

A pXRF In Situ Study of 16th–17th Century Fresco Paints from Sviyazhsk (Tatarstan Republic, Russian Federation)

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Table 1. Mineralogy and chemistry of pigments (alphabetically ordered) discussed in the text. Mineral names and composition according to IMA List of Minerals [40].

Pigment	Main Mineral Components	Main Chemistry	Colour
Antimony ochre	Stibiconite + Cervantite	$\text{Sb}_2\text{O}_3(\text{OH}) + \text{Sb}_2\text{O}_4$	White, grey, yellow
Antimony white	Senarmontite	Sb_2O_3	White, grey
Arsenic	Arsenic	As	Dark grey, grey
Arsenolite	Arsenolite	As_2O_3	White
Azurite ('Mountain blue')	Azurite	$\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$	Blue
Black lead	Plattnerite	PbO_2	Black
Black powder	Magnetite	Fe_3O_4	Black, grey
Blue lead	Galena	PbS	Grey, bluish black
Blue ochre ('Blue Fe oxide')	Vivianite	$\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$	Blue, grey
Bone black	Calcite + Apatite + Graphite	$\text{CaCO}_3 + \text{Ca}_5(\text{PO}_4)_3(\text{F},\text{OH}) + \text{C}$	Black, grey
Bone white	Calcite + Apatite	$\text{CaCO}_3 + \text{Ca}_5(\text{PO}_4)_3(\text{F},\text{OH})$	White, grey
Brown ochre ('umber')	Goethite + Pyrolusite	$\text{FeO}(\text{OH}) + \text{MnO}_2$	Brown, reddish brown
Burned umber	Hematite + Goethite + Pyrolusite	$\text{Fe}_2\text{O}_3 + \text{FeO}(\text{OH}) + \text{MnO}_2$	Reddish brown
Chrysocolla	Chrysocolla	$(\text{Cu},\text{Al})\text{H}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot n\text{H}_2\text{O}$	Blue, bluish green
Egyptian blue	Synthetic cuprorivaite	$\text{CaCuSi}_4\text{O}_{10}$	Deep blue
Green earth	Celadonite	$\text{KMgFeSi}_4\text{O}_{10}(\text{OH})_2$	Green

Green earth	Glauconite	$(K,Na)(Mg,Fe)(Al)Si_4O_{10}(OH)_2$	Green
Lapis lazuli ('ultramarine blue')	Lazurite	$Na_3Ca(Si_3Al_3)O_{12}S$	Deep blue
Lead white (Leadwhite)	Anglesite	$PbSO_4$	White, blue, light grey
Lead white (Leadwhite)	Cerussite	$PbCO_3$	White, grey, blue
Lead white (Leadwhite)	Hydrocerussite + Cerussite	$Pb_3(CO_3)_2(OH)_2 + PbCO_3$	White
Lime white (slaked lime)	Portlandite	$Ca(OH)_2$	White
Malachite	Malachite	$Cu_2(CO_3)(OH)_2$	Green
Naples yellow	Bindheimite	$Pb_2Sb_2O_7$	Yellow
Red arsenic	Realgar	AsS	Reddish orange
Red lead	Litharge	PbO	Red, dark red
Red lead	Minium	Pb_3O_4	Red
Red ochre	Hematite	Fe_2O_3	Red
Sienna	Goethite ± Lepidocrocite	$FeO(OH)$	Brownish yellow
Stibnite ('antimony')	Stibnite	Sb_2S_3	Grey, dark grey, black
Verdigris	Copper acetate + Copper hydroxide	$[Cu(CH_3COO)_2]_2 + Cu(OH)_2 \cdot 5H_2O$	Bluish green
Yellow arsenic	Orpiment	As_2S_3	Yellow
Yellow lead	Massicot	PbO	Yellow, reddish yellow, brownish yellow
Yellow ochre	Goethite ± Lepidocrocite	$FeO(OH)$	Yellow

Table 2. List of the frescoes studied and their location in the church. Abbreviation: Fr# = Fresco number.

Fr#	Description	Location
1	‘Assumption of the Mother of God’	Altar
2	‘Bishop Isaiah of Rostov’	Altar
3	Title in the center of the altar	Center of the altar
4	Towel* in the center of the altar	Center of the altar
7	Archangels	Drum**
8	‘God had a rest in the seventh day’	Prayer hall
9	Joint composition ‘Creation of animals’ and ‘Creation of Adam’	Prayer hall
10	‘Ascension of the Mother of God’	Prayer hall
12	‘Our Lady of the Sign’	Prayer hall
13	‘Apostle Philip of the Seventy’	Altar (lower part of the pillar)
14	‘Apostle Philip of the Seventy’	Altar (lower part of the pillar)
15	Joint composition ‘Creation of stars’ and ‘Blessing of water’	Prayer hall
16	‘Evangelist Matthew’	Prayer hall
17	Paint around window aperture (16 th c.)	Drum**
18	Paint around the window aperture (18 th c.)	Drum**
23	Early windows	Drum**
24	Towel*	Sacristy
25	Title	Drum**
26	Various images	Former exterior western wall
27	Various images	Former exterior western wall

NOTE: * Towel is the decoration motive running at the bottom along the walls; **Drum is the cylinder-shaped room under the dome in the Orthodox cathedrals.