , Ca, Fe, (Cu), Sn	Lead white, vermillion, lead tin yellow (type I), massicot, carbon black	White, red, medium-sized pale yellow, dull orange and occasional black particles, large dark or black boulders in the shadowed areas	
	Yellow area (N, 11-18, 41-43)	<b>Pb</b> , Hg, Ca, Fe, (Cu), Sn	Massicot, lead tin yellow (type I), vermillion, carbon black, indigo	Dull orange, pale yellow, red, blue particles	
	Green area (O, 19-23, 44)	<b>Pb</b> , Ca, Fe, Cu, Sn	Carbon black, indigo, azurite, lead tin yellow (type I), massicot	Very finely divided black particles mixed with medium-sized pale yellow, dull orange and blue ones	

# P.146-1910 - Young Lady holding a carnation



Analysis sites: letters indicate XRF spots, numbers mark Raman spots.



Area	Detail	XRF	Raman	Visual examination	Notes
Blue background (A, 41)	Left side	<b>Cu</b> , Pb, Ca, Fe	Azurite	Dark blue particles mixed with a few orange, brown and translucent white ones	
Flesh tones (i, M, 50,51,56, 64, 65, )	Forehead (i, 50, 51, 68)	<b>Pb</b> , Fe, Ca	Lead white, indigo	White with finely divided black particles and a few orange ones	Some orange particles look like red lead, but no spectrum was collected
	PR cheek (69, 70)		Red lead, pararealgar	Rare orange particles and one dull orange one	two or three azurite-like particles, one crystal that looked like lapis lazuli and two crystals vermilion-looking were present but may be associated to impurities
	Pink area (under lips) (M, 56, 73)	<b>Pb</b> , Fe, Ca, (Cu)	Indigo	Finely divided black particles and a few golden ones	
	Hands (64, 65)	-	Vermilion, carbon black	Black, dark brown/orange particles	Presence of a red lake/dye
Eyebrow (K, 54)	Left one	<b>Pb</b> , Ca, Fe, Mn	Carbon black	Black and dark brown particles with a few maroon ones	No signal from the dark maroon particles
Eyes (J, 52, 53, 74, 75)	White glint (J, 52)	<b>Pb</b> , Fe, Ca	Lead white	In relief, purely white	
	Blue iris (53)	-	Indigo	Grey with only a small portion of blue colour, made of finely divided dark blue particles	
	Eyelash line (74, 75)		Weak signal of indigo in the outer line	Inner line: red lake mixed with black and very rare orange (red lead) and red (vermilion) particles and gold paint  Outer line: black, dark brown and a few dull orange particles, and possibly a yellow dye	2 lines: inner area is red and the outer edge is brown
	Eyelid line				Similar to the outer edge of the eyelash line
Lips (L, M, 71, 72)	Lower lip, right side	<b>Pb</b> , Fe, Ca, (Cu)	-	Inner corner: black particles scattered in a red matrix  Lips: pink lake mixed with black particles; a few azurite-like particles, and gold paint	1 single lapis lazuli particle in the lips. Rare vermilion (possibly as impurities). Red lead belonging to the flesh tones underneath

Hair (N, 57, 58)	Right side	<b>Pb, Fe,</b> Mn, Ca	Carbon black	Mixture of black, dull yellow and gold particles	No signal from the yellow particles
Headdress (B-D, E, O, U, 42-47, 66, 67)	Red areas (B, 42)	<b>Pb, Hg,</b> Fe, Ca	-	-	Pure vermilion by look
	White areas (D, 44)	<b>Pb,</b> Hg, K		-	Less pronounced than in P.145-1910. K-containing compound
	Golden areas (C)	<b>Au,</b> Cu, Fe	-	-	
	Black areas (U, 43)	<b>Pb,</b> Hg, Ca	Carbon black	Only black crystals	
	Blue detail (O, P, 66,67)	<b>Pb,</b> Hg, Cu, Fe, Mn, Ca	Azurite	-	
	White lace (E, F, 45-47)	<b>Pb,</b> Hg, Cu, Fe, Mn, Ca	Lead white	-	Pararealgar found in areas without lace, gold or black
Ruff (Q, 59)	Left side	<b>Pb</b>	Lead white, indigo	White with some finely divided black and occasional pale blue particles	
Dress (R-T, 60-63)	Black stripes (T)	<b>P, Ca,</b> <b>Pb,</b> Fe, Hg, Cu	Carbon black (bone black)	-	
	Pink stripes (R, 60, 61)	<b>Pb,</b> Ca, Fe, Cu	Carbon black	-	
	Pink details on sleeves (S, 62, 63)	<b>Pb,</b> Cu, Fe, Ca	Vermilion	Medium-sized red, orange, black and a few gold particles	Presence of a pink lake/dye
Flower (G, H, 48, 49, 76)	Orange area (G, 76, 48)	<b>Pb,</b> Hg, Ca, Fe, Cu	Red lead	Mostly made of orange crystals	White highlights are very fluorescent and show a weak band of lead white
	Crimson area (H, 49)	<b>Pb,</b> Hg, Ca, Fe, Cu	-	Some medium-sized black particles scattered in a red matrix	Presence of a red lake/dye

### P.11-1947 – Unknown gentleman

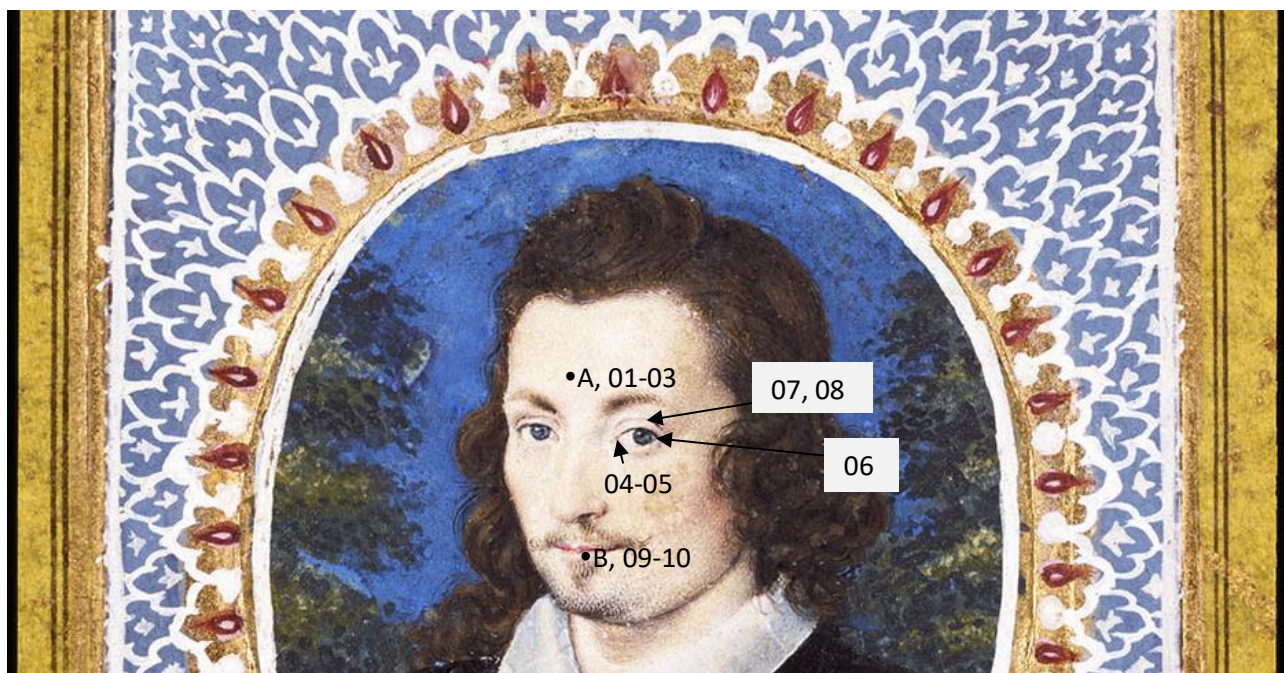


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	Raman	Visual examination	Notes
Flesh tones (01-03)	PR cheek (01)	Red lead	White matrix scattered with very sparse red and orange particles	
	PL cheek (02)	Vermilion		
	Nose (shadow) (03)	Vermilion	Mixture of black and crimson red particles	The presence of carbon black is suggested
Mouth (04)		Vermilion	The surface was made of only red particles	No orange particles visible
Eyes (05-09)	Inner corner (05, 06)	Red lead, vermilion, hematite, lead white	Mixture of black, maroon, a few red and yellow particles	The presence of carbon black is also suggested
	Eyelash line (07)	Hematite, carbon black	Mixture of black and maroon particles	Possibly a pink lake was used
	Eyelid line (08, 09)	Vermilion, hematite	Mixture of black and dark red particles with a few maroon ones	The presence of carbon black is also suggested



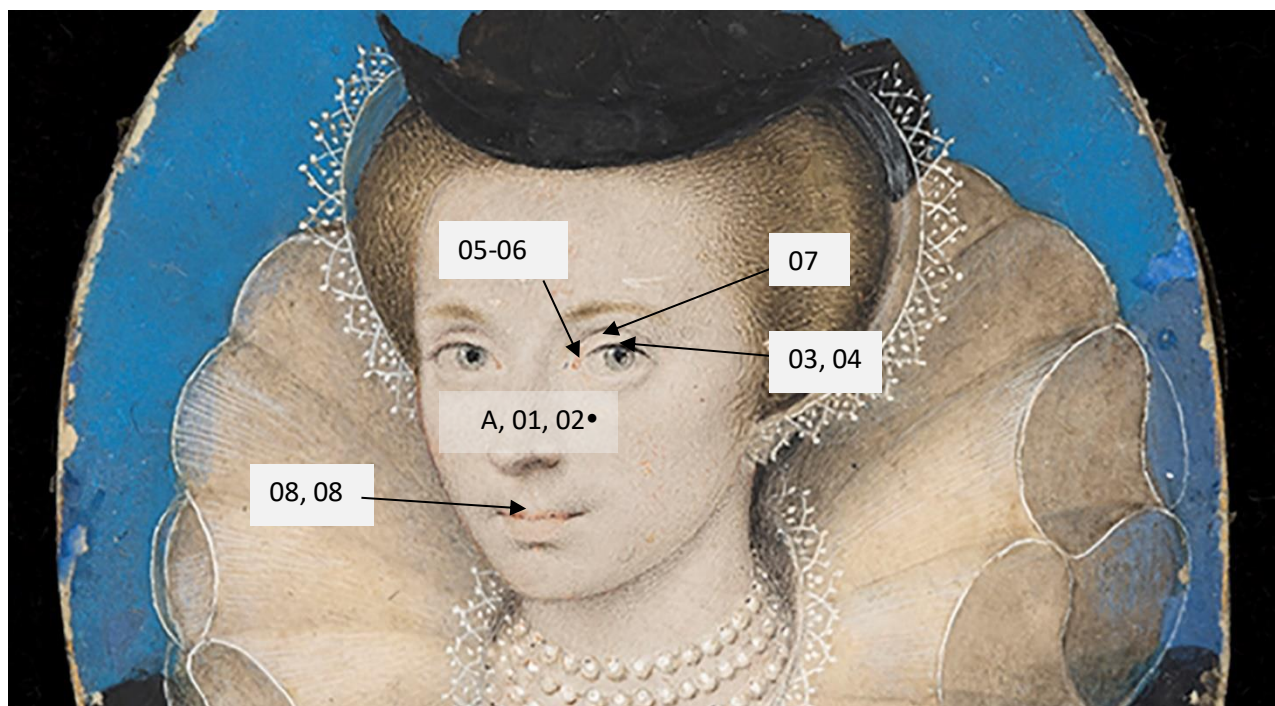
## IS.60-1978 – Unknown man in an Indian frame



Analysis sites: letters indicate XRF spots, numbers mark Raman spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, 01-03)	Forehead	<b>Pb</b> , Fe, Ca, Cu	Lead white, red lead, vermilion, carbon black	Bright white surface, with a few orange, black and crimson particles	
Inner corner (04, 05)	PL eye	-	Red lead, vermilion, indigo		The pink wash probably is due to the indigo
Eyelash line (06)	PL eye	-	-	Mostly black particles	Likely carbon black
Eyelid line (07, 08)	PL eye	-	carbon black, indigo	Mostly black	2 lines
Lips (B, 09, 10)	Upper lip, right side	<b>Pb</b> , Fe, Ca	-	Light crimson and black particles	Red lake
	Lower lip	-	Red lead		

## FM 3868 – Unknown woman

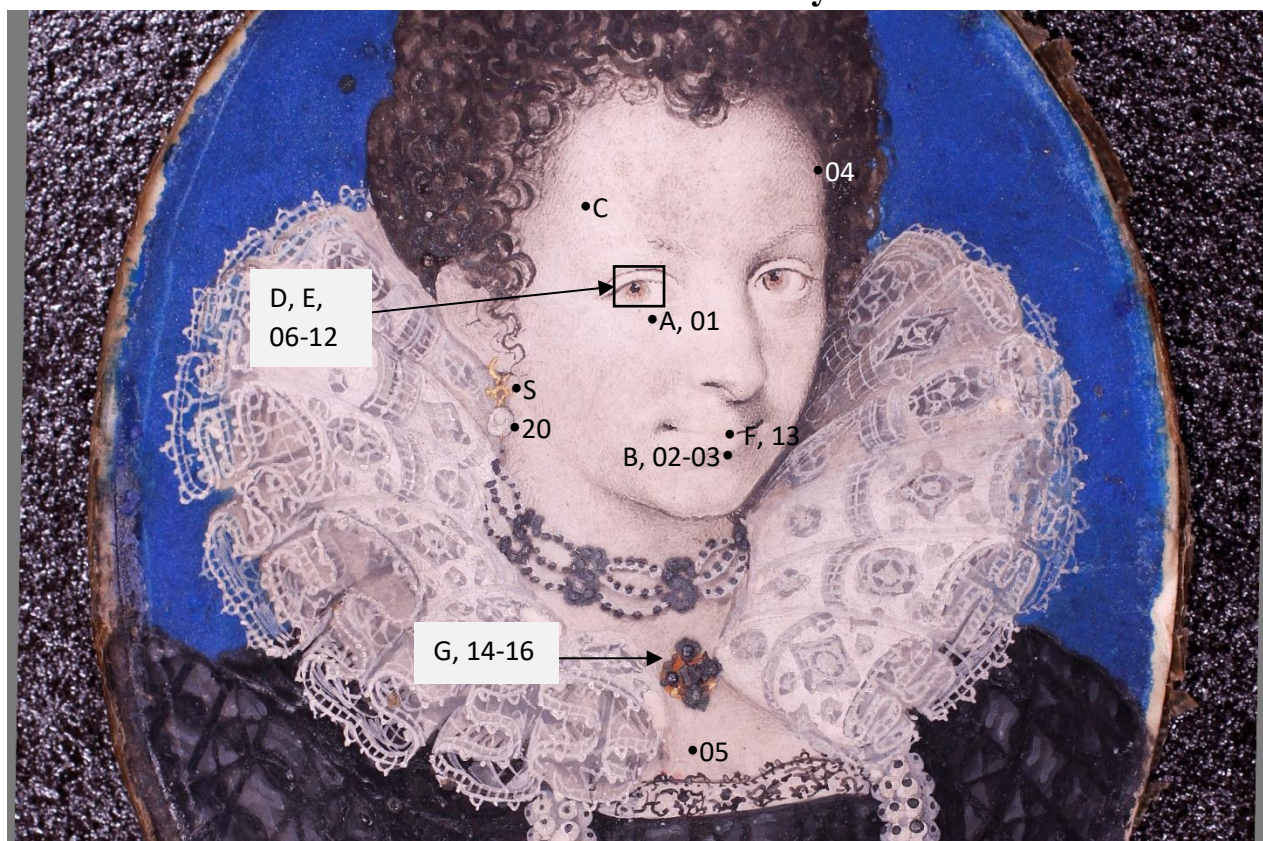


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, 01-02)	Cheek, bright white area	Pb	Lead white, carbon black, red lead, vermillion	Mix of white and finely divided black with a few orange and tiny dark red	
Right eye	Blue iris (03, 04)	-	Indigo	White and finely divided dark blue and a few pale blue	Possibly azurite. Lapis lazuli in one case.
	Inner corner (05-06)	-	Red lead, vermillion	Orange particles with crimson red and finely divided black	Carbon black. Brown lake?
	Eyelash line (07)	-	Carbon black	Black particles	Occasional almost invisible red particles, probably from the flesh tones
Mouth (08, 09)	Central line and bottom lips	-	Red lead, vermillion	Central line: red particles covered with a dark pink lake. Top and bottom lips: orange particles	Dark pink lake



## P.43-1941 – Unknown Lady



Analysis sites: letters indicate XRF spots, numbers mark Raman spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A-C, 01-05)	Cheek (under the eye)	<b>Pb</b> , Ca, Fe	Lead white	Surface is white with finely divided black particles.	
	Forehead (lacuna)	Pb, Fe, Ca			
	Forehead (shadow)	-	Vermilion	Several big crimson particles.	
	dark area (under the lips)	<b>Pb</b> , Fe, Ca	Carbon black, lapis lazuli, red lead		Lapis only in shadowed area, very few orange, rare vermillion (not saved).
	Cleavage	-	Vermilion	Large and small red particles	
Eyes (D, E, 06-12)	Brown iris	<b>Pb</b> , Fe, Ca, (Cu)	Hematite, lead white, calcite, carbon black	Particles dispersed in a yellow wash.	No identification on the yellow wash.
	Eyelash line	-	Carbon black	Only black particles	Eyelid line and eyebrows looked the same: only black particles.
Lips (F, 13)	Centre	<b>Pb</b> , Fe, Ca	Red lead	diluted pink lake, rare orange particles	Dilute pink lake
Jewel (G, 14-16)	Red area	<b>Pb</b> , Fe, Ca	Red lead, goethite	Orange and red crystals mixed with black ones	



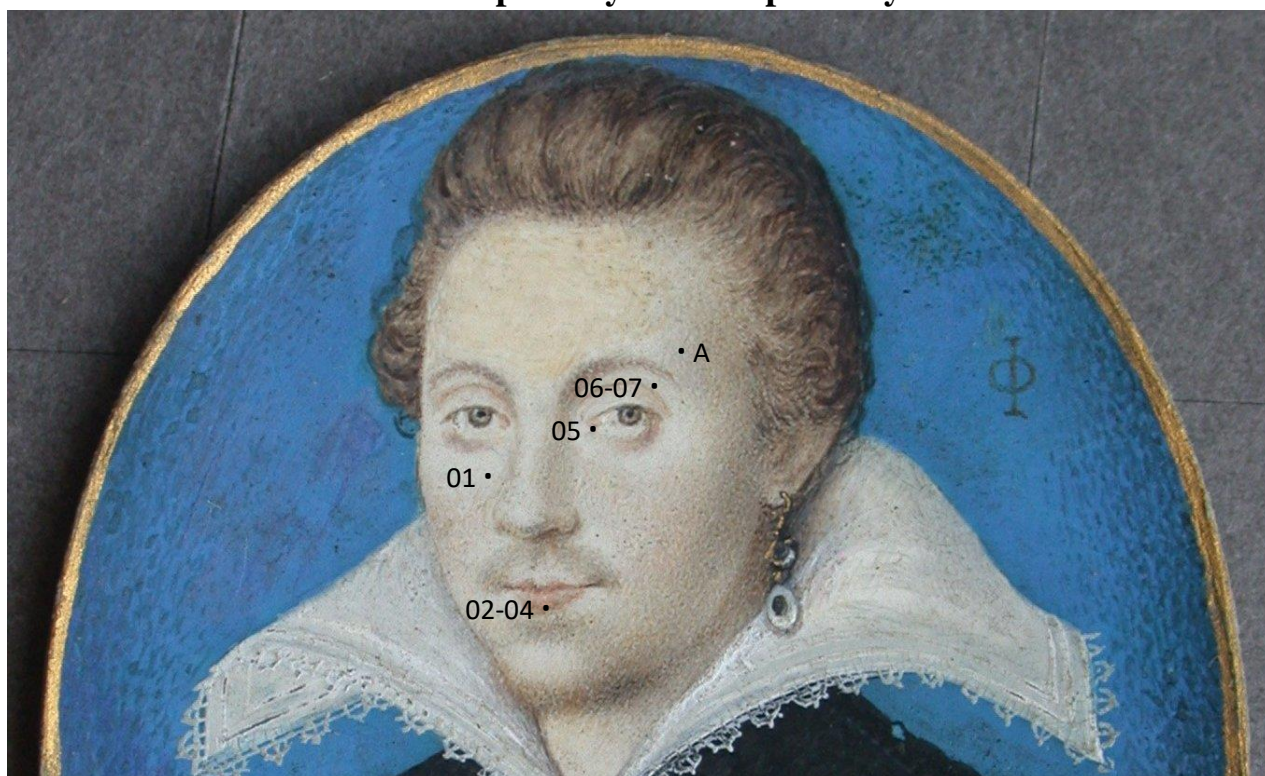
## E.1178-1988 – Robert Devereux



**Analysis sites: numbers mark Raman spots, letters indicate XRF spots.**

Area	Detail	XRF	Raman	Visual examination	Notes
Forehead (A, B, 01, 02)	Top, proper left side	<u>Pb</u> , Fe, Ca, (Hg)	Lead white, gypsum, vermilion	Pure white matrix with very few finely divided black particles, occasional clusters of crimson red and pale orange particles and a single orange one	The original area under the nose showed also yellow particles. The retouched area on the right side consisted of Ca and Ba.
Nose (C, 03-05)	Middle area	<u>Ca</u> , Ba, <u>Pb</u> , Fe, (Hg), (Cu)	Calcite, hematite	White with red particles, some splodges of yellow lake and occasionally maroon crystals	Retouched area
Eyebrow (D, 06)	Proper left one	<u>Pb</u> , Ca, Fe, Hg, Mn	-	Mixture of black, red and dark yellow particles	Retouched area No spectrum from the yellow particles (yellow ochre?)
Eyelid (07)	Proper left one	-	Carbon black, vermilion	Black and crimson particles	Crimson particles could appear as orange ones
Inner corner (08)	PL eye	-	Vermilion	Mix of red and a few orange particles	Probably retouched
Mouth E, 09-13)		<u>Pb</u> , Ca, Hg, Fe, (Ba), (Mn)	Vermilion	Mixture of red and black particles, a few pale blue ones, and a pale pink lake	Retouched area A medium-rich layer seems to be put on top Likely orange particles underneath

## 630-1882 – possibly Sir Philip Sidney

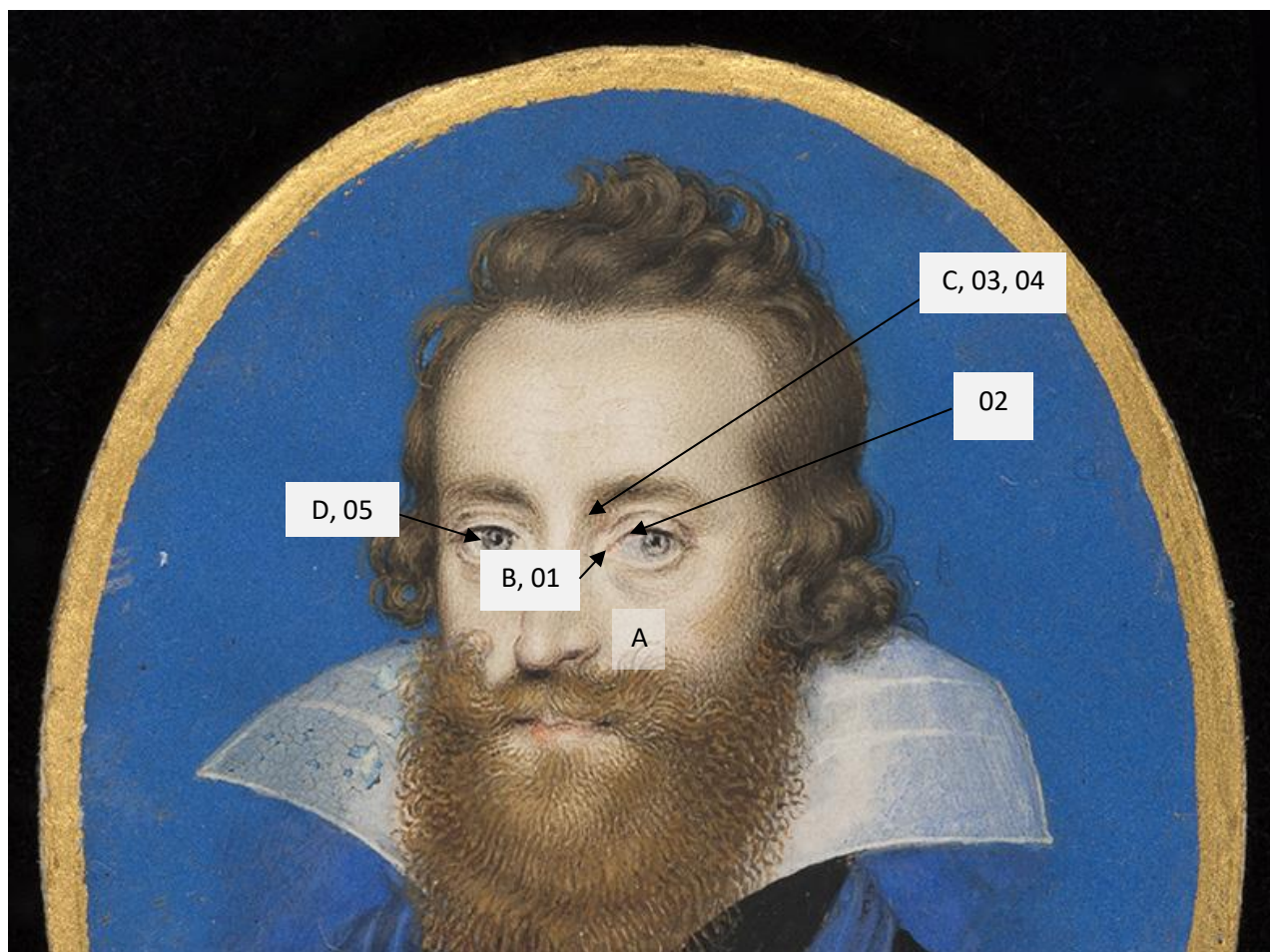


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination
Flesh tones (A, 01)	Forehead (original area)	Pb, Ca, Fe	-	
	Cheeks	-	Azurite	Red particles of vermilion mixed with very rare orange (red lead-looking) and a few azurite.
Mouth (02-04)		-	Red lead, vermilion, azurite	Mixture of red particles (vermilion), orange particle (red lead), pale blue (azurite) and black ones
Eyes (05-07)	Inner corner	-	vermilion, red lead	Particles of different colour that looked like vermilion, red lead and carbon black
	Eyelash line	-	carbon black, vermilion	Mixture of finely divided black particles mixed with vermilion.
	Eyelid line	-	-	Mixture of vermilion and carbon black



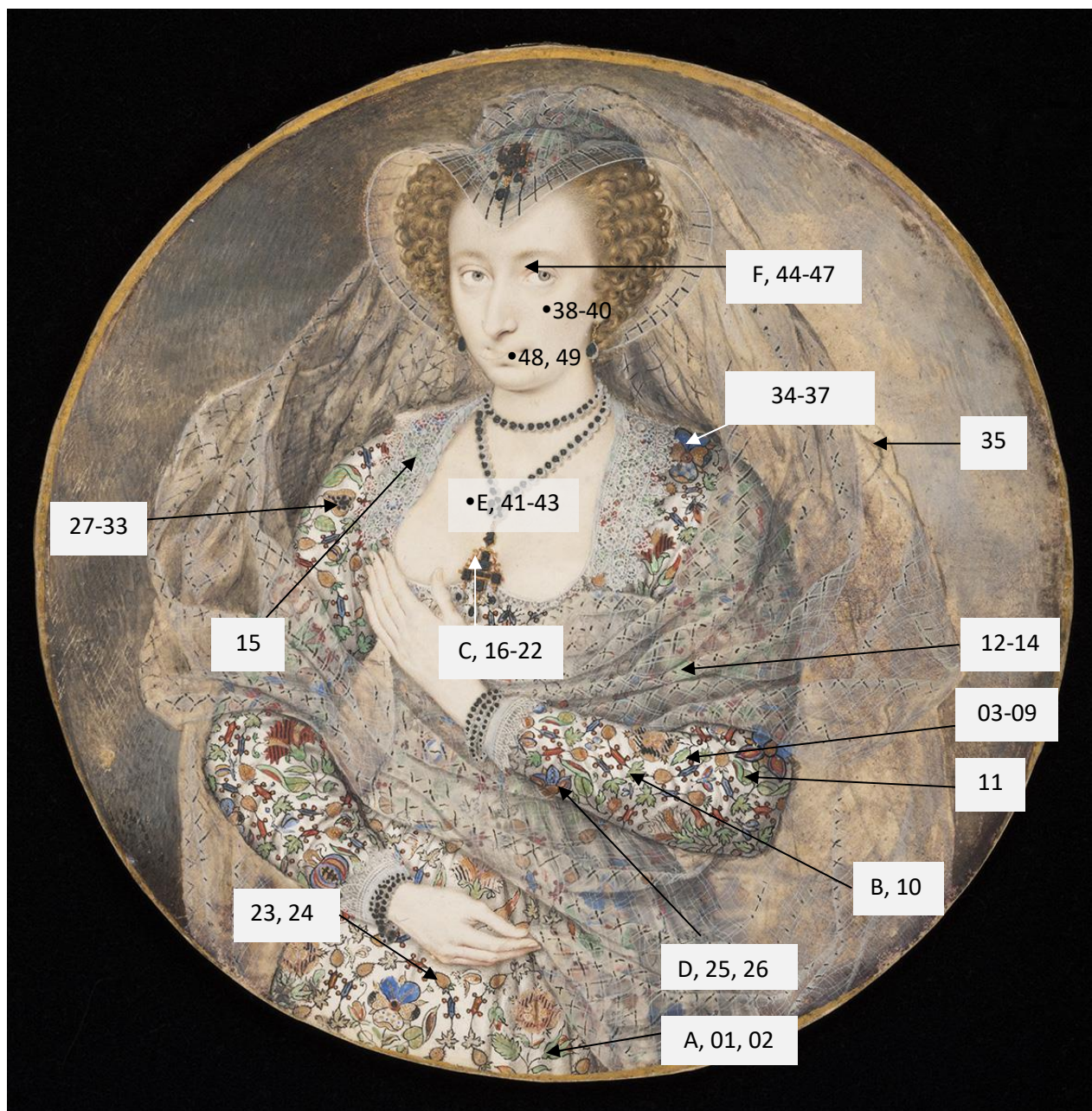
## FM 3869 - Ludovic Stuart



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A)	Proper left cheek	<b>Pb</b> , Ca, Fe	-	Orange, red and finely divided black particles	Possibly red lead, vermilion and carbon black
Eyes area (B, 1-5)	Inner corner (B, 01)	<b>Pb</b>	Red lead	Orange particles	
	Eyelash line (02)		Vermilion	Mixture of red and black particles	Likely carbon black
	Red hatches on the eyelid (C, 03-04)	<b>Pb</b> , Fe	Vermilion, red lead	Black and red particles with a few orange ones	Likely carbon black
	Iris (D, 05)	Pb	Indigo	White matrix scattered with finely divided black particles	No indigo was detected on the proper right eye (no blue colour was visible under the microscope)

## FM 3902 – Unknown woman in a floral dress

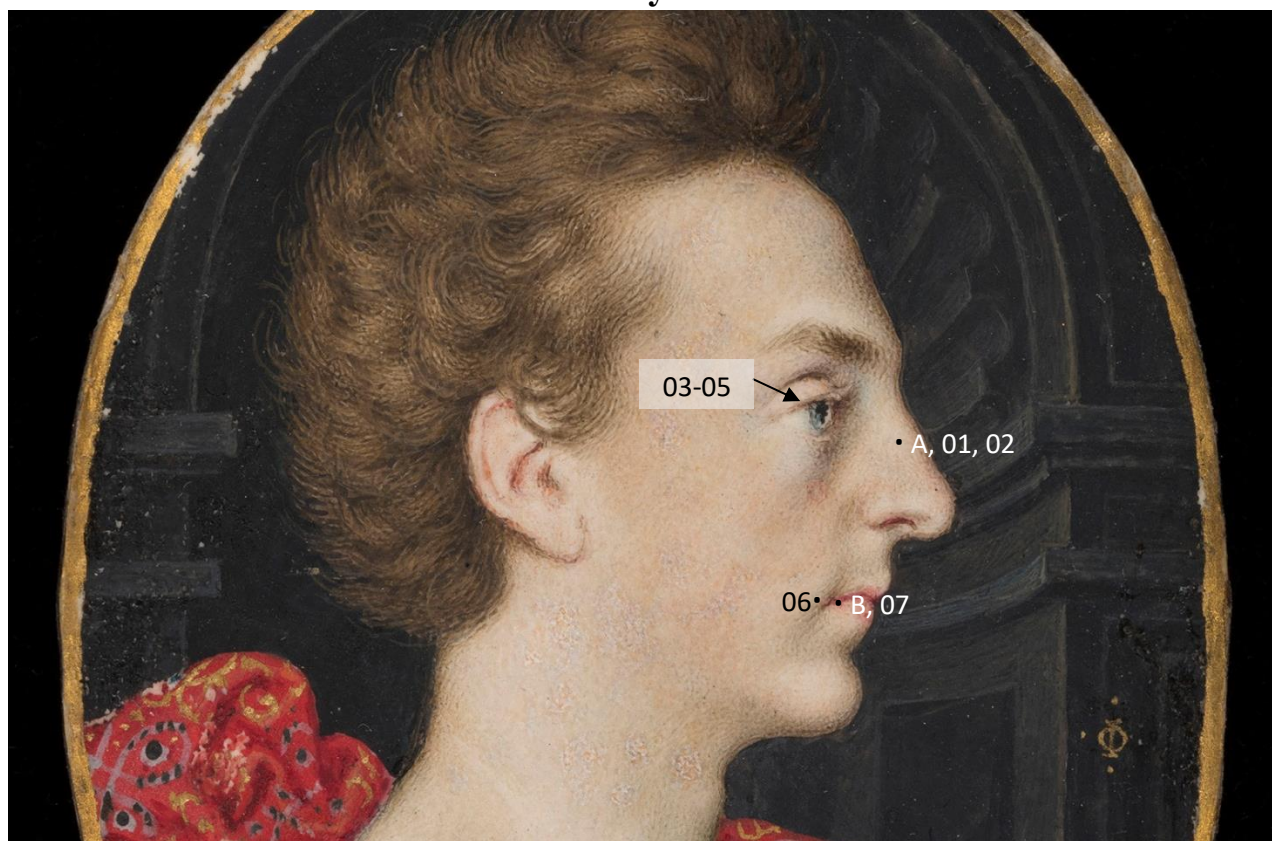


Analysis sites: numbers mark Raman spots, letters indicate XRF spots.



Area	Detail	XRF	Raman	Visual examination	Notes
Green areas (A, B, 01-15)	Green leaf (03-09)		Brochantite, lead white, azurite, lapis lazuli	Aqua-coloured crystals, a few pale blue and one dark blue	Yellow dye
	Green leaf (A, 01-02)	<b>Cu</b> , Pb, Ca, Si, Al, Fe	Azurite, indigo	Large and small green/aqua particles, with a few blue ones that looked like azurite	
	Green leaf with golden dots (B, 10)	<b>Cu</b> , Si, Ca, S, Al	Brochantite, lead white		Yellow dye
	Green leaf (near red) (11)		Brochantite		
	Leaves under the veil (12-15)		Brochantite, lead white, calcite, indigo, goethite, carbon black		
Orange areas (C-D, 16-26, 27-37)	Pendant (C)	<b>Pb</b> , As, Ca, Fe, Si, Al, K	Pararealgar, hematite, vermillion	mixture of different types of orange, some crimson red and some dark red particles	
	Strawberry		Pararealgar	orange particles mixed with white and black ones	
	Flower (D)	<b>Pb</b> , As, Fe, Al, Si	Pararealgar	mixture of dark red and orange particles	
	Pear		Pararealgar	dark orange and yellow particles, mixed with finely divided black and a few blue ones	
	Pansy		Pararealgar	orange particles mixed with black and white ones	
Flesh tones (E, 38-43)	Right cheek (38-40)		Lead white, vermillion, red lead	Mostly white, very few crimson, orange and finely divided black	
	Chest (E, 41-43)	<b>Pb</b> , Ca	Lead white, vermillion, red lead	Mostly white, very few crimson, orange and finely divided black	
Eyes (F, 44-47)	Eye's corner (F, 44-45)	Hg	Vermilion, red lead	Crimson red, orange and finely divided black	Possibly carbon black
	Eyelashes line (46-47)		Vermilion, carbon black	Mix of variable size red and black particles	Possible same composition even for the eyelid line
Mouth	Centre (48-49)	-	Red lead, vermillion	Bright orange particles mixed with a few red ones	Pink lake?

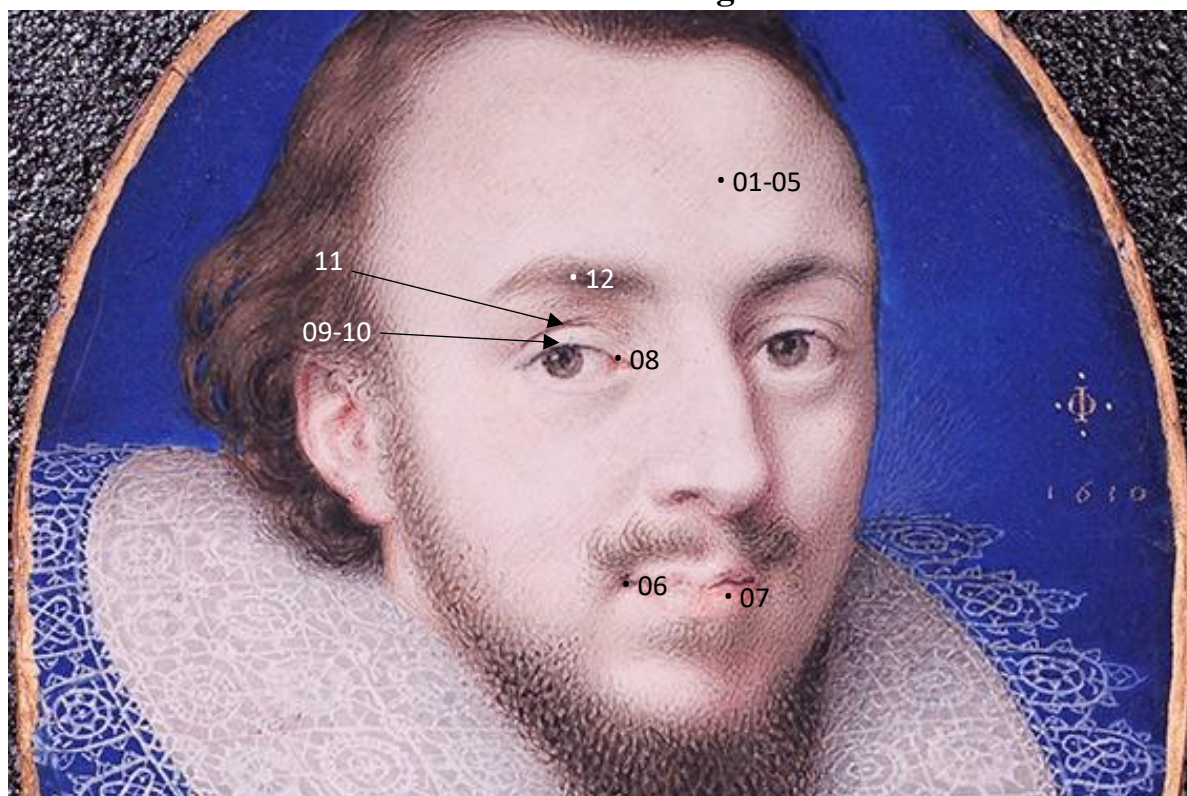
## FM 3903 – Henry Frederick



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, 01, 02)	Nose and neck	<b>Pb</b> , Ca, Fe, Si	Red lead, vermilion, lead white	White matrix scattered with orange particles and a few red ones	Indigo on the nose bridge
Eyelash line (03-05)			Carbon black, hematite and red lead	Purple colour made with black, maroon or dark red, a few orange particles	
Mouth (B, 06, 07)	Lower lip	<b>Pb</b> , Ca, Fe, Si	Red lead	Mostly made of a pink lake with orange particles on the lower lip	Pink lake Corner: indigo and possibly carbon black

## P.129-1910 – Unknown gentleman



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	Raman	Visual examination	Notes
Flesh tones (01-05)	White area	Red lead, lead tin yellow type I, goethite, hematite	Mixture of small-sized pale orange particles, boulders and acicular yellow ones and a few red and brown ones	No vermilion seen.
Mouth (06, 07)	PR corner	Hematite, carbon black	Mixture of maroon and black particles	Possibly a dark pink lake was used
	Lower lip	Red lead	Mostly orange particles	
Eyes (08-12)	Inner corner (08)	Red lead	Orange particles	Some light brown lines were drawn on top
	Eyelash line (09-10)	1 <sup>st</sup> line: hematite and carbon black	1 <sup>st</sup> line: maroon and black particles 2 <sup>nd</sup> line on top: mostly black	
	Eyelid line (11)	1st line: goethite and carbon black	1 <sup>st</sup> line: acicular yellow particles and black ones 2 <sup>nd</sup> line: maroon and black particles	2 <sup>nd</sup> line likely made of hematite and carbon black
	Eyebrow (12)	Red lead	Black matrix scattered with a few acicular yellow and occasional orange particles	The presence of carbon black and goethite was assumed



### P.39-1941 – Unknown woman



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (01)	Forehead	-	red lead, hematite	Red lead, hematite and some bright yellow particles	No vermilion
Mouth (02)		-	red lead	Lips: red lead Central line: pink lake with blue particles (azurite or lapis)	
Eyes (03-04)	Inner corner (03)	-	red lead	Mixture of red lead and a pale pink dye with blue particles	
	Eyelash line (04)	-	carbon black	Lower grey line: finely divided carbon black particles Upper line: large red lead particles, medium sized carbon black and finely divided hematite	
	Eyelid line	-	-	Mixture of a pink dye, red lead, black and hematite	
Head jewel (A, 05, 06)		<b>Fe, Pb, Au, Ca</b>	Goethite, hematite	Dull red-orange surface	

## FM 3865 – Richard Sackville



Analysis sites: numbers mark Raman spots, letters indicate XRF spots.

Area	Detail	XRF	Raman	Visual examination	Notes
Flesh tones (A, 01-05)	Forehead	<b>Pb, Ca, Fe</b>	Red lead, indigo	White matrix scattered with a few orange and black particles. Tiny yellow particles visible only under Raman microscope. In one occasion one red particle.	Yellow ochre? One particles of vermillion
	Forehead, redder area	-	Hematite	Redder hue obtained with a mixture of black, orange and a few maroon particles	Carbon black and red lead also present
	Forehead, bluer area	-	Indigo	Blue areas visible	
Lips (B, 06)	Lower lip	<b>Pb, Ca, Hg?</b>	Red lead	Orange particles and a pink lake was the mixture used for the lips.	Pink lake
Eyes (C, 10)	Inner corner	<b>Pb, Ca, Hg?</b>	red lead	Orange particles	